TMS08 Our AMP8 Water Outcomes Delivery Strategy

Contents

1. Executive Summary

This document sets out:

- Our projected performance for AMP8 and beyond for each of our water service outcomes, and our proposed targets.
- The underlying reasons for our past and future performance.
- Actions we are taking to deliver improved performance.

The table below shows the Performance Commitments (PCs) included for each outcome.

Table 1 – Water AMP8 Outcomes and Performance Commitments

Outcome	Performance Commitments
Safe, high quality drinking water	Compliance Risk Index (CRI) Customer Contacts About Water Quality
A reliable supply with minimal disruption	Supply Interruptions Unplanned Outage Mains Repairs
Fix leaks and ensure there is enough water in the future	Leakage Per Capita Consumption (PCC) Business Demand

For each PC we have set stretching targets for improvement. This includes:

- 43% improvement in water quality
- 37% improvement in leakage (from the 2020 baseline)
- 14% improvement in supply interruptions
- 15% improvement in mains repairs

Our programme is designed to deliver improvements based on customer priorities and government and regulatory requirements.

With respect to the proposed ODI framework, we have proposed an alternative approach, which we believe delivers a more balanced approach to risk, whilst delivering significant performance improvements and allowing maximum allowances to be invested in both the asset base and delivering service to customers. For further details please refer to TMS41 Aligning Risk and Return.

In common with other companies, our performance is vulnerable to widespread events, such as a freeze/thaw or large scale infrastructure failure particularly in densely populated areas, where we have specific challenges in responding to them because of factors such as the time needed to isolate and repair trunk main infrastructure, compounded by traffic congestion and the historic design of the network in London. We have set stretching targets that reflect our current performance and the rate of improvement that can be achieved over AMP8 to ensure a credible

and deliverable plan. It is also notable that the companies that form the upper quartile for each PC vary from year-to-year, which demonstrates the unlikelihood of delivering consistently high performance across all measures.

Our current performance is mixed, with performance on 'customer contacts about water quality' at upper quartile and 'supply interruptions' better than the industry average, but we have lagged the industry leaders particularly in leakage and mains repairs.

In order to improve the state of our assets and change the way we operate; our shareholders have put in significant additional funding and will continue to do so. Given the scale of our assets and operations, it will take time to deliver improvements. The scale of investment needs to be affordable for customers. Targets need to be set which reflect the time it will take to deliver change. Failure to recognise this would result in excessive ODI penalties, which in turn would slow down the pace of improvements and reduce our financial resilience.

We have developed an ambitious programme of innovation, implementing new technology and delivering improvements in working practices. We have learnt from other companies where they are implementing change successfully. In our PR24 submission, we have outlined the first elements of our longer-term plans, with the majority of expenditure funded from base expenditure, however we do have one Cost Adjustment Claim and four Enhancement Cases that have been submitted as part of our water Price Control submission. In summary, these are:

- Cost Adjustment Claim – increase our mains replacement to 500km, nearly doubling the rate of replacement in AMP7 to start slowing down the rate of asset deterioration, but also building the capacity for more extensive mains replacement in AMP9 and beyond, which will be needed to meet ambitious leakage targets sustainability. (TMS18 Cost adjustment claim: Mains Replacement)
- Enhancement Case - installing ultraviolet treatment technology at two London process plants to mitigate the risk of increasing levels of cryptosporidium in the River Thames and River Lee. (TMS23 Enhancement Case: Long term Water Quality Strategy: Cryptosporidium).
- Enhancement Case - continuing our lead communication pipe replacement programme, replacing 54,000 lead pipes. (TMS22 Enhancement Case: Long term Water Quality Strategy: Lead).
- Enhancement Case - replacing 13 km of trunk mains in London, which if they were to fail could place the health and safety of the public at risk. (TMS21 Enhancement Case: Reducing the risk of basement flooding).
- Enhancement Case - investment to deliver our Water Resource Management Plan, including the planning for new resources such as a new reservoir in Oxfordshire, and the continued roll out of our digital metering programme to allow customers to manage their water usage and allow us to pinpoint leakage more quickly and accurately. (TMS27 Enhancement Case: WRMP Supply Options and TMS28 Enhancement Case WRMP Demand Reduction).

In our submission we have also made a case for increased capital maintenance to start addressing an Asset Deficit estimated at £13.5bn in 22/23 price base (£11.5bn in 17/18 price base) across our water business. It will take many years of sustained investment to address our ageing infrastructure. In AMP8 we will focus on addressing key areas which are specifically

impacting on leakage and resilience with increased investment on our treated water service reservoirs, leak detection and repair and our SCADA (Supervisory, Control and Data Acquisition) systems. The latter are critical to monitoring and controlling our key assets such as the London water distribution system. TMS15 Asset Deficit provides more details.

2. Outcome 1: safe, high quality drinking water

Water quality is our customers' highest priority.

Our customers, stakeholders, regulators and Board will hold us to account through the adoption of two common Performance Commitments: Compliance Risk Index (CRI) and Customer Contacts About Water Quality.

- CRI measures the risk arising from water quality compliance breaches and considers three key elements:
    - The significance of the parameter breaching the standard;
    - The cause of the failure; and
    - The location of the failure which takes into account the proportion of the customers affected.

- Customer Contacts About Water Quality measures the number of contacts for all appearance, taste and odour contacts multiplied by 1,000 and divided by the resident population as reported to the DWI.

By 2050, our ambition is that water quality consistently meets water quality standards and there are no drinking water incidents that impact customers.

The remainder of this section looks at each Performance Commitment, setting out our proposed targets in the context of our current performance and providing an overview of the activity required to deliver the proposed levels of improvement.

2.1 Compliance Risk Index (CRI)

2.1.1. Performance, targets and incentives

We aim to deliver a more consistent level of performance with compliance in-line with both that expected by the DWI and being delivered by the leading companies in the industry. Our proposed target of zero (100% compliance) aligns with The Water Supply (Water Quality) Regulations 2016

The tables below set out our actual and projected medium- and long-term performance and targets. Our recent performance has generally been at industry average or better but our 2022/23 performance was poor due to a small number of high impact breaches.

Table 2 – Performance and Proposed Targets (Unit: index score)

AMP	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Thames Water*	1.22	1.95	0.66	2.42	2.59	10.96	2.50	1.75	1.75	1.50	1.25	1.25	1.00
Industry Average	2.88	3.70	2.67	2.41	3.23	3.57							
Industry Upper Quartile	0.52	1.78	0.88	1.53	0.91	1.09							
Proposed Target									0	0	0	0	0
Proposed Dead band									2.0	2.0	2.0	2.0	2.0

**Actuals to 2022/23; Forecast thereafter*

Table 3 – Long term performance trajectory (Unit: index score)

	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End of AMP actual/target	0.66	1.75	1.00	0.75	0.75	0.50	0.50

In terms of our CRI score, since 2019 microbiological breaches at our water treatment works have account for between 60%-90% of our overall performance. The scale of the CRI impact has been driven by these failures, specifically coliform detections, occurring at our large water treatment works serving London, as shown in the table below:

Table 4 – Analysis of CRI failures

		17/18	18/19	19/20	20/21	21/22	22/23
Thames Water CRI Score:		1.22	1.95	0.66	2.42	2.59	10.96
Microbiological failures at treatment works*		Breakdown not available using current CRI methodology		0.12	1.95	1.73	9.90
Turbidity failures at treatment works				0.03	0.04	0.08	0.27
Microbiological failures at service reservoirs				0.16	0.27	0.37	0.18
Zonal failures				0.35	0.16	0.41	0.62
*Impact of microbiological failures at large London treatment works							
Ashford Common WTW, West London	Single coliform detection. Ingress within treated water structures	Breakdown not available using current CRI methodology			0.949		
Coppermills WTW, East London	Single coliform detection. Ingress within treated water structures						3.499
Kempton WTW, West London	Single coliform detection in each year. Ingress within various treated water structures				0.787	0.897	
Hampton WTW, West London	Several coliform detections. Ingress into contact tank						5.374

Our analysis highlights the need to address water ingress at our largest and most complex water treatment sites, and we have already started a programme to remove some of these assets from operation to allow internal inspection and remedial activities. The insight from this programme has enabled us to develop a structured approach to improve performance, which has been shared with the DWI to ensure we mitigate future risks using a systematic and prioritised approach.

Section 2.1.2 describes the activities we are currently undertaking and plan to continue in AMP8, along with our proposed enhancement activity.

2.1.2. Activity to improve performance

Activities included within base expenditure

The activity included in our AMP8 plan is based on improving our risk management process, seeking insight and learning from leading companies, deploying innovation and adopting guidance from the DWI. Performance improvements will be entirely funded through base expenditure.

In the past, our risk management processes were not sufficiently integrated with event management, business planning and investment processes. The result was that whilst the water ingress risk on treated water structures was known, we did not act quickly enough to mitigate the risk of ingress or undertake the necessary long-term investment in a timely manner.

We have made improvements. We have defined and launched our Public Health Transformation Plan which underlines the importance of risk management. We have also implemented an enhanced hazard review process to identify and manage risks across our water treatment

facilities, including a more frequent drainage and inspection regime for our treated water structures.

The interventions, which span AMP7 and AMP8, include:

People: Technical Upskilling of all Operatives and Management

We have implemented a programme of continuous technical development for all our operatives, front line managers and senior managers. This is an Energy and Utility Skills based programme which is focused on competency, both through classroom learning and on-the-job task observations.

Phase 1, was completed in AMP7, and ensured:

- All front-line operatives were competent and achieved their "Licence to Operate"
- All managers achieved a 'Level 5' (Diploma) in the management of Water Treatment or Water Network
- The Executive team all received water quality training.

In AMP8, we will enhance the Licence to Operate reviews to incorporate higher level competency requirements. We will also extend the programme into water networks and leakage activity, with all personnel working on water networks to have passed our new Licence to Operate Competency Assessment.

Risk Management: Enhanced Engineering Hazard Review Assessments

In 2022 we commenced a detailed electrical, mechanical and control review of our 93 treatment works. By the end of AMP7 we will have completed 37 sites and all issues considered high risk will have been addressed.
As an example we have completed the Enhanced Hazard Engineering Review at Fobney WTW and the key risks that are now being addressed include:

- A new run to waste pumping station which will speed up the ability to return slow sand filters to service after maintenance.
- Undertaking improvements on the slow sand filter outlet chambers to reduce the risk of ingress.
- Upgrading the existing control system and plc on site to improve stability.
- Introducing sample flow monitoring on all individual slow sand filters to improve the integrity of the online monitors.
- Installing upgraded bleed valves on the high lift surge vessels to improve turnover.
- Bypassing pipework to be inspected and repaired which will reduce the risk of any ingress if negative pressures were to be experienced.
- Capping pipework from the RGF backwash lines which are only currently isolated from the treatment process via valves.

In AMP8, we will undertake the remaining 56 reviews, and will mitigate all key risks that could affect water quality or plant reliability by 2029/30.

Risk Management: New Chlorine Dosing Standard

A new chlorine dosing standard was introduced in 2023. This uses dynamic and real time changes to manage our chlorine dosing. Detailed analysis revealed why chlorine residuals historically fluctuated in our treated water, which could increase the risk of a microbiological contamination. The new dosing standard pre-empts these situations and provides improved dynamic control using a predictive, feed forward control philosophy.

We will continue to improve turnover and mixing in our service reservoirs which will help maintain chlorine residuals and will allow for improved chlorine dosing control. In AMP8 we will undertake Computational Fluid Dynamic studies at thirteen high risk service reservoirs and make modifications to improve turnover and mixing to improve water quality.

Risk Management: Groundwater Refurbishment Programme

Although turbidity at our groundwater sources is infrequent, we have experienced up to five turbidity breaches per annum over the last few years. Investigations tracked this back to corrosion on borehole rising mains – which although serviceable were increasing the risk of turbidity especially on start-up. To address this issue, during our routine borehole refurbishment programme all rising mains are now replaced with new stainless steel which is more resistant to corrosion. We will continue to mitigate the risk of turbidity at groundwater sources through this approach.

Risk Management: Dynamic River Quality Monitoring

Over the last few years, the river water quality in the River Thames, River Kennet and River Lee has shown signs of deterioration which places the efficacy of our treatment processes at Farmoor WTW (Oxford), Fobney WTW (Reading) and our London Process Plants at risk. Future investment is planned to mitigate this risk, but in the meantime, we have introduced an enhanced, real time river water quality monitoring system upstream of all abstraction points. Whenever river water quality drops below a specified threshold, abstraction ceases to reduce the risk of placing strain on our major treatment facilities.

Assets: Enhanced Inspection Programme and Refurbishment of Treated Water Structures

The primary driver for water quality breaches is the ingress of rain or ground/surface water into treated water structures. Due to this risk, we have implemented a new risk-based inspection regime for all treated water structures. At the five large water treatment works serving London, all treated water civil structures will be drained and inspected (considerably ahead of the current asset standard of every 10 years). Refurbishment works to address any points of ingress will be completed, including the installation of an external membrane barrier where necessary. This will significantly reduce the risk of ingress and resulting microbiological breaches at these locations.

Our AMP8 plan will build on the programmes in AMP7 and in particular we will:

- Increase investment in the structural integrity of our service reservoirs. We will rebuild our oldest service reservoir at Putney and undertake improvements at 9 service reservoirs;
- Deliver our ongoing capital maintenance programmes including four Slow Sand Filters Refurbishments, GAC Regeneration at 19 works, ozone treatment replacement at four surface water treatment sites and the upgrade of Fobney WTW;

- Continue our treated water structure inspection programme, with all high risk and medium risks assets inspected and all remedial works completed in AMP8; and
- Review all our sampling facilities and implement changes to improve the integrity of our sampling regime.

Our approach to improving our water quality performance through our Public Health Transformation programme has been guided and developed in collaboration with the DWI. The DWI's insight into best practice across the industry has allowed us to produce comprehensive plans to further improve our performance as we strive for industry leading performance.
This has been reinforced with formal commitments we have made to the DWI which in turn have bene reflected in notices issued by the DWI. Through AMP7 we have agreed 25 notices, we have addressed 4 and are working to fulfil the remaining 21. Key areas we have addressed include:

- Risk assessments and resilience
- Training and Competency
- Management of our slow sand filters in London
- Improvements at Sheeplands WTW – Henley on Thames

Some of the areas we continue to work to address include:

- Turbidity risks at 6 sites and general improvements across all sites
- Improved disinfection at Netley Mill WTW – a site that due to water quality issues has resulted in several prolonged supply interruptions in Surrey.
- Improved turnover in service reservoirs
- Service reservoirs and contact tank inspection programme

In its most recent annual water quality report, the DWI confirmed a number of key improvements had been completed and confirmed that our new approach to proactive audits, via the use of an innovative app, appeared to be industry leading.

Activities included within enhancement expenditure

Our AMP8 plan includes two specific enhancement cases relevant to water quality compliance. While they do not directly influence the CRI score, we have included reference in this section for completeness.

- Enhancement Case - installing ultraviolet treatment technology at two London process plants to mitigate the risk of increasing levels of cryptosporidium in the River Thames and River Lee. (TMS23 Enhancement Case: Long term Water Quality Strategy: Cryptosporidium).
- Enhancement Case - continuing our lead communication pipe replacement programme, replacing 54,000 lead pipes. (TMS22 Enhancement Case: Long term Water Quality Strategy: Lead).

Mitigating the risk of cryptosporidium at our Slow Sand Filter Plants in London

We plan to install ultraviolet treatment to mitigate the increasing risk of cryptosporidium detections at two of our four slow sand filter sites in London.

Although our biological slow sand filters across London are highly effective at producing large volumes of high-quality water, the latest research has demonstrated that their treatment effectiveness starts to fall when water temperatures drop below 10°C, reducing from 100% to 99.5%. This poses a risk of microbiological break-through including cryptosporidium oocysts. Since 2020 there have been 20 low level cryptosporidium detections at our slow sand filter sites, with 3 detected in 2020, 7 in 2021 and 10 in 2022. Working with the DWI we agree that these detections, although having no impact on public health, are an indicator that the treatment sites are not robust to the changing climate and pose a significant medium-term risk. This increasing risk is also exacerbated by increasing levels of cryptosporidium oocysts being detected in the River Thames.

We will address this risk in AMP8, with the installation of an ultraviolet treatment plant at Coppermills WTW in East London, and at Hampton WTW in West London. We will then complete the programme in the period 2030-2035 by undertaking similar work at Ashford Common WTW and Kempton WTW, both in West London.

We have chosen to prioritise investment at Coppermills and Hampton as both of these sites directly feed large populations, whereas Ashford Common and Kempton discharge the majority of their treated water into the ring main allowing both sites to be supported by the wider network.

The principal benefit of our cryptosporidium reduction enhancement case is to the DWI's Event Risk Index.

Refer to TMS23 Enhancement Case: Long term Water Quality Strategy: Cryptosporidium for further details.

Reducing the risk of lead contamination by replacing a further 54,000 lead communication pipes

We will continue with our ongoing programme of work to replace all lead communication pipes by 2050. We will also implement a trial to promote and support customers to replace lead pipes under their ownership.

While the impact of lead failures has historically been low (average of 0.005 CRI points per year over the last three years), we do detect lead levels above the standard of 10micrograms per litre, at customers' taps, on 15-20 occasions per annum and hence this ongoing programme is important to address both the DWI's and customers' expectations that water supplies are free from lead.

Refer to TMS22 Enhancement Case: Long term Water Quality Strategy: Lead for further details.

2.2. Customer contacts about water quality

2.2.1 Performance, targets and incentives

This PC is based on information provided to DWI on customer contacts. DWI released an Information letter in 2022 to revise reporting of contacts to take account of changes in communications, especially the increased usage of social media[1]. We have now implemented changes to our systems to meet the new information requirement.

We did not previously collect information in line with the new methodology. Some companies have, however, been able to back cast their performance. Using this information and our own data for 2023 we have estimated historic figures, for ourselves and other companies, in order to show past performance on a comparable basis to our targets for AMP8.

We are outperforming our target and our performance is better than the industry upper quartile (UQ). We have been improving at a faster rate than the rest of the industry and in 2021/22 we were the second-best performer.

For AMP8, we anticipate that the target will be set based on industry UQ. We are forecasting that we will maintain good performance and be able to continue outperforming the new UQ target.

Table 5 - Customer contacts about water quality (Unit: performance per 1,000 population)

	AMP6			AMP7					AMP8				
	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Thames Water*	0.58	0.61	0.62	0.48	0.40	0.42**	0.45**	0.45**	0.45**	0.45**	0.45**	0.45**	0.45**
Industry Average**	1.73	1.78	1.58	1.38	1.33								
Industry UQ**	1.14	1.03	0.99	0.94	0.91								
Proposed Target**									0.45	0.45	0.45	0.45	0.45

**Actuals to 2021/22 based on old methodology; 2022/23 new methodology; Forecast for new methodology thereafter*
***Based on the PR24 methodology ensuring a single contact can be categorised across more than one reason for the contact.*

Table 6 – Long term performance trajectory (Unit: performance per 1,000 population)

	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End of AMP actual/target	0.62	0.45	0.45	0.40	0.35	0.35	0.30

Reasons for customer contacts

Our improvement programme is based on analysis of the reasons for customer contacts. A summary of the key underlying reasons why customers make contact regarding water quality is shown in the table below.

[1] Annual Provision of Information on Customer Contacts, DWI Information Letter 04/2022

Table 7 - Reasons for customer contacting Thames Water (3 year averages adopting PR24 methodology)

Category	Underlying Reason
Appearance (66% of all contacts)	Discoloured Water
	Reported particles in the water
Taste and odour (34% of all contacts)	Chlorine
	"Musty/Earthy"

Over the last 3 years, water appearance (discolouration and particles) has been the most frequent reason for customer contacts about water quality.

Section 2.2.2 describes the activities we are currently undertaking and plan to continue in AMP8, along with our proposed enhancement activity.

2.2.2 Activity to improve performance

Activities included within base expenditure

This section sets out the action we have taken to improve performance and our plans to deliver further improvement in AMP8. Improvements in this PC are delivered through the overarching programme management associated with our Public Health Transformation Programme, described in section 2.1.

Our plans for AMP8 include a customer water quality self-help portal on our website. It will provide readily accessible and up to date information on bursts, planned and emergency works that may impact water quality. We expect this to reduce the need for customers to contact us to get information about any issues that are affecting them.

Addressing contacts about discolouration and particles

These contacts result primarily from the way in which we have operated our network, either during planned maintenance or during emergency incidents. Operating valves, reversing flows and causing surges in the network, displaces iron deposits, which results in discolouration and particles being present.

We carry out 600km of pipe flushing annually, under our DOMS (Distribution Operation and Maintenance Strategy) flushing programme, most of which is spread across locations in Thames Valley. This is to improve the local network quality and mitigate customer complaints relating to iron and metals. We will have an enhanced programme in AMP8.

Following our most recent significant discolouration event (in Merton on 28 January 2021, affecting 267,000 customers), we implemented changes to our processes for boundary valve operation, as this was the root cause of the incident. Key changes that will have been fully implemented by the end of AMP7 include:

- Upgrade to our Permit to Work system – any boundary valve operation now needs an approved permit, with hydraulic modelling to assess the risk of discolouration.
- All permits now have documented procedures including the sequencing of valve operations.
- Our new standard ensures that any valve operation that poses a risk must be accompanied with a flushing and sampling methodology to ensure water quality is not compromised.

- All boundary valves have been checked and marked to ensure all staff have up-to-date records of valve positions.

We have implemented a 'dead leg' identification tool on our GIS software which highlights dead legs (parts of the network which are never or seldom used). It is a key enabler for carrying out the 'Permit to Work' risk assessment and determining mitigation measures.

We have undertaken a strategic review of our trunk main system and prioritised the highest-risk dead legs, based on the pipe size and length. We have identified over 200 high-risk dead legs on the trunk main network and commissioned a £2.5m project to devise solutions for half of these dead legs, including measures to enable flushing, abandonment where appropriate, or hydraulic modelling to devise a plan for future mitigation. We will continue to remove dead legs on the network in AMP8.

We will undertake proactive maintenance plans (DOMS) and network risk assessments in AMP8, building on our AMP7 programme, and understand working practices that lead to discolouration and update training accordingly. For example, we are in the early stages of a programme of work to understand and address discolouration hotspots in Oxfordshire and North-East London.

Following successful trials in AMP7, we will be rolling out further use of 'Ice-Pigging' technique across twelve more trunk main locations in AMP8. This technique is now used across the industry and involves cleaning the sediments and residuals in the pipe by pushing through ice slurry. This approach will enable commissioning of throttled/isolated pipes, while mitigating the Water Quality risk and enhancing wider supply system resilience.

Addressing taste and smell issues

Customer contacts relating to taste and smell account for 34% of all contacts and are primarily driven by the chlorine residual that customers are detecting. At times, it is necessary for us to raise the chlorine dose during maintenance work. For example, during the enabling work and repairs to Hampton Contact Tank in 2023 the chlorine dose will be raised by 0.2mg/l (although we minimise the impact by monitoring the chlorine residual).

A new chlorine dosing standard was introduced in 2023, which provided dynamic and real time changes to our chlorine dosing practices. Fluctuations of chlorine residuals in treated water can increase the risk of a microbiological contamination. The new dosing standard pre-empts these situations by optimising chlorine dosing setpoints. This will minimise microbiological contamination while also reducing contacts associated with taste and smell relating to chlorine levels.

We are currently trialling new smart live Water Quality monitoring technology from ATi in four water supply systems, involving reservoirs with frequent low chlorine readings. We aim to roll this instrumentation out further across twelve supply systems in London and Thames Valley in AMP8 and enable holistic solutions and operating strategies with the use of hydraulic modelling to improve water quality.

Activities included within enhancement expenditure

There is no enhancement expenditure proposed in AMP8 to improve the number of customer contacts regarding water quality.

In response to Information Notice 23/07 issued in July23, we have not previously secured any enhancement funding to improve performance for this metric and hence there is no influence from enhancement on our historical performance trend.

2.3 Customer Line of Sight – Safe, high quality drinking water

Engaging with our customers, communities and stakeholders has played a key role in developing our AMP8 strategy for safe, high quality drinking water.

'I want safe, high-quality water' is consistently ranked amongst customers' highest priorities. We provide further detail of our overall PR24 engagement programme in TMS03: Customer Engagement

In this section we present the line of sight from what we heard to what we plan to do and highlight any areas where we have had to make trade-offs. For our Enhancement Cases in this area, we also provide further evidence of the line of sight, including customer views supporting the need for investment and our proposed solutions in:

TMS22: Enhancement Case – Long term water quality strategy - lead

TMS23: Enhancement Case – Long term water quality strategy - cryptosporidium

Table 8 – How we are responding to customer insight – safe, high quality water

What we heard		How we are responding
Water quality and safety	Customers want a dependable service from us across all core water service areas, including ensuring safe and high-quality drinking water. This is consistently ranked amongst customers' highest priorities.	Our 'Public Health Transformation Plan' is an integrated improvement plan which, through changes to operational practices and key investment, addresses the key issues that pose a risk to water quality.
Taste, smell and appearance	Whilst water quality is of high importance to customers, they only place a modest value on improving the taste, smell or colour of water.	Although our performance on water quality is industry leading, we will invest to improve the effectiveness of our disinfection process and deal with discolouration risks on our water network.
Water treatment	Customers are alarmed at the possibility of water becoming contaminated by harmful bacteria. When we tested potential water enhancements, improving water treatment and safety was a key priority for customers. Customers see the solutions in this area (improving processes and technology at water treatments plants) as relatively straightforward and as a potential 'quick win'.	Our 'Public Health Transformation Plan' provides increased mitigation to all key risks, which may impact the safety of the water we provide. In London we are proposing an Enhancement Case to mitigate the risk of increasing levels of cryptosporidium being detected in the raw water.
Lead pipes	Awareness of lead pipes is low among customers. However, upon learning about the health	We are proposing an Enhancement Case which will replace 54,000 lead communication pipes.

What we heard		How we are responding
	consequences and prevalence of lead pipes, many customers are surprised this is not in the wider public consciousness and want to know what water companies are doing to protect customers. Thames Water's long-term goal of replacing all lead pipes is what customers believe is wholly necessary.	We are also proposing a trial to support customers to replace their own lead supply pipe and internal plumbing.

Key tensions and trade-offs between customer views and our proposals

Reducing the risk of harmful bacteria in water supplies

The proposed investment of ultraviolet technology at two of our four large, slow sand filter sites, is a key element of our long-term water quality strategy. Customers view that addressing any risks that may pose a risk to water quality as "quick wins", however, delivering ultraviolet technology on some of the largest treatment facilities in the UK and Europe will take time.

We have considered all other investment needed across our four slow sand filter sites and believe a stretching, but credible delivery plan can address the risk at Coppermills WTW and Hampton WTW. We have chosen to prioritise investment at Coppermills and Hampton as both of these sites directly feed large populations, whereas Ashford Common and Kempton discharge the majority of their treated water into the ring main allowing both sites to be supported by the wider network.

During AMP8, we will undertake the design work at the remaining two sites to allow delivery in the period 2030-2035.

Table 7 on the previous page, provides a summary of customer views for each of the key areas for this outcome and considers how we have addressed each aspect within our plan. In the table below we provide specific details of the feedback from the various research inputs we received including our Outcomes and Wants research, Acceptability testing, Ofwat's collaborative research, Vision 2050 research and Enhancement Case Deep Dives.

Table 9: Key customer research that has informed our water strategy

Outcomes and Wants	Thames Water Triangulated Priorities [1]	Topics	Ofwat collaborative research [2]	Enhancement case deep dives [3]	Acceptability and affordability testing [5]	Vision 2050 research [6]
I want safe, high quality water	Receiving **safe, high-quality water** is the highest priority (1st of 10 Wants) to customers.	Water quality	Customers place a high importance on the '**Appearance, taste and smell of tap water**'. There is a core expectation that water should be clean and safe. Customers place a high importance on '**Do not drink notice**' because this is linked to significant health impacts, however nature belies probability. Customers place a medium importance on '**Boil water notice**' because of link to health impacts, however, this is modified by short duration of convenience.	Customers place a high priority on enhancements related to **'Improving water treatment**' as this has implications for safety and is therefore a key priority for customers. Customers place a medium priority on enhancements related to 'Replacing lead pipes'; customers see this as an area where we can have an individual impact (safety) and address societal needs (ageing infrastructure).	Customers placed a medium importance on our '**Customer contacts about water quality**' performance commitment; customers are split in their views on our performance here, heavily informed by their own personal experiences.	'**Guarantee high quality drinking water**' was ranked the most important of all Vision 2050 goals; customers view high quality water as the ultimate 'hygiene' factor and an essential aspect of Thames Water's service. They therefore support the goal to achieve no instances of poor water quality, with some even feeling we could go faster given the importance of this area of service. Customers place a medium importance on '**Replace all lead pipes**'; customers are concerned when informed about the health impacts and support action but some are not convinced of the severity of the issue and see it as less urgent to address.

Sources:
[1] What Customers, Communities and Stakeholders Want v18, Sia Partners, July 2023
[2] Ofwat + CCW customer preferences research, April 2022
[3] PR24 Deep Dives, February 2022; Enhancement case package options research, September 2022; Enhancement case deep dive research, May 2023
[4] Thames Water WRMP Consultation, May 2023; WRSE – Customer Preferences to Inform Long-Term Water Resource Planning, March 2021; WRSE Best Value Criteria, May 2021; WRSE Water resources quantitative research, June 2022
[5] Acceptability and Affordability Testing (Qualitative findings), May 2023
[6] Vision 2050 Research, May 2022

Section 3. Outcome 2: Reliable supply with minimal disruption

Our customers want a reliable water supply, with interruptions events kept to a minimum.

Our customers, stakeholders, regulators and Board will hold us to account through three common PCs: Water Supply Interruptions, Mains Repairs and Unplanned Outage.

- Water supply interruptions measures the average number of minutes lost per customer, across the whole customer base, due to interruptions lasting three hours or more. It is calculated using the following equation:

$$\frac{((\textit{Properties with interrupted supply} \geq 180\ \textit{mins}) \times \textit{Full duration of interruption})}{\textit{Total number of properties supplied (year end)}}$$

- Mains repair is an asset health measure. It measures the number of repairs carried out per 1000km of our clean water mains network, excluding communication and supply pipes and repairs caused by third party damage.

- Unplanned outage is also an asset health measure. It measures the unplanned loss of peak week production capacity as a percentage of the overall company peak week production capacity. Outages arising from planned works should be recorded separately to outages arising from unplanned causes, such as asset failure. It is calculated using the following equation:

$$\frac{\textit{Reduction in peak week production capacity} \times \textit{Duration in days}}{365}$$

Our ambition is to deliver an enhanced reliable service. Our customers will, on average, experience minor supply interruptions, with no major supply interruptions of greater than 48 hours. A step-increase in our mains replacement programme will halve the number of mains repairs needed, and we will improve asset reliability of our treatment works such that no more than 1% supply capacity is lost due to unplanned outages.

The remainder of this section looks at each of the above PCs in turn, setting out our proposed targets in the context of our current performance and providing an overview of the activity required to deliver the proposed levels of improvement.

3.1 Water Supply Interruptions

3.1.1. Performance, targets and incentives

We aim to deliver an immediate and sustained performance improvement in AMP8. While we have included an annual allowance for large events in our proposed targets, we recognise the need for consistency of response to, and recovery from, any failures. We acknowledge that leading companies will continue to improve, but we believe our forecast is realistically stretching and reflects the scale of the activities and investment needed to consistently turn around our performance given our large, complex and aging network.

Our target improvement recognises the challenges associated with operating and managing the largest infrastructure network in the UK, and hence comparing us directly to all other water companies can be misleading. For example, when failures occur on large scale assets, it can take several hours to safely isolate the pipes in order to prevent what is known as the "water hammer" effect where a rapid change in the network pressure results in further, consequential bursts. Therefore, before we have isolated the mains and started to re-direct flows, we have exceeded the three-hour target stipulated by Ofwat. This is further compounded by the high traffic density in London, which according to INRIX [2]is the most congested city in the UK, with travel times at least 70% greater than the next most congested city (Bristol).

The tables below set out our actual and projected medium- and long-term performance and targets. Our recent performance, despite the challenges above, has at times been around the industry average, but is volatile. AMP7 started with a marked improvement, but our 2022/23 performance was poor (although better than the industry average). While it is worth noting that it was one of our most challenging years to date from a climatic perspective, our performance continued to suffer from the impact of large events across our region.

Variability can also be seen in the performance across the sector; the industry average has fluctuated as a result of both climatic events and large-scale failures, and the composition of the companies within the UQ set has changed, demonstrating the difficulty in delivering a consistent and sustained high level of performance.

Table 10 – Performance and Proposed Target (unit: Minutes:Seconds)

AMP	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Thames Water*	24:23	18:57	17:59	13:39	11:03	19:54	10:55	10:30	10:00	09:45	09:30	09:15	09:00
Industry Average	19:34	12:49	10:06	13:37	13:39	28:01							
Industry Upper Quartile	06:12	07:23	06:42	04:46	03:43	08:03							

[2] INRIX provides cities and road authorities with an analytics platform for managing mobility across road networks – typically major routes and in cities.

AMP	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Proposed Target									10:00	09:45	09:30	09:15	09:00

Actuals to 2022/23; Forecast thereafter. AMP8 allows 5mins:01s large event provision in each year.

Table 11 – Long term performance trajectory (unit: Minutes:Seconds)

	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End of AMP actual/target	17:59	10:30	09:00	08:00	07:00	06:00	05:00

As noted above, large scale events have had a major impact on performance. These low probability, high consequence failures have occurred both on our trunk main network and at water production sites, with the effect compounded by an inconsistent response.

Table 12 – Analysis of large events on our water supply interruptions performance (Unit: Minutes:Seconds)

		17/18	18/19	19/20	20/21	21/22	22/23
Thames Water Supply Interruptions performance		24:23	18:57	17:59	13:39	11:03	19:48
Large events (Greater than 20,000 property hours)		08:08	00:52	06:46	06:24	03:38	09:12
*Sizeable contributing events:							
Fobney WTW	Raw water deterioration following Storm Alex				01:46		
Hampton WTW	Pumping station failure			04:44			
Netley Mill Water Treatment Works	Complications during planned maintenance, water quality shut-downs and power outages				00:31	01:05	01:45
Bromley	Trunk main failure	01:44					
Freeze Thaw	Norwood 12inch and 18inch trunk main failure	05:28					
Queens Drive	Trunk main failure			01:41			
Hackney Marshes	Trunk main failure				04:40		
Hendon, NW4	Two trunk main bursts					03:02	
Oxford Heyford Hill							05:52
Belsize Road, NW6							02:05

Our analysis highlights the wide variation in causal factors for large events. We also need to continue to improve our prevention and response to smaller events which contribute to our baseline/underlying performance. The operational conditions across the region where there is more major infrastructure and greater road congestion make the task more onerous in terms of

our ability to access and isolate bursts quickly. We also have the highest property density in our region which exposes more properties to supply interruption events.

Section 3.1.2 describes the activities we are currently undertaking and plan to continue in AMP8.

3.1.2. Activity to improve performance

Activities included within base expenditure

We have continued to refine our supply interruptions strategy which was initially developed at the start of AMP7. The ongoing review enables us to use our root cause analysis and learning from leading companies to adapt processes and procedures, better target investment and introduce new ways of working and equipment. Performance improvements will be entirely funded through base expenditure.

Key Principles of our plan include:

- Prioritising service recovery ahead of asset repair (adopting the "every second counts" mantra).
- Improve supply interruption contingencies for all planned work.
- Proactive maintenance in high-risk systems, increasing asset availability.
- Maximising 'Always in Supply' techniques on both planned and reactive works.
- Enhancing the speed and nature of response.
- Reducing bursts in high-risk systems by introducing Calm Systems.

Based on these principles, the interventions, which span AMP7 and AMP8, include:

Cultural change

We have established and are embedding new ways of working with a clear aim to maintain customers' supplies as much as possible.

Our workforce understands that 'every second counts', and therefore appreciates the need to prioritise service recovery ahead of asset repair. We have improved consideration of contingencies for all planned work to avoid or mitigate impact of supply interruptions. We have also improved processes, for example, using a 'mains throttling' [3]approach if a wider network impact is suspected and only shutting off supply when needed to complete the job.

There is greater ownership of challenges and issues, with senior managers conducting regular event learning workshops to identify opportunities to learn from our response to supply interruption events and to assign actions that will result in improved responses in the future.

Improved response

We now have 6 rapid response teams in place 24 hours a day which allow a quicker response, especially to larger scale incidents. They have the right experience and skills to focus on supply restoration and have an available fleet of fully stocked vehicles at their disposal.

[3] Mains throttling is the practice of restricting the flow of water through the repair location, rather than a full isolation. The former can help maintain supplies to customers whilst the repair takes place.

We have increased our clean water tankering capability to support supply interruption events through the purchase of additional vehicles, investing in more drivers and a dedicated 24/7 logistics function and control desk.

Over AMP7 we have built up our own tanker fleet and now includes 13 artic tankers and will be directly employing an additional 50 tanker drivers, which will remove our current reliance on the supply chain. During AMP8 we propose to expand to 31 vehicles during the early part of AMP8.

Through our 24/7 control centre we have established direct lines of communication to the emergency services and Local Resilience Forums, so that there is direct access to our 24/7 incident managers.

Improvements in our asset maintenance approach and increased monitoring

We have increased the level of planned maintenance on trunk and distribution mains and valves, assets critical to managing supply interruptions events.

We have started a programme to address the highest priority risks on our network, including the trunk main rehabilitation schemes to be delivered during AMP7 under the London Water Improvement Conditional Allowance (LWICA). LWICA schemes have been prioritised based on a holistic view of trunk main risk, which incorporates additional risk factors such as supply interruptions, traffic disruption, leakage and risk to public safety.

We have installed new cross-connections to improve network connectivity. This programme prioritises hotspots (those areas with historic poor performance or high risk of failure).

We are increasing asset availability through proactive maintenance of high-risk systems and increasing the focus on calming our network in AMP8. We plan to install a minimum of three pressure transducers per District Metered Area during AMP8 to improve our field measurements of pressure which will enable quicker response to ongoing events and will provide robust data for verifying incidents.

Digitising our network

The increased deployment of technology will enable smart system thinking, design and roll out to commence. Our “Smart Water” tools include the system risk visualisation tool that can provide early warning of sudden flow and pressure changes in our network, enabling quicker investigation and response times. Our supply demand tool allows us to effectively plan for upcoming weather events, such as freeze-thaw events, through ensuring network storage levels are optimised and arranging suitable staff deployment schedules.

In AMP8 we will trial remote transmission switching, retrofitting 500 trunk valves with battery powered SCADA integrated remote actuators on trunk mains, major feeds and strategic cross connections leading to significantly improved connectivity and network rezoning flexibility.

Calm Systems

We introduced a ‘calm systems’ team in 2022 to undertake ongoing reviews of our hydraulic systems to identify pressure transients and high-pressure variance. Solutions are then designed and delivered (with more complex interventions delivered by our Capital Delivery team) to calm

the pressure transients in the system and so reduce the pressure variances to lessen the risk of mains bursts. In AMP8, we plan to install dynamic, state of the art control systems on 15 key pumped systems, while starting a programme of investment on our London Ring Main pumping stations.

By the end of AMP7 we will have delivered 143 new control systems on our smaller to medium sized pumped systems which has delivered a reduction in mains bursts of circa 5% ad reduced leakage by circa 20Ml/d.

Working in partnership with stakeholders

Following the major bursts and impact on customers due to the widespread loss of supplies, we have been working in partnership with the following groups:

- All 13 Local Resilience Forums that cover our region, to ensure we have a coordinated "Loss of Water" contingency plan.
- Working with the emergency planning departments of local authorities and London Boroughs to plan for supply interruptions and how we can work together to improve the speed of supply restoration.
- The Water and Floods team at DEFRA to improve communication and understand the risks we manage and how government could support large scale supply interruptions.

Activities included within enhancement expenditure

There is no enhancement expenditure proposed in AMP8 to improve our supply interruptions performance.

3.2 Mains repairs

3.2.1 Performance, targets and incentives

We aim to deliver 15% improvement over AMP8, as we introduce several initiatives, including our increased mains replacement programme, calm systems and deliver a change to our leakage 'find and fix' strategy.

We recognise that we remain an outlier compared to the remainder of the sector, and will remain so at the end of AMP8, but we believe our proposals are stretching and ambitious.

The tables below set out our actual and projected medium- and long-term performance and targets. Our forecast is realistically stretching and reflects the scale of the activities and investment needed to consistently improve performance given the soil type much of our complex and aging network lies within, and the stresses it faces from heavy traffic and volume of water needing to be pumped to serve high density areas. We have included the expected benefits from the London Water Improvement Conditional Allowance (LWICA).

Table 13 – Performance and Proposed Target (unit: repairs per 1000km)

AMP	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Thames Water*	271.6	329.3	246.6	269.6	223.3	316.8	298.9	281.3	270.1	261.8	253.7	245.7	237.7
Industry Average	149.3	157.7	124.9	145.4	116.5	158.6							
Industry Upper Quartile	124.2	138.5	109.3	122.0	100.2	132.5							
Proposed Target									270.1	261.8	253.7	245.7	237.7

Actuals to 2022/23; Forecast thereafter
** AMP7 includes conditional allowance, with AMP8 showing expected Ofwat target*

Table 14 – Long term performance trajectory (unit: repairs per 1000km)

	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End of AMP actual/target	246.6	281.3	237.7	206.7	176.4	146.2	116.0

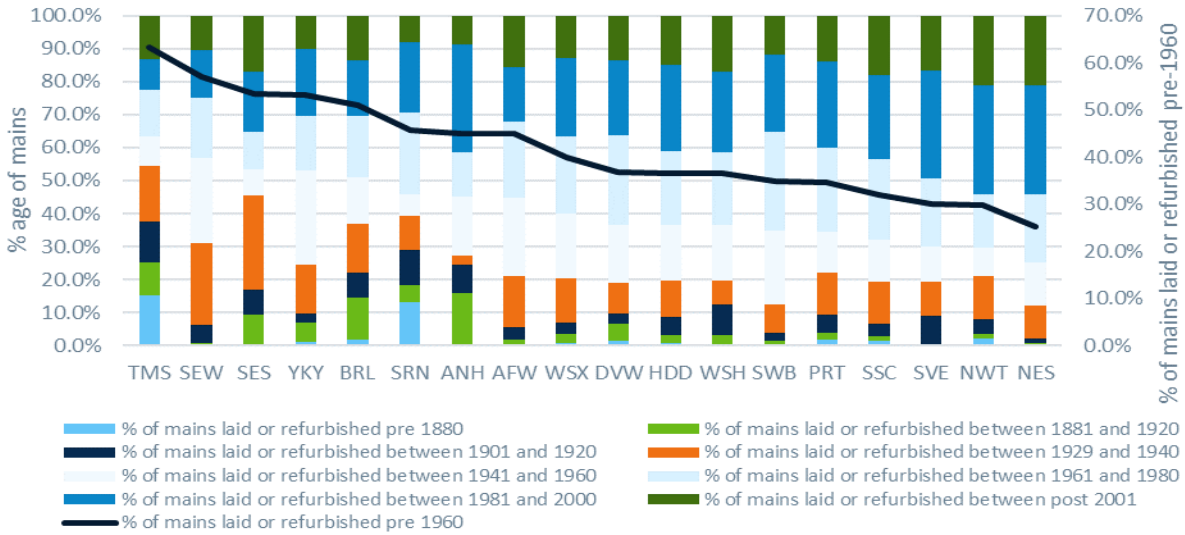
The number of mains repairs required can vary for several reasons. Details are included in TMS18 Cost adjustment claim: Mains Replacement, with a summary of key issues highlighted below:

- Age: Older water mains are generally more susceptible to bursting due to wear and corrosion over time. As the chart below shows, Thames Water has an older network than other companies. Significantly, around a fifth of our network was laid over a century ago, a time

when dimensional and metallurgical standards varied significantly to those introduced more recently.

Figure 1: Comparison of mains age across the industry

(Source: Ofwat cost assessment return 2016-17, Table 5 Lines 27-34)



- Material: The material used in water mains can influence their vulnerability. Different materials have varying levels of resistance to corrosion and stress. For example, older cast iron and galvanized steel pipes are more susceptible to corrosion compared to newer materials like ductile iron, PVC, and HDPE (high-density polyethylene).
- Soil Conditions: The soil in which water mains are buried can impact their stability and vulnerability to bursting. Aggressive or corrosive soils (such as London clay) can accelerate the deterioration of pipes. The table below outlines how compared to the industry average we have a significantly greater length of mains in highly corrosive soils.

Table 15 – Analysis of soil corrosivity

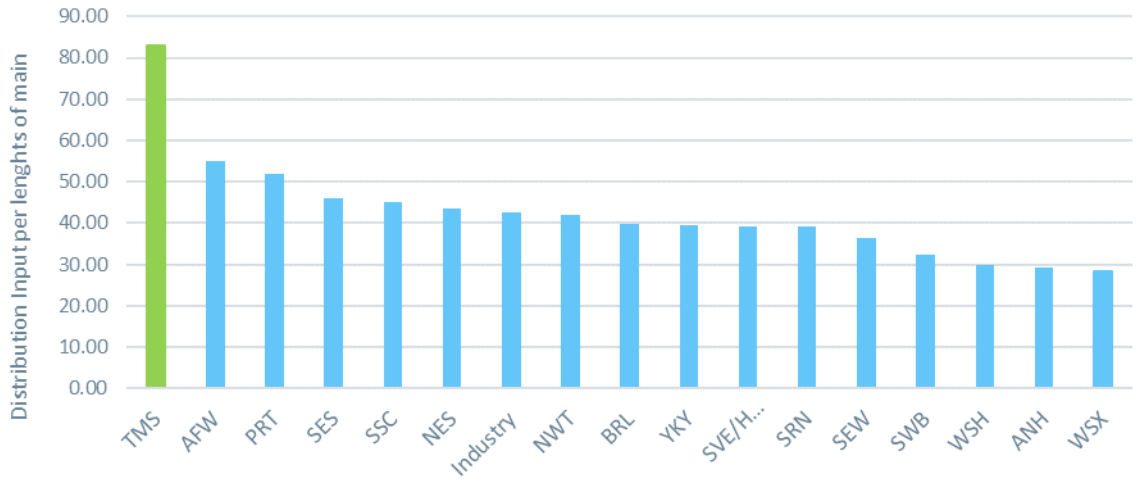
Corrosivity Class	London	Rest of England and Wales	Variance
Non-aggressive	37.9%	38.6%	-0.7%
Slightly aggressive	5.5%	10.2%	-4.7%
Moderately aggressive	16.1%	24.6%	-8.5%
Highly aggressive	34.7%	16.7%	18.0%
Very highly aggressive	4.8%	5.9%	-1.1%
Other	0.0%	4.1%	-4.1%

Source: TSD358-SSLRD Dataset

- Water Pressure: High water pressure can put additional stress on water mains, increasing the likelihood of bursts. Due to the scale of population, we serve, we need to pump far

greater volumes at higher pressure through our network than many other companies. The figure below shows the amount of water we input when compared to our network length.

Figure 2: Volume of water input into our system per length of main



Source: Thames Water analysis of APR data

- Temperature Fluctuations: Hot and dry and freezing cold weather leads to the ground expanding or contracting around pipes resulting in weakening them over time and/or bursting

- Heavy Traffic and/or Construction Activities: Heavy traffic acts to compress the soil around the pipes and this can cause damage to water mains, while construction or excavation work can cause inadvertent damage, leading to bursts.

In 2021, we commissioned the engineering consultancy Mott Macdonald[4] to review the condition and performance of our network as part of the evidence to support our London Conditional allowance submission. Their key findings are summarized below:

- Comparatively high number of reported (visible) leaks on mains;
- Pipe samples from failed water mains show heavy corrosion with through-wall corrosion in many cases;
- The lead-pack joints on many older cast iron pipes have become locked with corrosion, making them vulnerable to fracture when water temperatures drop in winter;
- High leakage recurrence in the worst performing DMAs, indicating that the pipes are in very poor condition;
- The network responds poorly to periods of cold or dry conditions, with leakage outbreaks; and
- High numbers of repairs at road junctions, suggesting vulnerability to traffic loading.

[4] LWI.G2.E1 - Rationale for London Additional Expenditure Factors Affecting Performance and Costs

Our analysis highlights the need to implement a wide range of interventions, from large-scale trunk and distribution mains replacement to deploying technology to help reduce changes in pressure and so calm the network.

Section 3.2.2 describes the activities we are currently undertaking and plan to continue in AMP8.

3.2.2 Activity to improve performance

Activities included within base expenditure

This section sets out the action we have taken to improve performance and our plans to deliver further improvement in AMP8. The performance improvement will be delivered through base expenditure, supported by a Cost Adjustment Claim.

The remainder of this section explains the impact of our activities for the remainder of AMP7 and AMP8, summarised below.

Table 16 - Expected impact of activity on mains repair performance: unit: (number of repairs)

	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Forecast of underlying performance (	*9,582*	*9,582*	*9,582*	*9,582*	*9,582*	9,582	9,582
AMP8 benefits from conditional allowance (LWICA)	-16	-112	-207	-207	-207	-207	-207
Calm systems	-	-55	-170	-285	-400	-515	-630
Pressure management	-	-45	-90	-135	-180	-225	-270
Leakage strategy – fixing fewer small active leaks	-	-345	-426	-508	-589	-670	-751
Total mains repairs	**9,566**	**9,025**	**8,689**	**8,447**	**8,206**	**7,965**	**7,724**
Normalised to show repairs per 1,000 km	**298.9**	**281.3**	**270.1**	**261.8**	**253.7**	**245.7**	**237.7**

Renewing our mains network

We have started a programme to address the highest priority risks on our network, including the wholesale replacement of four District Metered Areas under the LWICA.

Mains replacement will continue to be the key enabler for our long-term strategy. We want to build on the progress being made by stepping up the future rate of mains replacement. We believe that increasing our mains replacement to 500km will prevent further deterioration of our distribution network, with 275km delivered through our base allowance and the remaining 225km through expenditure funded outside of Ofwat's base cost models.

Using technology to reduce pressure and calm our network

As outlined in section 3.1.2 we introduced a Calm systems team in 2022 to undertake ongoing reviews of our hydraulic systems to identify pressure transients and high-pressure variance.

The team will have delivered 143 projects calming the network by the end of AMP7 and reducing bursts on the network. In AMP8, we plan to install dynamic, state of the art control systems on 15

key pumped systems, while starting a programme of investment on our London Ring Main pumping stations.

We also plan to continue our focus on pressure management, for example managing the pressures in DMAs using pressure reducing valves.

Refining our approach to active leakage repairs

The insourcing of our leakage repair teams in 2022 provided an opportunity to refine our approach to leakage detection which has now switched to focusing on the quality of leaks detected over the quantity. (The latter is the typical commercial arrangements for water companies that seek leak detection services from the market, as it is commercially the simplest way to monitor activity).

This change will allow the transition to focusing on those active leakage jobs that will have the greatest impact on the District Metered Area nightlines. It is the nightlines that measure consumption during the early hours of the morning, which in turn provides the best indication of the levels of leakage, given universal metering is not available in the water sector currently. There is a strong correlation between reducing nightlines and reducing leakage, whereas any measurement of flows during the daytime can be more significantly impacted by consumption.

We have assumed an 8% reduction in the number of active mains repairs required to meet our leakage target, in 2024-25 and a further 9% in AMP8.

Activities included within enhancement expenditure

There is no enhancement expenditure proposed in AMP8 to improve our mains repair performance.

Our base plan will be supported by a Cost Adjustment Claim to enable the replacement of 500km of mains in AMP8. Refer to TMS18 Cost Adjustment Claim: Mains replacement.

3.3 Unplanned outage

3.3.1. Performance, targets and incentives

This PC was introduced for AMP7. There is one adaptation planned for AMP8: the calculation methodology will no longer allow any outages due to raw water quality incidents.

The tables below set out our actual and projected medium- and long-term performance and targets. Our current performance is broadly in-line with other companies and has outperformed our AMP7 target.

During AMP8 we are aiming to improve our performance by 45%, as our Public Health Transformation programme outlined in section 3.1, increase reliability at our water production sites.

Table 17 – Performance and Proposed Target (Unit: % Peak Week Production Capacity)

AMP	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Thames Water*	Previously not reported in a consistent manner across the sector		3.70	2.50	2.30	2.65	2.34	2.34	2.30	2.05	1.80	1.55	1.30
Industry Average			4.68	2.89	2.82								
Industry UQ			2.43	1.03	1.36								
Proposed Target									2.30	2.05	1.80	1.55	1.30

**All figures based on the new AMP8 methodology and up to 22/23 are actuals with a forecast thereafter.*

Table 18 – Long term performance trajectory (Unit: % Peak Week Production Capacity)

	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End of AMP actual/target	3.70	2.34	1.30	1.25	1.20	1.15	1.10

Outages at our largest treatment works have the biggest impact on performance and improving reliability and performance at these works is critical in driving improvements in unplanned outages.

Table 19 – Analysis of unplanned outages for the last 3 years (Unit: % Peak Week Production Capacity)

	Average PWPC (Ml/d)*	20/21	21/22	22/23
Ashford Common	698	0.15	0.20	0.17
Hampton	667	1.06	0.36	0.29
Coppermills	542	0.34	0.38	0.27
Kempton Park	169	0.12	0.64	0.38
Walton on Thames	117	0.19	0.14	0.35
Other sites (84 number)	1,211	0.65	0.57	1.19
Total Thames Water unplanned outages	3,404	2.50	2.30	2.65

**AR23 used to show indicative size*

Analysis shows that our unplanned outages are predominantly caused by four factors:

- Automatic shutdown associated with water quality triggers being reached, (primary cause);
- Equipment failure
- Power outages due to failures with the local grid or fluctuations in the quality of the power being supplied to the site; and
- Actions taken to protect water quality, with sites automatically shutting down due to exceedances in turbidity and control set points.

3.3.2. Activity to improve performance

Activities included within base expenditure

The majority of interventions required to improve CRI will have a corresponding benefit to unplanned outages. Activity included in our AMP8 plan is based on improving our risk management process, seeking insight and learning from leading companies, deploying innovation and adopting guidance from the DWI. Performance improvements will be entirely funded through base expenditure.

Further details on our planned activity is included under section 2.1 covering the CRI Performance Commitment. The key programmes are:

- Enhanced Hazard Reviews – addressing key risks that could potentially impact water quality or plant reliability at our water production sites.
- Groundwater Refurbishment Programme – addressing the risk of turbidity which subsequently result in plants being shut down for water quality reasons.

This programme will be supplemented with an intervention which is focused on improving resilience against power failure and poor-quality power supplies which cause fluctuations and equipment and hence causing sites to "trip". We are liaising with the local electricity providers to address several areas of concern:

- Ensuring good working relationships so that we are given timely notice of planned power interruptions, to allow us to make alternative power provisions.

- Monitoring the quality of the power supply to sites that see a high level of equipment "trips" and feeding back the information so that they can make changes on their network to stabilise the supply.
- Ensuring they understand the higher risk stations, which if they suffer a power interruption could result in a pollution, thereby allowing the electricity companies to prioritise restoration in those areas.

We also recognise that during extreme weather, especially high winds, widespread power outages can occur. We will therefore maintain a fleet of mobile generators to allow us to provide alternative power supplies during events that overwhelm the local electricity distribution companies, allowing us to position mobile generators at our most sensitive sites.

Activities included within enhancement expenditure

There is no enhancement expenditure proposed in AMP8 to improve our unplanned outage performance.

3.4. Customer Line of Sight – A reliable supply with minimal disruption

Engagement with our customers, communities and stakeholders has played a key role in developing our AMP8 strategy for safe, high quality drinking water.

'I want a reliable supply with minimal disruption' is a high priority for customers, however, there is some divergence in views between groups and regions on certain issues, which we explore below. We provide further detail of our overall PR24 engagement programme in TMS03: Customer Engagement

In this section we present the line of sight from what we heard to what we are planning to do and highlight any areas where we have had to make trade-offs. For our Enhancement Cases in this area, we also provide further evidence of the line of sight, including customer views, supporting the need for investment and our proposed solutions.

The Enhancement Cases in this area are focused on addressing resilience and public safety related risks and hence do not have a direct line of sight to PC improvements. However, they are essential in order to reduce the risk of significant supply interruptions and protecting customers. For details refer to:

- TMS30: PR24 Water System Supply Resilience Programme
- TMS21: Enhancement Case: Reducing the Risk of Basement Flooding

The Enhancement Cases are supported by a Cost Adjustment Claim which can be found in TMS18 Cost adjustment claim: mains replacement.

Table 20 – How we are responding to customer insight – a reliable supply with minimal interruption

What we heard		How we are responding
Supply interruptions	Customers place a high priority on being able to rely on water being available 24/7. They expect us to proactively monitor, maintain and improve the network to ensure its reliability, now and in the face of future challenges. Customers find supply outages of more than 48 hours unacceptable.	We will reduce the number and length of supply interruptions our customers suffer by: • Improving the monitoring of our network and deploying dedicated rapid response teams allowing a faster response. • Enhancing our tanker fleet to allow direct infusion of supplies into the network. • Introduction of Calm systems reducing pressure transients and reducing the risk of bursts. • Changing our culture so that "every second counts"
Trunk mains replacement	Although customers place a lower priority on addressing this, given the common perception that this is of narrow benefit, customers accept that we have an obligation to protect all customers. They also recognise the longer-term benefits of proactively replacing assets and pipework at risk of failure.	We will deliver our trunk mains replacement enhancement programme to reduce the risk of basement flooding, starting with those which pose the biggest risk to properties, as we recognise that public safety is a "given" for our customers.

Key tensions and trade-offs between customer views and our proposals

Water supply resilience

When shown different options for plans for AMP8, the majority of customers preferred an approach whereby we undertake proactive enhancement investment to improve the resilience of our asset and hence reduce the risk of supply interruptions. They feel, that with an aging asset base, asset failure is inevitable, and costs would only further increase if resilience investment is left unaddressed.

They would prefer to see quicker improvements to 2030 rather than spread investment over the longer term. Future customers also have a higher preference for investment in this area which they see as tackling the resilience issue as soon as possible, as they are aware that future generations will inherit these issues.

Despite it being a high priority for customers, we are proposing to defer any further water supply resilience investment into AMP9. We will use AMP8 to complete the delivery of the current water supply resilience programme (WSSRP) currently being considered by Ofwat.

This trade-off is required in order to ensure we can both deliver and finance our wider programme and especially those programmes with statutory drivers. We will still undertake targeted interventions over AMP8 to balance risk and performance.

Trunk mains enhancement programme

Most customers do not have basements and therefore place a low priority on reducing basement property inundation from trunk mains bursts, however, this is a high priority for customers in London. Customers without basements (largely those living outside of London) viewed our plans to replacing trunk mains over AMP8 as a London-centric issue, which will benefit customers who are generally perceived to be wealthier, hence it is generally ranked as a lower priority compared to other areas.

Despite this tension between customer groups, we are proposing to deliver our trunk mains replacement enhancement programme. We consider this a legal obligation under Section 3 of the Health & Safety at Work Act 1974 and have prioritised delivery to mitigate potential risk to customers living in basement properties.

The table on the previous page, provides a summary of customer views for each of the key areas for this outcome and considers how we have addressed each aspect within our plan. In the table below we provide specific details of the feedback from the various research inputs we received including our Outcomes and Wants research, Acceptability testing, Ofwat's collaborative research, Vision 2050 research and Enhancement Case Deep Dives.

Table 21: Key customer research that has informed our water strategy

Outcomes and Wants	Thames Water Triangulated Priorities [1]	Topics	Ofwat collaborative research [2]	Enhancement case deep dives [3]	Acceptability and affordability testing [5]	Vision 2050 research [6]
I want a reliable supply with minimal disruption	Customers place a high priority (3rd of 10 Wants) on '**I want a reliable supply with minimal disruption**'.	Water supply interruptions	Customers place a high importance on '**Water supply interruption**' as this is a fundamental expectation of service.	Customers overall place a medium priority on enhancements relating to 'Improving water supply reliability'. Customers also place a medium priority on 'Improvements to providing alternative water supplies in an emergency (SEMD)'; customers agree that Thames Water have a responsibility to provide customers with water if supplies are disrupted, and feel it is important that emergency measures are in place.	Customers place a medium priority on '**Reliable supply**' as a performance commitment; our performance is deemed acceptable, however, generally feel that outages longer than two days are unacceptable.	Customers place a high priority on '**Provide a more reliable supply of water**'; customers are clear that a reliable supply of water is important. At the same time, many feel it is lower down the list of priorities for them as they either have never experienced such problems themselves or they do not see Thames Water's current performance (22 minutes of outage) as especially poor.
		Trunk mains replacement		Customers place a low importance on '**Reducing risk of basements flooding from trunk mains**'; most customers do not have basements and therefore place a low priority on reducing flooding, however, this is a high priority for customers in London.	Customers were positive towards replacement of pipes to '**Reduce the risk of basements flooding from trunk mains**' as an enhancement case, however, this is generally felt this was a 'London-focussed' issue with narrow benefit. Despite the relatively low impact on their bills, many felt the money could be better spent elsewhere.	

Sources:
[1] What Customers, Communities and Stakeholders Want v18, Sia Partners, July 2023
[2] Ofwat + CCW customer preferences research, April 2022
[3] PR24 Deep Dives, February 2022; Enhancement case package options research, September 2022; Enhancement case deep dive research, May 2023
[4] Thames Water WRMP Consultation, May 2023; WRSE – Customer Preferences to Inform Long-Term Water Resource Planning, March 2021; WRSE Best Value Criteria, May 2021; WRSE Water resources quantitative research, June 2022
[5] Acceptability and Affordability Testing (Qualitative findings), May 2023
[6] Vision 2050 Research, May 2022

Section 4. Outcome 3: Fix leaks and ensure there is enough water in the future

A sustainable supply of water is a high priority for customers and we are legally required to plan to deliver reliable supplies for the long term, as well as developing new strategic water resources. Reducing leakage and water demand are significant contributors to achieving our objectives.

Our customers, stakeholders, regulators and Board will hold us to account on delivering reductions in leakage and demand through three common PCs: Leakage, Per Capita Consumption and Business Demand. All three are measured as the percentage reduction from a 2019-20 baseline, using three-year averages.

- Leakage is measured as the percentage reduction of three-year average leakage in Ml/d from the 2019-20 baseline. Three-year averages are calculated from annual average values for the year and two preceding years and expressed in Ml/d.

  Annual average leakage is defined as the sum of distribution system leakage, including service reservoir losses, trunk main leakage plus customer supply pipe leakage.

- Per capita consumption (PCC) is measured as the percentage reduction of three-year average PCC in litres per person per day from the 2019/20 baseline. Three-year averages are calculated from annual average values for the year and two preceding years and expressed in Ml/d.

  Annual average PCC means the sum of measured household consumption and unmeasured household consumption divided by the total household population.

$$\frac{\textit{Measured household consumption + Unmeasured household consumption}}{\textit{Total household population}}$$

- Business demand is measured as the percentage reduction of three-year average business demand in Ml/d from the 2019/20 baseline. Three-year averages are calculated from annual average values for the year and two preceding years and expressed in Ml/d.

Our region is designated by the Environment Agency as an area of 'severe water stress'. The future water availability and supply position for London and Thames Valley is not enough to serve our growing population and forecast demand. We estimate that, by 2045, our customer base will grow by more than two million people to 11.8 million, resulting in a supply-demand deficit of up to 850 Ml/d by 2050, if no action is taken. Across the wider south-east, this deficit could reach more than 2,000 Ml/d per day.

By 2050, our ambition is for our water supply to be resilient to a 1 in 500-year drought. Over the next 25 years, we must deliver a step-change in reducing water use in homes and businesses and achieve significant leakage reductions.

Within our submission we have developed two Enhancement Cases to support this outcome:

- Development of new strategic resource options in line with our dWRMP. Refer to TMS27 Enhancement Case: WRMP Supply Options.
- Continuation of our smart metering programme and demand management reduction programme. Refer to TMS28 Enhancement Case: WRMP Demand Reduction.

The remainder of this section looks at each PC, setting out our proposed targets in the context of our current performance and providing an overview of the activity required to deliver the proposed levels of improvement.

4.1 Leakage

4.1.1. Performance, targets and incentives

Our leakage is currently higher than the rest of the industry. However, we have a larger target reduction than other companies, with a 20% target by 2024/25 compared with an industry median of 15% reduction. The target for this PC is company-specific, with a target reduction from a 2019/20 baseline. We are targeting a further large reduction in AMP8, to achieve a 37.1% reduction by 2029/30.

Our 2022/23 performance was significantly affected by the weather, with a summer heatwave, a severe drought (one of the worst on record) followed by a 'freeze-thaw' event in December. We are more affected than most other companies, due to the age of our network and the nature of the soils in our region, which are more corrosive in nature (Refer to section 3.2.1), or prone to causing heave and bursts, particularly in extreme temperatures.

The weather had an effect on leakage that began in July 2022 and was not recovered until April 2023. In 2022/23 we repaired 42% more burst mains than in 2021/22. We remain committed to our AMP7 target, but the 3-year averaging process means the impact of the 2022/23 outturn will continue to be felt in reported performance until 2024/25.

With extreme weather events becoming more frequent, there is a risk that performance in AMP8 will again be affected by the weather. We have not, however, built any allowance for adverse weather into the PC forecast. We have though considered the additional find and fix activity and subsequent base cost needed to mitigate the risk and details can be found in Technical Appendix TMS15 Asset Deficit. Without the additional find and fix activity, the profile below would be at risk.

The tables set out our actual and projected medium- and long-term performance and targets. We are targeting a 50% reduction in leakage by 2050.

Table 22 – Performance and Proposed Target (Unit: ML/d and % reduction from 2019-20 base, three-year averages)

AMP	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Annual Ml/d*	699.4	694.0	629.8	593.2	593.8	619.7	587.3	507.2	472.7	451.5	438.0	424.5	411.0
3- year Average Ml/d*			674.4	639.0	605.6	602.2	600.3	571.4	522.4	477.1	451.5	438.0	424.5
3-year averages – % reduction from 19-20 baseline				5.2	10.2	10.7	11.0	15.3	22.5	29.3	32.7	35.1	37.1
Industry Average				3.1	7.0	6.2							
Industry UQ				5.2	10.2	9.3							
Proposed Target									22.5	29.3	32.7	35.1	37.1

Actuals to 2022/23; Forecast thereafter

Table 23 – Long term performance (Unit: % reduction from 2019-20 base, three-year averages)

	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End of AMP actual/target - %age reduction	-	15.3%	37.1%	-42.6%	-46.5%	-49.7%	50%

Our long-term aim is to achieve the government's target of reducing leakage by 50% from a 2020 baseline by 2050.

Section 5.1.2 describes the activities we are currently undertaking and plan to continue in AMP8.

4.1.2. Activity to improve performance

Summary of Impacts

We have estimated the impact of our base and enhancement activities on our performance, as shown in the table below. This is sufficient to achieve a leakage reduction of 37.1% by 2029/30 from the 2019/20 base, compared with the 20.4% target for 2024/25.

Table 24 – contributions to leakage reduction (Unit: Ml/d)

Activity / Interventions	2029-30 Ml/d reduction from 2024-25	AMP8 Allocation
Mains replacement – London Water Improvement Conditional Allowance	-26.0	Base
Zonal reconfiguration, pressure management and Calm systems	-28.0	Base
Mains replacement (cost assessment claim)	-2.8	Base
CSL identified through Green Economic Recovery Smart meters[5]	-2.8	Enhancement
CSL identified and fixed through Smart meters	-36.6	Enhancement
Overall performance	**-96.2**	

This will be supported by additional find and fix activity which will primarily counteract recurrence and make us more resilient to adverse weather as mentioned above. (See below regarding the details regarding our PR24 enhancement case).

Activities included within base expenditure

Leakage Recovery Plan

[5] We have asked Ofwat to consider adjusting the GER funding conditions in light of the affect that the summer drought of 2022 and subsequent freeze-thaw event has had on the achievability of our end of AMP leakage target. The outcome of these discussions will determine if we can proceed with the GER programme

In response to the summer drought of 2022, and resulting increase in leakage, we implemented a substantial and ambitious Leakage Recovery Plan. This will continue through the remainder of AMP7 and see benefits as we enter AMP8. The Plan includes:

- Additional leakage funding of £65m.
- Increased repair and maintenance team capacity, supported by 100 additional enabling, logistics and support resources.
- Providing additional support for our customers in how they can identify, report and repair leaks on their pipes, based on learning from the 2018 extreme cold weather event ('Beast from the East').
- Changed working patterns and approaches, including new KPIs and performance management frameworks, to find and fix leaks more quickly.
- Building a plan to manage the potential impact of a more severe winter.
- Increasing the proportion of District Meter Areas which are fully operational, improving our ability to control the network and identify where leakage is highest.

Find & Fix Activity

Find and Fix activity is primarily focused on managing leakage levels by dealing with recurrence (the rate at which new leaks arise on the existing network). Sustainable leakage reduction is then delivered through the various initiatives proposed below. Find and Fix activity is therefore vitally important to provide a stable base and in terms of leakage benefit far outweighs any other activity.

Due to the material and age of our water network along with the underlying soil conditions, we need to undertake a far higher level of Find & Fix activity than other water companies, especially to counteract extreme weather events. We have though considered the additional find and fix activity and subsequent base cost needed to mitigate this risk and details can be found in Technical Appendix TMS15 – Asset Deficit.

Prevention of leakage though pressure management, 'calm systems' and zonal reconfiguration

We have been developing our data-driven 'calm systems' approach - a holistic approach to pressure management and network configuration, using real-time information to avoid pressure surges in the network. This has the benefits of improving water quality, customer resilience, leakage, and energy efficiency, with a particular focus on reducing mains bursts.

As mentioned in previous sections we introduced a Calm systems team in 2022 to undertake ongoing reviews of our hydraulic systems to identify pressure transients and high-pressure variance. Solutions calm the pressure transients and so reduce the pressure variances to lessen the risk of mains bursts. In AMP8, we plan to install dynamic, state of the art control systems on 15 key pumped systems, while starting a programme of investment at our London Ring Main pumping stations.

Mains replacement

Mains replacement will continue to be the key enabler for our long-term strategy. We want to build on the progress being made by stepping up the future rate of mains replacement. We believe that increasing our mains replacement to 500km will prevent further deterioration of our distribution

network, with 275km delivered through our base allowance and the remaining 225km through expenditure funded outside of Ofwat's base cost models. Further information on our approach to mains replacement are set out in PR24_TMS_Cost Adjustment Claim_001 (mains replacement).

London Water Improvement Conditional Allowance (LWICA)

The LWICA involves investing a further £700 million to address asset performance and integrity issues (approved by Ofwat in November 2022). £300m was included in the PR19 Determination and an additional £400m invested by shareholders. This will include replacement of 112km of distribution mains and seven large trunk mains in London, which will contribute to leakage reduction as well as a pressure management programme. Additional benefits from this programme will be achieved in AMP8.

The LWICA also includes a Smart System pilot, to be implemented in 2023/24 in North-East London. The project will link telemetry data to live network models and the work management system, to improve customer service and develop adaptive plans to achieve performance commitments.

Consumption and leakage information will be captured through high levels of smart meter penetration, flow and pressure loggers and zonal and district boundaries managed through a smart valving solution ensuring tight boundaries and reliable information. We will extend smart systems further in AMP8.

Trunk Mains Rehabilitation and Proactive Leakage Monitoring

We have made good progress on managing our trunk mains, especially following the Trunk Main Strategic Review published in 2017. We continue to gather information and data on the performance and condition of our 3,600km trunk network through a variety of methods including non-destructive and forensic testing on trunk main repairs. We are using improved modelling and insight to drive proactive replacement programmes through the AMP7 conditional allowance and an enhancement case focused on the risk of basement flooding for AMP8.

We will proactively survey approximately 1,000km of trunk mains annually identifying active leaks on our trunk main network using a mixture of Sahara technology and Correlation. Frequency of surveying is determined by the risk and consequence of main failure. To improve visibility of our trunk main network we are installing 127 additional Sahara chambers on the trunk main network in high-risk locations which will enable us to proactively inspect a further 50km of pipe.

We envisage through this approach we will repair approximately 150 trunk mains leaks per annum.

Smart Water

We are committed to the use of digital technology to improve our trunk main and distribution network monitoring, through the use of the data and using innovative monitoring techniques.

In terms of our trunk main network, we have primarily deployed Syrinix and Hydroguard units to identify leaks and bursts across the trunk main network on our highest risk pipes, with these monitoring points supplemented by a wider dataset in our System Risk Visualisation Digital Platform, which provides the Control Room a real time view of flows and pressures across the

entire network, allowing the location and impact of a burst or significant leak to be addressed quickly.

Across our distribution network, increased network sensors (pressure and acoustic logging) coupled with advanced analytics and AI, is facilitating significant reductions in leakage due to reduced awareness time as leaks are located more quickly. The approach is underpinned by the up-front classification of areas which allows for the deployment of the most appropriate leakage control solutions in each area. This innovative, digital solution is being developed through Thames' Smart Systems Proof of Concept area in North East London, which will be further expanded across AMP8.

In addition to the above, the improved data on asset condition when combined with advanced data analytics will help accelerate improvements in asset rehabilitation investment decisions.

Activities included within enhancement expenditure

Metering

We have an extensive metering programme for AMP8, which is the subject of a separate enhancement case and was included in our Water Resource Management Plan. This continues the smart metering programme currently being implemented and includes over a million new smart meters, with:

- Installation of smart water meters on previously unmeasured households – 256,000 properties
- Upgrade of basic meters to smart meters on 645,000 properties
- Installation of smart meters on previously unmeasured bulk properties, e.g. flats that cannot be individually metered – 55,000 properties
- Installation of smart water meters on 100,000 business properties.

Although the prime driver is encouraging water efficiency, smart metering enables leakage reduction by improving knowledge about network flows, assisting identification of leakage and, for external meters, improving identification of customer-side leaks. Our metering programme is forecast to deliver 39.4 Ml/d of leakage reduction in AMP8. This includes 2.8 M/d of carry over benefit from the Green Economic Recovery programme[6].

The impact of enhancement expenditure on our historical performance

In response to Information Notice 23/07 issued in July 23, we have outlined below the impact of enhancement expenditure on our historical performance.

AMP5 Enhancement

There was no leakage enhancement expenditure in AMP5.

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[6] We have asked Ofwat to consider adjusting the GER funding conditions in light of the affect that the summer drought of 2022 and subsequent freeze-thaw event has had on the achievability of our end of AMP leakage target. The outcome of these discussions will determine if we can proceed with the GER programme.

AMP6 Enhancement

At PR14, we were set a target to reduce leakage by 59 Ml/d through enhancement expenditure. In AMP6, we met the annual leakage targets in 2015/16 and 2019/20 and missed the target in the interim three-year period. Due to the complexities associated with leakage including variability due to the weather, the significant contribution to the target from find and fix activity, the Section 19 undertaking and the water balance process etc. we have capped the leakage benefit from our AMP6 enhancement programme at the 59 Ml/d.

There were three main components to our enhancement programme in AMP6. These were mains replacement, pressure management and fixing customer side leaks identified following installation of Smart meters. The costs of the programmes impacting leakage and allocated to enhancement, as set out in the table below, have been used to derive the assumed annual benefits.

Table 25 – AMP6 enhancement expenditure - contributions to leakage reduction (Unit: Ml/d)

Enhancement line	Activity	2015/16, £m	2016/17, £m	2017/18, £m	2018/19, £m	2019/20 , £m	AMP6, £m
Demand side enhancements (average)	Mains replacement	2.4	0.1	0.9	0.2	6.7	10.3
Demand side enhancements (critical / peak)		29.5	0	0	0	43.2	72.7
Meters introduced by companies		0	0.4	0.2	0.1	0.1	0.8
Demand side enhancements (average)	Pressure management	0	0.3	0	0	0	0.3
Demand side enhancements (critical / peak)		8.4	7.4	3.1	0	0	18.9
Meters introduced by companies		0	0.6	0	0	0	0.6
Resilience		0.2	0	0	0	0	0.2
Meters introduced by companies	Smart meters	40.3	54.6	44.3	33.8	18.2	191.3
Demand side enhancements (critical / peak)		0.9	0	0	0	0	0.9
Total		**81.7**	**63.4**	**48.5**	**34.1**	**68.2**	**295.9**
	Assumed benefit (cumulative Ml/d)	**16.3**	**28.9**	**38.6**	**45.4**	**59.0**	**59.0**

AMP7 Enhancement

At PR19 most leakage reduction activity was considered as base expenditure. However, we did receive enhancement funding for installing new smart meters which enabled 34.2 Ml/d of leakage

reduction in our PR19 plan (but the enhancement funding that we asked for to fix the 34.2 Ml/d of customer side leaks identified by the Smart meters was not allowed by Ofwat).

As per AMP6, our AMP7 leakage performance is volatile and subject to multiple complexities. However, similar to our assumptions on AMP6 enhancement benefit above, we consider it appropriate to attribute the 34.2 Ml/d of CSL reduction to the AMP7 enhancement programme.

Our AMP7 programme is on-track to meet our two-meter installation performance commitments M01 (399.7k Smart meter installations) and M02 (130k basic to Smart meter replacements) by the end of AMP7. We have profiled the benefits linearly as per the linear installation forecasts in the performance commitments, although we note the actual installation profiles are non-linear due to factors including Covid-19.

The LWICA programme includes leakage reduction targets of 27.7 Ml/d. Of this 1.7 Ml/d is forecast to be delivered in 2024/25.

The Green Economic Recovery programme[7] includes leakage reduction targets of 3.8 Ml/d. Of this, 1.0 Ml/d is expected to be delivered in 2024/25.

The assumed leakage benefits (annual average Ml/d) enabled by the AMP7 enhancement programmes are summarised in the table below.

Table 26 – AMP6 enhancement expenditure - contributions to leakage reduction (Unit: Ml/d)

Programme	Unit	2021/22	2021/22	2022/23	2023/24	2024/25	AMP7
PR19 Smart meters	Assumed benefit (cumulative Ml/d)	6.8	6.9	6.8	6.9	6.8	34.2
LWICA		-	-	-	-	1.7	1.7
Green Economic Recovery		-	-	-	-	1.0	1.0
Total		**6.8**	**6.9**	**6.8**	**6.9**	**9.5**	**36.9**

Cumulative benefits from enhancement expenditure to 2034/35

The table below summarises the outcome performance from base expenditure, the outcome performance from enhancement expenditure, and the overall outcome performance. The figures are expressed in annual average leakage levels.

Table 27 – Summary of leakage benefit from base and enhancement expenditure by AMP (Unit: Ml/d)

Leakage annual average (Ml/d)	AMP6	AMP7	AMP8	AMP9
End of AMP year	2019/20	2024/25	2029/30	2034/35
Leakage performance from base	688.8	603.1	546.3	540.3
Cumulative benefit from enhancement	-59.0	-95.9	-135.3	-159.0

[7] We have asked Ofwat to consider adjusting the GER funding conditions in light of the affect that the summer drought of 2022 and subsequent freeze-thaw event has had on the achievability of our end of AMP leakage target. The outcome of these discussions will determine if we can proceed with the GER programme.

Leakage annual average (Ml/d)	AMP6	AMP7	AMP8	AMP9
End of AMP year	2019/20	2024/25	2029/30	2034/35
Reported leakage (outcome)	629.8	507.2	411.0	381.3

4.2. Per capita consumption

4.2.1. Performance, targets and incentives

Our three-year average PCC in 2022/23 is 146.0 Ml/d, similar to our 2019/20 three-year average base. Although we are performing better than industry average and are currently upper quartile, we are underperforming against the 2022/23 target of a 3.4% reduction.

Table 28 – Performance and Proposed Target (Unit: % reduction three-year average)

	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
PCC (litres per person per day)*	145.8	147.1	144.9	152.8	144.7	140.6	141.3	141.0	139.3	138.9	138.4	137.8	137.4
3-year average PCC (l/hd/day)			146.0	148.3	147.5	146.0	142.2	141.0	140.6	139.8	138.9	138.4	137.9
3-year averages – % change from 19-20 baseline*				+1.6	+1.1	+0.1	-2.6	-3.4	-3.7	-4.2	-4.9	-5.2	-5.5
Industry Average						+5.0							
Industry UQ						+3.0							
Proposed Target									-3.7	-4.2	-4.9	-5.2	-5.5

Actuals to 2022/23; Forecast thereafter

Note: the sudden increase in 2021 reflects the various lockdowns associated with Covid and people working from home which impacted the household PCC measure.

The Government has set a legally binding target under the Environment Act 2021 to reduce the use of public water supply in England per head of population by 20% by 2038. To achieve this household water use is to be reduced to 122 litres per person per day. This is part of the trajectory to achieving a target of 110 litres per person per day by 2050. In addition to our action to encourage lower water use, achieving this PCC target will also rely on a range of new Government-led policy initiatives, including appliance labelling, compulsory standards on appliances, and action to reduce use in new developments.

Table 29 – Long term performance trajectory (Unit: % reduction three-year average)

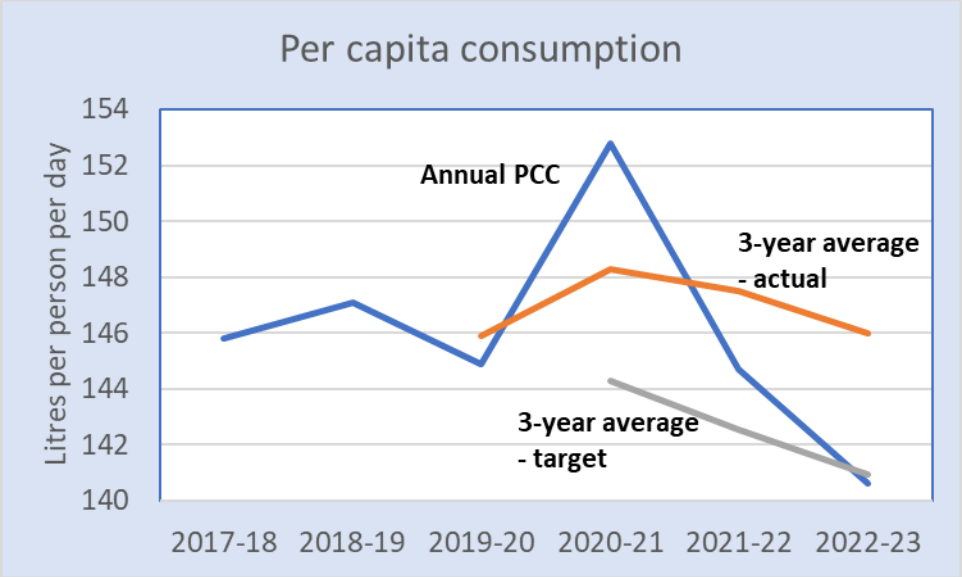
	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End AMP	-	-3.4%	-5.5%	-11.6%	-17.7%	-23.2%	-27.6%

Performance has been much affected by COVID lockdowns, a continued increase in working from home and very hot and dry summer weather in 2022/23. As a result, only one company met 2020/21 and 2021/22 targets and no company has met the 2022/23 targets. Ofwat has decided not to impose any ODI rewards or penalties until the Price Determinations in 2024, recognising

that exceptional circumstances have led to companies missing targets. We consider that the AMP7 targets should be adjusted to take account of these exceptional circumstances.

The graph below shows the spike in demand in 2020/21, mainly driven by COVID. There was a particularly large spike in demand in summer due to hot weather, combined with high levels of home working, increased use of hosepipes, sprinklers, and paddling pools. This has affected the 3-year average for the first three years of AMP7.

Figure 3 – Long term PCC performance



Although there are some signs of PCC coming down with reduced working from home, the extent of any permanent shift in PCC remains unclear. In 2022/23 we have seen a reduction in household consumption levels, despite experiencing a peak in water demand across the 2022 summer due to record heatwave temperatures and the nationwide drought.

It is very likely that we will miss the target of a 6.3% reduction by 2024/25, based on a three-year average. However, 2022/23 performance indicates that we are on target to deliver the 4.2% reduction built into our WRMP, which we considered to be achievable given our water efficiency and metering plans.

There has been a drop in measured (metered) household consumption, and an increase in unmeasured household usage. The reduction in measured household consumption supports our metering plan, and the continued focus on introducing smart meters.

While we can influence consumption through metering and encouraging water efficiency, there are many factors affecting water use which we cannot control, including:

- Extreme summer heatwaves.
- A high proportion of people working from home post-Covid, with future trends uncertain.
- The cost-of-living crisis – higher energy bills reduce the use of electrical appliances, which in many cases also reduces water use.
- Changes in household size.

We consider that our programme for water efficiency and smart metering means that we are doing everything within our control to deliver reductions in PCC.

4.2.2. Action to improve performance

Activities included within base expenditure

We continue to undertake large-scale water efficiency initiatives across a range of physical activities and online tools. Most of the household and non-household demand reduction activities are delivering measurable water savings that benefit both base and enhanced demand reduction targets. Only household water savings contribute to the wider PCC reduction agenda. The key household demand reduction activities that are mainly funded through base are outlined below.

Smarter Home Visits

Our Smarter Home Visits (SHV) activity included within base expenditure involves the physical retrofitting of water saving devices and fixing of continuous flows (ie. internal wastage) on households that were smart metered in previous AMP funding periods. SHV undertaken on newly smart metered households are funded through enhancement. The demand reductions achieved through base funded activities are helping to address recent water use impacts of Covid and post-cover hybrid-working. We are using smart meter data to assist targeting high usage households, in order to maximise the demand reductions achieved per SHV, alongside using continuous flow data to initiate targeted engagement for both wastage self-fixes and Customer Supply Pipe Leakage (CSL) action. We continue to share SHV and smart meter data insight with Government, regulators and other water companies to help inform PR24 programme development.

Wastage Fixes – Households

We continue to offer household customers with free wastage fixes, discovered through both smart meter data and SHVs. These separate home visits by qualified plumbers continue to deliver consistent and useful water savings per visit. The insight from our wastage fix initiative was supplied to Defra and Ofwat to inform National Water Target and PR24 demand reduction approaches. Our wastage evidence continues to be shared with regulators, industry and trade bodies, the manufacturing industry and product certification bodies to help inform activities aiming to address the UK's 'leaky-loo' issue.

Water Efficiency Incentive for Developers

Thames Water launched an industry-first Environmental Incentive for Developers, aimed at enabling and accelerating levels of water efficiency performance in all new development in our supply region. Our three-tiered discount scheme that encourages developers to better guarantee that water efficiency fittings/appliances are installed financially incentivises the inclusion of water reuse technologies (rainwater and greywater), plus achieve water neutrality through undertaking water efficiency its and wastage fixes in existing homes and businesses with, in the same water resource zone, which then offset the forecasted water demand from the new development.

Water Neutrality Pilot

Thames Water teamed up with a leading housing developer to pilot the concept of water neutrality on a new large housing development in South West London. The objectives of this pilot were to:

- Quantify how much water new homes actually use, compared to water performance levels of 125 and 110 litres/person/day as outlined in Part G of Building Regulations
- Quantify the water use and PCC benefits of using the 'fittings approach' from Part G
- Quantify the water savings volumes that can be made from retrofitting existing homes and businesses in the surrounding area

- Prove that achieving water neutrality by offsetting the forecasted water demand of a new development, can be done by improving the water performance of existing surrounding buildings

The results of this water neutrality project are being disseminated through the water utility and developer sectors, as proof that offsetting future new water demand can be achieved with relatively simple water device retrofits and wastage/leak fixes in existing homes and businesses.

Greenredeem/household incentive scheme

We are continuing our to deliver water efficiency benefits from previous AMP smart metering installations, by working with Greenredeem to provide smart metered customers with non-financial incentives and rewards for reducing their average daily consumption. This initiative is successfully enhancing measurable demand reduction by an additional 2-5%, on top of the demand reductions delivered by smart meter installations, wastage fixes and separate water efficiency visits. The demand reduction volumes per customer registered with Greenredeem continue to be very favourable. We have expanded the partnership with Greenredeem to include sewer abuse/blockage education and customer engagement. We will continue our use of incentives to enable greater demand reduction benefits to smart meters customers.

Online Water Calculator tool

Our free online calculator has continued to help thousands of households work out how much water they're using. This interactive tool also links this to water and energy costs, displaying the most appropriate water-saving devices and pop-up tips that customers can use to save water, energy and money. Customers can even test settings for the top five actions (like showering or washing the dishes) to see how much water and energy they could save in the future. This is also the first calculator of its kind to identify how much water a customer typically uses outside of their home, such as when they're showering at the gym. This means our customers can see exactly what impact they're having on water demand, and for the first time see their water use presented in PCC metrics. https://www.thameswater.co.uk/help/water-saving/water-saving-calculator

Stakeholder Collaboration and External Partnerships

We continued to engage with multiple government, regulator and industry groups that influence water policy, regulations and national projects. We contributed demand reduction insight and data, plus advice based on experience delivering large-scale smart metering and water efficiency programmes across household and business customers. These groups include; UK Water Efficiency Strategy steering group, UK Water Neutrality sub-group, Defra's Water Labelling steering group, Future Homes Hub, and the Retailer-Wholesaler Group's Water Efficiency Sub-Group.

As a long-term supporter of Waterwise, we are a long-term active member of the UK Water Efficiency Strategy Steering Group and Water Efficiency Network steering group. We have played key roles in the working groups on water neutrality and water reuse, resulting in guidance publications to advance both agendas.

We have been a key active member of the Retailer-Wholesaler Group's Water Efficiency sub-group, developing evidence and recommendations for future improvement on demand reduction within the non-household market.

Activities included within enhancement expenditure

Smart meters

We started to install smart meters on a significant scale in AMP6 and estimate that by 2021/22 this had resulted in a 32 Ml/d household consumption saving. By 2035, we plan to have a smart meter fitted to all household connections where it is feasible.

Smart meters deliver a number of benefits through:

- Improving our understanding of actual consumption levels and the distribution of water use across different housing types.
- Enabling the identification of high-water users and households with continuous flow (external customer supply pipe leaks and internal wastage) for targeting action.
- Enabling customers to see and better manage their personal water consumption.
- Being able to target leakage and wastage on customer premises quicker.

We estimate that smart-metered households use 13% less water than unmeasured households – 10% of this saving is due to changes in behaviour and 3% is due to the repair of wastage eg dripping taps. This compares with an estimated 10% saving generated by a 'dumb' meter installation. We have increased water savings by reducing the time before customers' bills are based on measured use from two years after installation to one year. Customers make greater savings once they are charged on a measured basis.

Our smart meter data shows at least 10% of London homes have continuous flows (customer side leakage or internal 'wastage'). Using smart meter data to identify continuous flow provides us with the opportunity to achieve significant water savings through simple device fixes. Household customers that have continuous flow recorded through their smart meter are contacted by email or letter. Within a week of receiving this notice about potential leakage or wastage, about 70% of customers fix their own leak.

Smart meter data also allows us to prioritise our Smarter Home Visit programme to target customers with high usage and continuous flow. Our advisors provide practical and personalised support for high-usage customers on how to be water efficient, including reducing the use of hot water, which can reduce their energy bills.

The insight from our smart meters has been shared with government, regulators and all water companies via external industry and independent groups, including the Water Efficiency Network, Smart Meter Advisory Group, UK Water Efficiency Strategy steering group, and Retailer-Wholesaler Group.

Our programme for smart metering in relation to households is set out below. It will result in household consumption savings of 45.9 Ml/d in total through enhancement expenditure. Elements of the programme relating to non-households are set out in the Business Demand PC. Full details of the programme are included in our Enhancement Case for smart metering.

Table 30 - AMP8 activity and water savings[8]

Programme	Description	Activity	Number	Water saved	
				Demand	Leakage
			,000s	Ml/d	Ml/d
Smart meter installation					
Progressive Metering Programme	Metering all remaining unmeasured properties, where feasible – flats, apartments, etc.	Meters installed	192	8.6	
Household replacements	Replacing existing dumb meters with smart meters	Meters replaced	645		12.2
Optants	Smart meters for customers requesting a meter	Meters installed	65		
Bulk meters	Meters where individual customers cannot be metered	Meters installed	55		22.7
AMP7	Full realisation of demand benefits from meters installed in 24/25			13.5	
Leveraging benefits from smart meters					
Metering innovation	Enhanced digital customer engagement to reduce water use and wastage	Visits / activity		2.0	
Household innovation	Pilots of tariffs, enhancements to devices, fittings, water reuse, and collaborative working with external parties	Visits / activity		5.2	
Household digital engagement tool	Digital engagement tools, driving behaviour change and continuous flow fixes	Visits / activity	624	5.8	
Smarter Home Visits	In-home water efficiency visits to undertake retrofit installations and wastage leak fixes	Visits	219	8.2	
Wastage fix	Visits by teams to fix internal wastage leaks such as leaky toilets, dripping showers and taps	Visits	18	3.3	
Greenredeem	Customers participating in Greenredeem receive email engagement with reports, advice and reward / incentive offers, based on their weekly water use	Customers	48	0.3	

Additional water efficiency activity

In addition to the water efficiency programme linked to smart metering, we will continue to encourage customers to save water, with an improved digital communication platform.

The impact of enhancement expenditure on our historical performance

[8] We have asked Ofwat to consider adjusting the GER funding conditions in light of the affect that the summer drought of 2022 and subsequent freeze-thaw event has had on the achievability of our end of AMP leakage target. The outcome of these discussions will determine if we can proceed with the GER programme

In response to Information Notice 23/07 issued in July23, we have outlined below the impact of enhancement expenditure on our historical performance.

AMP5 Enhancement

In AMP5, we delivered 5.31 Ml/d of enhancement water efficiency savings versus a target of 4.85 Ml/d. Of this, 4.25 Ml/d was delivered from 2011-12 onwards. The cumulative profile is set out in the table below.

Table 31 – AMP5 Cumulative annual household water efficiency savings through enhancement (unit: Ml/d)

	2010/11	2011/12	2012/13	2013/14	2014/15
Cumulative Ml/d savings	1.1	2.1	3.2	4.2	5.3

AMP6 Enhancement

In AMP6, we delivered 34.42 Ml/d of enhancement water efficiency savings against performance commitment WA4, compared with a target of 15.45 Ml/d. We have annual savings recorded for all years except for years 1 and 2 of AMP6, which were only reported cumulatively at 2017/18. Therefore, we have estimated the annual savings for 2015-16 and 2016-17 in the table below.

Table 32 – AMP6 Cumulative annual water household efficiency savings through enhancement (unit: Ml/d)

	2015/16	2016/17	2017/18	2018/19	2019/20
Cumulative Ml/d savings	6.7	13.4	20.2	27.2	34.4

As described in our Water Resource Management Plan (WRMP) Annual Review 2019-20, we planned to install 441,270 domestic water meters in AMP6 as part of the progressive metering programme. This was forecast to contribute a 27.6 Ml/d reduction in customer usage in response to moving to a metered tariff. A revised programme was established mid-way through AMP6 that included a lower total of 300,000-meter installations but achieving the same overall forecast level of demand reduction.

We met this revised target, delivering a total of 331,127 installations and we were able to achieve the same savings with a reduced programme using the experience gained during the first few years of delivery and by reducing the customer metering journey to one year (from 2 years).

The customer metering journey is the time between the meter installation and a customer being charged on a metered tariff. Customers have shown some savings following the installation of a meter due to more visibility of their water use. Larger savings are made by customers at the end of their metering journey once they are transferred to a metered tariff. Reducing the metering journey to 1 year meant that customers were moved to a metered tariff one year earlier than assumed in the WRMP14. The benefit profile we have assumed for AMP6 is shown in the table below.

Table 33 – AMP6 Cumulative household consumption savings through smart meters

	2015/16	2016/17	2017/18	2018/19	2019/20
Assumed benefit* (cumulative Ml/d)	2.0	5.0	9.0	14.0	27.6

* Judgement based on larger savings realised at end of customer journey and the customer journey reducing from 2 years to 1 year part way through AMP6

AMP7 Enhancement

At PR19, we received enhancement funding for installing new smart meters which enabled 32 Ml/d of household consumption savings in our PR19 plan and water efficiency which also enabled 32Ml/d of savings.

Our current PC performance is volatile and subject to multiple complexities. However, we consider it appropriate to attribute the 64 combined Ml/d of benefit to the AMP7 enhancement programme as we are installing the Smart meters and delivering water efficiency activities.

The assumed household consumption benefits enabled by the AMP7 enhancement programmes are summarised in the table below. We have assumed a non-linear profile for the water efficiency benefits due to the restrictions in place due to Covid 19.

Table 34 – AMP7 Cumulative household consumption savings through smart meters

Programme	Unit	2021/22	2021/22	2022/23	2023/24	2024/25
PR19 Smart meters	Assumed benefit (cumulative Ml/d)	6.4	12.8	19.2	25.6	32.0
Water efficiency		4.0	10.0	17.0	24.0	32.0
Total		**10.4**	**22.8**	**36.2**	**49.6**	**64.0**

Cumulative benefits from enhancement expenditure to 2034/35

The table below summarises the outcome performance from base expenditure, the outcome performance from enhancement expenditure, and the overall outcome performance. The figures are expressed in annual average PCC levels.

Table 35 – Summary of household consumption benefit from base and enhancement expenditure by AMP (Unit: Ml/d

	AMP6	AMP7	AMP8	AMP9
End of AMP year	2019/20	2024/25	2029/30	2034/35
Total of household consumption savings from enhancement (Ml/d)	67.3	131.3	178.2	213.6
PCC from base expenditure	151.6	151.2	149.7	146.1
Benefit to PCC from enhancement	-6.7	-12.3	-15.9	-18.3
Reported PCC (outcome)	144.9	138.9	133.8	127.8

4.3. Business demand

4.3.1. Performance, targets and incentives

This is a new common PC, which promotes the reduction of water uses by businesses in line with our Water Resource Management Plan.

Business demand towards the end of AMP6 was reducing, reflecting demand reductions achieved through the Smarter Business Visit programme, where water efficiency retrofits and internal wastage fixes were carried out by Thames Water accredited plumbers. This reduction in overall consumption was despite economic growth and a record hot dry summer, showing the success of targeted water efficiency activities and proactive engagement with businesses and retailers.

There was a large reduction in business demand in 2020/21 as a result of the COVID pandemic, which led to:

- A shift in balance between household and business water use, as a result of greater working from home during and after the COVID pandemic.
- A decline in economic activity – GDP fell by 11% in 2020.

Business water use increased in 2022/23 but is still below pre-COVID levels due to higher levels of working from home, which reduces business use and increases PCC. Uncertainty about future economic trends and the extent of working from home creates significant uncertainty for water companies in forecasting this PC, with the potential for large windfall gains or losses on the associated ODI.

Table 36 – Performance and Proposed Target (Unit:Ml/d and % reduction from 2019/20, three year average)

AMP	AMP6			AMP7					AMP8				
Year	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Business demand (Ml/d)*	485.2	472.2	454.2	364.8	388.5	423.8	425.7	429.2	427.9	426.6	425.1	423.2	421.4
3-year average (ML/d)			470.5	430.4	402.5	392.4	412.7	426.2	427.6	427.9	426.5	425.0	423.2
3-year averages – % reduction from 19-20 baseline				-8.5	-14.5	-16.6	-12.3	-9.4	-9.1	-9.1	-9.4	-9.7	-10.1
Industry Average													
Industry UQ													
Proposed Target									-9.1	-9.1	-9.4	-9.7	-10.1

Actuals to 2022/23; Forecast thereafter

As noted previously, the Government has set a legally binding target under the Environment Act 2021 to reduce the use of public water supply in England per head of population by 20% by 2038. As part of achieving this target, business water use needs to be reduced by 9%. This is part of the trajectory to achieving a targeted 15% reduction in non-household water use by 2050.

Achieving the 15% target will rely on a range of new Government-led initiatives, in addition to action by water companies.

Table 37 – Long term performance trajectory (Unit: % reduction from 2019/20, three-year average)

	AMP6	AMP7	AMP8	AMP9	AMP10	AMP11	AMP12
End of AMP year	2019/20	2024/25	2029/30	2034/35	2039/40	2044/45	2049/50
End AMP			10.1%	10.4%	12.6%	14.7%	15%

4.3.2. Action to improve performance

Activities included within base expenditure

Our base expenditure funded operations to reduce business demand primarily consist of water efficiency activities in business customer properties to retrofit water saving devices and fix internal leaks. Our Smarter Business Visits operators are qualified plumbers and will aim to deliver a 3.9 Ml/d reduction across a range of business customer categories, focusing on properties which are already smart metered or business types that typically yield large water savings per intervention (e.g. schools, leisure facilities).

Activities included within enhancement expenditure

The market operator for the non-household retail market in England (MOSL) recommends that water companies accelerate the rollout of smart meters to non-household customers. Our plan provides for smart meter upgrades to be completed by the end of AMP8.

This programme will play a crucial role in meeting Defra's water targets for business demand reduction. The enhancement will accelerate the provision of hourly non-household meter consumption readings for retailers and business customers, significantly improving non-household market viability and the opportunity for us, retailers and business customers to drive down water use and customer side leakage.

We will enhance our existing engagement and collaboration with retailers and expand our use of smart meter data to target water efficiency and continuous flow fix initiatives.

Elements of the programme relating to non-households are set out below. Full details of the programme are included in our Enhancement Case for smart metering.

Table 38 - AMP8 activity, costs and water savings

Programme	Description	Activity	Number	Water saved	
				Demand	Leakage
			000s	Ml/d	Ml/d
Smart meter installation					
Non-household replacements	Replacing all existing dumb meters with smart meters	Meters replaced	60	0.5	1.7
Leveraging benefits from smart meters					

Programme	Description	Activity	Number	Water saved	
				Demand	Leakage
			000s	Ml/d	Ml/d
Continuous Flow Fix Targeting	Use of smart meter data to notify retailers and businesses of continuous flow and encourage self-fixing	Visits / activity		4.5	
Retailer activity	Retailer engagement trials and use of smart meter data to encourage retailers to undertake water efficiency visits and interventions on their customers' properties	Visits / activity		0.5	
Smarter Business Visits	Water efficiency site visits by plumbers to install water saving devices, fix leaking taps, toilets, showers and install sensor controls in urinals.	Visits / activity	8.9	23.4	

4.4. Customer Line of Sight – Fix leaks and ensure there is enough water in the future

Engagement with our customers, communities and stakeholders has played a key role in developing our AMP8 strategy for fixing leaks and ensuring there is enough water in the future.

'I want you to fix leaks and ensure there is enough water in the future' is ranked as a medium priority relative to other wants, however, a higher priority is placed on the reducing leakage element. We provide further detail of our overall PR24 engagement programme in TMS03: Customer Engagement.

In this section we present the line of sight from what we heard to what we are planning to do and highlight any areas where we have had to make trade-offs. For our enhancement cases in this area, we also provide further evidence of line of sight, including customer views supporting the need for investment. Details of each Enhancement Case can be found in:

- TMS27 Enhancement Case: WRMP Supply Options
- TMS28 Enhancement Case: WRMP Demand Reduction

Table 39 – How we are responding to customer insight – fix leaks and ensure there is enough water in the future

What we heard		How we are responding
Water resources	Customers expect us to mitigate impacts from pressures such as a growing population and climate change to ensure that they continue to receive a reliable supply of water now, and in the future.	We will invest in new sources of water and build the necessary infrastructure to ensure we increase our resilience to drought e.g. Teddington DRA scheme, Severn to Thames transfer, and SESRO.
Demand management	Customers are generally positive about the idea of reducing their consumption ahead of developing new resources, but also want to see us also doing our bit (e.g. reducing leaks). They are accepting of the role of smart meters in helping to achieve this.	We will continue our rollout of smart meters and increase penetration to [74%] of our household customer base by the end of AMP8. We will also implement our targeted water efficiency campaign, including smarter home and business visits, as well as targeted customer engagement via email
Sustainable abstraction	Customers believe that improved water supply resilience should not come at the expense of the environment. They support limiting the amount of water taken from groundwater and rivers/streams, particularly those considered vulnerable e.g. chalk streams.	We will reduce abstraction in up to 4 rivers during AMP8, creating investment in new transfer mains to bring in water from other parts of the network.
Leakage	Customers feel that the current level of leakage is too high and place a high priority on reducing it. They see it as a waste of a valuable resource and results in negative perceptions towards us. They support the use of smart meters to help achieve this.	We will continue to find and fix leaks and use smart meters to locate them. We will deploy new technology and digitise our network to identify leaks quicker. We will deliver long term sustainable leakage reduction through an increasing mains replacement programme, pressure management and delivering "calm" networks. Our activities will deliver a 37.1% leakage reduction from a 19-20 baseline.

Key tensions and trade-offs between customer views and our proposals

Customers feel that current levels of leakage are too high and see reducing leakage as a top priority amongst core water service improvements. They feel asking customers to cut back on their use seems unfair given high levels of leakage – they expect us to be doing more in this area. While they feel our 2030 target is positive, challenging and realistic, the majority still want to see a more ambitious target.

We know our leakage levels are high when compared with other companies. Leakage reduction is a lower relative priority from Ofwat's central customer research compared with our own customer research. Despite our relatively poor performance, we are still within our reduction targets, but we know our customers would like us to do more.

Meeting our customer's expectations on leakage is difficult. By 2030 we will have delivered a large proportion of the technology and solutions that are the quickest to deploy such as systems, metering and pressure management. In order to deliver the scale of reductions customers expect this will require an extensive infrastructure renewals programme replacing a large proportion of our 32,000 km of water mains. This could have a significant impact on bills and will take time to deliver. Our plan therefore delivers the most cost-effective solutions earlier, with the target that innovation will help identify a cost-effective method for refurbishing water mains in the next 10 years.

Table 40: Key customer research that has informed our water strategy

Wants	Thames Water Triangulated Priorities [1]	Topics	Ofwat collaborative research [2]	Enhancement case deep dives [3] and WRMP / WRSE insights [4]	Acceptability and affordability testing [5]	Vision 2050 research [6]
I want you to fix leaks and ensure there is enough water in the future	Customers place a medium priority (5th of 10 Wants) on '**I want you to fix leaks and ensure there is enough water now and in the future**'.	Water resources and demand management	Customers place a lower importance on '**Severe drought**' as whilst there was the potential for significant health impacts, it was felt to be very unlikely to happen. Customers place a lower importance on '**Hose pipe ban**' as there is little impact on people and is to be expected during periods of drought. Customers also perceive UK's water levels to be high. Customers place a lower importance on '**Non-essential use ban for businesses**' as this was not felt to impact day-to-day business function and therefore deemed non-essential.	Customers' top priority is '**Securing the long-term security of supply in the region**'. When securing new water supplies, customers express a clear preference for solutions which are proven in their efficacy and which pose a lower risk to the environment. This is also the case for other source options e.g. water recycling and desalination. In relation to source changes, customers assess options by balancing their efficacy with the associated costs and time to implement.	Customers place a high importance on our proposals for our '**Water resources management'** enhancement case, driven by fears over water security, population growth and the impacts of climate change. Customers are generally comfortable with the costs and feel this offers good value for money. Customers see smart meters as a critical pathway to customer usage control, however, customers' experiences of efficiency devices has not always been positive. Customers feel a 'mind shift' is needed to reduce consumption i.e. communication, education, tips etc.	Customers place a high priority on '**Ensure there is enough water in the future, without taking too much from rivers and harming the environment**'; customers place high value on water and the environment. Striking the balance between securing supplies and protecting the environment is viewed as essential to the future of both customers' wellbeing and the environment. Customers place a low priority on '**Help customers to use much less water at home**'; most customers believe they are not wasteful with water and whilst there is support from the majority for the use of smart meters, some are concerned they may result in higher bills.

Wants	Thames Water Triangulated Priorities [1]	Topics	Ofwat collaborative research [2]	Enhancement case deep dives [3] and WRMP / WRSE insights [4]	Acceptability and affordability testing [5]	Vision 2050 research [6]
		Sustainable abstraction		Customers place a low relative priority on '**Reducing abstraction from vulnerable sources**'; customers preferred a medium over a high reduction scenario due to concerns around bill impacts.* Behind securing the long-term security of supply in the region, customers prioritise '**Reducing the dependency of the water supply system on sensitive habitats and groundwater sources**'.	Customers place a high importance on '**NEP Water**' as an enhancement case; customers recognise that 'protecting the environment' is a good thing and that chalk streams are rare. There is strong support from customers given the negligible bill impact and most were impressed by the committed targets for reduction from sensitive sources, however, some put less importance on protecting sensitive sources and questioned where the additional 80Ml/d would come from. Some customers also highlighted the environmental impact of installing new trunk mains	See '**Ensure there is enough water in the future, without taking too much from rivers and harming the environment'** above.
		Leakage	Customers place a medium importance on '**Leakage**'; whilst it as seen as a core mandate of water companies, it rarely impacts customers on a day-to-day basis	Behind securing the long-term security of supply in the region, customers prioritise '**improving the efficiency of the water supply system in terms of reducing leakage**'.	Customers placed high importance on '**Leakage**' as a performance commitment; they see leakage as wastage and perceive our performance in this area to be unacceptable. They want to see more ambition from us here to address this.	Customers place a high priority on our ambition to '**Reduce leakage to below 10%**'; by 2050 customers equate high leakage levels with higher bills and feel Thames Water has not been proactive in addressing this issue. Whilst some were concerned around the logistical complexities, customers generally view this as an urgent core responsibility to tackle as soon as possible.

Sources:
[1] What Customers, Communities and Stakeholders Want v18, Sia Partners, July 2023
[2] Ofwat + CCW customer preferences research, April 2022
[3] PR24 Deep Dives, February 2022; Enhancement case package options research, September 2022; Enhancement case deep dive research, May 2023
[4] Thames Water WRMP Consultation, May 2023; WRSE – Customer Preferences to Inform Long-Term Water Resource Planning, March 2021; WRSE Best Value Criteria, May 2021; WRSE Water resources quantitative research, June 2022
[5] Acceptability and Affordability Testing (Qualitative findings), May 2023
[6] Vision 2050 Research, May 2022

Section 5. Outcome 4: A positive impact on the community

We are responsible for some incredibly rich and diverse habitats within our region. We take great care to balance the needs of the animals, plants, birds and insects that call our sites home and are committed to continually improving our biodiversity performance at those sites and beyond.

We own and manage land in over 8,000 locations, from the Cotswolds in the west to Essex in the east. In total we manage a total of 66km[29] of land that we have established as our habitats baseline. This is an area that is around seven times larger than Richmond Park in London.

- We directly manage 5 nature reserves and a further 22 are managed by our conservation partners.
- Over 250 sites have been identified as being sites of biodiversity interest (SBI)
- 12 are sites of special scientific interest (SSSI).

These sites support a range of important animals or plants, including bats, dormice, otters, pollinating insects, orchids and wildflower meadows. Many of our open water reservoirs are of international importance due to the large number of wetland bird species they provide a home for.

Alongside a focus on biodiversity, our publicly accessible sites host two directly managed recreational fisheries, sailing clubs, heritage groups and other sporting clubs.

With the recent development of the Defra biodiversity calculator we are now able to measure the impact of investment we make for nature on our sites and as part of our 2025 – 2030 business plan have committed to increasing biodiversity at 7 of our wastewater sites, above and beyond that which has been achieved to date and which we currently manage.

Our customers, stakeholders, regulators and Board will hold us to account through the adoption of a new common Performance Commitments: Biodiversity.

- Biodiversity measures the net change in the number of biodiversity units on nominated land per 100km^2 of land in the company's area. A biodiversity unit is a measurement of an area's value to wildlife. It is based on the size and quality of habitats, and whether the habitat is sited in an area identified as being of strategic significance for nature.

By 2050, our ambition is to "*Implement a balanced land-use strategy, delivering investments, local jobs, biodiversity gain and access to nature-based recreation"*

The remainder of this section sets out our proposed target for biodiversity providing an overview of our approach and the activity required to deliver the proposed levels of improvement.

[9] Based on review of GIS data of Thames Water's landholding in March 2023

5.1. Biodiversity

5.1.1. Performance, targets and incentives

During AMP7 we became the first water company to have a bespoke biodiversity net gain PC, adopting the Defra methodology of measuring biodiversity net gain units.

In that time, we have created 301 biodiversity units across 100 reportable sites across our entire estate.

Now that biodiversity is a common PC, we have adopted the common methodology and will measure our performance based on the biodiversity unit gain in AMP8 alone.

The projected biodiversity net gain numbers are based on an estimated habitat baseline and hence are indicative only at this stage. Survey work will commence in spring 2024 which will provide a more accurate baseline and projected biodiversity net gain through AMP8.

We understand that sites can be added into the performance commitment at any point within AMP8. Therefore, if any site fails to meet their projected targets or if we are unable to do achieve all of the predicted habitat improvements due to reasons beyond our control e.g., contamination, archaeology; we will adapt our plans and new sites may be nominated.

Table41: AMP8 forecast performance trajectory (unit: biodiversity gain/units per 100km^2)

Year	25/ 26	26/ 27	27/ 28	28/ 29	29/ 30
Thames Water (biodiversity units)	0	0	0	8.47	8.47
PC – biodiversity units/100km^2	8,007.99	8,007.99	8,007.99	8,007.99	8,007.99
Proposed Target	0	0	0	0.11	0.11

The profile in the first three years of the AMP reflects the activity being undertaken to establish new habitats coupled with the fact that no change can be recorded until the second site visit, four years from the first visit (25/26).

We are yet to finalise our long-term plan and targets to 2050 for biodiversity. Through our survey work starting in 2024 this will be developed through AMP8 and in conjunction with our charity/environmental partners.

Overall, through developing our company wide habitats baseline we have identified a company-wide total of 7.794km^2 that is classed as "*land that has open habitats*" and is available for biodiversity enhancement. Across our water and wastewater sites we will improve 1.14km^2 of this land during AMP8.

Activity to improve performance

Activities included within base expenditure

Our Approach

In alignment with the definition for the biodiversity performance commitment, during PR24 we will measure the net change in the number of biodiversity units on land within nominated sites.

Sites nominated are based on their potential for biodiversity enhancement, and where there is support for habitat enhancement/creation works from within our business or external stakeholders including Natural England, conservation charities (such as RSPB and Mammal Society) and or community groups. This has been assessed as 7.794km^2, across water and wastewater sites in total.

Land identified as being required for other commitments, such as WINEP, water resources management plan, growth projects, solar energy projects or other uses will be excluded from nomination for biodiversity enhancement, to avoid further conflicts between land uses.

Baseline biodiversity units will be assessed based on habitat type and condition data gathered during a site visit by an appropriately qualified person, for each given piece of land nominated by the company. The methodology to be applied during the surveys will be informed by the baseline pre-intervention assessment method described within the Natural England publication "Biodiversity Metric 3.1 Auditing and accounting for biodiversity Technical Supplement (April 2022)".

The change in biodiversity units, relative to the baseline, will be calculated using the Natural England Biodiversity Metric 4.0. All survey work (including botanical surveys and condition assessments) to inform the biodiversity unit assessment will be undertaken by an appropriately qualified and trained person The methodology will follow that published by Natural England alongside the Biodiversity Metric. These requirements will follow the specification within "*BS 8683: Process for designing and implementing biodiversity net gain"* and also Thames Water's own Biodiversity Net Gain Strategy document, due to be published summer 2023.

All habitat and condition data for each site will be captured within a GIS database, along with time stamped (and ideally georeferenced) photographs taken during the site visit (along with any other imagery collected, such as drone footage).

Surveys will be repeated every four years. The change in biodiversity units, on a given piece of land, will be the aggregate change between the latest survey and the original (baseline) survey. No change can be recorded until the second site visit, four years from the first visit. Once the original (baseline) survey has been completed for the purpose of the performance commitment, Thames Water will continue to survey land every four years to record the habitats present and their condition.

Site Enhancements

The following investment and plans will be delivered through AMP8 at 2 water operational sites:

- Year 1: we will deliver a combination of wetlands, grassland enhancements and tree planting at Speen.
- Year 3: we will deliver a combination of wetlands, grassland enhancements and tree planting at Grimsbury.
- Year 4 and 5: the funding is set aside for contingencies such as replanting failures, or additional management to move the units in a positive direction if not achieved units in years 3 and 4 of monitoring.

In summary, across the 2 sites, various ecological enhancement works will be undertaken. These will include enhancement of grassland habitats to encourage wildflower species, improving habitat connectivity through planting of trees/hedgerows and wetland/pond creation. All enhancements will be linked to nature recovery plans prepared for each site.

These new initiatives will be supported with the ongoing management of 100 sites created in AMP 7 across our entire estate.

Reporting

We will report all habitats, including irreplaceable habitats or habitats designated as Sites of Special Scientific Interest. In addition, we will also record and report separately on the net change in biodiversity units based on the different biodiversity unit types. This includes reporting on the following three categories:

- Area
- Hedgerows; and
- Rivers

As per the Ofwat Biodiversity Performance Commitment definition, where the survey shows a positive net change in biodiversity on a site, we will continue to report the same net change in biodiversity each year until the next survey is scheduled (i.e after four years). This approach will apply in the following instances:

- When the change is not reported more than four times without a further baseline preintervention assessment;
- When appropriate management is in place to, at a minimum at least, conserve biodiversity; and
- When the company has no information that there may have been a loss in biodiversity, that it has not taken proportionate action to address.

If any of these conditions do not apply, we will record zero biodiversity units on that site, resulting in a negative net change on that site.

Where the survey shows a negative net change in biodiversity on a site, we will continue to report this until a further survey demonstrates biodiversity units on the site have changed. However, as described above, due to the time required to achieve target condition, this could take over 10 years. Accordingly, this could have the unintended consequence of incentivising 'easy wins' of enhancing low biodiversity value habitat rather than higher biodiversity value habitats at scale which may take longer to reach to target condition. It may be possible that an 'interim gain' in biodiversity units could be claimed for meeting a lower condition target by year 5. We propose that this should be agreed in advance with Ofwat.

Activities included within enhancement expenditure

There are no activities planned to be funded through an Enhancement Case for this performance commitment.

Customer line of sight – Positive impact on the community (Biodiversity)

Engagement with our customers, communities and stakeholders has played a key role in developing our AMP8 strategy to reduce our environment impact and restore the environment, and have a positive impact on the community .

Our activities in this area, such as improving Biodiversity, while important to our customers, tend to be a low relative priority, compared with core service areas. We provide further detail of our overall PR24 engagement programme in TMS03 Customer Engagement.

In this section we present a line of sight summary from what we heard to what we are proposing in this area

Table42: How we are proposing to respond to customer insight- biodiversity

What we heard		How we are responding
Biodiversity	Natural spaces are important to the public and they enjoy a wide range of recreational activities in nature. Customers feel that the natural environment improves quality of life. They would us to invest into the communities we operate in, including through programmes that provide access to our sites for recreation purposes.	Developing new habitats across 9 operational sites (7 wastewater, 2 water) including creation of new grasslands, wetlands and planting of trees and hedgerows. This is in addition to the 100 biodiversity sites created in AMP7 which we will continue to manage. Management of 12 Sites of Special Scientific Interest and 25 nature reserves. We will continue to open up our sites to the public including recreational fisheries, sailing clubs, heritage groups and other sporting clubs.

The table on the above, provides a summary of customer views for each of the key areas for this outcome and considers how we have addressed each aspect within our plan. In the table below we provide specific details of the feedback from the various research inputs we received.

Table 43: Key customer research that has informed our biodiversity plans

Outcomes and Wants	Thames Water Triangulated Priorities [1]	Topics	Ofwat collaborative research [2]	Enhancement case deep dives [3]	Acceptability and affordability testing [5]	Vision 2050 research [6]
I want you to reduce your impact and restore the environment I want you to have a positive impact on the community	Customers place a medium priority (7th of 10 Wants) on **'I want you to reduce your impact and restore the environment'.** Having **'a positive impact on the community',** which includes activities to improve biodiversity across communities, while important to customers, is a low relative priority compared with core service areas (10th of 10 Wants).	Biodiversity	Customers place a medium importance on **'Biodiversity'** which becomes important as a proxy for environmental policy, but the topic is ill understood.			**'Use of the land Thames Water owns to benefit wildlife and create natural spaces for people to visit'** was ranked a low priority for customers in our Vision 2050 research ; customers show mixed levels of interest in this area. Although some are keen for more wild spaces to improve local areas and provide safe spaces for families, others feel it has a lower priority and, given the utility bills crisis, wouldn't be the right area to invest in currently compared with core service areas.

Sources:
[1] What Customers, Communities and Stakeholders Want v18, Sia Partners, September 2023
[2] Ofwat + CCW customer preferences research, April 2022
[3] PR24 Deep Dives, February 2022; Enhancement case package options research, September 2022; Enhancement case deep dive research, May 2023
[4] Thames Water WRMP Consultation, May 2023; WRSE – Customer Preferences to Inform Long-Term Water Resource Planning, March 2021; WRSE Best Value Criteria, May 2021; WRSE Water resources quantitative research, June 2022
[5] Acceptability and Affordability Testing (Qualitative findings), May 2023
[6] Vision 2050 Research, May 2022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