SRN27 Water Resources - Demand Enhancement

2nd October 2023
Version 1.0

from Southern Water

Contents

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Glossary

Acronym	Term	Definition
	Abstraction	The removal of water from a source e.g. river
ADO	Average Deployable Output	Annual average deployable output from a source
AMP	Asset Management Plan	Water company business plan
BVP	Best Value Plan	A Water Resource Management Plan (WRMP) or regional plan which considers a range of factors (alongside economic cost) with the aim of increasing overall benefit to customers, the environment and society
Defra	Department of Environment, Food and Rural Affairs	The government department responsible for setting water policy
DO	Deployable Output	The output of a source or bulk supply as per the licence (if applicable); pumping plant and/or well/aquifer properties; raw water mains and/or aqueducts; transfer and/or output main; treatment; water quality
DPC	Direct procurement for customers	
	Drought Permit	An authorisation granted by the Environment Agency under drought conditions, which allows for removal and storage of water outside the schedule of existing licences on a temporary basis
	Drought Order	Powers granted by the Secretary of State during drought to manage quantities of water removed and released on a temporary basis
DYAA	Dry Year Annual Average	Represents a period of low rainfall and unrestricted demand and is used as the basis of a Water Resource Management Plan
DYCP	Dry Year Critical Period	The period(s) during the year when water resource zone supply and demand balances are at their lowest

DWI	Drinking Water Inspectorate	The government's drinking water quality regulator
	Eastern Area	Supply area comprising the Kent Thanet, Kent Medway East, Kent Medway West and Sussex Hastings Water Resource Zones
EA	Environment Agency	The government's environmental regulator
ED	Environmental Destination (or Environmental ambition)	A strategy developed at a regional level to help enhance the natural environment through water resources activities and sustainable abstraction (water removal)
ERP	Emerging Regional Plan	The draft least cost regional plan prepared by Water Resources South East (WRSE) under the National Framework, as put into public consultation in January 2022
	SRO Future Needs Assessment	Assessment to better understand how each of the SRO alternative options being assessed at RAPID Gate 2 could be evolved to meet future water resource needs (for more on this see Annex 5, Annex 12 and Annex 13 of SW's Gate 2 submission to RAPID in December 2021)
GW	Groundwater	Water held underground in the soil or in voids in rock
Ml/d	Mega litres per day	Millions of litres per day. Unit of measurement for flow in a river or pipeline
	National Framework	The Environment Agency's national framework for managing future water need for England by the means of regional planning introduced in March 2020.
NE	Natural England	The government's adviser for the natural environment in England
NYAA	Normal Year Annual Average	This is the demand for water expected under normal conditions
Ofwat	Office of Water Services	The economic regulator of the water sector in England and Wales
	SRO Options Appraisal Process	Process undertaken by SW to determine its selected SRO at Gate 2 of the RAPID gated process (for more on this see Annex 5 of SW's Gate 2 submission to RAPID in December 2021)
	Outage	Temporary loss of deployable output

PCC	Per Capita Consumption	Amount of water typically used by one person, per day
RAPID	Regulators' Alliance for Progressing Infrastructure Development	The collaborative regulatory group of Ofwat, the Environment Agency and DWI formed to accelerate development of new water infrastructure and design future regulatory frameworks
RBVP	Regional Best Value Plan	The Best Value Plan for the region prepared by WRSE – currently in development with a draft anticipated to be put into consultation in Autumn 2022.
	Source	A named input to a water resource zone where water is abstracted from a well, spring or borehole, or from a river or reservoir
SRO	Strategic Resource Option	Options that provide resource benefits
SW	Southern Water	Water and wastewater company operating in the South East of England
T100	Target 100	SW's water efficiency programme and target to achieve the long-term ambition of 100 litres/ person/ day
WRMP24	Water resources management plan 2024	SW's statutory water resources management plan submitted to the Environment Agency, Ofwat and DEFRA covering the period from 2025 onwards.

Executive summary

This document presents the need and justification for AMP8 enhancement expenditure on demand reduction, related to our demand management strategy and our long term strategic WRMP24.

Our demand management strategy aims to achieve our overall demand reduction objectives within our WRMP24, including meeting the Government's 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. This is a key investment plan towards achieving that long-term target.

Our demand management strategy comprises of the following components:

- Leakage reduction strategy which will reduce leakage by 50% by 2050
- T100 strategy and blueprint comprising of:
  - Household consumption reduction – which will reduce PCC to 100 litres per person per day by 2045
  - Non-household consumption reduction – which will reduce our overall consumption by 9% by 2038
- Smart metering strategy which will replace all existing meters with smart AMI meters by the end of AMP8 - smart metering is a key strategic enabler for us to achieve both our leakage reduction and T100 objectives. Our smart metering programme is covered by a separate enhancement case.

AMP8 is the first step in a long-term plan to achieve the required demand reductions. Expenditure of £326.5m is required for AMP8 for us to continue to reduce leakage and demand and contribute towards the government achieving its long-term targets. This comprises of £239m for leakage reduction and £21.4m for demand management activities (both the subject of this enhancement case) and £63.4m for rolling out smart metering, which is covered by a separate enhancement case).

To ensure our costs are optimised we have undertaken a series of benchmarking exercises upon which our unit cost estimates are based. This comprises our own outturn costs, historical industry benchmarks and cost data from ongoing work by other water companies where this is appropriate.

Our demand management targets are ambitious and stretching relative to our industry peers. Being close to frontier performance for leakage and per capita consumption in recent years means that we must do more to achieve the percentage reductions required to meet the long-term targets set by the government.

Customers will be protected in the case of non, or under-delivery of this investment and against our targets. The primary mechanism for protecting customers from the risk of under-delivery are through the outcome delivery incentives against each relevant performance commitment, PCC, Business Demand, Leakage and additionally Mains Repairs – where benefits can be estimated directly.

This enhancement case covers our T100 water efficiency programme for households and non-households and leakage expenditure programmes. Investment in smart metering expenditure is captured in a separate enhancement case.

Summary of Enhancement Case	
Name of Enhancement Case	Demand management
Summary of Case	Justification for expenditure for: • Household water efficiency reductions (T100) • Non-household water efficiency reductions • Leakage reductions Expenditure will enhance our supply- demand balance
Expected Benefits	• Investment in our T100 household water efficiency programme is expected to achieve 6.7Ml/d in reductions in AMP8 (smart metering will deliver an additional 11.1Mld) • Investment in our non-household water efficiency programme is expected to achieve 1.2 Ml/d in demand reductions (smart metering will deliver an additional 2.6Ml/d) • Leakage is expected to achieve 10.23 Ml/d reduction in AMP8 of which 6.91Ml/d is as a direct result of leaks found and repaired during the smart metering roll out • Mitigation of the need to deliver additional water supply schemes in stressed areas (additional recycling at high cost) • WRMP (Water Resource Management Plan) alignment to long term drought challenges and targets
Associated Price Control	Water network +
Enhancement TOTEX	• T100 household water efficiency programme - £16.1m • Non-household water efficiency - £5.3m • Leakage - £239.0m (exclusive of smart metering)
Enhancement OPEX	• T100 household water efficiency programme - £16.1m • Non-household water efficiency - £5.3m • Leakage - £8.4m
Enhancement CAPEX	• T100 household water efficiency programme - £0 • Non-household water efficiency - £0 • Leakage - £230.6m
Is this enhancement proposed for a direct procurement for customer (DPC)?	No – Our DPC team followed a framework to select projects for DPC based on the criteria set out by Ofwat. This investment did not meet Ofwat's criteria and hence was not selected for DPC.

1. Introduction and Background

The UK Government's Environmental Improvement Plan, under the Environment Act 2022 includes national targets for water demand reduction, including an overall 20% reduction in 'water into public supply' (Distribution Input) by 2050. This national water target agenda consists of three separate demand reduction targets;

- the reduction of Per Capita Consumption (PCC) to 122 l/p/d by 2038 and 110l/p/d by 2050
- the reduction of overall business consumption by 9% by 31 March 2038, and 15% by 2050
- the reduction of leakage by 37% by 2038 and 50% by 2050.

Ofwat's PR24 Final Methodology and AMP8 performance commitments have been informed by the national targets. Our AMP8 performance commitments on demand reduction (PCC, Business Demand and Leakage) will require all water companies to increase water demand reductions to achieve the total water use reductions required in the national targets.

WRMP24 is our strategic long-term plan to meet the supply-demand deficit in our region. This includes addressing the stresses of climate change, population growth, reducing unsustainable abstractions and a continual need to be resilient. Developing new water resources and reducing demand are both required to achieve a secure supply of water into the future. There is a need for us to reduce leakage across our network and play our part in enabling household and non-household customers to reduce their consumption. Rolling out smart metering is a key enabler to achieving our leakage and water efficiency objectives.

Our demand reduction activities will include water efficiency initiatives; a step change in customer engagement; the roll out of our smart metering programme and our leakage reduction activities. These activities will deliver Southern Water's contribution towards national water targets and our performance commitments for PCC (Figure 1) and Business Demand (Figure 2) and Leakage (Figure3) but our activities alone will not deliver the entire demand reduction agenda. Government policy interventions will play a pivotal role in achieving our water efficiency targets. Government intervention is required on areas including mandatory water labelling and enhancing water efficiency objectives within building regulations to achieve the water efficiency savings needed in our long-term WRMP.

Figure 1: Normal year per capita consumption forecast (litres/person/day)

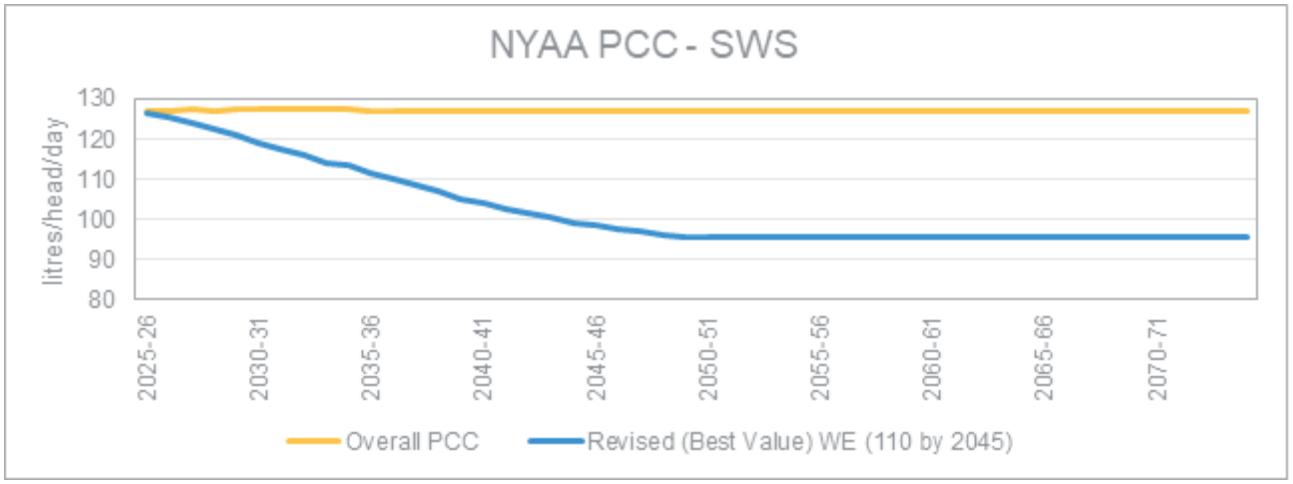


Figure 2: Non-household demand forecast against baseline 2019-20 position

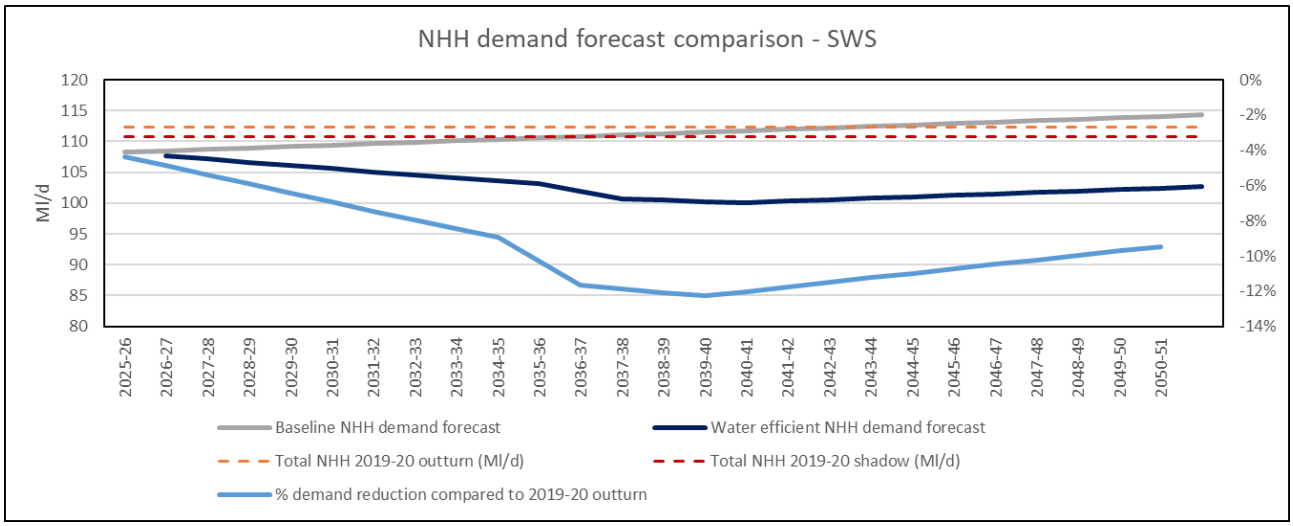
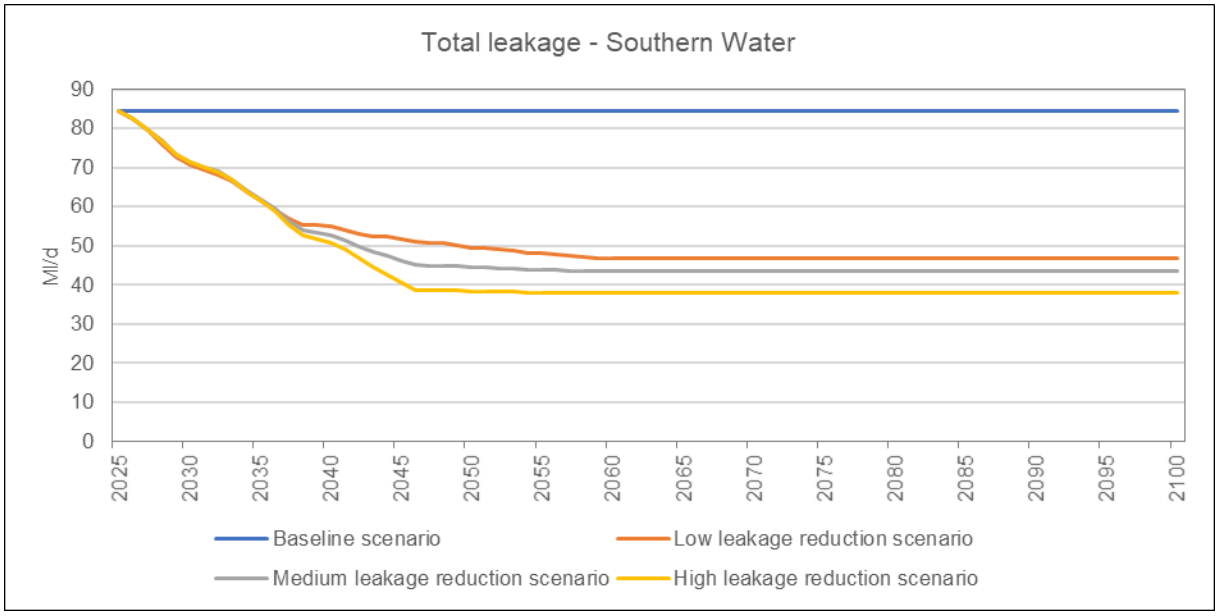


Figure 3: Total leakage reduction scenarios as modelled in our WRMP (annual leakage figures)[1]



The costs related to this enhancement case will be reflected in PR24 data table CW3 - Enhancement expenditure - water resources and water network+.

Table 1: Enhancement case links to business plan tables

Supply-demand balance	Units	dp	PR24 Ref		RAG ref
Demand-side improvements delivering benefits in 2025-2030 (excl leakage and metering); SDB capex	£m	3	CW3.44		4L.23
Demand-side improvements delivering benefits in 2025-2030 (excl leakage and metering); SDB opex	£m	3	CW3.45		4L.24
Demand-side improvements delivering benefits in 2025-2030 (excl leakage and metering); SDB totex	£m	3	CW3.46		4L.25
Leakage improvements delivering benefits in 2025-2030; SDB capex	£m	3	CW3.47		4L.26
Leakage improvements delivering benefits in 2025-2030; SDB opex	£m	3	CW3.48		4L.27
Leakage improvements delivering benefits in 2025-2030; SDB totex	£m	3	CW3.49		4L.28
Other enhancement (Freeform lines - by exception)					
Mains replacement Capex	£m	3	n/a		n/a
Mains replacement Opex	£m	3	n/a		n/a

2. Needs Case for Enhancement

Pressure on the demand and supply of water in the South-East outstrips the rest of the country because of continued population growth and the likelihood of more frequent, prolonged droughts caused by climate change. Furthermore, much of our water abstractions are from environmentally sensitive groundwater aquifers and rivers and need to be reduced. To sustainably meet these challenges, we need to reduce demand, by being water efficient, alongside finding new sources of water for our customers.

Our demand management strategy aims to achieve our overall demand reduction objectives within our WRMP24, including playing our part towards meeting the 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.

Our demand management strategy comprises of the following components:

- T100 water efficiency strategy including household (PCC reduction) and non-household (business demand) consumption reduction
- Leakage reduction strategy which will reduce leakage by 50% by 2050
- Smart metering strategy

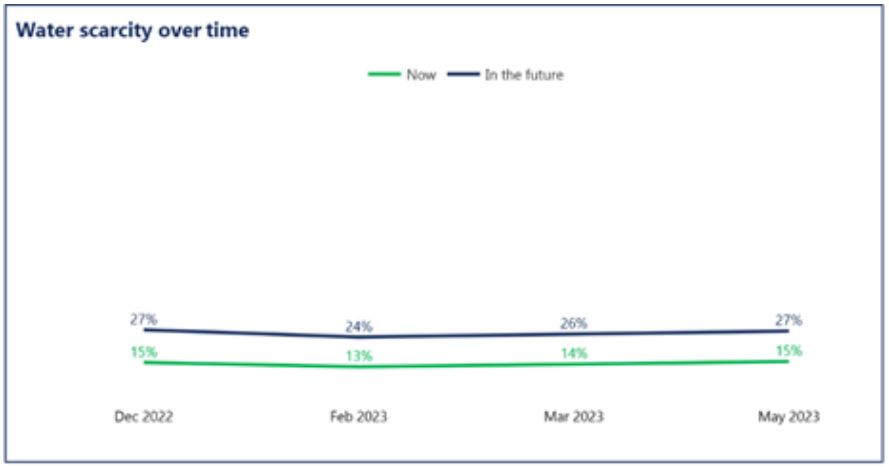
Target 100 (T100) is our water efficiency strategy; the blueprint by which we intend to create a culture where people are consciously using less water. It is a detailed blueprint for individual, social and cultural behaviour change required to deliver the significant shift in customer behaviour needed to achieve our targets.

Reducing leakage helps offset demand increases, reducing the extent of investment in new resources which would otherwise be needed to maintain the supply demand balance. It also demonstrates to our customers that while we are asking them to use water more efficiently as part of Target100, at the same we are reducing losses by as much as we can.

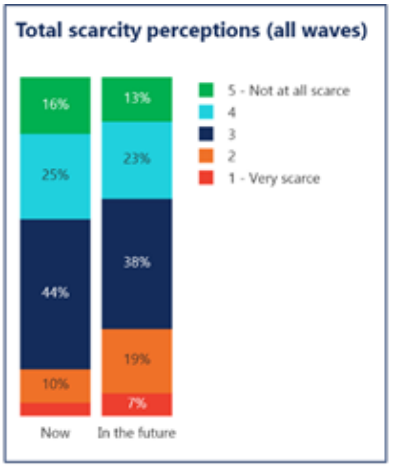
Smart metering (subject to a separate enhancement case) is a key enabler for us to achieve our PCC reduction, business demand reduction and leakage reduction targets.

Our customers need to understand why we are asking them to change their behaviour, how to make those changes and they need the tools to do so. Only 5% of our customers are aware there's a serious water scarcity problem[2] in our region (Figure 4). Data shows 44% of customers believe they use 0-20l of water per day indicating a lack of awareness of the amount of water they use. This indicates that there is a need to increase engagement with customers to achieve the behavioural changes needed related to water efficiency to achieve our targets.

Figure 4: Customer perception of water scarcity



Q85. How scarce do you think that water is for people living in the South East now, and in the future? Very scarce / Scarce by Wave
sample size = 2400; Dec 2022 = 600; Feb 2023 = 600; Mar 2023 = 600; May 2023 = 600



Q85. How scarce do you think that water is for people living in the South East now, and in the future? SUMMARY
sample size = 2400

As such we need to have a long-term demand management strategy and adapt our strategy over time as we receive new information. Customers expect us to lead by example by reducing our leakage and we need to start this now to achieve our long-term ambitions. Our consumption reduction plan is a comprehensive programme to reduce PCC to 100 l/p/d to 2045 in normal year conditions (110 l/p/d to 2045 under dry year conditions)[3]; non-household consumption reduction of 9% by 2038 and to half leakage by 2050. This starts with our AMP8 investment plan.

1.1. How is this investment aligned to our long-term ambition?

We want to create a future where our region's residents, developers, retailers, employers and employees are water stewards: aware of their water environment, feel connected to it, and willingly play their part in protecting and preserving it.

We intend to lead the industry on minimising raw water abstractions by reducing the demand for water and the amount consumed per person. This is beneficial both for our customers and the environment.

For customers, reducing demand is a more cost-effective way of meeting the supply demand balance gap than, for example, developing new capital-intensive water resources.

T100 is a directional strategy to move average household water usage to 100l/p/d. In our WRMP24 we are targeting to reach 100 l/p/d (in a normal year). by 2045. T100 is also a commitment to help retailers to reduce demand in the non-household sector by 9% (10.5 Ml/d) by 2038. Our current non-household plan forecasts to achieve this by 2037 – one year ahead of the government's national target.

1.2. Why is enhancement investment required?

Our WRMP24 is the primary driver for this enhancement investment. Our WRMP24 requires us to meet the forecast supply-demand balance gap. We can either achieve this through investment in new supply side options or by undertaking demand reduction activities, including leakage reduction. If we do not invest further in water efficiency and leakage reduction this would require additional investment in supply-side options.

Ofwat's modelled base allowances are set at the level of historical industry average activities for water efficiency and leakage reduction. Therefore, they do not allow for the step change in demand and leakage reductions required to deliver our AMP8 targets towards our long term 2050 targets. Our bottom up botex allowances forecast for PR24 assumes a level of expenditure on water efficiency and leakage compatible with historical expenditure (i.e. run rate). These allowances cover the natural rate of rise (i.e. current steady state occurrence of leaks) and business as usual activities. The enhanced investment will enable us to undertake the necessary step-change activities to achieve the government's target and meet our supply-demand deficit.

2.2.1. Water efficiency

Engaging with our customers on water efficiency is an ongoing part of our operations. This aims to prevent water use increasing over time by continuing to educate and communicate with our customers on this subject. Activities to maintain PCC at a stable level are funded through base expenditure allowances at the industry average level. Our WRMP identifies the need to significantly enhance our supply demand balance over the next 25 years which includes increasing our own water efficiency activities, these additional activities require enhanced investment.

2.2.2. Leakage

Natural rate of rise (NRR) in leakage represents the amount that leakage would increase by, over the year, if no leakage repairs were undertaken. Our most recent assessment of NRR is that leakage would increase by 120 Ml/d per annum if we did nothing. We currently undertake all our leakage repair activity through base expenditure and that is just to stand still. Investing in leakage reduction activities which go beyond our "stand-still" position (currently funded through base) requires additional investment through enhancement expenditure. Furthermore, if we do not invest now, our network will further deteriorate over time. We estimate that this additional deterioration will increase our NRR in leakage by 2.2Ml/d per year without investment. Our leakage reduction strategy includes 300km of mains replacement in AMP8. We plan to increase this renewal rate further in AMP9 and to 2050. Our customers have consistently told us that they want us to push harder on leakage reduction. We need to replace mains now to be able to achieve our long-term leakage reduction targets. Additionally, our mains replacement programme provides additional long-term benefits of:

- Reducing reactive mains repairs; and
- Helping reduce our water supply interruptions and move towards our 2050 target of no greater than an average of 2 minutes lost per customer per year.

1.3. What would happen if we did not invest?

Without any investment in reducing demand our household consumption will increase by 54Ml/d between 2025 and 2050. This will be compounded by increases in non-household demand. Without investing now and progressing in AMP8 we would also fall short of meeting the government's long-term demand management targets for PCC, Business Demand and Leakage.

Figure 5: Baseline demand without any interventions

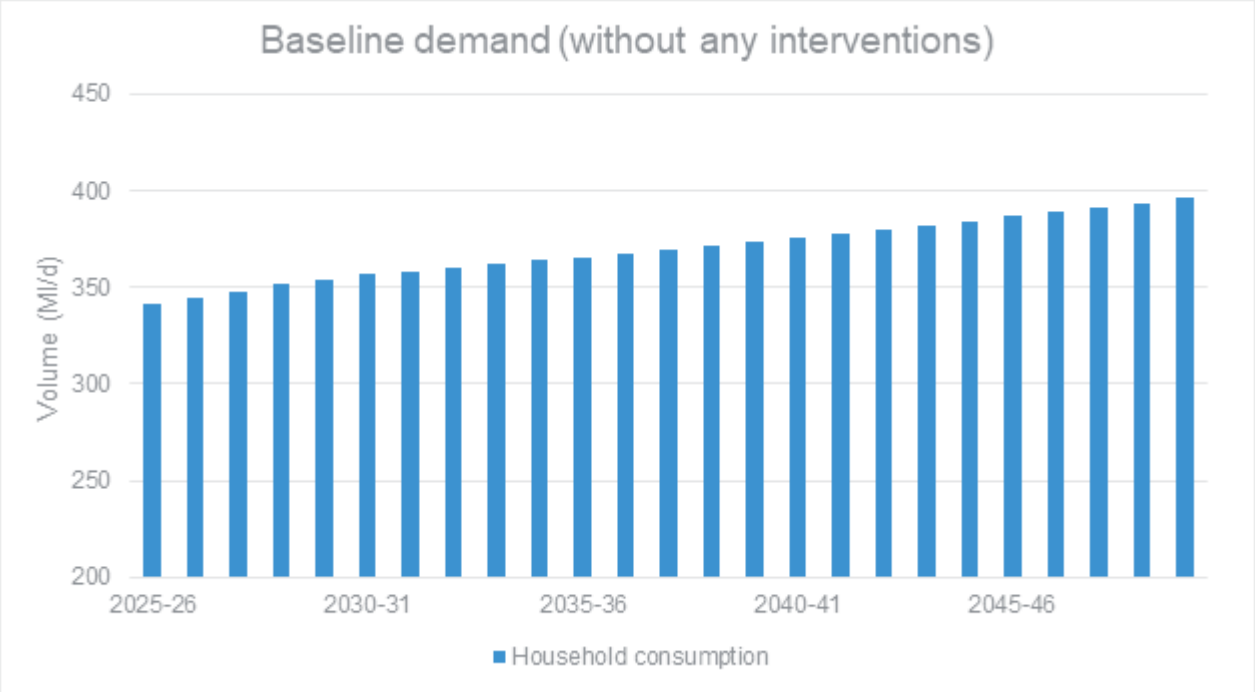
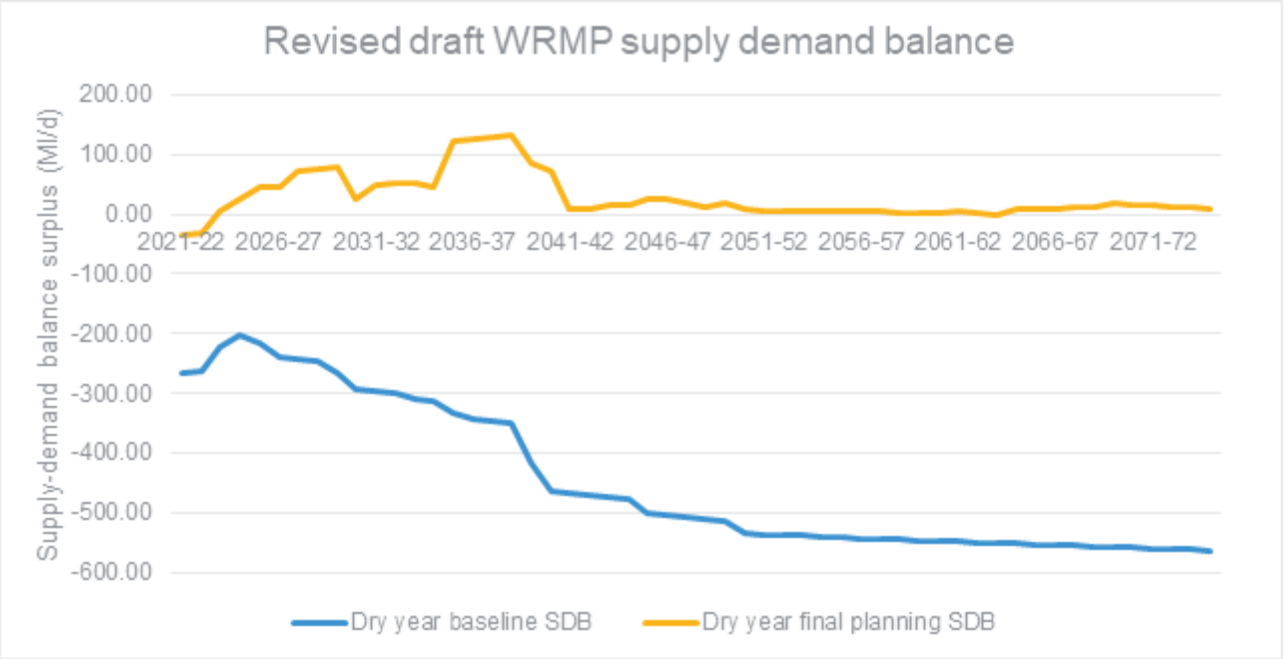


Figure 6 below shows that we are forecast to be in a significant supply-deficit of 200Ml/d in 2025-26 and if we do nothing that this situation will be exacerbated in the coming years. Our rdWRMP24 includes a range of both demand reductions and supply schemes to overcome this deficit.

Figure 6: Company level baseline and final supply demand balance



We have a statutory requirement to produce a WRMP that maintains our target level of service for water supply over the planning horizon. The final planning SDB line in the chart above is achieved through a best value plan, derived as part of the Water Resources South East (WRSE) regional plan and includes the demand and leakage activities set out in this case along with the schemes in our supply side enhancement case.

1.4. What do our customers want?

Water efficiency related behaviour change relies on:

i) a clear message of why our customers need to use less water
ii) offer them solutions; and
iii) make the change easy to adopt.

From a survey we carried out in April ’23 ‘Perceptions of Water Scarcity’, we found that only 5% of our customers are aware there’s a serious water scarcity problem in the region at all, which dropped from 11% in Nov ’22 which could indicate the seasonal nature of retaining water efficiency campaigns.

Our customers want us to take the lead and to make it easy for them to use less water. They want us to show visible leadership, but they want to play their part too. Our engagement has also indicated that the more informed our customers become about water scarcity and its impact to their local environment, the more they understand that reducing water requires a collaborative twin-track approach.
Keys insights learnt from our customer research:

- We have learned which consumption sources will give us the greatest impact and value for our investment: showers, toilets (leaking or excessive flushing) and garden hose use.

- Customers will not motivate themselves – cost is seen as a high motivating factor, but other levers are required.
- We need lead by example by tackling leakage and demonstrating efficiency.
- Greater awareness of water consumption is a key need for our customers. This is a challenge for us with current consumption data from AMR (dumb meter) data. We need to provide alternative solutions to help customers while we our smart metering programme is being rolled out.
- Customers want creative, quick and easy ways of helping them change their water use habits. We need to continue to be proactive in our approach to water efficiency education.
- In our draft Water Resource Management Plan 2024 consultation, we asked customers. “Do you support us achieving our WRMP target of reducing average personal daily use from 131 litres per person per day to a) 109 litres by 2040 or b) should we retain our more ambitious target of 100 litres per person per day by 2040?”. The results showed that 77.9% of respondents have support for greater water efficiency.

Our investment plan below has been informed and shaped by these insights to provide the best value options for our customers (Section 3).

1.5. How have stakeholders shaped this investment case?

We published our draft WRMP in October-22 and our consultation period closed on 20 February 2022. The consultation period invited views on the draft WRMP from stakeholders, customers and our regulators which we considered within the development of our revised draft WRMP. Our revised draft WRMP forms the basis of this enhancement case which takes on board consultation feedback from our regulators and customers. Our revised draft WRMP is pending acceptance by DEFRA and the EA.

The below tables provide an outline of the key changes related to our water efficiency and leakage reduction programmes between the October 22 plan and our revised draft plan (August 2023). This demonstrates the challenge we have already had applied to strategies underpinning this enhancement investment.

Table 2: Changes between our draft and revised draft WRMP – water efficiency

Household/Non-household	Change and part of plan affected	Description
Household	Government intervention assumptions	WRSE have undertaken a detailed scenario analysis of the impact of government interventions. In particular, this is relevant to the savings assumed from mandatory water labelling of products. Delivery of the benefits from mandatory water labelling is a key enabler of our T100 ambition. This is the main driver for achieving the PCC target of 100 litres per person per day by 2045 rather than 2050.
Household and non-household	Government environmental improvement plan HH and NHH targets.	We have reflected the government’s statutory target and Ofwat feedback on our draft plan to achieve a 110 litres per person per day by 2050 (dry year) within our household consumption reduction profile and glidepath. We have also reflected our contribution to the 9% non-household reduction target. These targets underpin the activities we plan to undertake both in AMP8 and beyond.
Non-household	More detail on the NHH programme activities and costs	We have reviewed our NHH programme and refined the activities within the plan to reflect our contribution towards the government target of a 9% reduction by 2038.

Household and non-household	Smart metering updates reflected in the T100 strategy	We received a number of responses related to the smart metering programme. Our revised draft plan reflects a lot of comments on smart metering
Non-household	Smart metering added to non-household programme	Following feedback on our draft plan we have included smart metering within our non-household plan.
Household and non-household	Increased the time horizon out to 2050	Our draft T100 horizon was out to 2040, we have extended this horizon to 2050 to reflect the Refined T100 water efficiency scenario.
Household and non-household	Reviewed scenarios in terms of dry/normal	We have reviewed our initial and refined T100 planning scenarios
Household and non-household	Consolidated learnings across the industry	We and our peer companies have obtained greater insight from ongoing demand reduction activities. This has enabled us to update and refine our assumptions on demand reduction benefits from the draft plan.
Household and non-household	Rationalised household/non-household activities/assumptions	We have consolidated the activities and the assumptions we have used with the household and non-household reduction plan.
Non-household	Included carbon costs and savings for NHH	We have undertaken an assessment of the carbon costs and savings that we had not undertaken within our draft plan.
Non-household	Improved costs estimate based on work done by us and other companies	We and our peer companies have obtained greater accuracy of costs from ongoing demand reduction activities. This has enabled us to update and refine our cost estimates compared to the draft plan.

Table 3: Changes between our draft and revised draft WRMP – leakage reduction

Key change	Description
Mains replacement optimisation	Using the Pioneer model to determine a more cost-efficient rollout of mains replacement at DMA-level considering length, leakage, bursts and deterioration. Our draft WRMP indicated a mains replacement profile of 1250km in AMP8 – this has been revised down to 300km in AMP8 prioritising those DMAs where the greatest benefits will be realised.
Mains replacement costs	Mains replacement unit costs have been reviewed and updated to align with long-term historical industry average benchmarks.
Smart Metering benefits to include NHH	Updating the smart metering benefits to include supply pipe leakage for non-household customers. An increase from 6.6 Ml/d to 6.9 Ml/d for AMP8
Updated logger costs for Digital Networks	Unit costs for pressure logger installations have been reviewed to the latest real costs from our suppliers
Leakage reduction profile	The leakage reduction profile for our revised draft WRMP has been confirmed as a 50% reduction in leakage by 2049-50 compared to a 2017-18 baseline.

3. Best Option for Customers

This section describes how we have developed our demand management investment programme it details the:

1. Demand management programme level process and best value framework we have used.
2. Identification and assessment of options for reducing demand across household and non-household consumption, and leakage reduction. This includes how customer engagement has shaped our proposed solutions.
3. Lessons we are learning from our ongoing work in AMP7 which are helping strengthen our AMP8 programme.
4. Our blueprint for a water-efficient culture describes our strategy and planned AMP8 activities which underpin this investment case for:
    a) Household consumption;
    b) Non-household consumption; and
    c) Leakage reduction.

2.1. Demand management programme development

This demand management enhancement case is driven by our strategic long term WRMP24. In turn our WRMP24 is based on The National Framework, Water Resource Planning Guideline and other supplemental policies which all recognise the need for water resource plans to not only secure supply but to also add wider environmental and societal benefit. They require the development of a Best Value Plan i.e. a plan that considers a range of factors in addition to economic cost such that it not only meets our supply obligations but also delivers greater resilience and additional benefits for our customers, the environment, and to wider society.

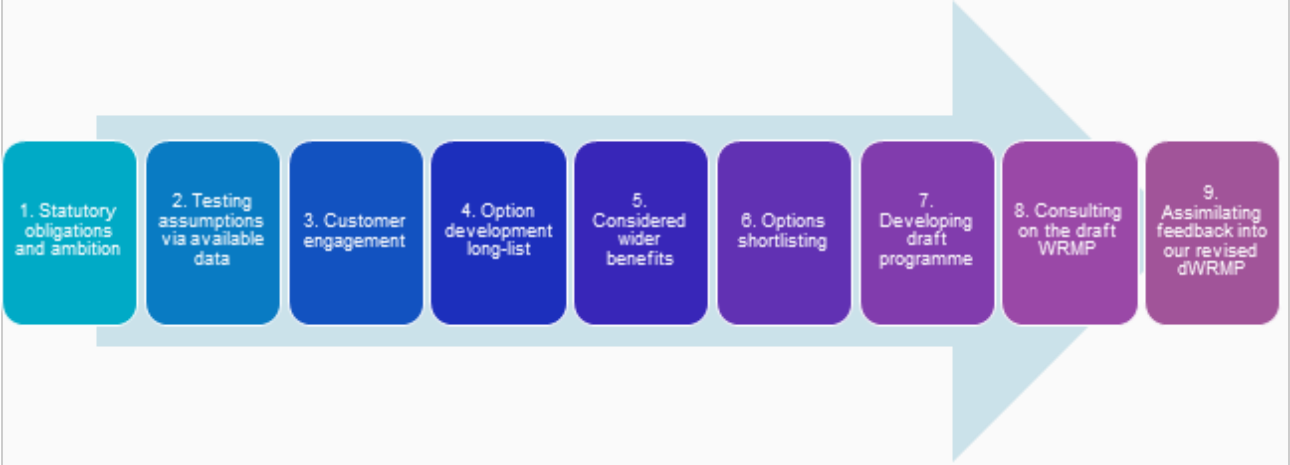
Our WRMP24 has been developed in close collaboration with the Water Resources South East group which developed a Best Value regional plan. The best value framework we have adopted for our WRMP24 is based on the principles laid out in UKWIR (2020)[4].
Our demand reduction profile was provided as an input to the WRSE modelling which generated the supply options. The demand reduction profile input was driven by:

- statutory targets;
- our draft WRMP process and consultation;
- a review of what is deliverable, affordable and intergenerationally fair; and
- alignment with our customer priorities.

We are aligned with WRSE as much as possible. There are other elements where we have adopted a common regional approach across the WRSE members, following an iterative process. This includes development of our adaptive planning pathways and best value metrics. In terms of investment modelling, we have worked with the regional group to provide the outputs so that results for the entire region are produced from a single source consistent between regional and company plans.

The broad process we have adopted to ensure the best value mix of activities for this enhancement case can be summarised in the following figure:

Figure 7: Process for developing our water efficiency programme



1. Statutory obligations and our ambition are our starting point to develop our long-term targets.
2. Tested our assumptions by reviewing a range of available data sources which indicated the need for a programme. The data sources we used were:
   - Water UK 'long-term PCC pathways' project (2019)[5]
   - Artesia "Options identification and analysis for T100 and NF110 pathways" (2021)
   - Engagement and collaborative workshops to share findings with other water companies.
   - Waterwise
   - Past WRMP19 and WRSE submissions
   - Academic papers
3. Engaging with our customers through focus groups, surveys and commissioned studies so that the T100 objectives and outcomes align to our customers priorities and help identify the best value options for the programme. We commissioned ethnographic studies to find out how people (12 participants) use water in their everyday routines and how those behaviours become habits. These were carried these out in the early stages of our work on T100 (between June-October 2022), by BVA Nudge Consulting, to gain missing vital insight into customer behaviour, which would help us design the right interventions that can enable actual behaviour change around reducing water usage. As a result of this work, we gained a clearer understanding of how customers actually use water, and we workshopped a range of outputs to deliver as future behaviour change interventions. The studies investigated how our customers typically use water when they shower, flush the loo and garden. The objective was to identify what hinders and what helps our customers to use less water. The research was done with the two most receptive segments identified from our customer base: the 'savvy and settled' and 'time-poor and receptive'. To see how the resulting insights work in practice to shape our plan of action at a more granular level, please see the below table. It's a precis of insights, our consequent nudge activity and the behavioural science principles that inform our best value options.

Table 4: Customer insights – nudges and behavioural science

Customer insight	Nudge	Behavioural science principle	Stage of adoption
Shorter showers: 4 mins			
I'm doing enough already	Send customers genuine personalised thank you messages	We like to feel our efforts are recognised and want to feel good about ourselves	Planned when smart metering is implemented
Don't know how much I use and it's the same price regardless	Create a visual interface/graphics/dashboard	Make water use tangible e.g. a bath-full can make information more persuasive	Adopted via water use calculator tool
Energy bills go up if I take long showers	Partner with energy companies	The cost of energy is on customers' minds	Adopted in campaign messaging
Water-saving isn't a priority	Smart shower heads	Our attention is drawn to what stands out and seems relevant	Currently testing various shower time reducing products
Flushing the loo			
Unaware I have a leaky loo	Proactively send out leaky loo strips etc.	We have an in-built desire to reciprocate	Adopted
Calling a plumber costs more than the leak	Free chatbot or specialist hotline for leaky loos	Make it easy	Planned
Gardening activities			
Lack of knowledge of how much water a plant needs (potted as opposed to flowerbeds) and watering techniques	Partner with gardening expert to create gardening guide	Make it easy	Planned
No awareness of volume of water used	Comms and marketing campaign to raise awareness of how much a hosepipe uses	Show water use from a hosepipe in tangible terms. Use cost, ease, environment and fairness as motivators	Adopted in ongoing campaigns
Hosepipes/jet washers used to wash down gardens/cars for aesthetic reasons	Comms and marketing campaign to raise awareness of how much water a hosepipe uses	People need to know there's a problem before they can change their habits. Use cost, ease, environment and fairness as motivators	Currently trailing effectiveness of garden hose flow monitors
Hosepipes used to water garden instead of watering cans	Testbed: hose-flow monitor trial. Increase water-butt adoption/grey water use.	Cost-efficient installation. Use ease, environment and fairness as motivators.	Offering free water butts to household and non-household customers
Panic behaviours during drought and hosepipe bans	Pre-empt panic behaviours and target with gaming behaviours via comms and marketing campaign	Raise awareness of behaviour before can change it. Built-in desire to compete. Cost, ease, environment, fairness as motivators	Adopted in ongoing campaigns

4. Developing a long-list of 40 sub-options for consideration to conduct a selection process across varying factors to identify the best value options; a short description is listed below.

Table 5: Water efficiency long-list of options

Ref	Sub-Option	Description
T100-AuditA	General Home Audit	Home visit and water audit to reduce wastage and consumption. Installation of water saving devices. Focussed on high water users.
T100-AuditB	General Home Audit (smart meters)	Using data from smart meters to target water efficiency opportunities through a home visit and water audit to reduce wastage and consumption. Installation of water saving devices. Separate option for every 10k properties audited up to 150k.
T100-Smart	Smart metering	Installation of smart water meters
T100-Tariff	Tariff differentiation	Implementation of seasonal or volume related tariffs. Requires Smart metering as a pre-requisite.
T100 Wasteful	Targeting wasteful behaviour	Communication campaign to raise awareness of water wastage and the opportunities to save water and costs.
T100-Innovation-Scale	Real time feedback	Use of real time feedback on water use to identify water wastage and promote water efficiency. Requires Smart metering as a pre-requisite.
T100-MoveHome	Targeted home move	Use of specific communications campaign and dedicated support for home movers. Aim to promote water efficiency is moving into the region or to look for water efficiency opportunities in the new home.
T100-energy	Linking water use to energy	Communications campaign to link water efficiency to saving money on energy bills. Requires Smart metering needed as a pre-requisite to be most effective.
T100-meteraware	Awareness of metering for behaviour change	Communications campaign to promote metering and raise awareness of what water homes are using to promote a wider behaviour change to save water
T100-goal	Goal setting templates	Use of on-line or app based engagement tools with customers that sets goals on saving water. Use of nudge or other behavioural techniques to support the goal targets. Smart metering needs as a pre-requisite to be affective.

T100-Moneyoff	Money off coupons for water savings devices	Money off coupons that can be redeemed against low water use appliances.
T100-community	Direct funding of community schemes	Provision of a fund to pay for community schemes to save water in the region. Grants given is the community can provide a solid business case on the savings they can achieve.
T100-Leg110	Building regs (110l/hd/day by 2030)	Changes to building regulations for new homes to set a standard of 110l/prop/day
T100-Leg85	Building regs (85/hd/day by 2035)	Changes to building regulations for new homes to set a standard of 85/prop/day
T100-LegAppliance	Appliance change with age	Communication programme or money off coupon programme to promote the changing of old water inefficient appliance for new more efficient ones
T100-LegMandatoryAppliances	Mandatory appliance change (water labelling)	Changes to legislation to a) include a water efficiency labelling on all new goods and b) introduction of new legislation to require new standards on water efficiency
T100-NationalAd	National advertising	National communication campaign to raise awareness of the need for water efficiency and promote the behaviour change on seeing water as a scarce good
T100-LocalAd	Local advertising	Targeted, local communication campaign to raise awareness of the need for water efficiency and promote the behaviour change on seeing water as a scarce good. Communication campaign to over all properties in a 5 year period.
T100-Aware	Awareness building	Communication campaign to raise awareness on why water efficiency is important.
T100-SWSuse	SWS leading by example	Programme of activities to promote the work SWS is doing to reduce its own water use.
T100-Colour-Shower	Colour changing shower heads	Use of colour changing showerheads to a) reduce the time taken in the shower and b) change to low flow shower heads
T100-Hose-restrictor	Garden hose trigger	Promotion of hose triggers to reduce wastage from garden hose use in the garden.
T100-Neighbourhood	Neighbourhood comparisons (Advizzo)	Provision of data to communities on their individual water use. Promotion of water efficiency through both neighbour comparisons and use of incentives (such as vouchers) to reduce water consumption.

T100-Energy2	Disaggregated energy reports	Provision of disaggregated energy consumption reports to show where energy is being used and show how reduction in water usage can reduce energy bills.
T100-Default-Applicances	Default settings on appliances	Communication campaign to promote customers to use the eco setting on appliances rather than the default settings
T100-Default-Toilets	Default single flush on toilets	Communication campaign to promote customers to use the single flush option on dual flush toilets.
T100-Reduce-garden	Reducing garden use	Communication campaign and supporting products and services to reduce garden water use.
T100-LeakyLoo	Leaky loo	Campaign and customer support to reduce waster losses from leaking valves on dual flush and other toilets.
T100-Teeth-Brush	Teeth brushing tap on	Communication campaign to turn taps off when brushing teeth.
T100-Shorter-showers	Shorter showers	Communication campaign to raise awareness on the amount of water used by a shower and promote shorter shower times.
T10-SchoolVisits	School visits	Education programme in primary schools to help school children understand where their water coms from, the challenges faced in the future and the simple actions they can take at home to reduce water use. Acts as an enabler for longer term behaviour change.

5. Considered a wide range of benefits and factors beyond just cost in line with Ofwat's public value principles to further guarantee best value for our customers. Data for each option was collated where available and drawn from a range of different sources covering SWS internal observed data from past studies through to industry reports and academic papers and cross referenced to other sources where available to validate the legitimacy of assumptions. Best Value metrics adopted in the WRMP24 are set out below

Table 6: Best value metrics used in our WRMP24

Best value objective	Criteria	Metric
Deliver a secure and wholesome supply of water to customers and other sectors to 2100	Meet the supply-demand balance	Public water supply – supply-demand balance profile (Ml/d) Provides additional water needed by other sectors (Ml/d)
	Leakage	50% reduction in leakage by 2050 from 3-year average 2019-20 baseline (%)
	Water into supply	Distribution input (DI) per property (litres per day)

	Customer preference	Customer preference for option type (score)
Deliver environmental improvement and social benefit	Strategic Environmental Assessment (SEA)	Programme benefit (score max) Programme disbenefit (score min)
	Natural capital	Enhancement of natural capital value (£m)
	Abstraction reduction	Reduction in the volume of water abstracted at identified sites (Ml/d) and by when (date)
	Biodiversity	Net gain score (%)
	Carbon	Cost of carbon offsetting (£m)
Increase the resilience of the region's water systems	Drought resilience	Achieve 1:500-year drought resilience (date achieved)
	Resilience assessment reliability	Programme reliability score
	Resilience assessment adaptability	Programme adaptability score
	Resilience assessment evolvability	Programme evolvability score
Deliverable at a cost that is acceptable to customer	Programme cost	Net present value (£m) using the social time preference rate (STPR)
	Inter-generational equity	Net present value (£m) using the long-term discount rate (LTDR)

6. Shortlisted options via a series of meeting and workshops were held with Southern Water staff supported by external consultants to review the unconstrained sub-option list. The options were also reviewed regarding their contribution to the overall strategy for customer service and raising awareness of water scarcity in the region and promotion of behaviour change. Following which several options were discounted to ascertain investing on the most promising (best value) options were selected to form the T100 plan. The following sub-options were removed from the unconstrained list for the reasons set out below.

Table 7: Sub-Options Removed from Unconstrained Option List

Ref	Sub-Option	Reason for removal
T100 Wasteful	Targeting wasteful behaviour	Double counting of savings with National and Local Advertising campaigns and Water Audits
T100-MoveHome	Targeted home move	No data.
T100-energy	Linking water use to energy	Double counting of savings with national and Local advertising.
T100-meteraware	Awareness of metering for behaviour change	Double counting of savings with national and local media campaign, and in smart metering benefits comms

T100-Moneyoff	Money off coupons for water savings devices	No data
T100-LegAppliance	Appliance change with age	Already in the baseline demand forecast
T100-SWSuse	SWS leading by example	Savings in Non-HH forecast (for STW use). Communication already in comms campaigns.
T100-Colour-Shower	Colour changing shower heads	Double counting with awareness campaign and product provision
T100-Neighbourhood	Neighbourhood comparisons (Advizzo)	Low scale and poor cost-benefit
T100-Energy2	Disaggregated energy reports	No data
T100-Default-Applicances	Default settings on appliances	No data
T100-Default-Toilets	Default single flush on toilets	No data
T100-Reduce-garden	Reducing garden use	Double counts savings with hose restrictor option
T100-Teeth-Brush	Teeth brushing tap on*	Double counts savings with awareness campaign
T100-Shorter-showers	Shorter showers*	Overlaps with awareness campaign
T10-SchoolVisits	School visits	Low option removed as not ambitious enough

7. Developed our draft WRMP programme which applied adaptive planning principles such as inclusion of investments which are no/low regret options, and which keep future options open. This will provide the flexibility to continuously improve in a changing environment and switch options (if needed) towards those that provide the best value in the future. A draft programme to meet the T100 target was developed using a triangulation of three pieces of analysis: Optimisation – the results of the options identification and analysis for T100 and NF110 pathways" (2021); Cost-Benefit – the relative unit cost-benefit of each sub-option; Balancing Short vs. Long-term needs – identifying those sub-options that are needed to develop long-term behaviour change and keep options open for future decisions.

   The draft WRMP water efficiency programme was developed as a blend to balance cost vs. certainty in delivery vs. sequencing to ensure future actions can be effective. An iterative process was undertaken for the activity in AMP8 (2025-2030) to ensure the programme initiatives expected out-turn matched the performance needed. In contrast the greater uncertainty and lack of options in the long-term and lack of long-term data meant the plan was not adjusted for delivery risk. A more traditional summation of possible sub-options was used instead. The result was a programme that sought to find the best balance overall rather than focus on one single objective over another and balance short and long-term risk. The final options in the programme were then structured into a feasible list under common catalysts heading needed for the behaviour changes on water efficiency - see Section 3.1

8. We consulted on draft plans with customers and stakeholders, and where appropriate, refined based on feedback and insights from customers. For example we received strong support for demand management, which is a key component of our strategy to ensure that we are able maintain uninterrupted supplies of water to our customers in all but the most extreme drought events. The

strategy set out in our dWRMP24 included reducing leakage by 50% by 2050 and reducing PCC to 109l/h/d by 2040 under normal year annual average conditions. The 77.9% of respondents have expressed strong support for reducing leakage and PCC. A number of respondents want us to aim for more ambitious targets and/or achieve the targets earlier.

9. Assimilated feedback from the extensive consultation process into our revised draft WRMP. The changes between our draft and revised draft WRMP's can be found in Section 2.6.

2.2. What lessons have we learned in AMP7?

3.2.1. Water efficiency

Our WRMP19 programme consisted of four pillars of activity designed to save water: increasing meter penetration and smart meter trials; home audits; proactive customer contact; and incentivising water-efficient behaviour.

We ended AMP6 at an average PCC of 128.1 l/p/d (2019-20), this increased to a peak average of 138.5 l/p/d during the Covid-19 pandemic. The water sector saw consumption rise, on average by 10.4%, during the pandemic, however ours was one of the lowest at 7.4% increase. This may be attributed to our high household meter penetration and our continued activity to encourage water efficiency.

PCC has reduced steadily as customers returned to the workplace -the average PCC for the year 2022-23 reduced to 128.5 l/p/d. Our campaign efforts throughout last summer and the introduction of a hosepipe ban in some areas due to drought may have also contributed to the reductions. Despite the impact from Covid-19, we learnt a lot from our activities in the first half of AMP7 that helped shape our revised T100 water efficiency strategy. These have helped identify the best value options as discussed in Section 3.

3.2.2. Leakage

Our WRMP19 aimed to reduce leakage by 15% over the AMP7 period. The first three years of our AMP7 programme did not deliver the leakage reductions we had forecast. This is due to a range of factors including hot and dry weather in summer 2022 followed by a freeze/thaw event in December 2022.

We have embarked on an ambitious turnaround programme[6] with the objective to maintain the start of AMP8 position as we originally forecast in WRMP19. With a renewed focus on reducing leakage by:

- increasing our detection resource by 21%
- Increasing our repair resource by 41%
- Improved repair cycle times resulting in a 59% increase in repairs
- Undertaken pressure management projects (booster control & transient mitigation)

The lessons from these focused activities will be rolled forward into AMP8.

2.3. The blueprint for a water-efficient culture: household

T100 is structured to take household customers through a gradual journey from understanding why they need to change their water habits, to how to use less water and finally to lasting, water-saving behaviour change. Our options analysis pin-pointed seven catalysts that are essential to help bring about a consciously water-efficient culture by 2050. These are:

i. Home audits
ii. Smart meter technology
iii. Innovative tariffs
iv. Communications and marketing;
v. Education;
vi. Water efficiency solutions; and
vii. Government interventions

Below we explain why activities within the seven catalysts provide the best value for our customers. The catalysts are the necessary components we need to make change happen. Some are predicated on others, such as the need for communications and marketing campaign and smart metering prior to introducing. Equally, creating a lasting water-efficient culture would be difficult without an education programme that targeted younger people, or the government interventions designed to constrain housing developers and appliance manufacturers from water-inefficient practices. Home audits and our water-efficiency enablers are effective on their own the benefits are enhanced through smart meter data and more so because they can be tailored directly to the customer for even greater water savings.

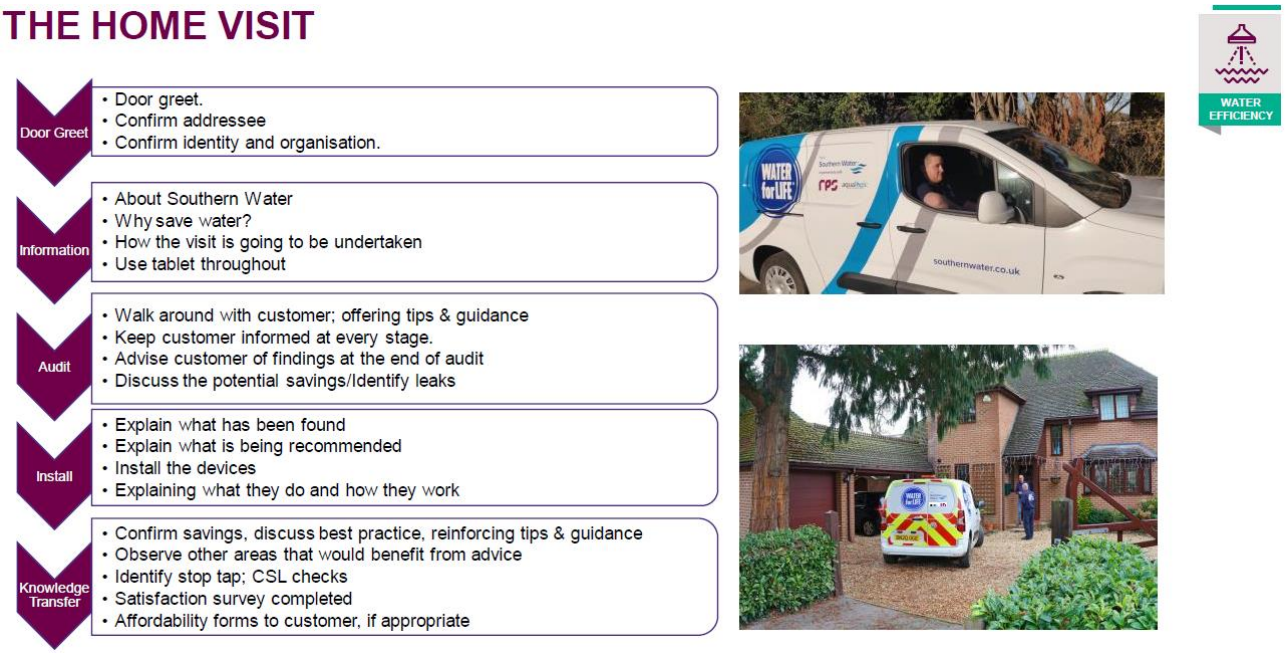
Home audits, smart metering and differential tariffs are key initiatives that are within our control. Communication, education and water-saving solutions (our initiatives and ideas) are key enablers that we have only indirect control over them and, therefore, come with high levels of risk in terms of delivering expected savings. The seventh of our catalysts, government interventions, is highly significant in terms of water savings, but is outside our control.

The following sections provide details of the seven household water efficiency catalysts in turn.

3.3.1. Home audits

Proven savings, as expected, resulted from home audits, offering water-saving tips and fitting efficiency devices in water-stressed areas. So far, we have completed 19,416 home audits (Apr 20'-Mar '23) and observed an average saving of, at least, 18 litres per household per day. We're continuing with proven water-saving home audits from our original T100 programme as they the savings are measurable and guaranteed when a visit is complete. However, they are dependent on our high users accepting a visit, requires better occupancy data and are more expensive than other options. Smart metering will improve their effectiveness (better value), giving us vital information from the resulting data to target customers based on opportunities to save water. The journey of our home audit, once a booking has been made, is shown in Figure 8 below; and currently save an average of 50l per visit per household per day based on annual meter reads.

Figure 8: Key steps of our home audits service



3.3.2. Smart meter technology

Smart metering technology is a key enabler to achieve our reduction targets. It is critical that customers can see for themselves how much water they use. Our assumption which is consistent across the sector is that smart metering will achieve a reduction in consumption of 3-5%. Furthermore, we cannot deliver other essential catalysts to behavior change without smart metering. Fair and accurate tariffs rely entirely on actual meter readings as do our smart water audits and our agile test and learning approach to solutions, which is designed to save time and give the customer the best value for money. Our smart meter trial began in the summer of 2022, testing the assumption that we can reduce water consumption by 3-5% by providing access to consumption data by means of an online platform (Advizzo). See our separate enhancement case on smart metering for details of our AMP8 investment plans.

3.3.3. Innovative tariffs

Differential tariffs such as rising block tariffs can incentivise customers to use less water – they can also reduce bills for our customers. There is a need for advanced education and engagement with our customers, so they are ready for and accepting of novel tariffs. Our plans for AMP8 include trials to specifically identify appropriate and fair incentive mechanisms. There are three phases to introducing a whole tariff approach: building awareness and readiness, smart meter roll-out alongside tariff pilots, and an evidence-based introduction to tariffs over time that are effective and fair.

3.3.4. Communications and marketing

As part of our ongoing proactive customer contact activities, in 2022 we partnered with third parties to run promotional stalls for us at general non-water-specific events across the region and ran water-saving advertising campaigns raising awareness in water-scarce, postcodes. Those customers who said they were aware of the campaign, 65% said they were taking action to reduce water use. ‘Save a little water, make a lot of difference’ is our refreshed, multi-platform, overarching awareness campaign (launched May 2023) that will form the backbone of the customer journey all the way to 2040 (Figure 9). It will run for a full 12 months with its messages and content adjusted every year. It is designed to raise awareness of water scarcity and encourage people to use less water via water saving tips.

Figure 9: Examples of media creatives used for summer 2023 campaign 'Save a little water, make a lot of difference'

The 'customer journey' from the 'unaware/uncaring', to the 'engaged steward' focuses on simple things people can do around the home. It has been informed by behavioural science insights gathered from our recent ethnographic studies.

Our strategy divides the customer journey into three stages:

1. **Build awareness of water scarcity and the need to use water wisely:** laying the foundations so customers start to view water as a precious resource.

2. **Make less water use socially acceptable:** once awareness of water scarcity has increased our activity will focus on engagement with water-saving activities.

3. **Celebrate and encourage behaviour change:** this focuses on personal use, spotlighting best practice and case studies as well as issuing regular reminders to use water wisely.

3.3.5. Education

We have launched two new T100 educational modules – 'Water Protectors' and 'Water Detectives' – as part of our educational programme 'New Wave'. They are a set of classroom modules designed by curriculum specialists to help children to learn simple ways of saving water and protecting our local environment. The newly produced content ranges from school assemblies, card games, classroom modules, school trips, interactive games customised to their local area. An example of the interactive7 Water Detectives map for Kent, shown in Figure 10, was created to help students learn about the water cycle and link it to their local environment. All these resources can be downloaded for free by any teacher across the UK.

Figure 10: Interactive map of water cycle for Kent

We're also working with schools across our region on education initiatives such as 'Water Wise' talks, a trial called 'Our River, Our Water' and running a 'Water Supply Challenge' for older students all aimed to build a water aware society and change behaviours. There is sufficient evidence from the research to indicate the investment in education to support a future generation that is water conscious.

3.3.6. Water-efficiency solutions:

These are the 'tools' we will give our customers to ease their journey towards using less water as part of continuous improvement through innovation. These include water-saving products or an enabler, such as creating the sort of conditions that will encourage new habits. These tools can be motivational (helping the customer to use less water through choice), such as switching off the tap while brushing teeth, or devices designed to encourage less water use, such as a water-efficient showerhead.

3.3.7. Government interventions

As part of its Environmental Improvement Plan 2023 , the Government has introduced a number of water efficiency targets for UK water companies. These include:

a) Reducing average Per Capita Consumption to 110 litres per head per day (110l/h/d) under dry year conditions.
b) Reducing non-household demand by 9% by 2037-38 compared to 2019-20 reported figures by 15% by 2049-50.
c) Reducing total water use person in England by 20% by 2037-38 compared to 2019-20 reported figure.

3.3.8. How we will deliver our programme

We have also identified three most effective ways of working that will increase the chance of success of our catalysts. These represent 'how' we will work on our plan of action to bring the best value for our customers in a changing world.

1. **Innovation:** every water-saving enabler will go through the same development process: ideation, experimentation, evaluation, and implementation. Our interventions will be informed by behavioural science.

2. **Agile delivery:** we are testing all potential water efficiency enablers on a small scale and doing it repeatedly. We learn from the findings, adapting, and scaling up when we have the evidence of effectiveness to deliver best value for our customers. This approach will be reviewed annually to help us re-forecast our work programme for the greatest benefit.

3. **Partnership-working:** we are working with stakeholders at a regional level to maximise benefits. A partnership approach will help us to identify and allocate funding within our local communities (See section 3.2.5 for more information.) At national level, we will continue to support new government interventions to help increase awareness of water scarcity and pave the way for future initiatives such as differing tariffs.

2.4. The blueprint for a water-efficient culture: non-household

T100 is committed to reducing demand across the whole supply network (alongside leakage) by supporting retailers and their customers to reduce water use in the non-household sector by 9% (10.5 Ml/d). We forecast to meet that goal by the end of 2037.

3.4.1. What our non-household customers want

Since non-household market opening in 2017 we have been in regular conversation with our retailers to understand their needs and how we can provide a high quality experience for their customers. These include regular performance account meetings, fora, surveys and MOSL-facilitated workshops. Retailers have told us that water efficiency and smart metering are two of their four main priorities. Retailers have their own efficiency targets and ideas we can trial together.

Many consultees to our draft WRMP (in particular MOSL, [redacted] and [redacted]) cite the important contribution of the non-household market to demand reduction and efficiency, as well as the critical role of smart meters to demonstrate demand reduction and fix leaks/wastage promptly. All three emphasise the collaboration needed between the retailer and wholesaler, and the need for incentives and funding to reduce consumption and sustain behaviour change. MOSL wanted us to dedicate more space in our main WRMP narrative document to detail the non-household sector plan, demonstrating its overall contribution to water reduction targets. Key areas MOSL want us to focus on include treating the smallest NHH customers effectively as households in terms of water efficiency advice and devices for economies of scale, and how we will offer water efficiency services to different categories of organisations. This is reflected in our work programme.

T100 is committed to reducing demand across the whole supply network (alongside leakage) by supporting retailers and their customers to cut water use in the non-household sector.

3.4.2. Our non-household strategy

Our non-household strategy has been developed by identifying activities that are under our control and maximising those with the greatest benefits.

We will work with non-households in three ways:

1. in partnership wherever possible;
2. innovate by trailing new water-saving solutions; and
3. through agile development principles – testing at small scale and adjusting our approach.

Our strategy involves offering solutions to businesses to switch to non-potable supplies (harvested rainwater, recycled greywater) and efficiency audits. We will explore opportunities to fund businesses to identify and deliver their own water efficiency innovations.

We have created a dedicated permanent position – Efficiency Co-ordinator – for the non-household sector to help deliver our strategy. Our priorities will be in those regions with greatest scarcity: Sussex North, the Isle of Wight and Hampshire, as well as high water users.

Government interventions in the household programme will be welcome (see Section 3.1.7). We would welcome greater debate on how policies can be developed to encourage greater non-household water efficiencies.

We are using information from our own non-household water efficiency activities alongside that of other water companies, retailers, stakeholders like Waterwise, public research and our in-house trials to form the basis of our selected options. Six catalysts (the workstreams and interventions) were identified that are essential to our blueprint for a consciously water-efficient business culture by 2038.

3.4.3. Trials and innovations

Water efficiency ideas and initiatives for businesses go through our ‘testbed’ to evaluate that they do to save water, how they can be measured and whether results are lasting. For example, we will use the testbed to investigate whether alternative supplies of water to potable (such as rainwater harvesting) can be used in businesses that need to irrigate, such as golf courses or plant nurseries. We are currently doing trials with farmers to test whether harvested rainwater can be used as an alternative to potable water, and we are auditing and retrofitting schools in partnership with Hampshire County Council. We are testing partnership models by offering funding to business users, communities and retailers to deploy water efficiency solutions locally. We continue to learn from other water companies who have successfully applied water-saving initiatives and are adopting successful solutions in our programme.

3.4.4. Water audits

Knowledge and results shared from other water companies indicate that water audits achieve positive benefits for non-households. Our plan includes auditing, advising, retrofitting, and helping set up on-site water recycling system. We intend to prioritise public sector buildings such as schools, hotels and leisure centres – targeting users where we can achieve the greatest benefit. Evidence indicates that a targeted approach can accelerate water savings significantly, with 3000 litres/day saved per visit.
For example, our audit and retrofit trial at a high water-consuming junior school in Hampshire, collaborating with our water retail partner [redacted], has resulted in a saving of 1,600 litres of water per day which reduced bills by 50%.

3.4.5. Partnership funds

Research and learning from initiatives undertaken by other water companies have shown there are opportunities for water savings though competitive funding approaches for non-households. The funding criteria will assess the best value and deliverable schemes and enables collaboration and ownership by the businesses.

For example, we are already funding the planning process for Littlehampton Golf Course to install a reservoir on site to reduce their mains water use. Scoping is underway for a further project to invest in rainwater harvesting equipment for farms in areas under stress during prolonged dry weather.

3.4.6. Incentives and tariffs

In 2022, we launched an incentive scheme 'You Save We'll Pay' to reduce water use and protect specific river levels on the Test and Itchen (where water levels were impacted by the drought). We gave businesses a discount of 10, 20 or 25% off their wholesale water charges when they saved the equivalent amount of water across three months. Nearly 4,000 water customers demonstrated a saving of 680 million litres of water during this period, indicating such incentives are valuable for our business customers.

We intend to use tariff mechanisms in a smarter way to incentivise organisations to use less potable water. We will need to do trials to understand the best mechanisms to reduce consumption and, in the meantime, have identified the following potentials:

- Adopting site, area-based, charging for surface water drainage
- Removing the discount for large users
- Changing to a volumetric measure for highway drainage charges linked to customer usage
- Trialling extensively around new tariffs.

3.4.7. Smart metering

Smart metering data smart meter will help target inefficient business users and continuous flows, and more importantly support water-efficiency incentives or tariffs. Our draft WRMP submission limited our Smart Meter deployment to Small NHH meters (15-22mm), a total of circa 46,000 meters. Subsequently we have reviewed the opportunity as part of our revised draft WRMP and we now aim to fit smart meters for all of our NHH customers in AMP8- Small, Medium and Large- a revised total of just over 52,000 meters. We are pro-actively engaging with retailers around our Smart metering plans and will maintain focus on their engagement as we progress.

3.4.8. Communications smart metering

In AMP8, we will develop and embark on a non-household campaign to business and retailers. We anticipate these working particularly well with those very small businesses who have similar water use patterns to households.

2.5. The blueprint for a water-efficient culture: our plan to reduce leakage

Broadly there are four approaches that we take to both maintain leakage and then reduce leakage beyond current levels:

1. Reducing leakage occurrence through better network management
2. Identifying leakage within our network to target mains replacement
3. Locating specific large leaks
4. Repairing leaks when they are found by repairing mains

Our leakage reduction strategy is a blended approach to achieving the required reduction targets that includes tried and tested activities such as find and fix, and significantly increasing our mains replacement programme. Over the medium term the benefits of our smart metering roll out will enable us to go further and target find and fix activities much more accurately to deliver even greater benefits.

The activities that were evaluated as part of our planning process are shown in the table below.

Table 8: Leakage reduction activities options evaluated within our planning process

Intervention	Potential Benefit Area	Option Commentary	Adopted in Plan
Enhanced Find and Fix	Locate	Enhanced leakage detection – resulting from a more data driven approach to area prioritisation – can reduce leakage within a DMA to less than 10%. Increased use of this approach, linked to an increasing availability of network data will enable more DMA's to be reduced and held at this level or lower.	Yes
Satellite/Drone surveying	Locate	This technology is being trialled as part of the AMP7 leakage programme and is primarily focused on detecting leaks on rural networks, especially trunk mains. Trunk mains leakage is a small component of overall leakage and therefore benefit for leakage reduction is considered minimal.	No
Pressure Management	Prevent	Over 55% of DMA's are fed from a pressure managed system. Almost 80% of these schemes have been optimised during the first 2.5 years of AMP7. Opportunities for pressure management still exist, especially the intelligent control of network booster pumps although opportunities and benefits are diminishing over time.	Yes

Improved Repair Techniques	Mend	Repair data does not suggest that there is an issue with repair quality with a low number of repeat visits undertaken.	No
Smart Metering	Aware	Smart metering is a key demand reduction driver in AMP8 and beyond and will increase visibility of customer side leakage as well as improve leakage targeting through better disaggregation of demand data at DMA level.	Yes
Smart networks / digital twin	Aware and locate	Introduction of a digital twin model in AMP7 and an extension of the number of sensors across the network will significantly improve the visibility of network behaviour and improve the targeting of leakage detection activity. This includes the trialling of fibre optic technology to provide enhanced data, thereby improving leakage detection response.	Yes
Digitalisation/Smart Networks	Aware	This tool has been developed during AMP7 to increase awareness and reduce response times to network events. Additional benefits are forecast by linking this capability with smart networks/digital twins by enabling a proactive rather than reactive response to issues.	Yes
Mains replacement	Prevent	Our NRR is 120Ml/d. Over time without investment our network will deteriorate further, increasing NRR by an estimated 2.2 Ml/d per year. Mains replacement would result in the stabilisation of the NRR and remove the requirement to continually increase the amount of activity required to hold leakage levels constant.	Yes
Communication pipe replacement	Prevent	Around 7,500 communication pipe repairs are undertaken each year as part of the leakage programme. Over 87% of these are repairs. Moving to a relay only policy would result in a longer life repair and a reduction in the rate of failure in the future as assets are renewed.	Yes
Supply pipe adoption	Mend	The adoption of customer supply pipes would introduce a significant up lift in asset liability at Southern Water and are not likely to realise a significant benefit over and above those presented through the smart metering roll-out.	No

The plan was built by an assessment of the costs and benefits of each individual leakage reduction option available. These were then summated to give an overall programme level view.

Our draft WRMP included 250km of mains replacement per year (1,250km per AMP) to combat network deterioration. 250km is more than double the reported mains renewals completed by any other utility as a proportion of total mains length since the end of AMP5. Our WRMP process revisited this length to develop a more targeted programme to prioritise those areas with the greatest volume of leakage.

Mains replacement provides a long-term supply-demand balance benefit. Additionally, mains replacements provide other benefits such as reducing reactive mains repairs and in the longer term will help towards our stretching supply interruptions target. In order to achieve our supply interruption, target we need to act now to improve our overall mains condition. This will prevent bursts which lead to supply interruptions and reduce the impact on our customers. These additional benefits and indirect benefits are important considerations in developing our long-term best value plan for leakage.

Our mains replacement programme aims to replace 300km of mains in AMP8 as part of a ten year ramp up to a level of 200km annual replacement (1.5% of our total mains length). By leveraging the Pioneer deterioration model, we were able to assess leakage and burst projections for individual pipe elements (lengths of contiguous pipe material and diameter) and determine a prioritised order of replacement delivering greatest efficiency. More detail of our approach to this can be found in Appendix A.

Changes to other initiatives were the inclusion of non-household benefits to the smart metering programme, aligned to the same method as for household; and an uplift to the cost of the digitalisation initiative to consider more recent logger costs.

The planned interventions included in our WRMP24 and which we are planning for AMP8 are summarised below.

Table 9: Leakage reduction activities included within our WRMP24

Intervention	Description
Traditional find and fix:	The function of this activity is to offset the natural rate of rise (NRR) in leakage. This represents the amount that leakage would increase by over the year if no leakage repairs were undertaken. Our most recent assessment of NRR is that leakage would increase by 120 Ml/d per annum. Without other interventions NRR is estimated to increase by 2.2Ml/d per annum.
Enhanced find and fix	This involves the use of more advanced analytics to assess the level of leakage within a DMA and target appropriate interventions. This may involve more time consuming leakage detection survey techniques or improving the data and allowances used to calculate leakage at a DMA level. This type of enhanced activity is able to reduce leakage at a DMA level to less than 10%. However, the challenge becomes maintaining this level across all DMAs.
Smart metering:	The roll-out of smart (AMI) meters is planned for AMP8, replacing the existing AMR and VMR meters. Smart meters provide more frequent information about consumption patterns which in turn allows the leakage calculation to be more accurate and at a more granular level. Leveraging this data will result in an improvement in the way enhanced find and fix activity is targeted enabling more DMA's to be maintained at a lower leakage level. Additionally, smart meters monitor for customer side leaks and generate alarms once a leak is detected. This will enable more customer side leaks to be detected and to reduce the run time of a leak.

Digital Networks:	Digital networks have the potential to change the way we target and detect leaks. Using near real-time data modelling techniques and incorporating an increased number of network sensors, such as pressure and acoustic loggers, smart meters and water quality sensors, can result in earlier identification of leakage outbreaks and narrow the area of interest significantly with the result that leak detection times are reduced. We estimate that this benefit can be realised with an average of 6 sensors per DMA. The advantage of these digital models is that as well as providing a leakage reduction mechanism they also provide an opportunity for increased efficiency as survey times will be reduced through improved targeting. This is achieved through accurate measurement, preventative maintenance, raised confidence in intervention identification and prioritisation of actions.
Advanced Pressure Management:	The water network is increasingly covered by pressure management and a significant amount of optimisation has been undertaken to minimise pressure variances. However, there is scope to expand this technology and approach to pumping assets. By changing the operating method of a pump to a controlled, rather than fixed output, pressures can be better managed within the network giving rise to similar benefits to more conventional pressure management techniques. Stabilising network pressures leads to a reduction in network fatigue, extending the life of network assets and reducing the number of burst events. Pressure management can create difficulties with leakage detection techniques that rely on acoustics to locate leaks as pressure management valves can introduce noise into the network masking leak noise. The implementation of digital modelling techniques gives opportunity to overcome some of these issues
Asset Renewal:	Our latest review indicates that NRR is deteriorating at 2.2 Ml/d per year. Unchecked this would require an additional 11 Ml/d of activity to be included in the plan by 2029/30 to maintain leakage at a constant level. Prevention of network deterioration is achieved by renewing the network as a rate that either maintains or improves network condition. We have included two asset renewal interventions in our plans:
Mains renewal:	Through asset deterioration modelling combined with discussions across operational departments within the business, Our approach to mains replacement is to steadily increase to an annual replacement rate of 200km over 2 AMPs. This rate will be proportionately higher than any other utility to date, and will be targeted based on deterioration modelling whilst assessing and minimising traffic disruption arising from mains replacement activity.
Communication pipe renewal:	The communication pipe is the section of the network that delivers water from a water main to the boundary of a property. Between April 2020 and March 2022 we completed 14,913 communication pipe leak fixes. Of these, over 87% were repairs. The delta between the average repair cost and relay cost is less than the cost of a second repair. We have therefore included an intervention that will result in all communication pipe leak fixes being undertaken as a renewal of the asset. This will result in a sustainable leak reduction through a fix that should have an 80 year plus life. This benefit will deteriorate as the mains replacement programme rolls out.

The AMP8 interventions outlined above have been set to lay the groundwork to maintain the ambition to reduce leakage by 50% by 2050.

The expenditure required for traditional find and fix activities to continue to combat our estimated 120 Ml/d Natural Rate of Rise will come from base expenditure. The other activities identified above are additional and provide an enhancement to the supply demand balance. These activities are the subject of this enhancement case.

We will communicate the progress we are making on leakage reductions to our customers. By doing this we will demonstrate to our customers that whilst we are asking them to reduce and conserve water we are

playing our part. Leakage and water efficiency will be working hand in glove to ensure a wholistic approach to demand management over the medium to long term.

4. Cost Efficiency

T100 water efficiency cost forecasts are based on a combination of our actual AMP7 water efficiency programme costs and best estimates. Where we do not have actual costs from ongoing activities, we use best estimates based on similar activities. Our forecasts for non-household water efficiency activities are based on unit costs for similar activities in the household programme, on-going trials or data from the wider industry.

Operational leakage reduction programme cost forecasts are based on our ongoing AMP7 activities. Unit costs related to our mains replacement programme are based on a combination of long-term industry benchmarks published in companies annual reports. We have cross checked these against our actual costs for similar activities that we are currently undertaking.

In developing our costs estimates, these are built up following the principles laid out in our SRN15 Cost and Option Methodology Technical Annex.

3.1. Household demand reduction

Our forecast household expenditure profile is based on several assumptions for each activity. Below we provide an overview of the basis for these assumptions for each activity and the totex in AMP8.

Table 10: Household demand reduction activities cost assumptions

Activity	Capex	Opex	Totex AMP8
Home Audits	We have assumed 0 capex – these are all operational initatives	We have assumed a full cost of £113 per home visit (2022/23 prices). This programme has been running for 4 years and we have reliable historical outturn costs with which to base our forecasts on.	£4.3m
Innovative tariffs	This programme is not due to start until 2030. In 2030 we have assumed a one off £2.0mm for the costs to maintain compatibility with our billing processes and any upgrades required. This is based on an Artesia report[8] which estimated increase of £1.44 in capex per household in 2019.	This programme is not due to start until 2030. In 2030 we have assumed £200k p.a. which is based on an Artesia report[9] which estimated increase of £0.1 in opex per household in 2019.	£0
Water efficiency enablers: • *Water efficiency and innovation* • *Media Campaigns*	We have assumed 0 capex – these are all operational initiatives	Estimates for media and education campaigns are based on our current actual costs for these activities. We currently spend £1.7m p.a on media campaigns and £450k p.a. on educational activities (2022-23 prices).	£11.8m

• *Education Campaign*			
Government initiatives	We have not assumed any costs for any involvement in any government initiatives.	We have not assumed any costs for any involvement in any government initiatives.	£0

Our household water efficiency programme for AMP8 is set in the context of achieving reductions over the long-term. Introducing net innovative tariff approaches is expected to yield a 6.9 Ml/d demand reduction from AMP9 but we need to undertake enabling work by engaging with our customers in AMP8 to meet our long-term ambition. Below we present our proposed costs and benefits for AMP8 activities in and how in Table 12 how our AMP8 programme sits within our long-term plan.

Table 11:Summary of AMP8 household water efficiency activities costs and benefits

Demand reduction activity (excluding smart metering)		Unit	2025-26	2026-27	2027-28	2028-29	2029-30	AMP8 Total
Water audit home visits	Cumulative savings	Ml/d	0.2	0.5	0.7	0.9	1.1	1.1
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.8	0.8	0.9	0.9	0.9	4.3
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	-0.1*
Innovative tariffs	Cumulative savings	Ml/d	0.0	0.0	0.0	0.0	0.0	0.0
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	0.0
Water efficiency enablers	Cumulative savings	Ml/d	0.0	0.0	0.1	0.1	0.1	0.1
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	2.1	2.1	2.1	2.1	3.3	11.8
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	0.0
Government initiatives	Cumulative savings	Ml/d	1.1	2.2	3.3	4.4	5.6	5.6
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex Savings	£m	0.0	-0.1	-0.1	-0.1	-0.2	-0.5
			2025-26	2026-27	2027-28	2028-29	2029-30	AMP8 Total
Total water saving and	Cumulative savings	Ml/d	1.3	2.7	4.0	5.4	6.7	6.7
costs	Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Opex	£m	3.0	3.0	3.0	3.0	4.1	16.1
	Opex Savings	£m	0.0	-0.1	-0.1	-0.2	-0.2	-0.6

*rounded to 2 d.p.

Table 12: Summary of long term household water efficiency activities costs and benefits

Demand reduction activity (excluding smart metering)		Unit	AMP8	AMP9	AMP10	AMP11	AMP12	Total
Water audit home visits	Cumulative savings	Ml/d	1.1	1.9	2.4	2.4	2.4	2.4
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	4.3	4.5	4.6	0.0	0.0	13.3
	Total Opex Savings	£m	-0.1	-0.3	-0.3	-0.4	-0.4	-1.5
Innovative tariffs	Cumulative savings	Ml/d	0.0	6.9	6.9	6.9	6.9	6.9
	Total Capex	£m	0.0	2.0	0.0	0.0	0.0	2.0
	Total Opex	£m	0.0	0.9	1.1	1.1	0.0	3.2
	Total Opex Savings	£m	0.0	-0.7	-1.1	-1.1	-1.1	-4.0
Water efficiency enablers	Cumulative savings	Ml/d	0.1	0.4	0.6	0.9	1.1	1.1
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	11.8	16.3	16.3	5.6	0.0	50.2
	Total Opex Savings	£m	0.0	0.0	-0.1	-0.1	-0.2	-0.4
Government initiatives	Cumulative savings	Ml/d	5.6	17.2	41.1	60.5	74.8	74.8
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex Savings	£m	-0.5	-2.0	-5.0	-8.4	-11.0	-26.8
			AMP8	**AMP9**	**AMP10**	**AMP11**	**AMP12**	**Total**
Total water saving and	Cumulative savings	Ml/d	6.7	26.3	51.0	70.7	85.2	85.2
costs	Capex	£m	0.0	2.0	0.0	0.0	0.0	2.0
	Opex	£m	16.1	21.7	22.0	6.8	0.0	66.6
	Opex Savings	£m	-0.6	-2.9	-6.5	-10.0	-12.6	-32.6

4.1.1. Carbon costing

Household demand reduction carbon costs and benefits have been calculated using the following three metrics:

- Embodied Carbon – carbon emissions embedded in the delivery of an asset
- Operational Carbon (delivery) – carbon emissions operational activity to deliver the option
- Operational Carbon (Water Saving) – carbon emissions from the reduced volume of water produced

The total carbon was calculated as the sum of each component as follows:

Total carbon = [embodied carbon] + [operational carbon for the years of install] + [operational carbon water saving for cumulative water saved]

The carbon data used is set out below.

Table 13: Water efficiency carbon data sources

Reference	Description	Value	Unit	Source
A	Travel	0.19469	kgCO2/km	(1)
B	Composite meter or water saving devices	1.60875	kgCO2e/property	(1)
C	Hot	8100	kgCO2e/Ml	(1)
D	Mileage for installation (0.27 x Properties)	24	miles/property	(1)
E	Km for Installation (0.27 x properties)	38.616	km/property	(1)
F	Carbon per Ml/d water produced	129.56	kgCO2e/Ml/d	(2)
G	Local Comms campaign	778.8	KgCO2/300k prop	(3)

1. Artesia (2021) 'Options identification and analysis for T100 and NF110 pathways'
2. Southern Water (2022), APR 2021/22, Table 11a
3. Assume 4,000km pa. per 300k properties @ 0.19469

There is estimated to be a net increase in carbon in AMP8 but as increasingly more water is saved net positive carbon is realised by 2050. The carbon impact of the household programme to 2050 is estimated to generate a net operational saving of 4,500 tonnnes CO2e.

Table 14: Cumulative carbon impacts of the Household T100 demand reduction programme – [tonnes Co2e]

Activity	2025-26	2026-27	2027-28	2028-29	2029-30
Smart metering	1,146	1,466	1,394	1,488	715
Home audits	45	35	25	16	7
Tariffs	0	0	0	0	0
Water efficiency enablers	-1	-2	-3	-4	-5
Govt initiatives	-51	-102	-155	-209	-263
Total	1,139	1,397	1,262	1,292	454

3.2. Non-household demand reduction

Our forecast non-household expenditure profile is based on a number of assumptions. Below we provide an overview of the basis for these assumptions in each activity and the totex in AMP8.

Table 15: Non-household demand reduction activities cost assumptions

Activity	Capex	Opex	Totex AMP8
Water Audits	We have assumed 0 capex	£220k p.a. (£1.1m across AMP8). This increased to £1m p.a. beyond AMP8. In AMP8 we are targeting highest users and beyond AMP8 we are targeting all users. Our unit rates are based on comparable activities undertaken by our peers and ongoing Southern Water trials on non-household customers.	£1.1m
Innovative tariffs	0	This is assumed to be £250k per AMP for the administration of the activity including resources to liaise with retailers.	£0.25m
Partnership funds	0	We have a trial in AMP7 that will expand in AMP8. AMP8 costs are assumed to be £300k p.a based on comparable work undertaken by South West Water.	£1.7m
Communications	0	Assumed to be £1.1m across AMP8 This is new work so we do not have outturn costs.	£1.1m
Trials and innovation	0	This will start in AMP8 and is assumed to be £1.1m across AMP8 based on comparable activities undertaken within our household programme. .	£1.1m

Our non-household water efficiency programme for AMP8 is set in the context of achieving reductions over the long-term. For example, expenditure on partnership working is not expected to yield immediate water efficiency benefits in AMP8 but in AMP10, AMP11 and AMP12 we expect to realise benefits without any

additional expenditure in those periods. Costs and benefits for AMP8 are provide in Table 16 and over the long term in Table 17.

Table 16: Summary of AMP8 non-household water efficiency activities costs and benefits

Demand reduction activity (excluding smart metering)		Units	2025-26	2026-27	2027-28	2028-29	2029-30	AMP8 Total
Water audits	Cumulative savings	Ml/d	0.2	0.5	0.7	1.0	1.2	1.2
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.2	0.2	0.2	0.2	0.2	1.1
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	-0.1	-0.1
Innovative tariffs	Cumulative savings	Ml/d	0.0	0.0	0.0	0.0	0.0	0.0
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.1	0.1	0.1	0.1	0.1	0.3
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	0.0
Partnership funds	Cumulative savings	Ml/d	0.0	0.0	0.0	0.0	0.0	0.0
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.3	0.3	0.3	0.3	0.3	1.7
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	0.0
Communications	Cumulative savings	Ml/d	0.0	0.0	0.0	0.0	0.0	0.0
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.0	0.3	0.3	0.3	0.3	1.1
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	0.0
Trials and Innovation	Cumulative savings	Ml/d	0.0	0.0	0.0	0.0	0.0	0.0
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.2	0.2	0.2	0.2	0.2	1.1
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	0.0
		Units	**2025-26**	**2026-27**	**2027-28**	**2028-29**	**2029-30**	**AMP8 Total**
Total water saving and	Cumulative savings	Ml/d	0.2	0.5	0.7	1.0	1.2	1.2
costs	Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Opex	£m	0.8	1.1	1.1	1.1	1.1	5.3
	Opex Savings	£m	0.0	0.0	0.0	0.0	-0.1	-0.1

Table 17: Summary of long term non-household water efficiency activities costs and benefits

Demand reduction activity (excluding smart metering)		Units	AMP8	AMP9	AMP10	AMP11	AMP12	Total
Water audits	Cumulative savings	Ml/d	1.2	3.4	5.3	5.3	5.3	5.3
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	1.1	5.6	5.6	0.0	0.0	12.4
	Total Opex Savings	£m	-0.1	-0.4	-0.7	-0.8	-0.8	-2.9
Innovative tariffs	Cumulative savings	Ml/d	0.0	0.0	2.1	2.1	2.1	2.1
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	0.3	0.3	0.3	0.3	0.3	1.4
	Total Opex Savings	£m	0.0	0.0	-0.3	-0.3	-0.3	-1.0
Partnership funds	Cumulative savings	Ml/d	0.0	0.1	0.2	0.2	0.2	0.2
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	1.7	2.8	0.0	0.0	0.0	4.5
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	-0.1
Communications	Cumulative savings	Ml/d	0.0	0.1	0.1	0.1	0.1	0.1
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	1.1	1.4	1.4	1.4	1.4	6.8
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	-0.1
Trials and Innovation	Cumulative savings	Ml/d	0.0	0.1	0.1	0.1	0.1	0.1
	Total Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Total Opex	£m	1.1	2.8	2.8	0.0	0.0	6.8
	Total Opex Savings	£m	0.0	0.0	0.0	0.0	0.0	0.0
		Units	**AMP8**	**AMP9**	**AMP10**	**AMP11**	**AMP12**	**Total**
Total water saving and	Cumulative savings	Ml/d	1.2	3.6	7.9	7.9	7.9	7.9
costs	Capex	£m	0.0	0.0	0.0	0.0	0.0	0.0
	Opex	£m	5.3	12.9	10.1	1.7	1.7	31.8
	Opex Savings	£m	-0.1	-0.4	-1.1	-1.2	-1.2	-4.1

4.2.1. Carbon costing

The non-household programme carbon costs have been calculated using a prorated approach against the comparable initiative in the household programme. The non-household programme comprises of many bands of businesses which gives a considerable amount of uncertainty around the actual savings. We have therefore applied an aggregated assumption on the carbon emissions for the non-household programme based on the Ml/d saving (Table 18). Similarly the household programme we expect to achieve net carbon benefits over the long -term and by 2050 will have saved 550 tonnes CO2e..

Table 18: Cumulative carbon impacts of the Non-household T100 demand reduction programme in AMP8 – [tonnes Co2e]

Activity	2025-26	2026-27	2027-28	2028-29	2029-30
Smart meters	262	525	787	1,049	1,312
Water audits	81	160	236	311	384
Tariffs	0	0	0	0	0
Partnership funds	0	0	0	0	0
Comms	0	4	8	11	14
Trials and innovation	0	0	0	0	0
Total NHH savings	344	688	1,031	1,371	1,710

3.3. Leakage reduction

Our forecast leakage expenditure profile is based on a number of assumptions. Below we provide an overview of the basis for these assumptions in each activity and the totex in AMP8.

Table 19: Leakage activities cost assumptions

Intervention	Cost assumptions	Totex in AMP8
Find and Fix/ Enhanced Find and Fix	Costs for this activity are based on our actual costs based on the number of FTEs we have working on find and fix activities and the benefits achieved. Based on December 2021 cost this equates to totex of £1.7m per Ml/d of leakage reduction.	£9.8m
Smart metering	Cost assumptions are covered in detail in the smart metering enhancement case.	Covered in separate enhancement case
Digital networks	Comprises of: ○ Loggers we assume [redacted] per logger which are based on our actual outturn costs for loggers with 10% added for installation Opex cost. ○ Digital tools of £4m and Situational Awareness platform of £2.4m based on December 2021 business case	£15.8m
Advanced pressure management	We have assumed 0.88 £/Ml/d based on Arcadis Horizon Scan 2018 and SW Business Plan TA11.2	£1.8m
Mains replacement	Uses Pioneer Data model inputs and Ofwat benchmark data for the mains replacement unit costs inputs	£198.0
Communication pipe (reactive) replacement	We have used the difference in cost between a repair and relay which is [redacted] per job (2021/22)	£13.6m

Below we provide more detail on the total costs and benefits from each activity.

Find and fix
Conventional find and fix methods (such as sounding, leak noise correlating and acoustic noise logging) are considered to be the primary measure for offsetting the natural rate of rise in leakage. The current assessment of NRR is that this equates to 120 Ml/d of activity per annum. There is an underlying assumption in the WRMP24 plan that this activity will continue to offset NRR in future years and therefore this is not included as an enhancement activity.

Enhanced find & fix
On a DMA by DMA basis, enhanced find and fix processes can reduce leakage to less than 10% of the water supplied to the DMA. We plan to expand our capability in this area and leverage new opportunities that

are anticipated from innovations in 'Digital Tools'. As a result we expect to be able to reduce leakage in more DMAs to 10% and to be able to hold them at this level, or lower.

Digital tools and the availability of more granular demand data will significantly improve leakage targeting and the understanding of the quantum of leakage that exists within a DMA. Increases in demand, especially during the summer months, that currently are reported as leakage, at DMA level, will be correctly captured and there is the possibility that the leakage calculation may move away from the current approach of using the flow during an hour at night and then estimating demand to a water balance approach where consumption is subtracted from demand and the residual assumed to be mostly leakage. This will remove a number of assumptions and extrapolations from the current calculation and improve the detection technicians confidence that leakage exists within the area under investigation.

The initial leakage benefit (6.9 Ml/d) was assessed as the difference between the forecast leakage level at the beginning of AMP8 and 10% of Distribution Input (DI). Three scenarios were then proposed delivering this benefit over different time periods.

During the leakage modelling phase, it was decided to use the enhanced find and fix initiative as a residual option by which the required leakage profile was achieved – i.e. the balancing factor. This resulted in a lower requirement being selected than was originally proposed, with a total reduction of 5.6 Ml/d being required over AMP8 and a total of 16.9 Ml/d of benefit up to 2050.

The cost benefit of the selected scenario and the initial options is shown in Table 20 below:

Table 20: Enhanced Find and Fix cost benefit of the selected scenario

Enhanced F&F	AMP8	AMP9	AMP10	AMP11	AMP12
Ml/d	5.61	6.91	1.80	0.84	1.77
£m	9.77	12.03	3.13	1.46	3.08
£m/Ml/d	1.74	1.74	1.74	1.74	1.74

Smart metering (direct benefits only)

Upon installation of a smart meter, we should immediately identify leaks on customer supply pipes. These direct benefits are not included within the smart metering annex. Other indirect benefits from smart metering are captured within the Digitisation/Smart Networks programme. Detailed decision making on the smart metering programme can be found in the smart metering enhancement case. Below we present the benefits of the smart metering programme related directly to those immediate leakage reductions as a result of finding and repairing leaks during the smart meter roll out.

Table 21: Smart metering direct benefits analysis

Smart Metering	AMP8	AMP9	AMP10	AMP11	AMP12
Ml/d	6.91	-	-	-	-
£m	-	-	-	-	-
£m/Ml/d	-	-	-	-	-

There are only direct leakage reduction benefits identified in AMP8 because we will have completed our smart meter roll out within AMP8.

The benefit assumed through this option is equivalent to a c. 46% reduction in the level of customer side leakage from the assumed level, in 2024/25, of 15 Ml/d. This has been devised based on the assumption that supply pipe leakage for metered household and non-households (92% of all properties) will be reduced by 50%. The benefits are expected to be realised soon after the rollout as customers are made aware of leakage downstream of the smart meter. There will be an additional benefit of increased visibility of customer consumption - this benefit is captured within the Digital Networks initiative.

The smart metering programme will enable the identification of customer side leaks to occur earlier in their life thereby reducing the run time of a leak. It will not reduce the number of leaks occurring as asset replacement is not being undertaken. The nature of the supply pipe leak repair offering (i.e customer fix or free fix) is likely to influence the level of benefits that can be realised as this can materially impact the time taken to repair due to the level of influence the company has on the repair process as we discussed in section 1.8.2 we will be reviewing our customer supply pipe leakage policy in detail throughout AMP8 to ensure we take the most cost beneficial approach going forward.

The costs for the smart metering programme have not been included in the leakage costs as they are already captured elsewhere in the demand programme, thereby avoiding any double counting.

Digital networks
This option contains several component parts that contribute to the overall benefit, namely:

Digital twin modelling
By modelling network behaviour in near real-time leakage management will move to a more data centric approach, improving leak detection efficiency, reducing leak run times and improve the understanding of outcomes against actions. AMP8 provides the perfect opportunity to develop this technological approach due to the significant increase in data that will result from the roll out of smart meters. In addition, it is estimated that by deploying, on average, 6 pressure sensors per DMA, leakage detection targeting and burst event response could be significantly improved from current levels generating both leakage savings and efficiencies.

Situational awareness
This is a tool that is being developed in AMP7 to increase awareness and response rates to network events, such as bursts, water quality and pump failures. There is an opportunity to further develop this capability by linking with the digital twin modelling to enable proactive maintenance and response to situations before they become events.

We have estimated that, implemented across the whole network, these two solutions could result in leakage benefits of 4.2 Ml/d across a 25 year planning horizon.

The cost of implementing this technology has been calculated based on a unit rate of [redacted] per pressure logger and unit. An allowance of £6.7m has been included to cover the development and implementation of the digital twin and situational awareness tools. Both these costs will be incurred in AMP8 as part of the development and implementation phase.

An ongoing cost of £1m has been included to cover logger battery replacement and maintenance each AMP.

Table 22: Digitisation/Smart networks cost benefit table for options over the next 25 years

Digitalisation/ Smart Networks	AMP8	AMP9	AMP10	AMP11	AMP12
Ml/d	0.84	0.84	0.84	0.84	0.84
£m	10.83	1.03	1.03	1.03	1.03
£m/Ml/d	12.86	1.22	1.22	1.22	1.22

Fibre optic networks

[redacted] This technology is not yet proven but is considered to be worth exploring over AMP8 and AMP9 to both prove the viability and cost effectiveness of the technology and quantify the additional benefits that may be generated over and above those included in the digital twin/situational awareness capability.

An initial cost estimate of £5m has been included in AMP8 and AMP9 to develop the understanding of the applicability of this technology to leakage detection. [redacted]

No leakage benefit has been included in AMP8 or AMP9. Leakage benefits of 1 Ml/d were included in AMP10 on the basis that this technology will be proven during this period with diminishing benefits thereafter. This is considered a low-risk approach as this level of benefit could be covered by the other options within the plan. This benefit is deteriorated over subsequent AMPs reflecting a reduction in ongoing opportunities arising from reducing leakage levels.

The cost benefit table for these options over the next 25 years is shown below:

Table 23: Fibre Optic cost benefit table for options over the next 25 years

Fibre Optic Networks	AMP8	AMP9	AMP10	AMP11	AMP12
Ml/d	-	-	1.00	0.85	0.72
£m	5.00	5.00	4.49	3.81	3.24
£m/Ml/d	-	-	4.49	4.49	4.49

Advanced pressure management

Advanced pressure management has been a successful lever for leakage reduction during the first part of AMP7 and it is expected that this will continue over the remainder of AMP7 as part of the overall AMP7 leakage reduction programme.

Given the current coverage of pressure management it is likely that there will be fewer opportunities to deliver future incremental benefits. Additional options are being explored as part of the AMP7 programme of work, especially in relation to the smarter control of booster pumps. This work is in its infancy and therefore future benefit, especially residual benefit post AMP7, is difficult to forecast.

We have therefore taken a cautious approach to estimating the level of benefit that may be achieved through pressure management and a range of benefit of between 6 Ml/d and 12 Ml/d over AMP8, AMP9 and AMP10 were modelled.

The costs for this programme of activity were based on unit rates derived for the initial draft of WRMP24.

The cost benefit table for the next 25 years is shown in Table 24 below.

Table 24: Advanced Pressure Management cost benefit table for the next 25 years

Adv. Pressure Management	AMP8	AMP9	AMP10	AMP11	AMP12
Ml/d	1.80	2.40	1.80	0.00	0.00
£m	1.83	2.44	1.83	0.00	0.00
£m/Ml/d	1.02	1.02	1.02	1.02	1.02

The selected scenario used in the plan was the low scenario.

Asset renewal

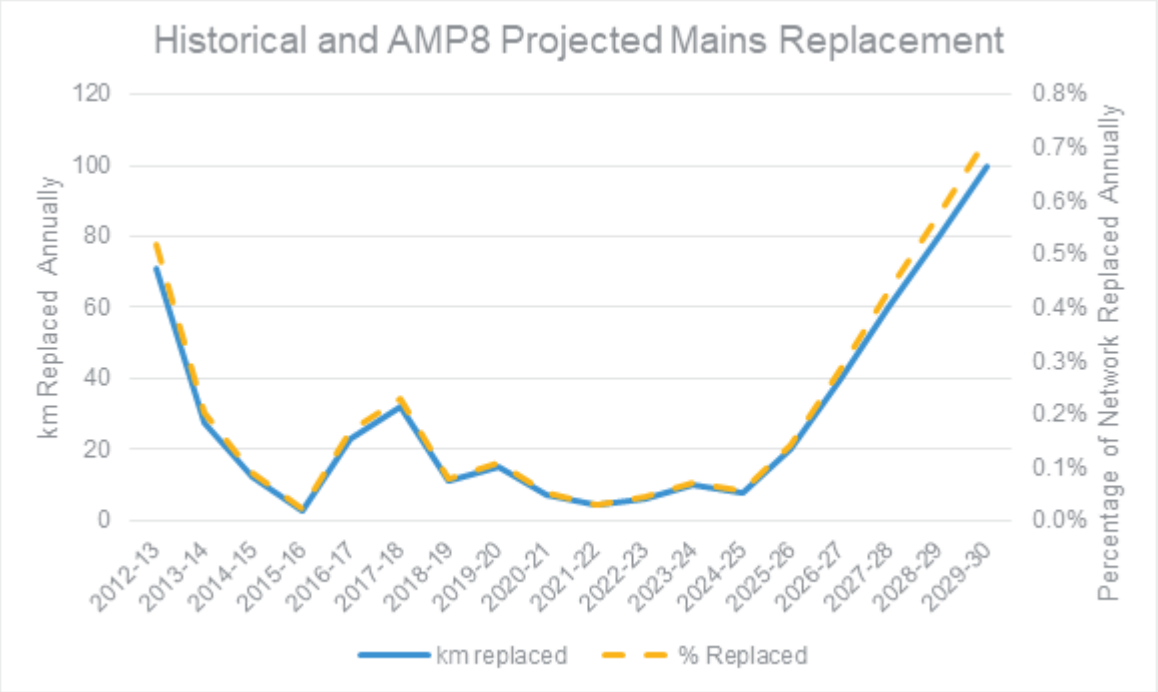
Our latest analysis (August 2022) indicates that Natural Rate of Rise – the rate of increase in leakage assuming no interventions are undertaken – is deteriorating at 2.2 Ml/d per annum. Offsetting deterioration requires asset replacement. For the purposes of the leakage plan this has been considered in two parts – mains replacement and communication pipe replacement.

Mains replacement

The Pioneer deterioration model was leveraged to provide a prioritised programme considering the leakage and burst rates of individual pipes (grouped according to contiguous lengths). This produced an optimised programme, achieving 4.29 Ml/d of savings from 300km of mains replaced in AMP8.

Further discussion with network operations teams highlighted the need for a phased approach to increasing the capacity for mains replacement, and with further optimisation of the Pioneer outputs increasing the cost efficiency for the prospective programme.

Figure 11: Historical mains replacement compared to planned activity in AMP8



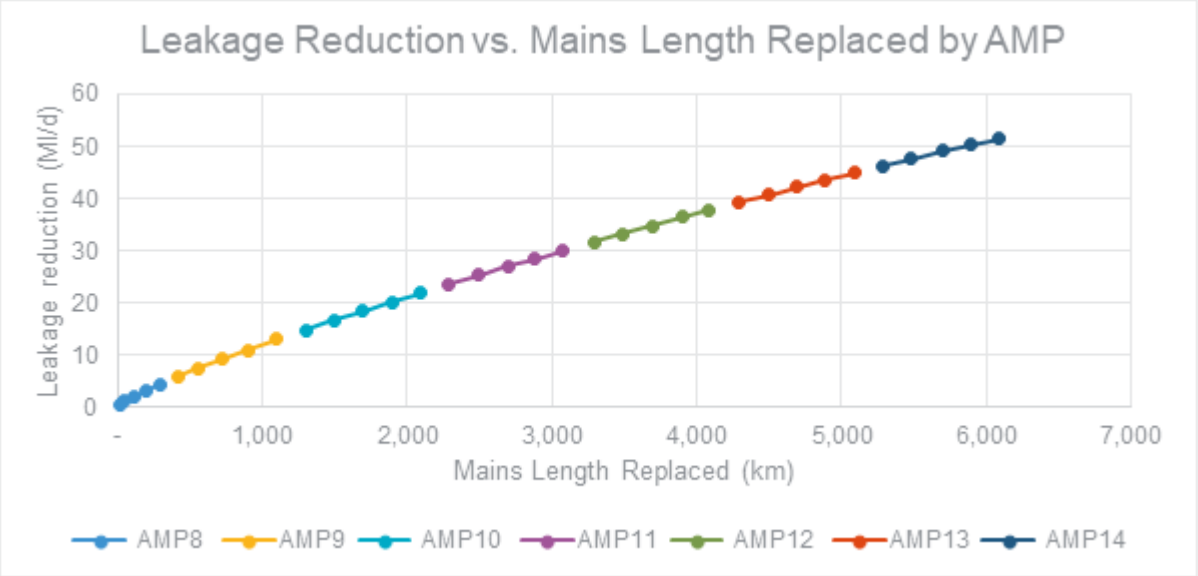
AMP8 begins at a rate of 20km, this is equal to the average rate delivered across the last 10 years, and 5 times that delivered in 2021-22. This increases by 20km each year through AMP9 to 200km/year by the end of AMP9 and sustaining this rate henceforth. As a result, a revised main replacement programme was determined as shown in the table below:

Table 25: Mains replacement programme by year/AMP (km)

Mains Replacement (km)	AMP8					AMP9					AMP10	AMP11	AMP12	AMP13	AMP14
	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35					
	20	40	60	80	100	120	140	160	180	200	1000	1000	1000	1000	1000

By the end of AMP14, it is anticipated that 45% of mains will have been replaced, bringing average asset life expectancy to a more-realistic 78 years (from 675 years based on the previous 10 years replacement rate) and reducing leakage by 50 Ml/d (excluding increases in Natural Rate of Rise). This can be seen in the chart below.

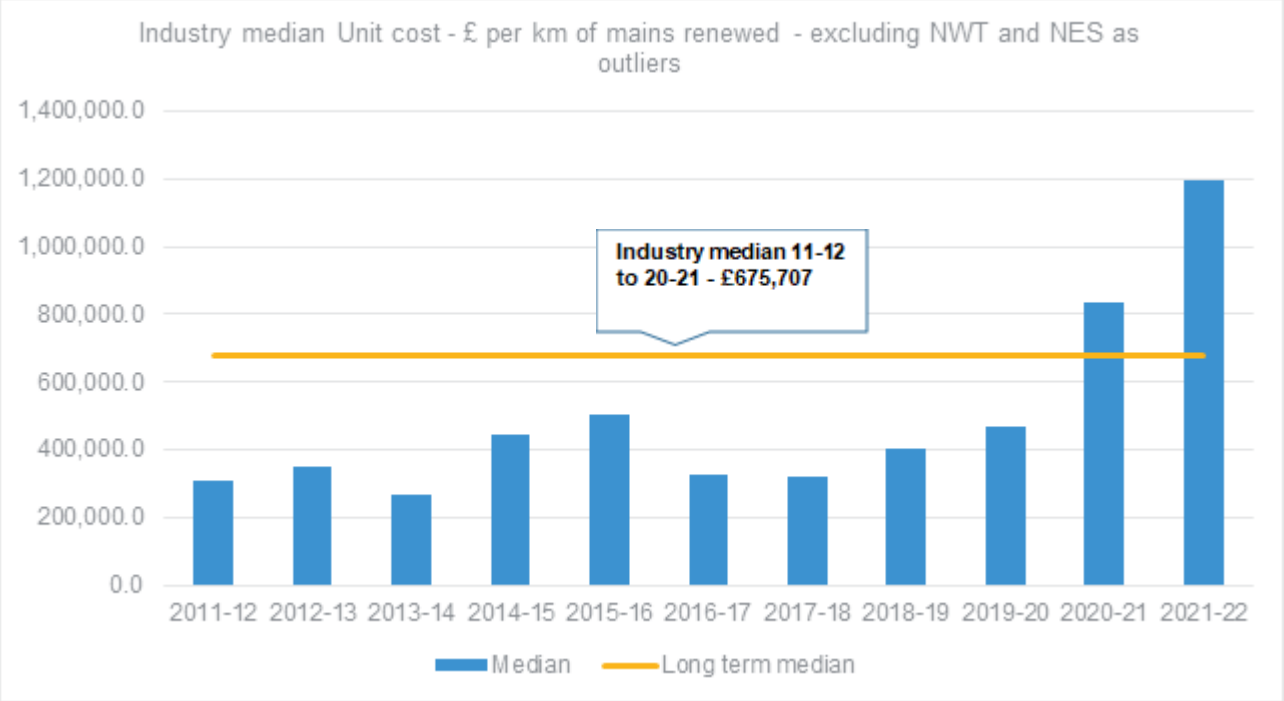
Figure 12:Forecast leakage reductions vs mains length replaced by AMP8 to AMP14



It is assumed that there will be continual reassessment of the plan based on the measured benefits of the programme within each AMP. Measured benefits and sampling should better inform the Pioneer model which should improve the outputs further.

The costs for this programme of activity have been based on Ofwat benchmarking. Due to a lack of outturn data we have used Ofwat data as this is a more extensive dataset than we have available. We have used Ofwat's long term median unit cost renewal rate across the industry using annual APR submissions between 2011-12 and 2020-21. We reviewed the renewals expensed in year (Infrastructure) total costs and total km of mains replaced or relined to provide a £/km unit rate (adjusted to 2022-23 prices). We excluded reported costs for Northumbrian Water and United Utilities which were significant outliers in the dataset. This provided a long-term median of £676/m as shown in the figure below.

Figure 13:Industry benchmarking of mains replacement unit costs



Source: Ofwat published industry performance data 2011 to 2022

The cost benefit table for the next 25 years is shown in Table 26 below.

Table 26: Mains Replacement cost benefit table for the next 25 years

Mains Replacement	AMP8	AMP9	AMP10	AMP11	AMP12
Total Ml/d	4.29	8.62	8.99	8.04	7.82
£m	198.02	543.81	672.97	658.04	688.49
£m/Ml/d	4.14	63.09	74.85	81.89	88.02

Comms Pipe Replacement

We undertake c. 7,500 communication pipe leak fixes a year. The majority of these are repairs rather than relays (full replacement of the asset). Over the two years covering April 2020 to March 2022 over 87% of leak fixes were repairs. The NRR analysis does not define the contribution individual repair types have to the overall deterioration rate. Therefore, for the purposes of scenario modelling, we have assumed that replacing rather than repairing these assets will reduce the deterioration rate by between 18%, for the low scenario, and 36% for the high scenario.

We have also assumed that the current rate of detection of leaks on communication pipes remains at the current level and that benefit will reduce over time. This is because of an increased asset replacement rate.

The cost of this programme of activity is calculated based on the difference of the cost of repair and the cost of a relay, assessed as [redacted], on average (based on average unit rates for 2021/22).

The cost benefit table for the next 25 years is shown in Table 27 below:

Table 27: Pipe Replacement cost benefit table for the next 25 years

Comms Pipe Replacement	AMP8	AMP9	AMP10	AMP11	AMP12
Ml/d	1.77	1.37	1.06	0.82	0.63
£m	13.59	13.59	13.59	13.59	13.59
£m/Ml/d	7.68	9.93	12.83	16.58	21.43

The overall cost benefit table of the selected plan is shown in Table 28 and Table 29 below.

Table 28: WRMP24 Leakage Reduction cost benefit table for the next 25 years

WRMP24 Leakage Reduction Benefits and Costs	AMP8			AMP9			AMP10			AMP11			AMP12		
	Ml/d	£m	£m/Ml/d	Ml/d	£m	£m/Ml/d	Ml/d	£m	£m/Ml/d	Ml/d	£m	£m/Ml/d	Ml/d	£m	£m/Ml/d
Advanced F&F	5.61	9.77	1.74	6.91	12.03	1.74	1.80	3.13	1.74	0.84	1.46	1.74	1.77	3.08	1.74
Comms Pipe Replacement	1.77	13.59	7.68	1.37	13.59	9.93	1.06	13.59	12.83	0.82	13.59	16.58	0.63	13.59	21.43
Advanced Pressure Management	1.80	1.83	1.02	2.40	2.44	1.02	1.80	1.83	1.02	0.00	0.00	1.02	0.00	0.00	1.02
Smart Metering	6.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Digitalisation/Smart Networks	0.84	15.83	12.86	0.84	6.03	7.16	1.84	5.51	2.99	1.69	4.84	2.86	1.56	4.27	2.73
Mains Replacement	4.29	198.02	46.14	8.62	-2.38	-0.12	8.99	8.99	0.45	8.04	74.85	3.93	7.82	658.04	34.96
Increasing NRR	-11	-	-	-11	-	-	-11	-	-	-11	-	-	-11	-	-
Net Leakage Reduction & Total Cost	10.23	239.03		9.14	31.70		4.49	33.05		0.39	94.74		0.79	678.97	

Table 29: WRMP24 Leakage Reduction cost benefit table annualised for AMP8 and AMP9

WRMP24 Leakage Reduction Benefits and Costs		AMP8					AMP9				
		2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Find & Fix	Ml/d	2.31	1.55	0.75	0.50	0.50	0.32	0.45	0.31	0.28	0.13
	£m	4.03	2.70	1.30	0.87	0.87	0.56	0.78	0.54	0.49	0.23
	£m/Ml/d	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74
Smart Metering	Ml/d	-	-	3.11	2.42	1.38	-	-	-	-	-
	£m	-	-	-	-	-	-	-	-	-	-
	£m/Ml/d	-	-	-	-	-	-	-	-	-	-
Advanced Pressure Management	Ml/d	0.60	0.60	0.60	-	-	-	0.60	0.60	0.60	0.60
	£m	0.61	0.61	0.61	0.00	0.00	0.00	0.61	0.61	0.61	0.61

	£m/Ml/d	1.02	1.02	1.02	-	-	-	1.02	1.02	1.02	1.02
Digital Networks	Ml/d	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
	£m	3.17	3.17	3.17	3.17	3.17	1.21	1.21	1.21	1.21	1.21
	£m/Ml/d	18.80	18.80	18.80	18.80	18.80	7.16	7.16	7.16	7.16	7.16
Comms Pipe Replacement	Ml/d	0.39	0.37	0.35	0.34	0.32	0.30	0.29	0.27	0.26	0.25
	£m	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72
	£m/Ml/d	6.95	7.32	7.70	8.11	8.53	8.98	9.45	9.95	10.48	11.03
Mains Replacement	Ml/d	0.27	0.71	0.91	1.18	1.23	1.52	1.56	1.77	1.80	1.97
	£m	8.81	25.42	40.17	58.19	65.42	85.46	92.54	110.81	118.51	136.49
	£m/Ml/d	33.14	35.97	44.09	49.47	53.10	56.06	59.44	62.74	65.78	69.25

We have structured the plan to meet the long-term 2050 target of reducing leakage by 50% whilst balancing the need to both reduce leakage over the long-term with a plan that has an appropriate level of risk.

5. Customer Protection

Our demand management targets are ambitious and stretching relative to our industry peers. Being close to frontier performance for leakage and per capita consumption in recent years means that we must do more to achieve the percentage reductions required to meet the long-term targets set by the government. As a result, we need a plan to achieve our targets which is deliverable, at an efficient cost and so customers are protected in the case of non, or under-delivery, against our targets. The primary mechanism for protecting customer from the risk of under-delivery against our targets are though the outcome delivery incentives against each performance commitment, PCC, Business Demand, Leakage and additionally Mains Repairs – where benefits can be estimated directly.

Furthermore, we expect additional indirect benefits on reducing average minutes lost to water supply interruptions over the medium and long-term. Attempting to estimate a quantifiable benefit for supply interruptions linked to this investment case may lead to spurious findings or misleading conclusions given the very diverse nature of the cause of supply interruptions – as a result we have not included supply interruptions as a direct form of customer protection for this enhancement case.

4.1. Common performance commitments

Water efficiency and leakage reduction are crucial parts of our WRMP and our PR24 business plan. If we do not achieve our performance commitment targets for PCC, Leakage, Business Demand and Mains Repairs we will incur outcome delivery incentive underperformance payments in these performance commitments. Please see our SRN14 Methodologies for Performance Commitments Technical Annex for details on quantification of performance commitment benefits from smart metering.

To protect customers from non-delivery of our demand management enhancement case we believe there are already strong incentives for us to deliver the investment as planned. We have therefore not included a separate price control deliverable related to demand management. An underperformance payment on per capita consumption, leakage and business consumption would be significant if the programme was not delivered. Coupled with the broader benefits from achieving our forecast demand reductions, there is a strong incentive for us to deliver this enhancement investment as planned.

4.2. Deliverability

As part of our draftWRMP24 we undertook a deliverability assessment against our initial T100 water efficiency target. This resulted in us moderating our T100 target to ensure that it was achievable. More details of this can be found in our WRMP24 technical Annex 16. Our leakage reduction programme is ambitious but broadly follows a linear programme of work that we can speed up or down. The key difference in terms of activities that we are planning to deliver is our mains renewals programme. Our overall AMP8 mains renewals programme is a significant step up compared to prior AMP periods. We are in the process of developing a delivery plan including readying the supply chain for the increase in workload. We have phased the delivery to enable us and our suppliers to establish and embed a delivery process that will provide the foundation for this multi-amp programme. This approach will enhance the deliverability of our plan and allow the supply chain to absorb the additional workload. More details of this can be found in our PR24 Business Plan SRN56 Deliverability Assurance Technical Annex.

6. Adaptive Planning

We have assessed this programme against the criteria for low regret investment identified in the LTDS guidance and Appendix 9 of the Final Methodology. The guidance identified that low regret investments meet the needs across a wide range of plausible scenarios, meet short-term requirements; or keep future options open, including cost minimisation.

We consider that the investment proposed in this enhancement case is a low regret investment for the following reasons:

- Our demand reduction plan is set in the context of our wider WRMP which balances supply and demand. Within our WRMP (which feeds our Long-Term Delivery Strategy). Our WRMP is an adaptive plan where key strategic choices, particularly on the supply-side will need to be made based on emerging information including on climate change, technological developments, actual growth in demand and environmental ambition. Demand reduction is required under our core pathway and all alternative investment pathways and. Demand reduction plays an important role in reducing the need to invest in additional supply schemes across the planning period.

- Our leakage strategy itself is inherently adaptive, given that we are able to scale up or down and reprioritise leakage activities on an ongoing basis. For example, as we gain greater insight from our smart metering roll out and we are able to more accurately identify leak locations, target find and fix and mains replacement activities our planned activities may change based on new information.

- Our water efficiency strategy is also adaptive as we continue to review our approaches and feedback back what works well, and what doesn't into our future work.

We have considered whether there is a need to present any alternative pathways for both leakage reduction and water efficiency. To identify whether there are any material trigger points in the future where we would We concluded that there would be no triggers that would materially change what we do so we have not presented any alternative pathways related to this enhancement case.

7. Conclusion

Section	Key Commentary	Page
Introduction & Background	Our demand management strategy aims to achieve our overall demand reduction objectives within our WRMP24 including meeting the governments 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. This is a key investment plan towards achieving that long-term target. As such we need to have a long-term demand management strategy and adapt our strategy over time as we receive new information. Customers expect us to lead by example by reducing our leakage and we need to start this now to achieve our long-term ambitions. Our consumption reduction plan is a comprehensive programme to reduce PCC to 110 l/p/d to 2045 (under dry year conditions); non-household consumption reduction of 9% by 2038 and to half leakage by 2050. This starts with our AMP8 investment plan.	11
Need for Enhancement Investment	Our WRMP24 is the primary driver for the enhancement investment. Our WRMP24 requires us to meet the forecast supply-demand balance gap. We can either achieve this through investment in new supply side options or by undertaking demand reduction activities (including leakage reduction). If we do not invest further in water efficiency and leakage reduction this would require additional investment in supply-side options. New supply side options are treated as enhancement expenditure as they deliver a step change in improvements to the supply-demand balance. As such demand reduction activities that provide additional supply-demand balance benefits are also enhancements.	15
Best Option for Customers	We have carried out a range of options appraisal processes including learning lessons from our AMP7 work, reflecting feedback as part of our draft WRMP consultation process and considering what is best value for our customers both not and over the long-term.	23

Cost Efficiency	We have challenged our costs using benchmarks from: ○ Internal outturn data ○ Third party water industry-wide data ○ Applying a in the round efficiency challenge of 1% per annum across the whole plan and ○ Benchmarks based on APR outturn data	46
Customer Protection	We have calculated the direct Performance Commitment benefits associated with our demand management investment plans for leakage, PCC, business demand and some associated benefits for mains repairs. We also expect some indirect benefits over the long-term for supply interruptions. The associated ODIs for these PCs will provide protection for customers against non- or under- delivery of our investment to achieve these targets.	64

Appendix

Appendix A - Mains replacement programme identification

The Pioneer deterioration model considers pipe material, involving age, diameter, land use, corrosivity, shrink swell, pressure, and diameter to provide an assessment of burst and leakage deterioration. The model output is presented as groups of contiguous pipe lengths known as elements, with a leakage and burst rate provided for each element for both 2020 and 2021 to show deterioration. Leakage values were not present for both years for each pipe element, so a combination value was developed which used the available years, or the average of both if available. Where deterioration could not be provided (as Pioneer did not have data for both years, it was inferred by the deterioration of elements for the same pipe material.

The total leakage across all pipes in Pioneer were adjusted linearly to match the expected AMP7 Y5 outturn leakage figure for mains and comm pipes (total leakage minus supply pipe leakage (76.9 Ml/d minus 15.07 Ml/d = 61.83 Ml/d). The cost of replacement was uniform and set in-line with Ofwat Benchmarking with an adjustment for price base year.

% Length	Leak Group										
Burst Group	1	2	3	4	5	6	7	8	9	10	Grand Total
1	3.14%	1.89%	0.69%	0.75%	0.76%	1.44%	0.87%	0.27%	0.11%	0.08%	10.00%
2	2.19%	1.60%	1.19%	0.80%	0.61%	1.18%	1.25%	0.61%	0.37%	0.20%	10.00%
3	1.89%	1.51%	0.83%	1.04%	1.12%	0.97%	1.46%	0.52%	0.44%	0.22%	10.00%
4	1.31%	1.89%	1.36%	0.88%	0.78%	0.72%	1.60%	0.71%	0.45%	0.30%	10.00%
5	0.71%	1.44%	1.47%	1.08%	0.56%	0.99%	1.36%	1.32%	0.58%	0.49%	10.00%
6	0.33%	1.05%	1.52%	1.34%	1.03%	0.99%	0.97%	1.53%	0.67%	0.55%	10.00%
7	0.23%	0.36%	1.74%	1.55%	1.50%	0.70%	0.79%	1.52%	0.77%	0.84%	10.00%
8	0.11%	0.16%	0.80%	1.41%	1.88%	0.96%	0.63%	1.50%	1.60%	0.96%	10.00%
9	0.06%	0.05%	0.32%	0.80%	1.39%	1.20%	0.64%	1.33%	2.55%	1.65%	10.00%
10	0.02%	0.04%	0.08%	0.34%	0.37%	0.86%	0.43%	0.70%	2.46%	4.71%	10.00%
Grand Total	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	100.00%

With the Pioneer outputs, it would have been possible to prioritise individual pipe elements. However, in reality, any mains replacement programme will have to consider efficiencies of replacing nearby mains, so the assessment was translated to DMA-level by classifying pipe elements according to a red, amber, green status where red represented the top (worst) 30% according to leakage and burst projections, amber being those in the 30-70% range, and green being anything beyond 70%,as is shown by the red and amber boxes in the table below:

DMAs were considered as potential candidates for replacement if they contained either at least 250m of red classification pipe elements or 1,000m of amber classification elements. For each DMA, all red and amber pipe elements would be replaced, and not those classed as green.

These parameters were devised so that the total length of both red and amber mains within candidate properties was greater than the total length for the entire programme (6,100km) ensuring that there were enough DMAs to be allocated to programme years.

This allowed cost benefit prioritisation of candidate DMAs according to their length and leakage benefit (not bursts at this later stage) of the red and amber classified elements within the DMA. The cost aspect of the

model did not consider material, size, diameter and ground type, as the costs were obtained as a single standard unit rate from the Ofwat Mains Renewal Benchmarking.

DMAs were then grouped by years and AMPs, allowing cost and benefit to be summarised accordingly. The year selected determined the final leakage benefit based on the rate of deterioration in leakage, Multiple iterations were conducted which refined the allocation of DMAs to years according to the deterioration (leakage informs the year of replacement, which revises the leakage benefit and requires further reprioritisation with the new cost-benefit values, hence iterations were required. 5 iterations were conducted, after which, the allocation of DMAs to programme years ceased to change. This process ensured that pipes with a higher rate of deterioration were prioritised first.

The output was a prioritised list of DMAs allocated to programme years, with an associated leakage and burst benefit. Costs and benefits for each year were then presented by Water Resource zone and adjusted for the offsetting of the annual increase in Natural Rate of Rise (NRR).