Hunter Water Operating Licence Review

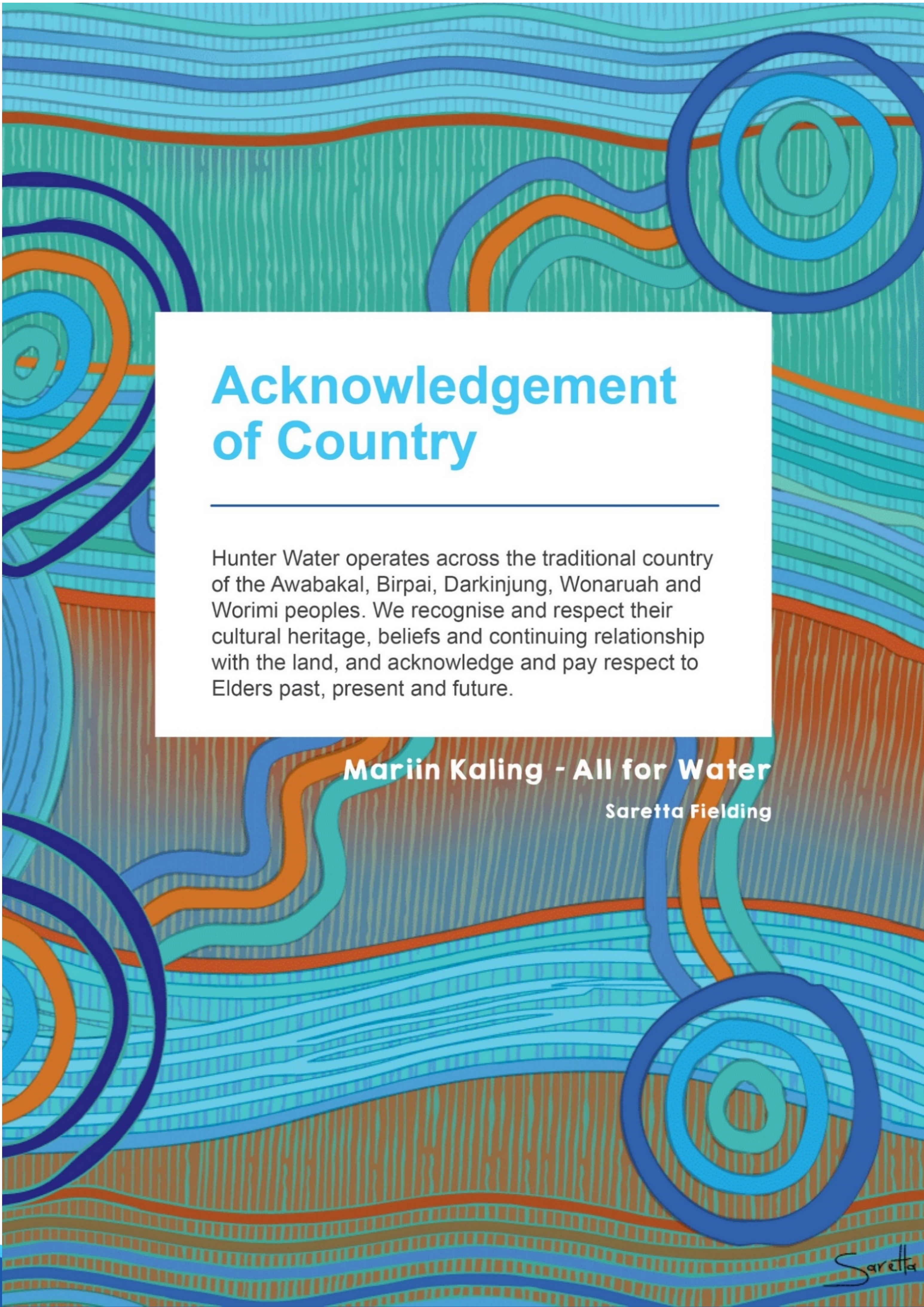
1 NOVEMBER 2021

Response to IPART's Issues Paper

Additional information
System performance standards

Acknowledgement of Country

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



Mariin Kaling - All for Water

Saretta Fielding

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PREFACE

On 8 September 2021 IPART released the Issues Paper for the review of the Hunter Water Operating Licence. Issues Paper sets out 16 preliminary positions and 49 detailed questions (23 with sub-questions). Of these, three questions (two with sub-questions) related to system performance standards.

On 8 October 2021 Hunter Water provided a comprehensive response to the Issues Paper, answering 22.5 of IPART's 23 questions. We indicated that cost-benefit analysis was underway to assist our consideration of the price-service mix for each performance standard. However, in that submission we did provide comprehensive background information, including a description of how we had involved customers in standard-setting, outline of performance drivers and a description of our approach to gathering inputs to the cost-benefit analysis.

This document fulfils our commitment, providing the full suite of information to enable stakeholders to comment on our proposed system performance standards and service levels.

A summary of the relationship between this submission of additional information and Hunter Water's 8 October response to IPART's Issues Paper is provided below.

Additional information System Performance Standards (this document)		Response to IPART Issues Paper Hunter Water Operating Licence Review		Modification
No.	Clause	No.	Clause	
	Preface			Rationale for provision of additional information
	Key Messages		Key Messages	Key messages related to system performance standards only. Hunter Water comment includes proposed levels of service (thresholds)
1	Introduction	2.2	Performance standards for service interruptions	No changes
2	Engaging with customers to inform the review of system performance standards and rebates	2.2.1	Engaging with customers to inform the review of system performance standards and rebates	No changes
3	Cost-benefit analysis (CBA)			Introductory paragraphs
3.1	Water continuity	2.2.2	Water continuity	Performance projection graphs Additional sub-section on CBA results and recommendation
3.2	Water pressure	2.2.3	Water pressure	Performance projection graphs Additional sub-section on CBA results and recommendation Minor reordering of text
3.3	Wastewater overflows	2.2.4	Wastewater overflows	Reordered sub-sections for consistency Additional sub-section on CBA results and recommendation

Additional information System Performance Standards (this document)		Response to IPART Issues Paper Hunter Water Operating Licence Review		Modification
	Appendix 1		Appendix 1	
Q4	Existing standards, revised service levels and optimisation	Q4	Existing standards, revised service levels and optimisation	Additional paragraph describing phase two customer engagement. Proposed levels of service (thresholds) included
Q5	Other standards	Q5	Other standards	No changes
	Appendix 2		Not applicable	New appendix containing full CBA report

KEY MESSAGES

IPART's preliminary position	Our assessment	Comment
System performance standards		
Retain system performance standards for water continuity, water pressure and wastewater overflows, as in the existing Licence, but revise the specified levels of service	✔	On 8 October we provided our submission to the majority of questions in IPART's Issues Paper. In our submission we proposed retaining four of the five standards and indicated that further analysis was underway to inform our proposed levels of service. Following completion of that work, we propose retaining the current levels of service, based on the results of cost-benefit analysis and equity considerations.

1. INTRODUCTION

Service level outcomes are an expression of quality which, coupled with price, shape the value that consumers place on all goods and services.

IPART seeks to replicate the outcomes achieved in competitive markets whereby customer preferences for combinations of cost and quality are revealed through purchasing choices. To do so, IPART:

- includes system performance standards in the Operating Licence
- specifies rebates for service failures in the Customer Contract, which are intended to signal 'fair play' for inconvenienced customers and consumers
- sets Hunter Water's prices on the basis that they recover the efficient costs of compliance with mandatory standards (including operating licence requirements and those set by environmental, health and water extraction regulators).

Hunter Water's 2017-22 Operating Licence contains five prescriptive system performance standards in relation to water continuity, water pressure, and dry weather wastewater overflows onto private properties.[1] Each system performance standard sets a hard limit on the maximum number of affected properties in any one year. A property count above the target level for any of the performance standards would represent a breach of the operating licence.[2]

2. ENGAGING WITH CUSTOMERS TO INFORM THE REVIEW OF SYSTEM PERFORMANCE STANDARDS AND REBATES

Over the last 18 months we have engaged with over 2,000 people and around 70 businesses over two phases of customer engagement to obtain a contemporary understanding of customer, consumer and community views on service levels.

2.1. Understanding customer preferences

Phase one of the service levels project sought customer feedback on:

- service level attributes that Hunter Water's customers consider important
- gap analysis showing where there is a gap between the relative importance and current level of satisfaction in relation to service level outcomes and attributes
- service level failures for which customers and consumers expect a rebate.

The scope, format and timing of field work was affected by the COVID-19 crisis. Engagement with residential customers, consumers and the community was able to proceed in a digital format, given evidence that people felt reassured by continued future planning of essential services. Fieldwork for non-residential customers was deferred.

Between April and June 2020 almost 1,200 residential households participated in telephone depth interviews, an online bulletin board and an online survey. The activities were informed by an internal working group drawing on expertise from across the business. The initial steps involved a review of 30 customer research initiatives completed by Hunter Water over recent years. The work also drew on a literature review of 107 service outcomes and 220 attribute measures across the Australian water industry.

A three day moderated online bulletin board (similar to a deliberative forum) hosted 50 people who contributed close to 3,000 posts describing their views and expectations in their own words.

Depth interviews were held with ten people who had recently interacted with Hunter Water in relation to a complaint, extended unplanned interruption, or account assistance.

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[1] System performance standards are performance standards specified in relation to service interruptions or impact.

[2] Breaching the hard limits on the number of affected properties/customers would constitute a breach of the operating licence and result in reduced compliance grades, enforcement actions or penalties (e.g. clause 17 and 17A of the Hunter Water Act 1991 (NSW) provides for penalties such as a letter of reprimand; monetary penalty up to $150,000; or cancellation of the operating licence).

Over 1,100 residents participated in the online survey involving ranking of service level attributes. Around 500 were recruited via a reputable survey panel provider. A similar number responded to an email invitation sent to customers. These data sets were merged to form the main sample, weighted by ABS Census data on age, gender, income and home ownership status for the Lower Hunter.

The 50 responses sourced via Your Voice (Hunter Water's online engagement platform), the corporate website and social media advertising were analysed separately, due to potential biases with opt-in sampling.

Most aspects of the services provided were rated as relatively important by a sizeable portion of the community (see Figure 2.1 and Figure 2.2).

Figure 2.1 Customer expectations of Hunter Water

Source: Online Bulletin Board, 29 April 2020. *Q: What do you expect from Hunter Water? What do you see as their key responsibilities/areas of priority? And of these what is the most important or most valuable to you?* (n = 44)

Figure 2.2 Phase one customer engagement findings


THE VOICE of OUR CUSTOMERS ON
WASTEWATER MANAGEMENT
TOP PRIORITIES
Stop wastewater overflows quickly and clean up thoroughly, regardless of the cause
Make the area safe to use, whether it's in my yard or in public places like parks, sporting fields or near schools
Reduce wastewater overflows that may impact on creeks and waterways
Have good preventative measures in place to minimise inconvenience, to protect public health and prevent harm to the environment
IT'S NOT ACCEPTABLE for SOME CUSTOMERS to HAVE RECURRING WASTEWATER OVERFLOWS ONTO their PROPERTY
It's important that overflows onto people's property are rare
I'd expect that if you have had an overflow into your property and you have notified HW and the issue had been rectified, then to have another one that would be very disappointing
PRISTINE RIVERS & BEACHES around the HUNTER are a TESTAMENT to the GOOD JOB HW are DOING
EXPECTATIONS are the SAME REGARDLESS of WHETHER an OVERFLOW is in WET or DRY WEATHER
Bad smells from the wastewater system reduce liveability and I worry it might have health impacts. Hunter Water should find the source of the smell and ensure it won't come back
I think life could be made very miserable very quickly for people in proximity to a foul wastewater smell
I FLUSH, IT GOES... THAT'S ALL I REALLY KNOW!
What happens to wastewater once it leaves my property? I'd be interested to know more about how the system works, particularly as it relates to my area
I'm uncertain which wastewater pipes on my property are Hunter Water's and which are mine; who is responsible to maintain them and what I can do to reduce the likelihood of something going wrong
I prefer to receive excellent water and wastewater services so I don't need to contact you. I value good customer service when things go wrong.
THE VOICE of OUR CUSTOMERS ON
CUSTOMER SERVICE
Most aspects of customer service are important - it's a blend of things that contribute to the customer experience
TOP PRIORITIES
SOLVE my PROBLEM/ENQUIRY QUICKLY
BE RESPONSIVE, ACCESSIBLE, PROFESSIONAL & KNOWLEDGEABLE ... IN ALL INTERACTIONS
I expect a mix of contact options or modes of interaction (phone, face to face, online) to optimise two way flow of information
HUMAN, LOCAL CONTACT
NO ROBOTS or OVERSEAS CALL CENTRES!
KEEP a RANGE of CHANNELS to CATER for EVERYONE'S CAPABILITIES and PREFERENCES
SOCIAL MEDIA RESPONSIVENESS SHOULD be THE SAME REGARDLESS of CONTACT METHOD... BUT CONTINUOUS MONITORING & RESPONSE NOT a RELATIVE PRIORITY
HELP the COMMUNITY to LEARN
PIPES near PROPERTIES
CUSTOMER v HUNTER WATER RESPONSIBILITIES
MONEY SAVING TIPS
WATER CONSERVATION
IDENTIFYING LEAKS
PROVIDE BILLS via EMAIL & AUTOMATIC PAYMENT by CREDIT CARD
I have always had a positive experience with Hunter Water
I would like to say how amazing the customer service department is and how helpful they have been when needed
The service provided is typically exceptional and of a great quality. The staff are very professional and take notice of personal water related issues
RENTERS (RESIDENTIAL TENANTS)
I'd like a separate "water usage" account so that I can monitor my use over time and have access to more ways to pay
Payment assistance for customers experiencing financial hardship is a high priority


THE VOICE of OUR CUSTOMERS ON
WHEN THINGS GO WRONG
PERCEPTIONS of CURRENT PERFORMANCE
KEEP UP the GOOD WORK
Short call wait times, and fast response times
Most problems are assessed within only a few hours of initial contact
Highly competent technicians able to resolve and rectify problems within their expectations
I feel respected and listened to by all staff
A LITTLE SLOW/RELAXED around BOTH COMMUNICATION & RESOLUTION of ONGOING ISSUES (e.g. multi-day water interruption)
I'M NOT CONFIDENT MY ONGOING ISSUE WILL EVER be SOLVED
— BUT —
It's one of those things that happens... out of Hunter Water's hands
...HAVING a PROBLEM/ISSUE DOESN'T MAKE ME FEEL ANY RESIDUAL ANIMOSITY TOWARD HUNTER WATER
SOLVE my PROBLEMS QUICKLY, & GET it RIGHT THE FIRST TIME
Provide a firm timeline to fix the issue. It might be okay for you to take longer to resolve my problem if you explain to me the reason why.
TIMELINE
I might like more information about what caused my problem (ask me). It could stop me worrying if the problem happens again (e.g. why my water was dirty).
Close the loop after the issue is resolved through follow up calls (e.g. check in with me that I don't still have a problem). This is not expected but I'll be surprised and delighted if you do it.
Fixing and cleaning up blocked (or overflowing) wastewater should be the highest priority
PROVIDE ENOUGH WATER to SEE ME THROUGH a LONG INTERRUPTION to WATER SUPPLY
1-2 DAYS
FIX BURST/LEAKING WATER PIPES FAST to AVOID FURTHER UNNECESSARY WATER WASTE
SMS me if the local water supply is interrupted. It's frustrating if I have to phone you late at night and you already know there's a problem.
ALERT
Make it easier for me to find out about account assistance (for financial hardship), especially if my household is renting.
FIX STRONG WASTEWATER (SEWERAGE) SMELLS & MAKE SURE THEY DON'T COME BACK
THE VOICE of OUR CUSTOMERS ON
SUSTAINABILITY
It's just a beautiful part of the world
THE LOWER HUNTER is VERY LIVEABLE - GREAT LIFESTYLE, NATURAL BEAUTY, BEACHES & NATIONAL PARKS for RECREATION
HW can best contribute to making the region more liveable by doing things related to water and wastewater services e.g. providing recreation opportunities and picnic areas adjacent to dams or assisting new developments, especially communities to be water sensitive
Hunter Water's investment supports economic wellbeing (e.g. construction jobs)
Drought water restrictions have reduced liveability
Don't harm the environment through your operations. Be good environmental custodians; protect plants, animals and waterways
Being sustainable is less important than doing well at supplying water, managing wastewater and providing good customer service
IT'S a NICE to HAVE
Climate change action and using renewable energy is important but I'm worried my bill will increase if Hunter Water do this
Prioritise actions that relate to water or wastewater services
e.g. recycling wastewater will help keep water plentiful, reduce the need for water restrictions and help to keep our beaches and waterways clean
31%
I DON'T KNOW HOW HW PERFORM on SUSTAINABILITY
81% of those who do say HW are performing HIGHLY or VERY HIGHLY
I'm interested in learning what Hunter Water is doing in terms of sustainability and protecting our environment and waterways
LOW AWARENESS
OPPORTUNITY to BETTER COMMUNICATE SUCCESS
~50% DON'T KNOW HOW HW are PERFORMING on THEIR TOP3 PRIORITIES
TOP PRIORITIES
RECYCLE WASTEWATER
RENEWABLE ENERGY/CLIMATE CHANGE ACTION
WASTE WATER DISCHARGES to SENSITIVE AREAS
CLOSE the LOOP!
YOU'RE DOING a GOOD JOB at ENGAGING US... BUT OUR PERCEPTION is THAT YOU'RE BETTER at LISTENING than ACTING on WHAT YOU'VE HEARD

2.2. Distilling aspects of service important to customers into standards appropriate for our Licence

We distilled the attributes into candidates for operating licence system performance standards using the following criteria:[3]

1. Standards should relate to a service interruption. This reflects a requirement in the Hunter Water Act 1991.[4]
2. Standards should relate to outcomes (benefits) important to customers.
3. Standards should be focused on IPART's regulatory responsibilities and avoid duplication with other regulators and regulatory requirements.
4. Standards should capable of being influenced by Hunter Water's actions.
5. Standards and measures should be capable of efficient and effective data collection and reporting, along with objective assessment.

Applying the criteria confirmed that water continuity, water pressure and dry weather wastewater overflows are appropriate service level attributes for performance standards in our Operating Licence.

Applying these criteria also determined that service outcomes of medium to high importance to customers that would not be suitable for performance standards in the licence were:

- Odours from the wastewater system
- Aesthetic aspects of water quality such as taste, odour or discolouration
- Customer interfacing and troubleshooting
- Environmental sustainability such as reducing carbon emissions, waste management, and improving wastewater system performance beyond environmental licence requirements.

Our preliminary position is to retain four of the five standards - retiring the water continuity standard relating to multiple short unplanned interruptions. There are currently two water continuity standards – one for long unplanned interruptions and one for multiple short unplanned drinking water supply interruptions. The latter standard was removed at Sydney Water's last operating licence review. Hunter Water's preliminary position is that this standard can be removed as it does not provide strong incentives for performance improvement. In the absence of a licence performance standard, we would achieve the same outcomes by basing our decisions on the cost of repair compared with the cost of replacement.

Having confirmed that four of the five measures underpinning the current system performance standards are based on service qualities that are valued by customers, and are appropriate for a mandatory threshold in a licence, we needed to test whether there are water and wastewater network management approaches that would result in an improved price-service mix from a customer perspective. Hunter Water can undertake additional activities to reduce the number and/or impact of these events, but these activities come at a cost that is ultimately recovered from customers via water and wastewater bills. Hunter Water could also reduce bills by spending less on managing its networks, but this would result in customers experiencing more of these inconvenient events.

[3] These criteria were based on GHD, 2006, Review of System Performance Standards for Hunter Water and Sydney Water, Report for the Independent Pricing and Regulatory Tribunal, page 12.

[4] Hunter Water Act 1991, Section 13(1)(c) *"The operating licence is subject to the terms and conditions determined by the Governor but must include terms or conditions under which the Corporation is required to ensure that the systems and services meet the quality and performance standards specified in the operating licence in relation to water quality, service interruptions, price levels and other matters determined by the Governor and set out in the operating licence."*

2.3. Considering the appropriate cost-service mix

We engaged experts The Centre for International Economics to estimate customer willingness to pay (WTP) to quantify the economic benefits of changes in service performance. In this project, the term WTP has the specific meaning found in the economics literature; that is, each customer's maximum WTP (or minimum willingness to accept (WTA) compensation) for the specified change in service. It is grounded in welfare economics — a field of economics focused on the allocation of resources to maximise welfare (i.e. utility or wellbeing). It is not used in relation to customers' satisfaction or attitude towards the level of their water bill.

The CIE used two stated preference techniques to estimate WTP; contingent valuation and discrete choice experiments (see Table 2.2).

Discrete choice experiment surveys involve presenting respondents with several choice questions. Each choice question shows two or more hypothetical scenarios with specified cost and asks the respondent to indicate their preferred option. The scenarios are described by multiple attributes and the levels assigned to attributes vary over scenarios and over questions. This variation is designed to support statistical estimation of the value placed by respondents on changes in each attribute. Examples of the choice tasks for water continuity and wastewater overflows are provided in Figure 2.3 and Figure 2.4.

Contingent valuation surveys involve presenting respondents with a specific policy or project proposal and asking whether they would vote for the proposal at a specified cost. The cost level is varied over respondents to allow the estimation of a demand curve and the expected value of WTP for the proposal.

Table 2.1 Stated preference technique used to estimate willingness to pay by topic

Topic	Relevance of standard to customers	Valuation requirements	State preference technique
Water supply interruptions	Risk faced by all customers over time	Scenarios varying on multiple dimensions, including scenarios yet to be developed	Discrete choice experiment
Wastewater overflows	Risk faced by all customers over time	Scenarios varying on multiple dimensions, including scenarios yet to be developed	Discrete choice experiment
Low water pressure	Persistent hotspots/worst-served customers due to growth areas and elevation relative to reservoirs	Two specific potential improvement programs	Contingent valuation

Source: The CIE, 2021, Customer willingness to pay: water and wastewater system performance, Appendix.

Figure 2.3 Example of a choice task on water continuity

		Current Package	Package A	Package B
Supply interruptions without warning				
Short unplanned interruptions	Chance each year of an interruption lasting 1-3 hours	14 per cent	10 per cent	14 per cent
Long unplanned interruptions	Chance each year of an interruption lasting 5-8 hours	2.5 per cent	4 per cent	Almost Never
Supply interruptions with written notice				
Planned interruptions	Chance each year of a planned interruption lasting 1-3 hours	4 per cent	1 per cent	7 per cent
The cost to you				
Cost	The permanent change in the amount you pay for water each year	No Change	You save $10	You pay an extra $10
Your choice				
If these were the only three options available to you, which option would you choose?		○	○	○

Source: The CIE, 2021, Customer willingness to pay: water and wastewater system performance, Appendix.

Figure 2.4 Example of a choice task on wastewater overflows

	Current Package	Package A	Package B
Your service level			
Chance of one wastewater overflow on your property each year	1.3 per cent	1.0 per cent	1.6 per cent
Chance of three wastewater overflows on your property each year	0.01 per cent	0.03 per cent	0.01 per cent
Time taken to unblock pipes so you can use your toilets, sinks and other drains	2 hours	3 hours	1 hour
The cost to you			
The permanent change in the amount you pay for wastewater services each year	No Change	You pay an extra $2	You save $5
Your choice			
If these were the only three options available to you, which option would you choose?	○	○	○

Source: The CIE, 2021, Customer willingness to pay: water and wastewater system performance, Appendix.

In May and June 2021, 674 households and 62 businesses participated in an online survey about water continuity, water pressure and rebates. Participants selected their preferred cost-service level point across 4,416 choice sets and 736 contingent valuation questions. Further, 617 households and 73 businesses participated in an online survey about wastewater overflows. Participants selected their preferred cost-service level point across 4,140 choice sets.

The large number of responses enables us to estimate the value to customers of very small changes in performance in the service level attribute we are seeking to influence, as well as any associated attributes that may be impacted by those actions. We are able to use these values as the 'benefit' in cost-benefit analysis of performance improvement or relaxation options.

A report summarising the method, results and findings from the research is available at www.thecie.com.au/hunter-water-wtp. The website provides a link to an appendix that provides further details, including the sample characteristics, statistical models and questionnaires used in the research.

Lower Hunter households told us:

- Unplanned interruptions are about 70% worse than planned interruptions
- Long interruptions are about twice as bad as short interruptions
- They value avoiding wastewater overflows more highly than they value avoiding water supply interruptions
- The time taken to unblock a wastewater pipe is important to customers
- Their willingness to pay for service improvement is lower than the compensation they would require for an equivalent service degradation
- Altruistic willingness to pay to improve other people's low water pressure is higher for those frequently rather than occasionally affected

3. COST-BENEFIT ANALYSIS

Water supply interruptions, wastewater overflows and water pressure failures impose economic costs on customers, since they are inconvenient, disruptive and may impose health and safety risks. Expenditure by Hunter Water on its networks can reduce the risk of these events occurring, but is an economic cost itself that will ultimately be borne by customers.

The cost-benefit analysis seeks to solve the question of whether customers would prefer those standards to be changed, taking account of the impact that would have on costs.

Cost and service outcomes were forecast over 25 years. In each case, the option of maintaining the current service level involved forecasts of additional expenditure over time, due to degradation of existing infrastructure and increasing property density.

3.1. Water continuity

3.1.1. Performance drivers

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.

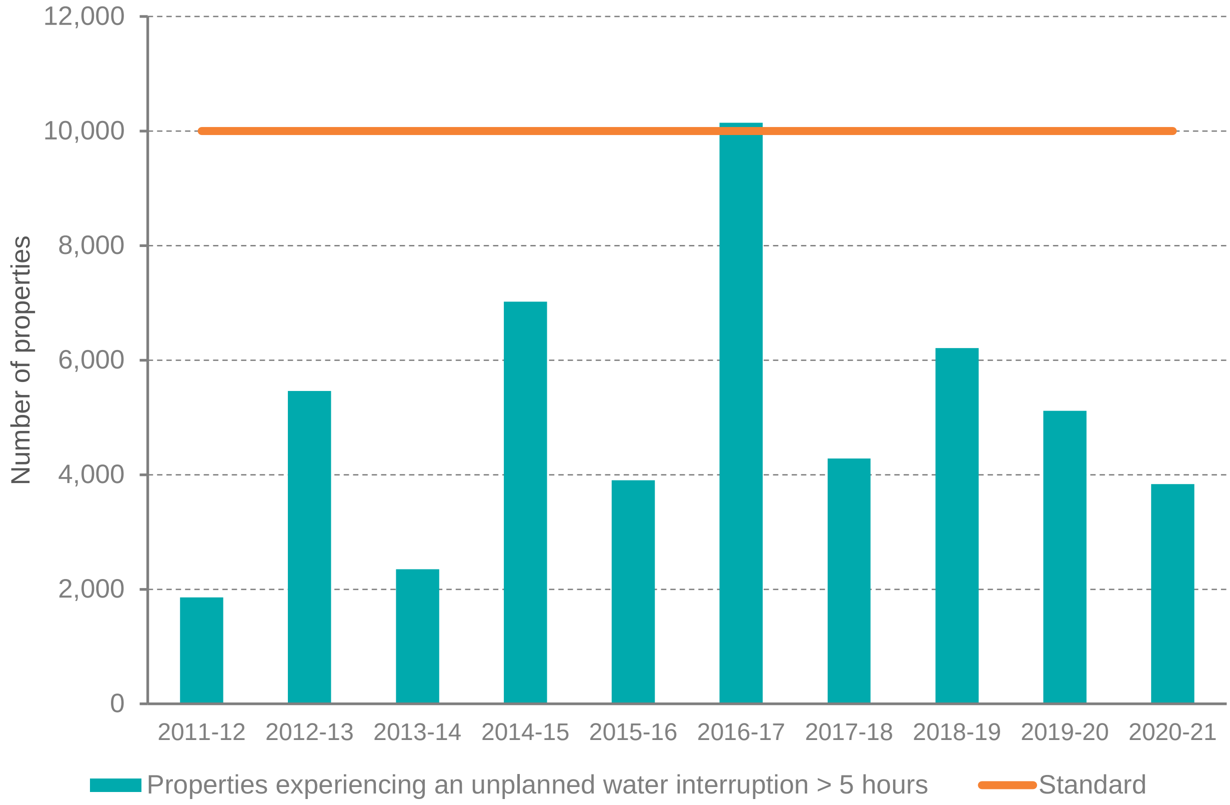
Alternative supply

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.

3.1.2. Historic performance

Hunter Water's Operating Licence sets a water continuity standard that requires no more than 10,000 properties each year be affected by an unplanned water interruption that lasts more than five continuous hours. We generally perform well against this standard but actual performance each year is highly variable (see Figure 2.5).

Figure 3.1 Historic performance against water continuity standard for long unplanned water interruptions



Source: Hunter Water.

3.1.3. Performance projections

The water continuity cost benefit analysis considers renewal of reticulation water mains as the primary performance lever available to Hunter Water to influence the number of properties affected by long, unplanned water interruptions.

Renewal of trunk water mains also affects performance against the water continuity standard in the operating licence but it is difficult to model the cost-service level trade-off in a CBA. Trunk main bursts and major leaks occur less frequently than reticulation failures but can occur without warning. The number of properties experiencing an unplanned interruption due to pipe failure is also more variable and can have a large impact on compliance.

As an example, there were only three trunk main failures in 2015-16 however these interrupted 2,072 customers (691 customers per trunk main failure). In comparison, there were 28 trunk main failures in 2017-18, affecting 374 customers (13 customers per trunk main failure). This variation is driven by a range of factors, such as:

- Single or dual feed arrangement, such as the ability to supply water from a second trunk main, which may source water from an alternative water zone
- Ability to isolate the failure quickly and as close as possible to the failure, which is influenced by valve spacing and operability.

As another example, in 2016-17 Hunter Water exceeded the licence standard requiring it to ensure that no more than 10,000 properties experience an unplanned water interruption that lasts more than five continuous hours, with a count of 10,144 properties (see Figure 2.5). The main contributor to the exceedance of the water continuity licence standard was a trunk main break in western Lake Macquarie in February 2017 impacting more than 5,000 properties. This event occurred over a weekend in a remote area of the network, and took some time to locate, isolate and repair. The severity of this Myuna Bay event was in large part due to the time it took to identify the failure and then locate the site of the failure. The first warning was a reservoir low level alarm as the system drained. As no public report of the main failure had been made, the burst location had to be located through inspection. This took some time as the area is relatively sparsely populated and the main is located away from the road near a wetland.

Hunter Water has since improved how it identifies and respond to events in similar circumstances, however such an event is unlikely to be well captured in a CBA of various performance standard thresholds.

Installing and operating 'intelligent network' technology has potential to reduce the duration of unplanned interruptions, by facilitating rapid isolation of the failure (trunk main break) location. As an example, flow meters and remotely controlled automated valves could potentially be used to isolate a failure and prevent a water storage reservoir from draining. This action may reduce the number of properties experiencing an interruption and/or reduce its duration.

As such technology is still emerging, it was not considered sufficiently proven for inclusion in the CBA for a performance standard that, if exceeded, may incur penalties ranging from a letter of reprimand; fine of up to $150,000; or cancellation of the operating licence (albeit unlikely under most circumstances). Hunter Water intends to consider intelligent network technology options as a means to efficiently comply with the water continuity standard within the operating licence period 2022-2027.

Several reticulation water mains renewal strategies are being assessed in the cost benefit analysis. We use the Pipeline Asset and Risk Management System (PARMS) software package to inform this work.

PARMS is a software suite developed by CSIRO in conjunction with Water Services Association of Australia (WSAA) and its members specifically to assist in the management of structural failures within water supply reticulation networks, including investment scenario analysis.

The analysis included the development of pipe deterioration models, descriptive and synthetic analysis of failures and renewals, and forward projections. The foundation is a series of deterioration curves specific to Hunter Water's water main cohorts, developed via statistical analysis of historical failure records and corresponding pipe attributes including length, material, age, diameter, soil type, static pressure and prior failure history.

The pipe burst rate varies across the supply area, with pipes in some areas deteriorating more rapidly than their age would suggest. Certain pipe materials and vintages are associated with high failure rates.[5] Cast iron pipes constitute the majority of the network and in turn generate the most failures. Pipes in clayey soils also tend to have higher failure rates. The variation in pipe failures across the system is partially explained by the distribution of soil types and different pipe materials that are vulnerable to soil expansion/contraction, however it is thought that other factors like pressure transients, soil corrosivity and surface loading may also be important.

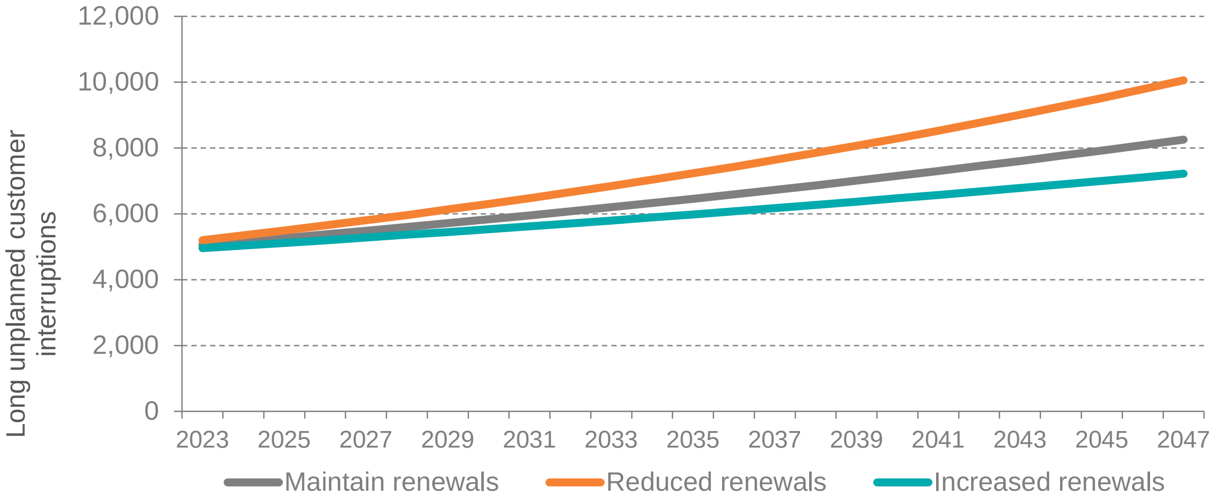
The base case for the analysis is a continuation of the current level of investment in renewals. This is forecast to result in increasing numbers of properties experience one of more unplanned interruptions over time, in absolute terms, as shown in Figure 3.2. This occurs due to aged-related deterioration of existing reticulation pipes and increasing property density over time. The increase in the number of interruptions over time is greater for the option will lower renewals expenditure and more moderate for the option with higher renewals expenditure.

Changes in the amount of investment in reticulation renewals also affects the number of properties experiencing planned water interruptions (see Figure 3.3). This occurs due to the need to isolate existing sections of water main to connect in the renewed section.

It is important to note that actual performance will vary more than shown in Figure 3.2 and Figure 3.3, due to factors such as weather and trunk main failures whereby a few breaks could impact a large number of properties.

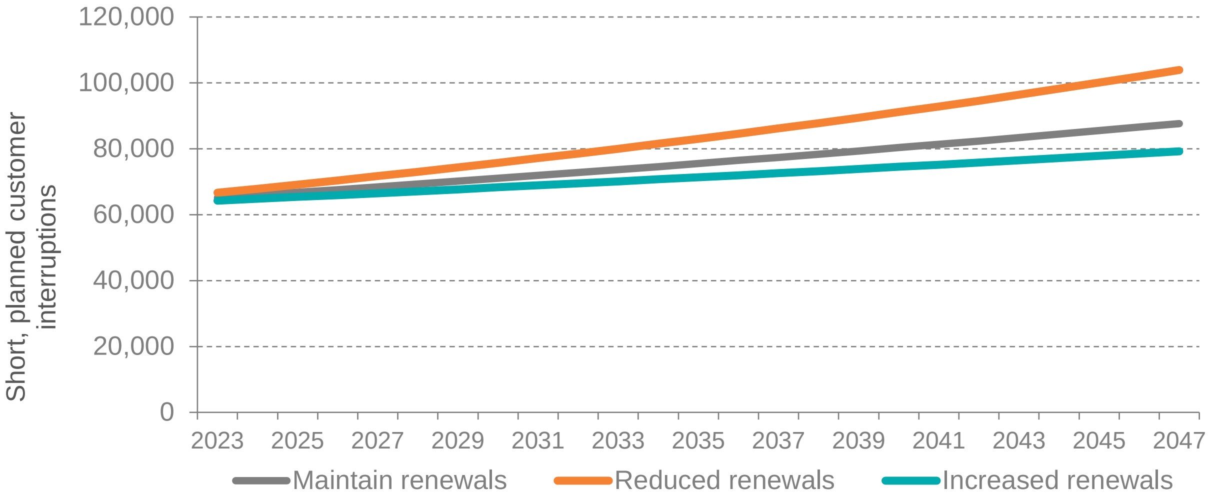
[5] In order of failure rate, problematic pipe cohorts include PVC-U laid prior to 1979, asbestos cement (AC) laid prior to 1955, cast iron (CI) 1933-1965, CI 1966-1972, CI laid prior to 1933, mild steel cement lined (MSCL) laid prior to 1955, ductile iron (DI) laid prior to 1978 and CI laid on or after 1973.

Figure 3.2 Forecast performance against water continuity standard over time



Source: The CIE, 2021, Cost-benefit analysis: system performance standards, Final report, prepared for Hunter Water.

Figure 3.3 Forecast increase in short, planned water interruptions associated with changes in water reticulation renewals investment



Source: The CIE, 2021, Cost-benefit analysis: system performance standards, Final report, prepared for Hunter Water.

In each of the options, the level of capital expenditure remains fixed in real terms over the forecast period Operating expenditure is higher for the options with lower capital expenditure due to the additional reactive work required to address the increased number of bursts and leaks that occur when we do fewer renewals. The cost of water losses due to bursts and leaks was also incorporated into the analysis, based on an estimate of the long-run marginal cost.

3.1.4. Results and recommendation

The present value of net benefits is calculated by subtracting the stream of future costs from the stream of future benefits, and discounting those values to adjust for the time value of money. Present values were calculated using a discount rate of 7 per cent in accordance with NSW Treasury guidelines. A positive present value of net benefits represents an increase in well-being from a societal perspective and a negative value represents a decrease in societal well-being.

The present value of net benefits for water continuity performance options is shown in Table 3.1. The full analysis is provided in Appendix 2.

The 'reduced renewals' option is the most economically efficient option. It results in large cost savings in the medium term from reducing expenditure on renewals but takes time for service performance to deteriorate. By 2038, the costs of water interruptions are forecast to exceed cost savings from reduced renewals.

Table 3.1 ***Net benefits of water continuity options relative to the base case of maintaining current water reticulation mains renewals expenditure***

	PV cost	PV benefit	PV net benefit
	$m	$m	$m
Reduced reticulation renewals	-28.6 (i.e. saving)	-16.0 (i.e. disbenefit)	12.6
Increased reticulation renewals	44.0	3.9	-40.1

Source: The CIE, 2021, Cost-benefit analysis: system performance standards, Final report, prepared for Hunter Water, p. 20.

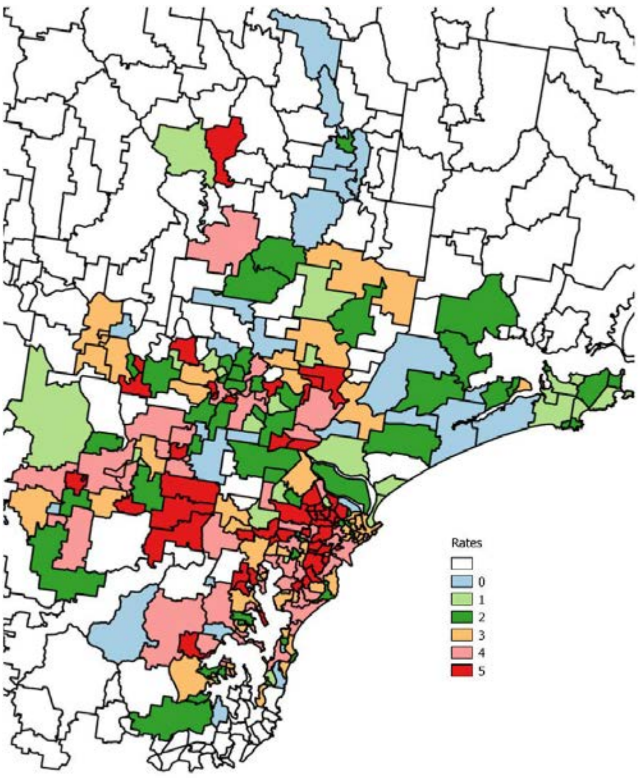
This result is robust to sensitivity testing however, there are several other factors to consider:

- unmodelled factors can, and do, materially affect performance
- the increased likelihood of supply interruptions is likely to fall on those customers who already face the highest risk of interruptions, which may be inequitable.

In sections 3.1.1 and 3.1.3, we noted that trunk water main bursts and leaks occur less frequently than reticulation failures but can occur without warning. The number of properties experiencing an unplanned interruption due to pipe failure is also more variable and can have a large impact on compliance. Hunter Water's 2016-17 non-compliance with the standard for long, unplanned water interruptions was predominantly due to a trunk main failure. The CBA also does not take into account factors beyond our control, such as the weather. This makes it difficult to model exact service outcomes.

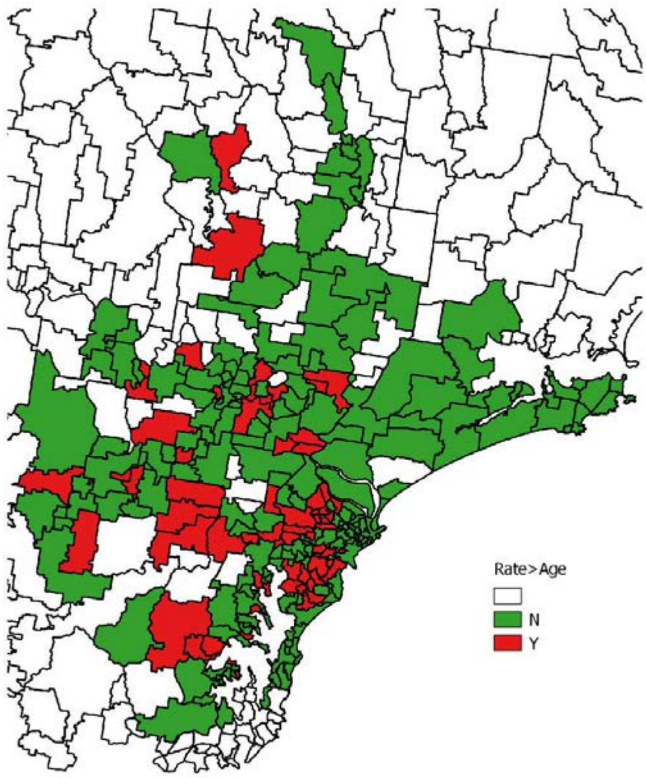
In section 3.1.3, we observed that pipe burst rates vary across the network. Figure 3.4 plots the historic failure rate in terms of its percentiles across the supply area. In this plot, dark red is the top 20 percentile-band (80-100) designated as rating 5, light red, the next 20 percentile-band (60-80) designated as rating 4, and so on. That is, dark red areas have had the highest structural failure rates and green and blue areas have had the lowest. Pipes in some parts of the supply area have been deteriorating more rapidly than would be expected for their age (see red areas in Figure 3.5), due to a range of factors. Our reticulation renewals program does prioritise the poorer performing areas, however the prevalence of problematic pipe material and soil combinations mean that the uneven distribution of interruptions may continue for some time, even under the base case.

Figure 3.4 Historic water reticulation main failure rates



Source: WISER Analysis, 2018, Investment planning for water reticulation pipes in Hunter Water, p. 16.

Figure 3.5 Parts of the network with water reticulation main failure rates that are higher than predicted by pipe age



Source: WISER Analysis, 2018, Investment planning for water reticulation pipes in Hunter Water, p. 17.

We note that IPART's recent discussion paper on its regulatory approach observed, *"In proposing targets for service outcomes, [water businesses should include] protections for individual customers, so that increases in efficiency do not come at the cost of a reduction in service to individual 'pockets' of customers"*.[6]

Given the difficulty of forecasting trunk main and location-specific network failures, we recommend, on balance, retaining the current performance standard and level of service in our next Operating Licence:

> *Hunter Water must ensure that in a financial year no more than 10,000 properties experience an unplanned water interruption that lasts more than 5 continuous hours.*

We welcome further discussions with IPART and stakeholders on alternative framing of the standard that meets the same intent, including rolling averages or normalising per 1,000 properties.

[6] IPART, 2021, Encouraging innovation in the water sector, Discussion paper, Water, p. 53.

3.2. Water pressure

3.2.1. Performance drivers

Low water pressure affects our customers in different ways. Some customers may only experience pressure below 20m on a small number of occasions for short periods of time during the summer months. Others will experience low pressure on numerous occasions for long periods of time during summer. Others are more severely impacted and experience it continuously during summer, and some all year round under all demand conditions.

In some cases, low pressure customers are clustered within a local supply area. This means that the whole supply area could experience low pressure during peak day demand, and this can become worse with growth.

Hunter Water's customer base continues to grow, and a minimum level of investment is needed to augment the capacity of the water network as growth occurs. We could achieve this in two ways:

- Invest to provide a continuous water supply to new development, and ensure that water pressure for existing customers does not deteriorate below 20 metres due to the additional demand. This scenario is akin to retaining the current licence limit and taking action to ensure that the limit is not exceeded.
- Invest the minimum to provide a continuous water supply to new development, such as ensuring that storage reservoirs do not run out of water but defer specific investments to ensure that water pressure for existing customers does not deteriorate below 20 metres due to the additional demand. This scenario is akin to removing the licence limit. The number of low pressure customers would increase and the non-compliance limit would be reached by approximately 2026.

We are aware that there are also small clusters of properties receiving frequent low water pressure. We intend to proactively consider customer outcomes and accountability for rectifying 'hot spots' receiving the worst service levels as part of our next pricing proposal rather than as a licence requirement.

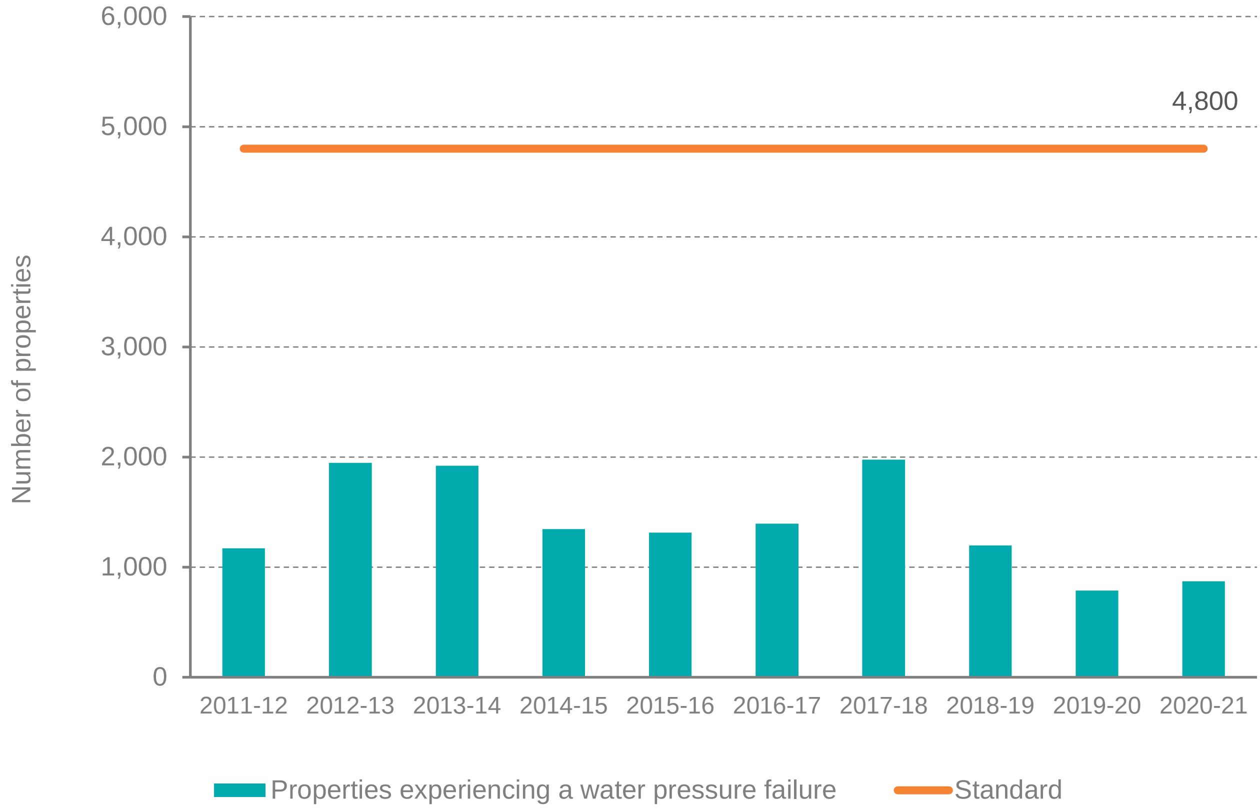
3.2.2. Historic performance

Hunter Water's Operating Licence sets a water pressure standard that requires no more than 4,800 properties each year be affected by low water pressure less than 20 metres (for a continuous 30 minute period during normal operation of the water network).

Hunter Water uses a theoretical customer demand scenario called peak day demand to assess system performance and design system capacity to facilitate growth. Peak day demand is a design scenario representing the highest total daily water demand that could occur each year, based on theoretical customer water demand.

Under theoretical peak demand, about 2,000 customers out of approximately 263,300 customers could experience low water pressure. The actual highest demand day in any given year will differ from the design peak day demand, generally due to climate impacts, such as drier or wetter than average years, and customer behaviour (See Figure 2.6).

Figure 3.6 Historic performance against water pressure standard



Source: Hunter Water.

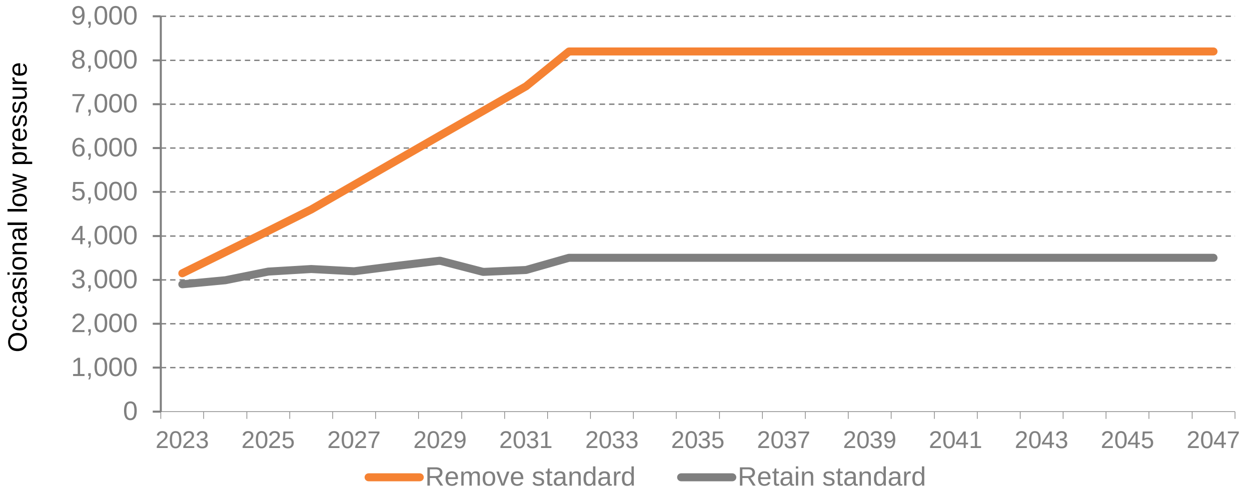
3.2.3. Performance projections

Hunter Water's customer base continues to grow, and a minimum level of investment is needed to augment the capacity of the water network as growth occurs. We could achieve this in two ways:

- Invest to provide a continuous water supply to new development, and ensure that water pressure for existing customers does not deteriorate below 20 metres due to the additional demand. This scenario is akin to retaining the current licence limit and taking action to ensure that the limit is not exceeded.
- Invest the minimum to provide a continuous water supply to new development, such as ensuring that storage reservoirs do not run out of water but defer specific investments to ensure that water pressure for existing customers does not deteriorate below 20 metres due to the additional demand. This scenario is akin to removing the licence limit. The number of low pressure customers would increase and the non-compliance limit would be reached by approximately 2026.

Performance for the base case and alternative performance option are as shown in Figure 3.5.

Figure 3.7 Forecast performance over time with and without the water pressure standard



Source: The CIE, 2021, Cost-benefit analysis: system performance standards, Final report, prepared for Hunter Water.

3.2.4. Results and recommendation

The present value of net benefits for water pressure performance options is shown in Table 3.2. The full analysis is provided in Appendix 2.

The 'retain standard' water pressure option results in a small net benefit to the community relative to a baseline without spending on water pressure. However, the result is sensitive to several key assumptions. The most economically efficient option is therefore uncertain.

Table 3.2 Net benefit of retaining the water pressure standard relative to the base case of removing the standard

	PV cost	PV benefit	PV net benefit
	$m	$m	$m
Remove standard	0	0	0
Retain standard	8.4	9.2	0.8

Source: The CIE, 2021, Cost-benefit analysis: system performance standards, Final report, prepared for Hunter Water, p. 23.

In section 3.2.1, we noted that the actual water pressure received by customers varies based on a range of factors, including weather-based actual water demand, geographic and topographic factors. Removing the standard may result in equity impacts whereby customers receiving lower pressure may experience worsening service.

We note that IPART's recent discussion paper on its regulatory approach observes, "In proposing targets for service outcomes, [water businesses should include] protections for individual customers, so that increases in efficiency do not come at the cost of a reduction in service to individual 'pockets' of customers".[7]

Given the net benefit of the retain option, combined with possible distributional impacts, we recommend, o retaining the current performance standard and level of service in our next Operating Licence:

[7] IPART, 2021, Encouraging innovation in the water sector, Discussion paper, Water, p. 53.

Hunter Water must ensure that no more than 4,800 properties experience a water pressure failure (< 20m head for ≥ 30 mins) in a financial year.

We welcome further discussions with IPART and stakeholders on alternative framing of the standard that meets the same intent (e.g. rolling averages or normalising per 1,000 properties).

3.3. Wastewater overflows

3.3.1. Performance drivers

Many factors influence the number of dry weather wastewater overflows from wastewater systems (see Table 2.3). In our cost benefit analysis we have considered changes in the amount of lining of wastewater pipes to prevent breaks and preventative jetting to remove obstructions (chokes) that we do. As for water continuity, we have modelled the deterioration of wastewater mains throughout our network based on materials, age and performance.

Table 3.3 Levers influencing uncontrolled dry weather wastewater overflow performance

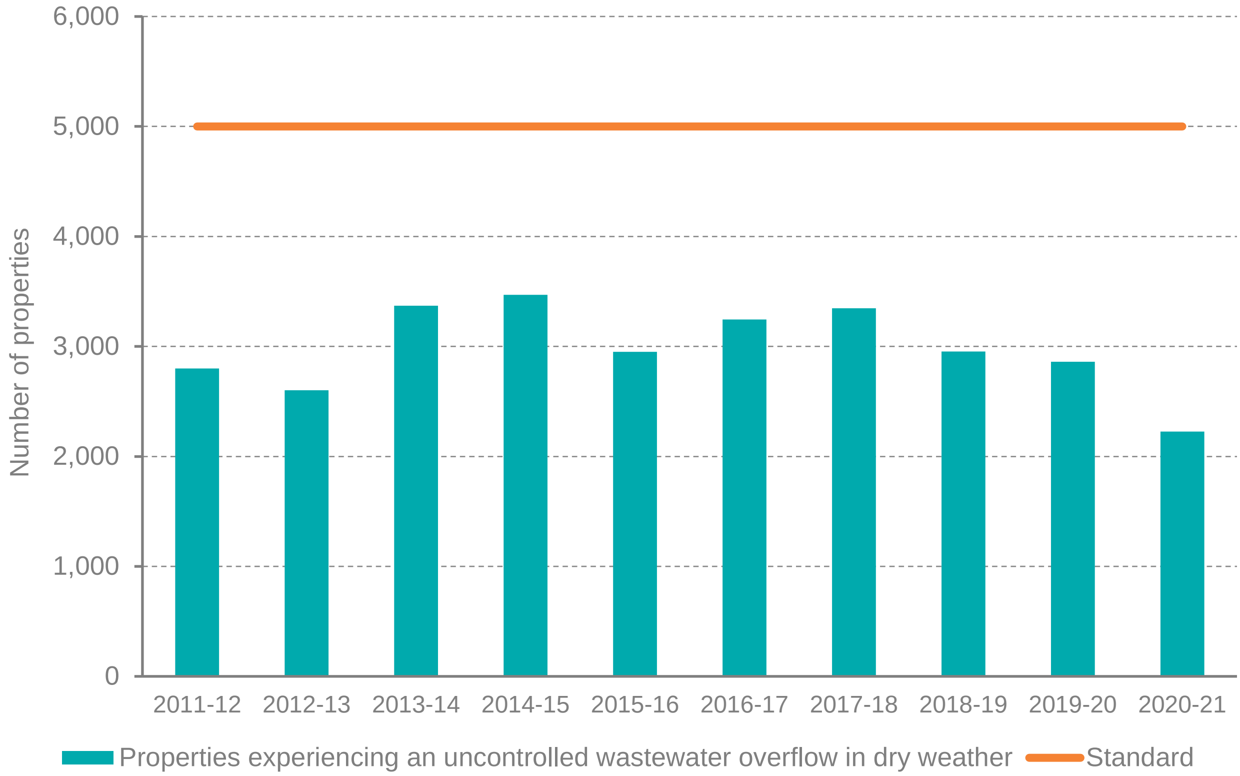
Levers available to water businesses	External factors
Infrastructure upgrades eg, lining/replacements/rehabilitations/renewals	Soil types
Triggers for CCTV inspection [or CCTV (to check for obstructions) then jetting (to remove obstruction) then CCTV (to check pipe condition)]	Climate, rainfall and season (eg, dry weather encourages root intrusion into mains; self-clearing of partial obstructions during wet weather; changing weather conditions and soil moisture levels cracking pipes).
Dedicated crew(s) with jetting truck	Number/frequency of obstructions
	Types of obstructions (eg, solids, rags, pipe pieces, congealed grease/fats, root, broken seals, wet wipes, gravel/debris)
	Non-compliant household plumbing (eg, . inadequate differential height between gully and floor waste; gully lid covered).

Source: Hunter Water.

3.3.2. Historic performance

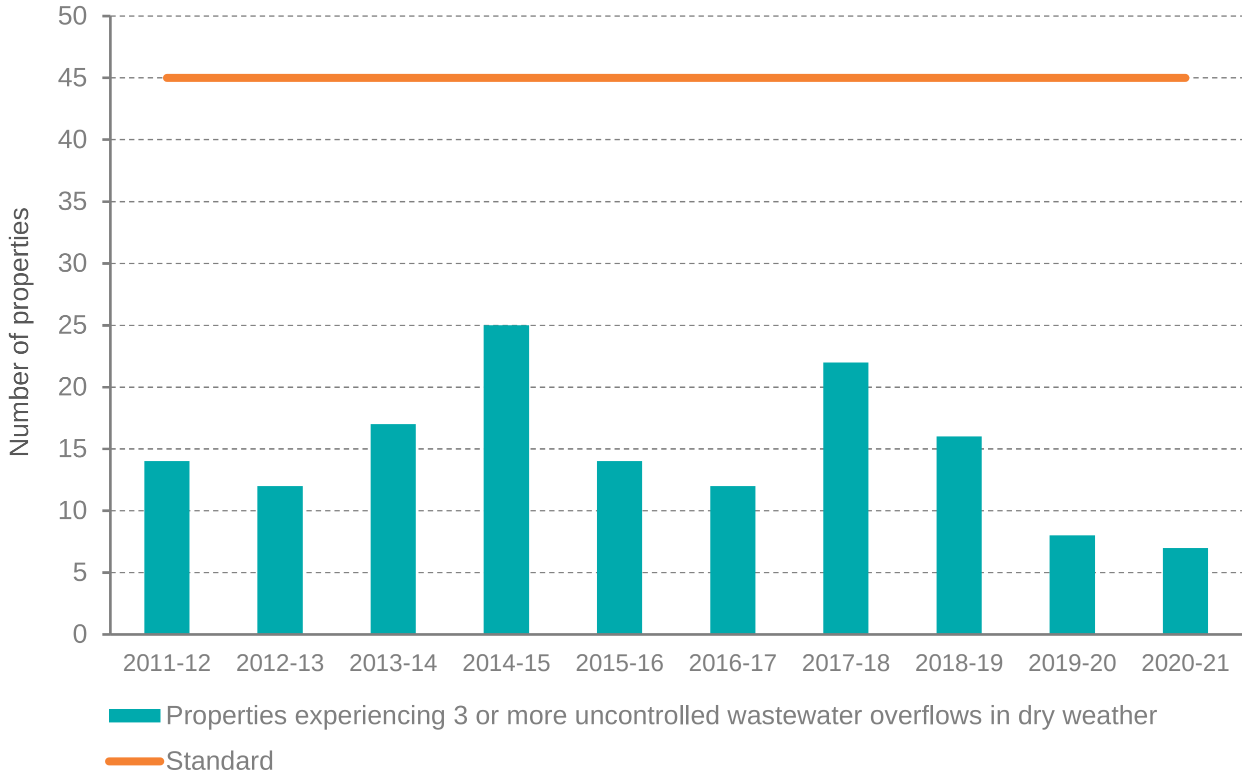
Hunter Water's Operating Licence sets a limits on the number of properties that can be impacted by one or multiple uncontrolled wastewater overflows in dry weather. We are currently complying with both parts of the wastewater overflow standard (see Figure 2.7 and Figure 2.8). Uncontrolled wastewater overflows in wet weather are regulated by the NSW Environment Protection Authority.

Figure 3.8 Historic performance against wastewater overflow standard (at least one overflow)



Source: Hunter Water.

Figure 3.9 Historic performance against wastewater overflow standard (three or more overflows)



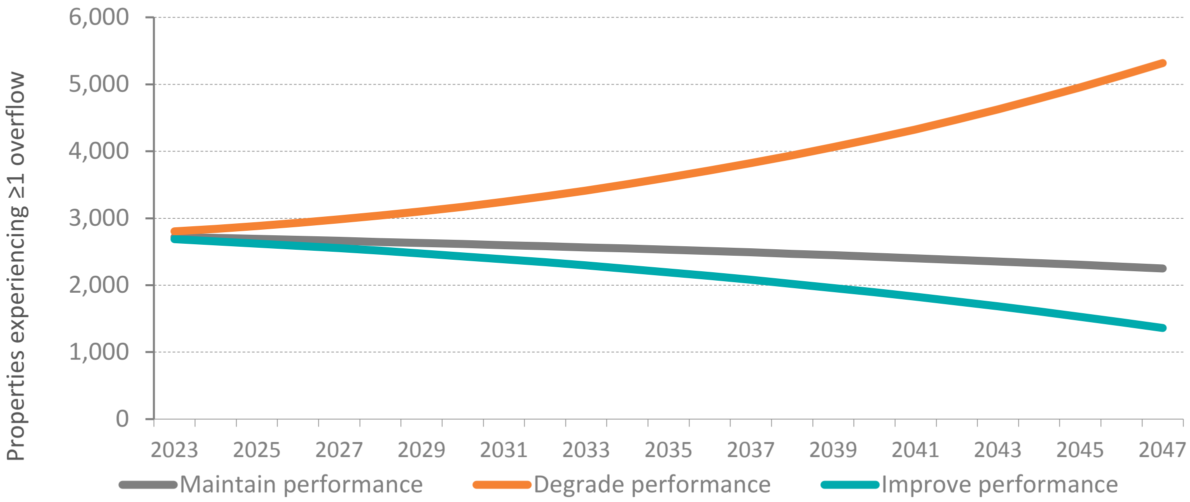
Source: Hunter Water.

3.3.3. Performance projections

In our cost-benefit analysis we have considered changes in the amount of lining of wastewater pipes to prevent breaks and preventative jetting to remove obstructions (chokes) that we do. Our base case involves maintaining our current performance, which costs more over time, as wastewater mains deteriorate with age.

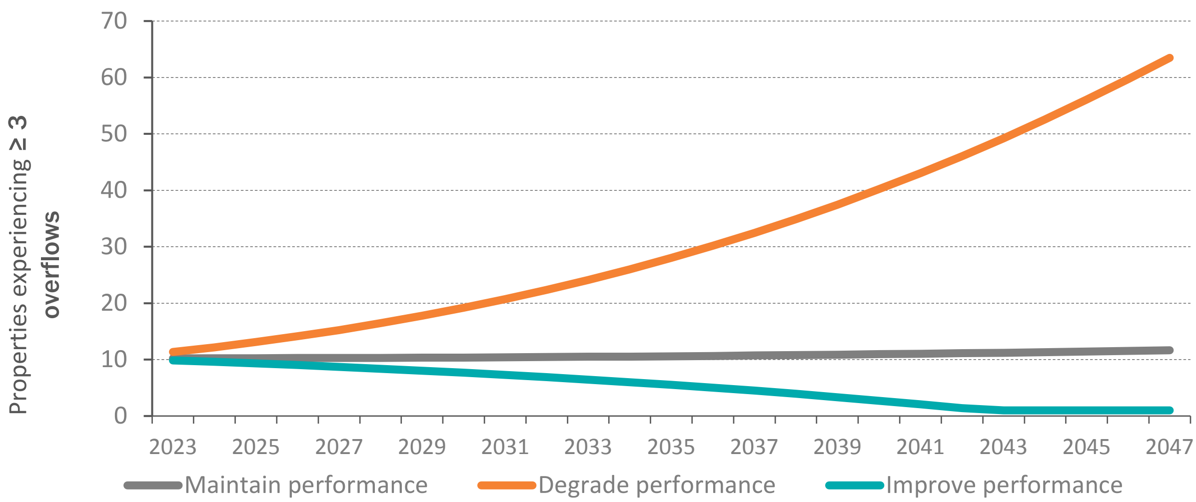
Performance for the base case and alternative performance options are as shown in Figure 3.8 and Figure 3.9. The differences in the number of overflows experienced by customers across the options grow wider over time. The improvement option results in a smaller change in performance than the options of allowing performance to degrade.

Figure 3.10 Forecast performance against wastewater overflows standard for one or more overflows over time



Source: The CIE, 2021, Cost-benefit analysis: system performance standards, Final report, prepared for Hunter Water.

Figure 3.11 Forecast performance against wastewater overflows standard for three or more overflows over time



3.3.4. Results and recommendation

The present value of net benefits for dry weather uncontrolled wastewater overflow performance options is shown in Table 3.4. The full analysis is provided in Appendix 2.

The 'retain standard' water pressure option results in a small net benefit to the community relative to a baseline without spending on water pressure. However, the result is sensitive to several key assumptions. The most economically efficient option is therefore uncertain.

The 'maintain performance' option is the most economically efficient of the wastewater overflow options considered in the cost-benefit analysis. Both the improvement and degradation wastewater options are forecast to result in a net cost relative to the 'maintain performance' option. The improvement option results in slightly better service, but the cost involved exceeds customer willingness to pay for the improvement. This result is robust to sensitivity testing.

Table 3.4 Net benefits of wastewater overflow options relative to the base case of maintain current performance

	PV cost	PV benefit	PV net benefit
	$m	$m	$m
Reduced performance	34.7	-77.6	-112.3
Improved performance	6.9	2.2	-4.7

Source: The CIE, 2021, Cost-benefit analysis: system performance standards, Final report, prepared for Hunter Water, p. 26.

We recommend retaining the current performance standards and levels of service in our next Operating Licence:

Hunter Water must ensure that in a financial year no more than 5,000 properties (other than public properties) experience an uncontrolled wastewater overflow in dry weather.

Hunter Water must ensure that in a financial year no more than 45 properties (other than public properties) experience 3 or more uncontrolled wastewater overflows in dry weather.

We welcome further discussions with IPART and stakeholders on alternative framing of the standard that meets the same intent, including rolling averages or normalising per 1,000 properties.

APPENDIX 1 RESPONSES TO IPART QUESTIONS

System performance standards for service interruptions

IPART sought comments:

4. Do you have any comments on retaining the existing system performance standards but revise the levels of service specified in the Licence? Should the level of service be set at an optimal level that reflects customers' willingness to pay for higher levels of performance?

Over the last 18 months we have engaged with over 2,000 people and around 70 businesses over two phases of customer engagement to obtain a contemporary understanding of customer, consumer and community views on service levels.

In our phase one customer engagement, we sought feedback on:

- Service level attributes that Hunter Water's customers consider important, resulting in a prioritised list of 30 attributes.
- Any perceived gaps between the relative importance and current level of satisfaction in relation to service level outcomes and attributes.

We have distilled the priority attributes into candidates for operating licence system performance standards using the criteria described in section 1.1.2. Through this process we confirmed that it is appropriate to retain the existing system performance standard categories - water continuity, water pressure and uncontrolled dry weather wastewater overflows.

We propose retaining four of the five standards. We recommend retiring the water continuity standard relating to multiple short unplanned drinking water supply interruptions. In the absence of a licence performance standard, we would achieve the same outcomes by basing our decisions on the cost of repair compared with the cost of replacement.

In our phase two customer engagement, we sought to quantify the economic benefits of changes in service performance. We used stated preference surveys to estimate each customer's maximum WTP (or minimum willingness to accept (WTA) compensation) for the specified change in service. As this is a specific type of customer engagement, we used expert consultants, The Centre for International Economics, to undertake the cost-benefit analysis on each standard, incorporating the willingness to pay work and expenditure impacts of maintaining, improving or degrading service levels.

The cost-benefit analysis seeks to answer the question of whether customers would prefer standards to be changed, taking account of the impact that would have on costs. For wastewater overflows and water continuity, we considered one option that would be expected to result in improved performance and one reduced performance. For water pressure, we considered the options of retaining or removing the current standard, representing maintained performance and reduced performance respectively.

The 'maintain performance' option is the most economically efficient of the wastewater overflow options. Both the improved and reduced wastewater performance options are forecast to result in a net cost relative to the 'maintain performance' option. The improvement option results in slightly better service, but the cost involved exceeds customer willingness to pay for the improvement.

The 'retain standard' water pressure option results in a small net benefit to the community relative to a baseline without spending on water pressure. However, the result is sensitive to several key assumptions. The most economically efficient option is therefore uncertain.

The 'reduce performance' option is the most economically efficient of the water continuity options considered in the cost-benefit analysis from a community perspective. However, this may mask the incidence of repeat problems in parts of the water system. That is, the increased likelihood of supply interruptions is likely to fall on those customers who already face the highest risk of interruptions.

We have also considered the equity impacts of changes to performance. For both water continuity and water pressure, reduced expenditure may mask the incidence of repeat problems in parts of the water system. That is, the increased likelihood of supply interruptions is likely to fall on those customers who already face the highest risk of interruptions. Similarly, the increased risk of receiving low water pressure is likely to fall on those customers who are already experiencing pressures near our minimum standard of 20m. Moreover, our customers have told us that maintaining water pressure and water continuity are amongst their top priorities and expectations of us.

On balance, we propose retaining the current level of service (thresholds) for all four system performance standards in our next Operating Licence.

Whilst optimization is conceptually sound, we are cautious that many assumptions and modelling simplifications may result in spuriously accurate thresholds that do not reflect real world conditions yet expose us to potentially-severe enforcement actions. Some examples include:

- The extent to which external factors outside our control, including weather, impact performance
- Discontinuities in the factors that we can influence, such as the changes in labour levels or crews that may only be achievable in integers
- Asymmetry customer willingness to pay and willingness to accept values around the status quo
- Dynamic changes in customer preferences and available technologies that change the cost-benefit analysis intra-period

The risk of unintended consequences due to interactions between regulatory requirements (e.g. tension between a water interruptions standard and efficient leakage management).

IPART sought comments:

5. Are there other standards that the Licence should include to hold Hunter Water to account for the levels of service it provides to the community?

As we learnt in our 2020 customer engagement, there are other aspects of our services that are highly valued by customers. Licensing is a rigid construct, which may not be the best way to hold us to account for delivering service outcomes that customers' value. Hunter Water prefers performance standards for a small sub-set of customer outcomes related to interruptions to the provision of our water services and wastewater services to be set in our operating licence as minimum standards. We agree with IPART's proposal in Discussion Paper 3 of its review of how it regulates water businesses that all other service levels and customer outcomes, are best addressed through pricing processes.

APPENDIX 2 COST-BENEFIT ANALYSIS

The full report on the cost-benefit analysis of system performance standards for Hunter Water, by The Centre for International Economics, is provided on the next page.

FINAL REPORT

Cost-benefit analysis

System performance standards

Prepared for
Hunter Water

19 October 2021

THE CENTRE FOR INTERNATIONAL ECONOMICS
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BOXES, CHARTS AND TABLES

1 Introduction

The problem

Water supply interruptions, wastewater overflows and water pressure failures impose economic costs on customers, since they are inconvenient, disruptive and may impose health and safety risks. Expenditure by Hunter Water on its networks can reduce the risk of these events occurring, but is an economic cost itself that will ultimately be borne by customers.

The levels of service with regard to water continuity, wastewater overflows and water pressure are regulated by the Independent Pricing and Regulatory Tribunal (IPART) via the system performance standards in Hunter Water's operating licence. The problem being addressed by this analysis is the question of whether customers would prefer those standards to be changed, taking account of the impact that would have on costs.

Approach

This report sets out the cost-benefit analysis (CBA) of several water and wastewater network management options with a view to identifying potential improvements in the system performance standards from a community standpoint. It follows standard practice in economic cost-benefit analysis by:

- articulating the problem;
- establishing a base case;
- developing the options;
- quantifying the changes for each option relative to the base case;
- placing monetary values on the changes;
- calculating the present value of net benefits;
- undertaking sensitivity analysis; and
- drawing conclusions.

The options and the cost and service level forecasts associated with each option were developed by Hunter Water. The approach to developing the options took account of the limited available timeframe by focussing on a few options. The CIE has used these options as inputs but has not conducted an engineering review of the forecast impacts of each option.

The values placed on changes in service levels have been drawn primarily from the CIE's September 2021 report for Hunter Water on customer willingness to pay.

2 The baseline and alternative options

Water continuity

The water continuity options considered in the CBA are:

- Maintaining reticulation mains renewals (baseline)
- Increasing reticulation mains renewals, and
- Decreasing reticulation mains renewals.

The CBA considers renewal of reticulation water mains as the primary performance lever available to Hunter Water to influence the number of properties affected by long, unplanned water interruptions.

Renewal of trunk water mains also affects performance against the water continuity standard in the operating licence but it is difficult to model the effect of investment on performance. Trunk main bursts and major leaks occur less frequently than reticulation failures but can occur without warning. The number of properties experiencing an unplanned interruption due to pipe failure is also more variable.

As an example, there were only three trunk main failures in 2015-16 however these interrupted 2 072 customers (691 customers per trunk main failure). In comparison, there were 28 trunk main failures in 2017-18, affecting 374 customers (13 customers per trunk main failure). This variation is driven by a range of factors, such as:

- Single or dual feed arrangement, such as the ability to supply water from a second trunk main, which may source water from an alternative water zone
- Ability to isolate the failure quickly and as close as possible to the failure, which is influenced by valve spacing and operability.

As another example, in 2016-17, Hunter Water exceeded the licence standard requiring it to ensure that no more than 10,000 properties experience an unplanned water interruption that lasts more than five continuous hours, with a count of 10,144 properties. The main contributor to the exceedance of the water continuity licence standard was a trunk main break in western Lake Macquarie in February 2017 impacting more than 5,000 properties. This event occurred over a weekend in a remote area of the network, and took some time to locate, isolate and repair. The severity of this Myuna Bay event was in large part due to the time it took to identify the failure and then locate the site of the failure. The first warning was a reservoir low level alarm as the system drained. As no public report of the main failure had been made, the burst location had to be located through inspection. This took some time as the area is relatively sparsely populated and the main is located away from the road near a wetland. Hunter Water has since improved how it identifies and respond to events in similar circumstances, however such an event is unlikely to be well captured in a deterministic forecast.

Installing and operating ‘intelligent network’ technology has potential to reduce the duration of unplanned interruptions, by facilitating rapid isolation of the failure (trunk main break) location. As an example, flow meters and remotely controlled automated valves could potentially be used to isolate a failure and prevent a water storage reservoir from draining. This action may reduce the number of properties experiencing an interruption and/or reduce its duration. As such technology is still emerging, it was not considered sufficiently proven for inclusion in the CBA.

All options use:

- Expansion of the water network at a rate of 0.55 percent per annum, which is the 10-year average annual change in National Performance Report indicator A2 length of water mains.
- Escalation in the number of properties interrupted over time, prior to application of intervention levers, based on a small non-weather-related annual increase factor to account for property density increasing over time at a rate of 0.77 per cent, which is the 10-year average annual change in National Performance Report indicator A3 number of properties served per km of water main. This assumption has the effect of increasing the number of properties affected by each break or leak.
- Forecasts of total water main failures, which were pro-rated to provide additional granularity for performance and cost estimates based on the 4-year average annual ratio of water bursts and leaks (31 per cent burst and 69 per cent leaks).

Capital and operating costs were calculated as follows:

- Unit reactive cost of water main breaks per job based on the 4-year average actual expenditure and length from 2016-17 to 2019-20.
- Unit reactive cost of water main leaks per job based on the 4-year average actual expenditure and length from 2016-17 to 2019-20.
- Capital expenditure to maintain performance of around $6 million ($2018) over the long term based on PARMS analysis (described below) and one moderate incremental change in investment bracketing the maintain performance estimate.

In 2018, Hunter Water assessed the performance implications of various reticulation pipe renewal investment strategies over a planning horizon of 25 years using the Pipeline Asset and Risk Management System (PARMS) software package.

PARMS is a software suite developed by CSIRO in conjunction with Water Services Association of Australia (WSAA) and its members specifically to assist in the management of structural failures within water supply reticulation networks, including investment scenario analysis.

The analysis included the development of pipe deterioration models, descriptive and synthetic analysis of failures and renewals, and forward projections. The foundation is a series of deterioration curves specific to Hunter Water’s water main cohorts, developed via statistical analysis of historical failure records and corresponding pipe attributes including length, material, age, diameter, soil type, static pressure and prior failure history.

The pipe burst rate varies across the network, with pipes in some suburbs deteriorating more rapidly than their age would suggest. Certain pipe materials and vintages are associated with high failure rates. Cast iron pipes constitute the majority of the network and in turn generate the most failures. Pipes in clayey soils also tend to have higher failure rates. The variation in pipe failures across the system is partially explained by the distribution of soil types combines with pipe materials that are vulnerable to soil expansion/contraction, however it is thought that other factors like pressure transients, soil corrosivity and surface loading may also be important.

PARMS modelling of alternative renewal strategies provides forecasts of average annual failure rates (per 100km of water main) and customer interruptions per customer (due to pipe failure, followed by isolation to enable repair) after 25 years assuming a constant number of connected properties and a long-term average annual expenditure level (e.g. $6m pa). For the purpose of this CBA, it was assumed that the improvement or deterioration in reticulation water main failure rate was spread linearly over the 25 years. The water main failure rate was used to forecast the total number of water main bursts and leaks across the entire length of water main in the network, then to drill down to projections of each of bursts and leaks. The number of properties experiencing a long unplanned interruption (> 5 hours) was imputed by taking 20 per cent of the total number of water main bursts and leaks (historic average proportion), multiplying it by the PARMS forecast customer interruptions per customer after 25 years (spread linearly to derive an annual forecast) and multiplying the result by the forecast number of properties served.

Changes in the amount of investment in reticulation renewals also affects the number of properties experiencing planned water interruptions. This occurs due to the need to isolate existing sections of water main to connect in the renewed section. The forecast number of properties experiencing a planned water interruption was derived based on the five-year average number of properties experiencing a planned water interruption due to renewals (2015-16 to 2019-20) and a pro-rata increase or decrease based on the incremental difference in renewals capital expenditure.

Wastewater overflows

The wastewater CBA considers three options, which are mutually exclusive:

- Maintaining performance (baseline)
- Improving performance, and
- Degrading performance.

All three options use:

- Forecasts of sewer main breaks and chokes, and property connection breaks and chokes to impute the number of properties affected by dry weather wastewater overflows and reactive job costs.
- Escalation over time, prior to application of intervention levers, based on a small non-weather-related annual increase factor to account for:

- Expansion of the wastewater network at a rate of 1.23 per cent per annum, which is the 10-year average annual change in National Performance Report indicator A5 *length of sewer mains and channels*
- Property density increasing over time at a rate of 0.16 per cent per annum, which is the 10-year average annual change in National Performance Report indicator A6 *number of properties served per km of sewer main*. This assumption has the effect of increasing the number of properties affected by each choke or break.
- An observed increase in sewer breaks over time of 1.5 additional breaks per year.

- Changes in the number (length) of sewer mains renewed (lined) and changes in the amount of preventative jetting of sewer mains to pre-emptively remove blockages as levers to change the number of sewer main breaks and chokes.
- Changes in interventions occur in 2021-22.

Capital and operating costs were calculated as follows:

- Unit cost of sewer lining was based on the 4-year average actual expenditure and length from 2016-17 to 2019-20.
- Unit costs to sewer main chokes, property connection chokes (shafts/branches) and repair sewer main breaks was based on the 2-year average actual expenditure from 2019-20 and 2020-21.
- The cost of CCTV inspections was converted to a cost per overflow by dividing the 2-year average actual expenditure from 2019-20 and 2020-21 by the number of properties affected by at least two dry weather overflows. This reflects Hunter Water's practice of triggering a CCTV inspection of the sewer main after the second overflow in any 12-month period, to check the structural condition of the pipe and the present of tree roots.

Baseline: Maintain current performance by increasing sewer lining and proportionately increasing preventative jetting

The theoretically optimal rate of sewer lining (from a lifecycle cost minimisation perspective) was determined by fitting a Weibull deterioration modelled to historic data on sewer main materials, age, performance and lining work.[1] The model is based on individual pipe segments, which were converted to a length using the average segment length of 36.3 metres. The deterioration model suggests a 6 per cent per year increase in sewer segments lined.

Performance was tested at half of this increased rate (3 per cent per annum) and a proportionate increase in preventative jetting. This yielded a slight improvement in properties affected by dry weather wastewater overflows each year, with the number of properties affected by multiple overflows roughly holding constant over time.

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1 The deterioration model was fit to past lining work then used to estimate (extrapolate) the renewal/lining rate (lengths) that minimise the sum of reactive and proactive expenditure based on similar pipe cohorts (e.g. materials, age). It assumes the past practice is the best/most appropriate decision at a pipe level; this is transferable to a system wide lowest life-cycle cost model; and, age is the only factor that is changing.

To expand on the method for deriving performance:

- Each additional section (line) of main cleaned by preventative jetting was assumed to reduce sewer chokes by 0.25 chokes. This reflects the midpoint of Hunter Water's observed reduction of 0.1 to 0.4 chokes per line cleaned when cleaning 800-1000 lines per year.
- The number of additional breaks and chokes (relative to the escalation described above for all scenarios) was increased in proportion to the length of pipes that the Weibull model suggested *should be lined but were not lined in the scenario*. These pipes were assumed to have a condition ratio of 0.65, with 20 per cent collapsing (breaking) in the first year and the remainder collapsing in an even spread across the subsequent 15 years. It was assumed that these additional breaks would be more complex to repair, therefore 25 per cent more expensive. Chokes were assumed to increase by the cumulative number of pipes that the Weibull model suggested *should be lined but were not lined in the scenario* at a rate of 0.3 chokes per year per pipe. This is the observed average repeat choke rate.
- The number of properties affected by at least one dry weather wastewater overflow was derived using a linear correlation between total breaks and chokes (main and property connection) based on 5 years of data. The correlation was quite strong, with an R-squared of 0.96. The number of properties affected by at least two, and at least three, dry weather wastewater overflows was derived using a linear correlation with sewer main chokes. The correlation over 5 years is quite weak but it is the best method based on available data.

S1: Improve performance by increasing sewer lining to theoretical engineering optimal and proportionately increasing preventative jetting

This option adopts the 6 per cent increase in sewer segments lined annually that was estimated by the deterioration model discussed above. A 6 per cent per year increase in preventative jetting was also applied.

S2: Allow performance to deteriorate by sewer lining at current rate and ceasing preventative jetting

In this scenario it is assumed that sewer lining continues at the average annual rate derived from five years of data from 2015-16 to 2019-20. The number of additional breaks and chokes (relative to the escalation described above for all scenarios) was increased in proportion to the length of pipes that the Weibull model suggested *should be lined but were not lined in the scenario*, as described in the baseline, as were the number of chokes. Cessation of preventative jetting results in an escalation in the number of chokes as described at the start of this section.

Water pressure

Two water pressure options were developed:

- A baseline scenario in which Hunter Water does not undertake any expenditure to limit the number of properties experiencing low water pressure other than the expenditure required by other drivers which incidentally affects water pressure, and
- A 'keeping headroom' scenario in which Hunter Water undertakes additional expenditure to limit the number of properties experiencing water pressure failures to 3500 per year.

The 'keeping headroom' option involves investment in mains augmentations and pump station upgrades that prevent customer growth in the network, such as the connection of new greenfield developments, from reducing water pressure for existing customers below 20 metres of head. These investments include:

- Newcastle
  - Stage 1 C/D Design (Newcastle-North Lambton-Highfields WD Upgrade)
  - Pit Street WPS Upgrade
  - 235m 150mm Macquarie Street trenchless connection
  - 49m 100mm cross connections in Morgan Street
  - 765m 250mm Llewellyn St Merewether
  - Stage 2 - Concept Design Lookout WD Works
- South Wallsend
  - Design of South Wallsend System
  - Rundle Ave Wallsend - 85m 100mm
  - Ganney St Wallsend - 200m 100mm
  - Creek Rd Maryland - 320m 150mm
  - Hardes Ave Maryland - 60m 100mm
  - Green Point augmentation - 310m 150mm & 100m 100mm
  - Myall Rd Cardiff - 620m 150mm
- Port Stephens LTP WTP - additional pump
- Morisset/Wyee
  - Concept Design of Morriset/Wyee
  - 400m 150mm main on Martinsville Rd to Matthews Valley Rd
  - 890m 150mm along Beach Rd from Silverwater Rd to Lake Rd
  - 40m 200mm from 375 main in Fishery Pt Rd to Mirrabooka Res
  - 60m 200mm between Morisset No 2 Res and the new Morisset Booster
  - 110m 250mm along Awaba St from 600 main on Moira Pk Rd to Park St
  - 40m 100mm Dalley Street
  - PRV adjacent to Wyee WPS
  - 620m 150mm along Babers Rd from Freemans Dr

Unplanned water interruptions were considered as a service outcome that could differ under the two options. On one hand, increasing water pressure may lead to more mains bursts. On the other hand, improving water pressure can involve the provision of additional reservoirs, which help to avoid unplanned interruptions resulting from peak demand. In this analysis, it has been assumed that these two effects will cancel each other out, leaving the risk of unplanned water supply interruptions unchanged.

The costs of additional water usage caused by higher water pressure were also considered. Research shows the relationship between pressure and consumption depends on many factors.[2] The increase in water usage resulting from improved water pressure for properties currently experiencing *frequent* pressure failures is estimated by Hunter Water at 8 kL per property per year, assuming a 20 per cent increase in outdoor usage and that outdoor usage is 18.8 per cent of total usage. The properties impacted by the options being considered in the CBA are experiencing only occasional pressure failures. The pressure increase in the 'keep headroom' option would be lower than the pressure increase assumed in the derivation of the 8 kL estimate. Our central case assumption is that this impact is approximately zero. An alternative assumption is considered in the sensitivity analysis.

2 Tuhovcak, L., T.Suchacek, J.Ricka 2018. The Dependence of Water Consumption on the Pressure Condition and Sensitivity Analysis of the Input Parameter.

Janus, T., B. Ulanicki 2018. Pressure dependency of total demand in water distribution networks.

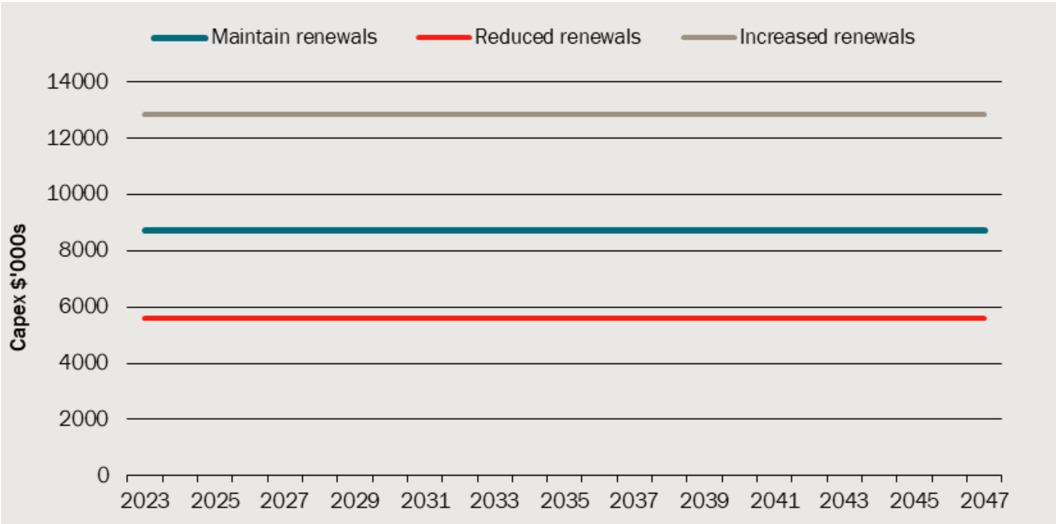
3 Changes under each option

The previous chapter described the options being considered in each CBA. This chapter sets out the forecasts of cost and service outcomes under each of those options.

Water continuity

The water continuity scenarios are defined by the level of capital expenditure, which remains fixed in real terms over the forecast period.

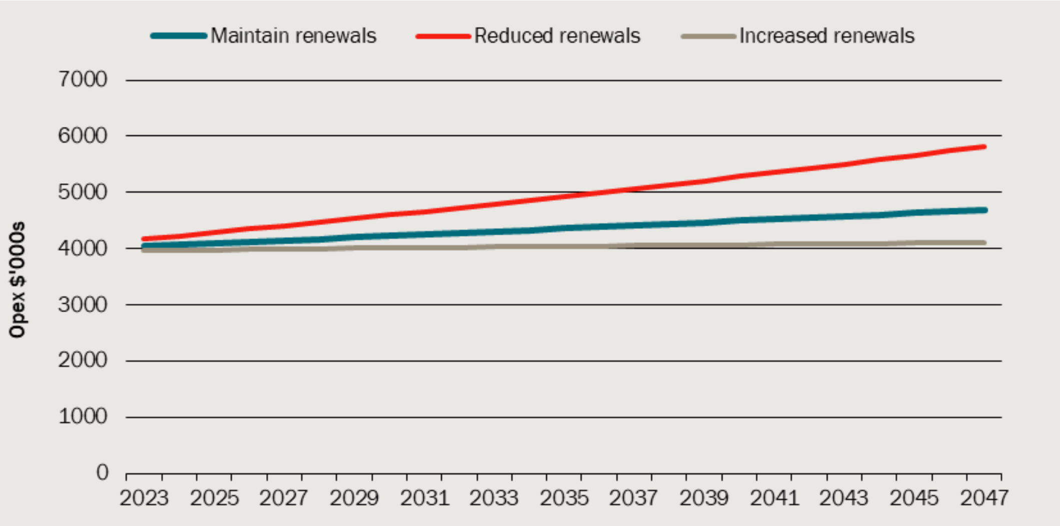
3.1 Capital expenditure under water continuity options



Data source: Hunter Water estimates

Operating expenditure is higher for the options with lower capital expenditure due to the additional reactive work required to address the increased number of bursts and leaks that occur when fewer renewals are being conducted.

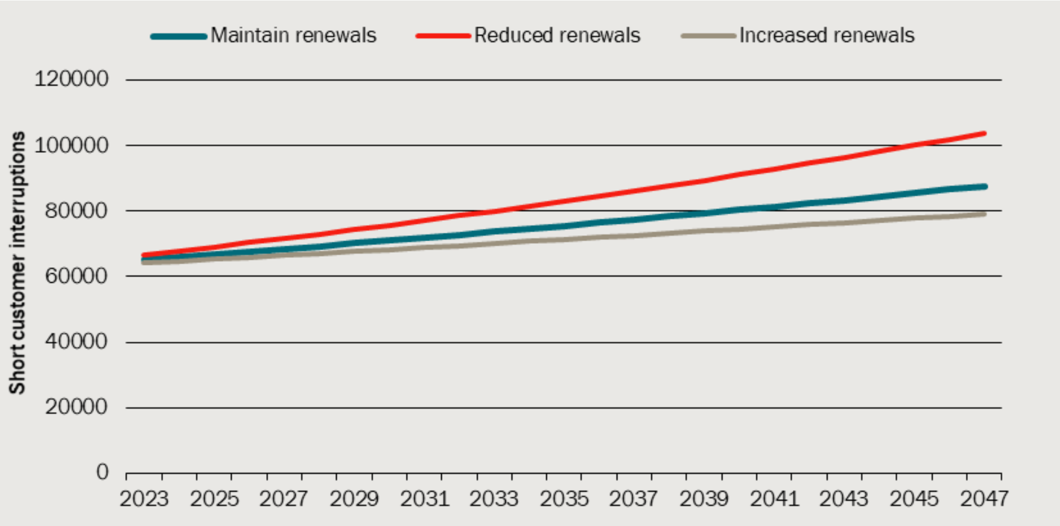
3.2 Operating expenditure under water continuity options



Data source: Hunter Water estimates

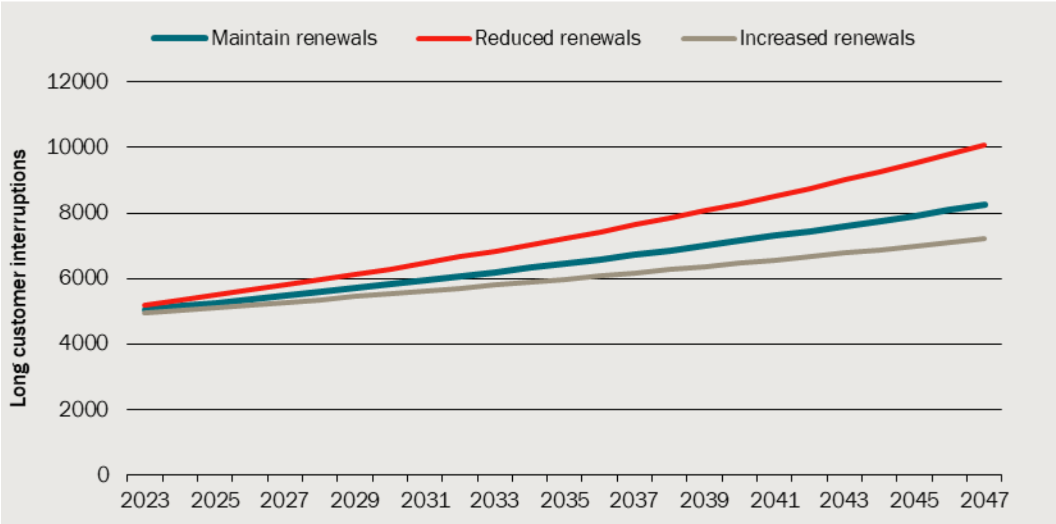
The number of interruptions increases over time under all of the options, due to increasing customer base and density, but the increase is greater for options with lower expenditure on renewals.

3.3 Short interruptions under water continuity options



Data source: Hunter Water estimates

3.4 Long interruptions under water continuity options



Data source: Hunter Water estimates

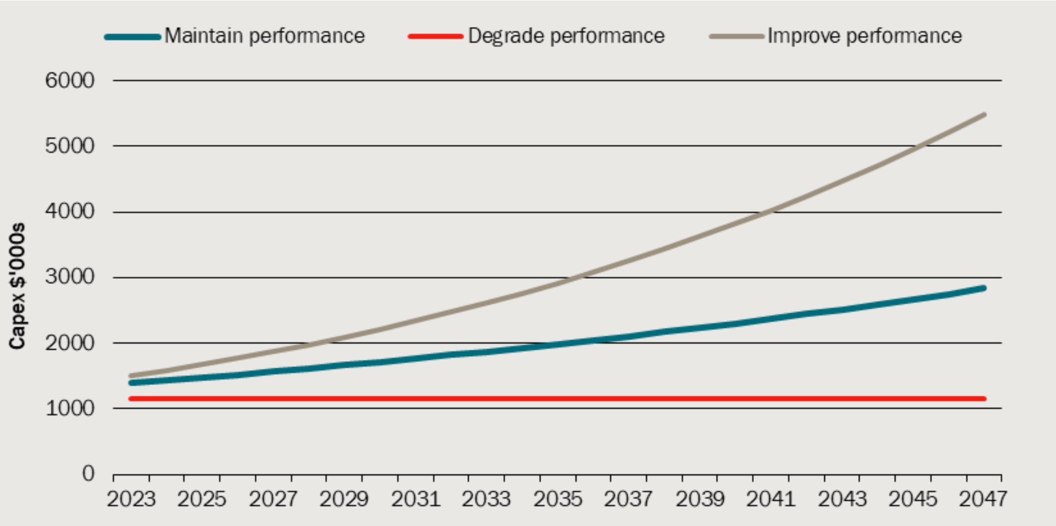
Planned interruptions increase with capital expenditure on renewals.

The CBA also considered the cost of water losses due to bursts and leaks. The volumes lost were assumed to be 670 kL per burst and 320 kL per leak, based on the observed average in the 12 months to 20 April 2020. The costs incurred due to lost water were assumed to be $2.72 per kL based on an indicative, order-of-magnitude estimate of long-run marginal cost (LRMC).

Wastewater overflows

The capital expenditure varies by definition across the three wastewater options. By the end of the 25-year horizon for analysis, the ‘improve performance’ option involves roughly double the annual capex required under the ‘maintain performance’ option, while the ‘degrade performance’ option is less than half of the annual capex required under the ‘maintain performance’ option.

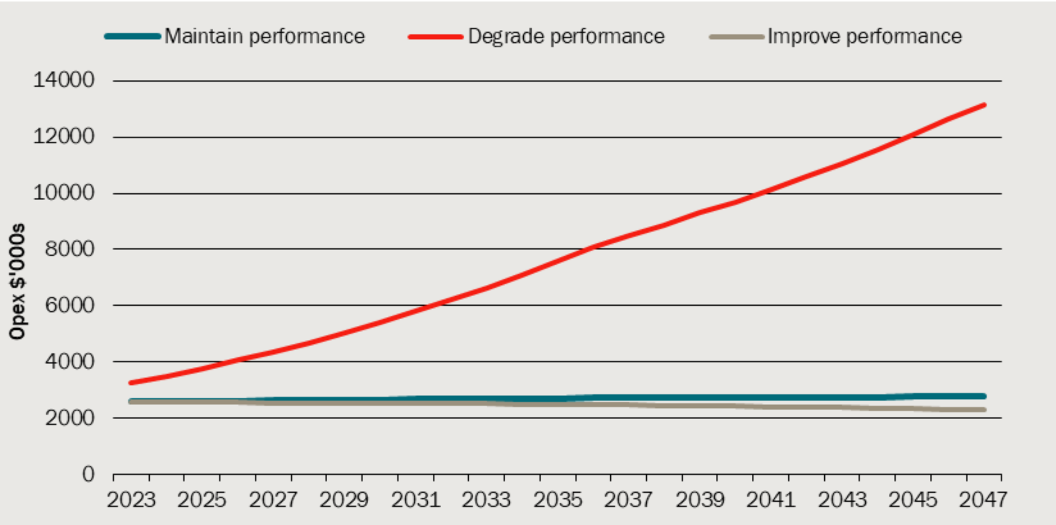
3.5 Capital expenditure under wastewater options



Data source: Hunter Water estimates

The 'improve performance' option involves a small net reduction in operating costs. While spending on preventative jetting increases, this is more than offset by reductions in reactive operating costs and spending on CCTV inspections after repeat overflows. The 'degrade performance' option involves are large increase in operating costs, driven largely by the costs of reacting to sewer main breaks occurring in sewers where relining would have been done in the base case. This increase is so large that the present value of total expenditure is higher under the 'degrade performance' option than under the base case.

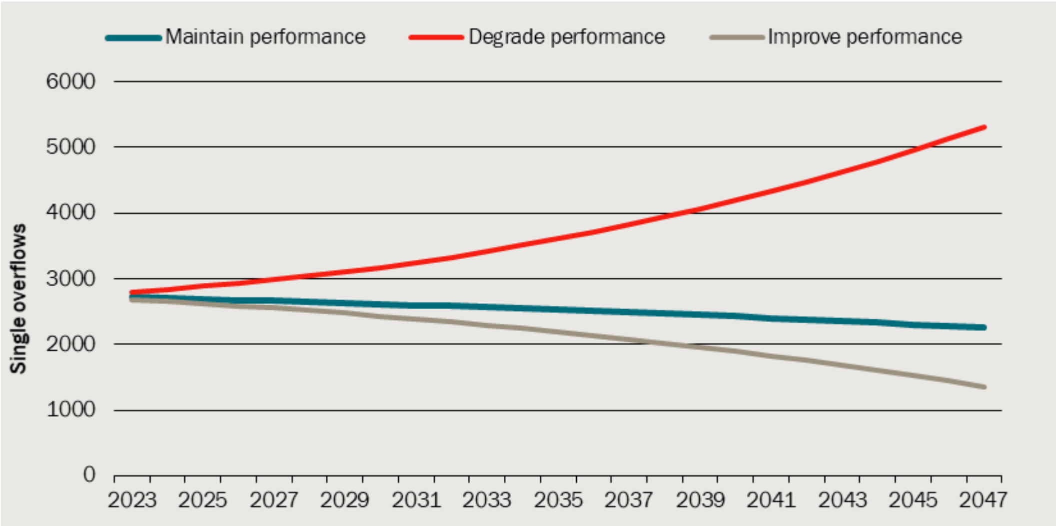
3.6 Operating expenditure under wastewater options



Data source: Hunter Water estimates

The differences in the number of overflows experienced by customers across the options grow wider over time. The improvement option results in a smaller change in performance than the degrade option. All of the options remain within the current licence limit for single overflows of 5000 properties up until 2045, when the 'degrade performance' option is forecast to breach the standard.

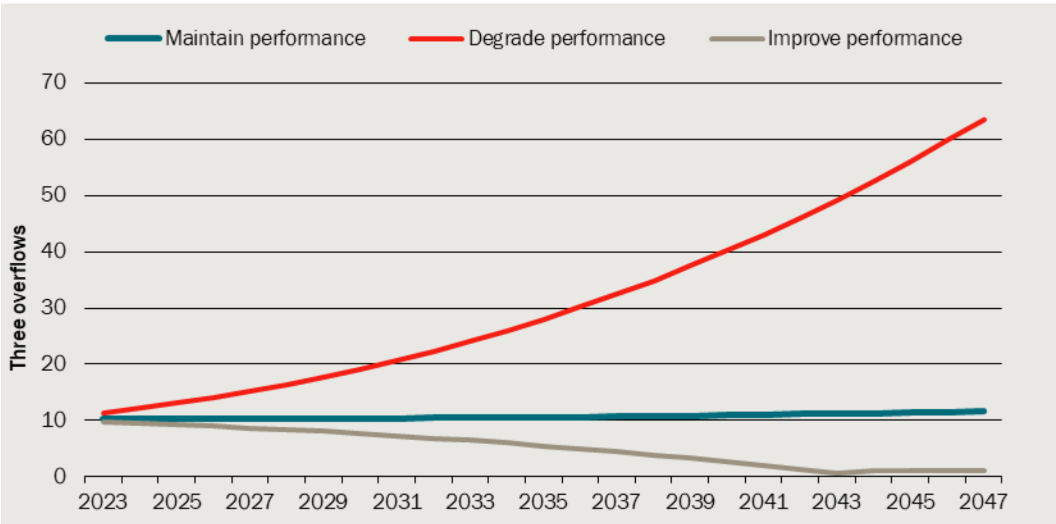
3.7 Properties experiencing a single overflow under wastewater options



Data source: Hunter Water estimates

The number of properties experiencing three overflows within a year is forecast to exceed the licence limit of 45 by 2042 under the 'degrade performance' option.

3.8 Properties experiencing three overflows under wastewater options



Data source: Hunter Water estimates

The number of overflows occurring on public land is assumed to be 590 in 2022/23 (the average observed over 2010-2018) and follow the same growth under each option as the single overflows discussed above. The WTP study conducted by Icon Water in 2016 showed that customers care about overflows happening on their street or in nearby public land.[3] The number of customers affected in this way per overflow on public land is

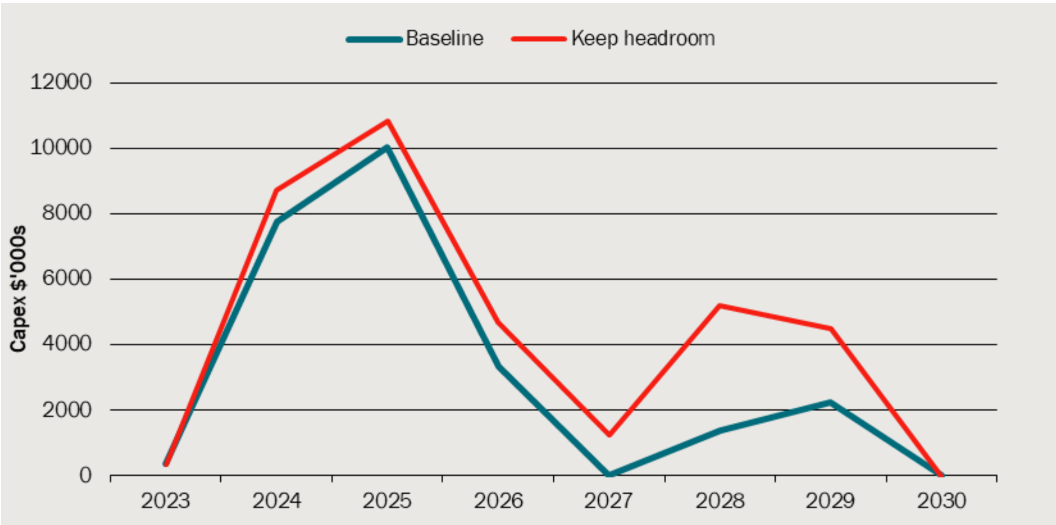
3 McNair, B. and Scarpa, R. 2016. Willingness to pay: Customer preferences for balancing cost with risks of water supply interruptions and sewer overflows. A report by Icon Water in partnership with University of Waikato.

uncertain. Our assumption for the central case is that five households are affected by each overflow on public land. Sensitivity to alternative assumptions is tested in chapter 6.

Water pressure

Forecast capital expenditure under the two water pressure options is shown in figure 3.9. The baseline option includes capital expenditure that has an effect on water pressure despite having drivers other than water pressure. The 'keep headroom' option includes additional capital expenditure to prevent connection growth from reducing water pressure to existing customers. It is assumed there is no difference in capital expenditure after 2030.

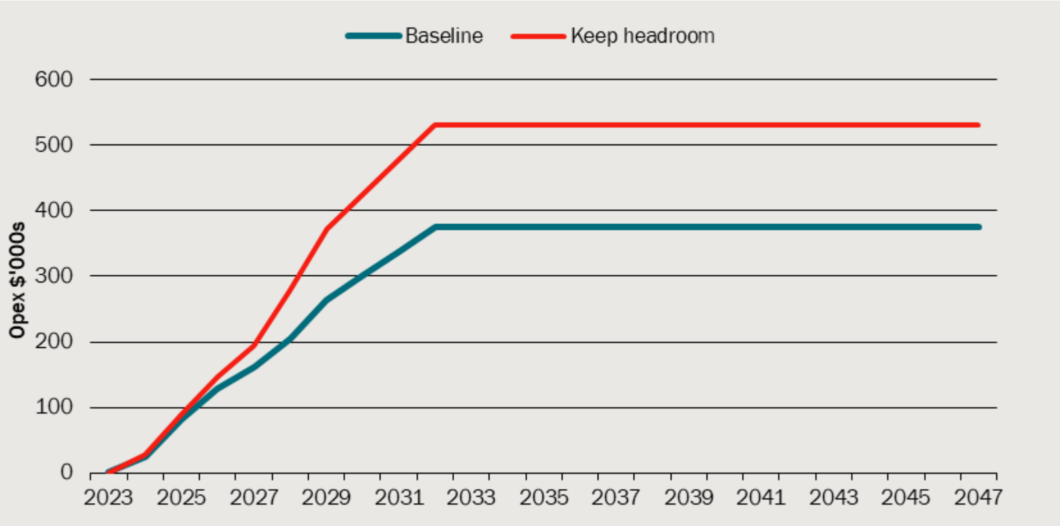
3.9 Capital expenditure under water pressure options



Data source: Hunter Water estimates

Operating expenditure increases linearly over 10 years to 1.5 per cent of cumulative capital expenditure, as shown in figure 3.10.

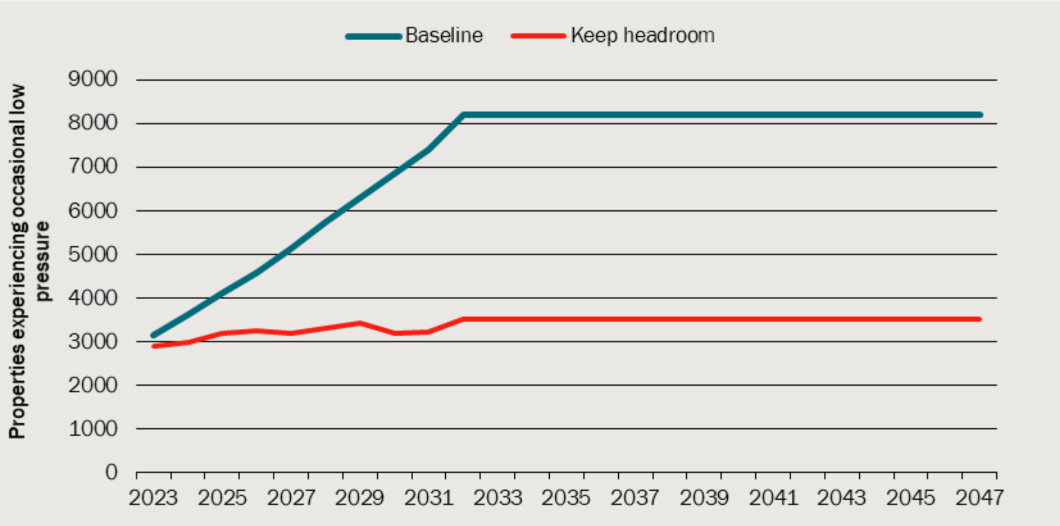
3.10 Operating expenditure under water pressure options



Data source: Hunter Water estimates

The number of properties experiencing frequent low water pressure was assumed to be constant at 301 properties under both options. These properties are in low pressure 'hot spots' that are not addressed under these options. The forecast number of properties experiencing occasional low water pressure under each option is shown in figure 3.11. In contrast to water continuity and wastewater overflow risks, which are distributed across the network, the parts of the network that would experience low water pressure under the baseline option are known in advance.

3.11 Properties experiencing occasional low water pressure under each option



Data source: Hunter Water estimates

4 Valuing the changes

The previous chapter set out forecasts of costs and service outcomes in each of the CBA options. This chapter describes the approach to measuring the differences in options in dollar terms.

Water continuity

Values for differences in the likelihood of residential customers experiencing water supply interruptions were taken from The CIE's September 2021 report to Hunter Water on customer WTP (see table 4.1). That study did not find statistically significant estimates of non-residential WTP due to insufficient sample size, however the study did find that an assumption that non-residential WTP is proportionate to bill size (relative to an average household bill) resulted in better model fit than an assumption that non-residential WTP is equal to household WTP. We therefore scale up non-residential WTP by the ratio of average non-residential to residential bills (5.13). Sensitivity analysis considers the alternative assumption that non-residential WTP is equal to household WTP.

4.1 Average willingness to pay for changes in interruption likelihood

	WTP	WTA
	$ p.a.	$ p.a.
Residential		
1 percentage point change in unplanned <5 hours	0.74	1.58
1 percentage point change in unplanned >5 hours	1.45	3.11
1 percentage point change in planned	0.44	0.93
Non-residential		
1 percentage point change in unplanned <5 hours	3.80	8.11
1 percentage point change in unplanned >5 hours	11.44	15.95
1 percentage point change in planned	2.26	4.77

Source: CIE

These values were aggregated over the whole customer base. The survey was conducted with an online panel and the drop-out rate was low at around 5 per cent. We note that some environmental valuation studies assume the drop-out rate represents a proportion of the population with zero WTP. These studies do not include options offering a reduction in cost. It is not clear what the equivalent assumption would be for WTA. The answer depends on whether the respondents dropped out because they are unaffected by changes in service performance, in which case WTA would be zero, or because they are extremely cost sensitive, in which case WTA would be infinite. It was assumed there would be no growth in real WTP over time.

The analysis also considers costs from the water losses that result from increased numbers of mains bursts and leaks. The long-run marginal cost of these losses, including the cost of bringing forward future supply augmentation, is in the order of $2.72 per kL. As there is significant uncertainty over this estimate, we consider an alternative assumption in the sensitivity analysis.

Wastewater overflows

Values for changes in the likelihood of customers experiencing wastewater overflows were estimated using the results of The CIE's choice modelling study conducted for Hunter Water in 2021. Estimates of WTP per household were taken directly from the study results. WTP per business was calculated by multiplying the household values by the ratio of the average non-residential water bill to the average residential water bill for the reasons described above in relation to water continuity.

The value for changes in the likelihood of overflows on public land was estimated at 36 per cent of the value for overflows on private property, based on the results of the WTP study conducted by Icon Water in 2016.[4]

4.2 Average willingness to pay for changes in overflow likelihood

	WTP	WTA
	$ p.a.	$ p.a.
Residential		
1 percentage point change in chance of one overflow	3.70	39.61
One tenth of a percentage point change in chance of two overflows	0.72	7.71
One hundredth of a percentage point change in chance of three overflows[a]	0.50	5.40
1 hour change in time to unblock	1.57	16.82
1 percentage point change in chance of an overflow on street or nearby public land	1.35	14.41
Non-residential		
1 percentage point change in chance of one overflow	19.00	203.20
One tenth of a percentage point change in chance of two overflows	3.70	39.56
One hundredth of a percentage point change in chance of three overflows[a]	2.57	27.70
1 hour change in time to unblock	15.50	133.8

[a] The baseline likelihood of a property experiencing 3 wastewater overflows in a year is around one hundredth of a percentage point.

Source: CIE

These values were aggregated over the whole customer base for the reasons discussed above in relation to water continuity.

4 McNair, B. and Scarpa, R. 2016. Willingness to pay: Customer preferences for balancing cost with risks of water supply interruptions and sewer overflows. A report by Icon Water in partnership with University of Waikato.

Water pressure

In contrast to water continuity and wastewater overflow risks, which are distributed across the network, the parts of the network that would experience low water pressure under the baseline option are known in advance. The valuation of the service change therefore has two components:

- affected customers' WTP to avoid occasional low water pressure, and
- unaffected customers' WTP, altruistically, to improve water pressure to affected customers.

The second component was estimated in the September 2021 WTP report by The CIE. Depending on how conservative an approach is used to estimate WTP from the responses to the contingent valuation question, average household WTP for a program fixing water pressure for 2500 properties that would otherwise experience occasional low pressure is either $2.17 or $4.67 per year for 10 years. We adopt the higher of these two figures in the central case. The methodology used to derive the lower figure was developed to counteract biases present in environmental valuation studies that are less problematic in utility customer valuation studies. The figures were converted to equivalent annual payments in perpetuity using the CBA discount rate.[5]

We assume business customers are not willing to pay to improve water pressure for other customers (with any shareholder altruistic WTP captured by the household WTP estimates).

The number of properties for which water pressure is fixed in the 'keep headroom' option relative to the baseline option is around 4700 beyond 2032. This is significantly higher than the 2500 asked about in the contingent valuation exercise. It is uncertain how much more customers would have been willing to pay for the larger program. Similarly, it is not certain how customers would value the number of properties fixed when the number is below 2500 in the years prior to 2027. Our assumption for the central case is that WTP increases linearly with number of properties fixed (WTP per property fixed is constant) up to the level estimated by the WTP study for 2500 properties, and WTP per property fixed is halved for properties in excess of 2500. We test sensitivity of results to this assumption.

There is no direct estimate of the first component from primary research in the Lower Hunter region. Research conducted by The CIE for Sydney Water in 2018 showed that the inconvenience of a one-hour water pressure failure is slightly lower than that of a long planned water supply interruption.[6] Given the inconvenience of a short planned interruption is also likely to be slightly lower than that of a long planned interruption, we use an estimate of WTP to avoid a short planned interruption from the September 2021 CIE WTP report as an approximation of WTP to avoid a water pressure failure. This approximation is $44 per affected household per pressure failure. It is calculated as 100

5 These estimates are adjusted accordingly when discount rate is varied as part of sensitivity analysis

6 Sydney Water 2019. Pricing proposal to IPART review of prices for Sydney Water Corporation from 1 July 2020. Appendices – customer engagement, p. 77.

times the value of avoiding a one percentage point change in the likelihood of a short planned interruption. Given a 100 per cent likelihood is well outside the range of likelihoods used in the WTP study, we treat this estimate with caution and test the sensitivity of findings to alternative assumptions.

The sensitivity analysis considers potential costs from the additional water usage that results from higher water pressure. The long-run marginal cost estimate of $2.72 per kL described above in relation to water continuity was used for this purpose. While there is significant uncertainty over this estimate, it is suitable for testing the sensitivity of results.

5 Present value of net benefits

The previous two chapters set out the cost and service outcomes under each option and the approach to measuring those outcomes in dollars terms. This chapter subtracts the stream of future costs from the stream of future benefits and discounts the stream of net benefits to current dollars so that the options can be compared on a common metric. Present values were calculated using a discount rate of 7 per cent in accordance with NSW Treasury guidelines. Sensitivity of results to a discount rate closer to IPART's current weighted cost of capital for the water sector of 4 per cent is tested in the next chapter.

Water continuity

The central case of the CBA finds net benefits from the 'reduced renewals' option and a net cost from the 'increased renewals' option.

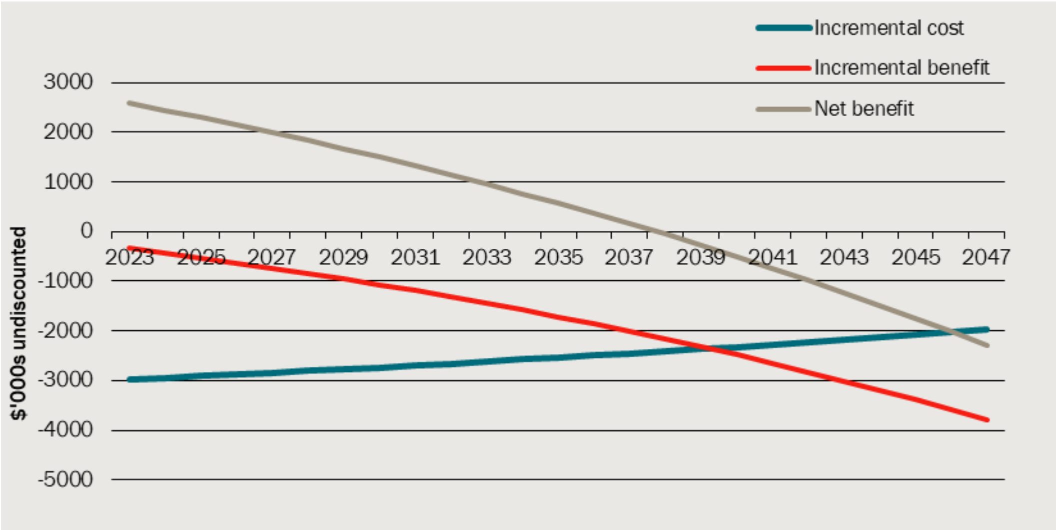
5.1 Net benefits of water continuity options relative to 'maintain renewals'

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Reduced renewals	-28 642	-15 991	12 651
Increased renewals	44 061	3 935	-40 126

Source: CIE

The reduced renewals option results in large cost savings in the medium term from reducing expenditure on renewals. It takes time for service performance to deteriorate. By 2038, the costs of water interruptions exceed cost savings from reduced renewals (see figure 5.2).

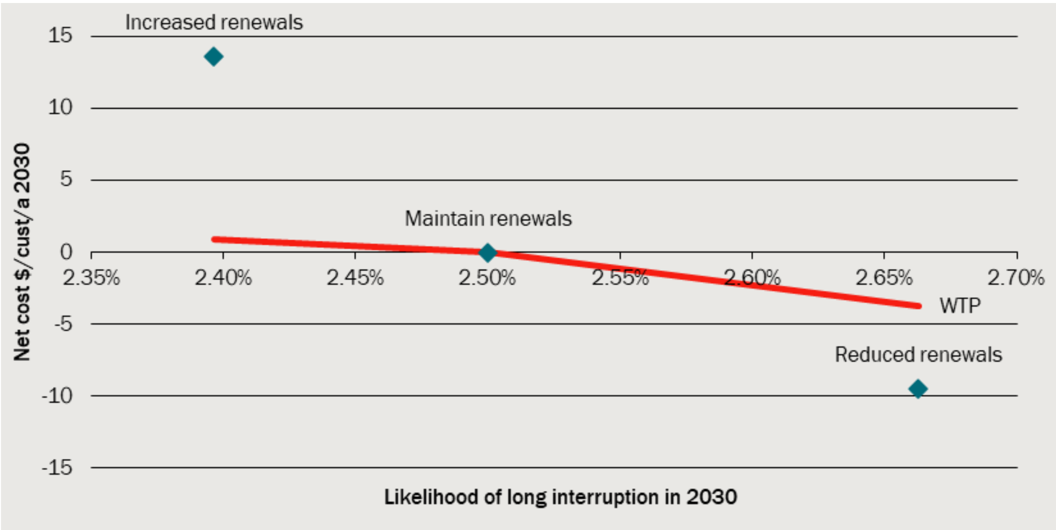
5.2 Costs and benefits over time for 'reduced renewals' option



Data source: CIE

A snapshot of the options from a customer perspective is provided for a single year, 2030, in the chart below. The cost of increasing renewals clearly exceeds WTP for the small reduction in interruption likelihood. The cost savings from reducing renewals exceed customer WTA compensation for the resulting increase in interruption likelihood.

5.3 Water continuity options from a customer perspective in 2030



Note: WTP and cost include values for all service attributes, not only long interruptions

Data source: CIE

Wastewater overflows

Both the improvement and degradation wastewater options are forecast to result in a net cost relative to the 'maintain performance' option.

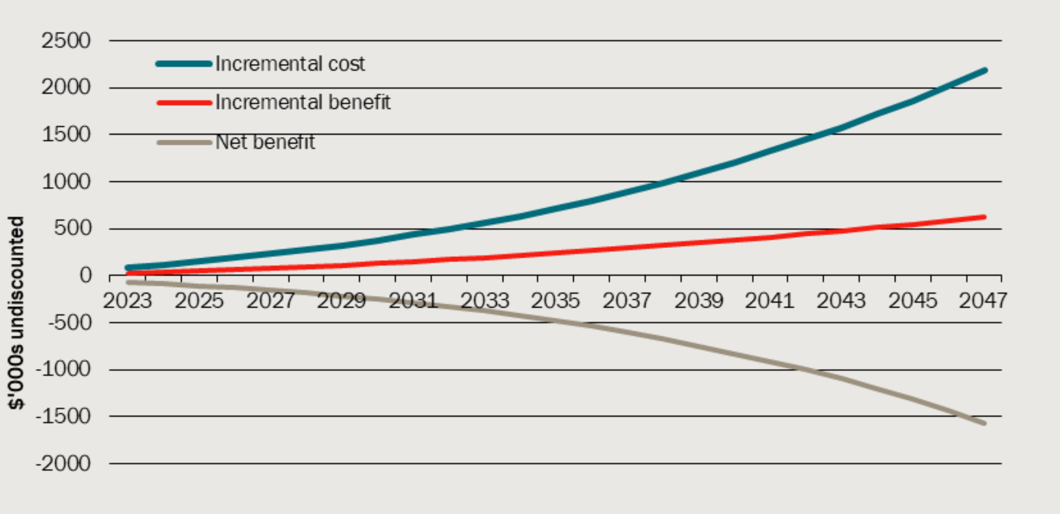
5.4 Net benefits of wastewater options relative to 'maintain performance'

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Degrade performance	34 704	-77 587	-112 291
Improve performance	6 941	2 205	-4 736

Source: CIE

The costs and benefits over time for the improved performance option are shown in chart 5.5. It shows net benefits are negative in every year of the forecast period.

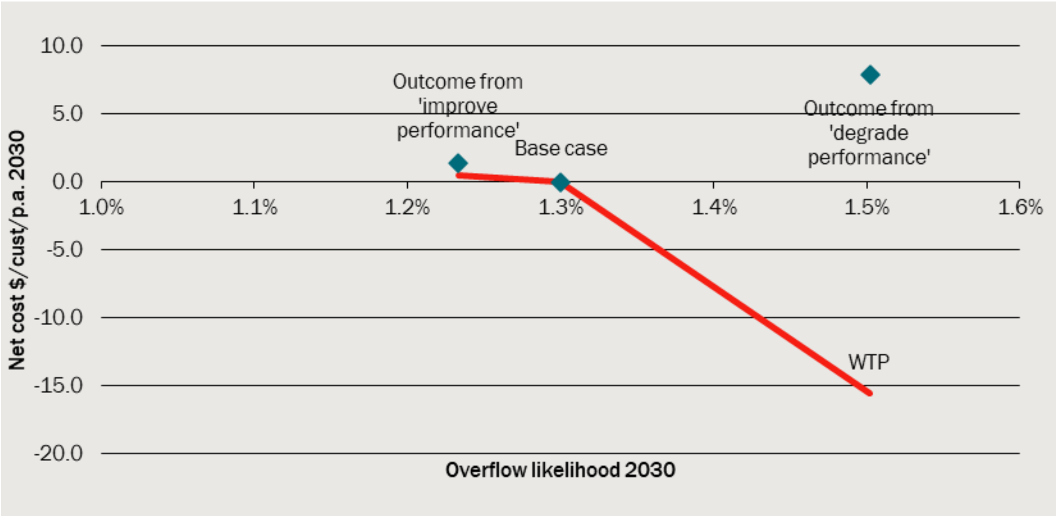
5.5 Costs and benefits over time for 'improved performance' wastewater option



Data source: CIE

A snapshot of the options from a customer perspective is provided for a single year, 2030, in chart 5.6. The degradation option is clearly unviable, as it results in worse service and higher cost. The improvement option results in slightly better service, but the cost involved exceeds customer WTP for the improvement. The chart illustrates that wastewater service levels may be close to the optimal level (based on current estimates of the marginal cost of service reliability), with total expenditure minimised and customers unwilling to pay the cost of improved service. Innovation and improvements in cost efficiency could change this optimum over time.

5.6 Wastewater options from a customer perspective in 2030



Note: WTP and cost include values for all service attributes, not only single overflows

Data source: CIE

Water pressure

Under central case assumptions, the 'keep headroom' water pressure option results in a small net benefit.

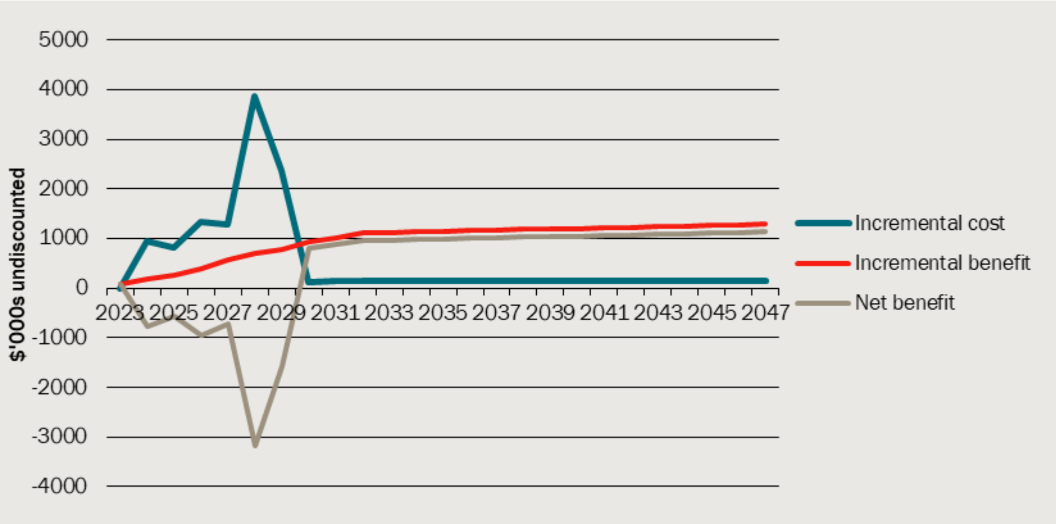
5.7 Net benefits of 'keep headroom' water pressure option relative to baseline

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Keep headroom	8 434	9 246	812

Source: CIE

The analysis considers additional costs incurred over the next 10 years and their ongoing impact on the number of properties experiencing water pressure failures. In the CBA analysis the benefit valuation was aligned to the timing of the benefits, even though customer WTP for the programs was expressed as a payment over a 10-year period. As a result, net benefits are negative in the first 10 years and positive thereafter, as shown in figure 5.8.

5.8 Costs and benefits over time for 'keep headroom' water pressure option



Data source: CIE

6 Sensitivity analysis

The previous chapter showed the present value of net benefits for each option under central case assumptions. This chapter analyses the sensitivity of those results to changes in key assumptions.

Water continuity

The ranking of water continuity options is not sensitive to the choice of discount rate (table 6.1).

6.1 Net benefits of water continuity options at discount rate of 4 per cent

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Reduced renewals	-37 164	-24 344	12 820
Increased renewals	58 433	6 002	-52 431

Source: CIE

Assuming non-residential customers have the same average WTP in dollar terms as households (rather than increasing with their bill (meter size and water usage)) does not affect the findings (table 6.2).

6.2 Net benefits of water continuity options assuming lower business WTP

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Reduced renewals	-28 642	-13 187	15 455
Increased renewals	44 061	3 187	-40 873

Source: CIE

The ranking of options is unaffected by reducing the assumed marginal cost of water losses from a LRMC measure of $2.72 per kL to a SRMC measure of $0.10 per kL (table 6.3).

6.3 Net benefits of water continuity options assuming lower cost of water losses

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Reduced renewals	-30 829	-15 991	14 838
Increased renewals	45 274	3 935	-41 339

Source: CIE

Wastewater overflows

The ranking of wastewater options is not sensitive to discount rate, as net benefits are negative in all years of the forecast period (table 6.4).

6.4 Net benefits from wastewater options at discount rate of 4 per cent

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Degrade performance	53 755	-123 021	-176 776
Improve performance	10 977	3 458	-7 520

Source: CIE

The results are also insensitive to assumptions about the level of WTP for non-residential customers. The results assuming non-residential WTP is equal to household WTP, rather than increased proportionately with bill size, are shown in table 6.5.

6.5 Net benefits from wastewater options assuming lower non-residential WTP

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Degrade performance	34 704	-67 661	-102 366
Improve performance	6 941	1 924	-5 017

Source: CIE

Assuming the number of customers affected by each public overflow is 20 rather than 5 increases the benefits from improved performance, but the present value of net benefits remains negative (table 6.6).

6.6 Net benefits from wastewater options assuming more customers affected by overflows on public land

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Degrade performance	34 704	-124 542	-159 247
Improve performance	6 941	3 565	-3 376

Source: CIE

Water pressure

The present value of net benefits decreases to slightly below zero under a lower discount rate of 4 per cent (rather than 7 per cent). This seems counterintuitive given the costs are incurred over the first 10 years and the benefits are enjoyed indefinitely. It is driven by the fact that the valuation of this indefinite benefit was expressed by survey respondents as an amount each year for 10 years, whereas the majority of the additional costs are incurred late in the 10-year period.

6.7 Net benefits from 'keep headroom' water pressure option assuming 4 per cent discount rate

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Keep headroom	10 124	9 712	-412

Source: CIE

If a more conservative approach to estimating WTP is used (Approach A from the CIE 2021 WTP report), then the 'keep headroom' option results in a significant net cost.

6.8 Net benefits from 'keep headroom' water pressure option assuming a more conservative estimate of willingness to pay

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Keep headroom	8 434	5 142	-3 292

Source: CIE

If the estimated WTP of affected properties is halved from $44 per year to $22 per year on account of a more conservative extrapolation of WTP to avoid changes in small probabilities to WTP to avoid an event occurring with certainty, then the present value of net benefits becomes approximately zero.

6.9 Net benefits from 'keep headroom' water pressure option assuming affected properties have lower willingness to pay

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Keep headroom	8 434	8 456	22

Source: CIE

The results are also sensitive to assumptions about how estimated WTP for a 2500-property program is scaled up for a larger program. If it is assumed households are not willing to pay any additional amount for a larger program, then the 'keep headroom' option is not economically viable. If it is assumed WTP increases linearly with properties fixed, then the 'keep headroom' option results in significant net economic benefits.

6.10 Net benefits from 'keep headroom' water pressure option under various assumptions about willingness to pay for

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Keep headroom – constant returns to scale	8 434	11 002	2 568
Keep headroom – zero WTP for properties fixed in excess of 2500	8 434	7 489	-945

Source: CIE

If it is assumed that each property avoiding water pressure failures uses 8 kL more water each year (an estimate developed for properties experiencing *frequent* pressure failures) and that the LRMC of that water usage is $2.72 per kL, then the 'keep headroom' option becomes very marginal.

6.11 Net benefits from 'keep headroom' water pressure option assuming costs incurred from increased water usage

	PV cost	PV benefit	PV net benefit
	$'000s	$'000s	$'000s
Keep headroom	9 215	9 246	30

Source: CIE

7 Conclusions

The 'reduce renewals' option is the most economically efficient of the water continuity options considered in the CBA from a community standpoint. This result is robust to sensitivity testing. However, Hunter Water may wish to consider the equity impacts of the option. The increased likelihood of supply interruptions is likely to fall on those customers who already face the highest risk of interruptions. We note IPART's recent discussion paper on its regulatory approach stated, "In proposing targets for service outcomes, includes protections for individual customers, so that increases in efficiency do not come at the cost of a reduction in service to individual 'pockets' of customers."[7] There is also uncertainty over the cost and performance forecasts used in the CBA that has not been covered in our sensitivity testing. Hunter Water has indicated that its tactical renewal modelling (local replacement assessments) suggests a greater degradation in performance for a given level of reticulation renewals than does the PARMS modelling used in the CBA, but this difference has not been quantified.

The 'maintain performance' option is the best of the wastewater overflow options considered in the CBA from a community standpoint. This result is robust to sensitivity testing. Hunter Water analysis indicates that it is already close to optimising the trade-off between proactive and reactive network expenditure. The key question for the CBA, then, is whether the costs of increasing proactive expenditure are outweighed by the value customers place on the reduced likelihood of overflows that would result. The answer to that question appears to be 'no'.

Whether the 'keep headroom' water pressure option results in net benefits to the community relative to a baseline without spending on water pressure depends on several key assumptions. The preferred option is therefore uncertain. The equity considerations discussed above in relation to water continuity are also likely to be relevant when considering the water pressure options, since the baseline option would involve worsening service for specific pockets of customers.

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7 IPART 2021. Encouraging innovation in the water sector. Discussion paper. August, p. 53.

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