love every drop anglianwater

WRMP24 Technical Document

Demand management option appraisal

April 2025

Demand Management Option Appraisal

1 WRMP24 Introduction

1.1 About our company

Anglian Water is the largest water and wastewater company in England and Wales geographically, covering 20% of the land area.

We operate in the East of England, the driest region in the UK, receiving two-thirds of the national average rainfall each year; that's approximately 600mm.

Our region has over 3,300km of rivers and is home to the UK's only wetland national park, the Norfolk Broads.

Between 2011 and 2021, our region experienced the highest population increase in England. Despite this, we are still putting less water into our network than in 1989.

1.2 Planning for the long term

Our company Purpose is "to bring environmental and social prosperity to the region we serve through our commitment to Love Every Drop". This purpose is at the heart of our business, having been enshrined in our Articles of Association in 2019.

Central to delivering this purpose is planning for the long term; one of the strategic planning frameworks we use to achieve this is the Water Resources Management Plan (WRMP), which details how we will ensure resilient water supplies to our customers over the next 25 years.

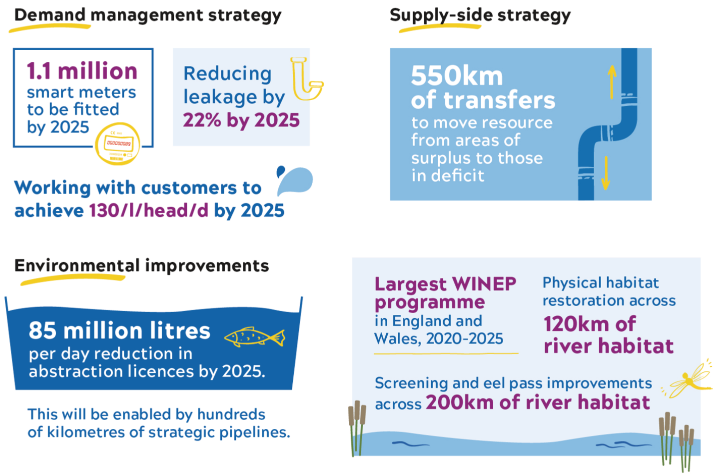
A WRMP looks for low regret investments[1] for our region, giving flexibility to adapt to future challenges and opportunities such as technological advances, climate change, demand variations, and abstraction reductions.

1.3 Water Resources Management Plan

We produce a WRMP every five years. It is a statutory document that sets out how a sustainable and secure supply of clean drinking water will be maintained for our customers. Crucially it takes a long-term view over 25 years, allowing us to plan an affordable, sustainable pathway that provides benefit to our customers, society and the environment.

Our previous WRMP, WRMP19, had an ambitious twin track strategy, combining an industry leading smart meter roll out and leakage ambition with a strategic pipeline across our region, bringing water from areas of surplus to areas of deficit. An overview of the WRMP19 strategy can be seen in Figure 1.

Figure 1 Our WRMP19 twin track approach



This WRMP focusses on the period 2025 to 2050, and is known as WRMP24. We have developed it by following the Water Resources Planning Guideline (WRPG)[2], as well as other relevant guidance, in order to meet our statutory requirements. This has ensured our WRMP24:

- Provides a sustainable and secure supply of clean drinking water for our customers.
- Demonstrates a long-term vision for reducing the amount of water taken from the environment, and shows how we will protect and improve it.
- Is affordable.
- Maintains flexibility by being able to respond to new challenges.

1 Investments that are likely to deliver outcomes efficiently under a wide range of plausible scenarios
2 https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline

- Complies with its legal duties.
- Incorporates national and regional planning, and
- Provides best value for the region and its customers.

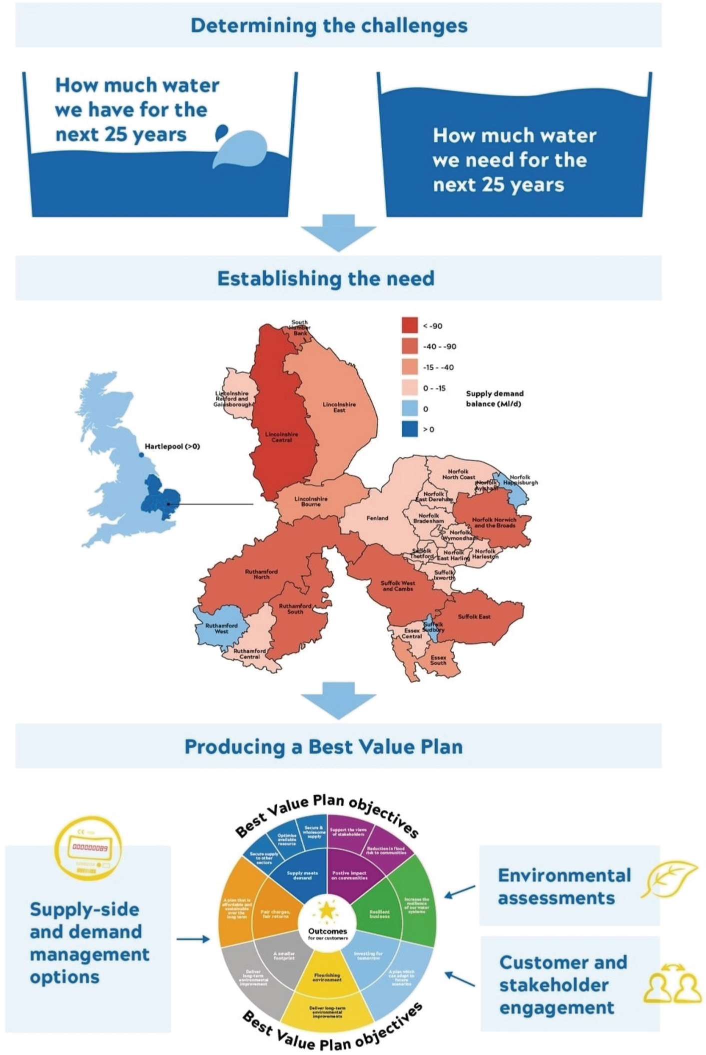
1.4 Developing our WRMP

Our WRMP24 has been progressed following the processes detailed in the WRPG, as shown in (Figure 2).

We start by determining the extent of the challenges we face between 2025 and 2050. We achieve this by developing forecasts to establish the amount of water available to use (supply forecast) and the amount of water needed (demand forecast) in our region. When these forecasts are combined, a baseline supply-demand balance is created. This tells us whether we have a surplus of water or a deficit, establishing our water needs for the planning period.

An appraisal for both demand management options and supply-side options is undertaken, starting with an unconstrained list of possible options which progresses through various assessments until a final constrained list is determined.

Figure 2 A high level overview of our WRMP24 planning process



Demand management options aim to reduce the amount of water being used by our customers and lost in our water network. Examples of these options include smart metering and the promotion of water efficiency measures, such as reducing shower times. Supply-side options are also developed; these provide additional water to supply to customers. Examples of these options include new raw water storage reservoirs or water reuse treatment works.

We environmentally assess both demand management and supply-side options so we can understand their potential environmental impacts and what could be put in place to mitigate these impacts; in some cases we exclude options from further consideration.

The next step is for the water savings associated with the chosen demand management option to be added into our baseline supply-demand balance to determine if our region's water needs are met. If the demand management options savings do not solve the need, supply-side options are added into the modelling process. This is undertaken in our Economics of Balancing Supply and Demand (EBSD) model which conducts numerous modelling runs, creating a range of plans that meet our objectives. These plans are also environmentally assessed.

We develop a best value plan from these different model runs and environmental assessments, encompassing the views of our customers and stakeholders who have been consulted throughout the plan's development.

1.5 Best value planning

To ensure we develop the right solution for our region's water needs, we have focused on 'best value'. To us, best value is looking beyond cost and seeking to deliver a benefit to customers and society, as well as the environment, whilst listening and acting on the views of our customers and stakeholders.

These views, from our customers and stakeholders, have helped build our best value framework, shown in Figure 3 which has been used as the basis for our decision making.

Figure 3 Best Value Plan wheel

1.6 Our WRMP24

Our best value plan, has been produced following a public consultation on our draft WRMP24. This consultation ran from December 2022 to March 2023. Taking into account consultation feedback and our revised forecasts, we:

- Increased our leakage ambition from 24% to 30%.
- Included projected non-household demand for the South Humber Bank, in north Lincolnshire.
- Developed non-household demand management options.
- Recognised further opportunities to utilise the existing resource we have; and
- Removed abstractions from the supply forecast that are likely to be closed due to Habitats Regulations.

1.7 Strategic context of the WRMP24

Our WRMP24 aligns with our Purpose, as well as internal and external strategic plans and initiatives. We have worked collaboratively with internal and external stakeholders, regulators and other water abstractors to achieve this.

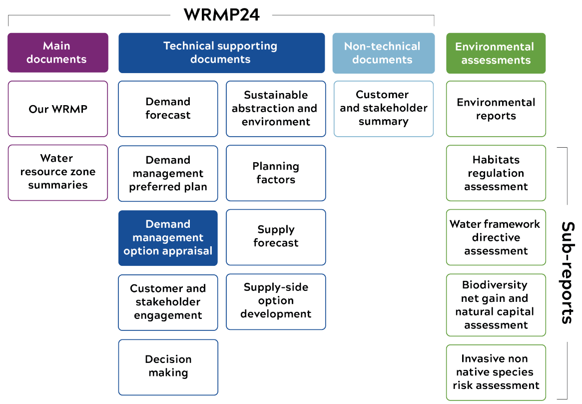
These interactions are highlighted throughout our WRMP24, showing the importance of collaborative planning. For instance, Regional Plans led by Water Resources East (WRE) and Water Resources North (WReN) have been significant in shaping our investment priorities and requirements, with WRE demonstrating the valve of the strategic regional options (SROs) at the regional, multi-sectoral level.

This WRMP24 has helped shape our company investment strategy for the Price Review (PR24), as well as our Long Term Delivery Strategy. We have also maintained close links with the Drainage Wastewater Management Plan and our Drought Plan.

1.8 Guide to our WRMP24 submission

Our submission comprises a non-technical customer and stakeholder summary, our main report and nine technical supporting documents, shown in (Figure 4) below. These technical documents are supported by a suite of independent environmental assessments.

Figure 4 Our WRMP24 reports



This report is concerned with the development of the demand management option appraisal report.

This is the WRMP24 Demand management preferred plan technical supporting document.

2 Options considered

Options and the rationale for selection

In the development of the WRMP24, we have sought to build upon the ambitious program, currently being implemented as part of our WRMP19 plan including our rollout of 1.1M smart meters and 14% (from the 2017/18 national framework base-line) reduction in leakage by 2024/25.

We intend to continue with our integrated, multi-AMP demand management strategy that:

- Recognizes the value of demand management to our customers and the environment
- Develops demand management programs holistically
- Recognizes the role demand management can play in managing future uncertainty, and,
- Challenges us and our customers to push the boundaries of what is achievable.

In order to develop this ambitious plan, we initially began by reviewing an extensive set of options, drawing on a wide range of sources. These options included;

- Multiple interventions to further reduce leakage
- Alternative methods and timescales for implementing a smart metering strategy
- A wide variety of water efficiency programs, utilizing the potential smart metering offers, to facilitate behavioural change.

We have reviewed an unconstrained list of options to further develop a shortlist of feasible options, noting that there are significant synergies between leakage reduction, smart metering and water efficiency activities.

Given these synergies and building upon our current understanding, as we initially roll out smart meters (we currently have >1M smart meters installed 2023/24), it has been essential to consider demand management programs, holistically through the development of 'strategic portfolios of options'.

Consequently, the feasible elements selected for demand management have been packaged into ‘high’, ‘medium’ and ‘low’ ‘strategic’ options for further analysis. Thus, our three strategic demand management options each consist of a combination of smart metering, leakage reduction, water efficiency and non-household activities, with additional scenarios being developed in order to sensitivity-test our preferred portfolio.

Each demand management portfolio sub-option, has been built using a number of simple assumptions and appropriate 'building blocks'. Options have then been aggregated into their respective portfolios at water resource zone level for the WRMP24.

Decisions regarding the geographical focus of each strategic portfolio have been informed by our 'Problem Characterization' risk assessment, supply-demand balance issues, current levels of leakage and metering, and the practicalities of implementation.

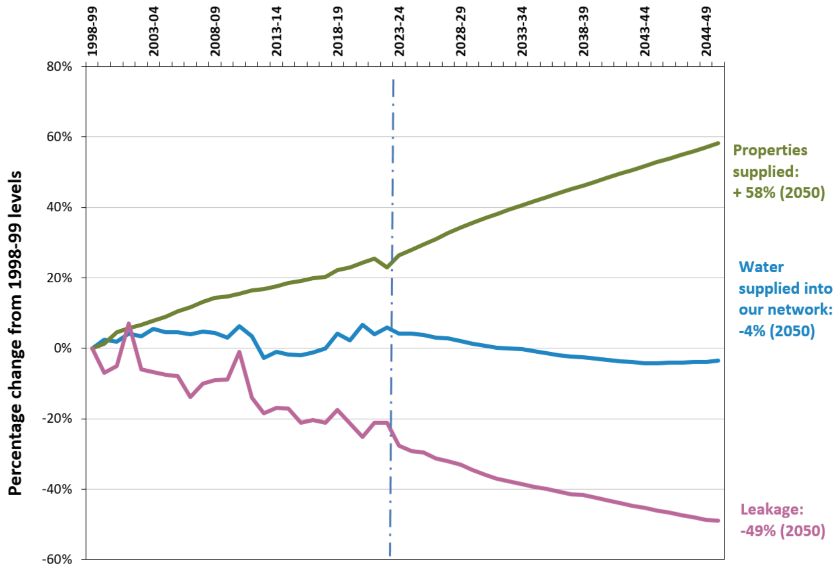
In addition to our key portfolios, we have created a significant number of scenarios (>50 in number) in order to sensitivity test our preferred plan.

2.1 Developing the option list

We have a strong track record delivering demand management. Our success, however, means that we have to be even more innovative in order to achieve further savings.

Our historic achievement can be seen as demand has remained relatively consistent since 1998 until the present. The scale of our ambition is illustrated below, as we intend to maintain demand at current levels, despite an increase in population of 918K (from 2024/25 to 2049/50). (Figure 5) This graph shows the percentage change in the number of properties supplied, the water we put into our network and leakage since 1998, based upon our WRMP24 projections.

Figure 5 Demand management: past achievements and future ambition



The next step-change in demand management will be achieved through technological innovations (built upon our smart metering program) and initiatives that are still relatively untested in a UK context.

In order to consider the widest possible range of options, we have developed and reviewed an unconstrained list of options that drew on:

- Our current business practices and how we could improve them
- Current practices and plans of other UK water companies
- Practices in other sectors (e.g. gas and electricity) to encourage demand management and behaviour change
- Practices in other countries or localities that experience water stress
- Opportunities provided by technology and innovation, and,
- Latest academic research.

This process has identified feasible options such as;

- the development of activities that might be enabled by our installation of smart meters, (specifically Advanced Meter Infrastructure (AMI) technologies).
- the use of rewards and competitions to incentivize behaviour change,
- the use of smart devices to assist with water efficiency and
- grey/green/black water re-use systems (at a development level) to reduce potable consumption to 80 l/ head/d.

Smart meters offer the opportunity to collect significantly more consumer consumption data than visual read meters (which are currently read annually or bi-annually). They transmit readings every hour over a fixed, long-range radio network. This data is then provided to customers over a dedicated website or 'customer portal' in order to enable informed choices regarding water usage.

Due to the interconnected nature of demand management, portfolios of options have been designed and evaluated holistically (taking into account option inter-dependencies), in order to inform the preferred plan for WRMP24.

2.2 Our unconstrained options list

As part of our WRMP24 program, we initially developed an unconstrained list of potential demand management options for further consideration and investigation.

This list of options has been assessed, with the relevant internal teams, for inclusion in the low (Extended Low), medium (Extended Plus) and high (Aspirational) preferred portfolios. The savings, other benefits and costs have been reviewed for each option, in order to avoid any duplication or over-assessment.

Options have been considered for their suitability for inclusion in our WRMP24 portfolios and/or inclusion in additional adaptive plans (if considered more tentative).

Water efficiency options can be shown (Table 1):

Table 1 Water efficiency options considered

Water efficiency behavioural change	SECTION 1: 1a - SMART HOMES - Provision of Smart Shower Sensors. Provision of other smart sensors and devices
	SECTION 1: 1c - SMART HOMES - Link up with other utilities to provide a smart hub for the home showing all your data in one place.
	SECTION 2: 2a - BEHAVIOURAL CHANGE - Continued development of the My Account app to provide quick easy access to data and services.
	SECTION 2: 2b - BEHAVIOURAL CHANGE - Further development of gamification within My Account. Continued support & development of rewards scheme to encourage water saving behaviours.
	SECTION 2: 2c - BEHAVIOURAL CHANGE - Continued provision of garden advice, promotions = and garden kits.
	SECTION 2: 2d - BEHAVIOURAL CHANGE - Campaigns to support our key messages and brand. Hyper local and seasonal.
	SECTION 2: 2f - BEHAVIOURAL CHANGE - Efficiency messaging improvements from smart meter data.
	SECTION 3: 3a - COMMUNITY - Work at a community level to encourage water savings with the results triggering a community reward.
	SECTION 3: 3c - COMMUNITY - Development of a smart city. Provide information into BIG data.
	SECTION 4: 4a - INTERVENTIONS - Scheme for vulnerable customers to fix leaky loos and leaky taps up to a capped value.
	SECTION 4: 4d - INTERVENTIONS -Leaky loos campaign (base option). This is a continuation of a service we offer in PR19.
	SECTION 4: 4e - INTERVENTIONS -Activity alarms for vulnerable customers - potentially a narrative piece
	SECTION 4: 4g - INTERVENTIONS -High consumption virtual visits (no continuous flow).
	SECTION 5: SMART DEVELOPMENTS - 5b Promote and provide services to smart large housing developments fitted via Alliance partners
	SECTION 5: SMART DEVELOPMENTS - 5d Incentivising Developers to install rainwater harvesting - single development
	SECTION 5: SMART DEVELOPMENTS - 5e Incentivising Developers to install rainwater harvesting - communal development
	SECTION 5: SMART DEVELOPMENTS - 5f Incentivising developers to install Water butts
	SECTION 5: SMART DEVELOPMENTS - : 5g "Stormsaver" option - 200 parcel housing - 80l/h/d - generic option trial
	SECTION 5: SMART DEVELOPMENTS - 5a Work with developers on trials of grey water reuse on large new developments. - Adaptive Plan
	SECTION 5: SMART DEVELOPMENTS - 5c In large housing developments create a community smart hub linked to rewards within their local community

Leakage, smart meter and tariff options can be detailed (Table 2):

Table 2 Leakage options considered

Leakage - Smart Meter - Tariff Demand Management Options	SECTION 4: 4b - INTERVENTIONS -Fix all customer supply pipe leaks for all customers up to a value of £500 (Final cost TBC) for P3 and above
	SECTION 4: 4c - INTERVENTIONS -Delivery of the customer side leakage journeys relating to P1-P4 break out leaks.
	SECTION 4: 4f - INTERVENTIONS -Network leakage detection - sensor development to add pressure and noise sensors into smart meters
	SECTION 7: metering - Smart Metering - 7a - Smart meter costs and benefits - 2AMP - 10 year rollout from 2020
	SECTION 7: metering - Smart Metering - 7b - Smart meter costs and benefits - 3AMP - 15 year rollout from 2020
	SECTION 7: metering - Smart Metering - 7c - Smart meter costs and benefits -- 12 year rollout
	SECTION 8: Leakage Options - High target - pressure management - ALC -etc.
	SECTION 8: Leakage Options - Low target - pressure management - ALC -etc.
	SECTION 8: Leakage Options - Medium Target - pressure management - ALC -etc.
	SECTION 2: 2e - ENCOURAGING BEHAVIOURAL CHANGE - Development of tariffs using smart meter data; summer demand tariffs

Non-household options can be described (Table 3):

Table 3 Non-Household demand management options considered

Non-Household Demand Management Options	SECTION 6: 6a Work with retailers to incentivise reductions in irrigation water usage:
	SECTION 6: 6b Work with retailers and end customers on trials of grey water reuse retrofit schemes.
	SECTION 6: 6e Introduce grants or rebates to incentivise retailers and end customers to introduce water efficiency measures / leakage fix
	SECTION 6: 6g Work with retailers to provide an option to repair leaky loos - plumbing loss - Toilet rebate - Incentivisation

This set of options has been characterised with all relevant assumptions and have been developed with associated costs and benefits, such that they could then be modelled in terms of cost/benefit analysis. Options have been constructed from agreed 'building blocks' and assumptions (including monetised qualitative elements such as 'societal value') in order to enable the full Cost Benefit Analysis process (CBA).

The potential cohorts to which options might be applied have also been considered:

- smart meter installation projections have been developed at both Planning Zone (PZ) and Water Resource Zone (WRZ), so that these costs and benefits can be appropriately apportioned.
- where smart devices (e.g. shower sensors) are being installed, we have accounted for the number of devices and attributed the costs and savings at WRZ level proportional to WRZ populations.

Fully characterised options have then been grouped into appropriate option portfolios for further appraisal.

2.3 Screening the unconstrained list and developing the preferred portfolio

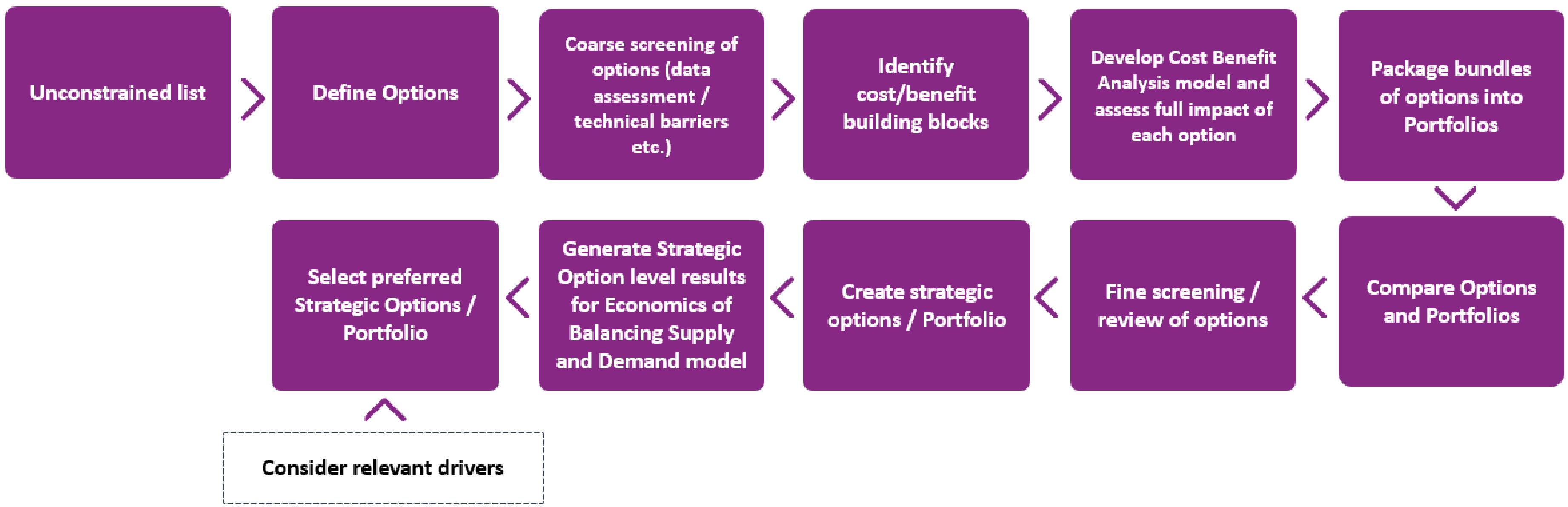
We have assessed our unconstrained list to identify feasible option-types using the screening criteria set out in WR27 Water resources tools (UKWIR, 2012). As a result of this process, a number of options have been screened out.

Our approach for the assessment of demand management options has been structured according to seven process steps:

- Options definition.
- Identification of cost and benefit elements, referred to as 'building blocks', to be included in the cost-benefit analysis. This step includes itemising the information needed for that calculation; and, where appropriate, includes a set of values and assumptions that could be used in the calculation in the absence of company-specific data.
- Assessment of full impact (i.e. costs and benefits) of each option. This step was carried out using bespoke Excel-based models.
- Options comparison and incremental impact calculation.
- Creation of strategic option portfolios.
- Generation of sub-option level results for the Economics of Balancing Supply and Demand (EBSD) model.
- Selection of the preferred strategic option representing the preferred demand management strategy.
- Sensitivity testing of portfolios, with regard to:
  - EBSD analysis,
  - Best for environmental destination,
  - Best value plan

The approach is illustrated in the following diagram (Figure 6):

Figure 6 Cost benefit analysis process



2.4 Option 'building blocks'

As we have characterised each option we have considered the applicability of a number of generic costs and benefits, as well as all the option specific values that might be required for full cost benefit analysis (CBA).

The generic benefits that have been considered are (Table 4):

Table 4 Option benefit generic 'building blocks'

Benefit impact	Description
Reduced level of customer use (average and/or peak)	Reduced average water use by customers. Benefit in Ml/day from reduction of customer use as a result of change in behaviour due to access to smart portals, media campaigns, direct messaging, or direct consequence of devices fitted. Amount of leakage reduced in Ml/day. Monetised using the MCW.
Reduced distribution network leakage	Reduced distribution losses i.e. leakage from the company owned water supply network following an implementation of a new option. Benefit service measure entry is in Ml/day, monetised using the MCW.
Customer supply pipe losses (CSPL) reduction	Benefit of reduced customer supply pipe leakage following an implementation of a new option. Benefit service measure entry is in Ml/day, monetised using the MCW.
Plumbing losses (PL) reduction	Benefit of reduced internal plumbing losses following an implementation of a new options. Benefit service measure entry is amount of leakage reduced in Ml/day, monetised using the MCW.
Reduced customer contacts *(e.g. from more accurate billing)*	Benefit from dealing with fewer customer enquiries (calls, written) regarding their bills as they will be able to access their details via a web portal.
Carbon reduction from reduced distance travelled for meter reading	Carbon emissions reduction from reduced meter reading travel.
Customer valuation	Customer preference from Willingness To Pay (WTP) studies. Evaluated through customer valuation work package and added to overall CBAs as a benefit.

The generic costs that have been considered are (Table 5):

Table 5 Option cost generic 'building blocks'

Cost Impact	Description
Asset capex cost	Capital expenditure associated with purchasing/acquiring the equipment and assets required to realise an option.
Asset replacement cost	Capital expenditure associated with reactive/proactive replacement of the assets (faulty; at the end of asset life).
IT Systems expenditure	On-going costs associated with back-office systems (which includes the IT systems for billing and the data management system).
Telecommunication Opex (IT)	Operational expenditure for communications, such as data costs, on-going licence fees and maintenance.
Customer engagement cost	Cost of awareness campaigns and customer education, including postage
Customer portal running cost	Cost of on-going activity to maintain the running of customer web portals and/or smartphone applications.

Cost Impact	Description
Asset installation cost	Cost of installing the assets both during the initial roll-out and when they are replaced as they reach the end of their useful life.
Operating cost	On-going cost associated with operational activity, e.g. meter reading for metering options, active leakage control (ALC) for leakage, incentivising developers or logistics/storage of equipment for water efficiency options.
Maintenance cost	Cost of maintenance activities, e.g. repairs.
Increased plumbing losses (PL) repair costs	Cost of additional repairs carried out by AWS following implementation of an option that allows identification of plumbing losses in a more efficient manner allowing for improved leak detection productivity.
Increased customer supply pipe repair costs	Cost of additional supply pipe repairs incurred by customers following implementation of an option that allows identification of leaks in a more efficient manner allowing for improved leak detection productivity.

Additional cost/benefit values have included:

- the cohort impacted
- option demand (consumption / leakage) savings
- decay rates associated with benefits
- carbon costs and benefits (associated with heating water)
- the 'Marginal costs of water'
- Customer and Societal valuations

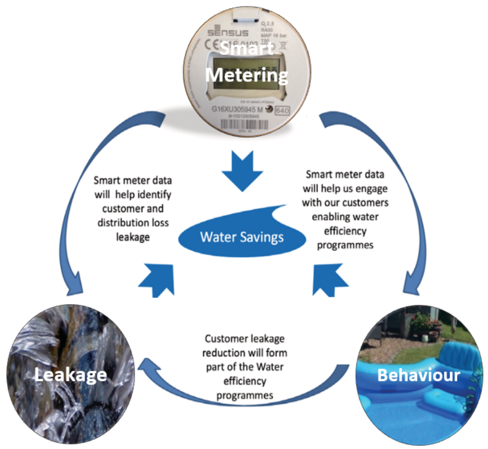
The assumptions for each option will be described in full detail in our consultant report on cost benefit analysis

2.5 Developing strategic portfolios

Using the remaining options on the 'short-list', we undertook a 'process of definition' in order to develop the detail of each option (for example, for smart metering options, this included roll-out trajectories, meter technology selection, customer interaction, supporting technologies, and all associated installation, maintenance, back-office costs), in order to understand dependencies and exclusivities, and to create options that can be specified at Water Resource Level (WRZ).

There are significant synergies between leakage reduction, smart metering and water efficiency activities.

Figure 7 Our holistic plan



For example, before we can ask our customers to conserve water resources we must show that we are doing our utmost, particularly by reducing leakage and fixing visible leaks as quickly as possible.

Smart metering is proving to be crucial in facilitating this process (as we install 1.1M smart meters during AMP7), allowing us to identify customer supply pipe leakage (cspl) and internal plumbing losses (leaky loos) and then to proactively contact customers, so that they can repair those leaks (these processes are currently being developed and refined). Smart metering data is also allowing us to identify leaks on our network more efficiently and assisting with network optimization.

Many potential water efficiency initiatives are dependent upon the installation of smart meters, including the introduction of targeted behavioural change initiatives (which we are currently developing), tariffs, and the installation of smart devices.

Given these synergies, it is essential to consider demand management programs holistically through the development of 'strategic portfolios'. Each strategic portfolio includes the completion of our smart meter rollout, additional leakage reduction, water efficiency and non-household sub-options, and has been built from the bottom-up, at the water resource zone (WRZ) geographic level.

Decisions regarding the geographical focus of each strategic option have been informed by our Problem Characterization scores, growth risk, current levels of leakage and metering, practicalities of implementation and considerations of supply/demand balance.

This approach is consistent with the approach to demand management in the Water UK study, *Water Resources Long Term Planning Framework (WRLTPF)*, which considered four demand management scenarios consisting of a combination of leakage, metering and water efficiency initiatives. These are shown below (Table 6).

- 'Business as Usual' (BAU) - Upper: this represents the situation that would occur if water companies continue with their current policies and methods for reducing demand, but the societal and policy support for demand management is low.
- 'Business as Usual' (BAU) - Base: as above, but with a greater degree of societal and policy support.
- Extended: this represents an ambitious extension to demand management, incorporating initiatives such as the use of differential tariffs to help reduce demand.
- Enhanced: this represents a significant advance in demand management, incorporating initiatives such as grey water re-use and much tighter controls on water efficient design for new households.

Reflecting this guidance, we produced an initial number of variations of the strategic portfolios, including complementary elements of leakage, smart metering and water efficiency interventions for evaluation.

We developed our initial view of low/medium/high portfolios of options for our preliminary cost/benefit analysis. These portfolios, were then reviewed, with respect to the key portfolio elements (smart metering, leakage, water efficiency and non-household measures) and our aspirations for the preferred plan. These considerations have led to the re-combination of key elements, as highlighted in the table below (Table 6):

- **Smart Metering**: We should continue current AMP7 rollout, completing our roll-out by 2029/30; consistent with WRMP19 program. We will look to adopt a form of compulsory/universal metering (i.e. customers with a meter will pay a measured charge)
- **Water efficiency**: We intend to pursue the most ambitious program (our highest portfolio) of water efficiency measures.
- **Leakage**: We intend to include our most ambitious program for leakage reduction, initially relying on the benefits from smart metering and customer-side leakage reductions. In the longer term, we will rely on an extensive program of mains replacement, achieving our currently assessed maximum leakage reduction of 30% (revised post Price Review - from the 2017/18 National Framework base-line). Note our plan exceeds PIC and NIC targets (if applied as a national metric). Our WRMP24 program, has been driven by our consultation responses and increases leakage reduction from the 24% included in our draft WRMP24 submission. The plan has been informed, by our current leakage level, AMP7 ambition, base-line maintenance cost and future enhancement costs.
- **Non-household Options**: For our WRMP24, we have quantified a number of options for non-household water efficiency and leakage. These options have been designed to help us mitigate non-household growth and reduce non-household demand to help us achieve the EA/Defra targets. We have been working closely with our Retail partners, who we expect will help deliver these water efficiency options with their customers.

Note: the selected shaded options, show our preferred option selection once initial cost benefit analysis had been conducted.

Note: values quoted in these tables reference our original optioneering based upon the 2021/22 base-year water balance. Our final WRMP projection is now based upon the 2023/24 base-year.

Table 6 Initial portfolio design

	BASELINE	LOW PORTFOLIO	MEDIUM PORTFOLIO	HIGH PORTFOLIO	ADDITIONAL ELEMENTS
SMART METER OPTIONS	No Additional AMI Smart metering after AMP7 rollout (1.1M installed) BAU - meter optants (with visual read meter installation)	AMI Smart metering (3 AMP - 15 year roll-out from 2020)	AMI Smart metering (2 AMP - 10 year roll-out from 2020)	AMI Smart metering (2 AMP - 10 year roll-out from 2020)	Compulsory / Universal Metering
WATER EFFICIENCY OPTIONS	BAU HH Water Efficiency No Enhancement	LOW HH Water Efficiency Package (include AMI 'plumbing loss' savings = PCC)	MEDIUM HH Water Efficiency Package (include AMI 'plumbing loss' savings - PCC)	HIGH HH Water Efficiency Package (include AMI 'plumbing loss' savings = PCC)	+ Non-HH Options (to be developed for Final Plan WRMP24)
LEAKAGE OPTIONS	No Additional Leakage reduction beyond AMP7 Target - leakage to grow with housing growth (additional cspl)	High Leakage (additional leakage delivered by Smart Meter AMI - cspl Additional Leakage -(to counter cspl from growth) (AMP12 approx. 24% reduction from 17/18 (NF) by 2050) Further 8% leakage reduction from 2025 to 2050.	High + Leakage Additional 8% in AMP8 (from 17/18) leakage reduction including AMI cspl - front loaded in WRMP24 period (AMP12 approx. 28% from 17/18 (NF) reduction by 2050) Further 12% leakage reduction from 2025 to 2050.	HIGH++ Leakage Additional 8% AMP8 leakage reduction (17/18) inc. AMI cspl - front loaded - include Mains replacement to max. (AMP12 approx. 30% from 17/18 (NF) reduction by 2050) Further 24% leakage reduction from 2025 to 2050.	+ Developer options (Trial in AMP8) + Tariffs (Potentially include in WRMP29)

Reassessment led to the refinement of the key portfolio design, in order to allow further Cost Benefit Analysis (CBA) comparisons. These portfolios have been designated as:

- low 'Extended Low' portfolio
- 'Extended Plus' portfolio,
- **Preferred high 'Aspirational'** portfolio.

After further consideration, post consultation, we have now designated the 'Aspirational' Portfolio as our preferred portfolio (with a more ambitious leakage program and Non-household options). The key features of each portfolio, with the preferred portfolio highlighted, are shown below (Table 7):

Note: values quoted in these tables reference our original optioneering based upon the 2021/22 base-year water balance. Our final WRMP projection is now based upon the 2023/24 base-year.

Table 7 Final portfolio selection

	BASELINE	LOW PORTFOLIO (Extended Low)	MEDIUM PORTFOLIO (Extended Plus)	HIGH PORTFOLIO (Aspirational)	ADAPTIVE PLAN Variants...
SMART METER OPTIONS	No Additional AMI Smart metering after AMP7 rollout (1.1M installed) BAU - meter optants (with visual read meter installation)	AMI Smart metering (3 AMP - 15 year roll-out from 2020)	AMI Smart metering (2 AMP - 10 year roll-out from 2020)	**AMI Smart metering** **(2 AMP - 10 year roll-out from 2020)**	Compulsory / Universal Metering
WATER EFFICIENCY OPTIONS	BAU HH Water Efficiency No Enhancement	LOW HH Water Efficiency Package (include AMI 'plumbing loss' savings = PCC)	HIGH HH Water Efficiency Package (include AMI 'plumbing loss' savings = PCC)	**HIGH HH Water Efficiency Package (include AMI 'plumbing loss' savings = PCC)**	Non-HH Options (Now developed for the WRMP24)
LEAKAGE OPTIONS	No Additional Leakage reduction beyond AMP7 Target - leakage to grow with housing growth (additional cspl)	High Leakage (additional leakage delivered by Smart Meter AMI - cspl Additional Leakage -(to counter cspl from growth) (AMP12 approx. 24% reduction from 17/18 (NF) by 2050) Additional 8% leakage reduction from 2025 to 050.	High Leakage (additional leakage delivered by Smart Meter AMI - cspl Additional Leakage -(to counter cspl from growth) (AMP12 approx. 24% reduction from 17/18 (NF) by 2050) Further 8% leakage reduction from 2025 to 2050.	**HIGH++ Leakage Additional 8% AMP8 leakage reduction (17/18) inc. AMI cspl - front loaded - include Mains replacement to max. (AMP12 approx. 38% from 17/18 (NF) reduction by 2050)** **Further 24% leakage reduction from 2025 to 2050**	Developer options (Trial in AMP8) + Tariffs (Potentially include in WRMP29)

Note that our current out-turn for leakage reduction will be approximately 6% as part of our WRMP19 program for AMP7 (2019/20 to 2024/25), reflecting the challenges faced during AMP7.

Having considered the responses to our consultation, we now intend to reduce leakage by a further 23% (taking into account our revised AMP7 out-turn), as part of our WRMP24 program. This is a very significant commitment;

- reaching our maximum feasible leakage reduction,
- noting that we are already achieving record low levels of leakage as part of our AMP7 program, and this will need to continue into the WRMP24 period.

After full consideration, we have concluded that the Aspirational Portfolio, best represents our ambitions and aspirations for demand management in the next 25 years, giving the best opportunity to meet our customers needs and external framework requirements.

Preferred Portfolio (Aspirational Portfolio - Code 1003)

- Reduction of leakage by 10.7Ml/d to 168Ml/d by 2029/30 (AMP8) and 45.5Ml/d to 134.5Ml/d by 2049/50 (AMP12), (Revised post price review) by a combination of leakage and smart metering strategies. *Revised out-turn values based upon the updated 2023/24 base-year (noting similar overall savings).*
- Implementation of smart metering over a 2AMP (10 year) program to maximum feasible penetration (96%); 16.95Ml/d saving by 2029/30, 30.40Ml/d by 2049/50 (note this includes AMI cspl savings).
- High 'Aspirational' program of water efficiency strategies, saving 9.3Ml/d by 2029/30 and 14.55Ml/d by 2049/50.
- Non-household water efficiency options saving 10Ml/d by 2029/30 and 50Ml/d by 2049/50.
- Total Option savings from base-line:
  - End of AMP8 (2030): 44Ml/d.
  - End of AMP12 (2050): 134Ml/d.

Our 'Aspirational' option allows us to:

- **innovate and deliver on our further ambitions for our demand management activities,**
- **show our commitment to meeting EA/Defra/National Framework targets for leakage reduction per capita consumption and non-household water efficiency**
- **deliver a strong economic case.**

The other strategic options do not strike the same balance, compared with our preferred 'Aspirational' option. We do not believe that the less ambitious, 'Extended' or 'Extended Plus' options go far enough in delivering the demand management (and leakage) that our customers and stakeholders expect.

Despite the cost associated with the 'Aspirational' option, especially with regard to leakage, we believe that this option continues the progress we are making with regard to demand management, and also shows our commitment to contributing to the National Framework targets for leakage and PCC (a 50% leakage reduction and 110 l/h/d PCC by 2049/50).

2.6 Scenario savings and growth

Key portfolios of options have been assessed with respect to forecast growth and how effective the overall packages are in mitigating the growth in consumption over the WRMP24 period (2024/25-2049/50), by reducing demand. Note that smart metering, water efficiency and non-household options will tend to reduce demand over the near term, whilst in the long term government led interventions and leakage targeted mains replacement will take over (savings consistently being greater than demand growth). Note that values for these scenarios have been generated using the 2021/22 base-line, with the final WRMP24 values being based upon the 2023/24 base-year.

The portfolios can be described:

2.6.1 Base-line (Code 1000)

- No additional leakage interventions beyond 2024/25. The base-line leakage level would initially be 164Ml/d remaining very close to this level by 2049/50, including housing growth associated cspl.
- Smart meter rollout to 2024/25 (approximately 1.1M meters) only. These smart meters would continue to operate through the WRMP24 plan.
- BAU water efficiency measures only.

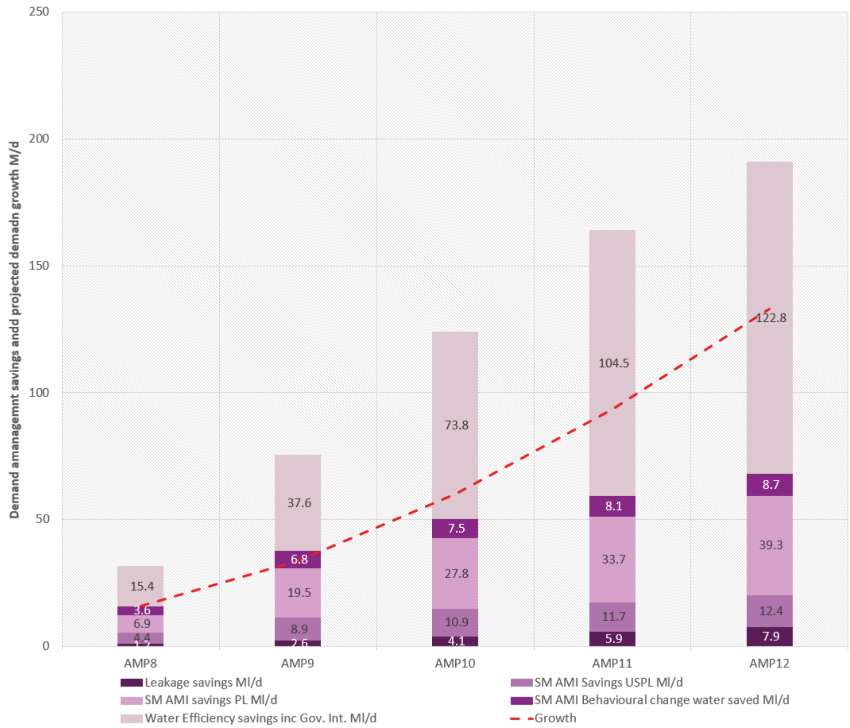
2.6.2 'Extended Low Portfolio' - Low Demand Management (Code 1001)

- Reduction of leakage by 5Ml/d by 2029/30 (AMP8) and 20.5Ml/d by 2049/50 (AMP12), by a combination of leakage and smart metering strategies. *(Note values based upon 2021/22 base-line)*

- Implementation of smart metering over a 3AMP (15 year) program to maximum feasible penetration (95%); 7.1Ml/d saving by 2029/30, 33.3Ml/d by 2049/50 (note includes SM leakage cspl savings)
- Low - program of water efficiency strategies, saving 6.4Ml/d by 2030 and 11.1Ml/d by 2050.
- Non-household water efficiency options saving 10Ml/d by 2029/30 and 50Ml/d by 2049/50.
- Total Option savings from base-line:
  - End of AMP8 (2030): 27.9Ml/d
  - End of AMP12 (2050): 106.6Ml/d

Low demand management option scenario (Extended Low): 3AMP smart metering, low leakage, low water efficiency and non-household options (Figure 8). *Note these values are based upon our original optioning (base-lined to 2021/22)*

Figure 8 'Extended Low' savings (1001) and growth



Key:

- 'Leakage savings' - associated with cspl reduction, mains replacement, shared supply cspl reduction.
- 'SM AMI savings PL' - plumbing loss reduction associated with smart meters.
- 'Metering water saved' - Smart meter behavioural change savings.
- 'SM AMI Savings USPL' - customer/underground supply pipe leakage reduction associated with smart meters.

- 'Water Efficiency savings inc. Gov Int' - water efficiency savings for both households and non-households, including government led intervention savings.
- 'Growth' - demand growth associated with additional population and non-HH growth in the preferred plan

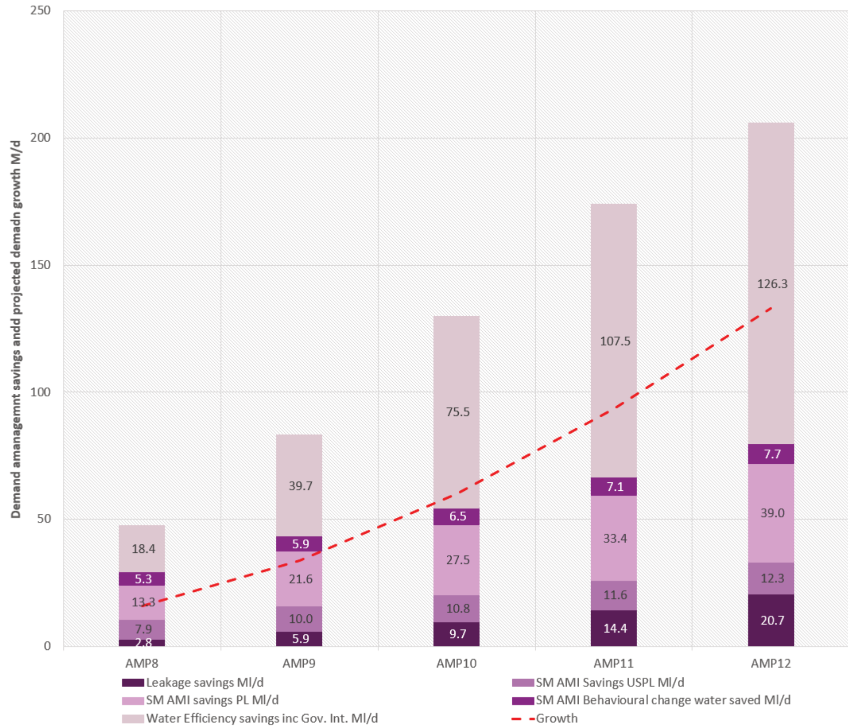
Note the graph also include the impact of government led interventions, which will be needed in order to achieve our target of 110l/h/d. This is an impact of 81.2Ml/d by 2049/50.

2.6.3 'Extended Plus' - Medium Demand Management (Code 1002M)

- Reduction of leakage by 10.7Ml/d by 2029/30 (AMP8) and 32.9Ml/d by 2049/50 (AMP12), by a combination of leakage and smart metering strategies.
- Implementation of smart metering over a 2AMP (10 year) program to maximum feasible penetration (95%); 18.1Ml/d saving by 2029/30, 31.9Ml/d by 2049/50 (note includes SM leakage cspl savings).
- High program of water efficiency strategies, saving 9.4Ml/d by 2029/30 and 14.6Ml/d by 2049/50.
- Non-household water efficiency options saving 10Ml/d by 2029/30 and 50Ml/d by 2049/50.
- Total Option savings from base-line:
  - End of AMP8 (2030): 44.0Ml/d
  - End of AMP12 (2050): 121.5Ml/d

Note the graph also include the impact of government led interventions, which will be needed in order to achieve our target of 110l/h/d. This is an impact of 81.2Ml/d by 2049/50. N*ote these values are based upon our original optioning (base-lined to 2021/22)*

Figure 9 'Extended Plus' savings (100M) and growth



The medium demand management option scenario (Extended Plus), plan: 2AMP smart metering, 'High' leakage (24% leakage reduction), Aspirational water efficiency (Figure 9).

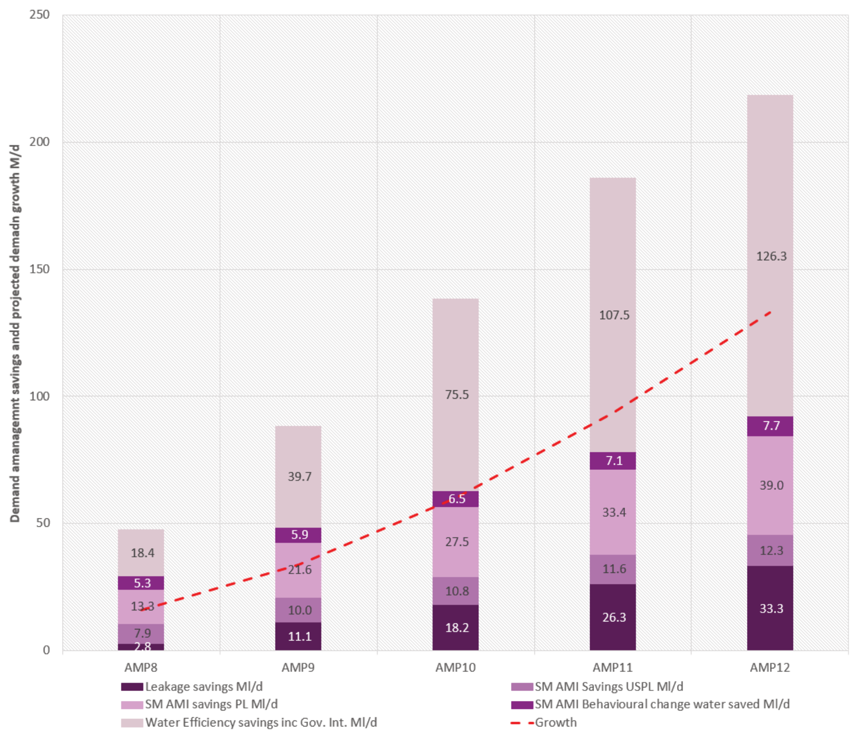
2.6.4 'Aspirational Portfolio' - High Demand Management (Code 1003) - Preferred Plan

- Reduction of leakage by 10.7Ml/d by 2029/30 (AMP8) and 45.5Ml/d by 2049/50 (AMP12), by a combination of leakage and smart metering strategies.
- Implementation of smart metering over a 2AMP (10 year) program to maximum feasible penetration (96%); 18.1Ml/d saving by 2029/30, 31.9Ml/d by 2049/50 (note this includes AMI cspl savings).

- High 'Aspirational' program of water efficiency strategies, saving 9.4Ml/d by 2029/30 and 14.6Ml/d by 2049/50.
- Non-household water efficiency options saving 10Ml/d by 2029/30 and 50Ml/d by 2049/50.
- Total Option savings from base-line:
- End of AMP8 (2030): 44Ml/d.
- End of AMP12 (2050): 134Ml/d.

Note the graph also include the impact of government led interventions, which will be needed in order to achieve our target of 110l/h/d. This is an impact of 81.2Ml/d by 2049/50. *Note these values are based upon our original optioning (base-lined to 2021/22)*

Figure 10 "Aspirational' savings (1003) and growth



Our preferred, most ambitious high demand management option scenario (Aspirational): 2AMP smart metering, 'High++' maximum feasible leakage reduction 30% (Revised with new 2023/24 baseline and AMP7 out-turn), Aspirational water efficiency portfolio (Figure 10).

2.7 Portfolio appraisal summary

We believe there is great potential for increasing future demand savings, driven by innovation and investment, building upon the ambitious demand management program currently being implemented in AMP7. Consequently, demand management strategies will play a vital role in ensuring that we meet our planning objectives, both for Anglian Water and for the regional Water Resources East plan.

Both the government and our customers expect us to continue to reduce demand for water resources. Our customers have told us that they prefer options that make best use of available resources and that leakage reduction should be prioritized.

Bearing this in mind, we believe, there is further potential for increasing future demand savings, facilitated by the ongoing roll-out of our smart meter program, assisting customers to engage with their water usage and making them part of the 'water saving' journey.

We have also used the results of our 'Problem Characterization' analysis, following Water Resource Planning Guidance (see our 'Decision making technical support document'), together with the out-comes of customer and stakeholder engagement to assist in developing our specific planning objectives, embodied in our Best Value Planning criteria.

What is a Best Value Plan?

This concept has been introduced for the latest WRMP24, with the aim that the WRE regional plan and WRMP24 should present a best value plan, both in the short term and the long term.

The WRMP24 should ensure a secure supply of wholesome drinking water for customers and protect and enhance the environment.

The best value plan considers and includes other factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and society overall (Figure 11).

Figure 11 Best Value planning criteria

Our current achievements in demand management, mean that we must go beyond 'tried and tested' demand management activities. In particular, it should be noted, that our standard 'dumb' meter penetration currently stands at a very high level, with 84% of our customers receiving a measured bill, (and 90% having a meter 2022/23) with the associated behavioural savings (as customers switch from being unmeasured to measured status) already being achieved.

We also now have >1M smart meters installed across the Anglian Water region, as part of our rollout of 1.1M meters, expected to be installed by 2024/25.

Additionally, our leakage levels are already significantly below our previously assessed Economic Leakage level (of 219.6Ml/d) at 181.1Ml/d (2023/24).

However, our ambition is to build upon our current position.

Further advances in demand management will be achieved through additional technological innovation and sophisticated data analytics, maximizing the impact of our smart meter rollout, and the implementation of 'frontier' initiatives, that are relatively un-tested in a UK context.

Our 'Aspirational' option allows us to:

- **innovate and deliver on our further ambitions for our demand management activities,**
- **show our commitment to meeting EA/Defra/National Framework targets for leakage reduction per capita consumption and non-household water efficiency**
- **deliver a strong economic case.**

Other strategic options do not strike the same balance, compared with our preferred 'Aspirational' option. We do not believe that the less ambitious, 'Extended' or 'Extended Plus' options go far enough in delivering the demand management that our customers and stakeholders expect.

Despite the cost associated with the 'Aspirational' option, especially with regard to leakage, we believe that this option continues the progress we are making with regard to demand management, and also shows our commitment to contributing to the National Framework targets for leakage and PCC (a 50% leakage reduction and 110 l/h/d PCC by 2049/50).

Thus, our preferred option ('Aspirational') has been assessed to 'best meet' our multi-criteria approach to selection, meeting customer need, mitigating growth and meeting all our obligations (Noting our RAG assessment). (Table 8).

Table 8 Comparison of options against selection criteria

Best Value Planning Objective	Critera	Extended Options	Extended Plus	Aspirational
Optimise our available resource	Mitigates near term growth			
	Mitigates long term growth			
	Fulfils regulatory obligations			
Affordable and sustainable over the long term	Reasonable cost			
Delivers long-term environmental improvement	Assists near term environmental destination			
	Assists long term environmental destination			
	Meets SEA requirements			
	Aligns with Net Zero ambition			
Increase the resilience of our water systems	Is deliverable/achievable			
A plan that supports the views of stakeholders and customers	Meets customer expectation			
	Aligns with WRE			

	Unlikely to meet criteria
	May meet criteria
	Will meet criteria

The 'Aspirational' option will form part of our ambitious and deliverable twin track approach, of using demand and supply solutions, to secure future water supplies.

2.8 Preferred portfolio summary

The key messages informing the preferred 'Aspirational' portfolio can be summarized:

Smart Metering:

We shall continue current AMP7 roll-out. The key scenario is that we will complete our roll-out by 2029/30 (in AMP8). This is consistent with our WRMP24 strategic need and WRMP19 program.

Compulsory metering:

We will look to adopt a form of compulsory metering (i.e. customers with a meter will pay a measured charge, at least in the most water stressed areas). However, we still need to conduct more research on customer impacts from this policy.

Water efficiency:

We intend to pursue our most ambitious program (highest portfolio) of water efficiency measures. This has high levels of customer support and is facilitated by our smart meter roll-out.

Per Capita Consumption Outcome (2050):

Once we have accounted for our smart meter program, water efficiency options and the impact of government led interventions, we expect to achieve a per capita consumption value of 104.42 l/h/d in 2049/50 (2023/24 base-line), in compliance with the Nation Framework / Defra / EA target.

Leakage:

We are very keen to implement our most ambitious program for leakage reduction in AMP8 and beyond, intending to achieve our maximum feasible leakage reduction (a 30% reduction from the National Framework base-line of 2017/18) by 2049/50. This ambition currently involves significant cost, but we have designed our program so that the majority of this impacts beyond AMP8, giving us time to investigate more cost effective technologies. The leakage program will rely on customer supply pipe leakage reduction and a significant leakage targeted mains replacement program (over 8000km).

Leakage Outcome (2050)

Our revised 30% reduction indicates our commitment to assisting the industry in achieving the National Framework target of a 50% reduction by 2049/50, and represents the maximum reduction in leakage that we consider feasible with current technologies (achieving our minimum leakage level), given our current frontier position with respect to leakage.

We, however, would argue that although we fully support the National Framework target of a 50% reduction in leakage, this must be seen as a national target and should only be considered at PWC level, once each company's current position has been reviewed. If the National Framework target is translated into nationally representative metrics (leakage per property / leakage per km of main), we easily reach the required attainment levels, whilst not necessarily meeting an absolute company level 50% reduction in leakage.

Non-household water efficiency

We have recognised the importance of demand management with regard to the Retail and non-household sector. We have also been mindful of the Defra/EA 9% target for non-household demand reduction by 2037/38 and the 15% reduction by 2049/50. We have consequently designed a set of non-household water efficiency options to help us achieve these targets.

Where feasible we have tailored options to achieve a 9% saving, whilst also reflecting current consumption volumes, smart meter data, and current savings estimations for 'plumbing loss' and cspl.

In total, these options help us achieve approximately 8% reductions by 2037/28 and 15% by 2049/50, but these reductions can only be achieved relative to the non-household demand position (including growth).

2.9 Metering

Our WRMP24 metering plan will consist of a continuation of our current AMP7 smart metering program, and will complete the replacement of our entire meter stock over 10 years, by 2029/30 (2 AMPs). We are currently progressing the rollout of our AMP7 program of smart meter installation of 1.1M meters by 2024/25 (We currently have >1M smart meters installed 2024/25). We have also readjusted our installation profiles to account for the AID program (Accelerated Infrastructure Delivery); installing an additional 60K smart meters in AMP7. Note that for the WRMP24 assessment, all smart meter savings associated with the AMP7 smart meter program are now included in our baseline forecast. Additionally, in parallel, we intend to install smart meters for all non-household properties in the Anglian Water region.

The data resulting from 'smart metering' is helping to inform our customers regarding their water usage and is assisting in our ability to inform them of potential water efficiency savings. It is also helping with our ability to detect leakage, speed up repairs and understand our system.

We intend to build upon our initial findings, refining our interactions with our customers and enhancing savings over time.

By the end of AMP7 (from our 2021/22 base-line), we now estimate that smart meters, combined with the behavioural change and the improvements in leakage performance that they enable, will result in up to 3.5Ml/d demand savings from behavioural change, 2Ml/d savings from quicker plumbing loss repairs (which impact PCC) and up to 1Ml/d reduction in cspl repairs.

The enhanced additional smart meter program is forecast to enable savings of 16.9Ml/d by 2029/30. By the end of our WRMP24 planning period (2049/50), we estimate smart meters will result in savings of 30.4Ml/d, constituted of:

- 7.6Ml/d of savings from behavioural change,
- 15.8Ml/d savings from quicker plumbing loss repairs, and up to
- 7.0Ml/d reduction from customer supply pipe leaks (cspl) repairs.

These values have been revised to reflect the 2023/24 base-year for the forecast.

We also intend to encourage our customers who have a meter, but are not billed upon their usage, to switch to being measured customers and hence we will develop our universal metering program.

2.10 Water efficiency measures

We forecast that our additional water efficiency activities will result in savings of 9.3Ml/d by 2029/30 (the end of AMP8), and 14.55Ml/d by 2049/50 (2023/24 base-line).

New technologies and our interventions will help promote the careful use of water by both our household and non-household (business) customers.

Additional water efficiency programs will include:

- the provision of smart water devices/sensors (shower). Potentially linking sensors (shower sensors) to MyAccount. Linking Smart devices to hubs, developments and communities
- continuing development of MyAccount App (and website) to provide easy access to customer data. Personalized engagement on discretionary/seasonal water use - virtual assistants.
- development of gamification and rewards schemes.
- additional community based campaigns -hyper local and seasonal
- provision of garden advice / garden kits for outdoor usage, with higher levels of engagement on discretionary/seasonal water use.
- a scheme to assist vulnerable customers with internal leaks.
- a leaky loo campaign for traditionally metered customers.
- further development of customer leakage journey to achieve maximum target run-times of 100 days (or below)
- enhanced schemes to assist vulnerable customers with internal leaks.
- research into 'Smart communities' - link smart systems to other utilities

Potential demand reduction savings for each of these programs have been quantified, using detailed assumptions and modelling, based upon both internal Anglian Water data and external research.

Now that we are gaining significant insight into customer consumption through smart meters (hourly readings), we are conducting detailed research into customer behaviour patterns, and segmentation, in order to inform our water efficiency measures and customer communications strategies. As we progress this understanding, it will inform our WRMP24 plan (through AMP8) and WRMP29. We aim to enhance this understanding with our 'Water Demand Reduction Discovery Fund'.

2.11 Leakage

Our target for AMP7 was to reduce leakage by 15%, from a value of 191Ml/d in 2019/20 (using the AMP7 revised regulatory calculation methodology). Reflecting current challenges, we now anticipate our AMP7 out-turn to be to 180.5Ml/d by the end of AMP7 in 2024/25. Taking 2017/18, as a base-year, we are now targeting a reduction of 6.0% by 2024/25.

Whilst considering our consultation responses and the National Framework target, we have revised and increased our ambition for leakage reduction for our WRMP24 plan. We originally proposed a conservative 24% reduction in leakage (from the 2017/18 National Framework) based upon an assessment of cost and benefit, but have now revised this to a more ambitious target of a 30% reduction by 2049/50 (based upon our revised AMP7 out-turn).

This 30% reduction indicates our commitment to assisting the industry in achieving the National Framework target of a 50% reduction by 2049/50, and represents the maximum reduction in leakage that we consider feasible with current technologies (achieving our minimum leakage level). Note that if the National Framework target is translated into equivalent metrics for leakage per km main and leakage per property our plan absolutely achieves the required values by 2050.

We will, however, argue that although we fully support the National Framework target of a 50% reduction in leakage, this must be seen as a national target and should only be considered at PWC level, once each company's current position has been reviewed.

This reduction in leakage relies upon a significant amount of mains replacement by 2049/50 (>8000km of mains replaced) at a very significant cost (>£4 billion), but we believe that these costs will be mitigated over time as technology advances. However, whilst sequencing this leakage reduction program, we have ensured that the bulk of these costs, impact after AMP8 (2029/30). This will allow us to review costs and benefits as part of the WRMP29 planning program.

Our aim, therefore, is to reduce leakage by an additional 45.5Ml/d by 2049/50 to a final figure of 134.5Ml/d (base-line leakage will remain relatively static with cspl, associated with additional new build properties, remaining at approximately 180.1Ml/d).This will represent a reduction of 30% from the 2017/18 position. (noting our current frontier position with regard to our leakage level, and the significant additional costs associated with further leakage reduction).

Leakage currently (2023/24) represents 15.4% of distribution input (DI) (182.6Ml/d leakage / 1178.1Ml/d DI) and will represent 12.4% of DI in 2049/50 (134.5Ml/d leakage / 1086.2Ml/d DI).

We are aiming to reduce leakage by targeting losses in our distribution system (through mains replacement), losses due to customer supply pipe leakage (identified using smart meters), leakage from shared supply properties (identified using smart meters) and internal plumbing losses (which is leakage, but impacts PCC).

2.12 Preferred plan costs and benefits

The cost of our enhancement for our demand management strategy will be £171million (totex) in AMP8 (2024/25-2029/30) (Excluding financing and including opex savings) with overall savings of 43Ml/d.

Costs and benefits have been reassessed for smart metering for the WRMP24, as we have now re-assessed smart meter savings for household continuous flow reduction (cspl and plumbing loss). We have also readjusted our installation profiles to account for the AID program (Accelerated Infrastructure Delivery); installing an additional 60K smart meters in AMP7. All smart meter savings associated with the AMP7 smart meter program are now included in our baseline forecast.

Costs and benefits can be shown for the 25 year period, as below (Table 9).

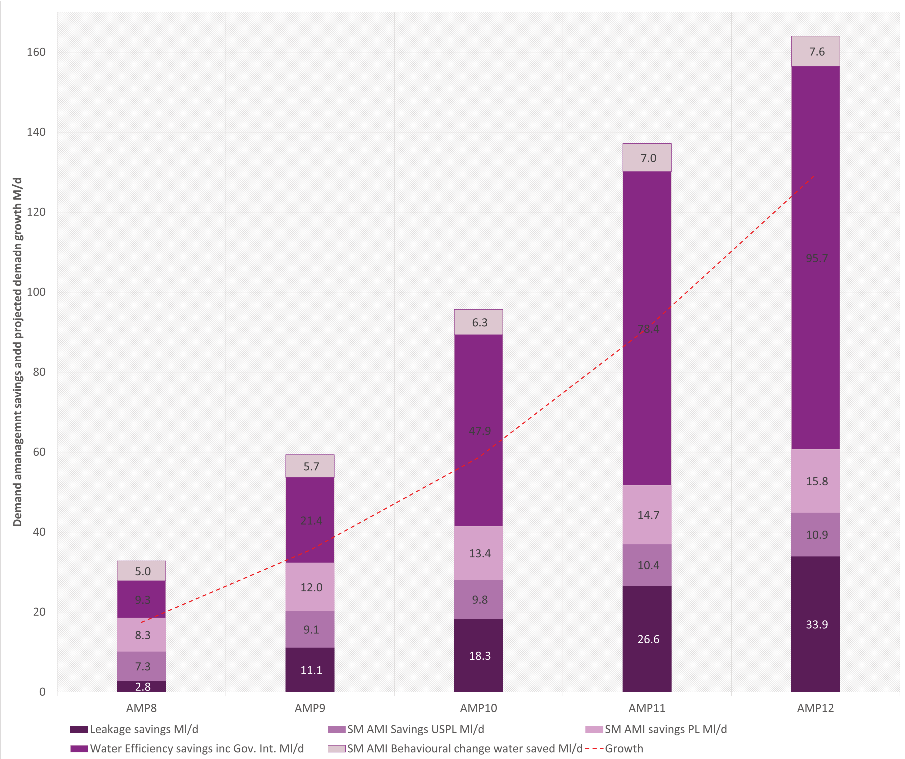
Table 9 Our preferred plan - Costs and benefits

		AMP8 - 2030				AMP12 -2050		
	Water Savings Final Year AMP8	Total Cost (Ex. Finance - Inc. Opex Savings)	Total Cost (Ex. Finance - Ex. Opex Savings)	Cost per Mld (AMP8)	Water Savings Final Year AMP12	Total Cost (Ex. Finance - Inc. Opex Savings)	Total Cost (Ex. Finance - Ex. Opex Savings)	Cost per Mld (AMP12)
Smart Metering (2AMP rollout)	15.56Ml/d	£124.95m	£117.31m	£7.44m per Ml/d	30.4Ml/d	£281.86m	£244.82	£7.44m per Ml/d
Water Efficiency	9.29 Ml/d without gov. interventions	£16.77m	£15.76m	£1.81m per Ml/d	14.55 Ml/d without gov. interventions 95.75 Ml/d with gov. interventions	£73.37m	£63.60m	£5.04m per Ml/d
Leakage	6.54 Ml/d without smart meter benefits (10.15 Ml/d with 2AMP rollout)	£36.42m	£37.87m	£5.57m per Ml/d	37.87 Ml/d without smart meter benefits (44.89 Ml/d with smart meter benefits)	£4370.70m	£4370.70m	£115.41m per Ml/d
Non-HH Water Efficiency	9.95 Ml/d	£3.87m	£4.83m	£0.38m per Ml/d	49.74Ml/d	£2.61m	£24.14m	£0.05m per Ml/d
Total savings for the preferred portfolio (Ex Gov. interventions)	**42.86Ml/d**	**£171.17m**	-	**£3.99m per Ml/d**	**133.24 Ml/d**	**£4619.84m**	-	**£34.67m per Ml/d**
PCC Out-turn	123.54 l/h/d AMP8 (NYAA)				107.59 l/h/d AMP12 (NYAA)			

Note that significant costs for our smart meter program are now considered to be part of our base-line. Base-line costs for maintaining leakage levels are also rising as we reach lower and lower values.

As can be seen, in totality, for our preferred option package, the demand management program should maximise the potential savings that might be achievable, as we build upon our smart meter program and effectively mitigate the growth impact from demand. The water efficiency values, shown also include savings associated with government led interventions which will be a significant factor by 2049/50 (84Ml/d). (Figure 12).

Figure 12 Aspirational DMO option savings (Including Gov. led interventions)



Water efficiency option savings can be shown, as described below:

- 'Leakage savings' - associated with cspl reduction, mains replacement, shared supply cspl reduction.
- 'SM AMI savings PL' - plumbing loss reduction associated with smart meters.
- 'Metering water saved' - Smart meter behavioural change savings.
- 'SM AMI Savings USPL' - customer/underground supply pipe leakage reduction associated with smart meters.
- 'Water Efficiency savings inc. Gov Int' - water efficiency savings for both households and non-households, including government led intervention savings.
- 'Growth' - demand growth associated with additional population and non-HH growth in the preferred plan

2.13 Demand Management Options and WRZ Targeting

During the demand management options appraisal process, consideration has been given regarding the way in which the options should be implemented across the AWS region.

Current and forecast metrics have informed the prioritisation of the options (metering, leakage and efficiency / behaviour) and have offered different perspectives in assessing how options might be rolled out as part of the WRMP24 plan.

Option targeting and prioritisation has been directed at WRZs/PZs based upon identified:

- Forecast WRZ risks and issues (supply/demand and abstraction issues; growth)
- Opportunities based upon current WRZ status (leakage status; meter penetration)
- Potential barriers (technological) to option development (geographic implications - household distribution/density)

3 Metering options

3.1 Overview

All of the strategic options we tested include the continuation of our smart meter installation program, across our region, with either a 10 year (2AMP) roll-out for our 'Extended Plus' and 'Aspirational' portfolios, or a 15 year (3AMP) roll-out in the 'Extended Low' portfolio. All these options reach the feasible meter penetration limit by the end of the WRMP24 planning period (95%).

By 'smart meters' we specifically mean Advanced Meter Infrastructure (AMI) meters and their associated transmission networks, with data provided to our customers over a dedicated website, 'customer portal' or mobile application.

These options all build upon our smart meter installation program, currently being implemented in AMP7. We expect to install 1.1M smart meters by 2025 (We currently have >1M smart meters installed 2024/25). We have also readjusted our installation profiles to account for the AID program (Accelerated Infrastructure Delivery); installing an additional 60K smart meters in AMP7.

- We believe that smart meters offer the potential to deliver significant future demand savings, through innovative methods of customer engagement that are enabled by the frequent data provided (over and above what they would save with our current 'visual read' meters).
- The frequent consumption data that smart meters generate will also allow us to unlock a range of additional benefits. For example; a better understanding of demand will allow us to improve the efficiency of our operations through targeted network optimisation.
- Finally, smart metering is also an integral part of our strategy to achieve the leakage targets associated with each of the strategic options.
- Smart meters are allowing us to identify customer supply pipe leakage and plumbing loss leaks inside a customer's property. Although these leaks are not our legal responsibility to fix, they represent a significant proportion of total water lost through leakage. For example, in 2023/24, cspl accounted for nearly 22% of our total leakage. Once we have identified these leaks, we will then contact customers and proactively encourage them to fix their leaks. Smart metering data is also helping us to identify leaks on our network which can then be fixed more quickly, saving water.
- Smart meters will also facilitate a range of future water efficiency initiatives, such as non-price behavioural change incentives, financial incentives, or tariff options, which may generate further water saving.

As part of our original evaluation of smart meter technologies, for our WRMP19 program, we reviewed several types of technology including AMR (Automatic meter reading) and AMI (Automated meter infrastructure) meters.

- **AMR technology**

AMR is a technology of automatically collecting consumption data and transferring that data to a central database for billing and other purposes. We have trialled AMR meters in Colchester (2012-2017) with 21,000 meters installed, targeted by a 'mobile' network of passive readers. We equipped around 10 refuse collection lorries operated by Colchester Borough Council with passive readers which 'listened' for the AMR water meters, on their weekly refuse collection rounds. We found that reading yields varied from week to week, but, generally, only around 50% of meters were read every week and 75% read every four weeks (we would still need to visit the properties to guarantee a billing read). These results did not give us confidence that we could use this method of data retrieval for our customers, as it is clear that around a quarter of our customers would miss out altogether on weekly and even monthly reads. We would not be able to meet the customer expectation of a regular and reliable reading. Even if the data were reliable and comprehensive, the data can not be used to track down leaks on the network; a major benefit of hourly smart meter data.

We, therefore, decided not to progress AMR metering for our smart meter program, as a viable long term solution.

Thus, under our preferred smart metering option, we are installing AMI meters (monitored through a fixed network) to provide detailed granular daily usage data to our customers and for ourselves.

- **AMI technology: The currently preferred technological solution**

Our preferred solution currently involves smart meters and smart point transmitters. In this system, data is passed from the 'smart meter' to a 'smart point' on the under-surface of the meter box, which then transmits this, via a radio mast network. This is necessary as many external meters may be located at depth, where signals would be lost. This technology (as tested in our Newmarket/Norwich trials) allows hourly readings from the customer meter. Under the current system, the data is transmitted every four hours, (transmitting the last 12 reads each time). This means that we have several opportunities to capture each hourly read. These multiple reads (and data redundancy) are key to ensuring data accuracy and consistency, as the data is processed and analysed.

Data is then sent to our systems twice a day. Currently we receive the previous day's data, (e.g. Today's data will be visible to us from midday tomorrow), however, we are planning to get as near 'real time' data as is feasible. With regard to this data acquisition process, we are currently using a managed service from a proven supplier.

The key outcome of this will be the data that we receive, not necessarily the final technical solution we use.

3.2 Smart meter option development

Options for metering have been developed with reference to the following key variables:

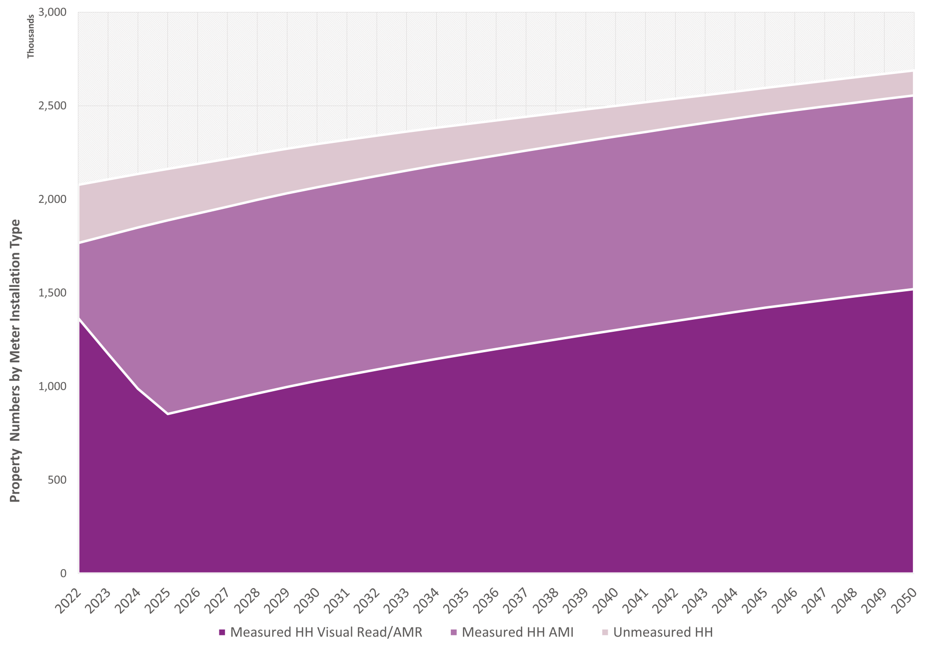
- **The metering trajectories** i.e. the number of properties, where meters would be installed, split by metering program (for example, optant metering, selective metering, enhanced metering, pro-active replacement, reactive replacement). In addition, the number of new domestic supplies (which will be metered on connection) per year was sourced from the property forecast prepared as part of the WRMP24 process.
- **The roll-out pattern and speed.** This information was provided as the number of meters to be installed per year per planning zone, as developed in accordance with the WRZ risk assessment.
- **The type of meters deployed:** dumb or smart;
- **The technology used to read meters:** manual reading for dumb meters and fixed network for AMI meters; and
- **The type of interaction with customers:** postal, email, customer portal for AMI metered customers.

3.3 Smart meter option summary

Several options have been developed to support demand reduction under the category of metering. These options are:

- Business as usual (BAU): Base-line metering; smart meters installed in alignment with WRMP19 (1.1M smart meters installed by 2025), with AID (accelerated infrastructure deployment) for AMP7. No additional smart meters beyond 2024/25. The figure below (Figure 13), shows the number of smart meters remaining the same, whilst 'visual read meters increase and unmetered customers decrease (as customers switch).

Figure 13 Base-line meter projections (smart and 'visual read')



- Advanced metering infrastructure (AMI) metering over 3 AMP periods. The Figure below (Figure 14), shows the number of smart meters increasing to full penetration by 2034/35, with no visual read meters beyond this point, whilst unmetered customers decrease (as customers switch).

Figure 14 Smart meter rollout, 3AMP, 15 year (from 2020)

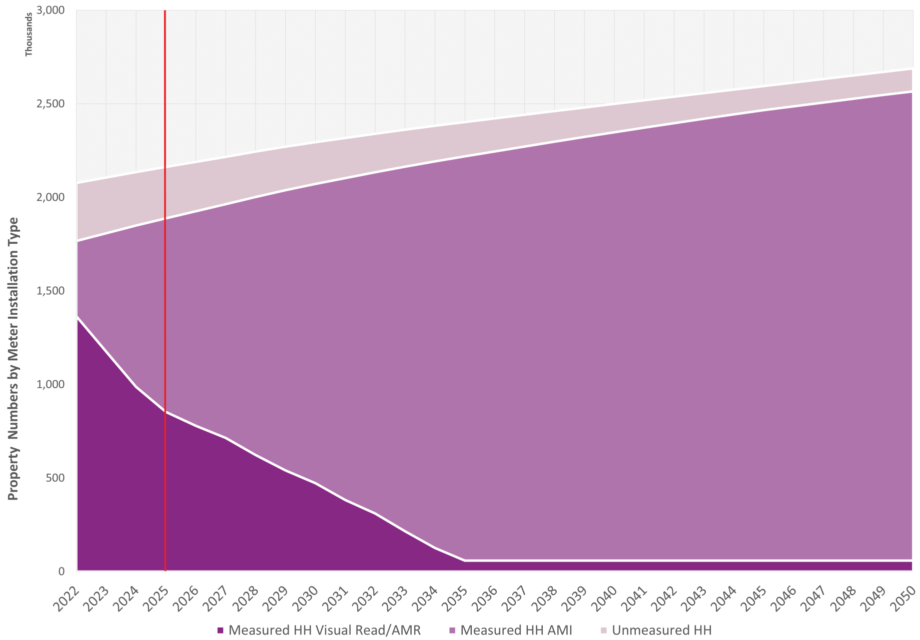
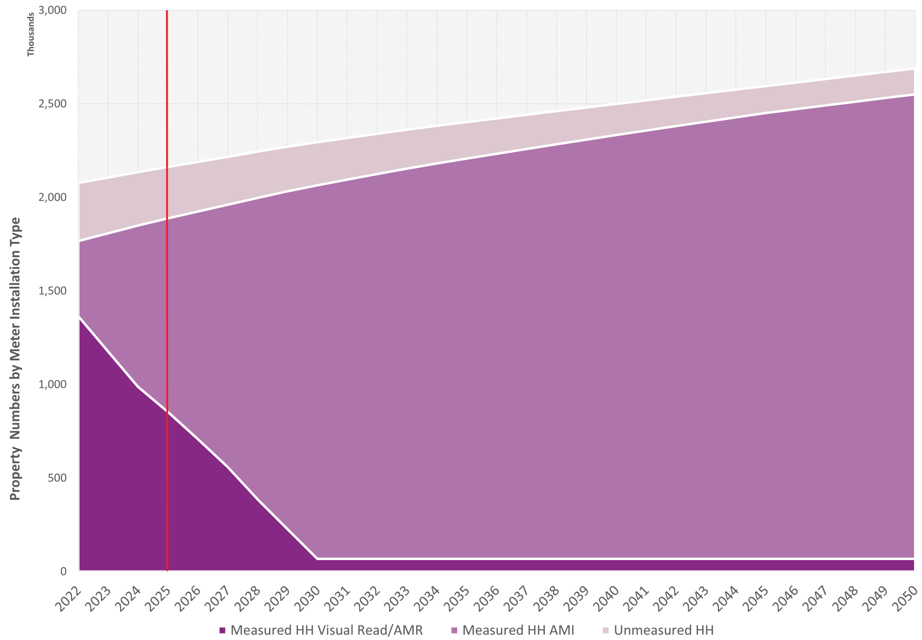
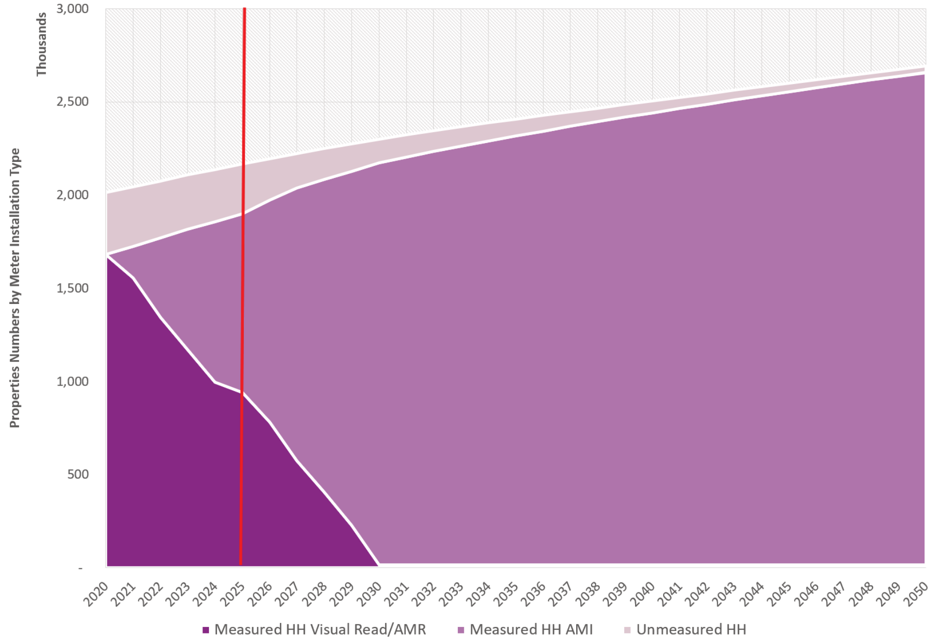


Figure 15 Smart meter rollout, 2AMP, 10 year (from 2020)



- Advanced metering infrastructure (AMI) metering over 2 AMP periods The figure below (Figure 15), shows the number of smart meters increasing to full penetration by 2029/30, with no visual read meters beyond this point, whilst unmetered customers decrease (as customers switch).
- Advanced metering infrastructure (AMI) metering over 2 AMP periods with a 'compulsory' element. The figure below (Figure 16), shows the number of smart meters increasing to full penetration by 2030, with no visual read meters beyond this point. The unmetered customers rump decreases further to it's theoretical limit, with maximum meter penetration.

Figure 16 Smart meter rollout, 2AMP, 10 year (from 2020) to maximum penetration



For the purposes of our cost benefit analysis we have assumed that the same or similar technology, as is currently being implemented for our company wide roll-out, is to be utilized. We have, therefore, used data from the current smart meter roll-out to inform our analysis.

All smart metering programs have been designed to reach full household meter penetration and are differentiated by the roll-out duration and, therefore, speed of installation. The strategies have been built to achieve over >94% coverage (with a scenario achieving >95%); this is considered to be a technically acceptable limit above which the cost of metering the remaining households is disproportionately high (i.e. flats with internal meters).

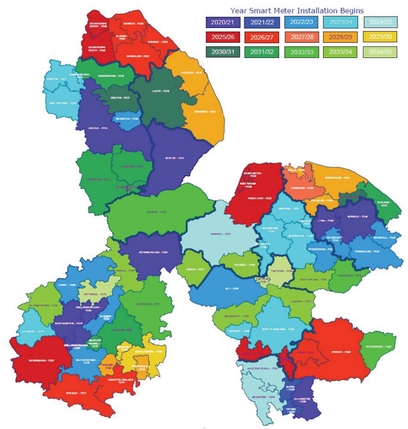
3.4 Meter programs and WRZ targeting

We have considered two key options for smart meter rollout, 10 year (2AMP) and 15 year (3AMP) from 2020. Whilst developing these projections we have considered several factors including:

- operational consideration (team deployment across the region)
- current meter penetration and the nature of the area (urban/rural)
- current and near term supply/demand balance (SDBI) pressures
- network infrastructure installation

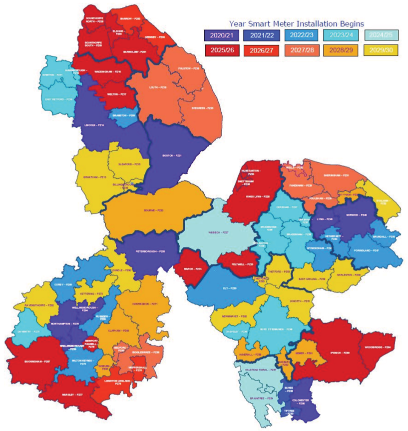
This has led to the following installation program for a 15 year roll-out to 2034/35 (Figure 17).

Figure 17 3AMP-15 year smart meter rollout



For our preferred plan we anticipate a 10 year roll-out to 2029/30 (Figure 18).

Figure 18 2AMP-10 year smart meter rollout



3.5 Metering costs and benefits

Current actual costs have been used to develop all the options, including all costs for below ground meter installation, internal installation, customer contacts and data systems. These costs have been provisionally included to reflect a 2020/21 cost base (as directed in the WRPG). Additionally, estimates for the cost of the communications network have been provided, by our chosen partners, for our current smart meter roll-out. These costs have been developed to reflect our future annual rollout plans.

Labour costs have been considered, from both the perspectives of using in-house or out-sourced resources.

Current thinking involves the concept of a 'Wheel and Hub' with the network being at the centre of system of services, accessible, both to our customers and internally for our monitoring systems. The network should meet a 'One for all' requirement; for leakage, telemetry, systems monitoring etc.

3.6 Metering core assumptions

The following core assumptions have been used in the modelling of future metering costs and benefits (Table 10).

Table 10 Metering key assumptions

Assumption	Description
AMP7 Smart Meters - base-cost	Note that smart meters installed in AMP7 are not considered part of WRMP24 enhancement and costs/savings are included in the baseline projection.
Preferred Smart Meter Rollout	The preferred portfolio currently includes a 2AMP smart meter rollout in alignment with WRMP19.
Behaviour saving attribution	Note that further consideration might be required regarding the attribution of behavioural change savings to smart meters (as opposed to Water Efficiency) as part of the CBA.
Baseline Options	Smart meter baseline options considered: • Smart Meter network to be switched off and all the AMI go back to AMR functionality, losing all AMI consumption/cspl/etc. savings. • Maintaining the Smart Meter network post AMP7 with the 1.1M installed meters, (and the relevant savings) but without adding any additional AMI - the absolute number of AMI (and savings) stays constant throughout the AMPs - Currently used in modelling. • Maintain AMI network with the smart meters already installed in AMP7 (and the relevant savings). Add AMI to all new-builds, switchers and optants in AMI metered PZs (in the AMI AMP7 program) - the absolute number of AMI meters (and savings) increases throughout the WRMP in alignment with growth.
CBA	Includes all metering costs (including PMX exchange) discounted over 80 years.
Back office	Back office system costs (IT systems, data management) have been included in the modelling.
Customer use	15% reduction of PHC when installing new 'visual read' meter to an unmetered property.
Behaviour Change Reduction with Smart Meter	An additional 2% reduction, due to behaviour change (16.7% in total from 'visual read' unmeasured) when installing new AMI meter to an unmetered property (initial 15% for unmeasured to measured status, with an additional 2% subsequently applied for smart meter savings) - Alternatively, 2% reduction when replacing existing metered/measured property with a smart AMI meter.

Assumption	Description
Plumbing loss savings	Savings currently based on initial findings from Newmarket/Norwich (long term 2 year data). Current estimate 12.1 l/prop/day reduction from base-line (20.4 l/prop/day). Approximate 4% reduction in PHC.
CSPL (Customer Supply Pipe Leakage)	Savings currently based on initial findings from Newmarket/Norwich (long term 2 year data). Current estimate 6.7 l/prop/day reduction from base-line (9.8 l/prop/day). Approximate 2% reduction in PHC.
Overall Smart Meter savings	Savings from behaviour, plumbing loss and cspl currently are estimated to be approximately 8%, which is an increase from WRMP19 (approximately 6%) based upon the new Plumbing loss/cspl data. Further updates on these savings will be possible as the smart meter program is established.
Leak Run Times	Current estimates of run times for Newmarket and Norwich give an average of 112 days. The majority of the leaks are rectified within 30 days with a smart meter, but the average is extended, due to a small number very long running unfixed leaks

3.7 Comparative cost of metering programs

Detailed analysis has been carried out with regard to each element of the meter rollout program, as both smart meters are introduced and 'visual read' meters continue to be replaced. This will reflect the sequential rollout of the smart meter program, WRZ by WRZ.

Thus for each metering program the following average costs per meter have been determined for AMP8 (and AMP9 for the 15 year roll-out).

These costs reflect the different metering programs:

- PMX - Proactive meter replacement of meters as they reach the end of their life, will be a mixture of dumb and smart based on geography.
- AMI Smart meter - Proactive replacement of 'dumb' meters which have not reached end of life in areas designated for smart meter rollout; all smart.
- RMX - Reactive replacement of meters. Meters which have malfunctioned; will be a mixture of dumb and smart based on geography.
- Meter Options - Customer driven meter installation program at the request of customers; will be a mixture of dumb and smart based on geography.
- Selective - Company driven meter installation program at properties where the current method of charging is not appropriate (RV no longer valid, unregistered properties); will be a mixture of dumb and smart based on geography.

In addition we have modelled the following types of interventions, associated with smart metering.

- AMI Leakage - Company driven program of leak investigations and visits where help for the customer to fix leaks is identified through smart meter data. We help identify the source of the leak in the customer's home or supply pipe, the customer then repairs it (for vulnerable customers).
- AMI Maintenance - Reactive replacement of smart points used to provide smart meter data.

Indicative costs can be shown (Table 11):

Table 11 Meter program installation costs

Meter installation costs	Average cost per meter AMP8
AMI - Smart meter	£60.02
PMX, internal (AMI uplift)	£23.02
PMX, external (AMI uplift)	£47.32
Visual read meter	£12.70
AMR meter	£37.00

Additionally, the meter volumes anticipated for each metering program for AMP8 can be shown (Table 12).

Table 12 Smart meter installations for AMP8 (2025-2030)

Program	2025/26	2026/27	2027/28	2028/29	2029/30
(AMI) - new installations (household)	36,493	36,168	36,825	34,924	32,428
(AMI) - upgrades from basic or AMR meters (household)	155,040	153,001	171,293	151,250	149,897

As discussed, the smart meter program has been designed to be geographically introduced area by area, as the data transmission network is completed. 'Visual read' meters will, therefore, continue to be installed in areas, where the data network has not been installed.

3.8 Metering quantitative benefits

Reduced customer use

Both dumb metering and smart metering can help reduce household water consumption.

Our assumptions regarding reductions in customer usage have been informed by;

- previous experiences of 'visual read' metering programs in the UK, which suggest that switching from being unmeasured to measured saves approximately 15%.
- data from the full smart meter roll-out (we now have >1M smart meters installed (2024/25)
- data from our long term Newmarket/Norwich trials and
- the experience to date from the energy smart meter roll-out.

The latest research into the effectiveness of metering programs, especially on the impacts of large-scale meter roll-out for remotely read (but not smart) meters in the UK indicate average savings of up to 16.5%. The international evidence for the impact on demand from all types of water metering reports demand savings in a range of 5 to 22%. The higher range of savings has been found to be associated with increased engagement with customers and smarter tariffs, such as IBTs.

There is emerging evidence that suggests smart meters can deliver additional water saving benefits, beyond the installation of a 'visual read' meter. Smart metering can reduce household consumption through:

- improved engagement with the customer (more accurate information accessible via a customer portal / mobile application; comparisons of water use within peer groups; provision of water efficiency advice, customer engagement program, etc.),
- the customer being made aware of, and reducing leaks on their supply pipes and by reducing 'plumbing losses' within their property.

In addition to offsetting strategic demand growth, lower consumption results in lower energy (pumping) and treatment costs for water.

This saving is calculated in our modelling, by utilizing water volumes and by using the marginal cost of water. Lower consumption will also mean lower bills for customers on measured charges. As less water is used by customers, there may also be a benefit in reduced costs for waste-water pumping and treatment, as less water is returned after usage. However, the evidence base for this is not as robust, as for reduced water consumption, therefore, we have not quantified this benefit at this time. It is also to be noted that waste-water returns are heavily weather dependent, due to infiltration of rain and storm water into waste-water systems.

We have not explicitly calculated the impacts of 'time of use tariffs' (or any other smart tariffs). We have not included these as a specific benefit in the assumptions above. However, we have assumed that over time, 'time of use', summer tariffs (which we will trial), or other sophisticated tariffs may be introduced to maintain or enhance the water savings. Smart meters are essential to unlocking smarter tariffs, therefore, we intend to trial and implement this type of option, as we progress towards our full smart meter roll-out (2029/30).

The ability of smart meters to reduce customer demand is closely interlinked with the provision of information. There are strong links between the proposed smart metering program and our water efficiency interventions. These will support each other to maximise the reductions in demand that can be achieved. A number of our proposed water efficiency activities are enabled by smart meters, but the benefits of those activities are not explicitly captured in our smart metering CBA.

3.9 Behavioural change savings

We have been keen to ensure that potential demand savings, that might be realized by the introduction of smart meters, are achievable and realistically reflected in the WRMP24 plan. We have, been keen to review our original assumptions from WRMP19 and in the WRMP24 plan, on the basis of longer term analysis. We have, therefore, conducted detailed independently verified, analysis of household data from both our full smart meter rollout data and the Newmarket/Norwich trials.

This has included:

- data from the full rollout of smart meters across the Anglian Water region (a cohort of approximately 150K smart metered properties with more than a full year of continuous data has been analysed, from the current installed base of >1M smart meters (2024/25)),
- along with the Newmarket and Norwich trial data (with a duration of more than 4 years) originally used for the WRMP24 plan. This long term sample of consumption/leakage data, for properties collected over the last four years, has allowed us to to observe what might be termed a 'new normal' for consumption and leakage.

This analysis has allowed us to determine values observed for cumulative and year on year changes in ADC (Average Daily Consumption per property); comparing values over the long term. Additionally, trial data has been compared with our internal regional consumption monitoring data, as a 'control'.

As more data has become available from our full AMP7 smart meter roll-out, we have continued to improve our understanding of smart meter benefits. We currently have installed over 1M smart meters (2024/25). We have also engaged with other UK water companies, through WRE (and WRSE), to further validate the appropriateness of the assumptions taken forward.

For the purposes of our demand forecast and CBA modelling, we have used the following assumptions:

- A behavioural change demand reduction of 15% in household consumption on installation of a meter to an unmetered property with the customer switching to being charged, based upon measured volume (based upon the average individual WRZ unmeasured PPC consumption values)
- A further behavioural change demand reduction of 2% (16.7% in total from the base value) when installing a new smart meter to an unmetered property, and
- A behavioural change demand reduction of 2% when replacing a dumb meter with a smart meter. This conservative estimate is based on the early results we have from Newmarket and is in line with the experience in the energy sector.

At this point in time, we believe a 2% reduction in consumption, due to behavioural change, when installing a new smart meter to an unmetered property, is representative of the long term impact we can expect on roll-out.

This aligns with the original assumption used in WRMP19 (3%), however, given that we have increased the potential savings from plumbing loss reduction and that we are also including a significant portfolio of water efficiency measures, we have felt it prudent to reduce the savings attributed purely to smart meter introduction to a 2% reduction for WRMP24 (when changing from dumb metering to smart metering).

Whilst, pursuing our analysis, we have also been mindful of the current volatility in household consumption due to the impacts of the Covid19 pandemic and the more recent rises in energy costs and their impacts on water usage (the 'cost of living crisis').

3.10 Plumbing loss and cspl savings

Plumbing loss and customer supply pipe leakage

Key to the detection of plumbing losses and customer supply pipe leakage, is continuous flow data from the hourly reads provided by smart meters. Thus, the availability of continuous flow information allows the identification of flow, when customer usage should be at a minimum or zero (night-flows), which typically indicates leaks in the system. Identification of these flows will enable any associated leaks to be speedily repaired, as these typically go unnoticed. Repair of the leaks results in lower energy and treatment costs, which are calculated using the marginal cost of water value of £92/Ml.

Initial analysis, has been conducted to review leaks detected and repaired after smart meters have been installed.

Long term data has been required for our analysis, in order to:

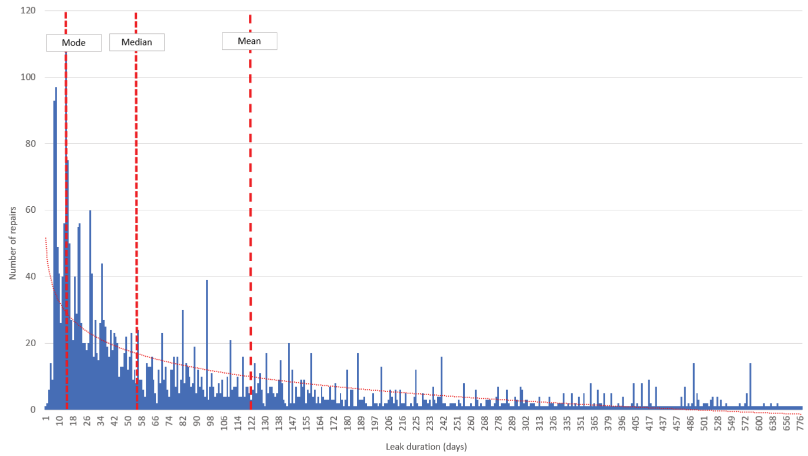
- understand initial leakage levels (associated with 'visual read meters') as smart meters 'discover' pre-existing leaks in properties (the pre-smart 'normal').
- break-out rates, as smart meters identify new leaks (and the new smart meter 'normal').

Research, based upon the long term Newmarket and Norwich data, has indicated that currently, even with smart meters, average leakage run-time duration is greater than 100 days. This number is driven by our customers who are responsible for fixing their own leaks, however, our policy is to work with customers to accelerate this process dramatically.

Although this appears to be a relatively high number, considering that smart meter customers should be contacted within three days, it must be noted that this average is skewed by a number of very long running leaks (with the vast bulk of leaks being fixed within 28 days). This figure has been calculated using the total days of leakage run-time divided by the numbers of leaks (so that leaks with run-times of 600 or 700 days disproportionately affect the overall number). Note that the maximum number of leak repairs occur between the 7 and 14 day period, such that the median run-time is 56 days, with the mode value of 14 days.

However, it is well below the estimated 210 days run-time for conventional 'visual read' meters. The distribution of leaks and run-times can be seen below. (Figure 19)

Figure 19 Newmarket and Norwich smart meter leak duration



This data has been used in order to determine the current and future 'normal' for cspl (leakage), 'plumbing loss' (PCC) and behavioural change savings.

Leaks are assessed by their relative size, P1 to P4, as below (Table 13) and this determines the nature of our intervention and communication with our customers. As part of our smart meter program, we are developing new and innovative ways to contact and communicate with our customers to assist them with finding and fixing their leaks and save money.

Smart meter data is now giving much greater insights into household continuous flow, indicating that 11% of customer properties have a continuous flow (leak) discovered upon the installation of a smart meter, and we experience a 4% leakage break-out rate.

Table 13 Leak sizes and interventions

Leak split (priority)	Volumes (litres/hr)	AWS action
P1	>1500	Sent to CLST -CLST is the customer leakage support team who work with the customer to ensure they are going to repair the leak - immediate action
P2	500-1500	Customer virtual visit leak investigation
P3	40-500	Customer virtual visit leak investigation
P3A	8-40	Major leak letter informing customer of leak details and required actions (customers can request a visit)
P4	<8	Minor leak letter informing customer of leak

As well as modelling the current situation with regard to smart meter leakage savings, options have been considered which should lower the average leak duration below the current >100 day period, and, therefore, increase savings.

Our original draft WRMP24 understanding of smart metering (based upon our trial data) suggested that potential future targets would yield savings as below (Table 14).

Table 14 2025 Potential leak run-times and savings for alternate scenarios

Scenario	HH SM Properties @ 2025 - AMP7	Target max runtime (Days)	Average runtime (Days)	CSPL saving - AMP7 (Ml/d)	PL saving - AMP7 (Ml/d)	Total saving from baseline - AMP7 (Ml/d)
Baseline (Visual Read)	1,100,000		210**	N/A	N/A	N/A
Current smart metering	1,100,000	(795*)	112	7.4	13.3	20.7
Runtime=100 days	1,100,000	100	59	8.8	17.9	26.7
Runtime=80 days	1,100,000	80	51	9.0	18.5	27.5
Runtime=60 days	1,100,000	60	42	9.2	19.2	28.4
Runtime=40 days	1,100,000	40	31	9.5	20.1	29.5

- - *"If the active leakage control policy is to carry out leak detection surveys across the whole system on an annual basis, then some leaks will be up to one year old, having just occurred after the last survey, whilst some will be no more than a few days old. The average duration of an unreported burst will be half of the interval of the survey". We therefore assumed here that for meters read once per year the average leak detection time is six months i.e. 180 days.*
  - **Note that analysis from Newmarket/Norwich indicates that the average leak run time is >100 days and that the maximum run-time in the dataset was 795 days.This figure has been calculated using the total days of leakage run-time divided by the numbers of leaks (so that leaks with run-times of 600 or 700 days disproportionately affect the overall number). Note that the maximum number of leak repairs occur between the 7 and 14 day period, such that the median run-time is 56 days, with the mode value of 14 days.*
  - *** Note that the estimate of average run-time for conventional 'visual read' meters has been assumed to be based upon a yearly read, giving an average half yearly runtime of 180 days plus the grace period for repair of 30 days, giving a total of 210 days. The actual value may be higher.*

In detail, future savings have been calculated, based upon:

- the average number of leaks that should occur for a given number of properties (the break out rate)
- an assessment of run-times and leak volumes (with smart meter interventions in place)
- an estimate of where varying sizes of leaks might occur. We have currently assumed that smaller leaks will on the whole be attributable to internal plumbing losses and larger leaks will tend to be customer supply pipe leaks.

This led to the following original analysis for each leakage category, based upon their attribution to internal plumbing loss or external customer supply pipe leakage (cspl), which was originally included in the draft WRMP24 (Table 15).

Table 15 Analysis of plumbing loss and cspl savings for differing run-time scenarios

Leaks	Household	All			Leak run-times			
				Average leak duration:	59 days	51 days	42 days	31 days
				Target duration:	100 days	80 days	60 days	40days
	% of Px leaks	Baseline (Dumb meters)	Current smart meters	Saving on switch from dumb to smart meter	Future smart meters	Future smart meters	Future smart meters	Future smart meters
		l/prop/d	l/prop/d	l/prop/d	l/prop/d	l/prop/d	l/prop/d	l/prop/d
CSPL								
P1	90%	2.7	0.62	2.09	0.61	0.61	0.62	0.60
P2	27%	2.4	0.42	1.94	0.23	0.19	0.15	0.11
P3	31%	3.8	1.38	2.45	0.69	0.60	0.49	0.37
P3A	16%	0.8	0.53	0.27	0.24	0.21	0.17	0.12
P4	100%	0.1	0.16	0.01	0.08	0.07	0.06	0.04
Total		9.8	3.1	6.7	1.9	1.7	1.5	1.2
PLUMBING LOSSES (PL)								
P1	10%	0.3	0.07	0.23	0.07	0.07	0.07	0.07
P2	73%	6.3	1.11	5.18	0.63	0.51	0.40	0.28
P3	69%	8.5	3.05	5.41	1.53	1.33	1.09	0.82
P3A	84%	4.1	2.74	1.38	1.24	1.07	0.87	0.64
P4	90%	1.2	1.34	0.11	0.68	0.59	0.48	0.35
Total		20.4	8.3	12.1	4.1	3.56	2.91	2.16

After further consideration of the data from the wider smart meter rollout cohort (>150K smart meters), we have, however, concluded that current continuous flow savings attributable to smart metering should be limited to 40% of those originally estimated for the draft WRMP24 (for 2021/22) and that this should then increase, as systems become embedded (and as an indication of our ambition) on a glidepath to a value of 90% of the original estimation by 2031/32 (and beyond).

This revised analysis indicates that we potentially expect continuous flow savings for cspl and plumbing loss as below (Table 16).

Table 16 Smart meter continuous flow reduction glide-path

10 year profile - 90% outcome	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
cspl saving profile (l/prop/d)	2.68	3.01	3.35	3.69	4.02	4.34	4.69	5.03	5.36	5.70	6.03
plumbing loss profile (l/prop/d)	4.84	5.45	6.05	6.66	7.26	7.87	8.47	9.08	9.68	10.23	10.89
total saving (ex. Behaviour) (l/prop/d)	**7.52**	**8.46**	**9.40**	**10.34**	**11.28**	**12.22**	**13.16**	**14.10**	**15.04**	**15.98**	**16.92**

Note that we still expect significant reductions in continuous flow (both for plumbing losses which impact PCC and customer supply pipe leakage (cspl) which impacts our leakage total) from the 7.5 l/prop/day, which we are currently seeing, to 16.9 l/prop/d by 2031/32.

We will continue to analyse data to ascertain the potential final 'new normal' for household leakage/continuous flow and to realise the full smart meter benefit.

For our WRMP24 we have continued to assume a 2% impact on customer behaviour (per capita consumption). We, therefore expect to realise:

- a 2% impact on customer behaviour (per capita consumption).
- an average reduction of 10.89 l/prop/day, due to the timely identification of plumbing loss leaks and their repair by the customer, by 2031/32. This is an approximate 3% reduction in per capita consumption.
- an average reduction of 6.03 l/prop/day, due to the timely identification of customer supply pipe leaks and their repair by the customer, by 2031/32. This is an approximate 2% reduction in per capita consumption.

This can be visualised as shown (Figure 20).

Figure 20 Revised SM continuous flow saving assessment for WRMP24

	Base-line pre-smart		2022 with smart	2032 with smart		2022 Saving	2032 Saving
Baseline - cspl. (leakage)	9.8 l/prop/day	With SM - cspl. (leakage)	7.12 l/prop/day	3.77 l/prop/day	SAVING - cspl	2.68 l/prop/day	6.03 l/prop/day
Baseline - Plumbing Loss. (PCC)	20.4 l/prop/day	With SM – Plumbing loss. PCC)	15.56 l/prop/day	9.51 l/prop/day	SAVING – Plumbing Loss	4.84 l/prop/day	10.89 l/prop/day
Current BL – cspl/PL total Per Property	30.2 l/prop/day	Total cspl/PL with a Smart Meter	22.68 l/prop/day	13.28 l/prop/day	Total SAVING Per Property	7.52 l/prop/day	16.92 l/prop/day
Current Base-line assessment of cspl/PL per property		Assumed 'new normal' level of cspl/PL per property with SM for 2022 and 2032			SM SAVINGS for cspl/PL per property for 2022 and 2032		

30 l/prop per day base-line assumption has been agreed in alignment with the water balance assessment.

Behaviour change SAVING assumed to be 2% per person for consumption, due to water efficiency (note potential for double counting with WEF options has been considered)

Note that these savings from our smart meter program are key to achieving our target of 110 l/h/d by 2050.

At this point in time we have assumed there are no customer supply pipe leakage savings from unmeasured properties, attributable to smart metering program, because there is no financial incentive for the customer to undertake a repair. However, in practice, due to our enhanced program, some customers will be metered, but paying unmeasured charges and in this case we will be able to identify these leaks.

Note that the savings (over the WRMP24 planning period), from the 1.1M smart meters being installed between 2020 and 2025 (AMP7) are included in the WMP24 baseline forecast, with only the savings from the additional smart meters installed in AMP8 included in the WRMP24 enhancement program.

As part of our final aim for the WRMP24 and will develop further options that should assist in reducing leakage run-times further. These are termed our 'leakage 100' options based upon a maximum run-time of 100 days.

3.11 Reduced customer service costs

Smart metering will reduce the cost of dealing with customer contacts. This is mainly the result of more accurate billing, leading to fewer 'bill shocks' for customers (which result in customer contact). We will also have more detailed and regular information available to our Customer Services staff, which will allow us to answer enquiries more efficiently. This will be treated separately from the costs of up-front customer engagement regarding the introduction and installation of smart meters.

We have used our existing data on the cost of individual customer contacts to inform our preferred plan. To simulate lower customer service costs, we have assumed that customer contacts would reduce from 0.61 per property per year to 0.39 contacts per property post the smart metering program.

3.12 More efficient meter reading

A key expected benefit of smart metering will be a reduction in meter reading costs compared with dumb metering. Meter reading using the traditional walk-by or drive-by methods will be phased out and savings will start accruing through AMP7 and beyond into the WRMP24 planning period, achieving full impact upon the completion of the smart metering roll-out program (2029/30).

The following elements have been included in the quantification of this benefit:

- Reduced household meter reading activity from remote data transfer via Fixed Network.
- Cost saving from stopping leakage reads.

In addition to a reduction in operational costs, the avoided travelling required for meter reads will reduce carbon emissions; this benefit has been quantified and included within this building block.

3.13 Replacement of loggers with smart data

We currently install data loggers when a non-household customer exceeds a certain level of daily use or for customers with high levels of night use. Once the smart meter data network is available, we will look to consolidate systems, such that the data these provide would be readily available. This will potentially negate the need for their replacement. IT investment, however, will be required to create the necessary flows of data through the various corporate systems to ensure leakage reporting continues unchanged.

3.14 Reduced carbon emissions

Reduced demand for water has a resultant impact on a customer's carbon emissions. We have, consequently, considered carbon impacts associated with reduced demand for water in the following way:

- Carbon emissions associated with the direct use of electricity are not monetised separately, as electricity prices already account for this cost. Hence, the carbon emission costs associated with water pumping are already included in the electricity costs from pumping the water.
- Carbon emissions associated with other forms of fuel (gas, oil, petrol, diesel, etc.), along with non-electricity embedded carbon, do have a monetary value assigned to them. In line with Ofwat's approach, the calculation of the impacts from changes in hot water use in the home only considers the carbon emissions associated with those changes. The monetary value has, therefore, been calculated for the non-electricity heating of water.

3.15 Metering conclusions

Our preferred metering strategy will consist of a continuation of our WRMP19 smart metering program, and will complete the replacement of our entire meter stock over 10 years, by 2029/30 (2 AMPs). We are currently progressing the rollout of our AMP7 program of smart meter installation of 1.1M meters by 2024/25 (We currently have >1M smart meters installed 2024/25). We have also re-adjusted our installation profiles to account for the AID program (Accelerated Infrastructure Delivery); installing an additional 60K smart meters in AMP7. All smart meter savings associated with the AMP7 smart meter program are now included in our baseline forecast.

The data resulting from smart metering is helping to inform our customers regarding their water usage and is assisting in our ability to inform them of potential water efficiency savings. It is also helping with our ability to detect leakage, speed up repair and understand our system.

We intend to build upon our initial findings, refining our interactions with our customers and enhancing savings over time.

By the end of AMP7 (from our 2021/22 base-line), we now estimate that smart meters, combined with the behavioural change and the improvements in leakage performance that they enable, will result in up to 3.5Ml/d demand savings from behavioural change, 2Ml/d savings from quicker plumbing loss repairs (which impact PCC) and up to 1Ml/d reduction in cspl repairs.

The enhanced additional smart meter program is forecast to enable savings of 15.6Ml/d by 2029/30. By the end of our WRMP24 planning period (2049/50), we estimate smart meters will result in savings of 30.4Ml/d, constituted of:

- 7.0Ml/d of savings from behavioural change,
- 15.8Ml/d savings from quicker plumbing loss repairs, and up to
- 7.6Ml/d reduction from customer supply pipe leaks (cspl) repairs.

Note these savings have been revised based upon the 2023/24 base-year forecast.

From 2024/25 to 2049/50, we estimate that the entire smart meter rollout will save approximately 50Ml/d of water due to behaviour change and reduction in plumbing losses and customer supply pipe leakage (cspl).

We also intend to encourage our customers who have a meter, but are not billed upon their usage, to switch to being measured customers.

3.16 Metering qualitative benefits

There are a broad range of additional benefits to our smart meter options, beyond those quantified in our CBA and described above. Fundamentally smart meters are allowing us to revolutionise the service we provide to our customers.

3.17 Customer focus

We believe there is great potential for smart metering to encourage customer engagement, making them part of the ‘water saving’ journey, and allowing us to produce an individually tailored service.

Moving from estimated bills, or annual meter reading, to more accurate and timely consumption and billing information will assist our customers to understand their water usage (as well as helping to identify leaks). By providing more online functionality, we are enabling customers' access to a more modern service, which is in line with current digital expectations. Additionally, the data which is now becoming available from smart metering is providing ‘peace of mind’ for customers, as they can be confident that the meter is recording consumption hour by hour and that any leaks will be identified in a timely manner.

Improving the nature and accessibility of consumption data may also allow opportunities for further demand management through innovative tariffs (which we are beginning to trial) and other service offerings. As highlighted in the UEA's research on price and non-price signals, the provision of consumption information is an important enabler for behavioural change. Providing timely price signals and engaging customers with their own water consumption, is a prerequisite for the potential development of new tariffs.

Our understanding of local supply and demand issues, is allowing us to tailor our engagement with customers so that they might be engaged more directly (for example allowing the link between behavioural change and conservation efforts on local water courses to be demonstrated).

3.18 Environmental benefits

By helping to enable demand reductions, smart meters are providing significant environmental benefits. In particular they are mitigating growth, reducing the amount of water abstracted from the environment and potentially off-setting the need for additional supply side investments (which often have larger environmental impacts). Additionally, in mitigating demand, smart metering and our new methods of engagement, will help improve the resilience of our services to extreme events.

3.19 A holistic approach to water efficiency activities

There are strong links between the smart metering program and both leakage and water efficiency options. As previously discussed, our ambitious target for leakage reduction will only be achieved with the supporting data from our smart meter program.

There is also a very strong link between our smart meter strategy and our water efficiency program. Our ability to show customers their water use in near real-time, is allowing a 'step change' in customer understanding of their consumption, allowing us to tailor water efficiency initiatives directly to our customers.

Smart metering will also allow us to optimise our network operations. Understanding consumption patterns better means that we can improve our models and pressure/pumping systems to save energy and costs.

3.20 Smart metering scenarios and costs

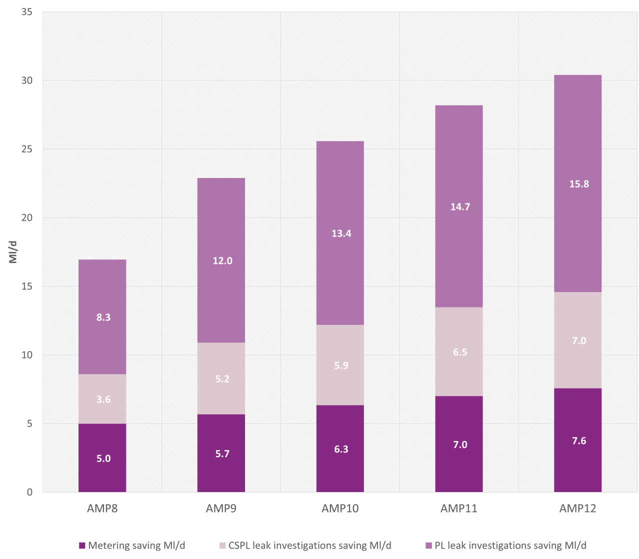
The smart meter installation options have been modelled to reflect a 2 AMP (10 year rollout from 2020) and an option of a 3 AMP (15 year rollout from 2020).

- Note that significant costs for smart metering are now being accounted for in the base-line, rather than in WRMP24 enhancement.
- Note that the additional financing costs are calculated using the WRMP24 guidance, using 3.2% WACC based on the CMA PR19 re-determination. Opex savings are calculated based upon the value of water saved only.
- Note all tables and graphs show AMP out-turn (Final Year) values not AMP average.

2AMP (10 year) Smart meter installation program Extended Plus - Preferred Plan

Full installation by 2030 is our favoured option and aligns with leakage aims for AMP8. Benefits being realized by 2030 will greatly help our supply-demand balance (34Ml/d by 2050). Meter penetration will be 95.2% by 2050 (Figure 21).

Figure 21 Smart meter savings - 2AMP rollout



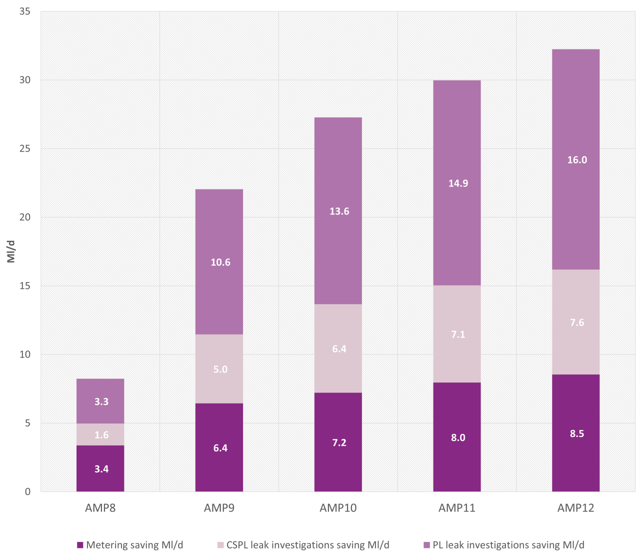
The 2AMP roll-out costs can be shown for AMP8 and AMP12, for the enhancement program Table 17.

Table 17 Smart meter 2AMP option costs

	Total Cost (AMP8) 2030	Out-turn Saving (AMP8) 2030	Cost per Ml/d (AMP8) 2030	Total Cost (AMP12) 2050	Out-turn Saving (AMP12) 2050	Cost per Ml/d (AMP12) 2050
WRMP24 Enhancement Only (AMP8 to AMP12)						
Fixed Capex/Opex inc - Finance	£124.95m	15.56Ml/d	£7.44m	£281.86m	30.40Ml/d	£7.44m
Fixed Capex/Opex pre - Finance	£117.31m			£244.82m		
Opex saving	£1.50m			£18.77m		

3AMP (15 year) Smart meter installation program

Figure 22 Smart meter savings - 3AMP roll-out



The 3AMP roll-out costs can be shown for AMP8 and AMP12, for the enhancement program (Figure 22).

Table 18 Smart meter 3AMP option costs

	Total Cost (AMP8) 2030	Out-turn Saving (AMP8) 2030	Cost per Ml/d (AMP8) 2030	Total Cost (AMP12) 2050	Out-turn Saving (AMP12) 2050	Cost per Ml/d (AMP12) 2050
WRMP24 Enhancement Only (AMP8 to AMP12)						
Fixed Capex/Opex inc - Finance	£81.16m	8.45Ml/d	£9.60m	£341.17m	32.24Ml/d	£8.85m
Fixed Capex/Opex pre - Finance	£77.40m			£302.77m		
Opex saving	£0.72m			£17.43m		

3.21 Compulsory metering

As we are in an area of serious water stress, we have an obligation to consider the costs and benefits of compulsory metering.

The results from multiple sources show that, generally, customers are much more supportive of universal and compulsory metering than has been the case previously. However, customers who pay measured charges tend to support compulsory metering, whereas those who pay unmeasured charges do not. We believe the higher levels of support for compulsory metering reflect the larger proportion of customers paying measured charges.

Defra's Guiding Principles state that the government does not believe a blanket approach to water metering is the right way forward.

The majority of our customers, 84% (in 2023/24) are metered and pay measured charges. Additionally, another 7% of our customers have a meter fitted (through our enhanced program), but are not billed upon their measured volume. In total we have 91% of our customers with a meter.

By the end of WRMP24 (2049/50) we expect 95.2% of our customers to be metered and measured, which we would consider to be close to our theoretical maximum meter penetration (our current absolute maximum meter penetration by 2049/50 has been estimated to be 95.4%). However, our modelling indicates that we would still have a number of metered/unmeasured customers at the end of the WRMP24 planning period, without further intervention.

Analysis shows that unmeasured customers tend to use more water than our measured customer base. Currently (2023/24) measured customers have a PCC of 120.6 l/h/d and unmeasured customers have a PCC of 164.4 l/h/d.

Customers are currently switched to being metered and measured upon request, or upon moving house (in that, any house which has a meter, automatically becomes a measured property upon the arrival of new occupiers) and as part of our WRMP24 innovation program we will investigate how we might engage with our unmeasured/metered and unmeasured/unmetered customers further, in order to persuade them of the benefits of measured status, and help us to achieve the maximum measured/metered penetration possible.

To test a potential universal and compulsory metering program, we have analysed an alternative scenario. This achieves a marginally higher metered/measured penetration of 95.4% by 2049/50 as opposed to the 95.2% level achieved in our preferred WRMP24 plan.

- This higher scenario only saves an additional 1.84Ml/d by 2049/50 (32.24Ml/d as opposed to 30.40Ml/d)
- However this scenario costs £253.02M (new 302.77M) as opposed to (new £244.82M) £223.29M for our preferred plan (Enhancement costs only, excluding finance and opex savings); a significant cost for a marginal benefit.

As part of the development of our WRMP24 we have continued to investigate how we might pursue a universal (or compulsory) metering strategy, whilst being mindful that:

- the costs of achieving 100% metering penetration will be very high, supposing this is feasible.
- compulsory metering could cause affordability problems for some customers and
- compulsory metering could result in a loss of customers' goodwill.

As part of our compulsory metering program we would also also move our remaining unmeasured (unmetered) customers to an assessed charge. This would mean that these customers would be charged based on an assessment of likely water use determined from a survey of the property.

Our current view is that the additional cost to reach the 95.4% theoretical maximum meter penetration, would not be cost beneficial, however we do intend to implement a compulsory metering program in AMP8, such that we encourage all customers who have a meter to switch to pay a measured charge.

Whilst considering this program we have consulted with a group of our vulnerable customers, in order to understand and try to alleviate their concerns. We understand that there are particular groups of customers (who might have high usage due to ill health), who might be impacted, and we are keen to help them as much as possible through any transition period. We do currently have a number of tariffs designed to help our most vulnerable customers and we will work to ensure that these will be developed further in parallel with any compulsory program.

4 Leakage Options

We are determined to continue to improve on our excellent long term performance reducing leakage. To this end we have considered a large number of sub-options for leakage reduction activities. We have ordered the long list of detailed sub-options by Average Incremental Cost (AIC) and adjusted for overlaps and dependencies. We used this AIC ranking to generate a number of sub-option scenarios, for each of our WRZs. These portfolios have been aligned to our broad option packages which cut across leakage, metering and water efficiency. These options are above and beyond the activities which we are currently undertaking.

Whilst developing our preferred plan we have reviewed;

- the Leakage Routemap, PIC (Public interest commitment) and NIC (National infrastructure commitment) targets,
- our current position as a company (in relation to other water companies) and
- future potential outcomes.

Costs and benefits have been generated for a number of scenarios achieving alternate leakage reductions and the preferred plan has been selected to provide us with an ambitious, but achievable goal, indicating our level of commitment to the National Target, without burdening our customers with significant additional costs in the near term.

Our intention is to make a fair and equitable contribution to the overall national leakage target of a 50% reduction in leakage from the 2017/18 base-line for England and Wales.

We have assessed a 50% reduction in leakage (achieving a leakage level of >90Ml/d) as requiring very significant mains replacement at an estimated cost of over £20 billion. We currently consider this to be an unrealistic burden upon our customers and have, consequently settled upon a leakage reduction of approximately 30%, which still allows us to meet the industry level NIC and PIC targets (in terms of leakage per property and leakage per km of main). To achieve our ambition we will need to use innovative techniques, as well as tried and tested methods (including mains replacement).

Smart metering is currently offering an opportunity for a step change in detecting customer supply pipe (external) and plumbing loss (internal) leaks by improving our understanding of continuous flows in customer properties (usually indicating a leak), as well as increasing our overall understanding of our network. Customer supply pipe leakage currently accounts for 22% of total leakage (2022/23). As smart meters are introduced we expect cspl to be reduced by 70%.

We will continue to actively explore how the use of state-of-the-art technology can help us to achieve further leakage reductions. This is why the concept of ‘zero leakage and bursts’ is one of the seven goals of our 'Shop Window' initiative. We also continue to actively trial technologies such as fibre optics to detect leaking pipes and the use of satellite imagery to identify leakage.

4.1 Leakage core assumptions

A range of leakage scenarios have been developed reflecting Active Leakage Control (ALC) measures, pressure management, and mains replacement.

Options included:

- Increased leakage ‘Find & Fix’ activity
- Pressure management schemes
  - Type 1 - Lower Variance Higher Range Of Pressure: Creation of new optimised network areas by installing new and sometimes automated boundary valves, thus creating a discrete, but dynamic area, together with the installation of pressure control equipment with advanced sensing/monitoring points and advanced anomaly detection systems.
  - Type 2 - Higher Variance Higher Range Of Pressure: Creation of optimised network areas by removing areas of high head-loss and reducing higher pressures.
  - Type 3 - Higher Variance Lower Range Of Pressure: Creation of optimised network areas by recovering head-loss and managing resultant pressures and demands. Understanding the likely lengths of main and assets in order to configure and manage pressures within the area.

- Leakage driven mains replacement
- Replacement of shared supplies for household properties currently fed via a shared supply.

Note that base maintenance costs are not included. All costs refer to enhancement.

Note that the base-line assessment for leakage has been modified to reflect new reporting methods since WRMP19.

Option savings for Cost Benefit Analysis:

Assumed savings vary by option, with DMA characteristics and current leakage levels driving potential reduction.

Cost assumptions:

- Increased leakage 'Find & Fix' activity: based on current activity for annual maintenance and proportional increase in 'Find & Fix' cost for transitional activity assuming no change in the current ALC process. Post-implementation ALC costs proportionally increased to reflect more frequent surveying to maintain leakage at the lower level.
- Pressure management schemes costed between £75K and £200K
- 194 Pressure management schemes included, with an average cost per Ml/d of £1.9m.
- Leakage driven mains replacement costed at out-turn rates.
- Shared supply leakage reduction are just over £1m per Ml/d saving.

Further considerations:

- Permanent noise logging implementation needs further consideration for inclusion in leakage modelling.
- Further consideration will be needed regarding how we embed the use of smart meter data into our leakage operations.
- Note that there is uncertainty regarding both the associated costs and benefits.

4.2 Leakage reduction sub-options

The sub-options we have considered to enable reduced leakage are outlined in the table below. For all of these sub-options, except the targeted investigations, the potential sites where this sub-option could be deployed have been allocated to the strategic options on the basis of the AIC ranking:

- The least costly sub-options being included in the 'Extended' package,
- The following tranche of sub-options in the 'Extended Plus' package and,
- A further set of sub-options in the 'Aspirational' package.

The types of leakage intervention can be described in detail as below (Table 19):

Table 19 Leakage sub-options

Type	Name	Description
Leakage enabling	Identifying previously unknown consumption	Use of analytical methods and surveys to identify customers that are likely to be using more water than estimated by comparing metered consumption with expected consumption for customers with the same given characteristics. These properties are then examined in the field to identify unknown connections or previously under-registering meters. This includes improving understanding of plumbing losses, especially within properties. Plumbing losses are part of consumption, but because they appear in night flows they can be mistaken for leakage.
	Improved district metered area meter operability	Increased maintenance expenditure on district metered area (DMA) meters to improve reliability and data collection. This will provide leakage data more reliably which will allow high leakage DMAs to be identified and allow rises in leakage to be identified quickly. In line with regulatory requirements to ensure 95% of DMAs are operational.
	More large user logging and bulk metering to improve understanding	Increase the number of large non-household consumer meters and Water Recycling assets that are permanently or temporarily logged, particularly for night flows. This provides better information on where leakage exists for operational use and also provides greater accuracy in leakage reporting.
	Trunk main and service reservoir leakage reduction by improved metering	Increased metering of our upstream network. Improving understanding where water flows and where losses are occurring. Enabling better regulatory reporting and better targeting of leakage reduction methods in the right places.
	Raw water mains monitoring	Increased metering of our upstream raw water network. Improving understanding where water flows and where losses are occurring. Enabling better regulatory reporting and better targeting of leakage reduction methods in the right places.
	Metering SR inlets and outlets	Increased metering of our reservoir inlet and outlet meters. Allowing reservoir losses to be separated from other distribution losses, improving understanding where water flows and where losses are occurring. Enabling better regulatory reporting and better targeting of leakage reduction methods in the right places.
Leakage reducing	Targeted investigation of high leakage DMAs	Investigation of DMAs with high leakage or with high recurrence rate and resolution of the cause of the problem. This will include a seven-stage program starting with data gathering and ending when resolved. Resolution may range from correction of erroneous data to significant infrastructure renewal or redesign.
	Targeted extension of pressure management	Design, construction, and commissioning of new pressure management schemes. Schemes are of two types - those at a specific level (e.g. a DMA) and non-specific schemes at a planning zone level.
	Upgrade of controllers for PRVs and pumps	Retrofit improved controllers to pumps and valves to enable more precise and responsive pressure profiles to be maintained that minimise leakage whilst providing adequate pressures at critical points at all times.
	Jack-head tower optimisation	Redesign of Jack-head tower systems to reduce the range of pressures in the area supplied. Variable pressure and high pressures cause higher burst frequencies and higher leakage levels than would occur if fed at a lower and more even pressure.
	Transient investigations	Investigating the existence of pressure transients using transient loggers, tracing the sources of those transients and removing the causes. This is a newly developed branch of leakage control activity.
	Leakage targeted mains replacement	Leakage targeted water mains replacement in order to reduce water losses from our network. The main benefit is to reduce 'background' losses, which are made up of many small leaks which are undetectable due to their low flow rates.

The leakage sub-options represent a range from tried and tested to innovative and less certain. The table below captures the basis for our assumptions (Table 20).

Note that leakage reduction options are assumed to require repeat costs every ten years.

Table 20 Leakage source of assumptions

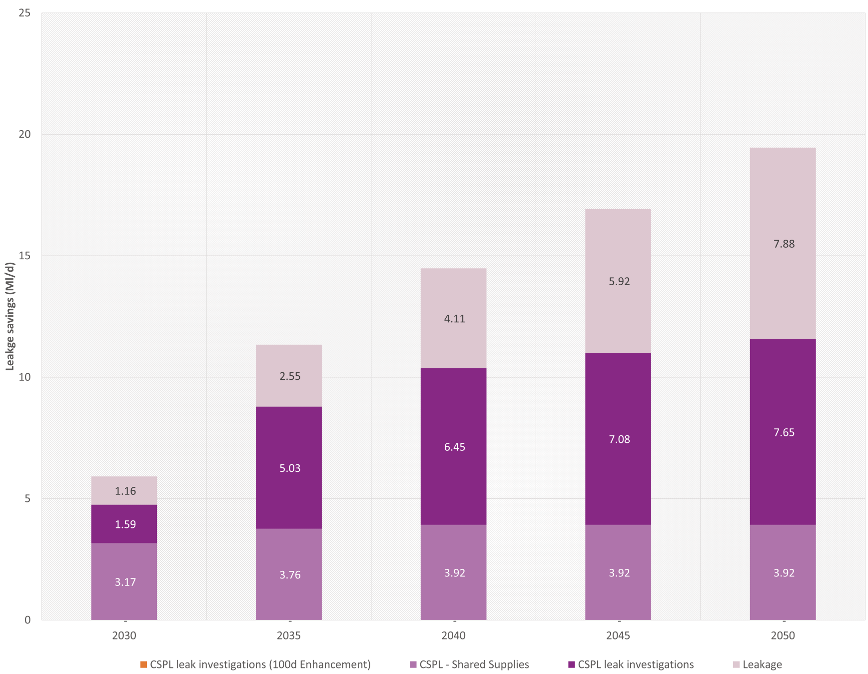
Name	Notes
Targeted investigation	Resolution of leaks can occur at different stages of investigation, resulting in a wide range of actual costs of resolution. We have used the results of investigations and examples of costs and proportion of investigations solved at the different stages to project costs and savings. The expected savings from customer supply pipe leaks has been factored down to account for smart metering option.
Pressure management	These schemes may cover the same DMAs that are identified in the high leakage DMA investigations - the scheme savings are factored down to take account of these overlaps. An allowance was also made to account for the number of schemes that would prove unfeasible at the point of detailed design or implementation. Cost and benefit information is based on our experience of the cost of these schemes to date in AMP7. Savings projected beyond specific schemes already identified using the UKWIR 2011 Long Term Leakage projection method.
Pumps and valves	These options are for specific existing schemes using the costs and benefits calculated from leakage levels, pressures and burst rates for the areas affected. Extrapolation of these options to cover schemes not yet identified is implicitly included in the extrapolation of the "Extension of Pressure Management" option using the UKWIR 2011 Long term Leakage methodology. Cost and benefit information based on our experience of the cost of these schemes to date in AMP7.
Tower optimisation	The costs and benefits estimated are based on a limited data set. We have concluded one optimisation scheme and extrapolated to the other feasible schemes, which are spread equally across the network.
Transient investigations	Transient investigations are a newly developed branch of leakage control activity. We have used data from our trials to derive cost and benefit estimates that could be made from a number of individual investigations.
High cost intensive investigation	High cost intensive investigation included in the "Aspirational" portfolio and is based on a very limited data set.
Leakage targeted mains replacement	Water mains replacement is one of the key methods for reducing physical water losses from the network and is included in our 'Aspirational' portfolio. The main benefit of this is that it should reduce so called 'background' losses. Background losses are a component of total physical losses that cannot be detected and therefore reduced using active leakage control (ALC). This is because background leakage is made up of many small leaks which are undetectable due to their low flow rates. These types of options require an estimate of the relationship between the fraction or length of network renewal (typically at DMA level) and the leakage saving. The fraction/length of mains targeted for renewal can be identified using similar approaches and range from 100% of network within a DMA to selected lengths informed by hotspot analysis.

4.3 Leakage scenario costs and benefits

The leakage options that have been considered are:

Extended Low Option (Scenario 1001) (Figure 23)

Figure 23 Extended low option leakage savings



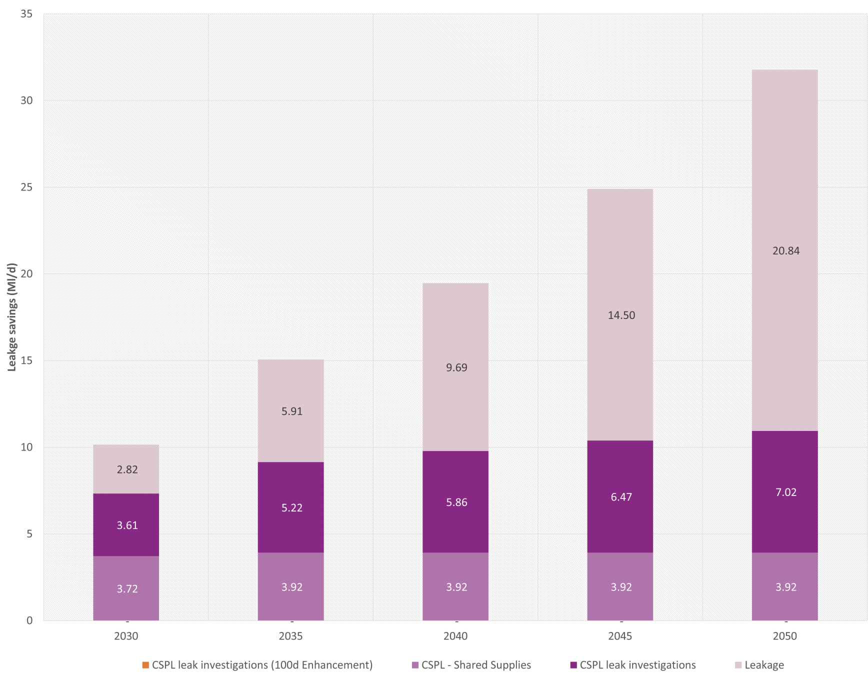
This option includes additional leakage water savings of 5.9Ml/d (associated with 3AMP smart meter roll-out) by 2029/30 and 19.5Ml/d by 2049/50 (including smart meter savings). Within these scenarios, we have considered direct leakage reduction options and options for activities that enable further leakage reduction. See Figure 24 for more detail.

Table 21 Extended Low option costs and savings

	Cost (AMP8)	Saving (AMP8)	Cost per Ml/d	Cost (AMP12)	Saving (AMP12)	Cost per Ml/d
Total financial (pre financing)	£12.8m	5.9Ml/d 3AMP SM	£2.95m	£37.6m	19.5Ml/d	£3.2m
Total financial (with financing)	£13.4m			£39.3m		

Extended Plus Option (Scenario 1002M) (Figure 24)

Figure 24 Extended plus option leakage savings



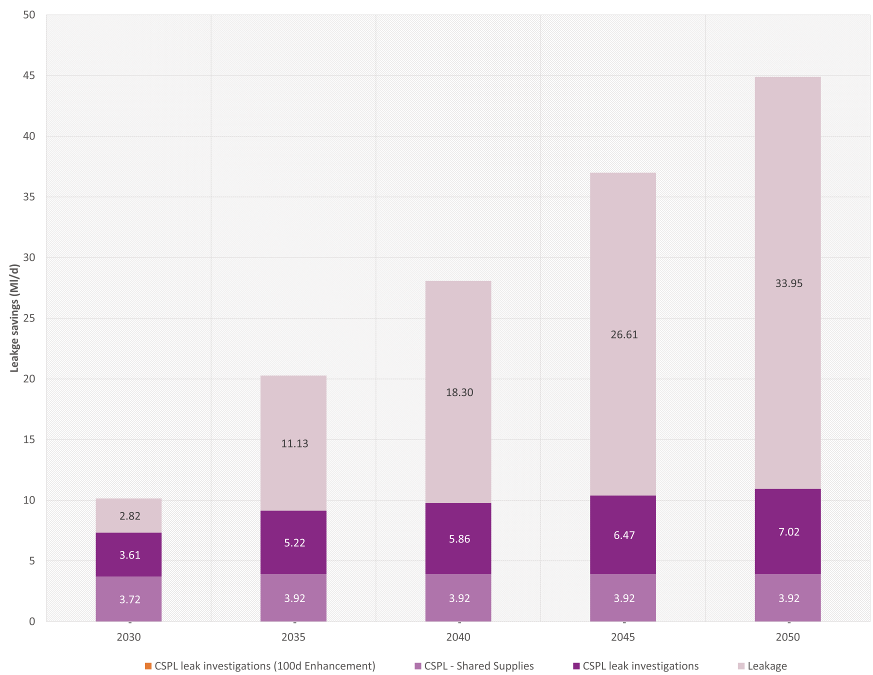
This option includes additional leakage water savings (associated with limited mains replacement) of 4.7Ml/d or 11Ml/d if associated with 2 AMP smart metering (AMP8)) by 2030 - 19.4Ml/d by the end of the WRMP24 period (including smart meter savings). See (Table 22) for further detail.

Table 22 Extended Plus costs and savings

	Cost (AMP8)	Saving (AMP8)	Cost per Ml/d	Cost (AMP12)	Saving (AMP12)	Cost per Ml/d
Total financial (pre financing)	£36.4m	10.2Ml/d inc. 2AMP Smart Metering	£5.6m	£785m	31.8Ml/d	£32m
Total financial (with financing)	£37.9m			£953m		

Aspirational Preferred Option (Scenario 1003)

Figure 25 Aspirational Preferred Option leakage savings



This option includes additional leakage water savings of10.15Ml/d by 2029/30 and 44.89Ml/dby the end of the WRMP24 period (including significant mains replacement and smart meter savings (2AMP roll-out). This is the preferred option for our WRMP24, indicating the level of commitment to achieving our lowest feasible level of leakage and contributing to the Nation Framework target. This option achieves a 30% reduction from the 2017/18 NF base-line.

Note the majority of the cost for this option impacts beyond the AMP8 period (Figure 25).

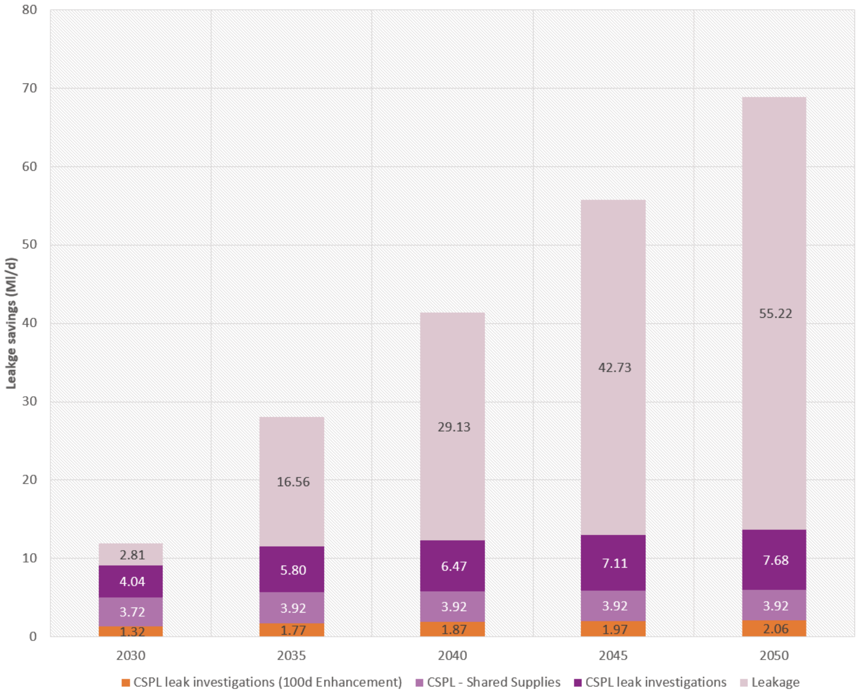
Table 23 Aspirational preferred option costs and savings

	Cost (AMP8)	Saving (AMP8)	Cost per Ml/d	Cost (AMP12)	Saving (AMP12)	Cost per Ml/d
Total financial (pre financing)	£36.4m	10.2Ml/d inc. 2AMP Smart Metering	£5.6m	£4,370m	45Ml/d	£116m
Total financial (with financing)	£37.8m			£5,164m		

Theoretical 50% leakage reduction (Scenario 1003T)

In addition to the key portfolios we also reviewed a 50% leakage reduction scenario. This option would require very significant mains replacement at a very high extra cost (circa £20 billion) (Table 24).

Figure 26 50% leakage reduction option



This option includes additional leakage water savings of 11.89Ml/d by 2029/30 and 68.89Ml/d by the end of the WRMP24 period 2049/50 (including smart meter savings and significant mains replacement) (Figure 26).

This option would reduce leakage from the AMP7 out-turn of 164.2Ml/d to a value of 94.22Ml/d by 2049/50 (a 50% reduction from the 2017/18 reported value of 191.3Ml/d.

Table 24 50% reduction option costs and savings

	Cost (AMP8)	Saving (AMP8)	Cost per Ml/d	Cost (AMP12)	Saving (AMP12)	Cost per Ml/d
Total financial (pre financing)	£38m	11.9Ml/d inc. 2AMP Smart Metering	£5.8m	£20,475m	68.9Ml/d	£346m
Total financial (with financing)	£39m			£21,269m		

4.4 Leakage portfolio considerations

We continue to believe that minimizing the amount of water we lose from our system through leakage is the right thing to do for our customers and the environment. The National Framework sets an overall goal of a 50% reduction for leakage for the whole of England and Wales by 2050[3], building upon Ofwat's methodology for the PR19 price review, which includes the stretching target for companies to reduce leakage by 15% by 2024/25.

As stated in the 'Leakage Routemap to 2049/50'

> *In 2019 the English water companies made a Public Interest Commitment (PIC) to "Triple the rate of sector-wide leakage reduction" by 2030. The water sector has also taken up the National Infrastructure Commission's (NIC) challenge by committing to halving leakage from 2018 levels by 2050.*[4]

In accordance with these ambitions, we have committed to achieving a 14% reduction in demand for AMP7, and a further ambitious program of reductions for WRMP24, achieving a 30% reduction from the National Framework 2017/18 base-line.

As part of this evaluation we have reviewed the current position of Anglian Water (and the other Water Companies) with respect to the Public Interest Targets and the National Infrastructure Commission Target of a 50% reduction.

Note these targets have been converted into attainment curves, based upon a 50% reduction from the 2017/18 national base-line (total leakage) position.

3 *'Environment Agency (March 2020), Meeting our future water needs: a national framework for water resources - Main Report'*, p. 65
4 Water UK (2022),*'A Leakage Routemap to 2050'*, p. 7

This graph below (Figure 27) updated to current values (2023 values used to update the original graph shown in the 'Leakage Routemap to 2050' report[5]) shows the wide range of current leakage positions for different water companies, and indicates that for the national 50% reduction to be achieved some companies need to reduce their leakage values by a much larger amount than other forefront companies such as Anglian Water. Additionally it must be noted that as companies, such as Anglian Water, reach lower and lower leakage levels, the costs for finding and repairing greater numbers of smaller and smaller leaks will lead to diminishing returns for significantly higher costs.

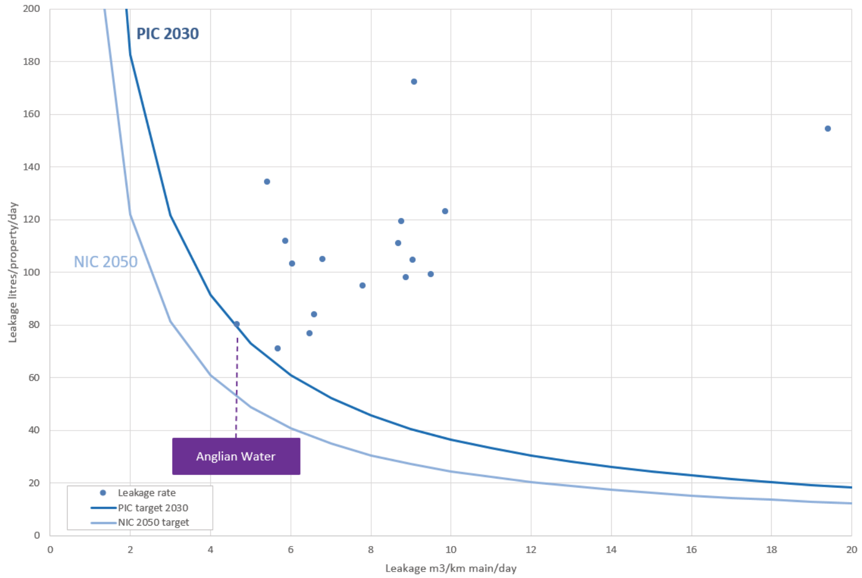
Note that the attainment curves for PIC and NIC targets have been created in the National Leakage Routemap, by aggregating the water company leakage values to a national value, halving this, and then creating a set of equivalent figures for the combined metrics of leakage per Km main and leakage per property. (*Figure 27*)

As can be seen Anglian Water is a frontier company with respect to leakage, as of 2023. In light of this and as part of our leakage option analysis we have determined how different levels of leakage reduction for Anglian Water (and our customers) will be reflected, against these attainment curves.

The graph below (Figure 28) shows the leakage position for each AMP out-turn year (2030, 2035, 2040 etc.) up to the year 2050. As can be seen even with our current base-line and the impact of smart meters (on cspl), we expect leakage to be below the PIC target by 2025 and below the NIC target by 2040.

As part of our post consultation review, we noted that key consultees stressed that we should be more ambitious with regard to our leakage reduction program. Our revised leakage reduction program represents a very significant expansion from our Draft WRMP24 (originally a 23.4% reduction from 2017/18, updated to a 38% reduction from 2017/18), having taken into account the strength of response regarding our original position, and achieves the maximum leakage reduction that we believe is feasible with current technology. This augmented plan does, however, come at a very significant cost in the longer term.

Figure 27 Relative positions of PWCs with respect to National Targets 2023



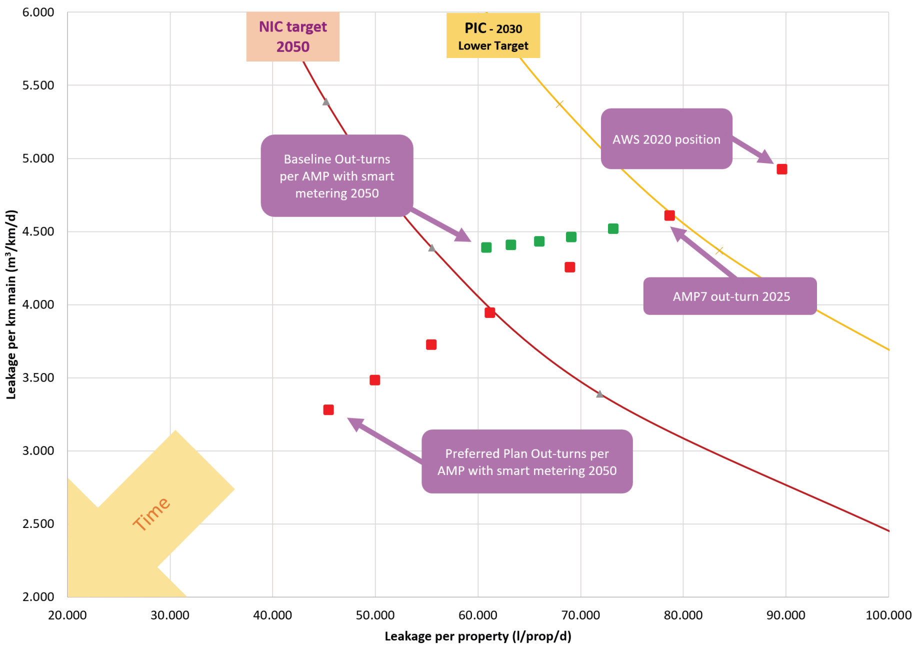
It must be noted that the additional 25Ml/d saved, is currently estimated to cost >£4 billion, due to the inclusion of a major mains replacement program of over 8000km (>20% of our network). We have, therefore, sequenced the plan such that the vast majority of the cost should impact AMP9 and beyond (post 2030). As we review the plan for WRMP29 we will investigate how technological improvement can mitigate these costs.

We consider that this revised position indicates our level of ambition in making a fair and equitable contribution to the overall national leakage target of a 50% reduction in leakage from the 2017/18 base-line for England and Wales.

With our preferred plan for our WRMP24 we expect to be below the NIC target by 2030, reaching the exceptionally low levels of 2.9m^3 per km of main/day or 40l/prop/day respectively, by 2050, compared to 4.2m^3 per km of main/day or 71.6l/prop/day in 2025. These levels will be unprecedented across the industry (Figure 28).

5 Water UK (2022), *'A Leakage Routemap to 2050'*, p. 56

Figure 28 Base-line and preferred plan leakage forecasts and NIC/PIC attainment curves



Preferred plan values for leakage per property and leakage per km of main are shown below (Table 25), indicating;

- a 33% reduction in leakage per property from the 2019/20 base-line, by 2049/50 and
- a 49% reduction in leakage per km of main from the 2019/20 base-line..

Table 25 Preferred plan AMP out-turn values

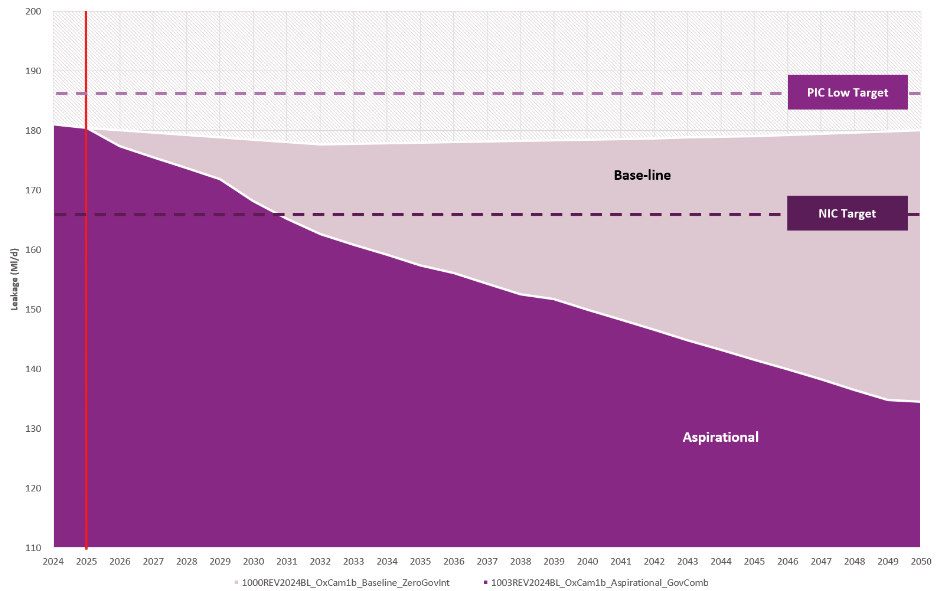
Preferred Plan	2025	2030	2035	2040	2045	2050	NIC Target
litres per property per day l/p/d	78.64	68.96	61.13	55.44	49.96	45.44	55.51

Preferred Plan	2025	2030	2035	2040	2045	2050	NIC Target
litres per km main - m3/km/day	4.6	4.3	3.9	3.7	3.5	3.3	4.39

Note the base-line values for 2020 are 4.9 litres per km of main and 89.6 litres per property.

Alternatively the key scenarios can be visualised, as below (Figure 29) This shows that the preferred scenario achieves both the PIC and NIC ambition, whilst also indicating the level of our ambition in adopting the 'Aspirational' program for leakage reduction.

Figure 29 Leakage scenarios and NIC/PIC targets

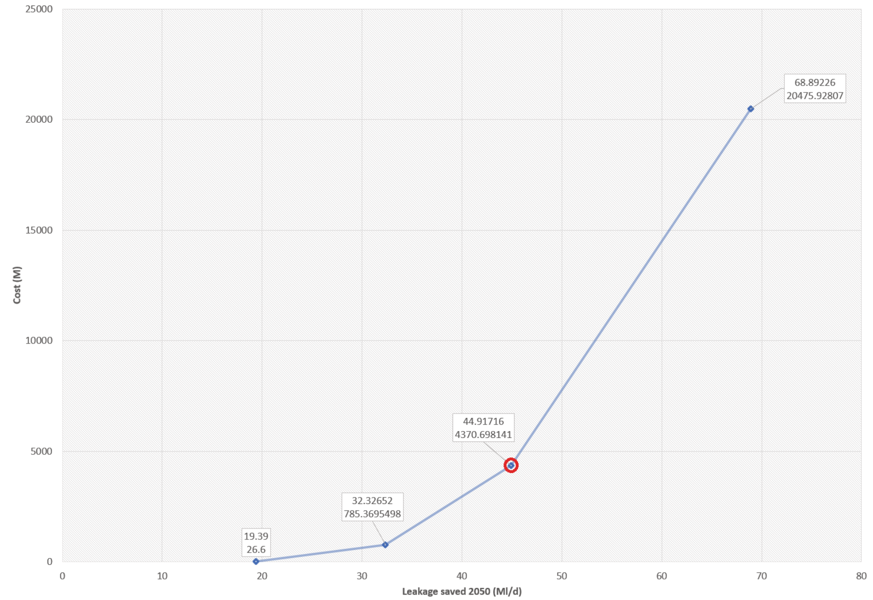


Leakage reductions have been modelled at a granular level using DMA geographies (District metering areas) to determine current leakage levels, zonal pressures and minimum leakage levels that might be achievable. Options have been modelled which would impact leakage including pressure management and network optimization, active leakage control, mains replacement and cspl 'find and fix' (due to the introduction of smart meters). We have then generated a number of scenarios, achieving different levels of leakage reduction for alternate costs.

Through our analysis, we have found that achieving a reduction of 50% of leakage from our 2017/18 position (equivalent to a leakage level of 90Ml/d), is not a reasonable option, due to the uncertainty associated with the possibility of realizing this reduction (potentially being below our background minimum leakage level) and the fact that we currently estimate that it would inflict huge costs on our customers (potentially a current estimation of £20 billion). It must also be noted that pressure management and network optimisation schemes may well be fully exhausted using current technology (in terms of further leakage reduction) by 2024/25. The significance of this is that the vast majority of additional leakage reduction would need to be associated with mains replacement. The disruption and detrimental environmental impact associated with extensive mains replacement, along with the material and carbon requirements would also be significant negative considerations, ruling out the viability of this option.

As can be seen (Figure 30), costs exponentially increase as we reach lower levels of leakage, as more cost effective options are exhausted and an increased number of mains replacement options are selected.

Figure 30 Leakage enhancement costs and benefits beyond our preferred plan



Whilst balancing our desire to continue to reduce leakage, we have considered the following:

- how we might achieve the NIC and PIC targets.
- the current leakage position of Anglian Water and other water companies.
- feasible options for leakage reduction.
- exponentially increasing costs to our customers as a result of achieving lower and lower levels of leakage.
- potential rising costs to maintain these lower levels of leakage.
- whether it is equitable to expect certain customers to pay very high costs for relatively low additional leakage reductions, while other customers face much lower costs.
- potential minimum leakage levels with current and future technologies.
- achieving our current ambitious target of leakage reduction in AMP7.

- our current smart meter rollout and embedding the new process for cspl reduction in our systems.
- consultation responses
- our ambition for leakage reduction in the context of other water company draft plan submissions
- longer term technological advancement

In order to achieve our preferred plan, we will need to use innovative techniques, as well as tried and tested methods. We will continue to explore new solutions and operational practices to reduce leakage. The sub-options we have identified not only address the symptoms of leakage, but activities such as pressure management also allow us to take action to prevent leakage occurring in the first place.

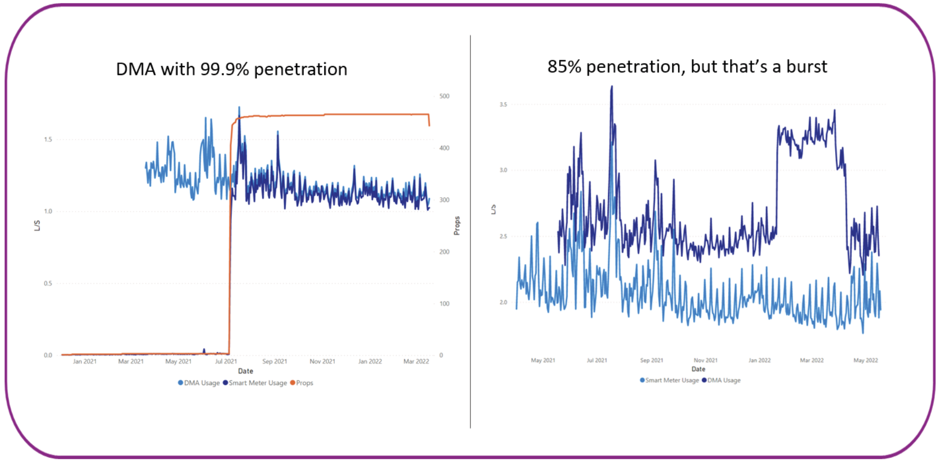
As part of our demand management strategy we have considered detailed activities that enable, support and sustain further leakage reduction. These include a mix of well understood interventions and others that are more innovative.

We are actively exploring how the use of state-of-the-art technology can help us to achieve further reductions, and that is why we have made ‘zero leakage and bursts’ one of the seven goals of our Shop Window initiative. We are actively trialling technologies such as thermal imagining drones to detect leaking pipes and the use of satellite imagery to identify leakage.

Additionally, our smart metering program is facilitating an opportunity for a significant advance in detecting leaks by improving our understanding of continuous flows into customer properties (usually indicating a leak). The benefits of leak detection associated with smart metering are included within the metering business case. In addition, live data for actual consumption is making the identification of network leakage more accurate by measuring the actual difference between bulk (district) meters and customer use. This benefit is captured in the metering cost benefit analysis.

Customer supply pipe leakage currently accounts for approximately 23% of total leakage. As smart meters are introduced we expect that cspl will be reduced by 70% from the current level (Figure 31).

Figure 31 Smart Meter DMA data showing leakage



With our preferred plan our intention is to show the scale of our ambition as a leader in leakage reduction and make a fair and equitable contribution to the overall national leakage target, such that the preferred plan provides us with an ambitious, but achievable goal. burdening our customers with significant additional costs.

4.5 Leakage summary

We have recognised the importance of our our role as an industry leader in leakage reduction, in helping to meet the National Framework 50% leakage reduction target. We have also taken into account consultation responses to our initial draft WRMP24 suggested leakage reduction program.

We must also note that our we currently record very low levels of leakage compared to the rest of the industry. This makes the realization of addition leakage reduction more difficult and costly.

We note that all key leakage scenarios have been modelled and the respective leakage levels for the WRMP24 planning period have been generated. As shown above all scenarios achieve the PIC and NIC targets.

For the WRMP24 program we intend to adopt the Aspirational portfolio in order to reduce leakage by 30% (from the 2017/18 base-line position), reaching a leakage level of 134.51Ml/d - 12.4% of demand

This represents the current feasible maximum level of leakage reduction and consequently, achieves what we would assess as our minimum background leakage level (with current technology).

However, this augmented plan does come at a very significant cost in the longer term (>£4 billion). We have, therefore, sequenced the plan such that the vast majority of the cost should impact AMP9 and beyond (post 2030). As we review the plan for WRMP29 we will investigate how technological improvement can mitigate these costs.

If the National Framework target is translated into nationally representative metrics (leakage per property / leakage per km of main, we easily reach the required attainment levels, whilst not necessarily meeting an absolute company level 50% reduction in leakage.

We do not consider achieving a 50% reduction at a company level to be feasible or desirable,

- as we have now exhausted more cost effective leakage reduction options and this
- would require a very significant mains replacement program, (beyond that currently included) with
- a theoretically estimated cost of >£20 billion.

We would not consider it fair or equitable to expect certain customers to pay very high costs for relatively low additional water savings and leakage reductions, while other customers face much lower costs. Additionally, achieving these levels of leakage is associated with great uncertainty.

5 Water efficiency measures

5.1 Water efficiency core assumptions

The following core assumptions have been used in the modelling future water efficiency measure costs and benefits.

- **Behaviour saving attribution:** Note that we have considered the attribution of behavioural change savings to smart meters (as opposed to Water Efficiency) and the potential issues of double counting, as part of the CBA process (2% behaviour savings are currently attributed to smart meter installation; reduced from the 3% originally included in WRMP19).
- **Option impact:**Assumed savings vary by option, demographic and uptake.
- **Decay Rates:**
- Smart Showers saving achieved is applied in full for 5 years.
- Garden Advice savings achieved is applied in full for 7 years.
- Leaky Loos savings achieved is applied in full for 15 years.
- Community Rewards achieved is applied in full for 15 years.
- **Sustained Saving:** Fixed proportion of savings, typically 1litre/prop/day, is assumed to be permanent behaviour change, sustained after the period of full savings (see above). Leaky Loos option is assumed to have no sustained saving, beyond 15 years.
- **Cost assumptions:** Cost of devices/technology based on actual/assumed AWS values, e.g. smart shower sensor, MyAccount app development. Operational costs based on actual/assumed AWS values, e.g. interventions such as customer visits, escalations, customer letters.
- **Further considerations:** Changes to policies and costs from different level(s) of interventions/customer engagement, e.g. in dealing with customer-side leaks (external/internal) identified from smart meter data.

5.2 Water efficiency options considered

We identified a number of sub-options for water efficiency. These have been developed, drawing upon our own research and analysis undertaken by the University of East Anglia on our behalf.

The sub-options have been grouped into three packages, aligned to our 'Extended', 'Extended Plus' and 'Aspirational' strategic options. Each of these sets comprises three exclusive options i.e. low, middle and high savings (Table 26).

The costs and benefits associated with these sub-options have been assessed exclusive of (or in addition to) the costs and benefits associated with our base-line strategy.

Table 26 Water efficiency sub-options

Low additional water efficiency ('Extended Low') includes the sub-options:	Medium additional water efficiency (initially tested portfolio) includes the sub-options:	High additional water efficiency ('Extended Plus' (preferred) and 'Aspirational' portfolio) includes the sub-options:
• Provision of smart water devices/sensors (shower). • Continued development of 'MyAccount' to provide easy access to data. • Development of gamification and rewards schemes. • Provision of garden advice / garden kits for outdoor usage. • Scheme to assist vulnerable customers with internal leaks. • Leaky loo campaign for traditionally metered customers. • Development of customer leakage journey to achieve maximum target run-time of 100 days	• Link sensors to 'MyAccount' • Additional community based campaigns -hyper local and seasonal • Higher level of engagement on discretionary/seasonal water use. • Enhances schemes to assist vulnerable customers with internal leaks. • Additional development of customer leakage journey to achieve maximum target run-time of 100 days	• Link Smart devices to hubs, developments and communities • Personalised engagement on discretionary/seasonal water use - virtual assistants. • Smart communities - link smart systems to other utilities

The three portfolios were modelled in accordance with base assumptions including; the size and demographic of the target customer audience, assumed savings per unit affected, PCC values etc. Due to the interdependencies of the water efficiency options with smart metering, options have been developed for both the 2AMP and 3AMP rollout.

Our assessment of these water efficiency options has led us to adopt the most ambitious 'Aspirational' portfolio for our preferred plan.

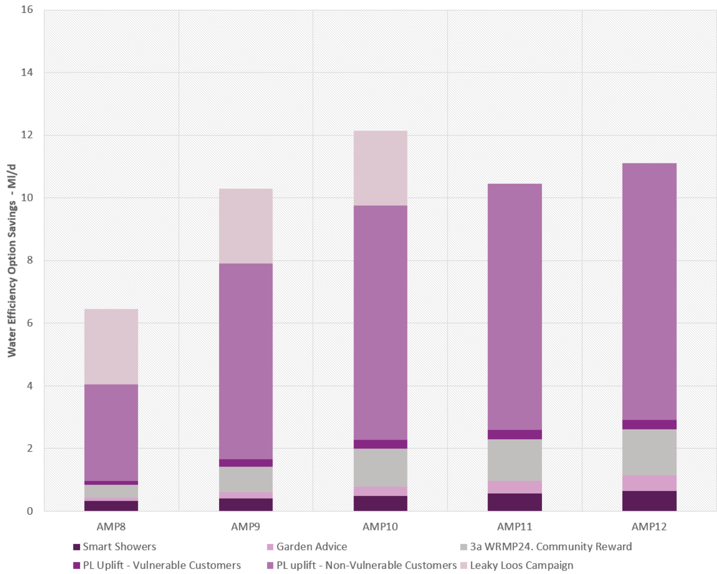
5.3 Water efficiency costs and benefits

As part of our option appraisal process we have developed a number of scenarios combining water efficiency sub-options.

5.3.1 Low scenario (Extended Low)

5.3.2

Figure 32 Extended Low water efficiency scenario



5.3.3

Note that the savings shown in the graph (Figure 32) only include Anglian Water demand management option savings (and exclude the impact of government led interventions, as detailed in the table (Table 27) below).

Table 27 Costs and savings (Low portfolio)

	Cost (AMP 8) Exc Opex saving	AMP8 Out-turn Saving (AMP 8)	Cost (AMP12) Exc Opex saving	AMP 12 Out-turn Saving (AMP 12)
OPEX	£11.15m	6.38Ml/d	£44.26m	11.05Ml/d

For our low portfolio of water efficiency measures we expect the following costs and benefits (Table 28):

Table 28 Costs and benefits for our low water efficiency portfolio

	AMP 8 -2030 out-turn water saving per year Ml/d	Opex (£) AMP8 - 2030	Opex saving (inc. value of water saved) (£) AMP8 - 2030	AMP 12 -2050 out-turn water saving per year Ml/d	Opex (£) AMP12 - 2050	Opex saving (inc. value of water saved) (£) AMP12 - 2050
Smart Showers	0.33Ml/d	£824,000	£33,324	0.65Ml/d	£4,120,000	£368,580
My Account		£1,337,584			£6,782,784	
Garden Advice	0.10Ml/d	£531,000	£10,098	0.50Ml/d	£2,655,000	£218,792
3a WRMP24. Community Reward	0.41Ml/d	£75,000	£41,381	1.43Ml/d	£375,000	£760,141
PL Uplift - Vulnerable Customers	0.12Ml/d	£124,941	£13,977	0.32Ml/d	£947,694	£194,292
PL uplift - Non-Vulnerable Customers	3.09Ml/d	£3,207,808	£362,542	8.16Ml/d	£24,331,725	£5,032,591
Leaky Loos Campaign	2.39Ml/d	£51,696	£260,184		£51,696	£1,194,489
Mandatory water labelling	*3.52Ml/d*			*81.19Ml/d*		*£26,371,240*
Innovation Fund		£5,000,000			£5,000,000	
	9.97Ml/d	£11,152,028	£721,526	92.24 Ml/d	£44,263,898	£34,140,125

5.3.4 Medium scenario (Extended Plus)

Savings have been calculated for each of the water efficiency measures and can be shown in the chart (Figure 33), and table (Table 29).

Figure 33 Medium portfolio water efficiency savings

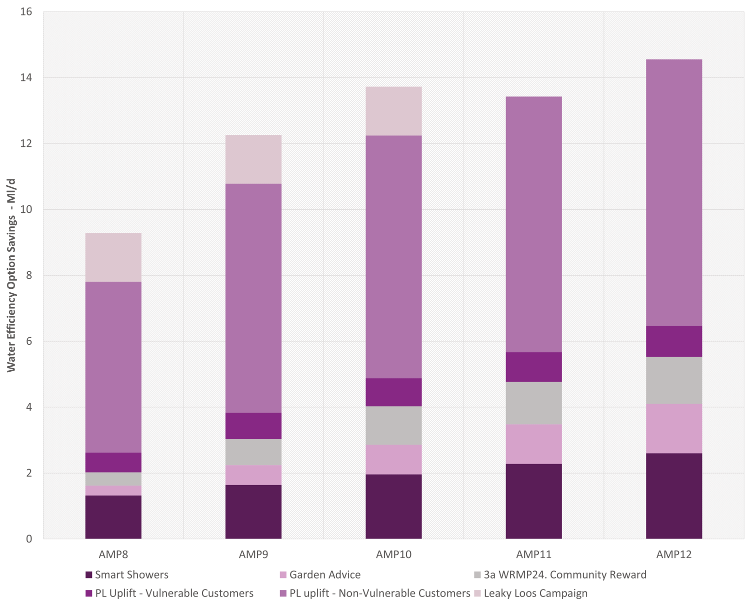


Table 29 Costs and savings (Medium scenario)

	Cost (AMP 8) Exc Opex saving	AMP8 Out-turn Saving (AMP 8)	Cost (AMP12) Exc Opex saving	AMP 12 Out-turn Saving (AMP 12)
OPEX	£16.77m	9.29Ml/d	£73.37m	14.55Ml/d

For our medium portfolio of water efficiency measures we expect the following costs and benefits (Table 30):

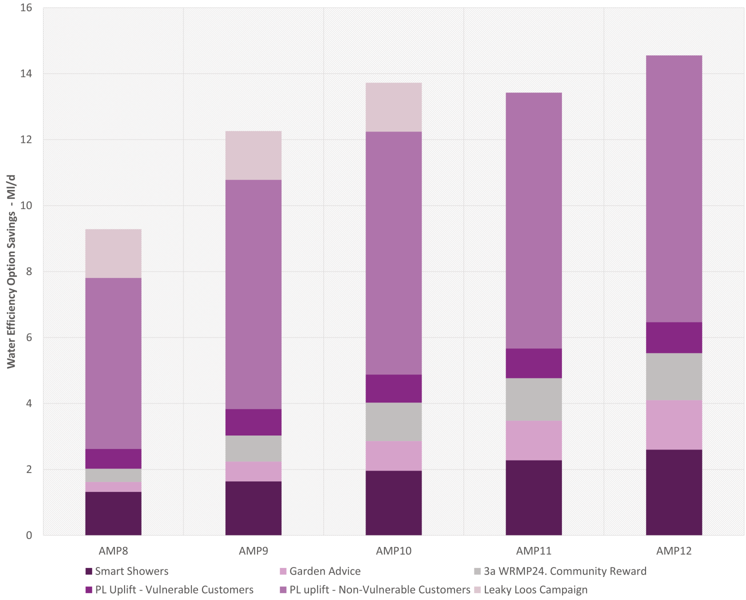
Table 30 Costs and benefits for our medium water efficiency portfolio

	AMP 8 -2030 out-turn water saving per year Ml/d	Opex (£) AMP8 - 2030	Opex saving (inc. value of water saved) (£) AMP8 - 2030	AMP 12 -2050 out-turn water saving per year Ml/d	Opex (£) AMP12 - 2050	Opex saving (inc. value of water saved) (£) AMP12 - 2050
Smart Showers	0.83Ml/d	£2,060,000	£83,309	1.62Ml/d	£10,300,000	£921,451
My Account		£1,953,066			£10,672,445	
Garden Advice	0.20Ml/d	£1,062,000	£20,196	1.00Ml/d	£5,310,000	£437,584
3a WRMP24. Community Reward	0.41Ml/d	£75,000	£42,075	1.46Ml/d	£375,000	£776,453
PL Uplift - Vulnerable Customers	0.40Ml/d	£295,127	£42,583	0.63Ml/d	£1,963,545	£426,368
PL uplift - Non-Vulnerable Customers	5.22Ml/d	£3,788,647	£551,493	8.11Ml/d	£25,206,690	£5,521,929
Leaky Loos Campaign	1.51Ml/d	£33,033	£194,740		£33,033	£763,278
Mandatory water labelling	*3.52Ml/d*		*£177,217*	*84.35Ml/d*		*£31,401,523*
Innovation Fund		£5,000,000			£5,000,000	
Totals	12.09 Ml/d	£14,266,874	£1,111,614	97.17 Ml/d	£58,860,713	£40,248,586

5.3.5 Revised water efficiency options (preferred plan) - (minus Gov. interventions)

5.3.6

Figure 34 Aspirational Water efficiency scenario savings



Note that the savings shown in the graph (Figure 34) only include Anglian Water demand management option savings (and exclude the impact of government led interventions, as detailed in the table (Table 31) below.

Table 31 Costs and savings (High (Preferred) Scenario)

	Cost (AMP 8) Exc Opex saving	AMP8 Out-turn Saving (AMP 8)	Cost (AMP12) Exc Opex saving	AMP 12 Out-turn Saving (AMP 12)
OPEX	£16.77m	9.29Ml/d	£73.37m	14.55Ml/d

For our preferred high Aspirational portfolio of water efficiency measures (included in our preferred plan) we expect the following costs and benefits (Table 32).

Table 32 Costs and savings for our Aspirational preferred water efficiency portfolio

	AMP 8 -2030 out-turn water saving per year Ml/d	Opex (£) AMP8 - 2030	Opex saving (inc. value of water saved) (£) AMP8 - 2030	AMP 12 -2050 out-turn water saving per year Ml/d	Opex (£) AMP12 - 2050	Opex saving (inc. value of water saved) (£) AMP12 - 2050
Smart Showers	1.32Ml/d	£3,296,000	£133,295	2.60Ml/d	£16,480,000	£1,474,321
My Account		£2,593,649			£15,580,917	
Garden Advice	0.30Ml/d	£1,593,000	£30,294	1.50Ml/d	£7,965,000	£656,376
3a WRMP24. Community Reward	0.40Ml/d	£75,000	£41,137	1.43Ml/d	£375,000	£757,897
PL Uplift - Vulnerable Customers	0.60Ml/d	£439,100	£63,374	0.94Ml/d	£2,930,357	£636,442
PL uplift - Non-Vulnerable Customers	5.18Ml/d	£3,757,917	£547,178	8.09Ml/d	£25,078,657	£5,495,080
Leaky Loos Campaign	1.48Ml/d	£32,328	£191,485		£32,328	£746,966
Mandatory water labelling				*81.19Ml/d*		*£26,371,240*
Innovation Fund		£5,000,000			£5,000,000	
Totals	9.29 Ml/d	£16,772,305	£1,111,614	95.75 Ml/d	£73,369,402	£36,138,323

5.4 Water efficiency building blocks

Plumbing loss reduction

Leaks within the customer's premises are known as plumbing losses. These are considered consumption (PCC) rather than leakage, but are nevertheless a waste of resources. By promoting awareness of internal leaks (including leaking loos) and encouraging rectification, we can reduce these losses of water and customers will save money on their water bills.

Reduced customer use

There is a clear desire from our customers to save water. Our customers believe this should be driven by us offering a service tailored to their individual needs. Customers generally express a willingness to have water efficient devices and products installed in their homes, if we could assist by providing a fitting service.

Through our water efficiency options and the introduction of smart metering, we are beginning to develop systems which support our customers in understanding their consumption and potentially using significantly less water. We have been mindful of this linkage in our analysis and have taken careful steps to avoid double counting. The high proportion of our customers paying measured charges, means that if customers use less water, they will save money on their water bills.

In addition to off-setting strategic demand growth, lower consumption results in lower energy (pumping) and treatment costs for water. This saving is calculated in the model by utilizing water volumes and the marginal cost of water.

Hot water carbon saving

Reduced demand for water has an additional impact on customer's bills and carbon emissions. Heating water in the home accounts for up to 15% of household energy bills, according to the Energy Saving Trust. We have considered carbon impacts associated with reduced demand for water in the following way:

- Carbon emissions associated with the direct use of electricity are not monetised separately, as electricity prices already account for this cost. Hence the carbon emission costs associated with the pumping of water are already included in the electricity costs.
- Carbon emissions associated with other forms of fuel (gas, oil, petrol, diesel, etc.), along with non-electricity embedded carbon, do have a monetary value assigned to them. In line with Ofwat's approach, the calculation of the impacts from changes in hot water use in the home considers only the carbon emissions associated with those changes. The monetary value has, therefore, been calculated for the non-electricity heating of water.

Costs

The costs of our water efficiency sub-options are largely operating costs. The main costs are:

- System operating costs, for example, the online water calculator for developers
- Operating costs, such as home audits
- Customer engagement costs, associated with customer facing campaigns and information provisions, and
- Portal running costs, to maintain the operation of the customer facing portal.

Maintaining changes in customer behaviour has been found to prove difficult. We have, therefore, assumed that water savings will decay to 0% five years after the audit.

For some of the more innovative sub-options, we have made reasonable estimates based on the best information available to us. We have reviewed assumptions as part of our PR24 business planning process.

5.5 Water efficiency conclusion

Having assessed all the available water efficiency options, we plan to pursue the highest level of ambition, via our Aspirational portfolio. The demand reductions from these measures, will maximize the potential for smart metering to leverage behavioural change.

Our preferred Aspirational plan includes the full suite of options we have considered (Table 33), as we have found these options cost beneficial (As shown in the 'Aspirational' portfolio).

Table 33 Water efficiency sub-options

Preferred plan - sub-options:
· Provision of smart water devices/sensors (shower). · Link sensors to 'MyAccount', smart-hubs, smart developments and communities. Smart communities - link smart systems to other utilities · Continued development of 'MyAccount' to provide easy access to data. · Additional community based campaigns -hyper local and seasonal · Development of gamification and rewards schemes. · Provision of garden advice / garden kits for outdoor usage. · Personalised engagement on discretionary/seasonal water use - virtual assistants. · Enhanced scheme to assist vulnerable customers with internal leaks. · Leaky loo campaign for traditionally metered customers. · Additional development of customer leakage journey to achieve maximum target run-time of 100 days

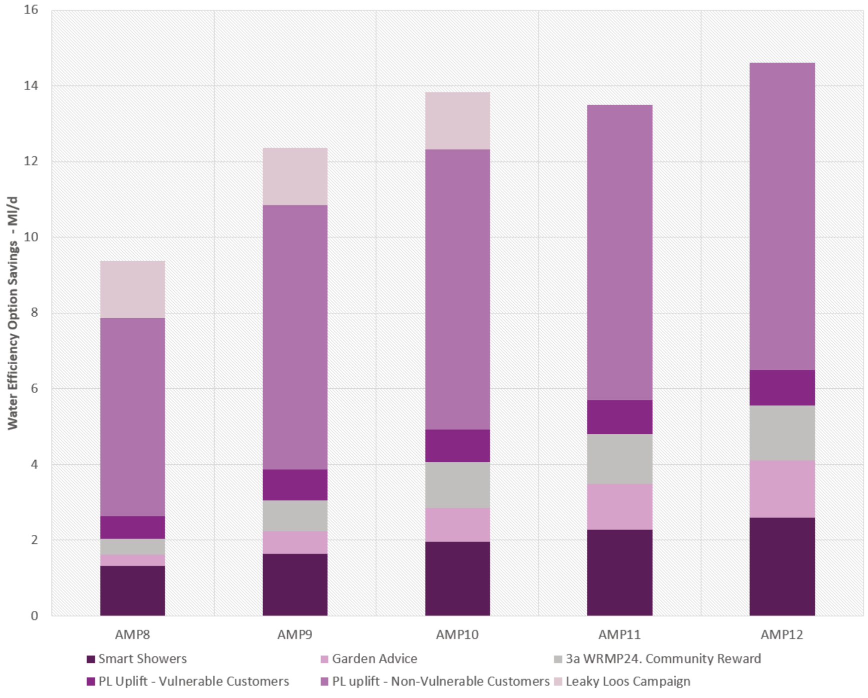
For our preferred portfolio of water efficiency measures we expect the following costs and benefits, see (Table 34) and (Figure 35).

Table 34 Costs and savings for our Aspirational preferred water efficiency portfolio

	AMP 8 -2030 out-turn water saving per year Ml/d	Opex (£) AMP8 - 2030	Opex saving (inc. value of water saved) (£) AMP8 - 2030	AMP 12 -2050 out-turn water saving per year Ml/d	Opex (£) AMP12 - 2050	Opex saving (inc. value of water saved) (£) AMP12 - 2050
Smart Showers	1.32Ml/d	£3,296,000	£133,295	2.60Ml/d	£16,480,000	£1,474,321
Smart Hub						
My Account		£2,578,961	£		£16,480,000	£
Garden Advice	0.30Ml/d	£1,593,000	£30,294	1.50Ml/d	£7,965,000	£656,376
3a WRMP24. Community Reward	0.40Ml/d	£75,000	£41,137	1.43Ml/d	£375,000	£757,897
PL Uplift - Vulnerable Customers	0.60Ml/d	£439,100	£63,374	0.94Ml/d	£2,930,357	£636,443
PL uplift - Non-Vulnerable Customers	5.18Ml/d	£3,757,917	£547,178	8.09Ml/d	£25,078,657	£5,495,080
Leaky Loos Campaign	1.48Ml/d	£32,328	£191,485		£32,328	£746,966
Mandatory water labelling				*81.19Ml/d*		*£26,371,240*
Innovation Fund		£5,000,000			£5,000,000	
Totals	9.29 Ml/d	£16,772,305	£1,006,764	95.75 Ml/d	£73,369,402	£36,138,323

As part of our preferred plan we have included our 'Innovation and discovery' funding in order to further our understanding of customer behaviours and the potential for future water efficiency initiatives. We have termed this our 'Water Demand Reduction Discovery Fund'. This is described in full in our 'Demand management preferred plan technical supporting document".

Figure 35 Preferred 'Aspirational' water efficiency savings



6 Non-household water efficiency

Non-Household water efficiency option development

Non-household consumption accounts for a substantial proportion of overall demand in Anglian Water, representing 26% of our overall demand (2023/24). Understanding and forecasting this segment of demand is crucial to the demand forecasting process. Additionally, developing water efficiency strategies for non-household sectors will form a key additional element for any demand reduction strategy, for water companies, retailers and other major sectors that are heavily dependent on water.

As, the Water Resources Planning Guidance states:

> *'You should clearly demonstrate how you will deliver non-household water efficiency. Your final plan should see an overall reduction in non-household consumption In England, you should set out how it contributes to Defra's water demand target and associated Environmental Improvement Plan, which seeks a 9% reduction of non-household water consumption by 2037/38, from a 2019/20 baseline, as part of the delivery of the distribution input per person reduction.'*[6]

As part of the WRMP24 demand management option development process, and in conjunction with our WRE partners, we have engaged with our regional retailers and business customers, in order to gauge opinion on further water efficiency measures for the business sector.

This recent engagement (in association with WRE and 'Blue Marble') has been conducted:

- to understand the retailer perspective regarding the promotion of water efficiency.
- to develop and refine propositions and understand and overcome barriers.
- to explore these propositions and how they might be implemented with retailers and non-household customers

We are, in accordance with the EA Water resource planning guidelines, actively engaged in developing water efficiency options and have included our initial portfolio of non-household options in our WRMP24. These include;

- measures to reduce customer supply pipe leaks, based around the provision of smart meter data and further potential incentives
- measures to reduce leakage from internal plumbing losses, based around the provision of smart meter data and further potential incentives (leaky loo find and fix)
- assistance and incentivization with regard to water visits and the retrofit of water efficient devices (these potentially funded by wholesalers)

We are also looking into evaluating additional measures with our partners, including:

- water recycling / reuse (grey/green/blackwater reuse); provision of information/scheme design/consultancy support
- incentives and rebates for water consumption reduction; potentially linked to other utilities (energy)

We are currently installing smart meters for all non-household businesses, as part of our full smart meter roll-out. These smart meters will be essential in providing Retailers with the data necessary to facilitate water efficiency and leakage reduction.

For the WRMP24 we have now assessed and quantified options for further development and trials, whilst also considering how we might address barriers to their implementation (funding issues, access issues etc.).

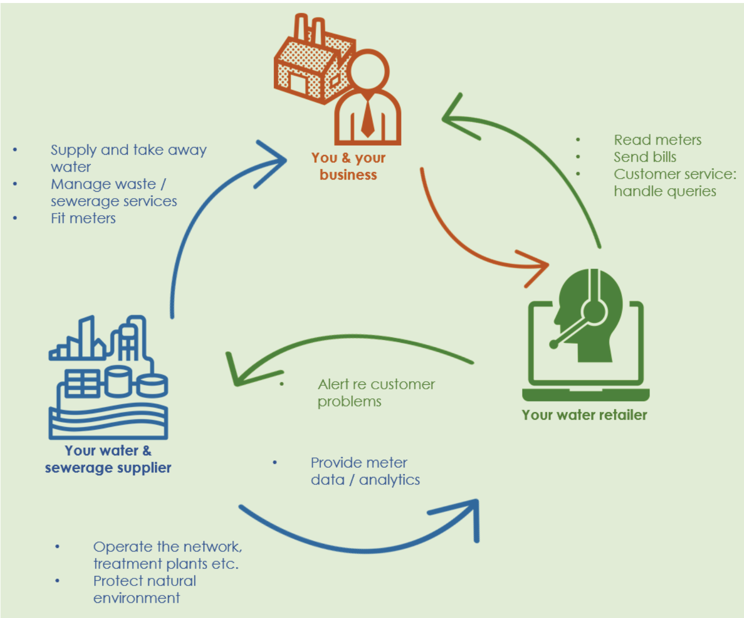
6 Environment Agency (March 2023), '*Water Resources Planning Guidance for WRMP24*', p. 77

6.1 Water efficiency, business customers and 'Retail' separation

Under the aegis of WRE, and as part of the WRMP24 pre-consultation process, we have engaged with non-household customers, retailers and our other water company partners, with regard to the development of non-household water efficiency measures.

Our relationship with our Retail partners has developed through AMP7, as we work with Retailers on operational matters, water demand and drought. The relationship between wholesalers, retailers and non-household customers is complex (Figure 36) and, consequently, the development of water efficiency options that are actionable, requires sensitivity and collaboration.

Figure 36 Wholesaler, retailer, non-household customer relationships



As part of our WRE collaboration we have engaged Blue Marble, to assist in our consultation with Retailers and their customers, as we design potential water efficiency offerings.

Additionally, we routinely engage directly with each individual Retailer in our area, providing relevant information regarding current supply-demand conditions and our plans. Each Retailer has a dedicated 'Wholesale Account Manager' and water efficiency is now a standing item on the agenda, reflecting our keenness to engage with Retailers on innovative ways of collaboration, to ensure the efficient use of water.

Significant barriers still remain with regard to retail separation and engagement with businesses (Figure 37). However, there appears to be an appetite for water efficiency, despite very significant pressures on businesses at this current time in other directions (inflation, employment costs, energy costs, Covid19 lockdown recovery).

As part of our consultation we have sought to fully understand how retailers and their customers perceive these barriers (to the implementation of water efficiency measures) and how we might address them.

Figure 37 Potential barriers to water efficiency option implementation

Capability barrier (skills/knowledge)	Lack of accessible & accurate **consumption data**
	No sense of **how** to be (more) water efficient
Opportunity barrier (time or money)	No sense of **when** to be (more) water efficient
	No/inadequate **cost benefit** to save water
Motivation barrier (why want to do it)	Lack of **awareness of water scarcity** context / need
	Water restrictions/bans not seen as a **business threat**
	Deferred responsibility: looking to the industry and government to promote/implement water efficiency
	Lack of **incentives to save** (or disincentives not to)
	Limited **consequences** if NHH do nothing (e.g. customers not demanding this)

As can be seen, a number of these barriers will be addressed, with the use of smart meter data and improvements in our messaging, regarding the potential for water savings and the strategic need in our region. Smart metering in particular will allow the detection of leakage to be much more proactive, and will facilitate interventions to assist customers with their repairs in a much more timely fashion, as well as allowing before and after comparisons of water usage once water efficiency measures have been implemented.

Additionally, we need to focus on the overarching strategic need for demand reduction, whilst supporting the idea that this will also save customers money, as they become more water efficient, (noting that for many non-household consumers water bills will be only a small part of their costs, in comparison with energy, employment and other business costs). We also need to stress our narrative surrounding our environmental destination, informing the need for water efficiency measures.

Additional complexity with regard to the implementation of water efficiency measures comes from the wholesale-retail framework, which delineates non-household customer relationships.

All parties have been shown to be supportive of the idea of water efficiency, so we are keen to develop options and quantify costs and benefits. We have consequently, developed a number of options for discussion and evaluation, as below (Figure 38):

Figure 38 Non-household options for consideration

EXTERNAL SUPPLY PIPE LEAKAGE – ON CUSTOMER PREMISES Use smart meter data to inform customers speeding up leakage repair - incentivise	**INTERNAL PLUMBING LOSS LEAKAGE – ON CUSTOMER PREMISES** Use smart meter data to inform customers speeding up leakage repair - incentivise	**WATER AUDIT & RETROFIT WATER EFFICIENT DEVICES** Provide information – products – water audits
TARIFFS Develop tariffs / incentives to promote water efficiency	**PURCHASE / REPLACEMENT OF WATER USING APPLIANCES** Provide information on appliances – online efficiency calculator – incentivise replacement	**WATER REUSE – RECYCLING** Provide information – liaison with consultants – expert advice on bespoke solutions – potential incentivisation

In recognizing that the Retailer owns the relationship with the end-user non-household customer and that they will, in most cases, have a greater understanding of water consumption for their customers, we are working with Retailers to develop the most effective measures from these options.

Currently we have identified two main options that would appear to be suitable for further development:

- Measures that will impact leakage and plumbing losses
- Implementing water audits and the installation of water efficient devices

6.2 Non-household segmentation

Business customers have diverse characteristics with regard to their water consumption, given that they will range from very large to very small concerns and will utilize water for many varied purposes (personal usage, industrial process usage, irrigation etc.). Consequently, we have considered a variety of ways of segmenting non-household customers. For the purposes of our consultation we have relied upon the characterisation developed by MOSL (the Market Operator Services Ltd).

MOSL have produced a characterisation based upon the complexity and overall volumes of usage, which will be useful in understanding consumption and tailoring water efficiency options in their application.

These groupings can be described as follows:

Low complexity with low volume:

- Domestic-like water needs: kitchens, toilets and some bathroom facilities - mainly for customer use;
- watering gardens and washing machines
- Very small organisations

Low complexity with high volume:

- Similar to domestic use, but on a larger scale
- Water use critical for business customer use; large retail, hotels

High complexity with low volume:

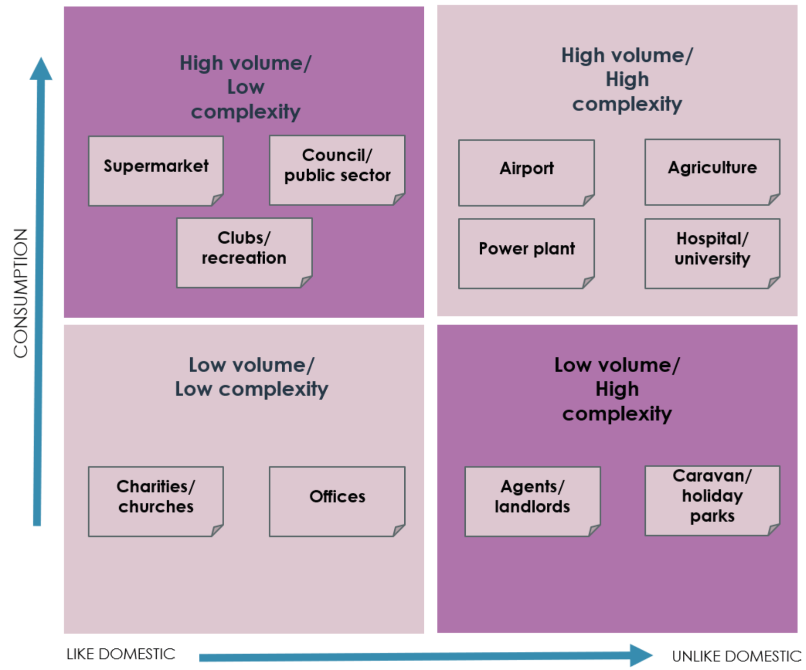
- Water use critical in manufacturing processes - as well as being used for staff toilets / domestic use
- Agricultural uses e.g. drinking water for animals, essential cleaning of machinery

High volume and complexity:

- Water used in processes at higher volumes
- Agriculture with high usage and complex needs e.g. arable and livestock mix
- Caravan park with individual water meters for each site

This can be visualised (as in the Blue Marble work (Figure 39)):

Figure 39 Non-Household groups (by complexity and volume) with examples



Internally, we have also sought to characterise the non-household customer base in alignment with the segmentation which currently informs our Non-Household demand forecast and split the base-line values by consumption volume (Table 35). We will utilize this information as we design our non-household water efficiency offerings and targeting. As part of our analysis we have used the following designations and volume bandings, in order to understand where water is used and the number of customers involved.

Table 35 Non-household consumption banding

Consumption bands
Very Low Band (0 -1 m^3/prop/d))
Low Band (1 -3 m^3/prop/d))
Medium Band (3 -10 m^3/prop/d)
High Band (10 -100 m^3/prop/d)
Very High Band (>100 m^3/prop/d)

In designing our options, it is noted that low volume users will probably utilize water in a similar fashion to our domestic users, while high volume users will in most likelihood utilize water for processing purposes.

We will review potential banding characterisations, in alignment with other criteria, including current tariffs, as we progress the development of the water efficiency options and targeting. This segmentation has been derived purely to give an initial insight into the number of customers and volumes by sector that we currently see with regard to non-household demand.

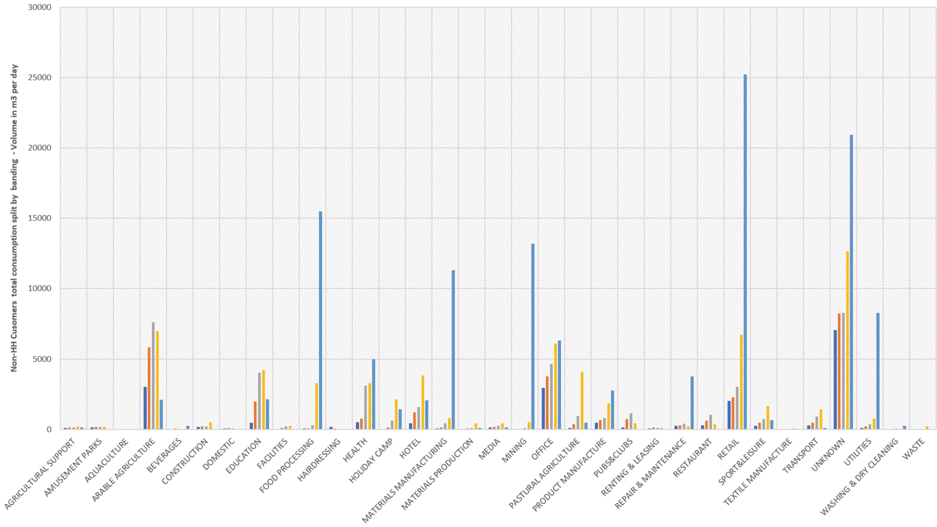
The different non-household groups have been characterised (Table 36)

Table 36 Non-household sectors

Non-household customer segments	
AGRICULTURAL SUPPORT	MEDIA
AMUSEMENT PARKS	MINING
AQUACULTURE	OFFICE
ARABLE AGRICULTURE	PASTURAL AGRICULTURE
BEVERAGES	PRODUCT MANUFACTURE
CONSTRUCTION	PUBS & CLUBS
DOMESTIC	RENTING & LEASING
EDUCATION	REPAIR & MAINTENANCE
FACILITIES	RESTAURANT
FOOD PROCESSING	RETAIL
HAIRDRESSING	SPORT&LEISURE
HEALTH	TEXTILE MANUFACTURE
HOLIDAY CAMP	TRANSPORT
HOTEL	UNKNOWN
MATERIALS MANUFACTURING	UTILITIES
MATERIALS PRODUCTION	WASHING & DRY CLEANING
MEDIA	WASTE

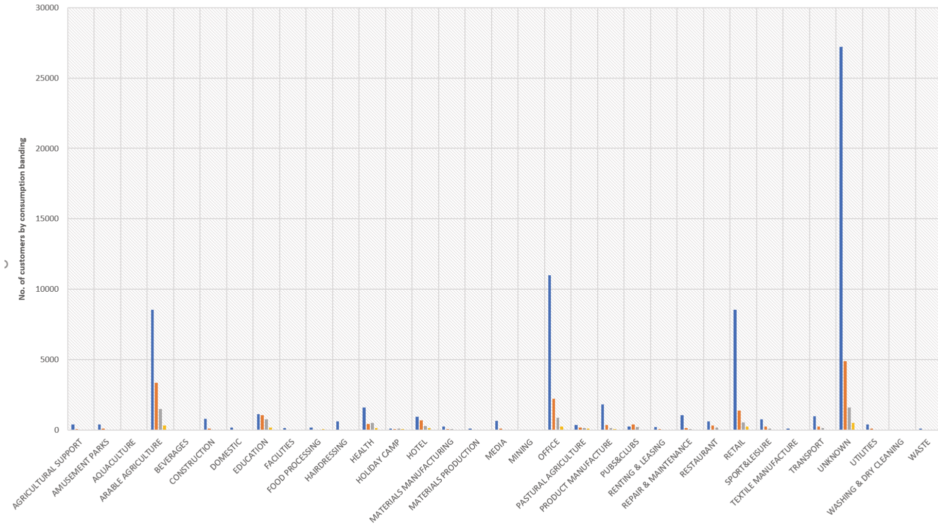
This has shown that for some sectors most of the consumption is in the highest volumetric band (food processing mining, retail), whereas other sectors are more evenly split (office, education, arable agriculture)(Figure 40).

Figure 40 Non-household sectors split by consumption per band



When we look at the number of customers by consumption band we find that for those sectors highlighted above it is a very small number of customers using very high volumes (Figure 41). The office, retail, arable agriculture and unknown sector has the highest numbers of small users.

Figure 41 Non-household sectors split by number in each consumption band



We will utilise these characterisations and sector definitions to assist in informing how we might target options and quantify potential savings.

6.3 Potential water efficiency options

For our WRMP24, we have now developed a number of non-household water efficiency options, which we will trial prior to full implementation in AMP8 (2025/26 onwards).

As part of the development of these options we are actively working with our retail partners to overcome barriers to the development of these options, including;

- working within the retail/wholesale framework
- the provision of meaningful data for retailers and non-household customers
- characterizing the multiple sectors and business concerns involved (large, small, simple, complex)

- understanding the different behaviours and water usage of the multiple sectors involved (household equivalent, industrial process, irrigation etc.)
- ensuring that business customers understand the overarching need for reductions in demand as part of our environmental destination, sustainability and resilience ambitions.

Additionally, given the diversity of different types of organisation and their water consumption, we are working to develop methods of best characterising businesses, so that water saving measures might be more efficiently targeted to their needs.

Our consultation has indicated that customers are currently unsure about the need to reduce water consumption and how they might become more water efficient. However, we found there is an appetite to engage with additional water efficiency measures, which will help business customers with their bills, if we as water wholesalers can assist with this process.

As noted, we as an industry, need to:

- ensure that businesses understand why water efficiency is important in the context of the regional water resource strategy.
- convince businesses that there may be water to be saved and that this will be beneficial, both for the regional environment and for their own business resilience.
- develop actionable options that we can trial and then implement with our retail and business partners.

Our consultation suggested that there are two initial options that should be initially developed, and we have now quantified these for inclusion in the WRMP24.

We are currently beginning to investigate implementing these options in trial form with input from ourselves, as water companies, as well as our Retail partners and their business customers.

These two initial options concentrate on the following:

6.3.1 Reducing leakage (both internal plumbing loss and supply pipe leakage) for business customers

- For this option we will leverage our smart meter introduction and the data that would be available. Continuous night flows (or irregularities in consumption) would be analysed and notifications sent to business customers, indicating a potential leak.
- Business customers would have the option to 'self audit', utilising on-line processes or 'virtual visits', in order to assist with the identification and repair of the leak. The audit would also help in identifying whether the leak was internal (plumbing loss, 'leaky loo') or external (customer supply pipe leakage)
- If the leak is internal and a plumber were to be required, water efficiency visits would be incentivised.
- If the leak were found to be external, we would investigate the provision of a 'find and fix' service.
- This type of option should be targeted at all sizes of business customer, of all types of complexity.

We have received positive feedback on this potential option and will look to trial this in collaboration with our WRE partners. Businesses are concerned about leakage (and its impact on their bills) and have suggested that assistance with reducing leakage, including notification alerts and incentivisation, would be appreciated. Businesses have understood, the significant role that smart metering could play with respect to this.

6.3.2 Enable businesses to reduce water usage with our Retail partners

- In order to assist customers to become more water efficient, we would look to develop on-line self auditing systems, that could guide businesses to understand their consumption and then produce recommendations regarding potential usage reductions (this might also be linked to energy usage). This auditing tool should be able to provide usage comparison data, benchmarking potential reductions that might be seen and, also, generate cost and benefit data.
- This type of option would appear to be most suitable for targeting low complexity, high consumption businesses.
- Additional 'virtual visits', where customers could be talked through this information will also be part of the service.

- Part of this option should also involve the possibility of in-person, 'audit and install' visits. In this case, an expert auditor visits the customer, identifying areas for improvement and offering advice. Additionally, the operatives may be able to assist with simple plumbing fixes and retrofitting water efficient devices (for example, toilet cistern replacement), as part of the visit.
- Further incentives may be considered to encourage businesses to action any areas of improvement identified.

Again, we have received positive feedback on this option, which should give clear guidance on water efficiency and offer assistance in remedying any areas of concern.

It should be possible to develop these options for most of the business customer base, but more complex interventions may well be necessary for the largest non-household consumers. We will look to investigate these options as part of our "Water Demand Reduction Discovery' program.

Options that might be targeted at larger users will potentially include:

6.3.3 Encouraging businesses to adopt water recycling systems

- For larger businesses, we see definite potential in the development of grey, green, rainwater and blackwater water re-use systems. These systems range in cost and complexity and would potentially require bespoke design for each different business need. However, we believe there is significant scope in working with businesses, especially where new developments are being constructed to encourage the installation of these systems from the outset (Retrofitting might prove more costly).
- For this option we are considering how information on these options might be provided by the retailer, including;
    - summaries of existing technologies,
    - case-studies of exiting installations and
    - how they might be applied for the business in question
- Water companies could also be in a position to offer audits and advice to developers and businesses, as large scale sites are constructed.
- We are also considering how we could incentivize this type of water re-use option (potentially with reward tariffs), providing feasibility studies for water capture and on-site storage developments.
- We will also need to liaise with local authorities as well as developers to facilitate the installation of water re-use systems, as new-build projects are designed and constructed.
- Such options could be tied to 'green 'accreditation systems, recognising the contribution to the local environment.
- We note that these systems, might be more appropriate for larger non-household customers, which might have a requirement for non-potable water usage (irrigation).

We intend to develop these options for trial and full implementation in our WRMP24. However, we still need further research before we will be in a position to quantify some of the options for full cost/benefit analysis.

6.4 Non-household option costs and benefits

For our option appraisal process we generated a low, medium and high portfolio of options based upon the target cohort size.

6.4.1 Low portfolio of non-household options

We have developed a low non-household water efficiency portfolio of options may be summarised as follows (Table 37):

Table 37 Non-household water efficiency options Low

Type of visit	Size of customer (consumption)	Expected no. Properties impacted per year (based upon our customer base)	Expected saving (per property per day)
Delivery of smart meter targeted water saving efficiency packages, similar to household drop20 campaigns. This will be undertaken on a scaled basis (dependent on the size of water consumption).	Low Consumption	2000	86 litres per water efficiency package
Specialist water efficiency audits, with find and fix for consumers using approximately 25,000 litres per property per day.	Medium Consumption	50	2,127 litres per property
Specialist water efficiency audits with find and fix for larger consumers (approx. 500,000 litres per property per day).	High Consumption	5	43,775 litres per property
Retailer incentives for plumbing loss reduction A £100 incentive to retailers to reduce plumbing losses.	All users	2000	59 litres per property
Smart meter identified plumbing loss fix Non-household plumbing loss repairs for properties identified, through smart metering, to have continuous flow. These visits will be aligned with water efficiency visits.	All users	2000	240 litres per property
Smart meter identified customer supply pipe leakage (cspl) fix. Non-household repairs for properties identified, through smart metering, to have continuous flow. These visits will be aligned with water efficiency visits.	All users	2000	9 litres per property

These low options will result in costs and savings (Table 38):

Table 38 Non-Household water efficiency option savings

	AMP8 Out-turn water saving per year Ml/d	AMP8 Opex (£)	Opex saving (inc. value of water saved) (£)	AMP 12 Out-turn water saving per year Ml/d	AMP12 Opex (£)	Opex saving (inc. value of water saved) (£)
	AMP8	AMP8	AMP8	AMP12	AMP12	AMP12
NHH PL repairs	2.4Ml/d	£0.97m	£0.24m	12.0Ml/d	£0.97m	£5.24m
NHH PL100 repairs	0.59Ml/d	£1.00m	£0.059m	2.94Ml/d	£5.00m	£1.29m
NHH WEF Visit Lower	1.42Ml/d	£0.74m	£0.14m	7.09Ml/d	£3.70m	£3.1m
NHH WEF Visit Upper	0.53Ml/d	£0.60m	£0.05m	2.66Ml/d	£3.00m	£1.16m
NHH WEF Visit Super High	1.09Ml/d	£0.26m	£0.11m	5.47Ml/d	£1.3m	£2.38m
Totals	6.03Ml/d	£3.57m	£0.599m	30.16Ml/d	£13.97m	£13.17m

Additionally, the cspl reduction option will result in the costs and benefits, below (Table 39):

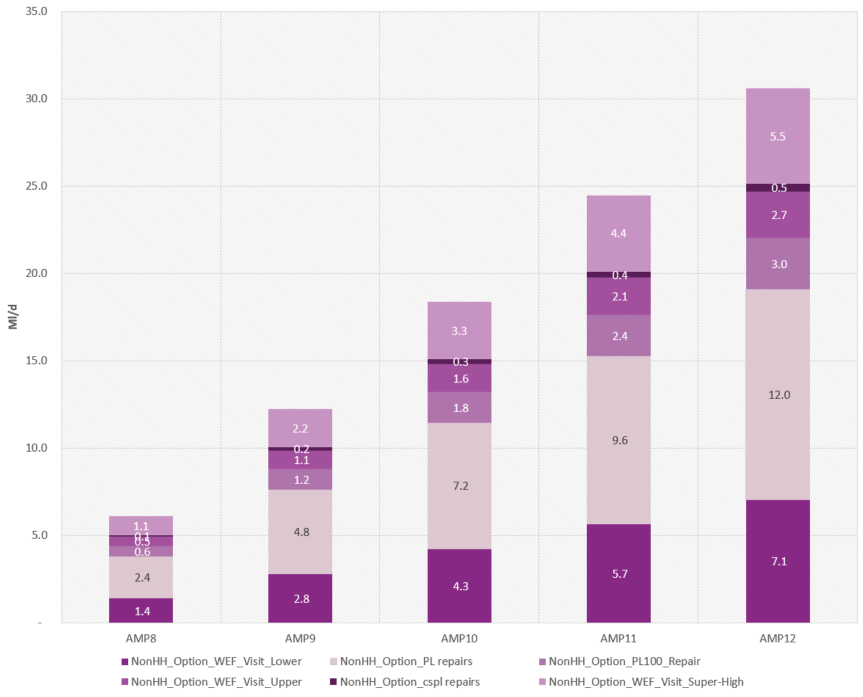
Table 39 Non-Household cspl savings from smart metering

	AMP8 Out-turn water saving per year Ml/d	AMP8 Opex (£)	AMP8 Cost per Ml/d	AMP 12 Out-turn water saving per year Ml/d	AMP12 Opex (£)	AMP12 Cost per Ml/d
	AMP8	AMP8	AMP8	AMP12	AMP12	AMP12
CSPL leak investigations (100d Enhancement)	0.09Ml/d	£0.03m	£0.24m/Ml	0.43Ml/d	£0.15m	£0.24m/Ml

Overall the low portfolio will save 6.12Ml/d in 2029/30 at a cost of £3.6m. By the end of the WRMP24 period, these options will save 30.59Ml/d at a cost of £14.12m (excluding opex savings).

These savings (excluding cspl) can be visualised as below (Figure 42).

Figure 42 Low Non-household option savings



6.4.2 Preferred portfolio of non-household options

The preferred portfolio of non-household water efficiency options may be summarised as follows (Table 40):

Table 40 Non-household water efficiency options Preferred

Type of visit	Size of customer (consumption)	Expected no. Properties impacted per year (based upon our customer base)	Expected saving (per property per day)
Delivery of smart meter targeted water saving efficiency packages, similar to household drop20 campaigns. This will be undertaken on a scaled basis (dependent on the size of water consumption).	Low Consumption	3000	86 litres per water efficiency package
Specialist water efficiency audits, with find and fix for consumers using approximately 25,000 litres per property per day.	Medium Consumption	108	2,127 litres per property
Specialist water efficiency audits with find and fix for larger consumers (approx. 500,000 litres per property per day).	High Consumption	10	43,775 litres per property
Retailer incentives for plumbing loss reduction A £100 incentive to retailers to reduce plumbing losses.	All users	3000	59 litres per property
Smart meter identified plumbing loss fix Non-household plumbing loss repairs for properties identified, through smart metering, to have continuous flow. These visits will be aligned with water efficiency visits.	All users	3000	240 litres per property
Smart meter identified customer supply pipe leakage (cspl) fix. Non-household repairs for properties identified, through smart metering, to have continuous flow. These visits will be aligned with water efficiency visits.	All users	3000	9 litres per property

The preferred options will result in costs and savings (Table 41):

Table 41 Non-Household water efficiency option savings

	AMP8 Out-turn water saving per year Ml/d	AMP8 Opex (£)	Opex saving (inc. value of water saved) (£)	AMP 12 Out-turn water saving per year Ml/d	AMP12 Opex (£)	Opex saving (inc. value of water saved) (£)
	AMP8	AMP8	AMP8	AMP12	AMP12	AMP12
NHH PL repairs	3.60Ml/d	£0.291m	£0.36m	18.0Ml/d	£1.45m	£7.87m
NHH PL100 repairs	0.89Ml/d	£1.50m	£0.089m	4.42Ml/d	£7.50m	£1.93m
NHH WEF Visit Lower	2.13Ml/d	£1.11m	£0.21m	10.63Ml/d	£5.56m	£4.65m
NHH WEF Visit Upper	1.15Ml/d	£1.40m	£0.11m	5.74Ml/d	£7.02m	£2.51m
NHH WEF Visit Super High	2.19Ml/d	£0.52m	£0.22m	10.94Ml/d	£2.60m	£4.78m
Totals	9.95Ml/d	£4.828m	£1.004m	49.74Ml/d	£24.144m	£21.766m

Additionally, the cspl reduction option will result in the costs and benefits, below (Table 42):

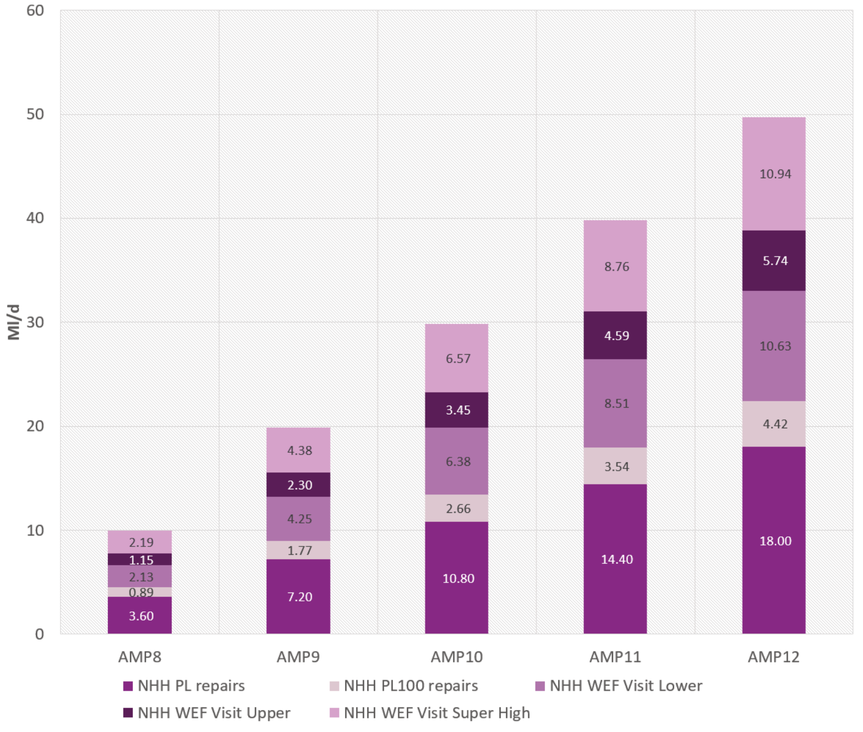
Table 42 Non-Household cspl savings from smart metering

	AMP8 Out-turn water saving per year Ml/d	AMP8 Opex (£)	AMP8 Cost per Ml/d	AMP 12 Out-turn water saving per year Ml/d	AMP12 Opex (£)	AMP12 Cost per Ml/d
	AMP8	AMP8	AMP8	AMP12	AMP12	AMP12
CSPL leak investigations (100d Enhancement)	0.13Ml/d	£0.05m	£0.36m/Ml	0.65Ml/d	£0.23m	£0.36m/Ml

Overall the options will save 10.08Ml/d in 2029/30 at a cost of £4.878m. By the end of the WRMP24 period, these options will save 50.39Ml/d at a cost of £24.374m (excluding opex savings).

These savings (excluding cspl) can be visualised as below (Figure 43).

Figure 43 Non-household water efficiency savings (excluding cspl)



6.4.3 High portfolio of non-household options

We have developed a portfolio of high non-household water efficiency options which may be summarised as follows (Table 43):

Table 43 Non-household water efficiency options High

Type of visit	Size of customer (consumption)	Expected no. Properties impacted per year (based upon our customer base)	Expected saving (per property per day)
Delivery of smart meter targeted water saving efficiency packages, similar to household drop20 campaigns. This will be undertaken on a scaled basis (dependent on the size of water consumption).	Low Consumption	4000	86 litres per water efficiency package
Specialist water efficiency audits, with find and fix for consumers using approximately 25,000 litres per property per day.	Medium Consumption	150	2,127 litres per property
Specialist water efficiency audits with find and fix for larger consumers (approx. 500,000 litres per property per day).	High Consumption	15	43,775 litres per property
Retailer incentives for plumbing loss reduction A £100 incentive to retailers to reduce plumbing losses.	All users	4000	59 litres per property
Smart meter identified plumbing loss fix Non-household plumbing loss repairs for properties identified, through smart metering, to have continuous flow. These visits will be aligned with water efficiency visits.	All users	4000	240 litres per property
Smart meter identified customer supply pipe leakage (cspl) fix. Non-household repairs for properties identified, through smart metering, to have continuous flow. These visits will be aligned with water efficiency visits.	All users	4000	9 litres per property

The high options will result in costs and savings (Table 44):

Table 44 Non-Household water efficiency option savings

	AMP8 Out-turn water saving per year Ml/d	AMP8 Opex (£)	Opex saving (inc. value of water saved) (£)	AMP 12 Out-turn water saving per year Ml/d	AMP12 Opex (£)	Opex saving (inc. value of water saved) (£)
	AMP8	AMP8	AMP8	AMP12	AMP12	AMP12
NHH PL repairs	4.8Ml/d	£0.39m	£0.48m	24.0Ml/d	£1.93m	£10.49m
NHH PL100 repairs	1.19Ml/d	£2.00m	£0.12m	5.89Ml/d	£10.0m	£2.57m
NHH WEF Visit Lower	2.84Ml/d	£1.48m	£0.28m	14.17Ml/d	£7.41m	£6.20m
NHH WEF Visit Upper	1.59Ml/d	£1.94m	£0.15m	7.97Ml/d	£9.75m	£3.48m
NHH WEF Visit Super High	3.29Ml/d	£0.78m	£0.33m	16.41Ml/d	£3.9m	£7.17m
Totals	13.71Ml/d	£6.59m	£1.36m	68.44Ml/d	£32.99m	£29.91m

Additionally, the cspl reduction option will result in the costs and benefits, below (Table 45):

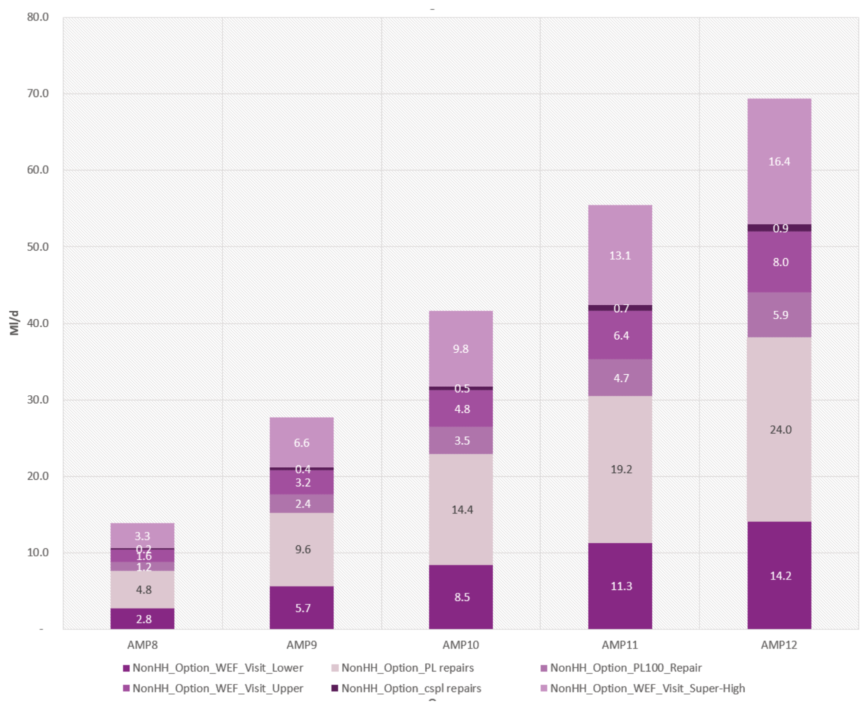
Table 45 Non-Household cspl savings from smart metering

	AMP8 Out-turn water saving per year Ml/d	AMP8 Opex (£)	AMP8 Cost per Ml/d	AMP 12 Out-turn water saving per year Ml/d	AMP12 Opex (£)	AMP12 Cost per Ml/d
	AMP8	AMP8	AMP8	AMP12	AMP12	AMP12
CSPL leak investigations (100d Enhancement)	0.17Ml/d	£0.07m	£0.48m/Ml	0.87Ml/d	£0.31m	£0.48m/Ml

Overall the options will save 13.88Ml/d in 2029/30 at a cost of £6.66m. By the end of the WRMP24 period, these options will save 69.31Ml/d at a cost of £33.33m (excluding opex savings).

These savings (excluding cspl) can be visualised as below (Figure 44).

Figure 44 High Non-household option savings



6.5 Preferred Non-household options

For the WRMP24 we have now assessed and quantified options for further development and trials, whilst also considering how we might address barriers to their implementation (funding issues, access issues etc.).

It must be noted that the options that have been developed will all need Retailer participation for their delivery and success.

Our initial assessments for costs and benefits, have been based on smart meter data, internal cost estimates for similar household options and external consultant information.

These options have been included in our preferred portfolio for implementation from 2024/25 to 2049/50 and are described below:

1. Water Efficiency Visits - Low size customer (Retailer driven)

This option is the **Smart meter targeted Non-Household Water Efficiency Audit for smaller** customers with lower estimated Per property consumption values (similar to the household 'drop20' option, with similar targeted interventions; leaky loos, taps etc.).

This option will deliver water saving efficiency packages, on a scaled basis, dependent upon the size of water consumption per property:

- companies with a per property consumption similar to 300l/prop/d to be provided 1 no equivalent 'drop20' interventions.
- companies with a PHC similar to 1500l/prop/day to be provided 3 no. equivalent 'drop20' interventions.
- companies with a PHC similar to 5000l/prop/day to be provided 5 no. equivalent 'drop20' interventions.

The assumed saving per property is 86 l/prop/day, (based upon a 9% saving). This option is expected to target approximately 3000 properties per year. This would equate to approximately 75% of all properties over the WRMP24 period. (15,000 visits over AMP8). Note that this option is driven by smart meter data, indicating properties with high usage / continuous flow.

2. Water Efficiency Visits - Medium sized customers (Retailer/consultant driven)

This option is the **Smart meter targeted Non-Household Water Efficiency Audit for medium**sized customers with medium estimated per property consumption values.

This option will deliver smart meter targeted specialist water efficiency 'Water Audit Visits' with 'find and fix' services for larger consumers (with per property consumptions of approximately 25,000 l/prop/day).

Costs are currently estimated at £2,600 per visit, based upon specialist consultant information.

Savings have been initially assessed at 2,127 l/prop/day (based upon an average 9% reduction). This option is expected to target approximately 108 properties per year.

3. Water Efficiency Visits - High sized customers (Retailer/consultant driven)

This option is the **Smart meter targeted Non-Household Water Efficiency Audit for large**sized customers with large estimated per property consumption values.

This option will deliver smart meter targeted specialist water efficiency 'Water Audit Visits' with 'find and fix' services for very large consumers (with per property consumptions of approximately. 500,000 l/prop/day).

Costs are currently estimated at £10,400 per visit, based upon specialist consultant information.

Savings have been initially assessed at 43,775 l/prop/day (based upon an average 9% reduction). This option is expected to target approximately 10 properties per year.

4. Water Efficiency Visits - Retailer Incentive - plumbing loss reduction (Retailer driven)

We will look to incentivize 'plumbing loss' repairs with a £100 incentive to the retailers in order to impact longer running leaks.

This option is expected to potentially save another 59 l/prop/day, with 3000 properties per year targeted. This is similar to the the target 100 program that has been developed for the household sector.

5. Smart Meter identified Plumbing Loss Fix

This option targets non-Household Plumbing loss repairs for properties identified to have continuous flow (through smart metering).

The number of properties targeted will align with the water efficiency visits (i.e. 3000 per year - with approximately 75% of non-household stock impacted by 2050).

Costs have been based upon similar customer journeys for household leakage.

Savings are currently estimated to be 240l/prop/day, based upon most recent smart meter data.

6. Smart Meter identified cspl Fix

This option targets non-Household customer supply pipe leakage (cspl) repairs for properties identified to have continuous flow (through smart metering).

The number of properties targeted will align with the water efficiency visits (i.e. 3000 per year - with approximately 75% of non-household stock impacted by 2050).

Costs have been based upon similar customer journeys for household leakage.

Savings are currently estimated to be 9l/prop/day, based upon most recent smart meter data (this based upon the bulk of the properties with a low per property consumption).

Options 1, 4 and 5, will act together to drive (Retailer) Water Efficiency Visits, informed by smart meter continuous flow, enabling plumbing loss find and fix.

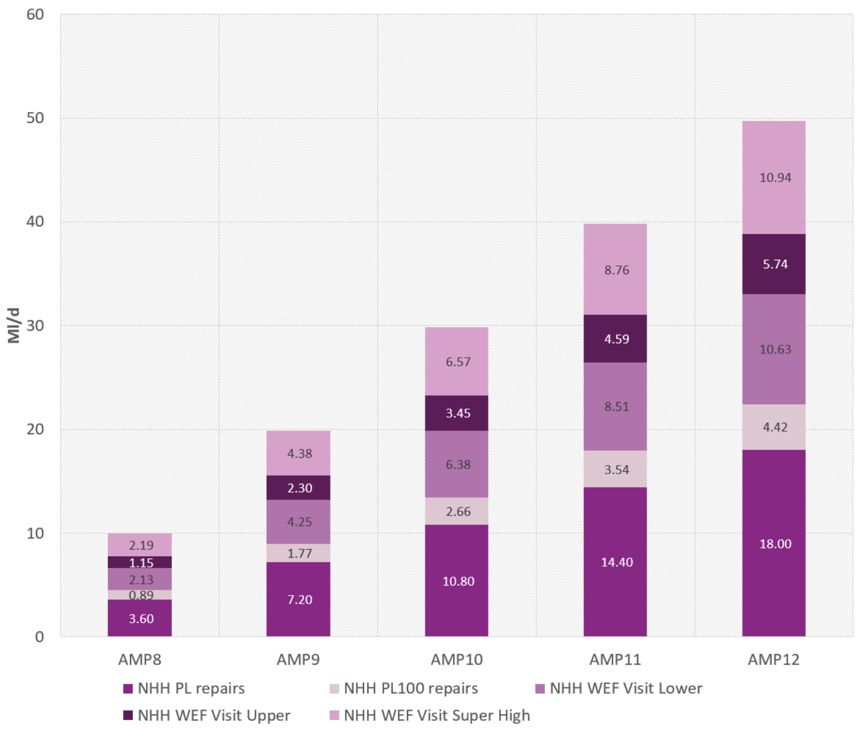
Note that whilst considering appropriate savings for each of the options we have been mindful of the Defra/EA target of a 9% reduction by 2037/38, tailoring savings, where appropriate, to adhere to this figure, where feasible.

Savings and target cohorts have been considered in the light of Thames Water recent findings of approximately 3000l/prop/day average savings for 3000 visits per year, with an average cost of £250K per Ml/d saving. Note we have modelled a more conservative 650l/prop/d at a cost of £475K per Ml/d.

Overall the options will save 10.08Ml/d in 2029/30 at a cost of £4.878m. By the end of the WRMP24 period, these options will save 50.39Ml/d at a cost of £24.374m (excluding opex savings).

These savings (excluding cspl) can be visualised as below (Figure 45).

Figure 45 Non-household water efficiency savings (excluding cspl)



7 Additional options

7.1 The potential for tariff development and price signalling

Overview

As part of WRMP24, we have continued to review the potential for applying tariffs and price signals, as part of our demand management strategy. The majority of household customers pay their water bill based on a simple two part tariff structure, with a fixed charge (calculated on a per diem basis) and a uniform unit charge for volumetric usage (currently in 2023/24, 84% of our customers pay on a measured/metered charge).

In order to assess the feasibility of more complex tariff options, we commissioned the University of East Anglia Centre for Competition Policy to review the international experience of price and non-price approaches to manage water demand. This research suggested that, before tariffs with differentiated price signals can be implemented successfully, certain pre-conditions must be met.

These include, but are not limited to, the points listed below.

- Customers need to be able to understand their consumption and engage positively in managing their demand, otherwise introducing tariff changes (such as Increasing Block tariffs) may have unintended, adverse consequences both to customer bills and to demand (smart meters will be essential in the implementation of these tariffs).
- Access to near real-time information is key to informing the customer of the relationship between usage and cost, and thus, the impact on bills of particular customer behaviours.

Additional consideration needs to be given to the following:

- Tariffs and price differentials would need to be implemented fairly, so that no group of customers would be discriminated against.
- We would need to be mindful of impacts on particular demographic groups and vulnerable customers in the implementation of tariff structures.
- It is noted that the current framework for pricing determines the overall cost of water, such that any seasonal price rises that might be implemented, would need to be counteracted by price reductions at other points in the year. However, it is noted that despite this charging balance, seasonal demand management messaging could be reinforced by targeted seasonal tariffs, at key times of high summer demand.
- Tariffs will only be successful if they can successfully be used to reinforce and emphasize behavioural change messaging.

We consequently believe that for the successful implementation of more complex tariffs, full smart meter rollout needs to be achieved (in our preferred plan we will fully rollout smart meters by 2030, achieving 91.1% metered and measured status by that point). We also understand from our engagement with customers that some find their bills and the basis for charging unclear or confusing and that our smart metering communications should be used to improve this understanding, by making consumption information more visible to customers, along with related costs. As part of our WRMP24/PR24 consultation process we are contacting a selection of our most vulnerable customers to ascertain their views on their unmeasured status, and potential volumetric billing, in order to understand and alleviate their concerns.

Having reviewed more general IBTs (Increasing block tariffs), we believe that a more targeted seasonal approach regarding summer tariffs may prove more beneficial, when accompanied by relevant messaging (via our smart meter MyApp account system). We would stress that potential tariffs should be viewed as a mechanism to reinforce seasonal messaging regarding summer usage. Additionally, we would also note that 'perennial summer tariffs' should be considered separately from 'discretionary use drought tariffs' that might be implemented during times of severe weather stress.

We believe it is necessary that we trial the effects of potential tariffs in AMP8, as part of our WRMP24 innovation program (including the messaging and presentation of tariffs), before we would consider wide-scale roll-out, as part of WRMP29 in AMP9 and beyond. Given that we will need to trial such an approach, in order to determine potential benefits, we have not included tariffs as a feasible option in our WRMP24. We, however, believe that more complex price signals may have a role to play in our future demand management activities, once our smart meter installation program is complete.

7.2 Price incentives

Whilst considering the widest range of potential demand management options, we have also considered more complex tariffs.

A simple, two-part tariff with a volumetric charge per unit of water already sends a price signal to customers about each incremental unit consumed. However, more sophisticated tariffs (potentially tariffs which should impact summer peak demand) might produce more complex price signals relating to overall usage, when that usage occurs and for what purpose. These tariffs should send differential price signals to our customers through their bills, which might cause desired changes to their consumption behaviours.

This raises the question regarding whether and by how much price signals can affect behaviour, and whether other messaging is required alongside or in place of price signalling in order to properly engage customers. As part of our review, we commissioned the Centre of Competition Policy Study (UEA) which concluded:

- Price and information-based interventions can work together to reduce demand, and,
- Price signals work best with engaged customers and alongside relevant and timely information, particularly consumption information.

7.3 Demand and the price of water

A key potential element of residential water demand management is water pricing.

Making water a more expensive commodity should, in theory, tend to reduce residential water demand. However, academic consensus currently suggests that water is not particularly price-sensitive, as it is such a necessity, and as it remains relatively inexpensive, in comparison to other living expenses.

The degree to which price affects demand for a product or service is known as **price elasticity**. If demand is price inelastic, as appears to be the case with water, then changes in the marginal volumetric rate faced by a consumer will have little effect on demand.

- Previously we have assumed (for planning purposes) that for every 10% increase in price, demand should reduce by 1.5%. However, previously estimating price elasticity of demand for water from observed customer behaviour has proved challenging. Smart metering should allow a much more robust analysis of impacts, as we trial summer tariff options.

Demand behaviours are specific to a given demographic, customer circumstance or external influence (weather), and may well vary both between customers and between different time periods for individual customers. For example, demands for essential uses of water are less likely to be responsive to marginal price than 'discretionary' uses, such as garden/plant watering. The key conclusions of the UEA research can be summarized:

- Water demand is in general price inelastic
- Summer demand is thought to be more price elastic than winter demand, and similarly outdoor household use is regarded as more price elastic than indoor use
- There is evidence which suggests that having price information next to consumption information on the bill may increase the price elasticity of demand by a factor of 30% i.e. make demand more responsive to price (this should be tested, as our smart meter rollout progresses) and
- The demands of lower income households tend to be more price elastic than those of higher income households

As the only supplier of water to customers in our region, we have a special responsibility to ensure our charges are fair and customers understand how their bills are calculated. We are also committed to ensuring the affordability of water for customers in our region. There are also questions about how price interventions would sit within a regulatory model based on total allowed revenues. Simply increasing the price of water is not acceptable to us, our customers or our regulators.

Understanding our customer base and demographic profile will be key to implementing tariff schemes. Additionally, understanding the nature of discretionary use will also be fundamental to determining how associated behaviours might change and how we might encourage this.

Approaches to sending price signals might be described:

- Increasing block tariffs;
- Seasonal tariffs;
- Time-of-day tariffs; and
- Premium tariffs for outdoor use

Having reviewed the complexities of these various options we have concluded that we should pursue initial trials of seasonal tariffs. We, believe that price differentials (through the introduction of tariffs) would potentially be most beneficial if applied to peak summer consumption (or periods of drought), which might be more price elastic than winter use (potentially confined to more essential types of consumption). This type of tariff, would still need careful consideration with respect to it's impact, but could be used to support specific messaging to mitigate summer (and times of drought) demand.

7.4 Increasing block tariffs

In a block tariff, different unit prices are charged for pre-specified blocks (quantities) of water used by the consumer. An increasing block tariff (IBT) is where the unit price increases with each successive block of consumption. This is different from our current two part tariff of a fixed standing charge and a fixed charge per unit of consumption. A clear advantage of an IBT is that it attempts to find some balance between the two objectives of affordability and water conservation by providing a cheaper initial block. However, there will still be some trade-off between these two objectives.

IBTs are in use in several locations around the world, including the USA, Spain, Portugal and Australia. The effectiveness of IBT systems in practice appears to depend on whether they are appropriately designed, as well as positively received by customers. Challenges may arise at both stages of this process, due to the complexity of an IBT.

We have considered the option of developing an IBT system for household customers paying measured charges.

One potential attraction of an IBT system is that by its existence it could convey helpful signals to our customers regarding the importance of water conservation, quite apart from the direct effect upon individual consumers' demand from the change in marginal price . The introduction of an IBT might incentivize lower demand, making a significant contribution to our demand management program. The replacement of our single volumetric charge with an IBT including multiple marginal volumetric rates could, in principle, bring about a further net reduction in demand in line with the differential elasticity, depending upon types of water usage. (i.e. by discouraging customers' discretionary use).

The expectant outcome should result in higher usage households seeing an increase in their bills, whilst lower usage consumers would see a reduction. This could be seen to bring about an improvement in fairness, depending on the size and calculation of the "essential use" block.

Part of the UEA research identified factors likely to improve the effectiveness of IBTs. These are listed below.

- Adoption as a response to severe weather conditions, such as a drought.
- Sufficiently high unit prices for high blocks.
- Continuous adjustments of rates and structures when needed.
- Clear price information included on households' bills.
- Adoption for a sufficiently long period.
- Adoption alongside non-price conservation tools.
- A clear understanding of real time consumption data by Anglian Water and our customers.

These factors provide important prerequisites, and some challenges, which would have to be carefully considered before a case could be made for the introduction of IBTs in our region. In addition, several concerns with IBTs have been identified, as outlined below.

- Without full smart meter penetration, evidence suggests that this option would not be feasible (given that the measure would need to be implemented fairly and without discrimination) and further work is needed in order to determine whether the introduction of an IBT, at least in isolation from other behavioural initiatives, would have a significant effect on total household demand in our region.

- In order to maintain the same level of overall revenue recovery in line with regulatory controls, the introduction of a higher consumption block or blocks at a higher marginal price would have to be combined with a lower marginal price for the lower consumption blocks. This could have unintended negative consequences, including potentially causing an increasing overall demand.
- If expenditure on the customer's water bill is a relatively small part of the expenditure, for the majority of households, and IBTs are complex, then acquiring the level of information to engage rationally with the price signals may not be economically viable.
- If customers do engage, an overall reduction in demand will depend upon the price elasticity of demand for customers using different levels of consumption. It may be that the price elasticity of demand at higher levels of usage is indeed higher than it is for lower levels of usage, in which case a net reduction in demand could be expected. However, this would have to be established empirically.
- It would not be sensible or fair to introduce a simple IBT structure with a uniform fixed size for the first block, because this would mean that low occupancy households with relatively high levels of demand (high PCCs) could avoid paying the "premium rate", and high occupancy households with relatively low levels of demand (Low PCCs) might be unable to avoid it. It seems essential, to relate the size of blocks to household occupancy at least, and potentially other household characteristics, for it to be seen as fair. Acquisition and maintenance of such information would incur significant transaction costs.
- IBTs are likely to have different affects on different income groups. Higher occupancy or higher income groups may tend to use more water (bigger gardens, power showers etc.) and conversely, lower income groups may have older (less water-efficient) appliances, and are more likely to occupy housing stock (characterized by older or bigger cisterns and perhaps the presence of baths rather than showers).
- If blocks were set on an annual basis, then given the April to March charging year, customers would typically be using up their "basic" blocks during summer months, and only going into higher rate block(s) later on in the year, generally during winter. This would potentially create issues with the timing and narrative around how and when cost changes might occur.
- The widespread use of direct debit (which brings its own benefits to both customers and the company) would tend to operate in such a way as to weaken the price signals that the tariff structure is intended to convey.

Our evaluation suggests that the presentation of a higher volumetric rate would require careful positioning with customers and stakeholders, to emphasize why this would be beneficial, and that the move would be overall revenue neutral. Significant complexity would surround the introduction of this measure in terms of cost and practicality. Further research and trials would be needed in order to ascertain whether IBTs would produce meaningful and lasting impacts on demand

7.5 Seasonal tariffs

Seasonal tariffs involve measured households facing a lower volumetric cost for water during the winter (October to March) and a higher one during the summer (potentially April to September). There are many permutations of seasonal tariffs. "Summer" could last for just two or three months, or as long as seven or eight. In some examples elsewhere in the world there are "shoulder" seasons as well as "peak" and "off-peak" seasons.

The intention of seasonal tariffs is to target and reduce the higher discretionary use of water that occurs in the summer. Summer peak demand is considered to be more price elastic, so the increase in tariff could be expected to lead to a reduction in demand, whereas any increase in winter demand, which is considered to be relatively price inelastic, could be expected to be negligible. This would lead to an overall reduction in household consumption and assist at times of peak stress for water supplies. Given the potential for future climate change this could be a useful option to mitigate the additional summer consumption that we might experience. Additionally, seasonal tariffs should help to signal the importance of water resource issues.

Although the overall uplift in demand between summer and winter (once averaged) appears relatively small (approximately a 5% uplift) it must be noted that peak summer demand can be >30% higher than normal (consisting of additional washing, gardening, outdoor pool usage, car-washing etc.), and we are now seeing our highest recorded peaks and these peaks lasting for longer durations.

We believe that a more targeted seasonal approach regarding summer tariffs may prove beneficial, when accompanied by relevant messaging (via our smart meter MyApp account system). We would stress that potential tariffs should be viewed as a mechanism to reinforce seasonal messaging regarding summer usage, in order to potentially change behaviours.

Additionally, we currently believe that there may be scope to introduce a discretionary seasonal tariff option, once smart metering has been fully implemented, that would potentially be introduced only during times of drought or severe water stress.

We understand that these options would be needed to be trialled and that we would need to consider:

- Our understanding of how discretionary use is constituted and how the associated behaviours might be changed.
- The messaging that would need to be associated with such a tariff to drive behaviour change, noting that we would need to maintain the same level of overall revenue recovery in line with regulatory controls.
- The widespread use of direct debits to pay bills might undermine the price signal, with customers focused on the single direct debit amount without engaging with the intricacies of how it is constituted.
- Seasonal tariffs may be considered unpopular by customers: previous experience suggests that customers may see the approach as cynical, especially when it applies to discretionary and essential use.

Trials for the implementation of seasonal tariffs have now been considered and are intended to begin before the start of the WRMP24 planning period, (as discussed below).

7.6 Our summer tariff trial

As we prepare for AMP8 and the WRMP24 program, we will implement our initial tariff trial from April 2024. We have, therefore worked with the Centre for Competition Policy (CCP) at the University of East Anglia (UEA) to develop a robust methodology and provide guidance on trial design and data analysis, aligned to Ofwat's principles.

As discussed the CCP report (2018) questioned the effectiveness of RBTs in the UK context given;

- low discretionary use,
- low Price Elasticity of Demand, and
- the relatively low value of water.

We have also been working with the Centre for Climate Change & Social Transformation (CAST) to better understand;

- how customers use water,
- how they understand their use and
- the value they place on that use.

Given that we operate in a water scarce region, we believe that innovative tariffs could be aimed at supporting customers struggling to pay or incentivising customers to reduce discretionary demand for water.

Our focus is on water efficiency, helping customers to value water more, use less, and so reduce the need for future bill increases, as well as reducing their charges as households today, whilst mitigating additional demand from future growth. We are concerned that the RBTs reliance on free or low cost blocks of water are inconsistent with the messaging to customers which we have used for the last 20 years to “love every drop”. We are also concerned that without accurate occupancy data, free or low cost blocks of water benefit low occupancy/low demand households to the detriment of higher occupancy households, unless the relative income of households is taken into account.

The generosity of our customers demonstrated in the recent consultation on support for a maximum contribution of £24 for our social tariff LITE, means that we can focus support for customers with affordability issues through the LITE tariff system.

The current smart metering roll-out gives us an almost unique position to trial seasonal tariffs, as a means of encouraging greater water efficiency, but also to test whether an element of progressive charging can be in-built to lower charges for those customers with little or no non-essential use. We intended to share the results of this initial trial with the industry.

We note that price elasticity of demand suggests price alone will not drive demand reductions, so a comprehensible structure and messaging are crucial, linked to our WRMP24 strategic requirements and regional environmental goals.

We remain open minded regarding RBTs and will look to build on wider industry experience relating to their effectiveness in any future trials we undertake.

We are planning to start a trial of a seasonal tariff from 2024/25 (in preparation for AMP8). The tariff will consist of a higher volumetric charge in the summer months and a lower volumetric charge for the remainder of the year. We plan to test variations in price differentials across seasons and different communication strategies across several customer cohorts:

- 1. Control group
  - a. Standard messaging
  - b. Test messaging 1
  - c. Test messaging 2
- 2. Seasonal tariff 1
  - a. Standard messaging
  - b. Test messaging 1
  - c. Test messaging 2
- 3. Seasonal tariff 2
  - a. Standard messaging
  - b. Test messaging 1
  - c. Test messaging 2

This scientific study will help to inform future pricing structures as we complete our smart meter roll-out and develop our water efficiency strategies.

7.7 Other tariffs

Time-of-use tariffs

Time-of-use tariffs are used in other sectors, notably electricity, but are not common in the water sector.

Household consumers generally have diurnal peaks (the early morning and the late afternoon/early evening) and the theory is that by setting prices higher at these times it would encourage customers to shift their demand or to reduce it altogether. However, the diurnal peaks, by their very nature, reflect a general patterns in human behaviour specific to those times of day (washing in the morning and cooking, washing in the evening).

There might be some potential for a case of time-of-day tariffs in circumstances where there are delivery system constraints, such that pressure and continuity are threatened during the height of the daily peaks, however such tariffs would be complex to design and to administer and it is not reasonable to expect customers to change these fundamental behaviours.

Premium tariffs for outdoor use

Neither the seasonal tariff option nor the Incremental block tariff option ensure that the premium tariff rate is targeted only at discretionary outdoor usage. However, having a targeted tariff would only be possible if this usage could be specifically identified, which could prove to be very problematic. This could be an expensive option as it would require additional monitoring/metering for external use and may not prove effective, given that the price elasticity of outdoor use may be inherently limited.

7.8 Conclusions

We believe that more complex price signals may have a role to play in our future demand management activities, once we have achieved full smart meter rollout. A key prerequisite for extending the use of price signals is that customers have real-time consumption data linked to price information available to them, and that they also understand their usage within the wider context of water conservation.

We would stress that potential tariffs should be viewed as a mechanism to reinforce seasonal messaging regarding behavioural change and water efficiency with regard to summer usage.

However, we note that there are certain preconditions to be met to enable successful pricing interventions.

- We need to improve our understanding of customer usage patterns (and particularly household occupancy) to effectively design price interventions.
  - The roll-out of smart meters will vastly improve the quality of the data we have about consumption. In conjunction with this, engaging with customers via a web-portal, in relation to other ‘non-price’ initiatives, provides a route to obtain information about occupancy.
- We need to establish the scale of impact that price interventions would have in our region. We need to be confident that changing our simple two-part tariffs would have the intended consequences. Therefore,

- ahead of such an action we would need to undertake robust trials to establish the evidence base.
- The introduction of more complex price signals would need to be part of a wider package of pricing and billing initiatives designed to inform customers and influence their behaviour in such a way as to achieve meaningful reductions in demand.

We intend to build upon the work currently being undertaken with regard to our smart meter program and associated customer communications and design trials of potential tariff interventions (seasonal) as part of our 'Water Demand Reduction Discovery Programme' in AMP8. It is clear that any price interventions need to be supported by other, non-price activities. In the future, there is likely to be a strong link between our activities to promote water efficiency and our ability to successfully implement pricing interventions.

These trials will need to be closely linked with our other water efficiency options including (as described above):

- The provision of information on water consumption within the home and how it might be reduced.
- Smart devices (e.g. shower timers).
- The provision of comparative information on customers' usage (comparisons with neighbours and/ or other households with similar characteristics).
- Community engagement: Encouraging customers to take on challenges or pledges to achieve specified goals.
- Providing feedback on customers' behaviour, including 'alerts' when consumption patterns vary, which may indicate possible leaks.

8 Cost benefit analysis

Cost benefit summary

Integral to our WRMP24 process has been the cost-benefit analysis of all the strategic option portfolios which have been developed. This section presents the cost-benefit and water saving results by strategic option.

Results can be summarised:

The '**Extended**' option portfolio is cost-beneficial overall, but does not offset predicted long-term growth and does not achieve near term savings to offset immediate supply-demand issues.

This option;

- achieves the NIC target for leakage (if nationally applied), with minimal reductions from 2024/25.
- does not quite achieve the 110l/h/d PCC target (by 2050) and,
- does not align with our WRMP19 2AMP smart meter rollout.

Additionally, we do not believe that the Extended option is sufficiently ambitious to deliver the water savings that we, our customers and our stakeholders expect.

The '**Extended Plus**' option portfolio is the most cost beneficial overall.

This option:

- more than offsets current predicted long-term demand growth and achieves near term savings to offset immediate supply-demand issues,
- achieves the NIC target for leakage (if nationally applied), with moderate reductions (a 24% reduction from the 2017/18 base-line),
- achieves the 110l/h/d PCC target (by 2050) and,
- aligns with our WRMP19 2AMP smart meter rollout.

The preferred'**Aspirational**' option portfolio is less cost beneficial overall, but would deliver the highest level of water savings and align most with Anglian Water ambition and EA/Defra expectation.

The water savings associated with the 'Aspirational' option rely on more uncertain activities (with regard to water saving) such as significant levels of mains replacement, but indicate the level of ambition we have to reduce demand and leakage.

This option:

- more than offsets current predicted long-term demand growth and achieves near term savings to offset immediate supply-demand issues.
- achieves very low levels of leakage including mains replacement and achieves the NIC target for leakage (a 38% reduction from the 2017/18 base-line).
- achieves the 110l/h/d PCC target (by 2050) and,
- achieves a reduction in non-household demand of 8% by 2037/38 and 15% by 2049/50 (relative to growth)
- aligns with our WRMP19 2AMP smart meter rollout.

Overall we conclude that the 'Aspirational' portfolio delivers the ambitious water savings we require, with sufficient levels of confidence in achieving those reductions, whilst meeting our framework obligations and mitigating near term costs.

8.1 CBA approach

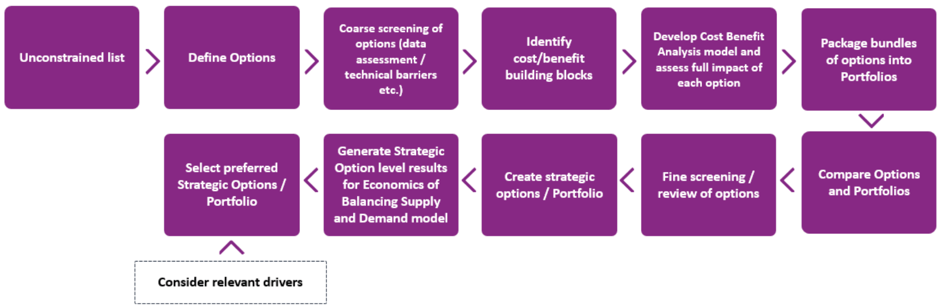
Our approach for the assessment of demand management options has been framed according to a structured process:

1. Options definition.
2. Identification of cost and benefit elements, referred to as 'building blocks', to be included in the cost-benefit analysis. This step includes itemising the information needed for that calculation; and, where appropriate, includes a set of values and assumptions that could be used in the calculation in the absence of company-specific data.
3. Assessment of full impact (i.e. costs and benefits) of each option. This step was carried out using bespoke models.
4. Options comparison and incremental impact calculation.

5. Creation of strategic option portfolios.
6. Generation of sub-option level results for the Economics of Balancing Supply and Demand (EBSD) model.
7. Selection of the preferred strategic option representing the preferred demand management strategy, taking account of 'Best Value Planning' criteria.

The general approach is illustrated in the following diagram (Figure 46):

Figure 46 Cost benefit analysis process



Our evaluation and preferred plan selection process has, included the following assessment methods:

- Cost benefit analysis and portfolio comparison.
- Sensitivity testing utilizing the EBSD (Economics of Balancing Supply and Demand) model.
- Evaluation of our portfolios against the 'Best Value Plan' and 'Least Cost' criteria.
- Additional sensitivity stress testing of the preferred plan, based upon the Ofwat Reference Scenarios.

8.2 Sources of evidence and assumptions

The sources of evidence and assumptions that have underpinned the analysis include:

- Anglian Water's own data or data provided by the Company's consultants and contractors;
- Unpublished evidence obtained by Anglian Water through professional contacts and networking with other UK water companies;
- Published sources such as relevant research reports and;
- Assumptions made in discussions with relevant Anglian Water experts and based on their experience and engineering judgement.

8.3 CBA modelling

To develop our CBA models, we have identified a comprehensive list of quantitative costs and benefits, known as building blocks. The development of these building blocks has been based upon our own data, expertise and experience, as well as published and unpublished information available to us through industry research groups and academic research.

These building blocks may apply to all, some or only a few of the demand management sub-options. The single, coherent list of building blocks developed across all the demand management options allowed us to develop consistent models to undertake the CBA on an aligned basis. The building blocks we have identified are described below.

In order to monetise the cost and benefit building blocks associated with each sub-option, we have developed assumptions about the costs, take-up and water savings. We have used the best information available to us at this point in time. The assumptions are based on our own experiences of costs and benefits from our extensive demand management activity to date, industry standards, and learning from our innovative trials. As our innovative trials progress further, data will become available on the most effective demand management interventions, we will continue to refine our plans.

The results of the assessment have been extracted from our WRMP24 model developed for metering, household water efficiency and leakage assessment. The modelling allows us to input values for each of the individual building blocks associated with each sub-option (e.g. smart metering or retrofitting of devices) over an 80-year period. They enable a cost-benefit comparison of different strategies through the calculation of incremental difference between the impacts of the compared options.

8.4 Cost and benefit building blocks

In order to determine the preferred strategic portfolio, we have undertaken a cost benefit analysis of the three strategic options, along with sensitivity testing scenarios. This has included the identification of all of the costs and benefits, the majority of which we have monetised.

Of course there are important non-economic benefits associated with demand management, and it was important to consider the qualitative benefits (that cannot be easily monetised) associated with each strategic option. In addition, all of the strategic demand management options have been assessed in the Strategic Environmental Assessment.

We have also considered how our preferred portfolio aligns with the 'Best Value' planning framework criteria.

8.5 Benefits

There are a number of quantifiable benefits from demand management. If we can reduce the amount of water consumed by customers and lost through leaks, we will:

- Reduce costs for customers through lower consumption of water
- Reduce treatment and pumping costs for ourselves
- Defer capital investment in supply-side solutions, and
- Reduce CO_2 emissions from us and customers, as we will be pumping less water around our systems.

The full list of benefits that formed our cost-benefit building blocks considered in our analysis is provided below. Some of the benefits have a broader impact than purely financial elements - these wider benefits are noted in the following table.

8.6 Benefit categories

The generic benefits that have been considered are (Table 46):

Table 46 Option benefit generic 'building blocks'

Benefit impact	Description	Leakage	Metering	Water Efficiency
Distribution system losses reduction	Reduced distribution losses, as the result of fewer leaks or quicker repairs. As well as the monetised benefit there are significantly wider benefits through lower abstractions and water remaining in the environment.	*	*	
Plumbing losses reduction	Reduction of plumbing losses within customer properties. As well as the monetised benefit there are wider benefits through lower abstractions and water remaining in the environment.		*	*
Reduced customer contacts (e.g. from more accurate billing)	Fewer customer enquiries regarding their bills as information accessible through the web portal.		*	
Reduced distance travelled for meter reading	Carbon associated with emissions due to meter- reading travel. As well as the monetised benefit, there are wider benefits through reduced CO_2 emissions.		*	
Reduced level of customer use (average and/or peak)	Reduced average water use by customers. As well as the monetised benefit there are wider benefits through lower abstractions and water remaining in the environment.		*	*
Operational Carbon emissions per ML/D - from treating less water	Carbon associated with emissions due to water production / operations	*	*	*
Customer supply pipe losses (CSPL) reduction	Benefit of reduced customer supply pipe leakage. As well as the monetised benefit there are wider benefits through lower abstractions and water remaining in the environment.		*	*
Hot water carbon savings	Reduced carbon emissions as customers use less hot water. Calculated in line with Ofwat's approach. As well as the monetised benefit, there are wider benefits through reduced CO_2 emissions		*	*
Customer valuation	Customer preference from societal valuation studies. Evaluated through customer valuation work package and added to overall CBAs as a benefit.	*	*	*
Value of deferred supply- side capital investment	The financial benefit of deferred and avoided costs associated with developing new supply capacity.	*	*	*

8.7 Qualitative benefits

As well as quantitative benefits, we considered a wide range of qualitative benefits. These are benefits that are important to us and our stakeholders, but cannot be easily monetised.

These include items such as:

- Water left in the environment as a result of demand management activity
- Helping connect customers to their environment
- Improved resilience of our systems
- Offsetting demand growth, which helps us to manage deterioration risk
- Offsetting or mitigating the impacts of climate change, and
- Enabling future innovation, such as smart meters potentially unlocking tariffs.

8.8 Cost categories

The generic costs that have been considered are (Table 47):

Table 47 Option cost generic 'building blocks''

Cost Impact	Description	Leakage	Metering	Water efficiency
Asset opex cost	Cost of purchasing the equipment and assets required to realise a sub-option. Cost of water saving devices are opex.	*	*	
Asset replacement cost opex if not covered under warranty	Cost of reactive/proactive replacement of the assets (faulty; at the end of asset life).	*	*	
Telecommunications capex (IT)	Cost of purchasing and installing communications equipment to operate data transmission systems. The cost of this equipment (for example, data collectors and radio masts) would also be accounted for in this impact		*	
Telecommunication opex (IT)	The operating costs for communications, such as data costs, on-going licence fees and maintenance.		*	
Customer engagement cost opex	Cost of awareness campaigns and customer education, including postage. Would minimize postage costs by working with Housing Associations and other partners e.g. energy advice partners		*	*
Customer portal running cost opex	Cost of on-going activity to maintain the running of any customer web portals and/or smartphone apps - any uplift required to My Account running costs as a result of integrating the plug and play app.		*	*
Asset installation cost	Cost of installing the assets both during the initial roll-out and when they are replaced as they reach the end of their useful life		*	
Operating cost	On-going cost associated with operational activity, e.g. meter reading for metering options	*	*	
Maintenance cost	Cost of maintenance activities, e.g. repairs	*	*	
OCIP and other Insurances	To cover liabilities, particularly associated with visiting customer properties and retrofitting devices.			*
Increased repair costs	Cost of additional repairs carried out by us as a result of more leaks being identified.		*	
Customer supply pipe losses (CSPL) repair costs	Cost of supply pipe repairs incurred by customers following identification of leaks on supply pipes.(1)		*	

8.9 Value of deferred supply-side capital investment

Reducing demand for water supplies not only reduces operating costs, but has the potential to defer or even avoid capital investment in supply-side schemes. Where there is a forecast deficit in the baseline supply-demand balance, a reduction in demand can reduce, defer or even eliminate that deficit. This can have a significant impact on the selection of supply-side options.

The consideration of deferred supply-side capital investment in setting demand management policy is established industry practice, as demonstrated by the examples set out below.

- The WRC report 'Leakage Policy and Practice' states that the benefit of leakage reduction to the water undertaker should be thought of in terms of:
  - a reduction in annual operating costs; and,
  - deferment of capital schemes.
- The Environment Agency, Ofwat and Defra review of the sustainable economic level of leakage (SELL) states that, in determining leakage targets, companies should consider the impact of leakage upon the capital program and the potential for the deferment of expenditure.
- The UKWIR report 'Smart metering in the water sector - making the case' states that companies should consider the impact of smart meters

on demand (particularly seasonal peak demand) and the requirement for the development of new water resources.

- In 2011 Ofwat assessed the costs and benefits of faster, more systematic water metering in England and Wales, compared with the then current approach. The assessment includes the impact of reduced demand on both operating costs and capital investment.

In this assessment, we have quantified the impact of each of the strategic demand management options on the supply-side capital investment required to mitigate supply-demand deficits. We have done this by running different scenarios in our EBSD model, and then comparing the scheme selection and associated totex requirements. All of the scenarios were run using a feasible options list made up of supply-side options only.

8.10 Notes on the derivation of deferred supply-side capital investment values

The values for deferred supply-side investment over the 25 year WRMP plan period are considerable; being equivalent to;

- £530m for the 'Extended' portfolio.
- £633m for the 'Extended Plus' portfolio and
- £726m for the 'Aspirational' portfolio (our preferred plan).

These values are noted to play a central role in the cost/benefit analysis, and consequently have been scrutinised to ensure that they align with Guidance and are truly reflective of the supply-side costs that would be incurred, if no demand management took place.

These figures have been calculated to reflect totex values in order to ensure that 'like for like' figures are being compared in the CBA.

As part of our refinement processes, we have looked to improve our understanding of how this might be derived to more accurately reflect 'timings' and how investment would be staged through the 25 year period.

External audit has suggested that this might be derived to potentially reflect some or all of the following:

- 'Whole life' cost - this could potentially take into account asset lives, but may be much more complex to derive.
- The values could be assessed from the perspective of the 'bill impact' implications of the development of supply-side option. This would be a more 'customer focused' methodology, but might provide a somewhat short term focus to the results.
- The benefits could be considered in a more holistic fashion (quantifying natural / environmental / societal capital). This might be much harder to ascertain and quantify, but would tie in with our 'societal valuation' processes.

We will continue to investigate these methodologies, as part of our ongoing WRMP review and improvement strategy.

8.11 Societal valuation

In order to inform our cost benefit analysis, we have undertaken extensive work to understand the value that customers place on certain standards of service and different outcomes.

The overall methodology and approach for delivery of societal valuations required for the WRMP24 and PR24 business planning has been underpinned by the development of a valuation strategy. We developed this strategy by prioritising the values required for business planning (including WRMP24) and assessing them against the four criteria listed below:

- Customer priority
- Stakeholder importance
- Size of investment program, and
- Sensitivity to cost benefit analysis.

Water resource options, including leakage and demand management, have been assessed as being a high priority. As a result, the PR24 societal valuation program looked to ensure that there were a range of valuation studies and valuation methods that could inform this process for water resource options including:

- A Main survey: a stated preference study covering a broad range of service attributes across the business including leakage reduction and water restrictions.
- A Second stage water resources study: focusing on customer preferences and valuations for water resource options and water restrictions.

The second stage resilience study utilised a stated preference approach, which is a survey-based method for eliciting customer priorities and preferences for changes in service levels.

8.12 Customer values for water resource options

This resilience study elicited customer preferences for a range of water resource options:

- Demand management options: leakage reduction, incentives and education to save water, providing water saving devices, compulsory metering, encouraging metering.

The survey also asked customers to value the benefits of the introduction of smart meters. These benefits result from the abundance of frequently read consumption data that the smart meters provide, enabling customers to manage their consumption more effectively, thus saving water and money. In addition, smart meters should also help in identifying potential leaks.

Given the complexity associated with these areas, we have placed a large focus on ensuring that our surveys were accessible and meaningful. This included a comprehensive design and testing phase, a focus on ensuring the survey was engaging with customers, to promote understanding and considered responses, and undertaking detailed analysis and validity testing of the results. In order to add further assurance and deepen our understanding of the results, we followed up the surveys with customer focus groups that discussed the results and checked our interpretation of them.

8.13 Societal valuation - smart meters

For smart metering, we have evaluated the value that customers place on having a smart meter. Smart meters are helping us and our customers to identify leaks. In order to account for this, we have apportioned some of the monetised benefit, from the customer valuation for fixing leaks, to the AMI business case. This has been done on a pro-rata basis for both reduced cspl, which will be enabled by the smart metering system, and the reduction in distribution network losses attributable to smart metering. We have been careful to avoid double counting of these benefits within the leakage business cases.

8.14 Applying the societal valuations

The results from our studies have been taken into account in providing recommended values for use in the WRMP24 demand management strategy cost-benefit appraisal. This reflects a process of triangulation, which is the use of multiple, independent data sources and research methods, in order to produce a common perspective or understanding. The key steps in the process include synthesising and assessing the evidence based on relevance and robustness. The process also involves reviewing the recommended values in comparison with PR24 values and other company studies, maintaining the context of the wider customer engagement evidence.

The triangulation has resulted in a range of estimates for each category of intervention. The ranges are made up of low, middle and high estimates. We have undertaken our CBA using both the low and middle points of the societal valuations, in order to take a conservative approach to these benefits.

For ‘leakage reduction’, ‘providing water savings devices’ and ‘incentives & education to save water’, we have applied the values to the water saved in each of these categories under each of the options.

For smart metering, we have accounted for the value that customers place on having a smart meter. Additionally, smart meters can also help customers and ourselves to identify internal plumbing leaks, cspl and distribution losses.

8.15 CBA results

The costs and benefits of the options are shown in the figures below (Figure 48) and (Figure 47), with both the 'Extended Low' and 'Extended Plus' being cost beneficial (and 'Aspirational' being cost beneficial for AMP8).

However, neither of the lower options embody the levels of demand management that will be required to achieve EA/Defra targets;

- for leakage (and the 50% reduction target),
- household demand and PCC (110l/h/d by 2050),
- non-household demand reduction (9% reductions by 2038 and 15% by 2050) and,
- our environmental ambition.

Our preferred portfolio is, therefore, the Aspirational option. This will include our highest feasible reduction in demand and leakage (and the associated costs for mains replacement). As discussed, we have designed the program, such that the bulk of these costs impact beyond 2030, giving us the opportunity to investigate further technological innovation to mitigate these potential costs. The 'Aspirational' option is, consequently, cost beneficial for AMP8.

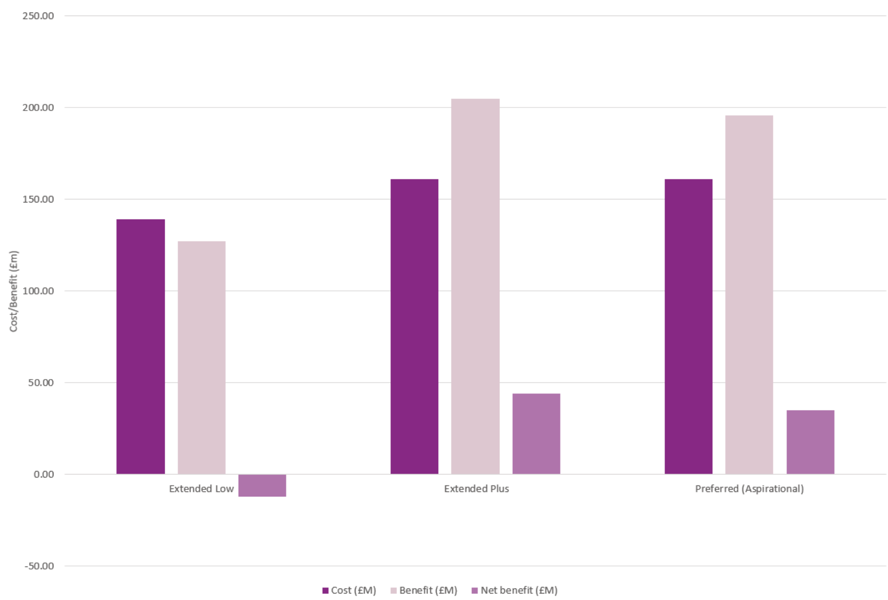
This plan indicates our level of ambition for demand management, and will allow us to more than offset any growth in demand, mitigating deterioration risks and assisting with near term supply/demand issues.

We believe that despite the significant long term costs associated with the 'Aspirational' option, it strikes the right balance between protecting the environment, maintaining a sustainable and resilient future, offsetting supply side investment and ensuring affordability for our customers.

We have analysed the options over the near term (5 year AMP8) and long term (the full 25 year WRMP24 period).

For AMP8 (2025-2030), both the 'Extended Plus' and 'Aspirational' portfolios are cost beneficial, showing similar values (£44m and £35m respectively). The marginal difference is due to the inclusion of some mains replacement in our preferred plan.

Figure 47 Total costs and benefits (AMP8 year incremental NPV)



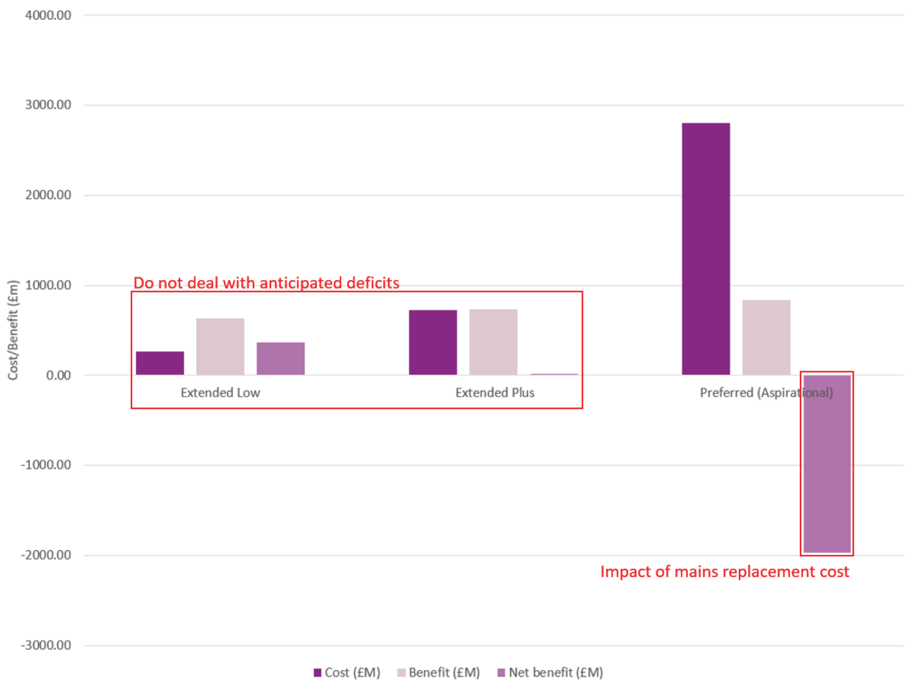
The values for AMP8 (2025 to 2030) can be shown (Table 48):

Table 48 Net cost and benefit for the portfolios (5 year)

Option	Cost (£M)	Benefit (£M)	Net benefit (£M)
Extended Low	138.72	127.16	-11.56
Preferred Plan (Extended Plus)	160.32	204.79	44.46
Aspirational	160.32	195.82	35.50

For the full 25 year WRMP24 plan period, both the 'Extended' and 'Extended Plus' options are cost beneficial, with the 'Aspirational' portfolio showing the impact from the inclusion of extensive mains replacement. However, neither of the lower options ('Extended' or 'Extended Plus') are sufficient to deal with anticipated deficits.

Figure 48 Total costs and benefits (25 year incremental NPV)



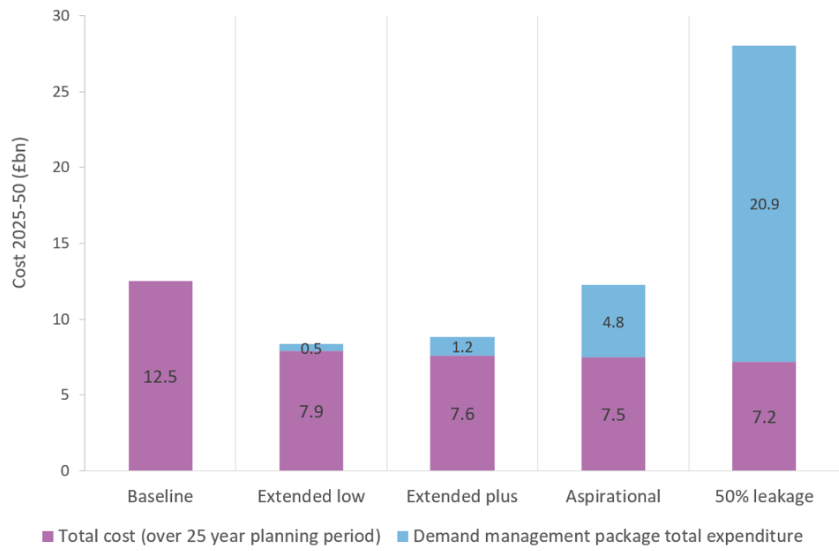
The values for the full 25 year WRMP24 plan period can be shown (Figure 48).

Table 49 Net cost and benefit for the portfolios (25 year)

Option	Cost (£M)	Benefit (£M)	Net benefit (£M)
Extended Low	£264.72m	£634.15m	£369.42m
Preferred Plan (Extended Plus)	£724.42m	£737.19m	£12.77m
Aspirational	£2797.74m	£830.45m	-£1967.29m

The cost of the enhancement for our demand management strategy is £171million (totex) in AMP8 (Excluding financing and including opex savings) with overall savings of 43Ml/d.

Figure 49 Comparison of combined demand and supply costs



The figure above (Figure 49) provides the combined supply-side options and demand management option costs. The baseline and Extended low scenarios do not satisfy the full supply demand balance and leave residual deficits. The remaining three portfolios all satisfy the supply demand balance, but the demand management costs increase sharply compared to the supply-side option costs which only slightly decrease.

This analysis has been complemented by further 'Best Value' planning assessments, as described in Section 9, in order to reach our preferred plan policy decision.

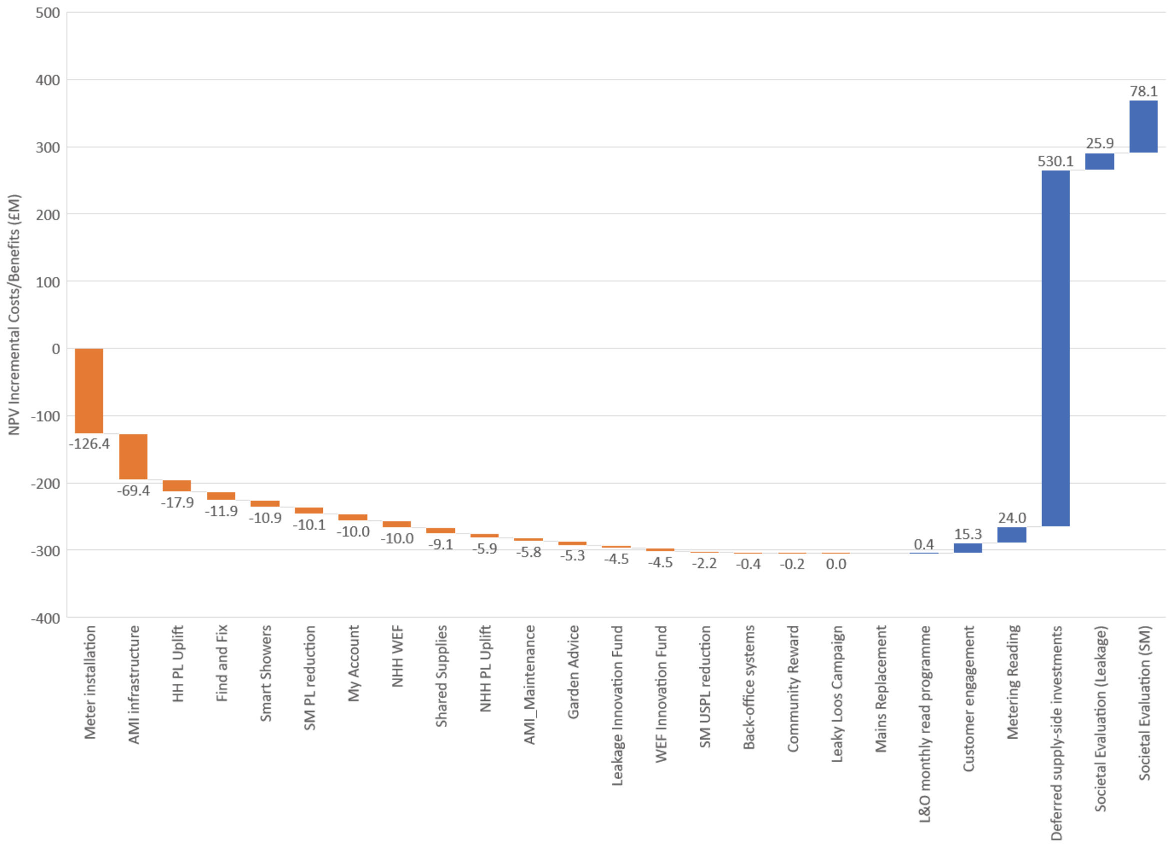
8.16 Overall costs and benefits

In order to determine the overall costs and benefits (both quantitative and qualitative) we have generated both waterfall plots and water savings plots for each of the main portfolios tested (Extended Low, Extended Plus (preferred) and Aspirational. These plots are base-lined at zero and show cost impacts as a negative and cost benefits as a positive.

8.17 Extended Low scenario analysis

The Extended Low strategic option represents the least ambitious scenario of our demand management enhancements, including a 3AMP (15 year) rollout of smart meters, a low water efficiency program and non-household options. The figure below presents the aggregate results of our CBA for this strategic option (Figure 50).

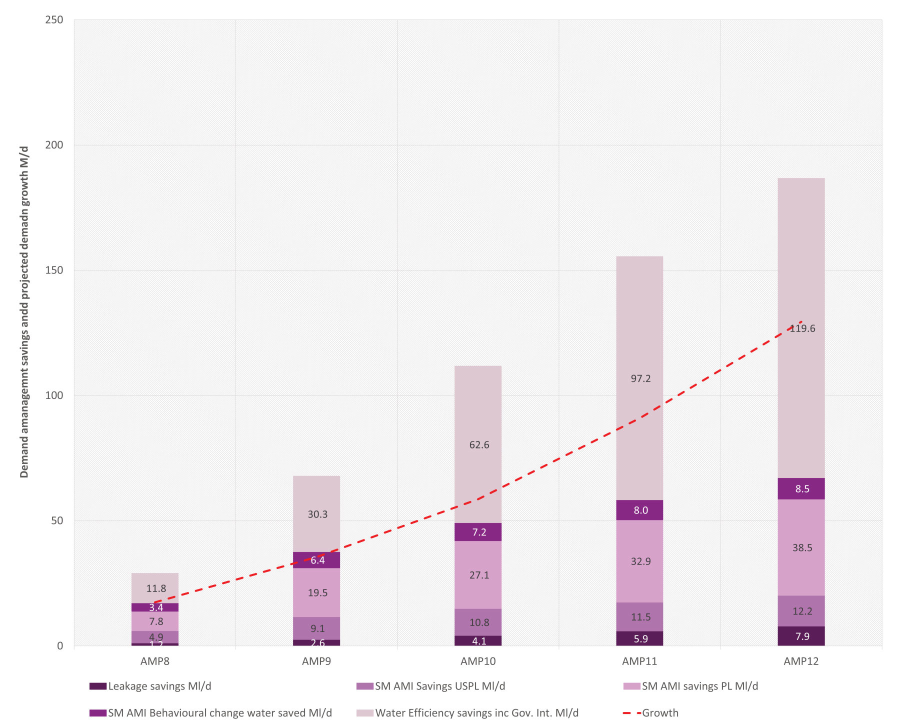
Figure 50 Totex NPV (2025/26 to 2049/50) - Extended Low



Despite the CBA being cost beneficial for this package, it would not, alone, be sufficient to mitigate expected demand growth in the long term Note this is only achieved with government led interventions. In the near term, this scenario, would not be sufficient to assist with the anticipated abstraction reforms and environmental destinations. This means that we would need additional supply side investment in comparison with the other strategic options.

Savings (and demand growth) for this option can be shown (Figure 51).

Figure 51 Low demand management scenario savings (ExtLow)



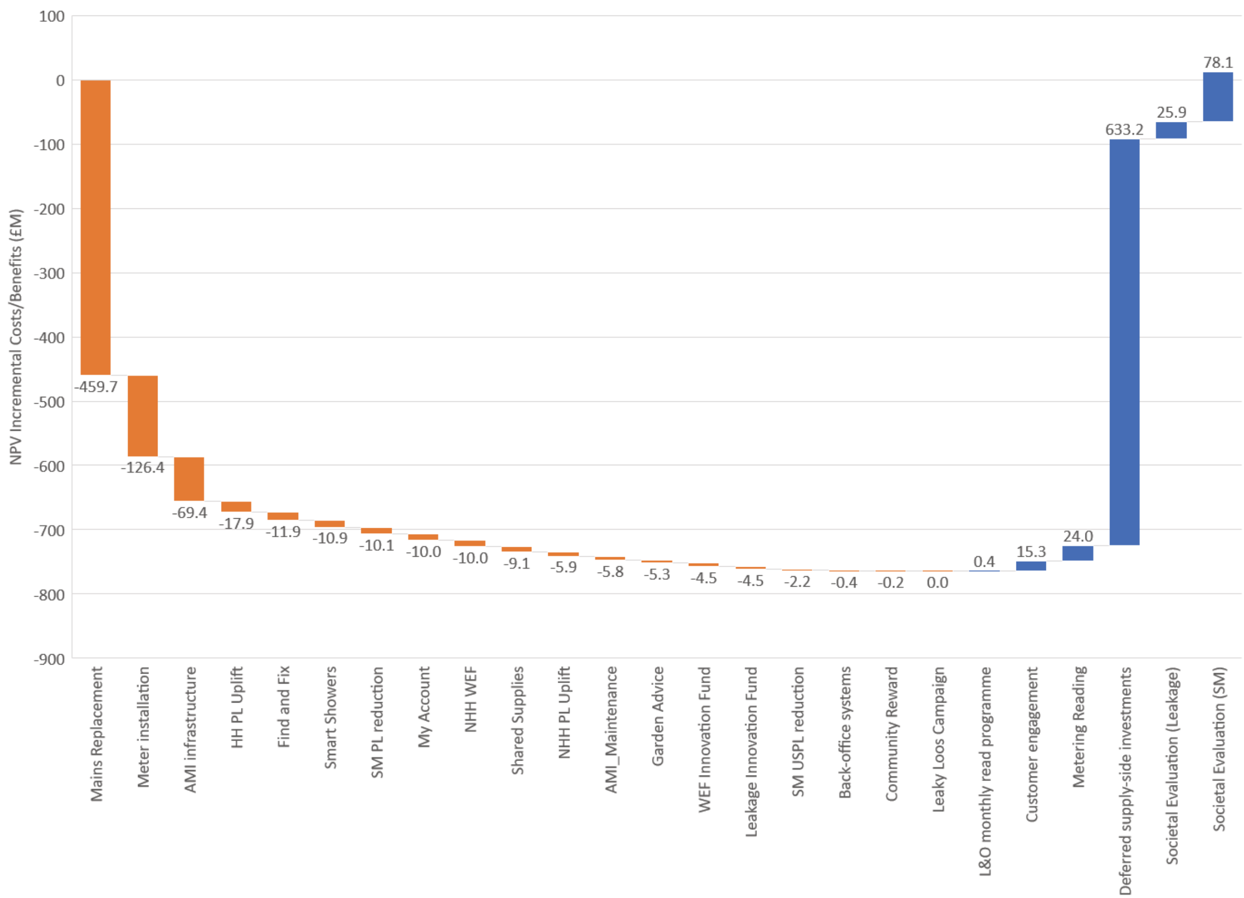
- *Note that the graph also shows the impact of government led intervention savings (in the water efficiency category). Including a 81.19Ml/d saving in 2049/50.*

8.18 Extended Plus scenario analysis

The 'Extended Plus' strategic option represents a more ambitious extension of our current demand management strategies, including the completion of our smart meter rollout by 2030 (2AMP), high water efficiency program and non-household options. However, it includes only a relatively low target for leakage reduction (24% from the 2017/18national framework base-line)

The figure below presents the aggregate results of our CBA for this strategic portfolio (Figure 52).

Figure 52 Totex NPV (2025/26 to 2049/50) - Extended Plus

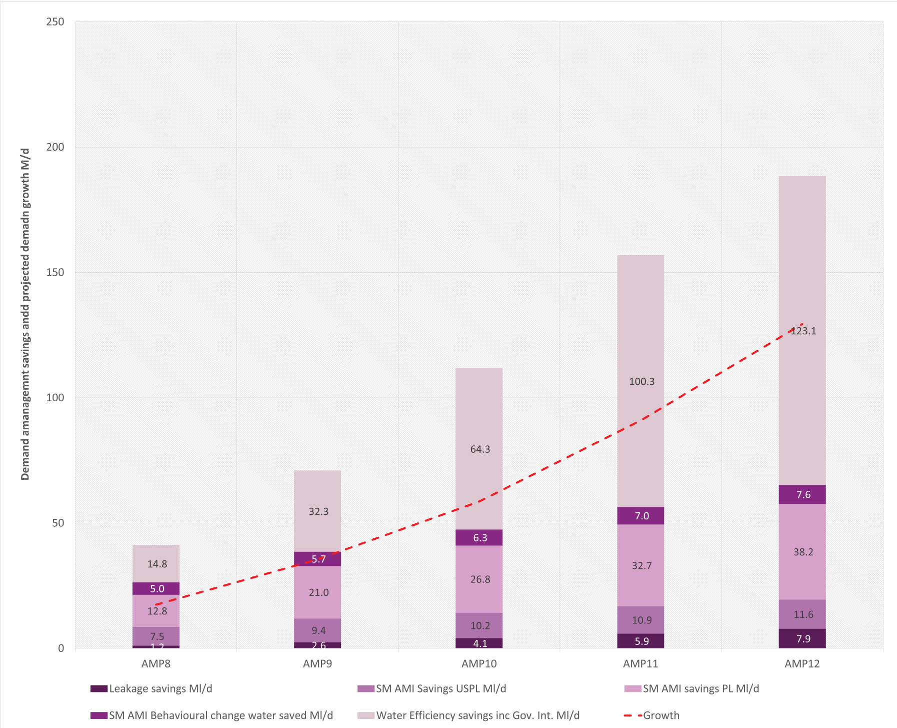


With regard to demand reductions (water savings), this option would deliver our 2AMP smart meter roll-out and build upon our WRMP19 water efficiency and leakage reduction measures. It would be sufficient to mitigate expected demand growth in the near term, but would require government led interventions in the long term.

In the near term, this scenario, would also assist with the anticipated abstraction reforms and envisaged environmental destination. This means we would need less supply side investment in comparison with the Extended Low portfolio.

Savings (and demand growth) for this option can be shown (Figure 53).

Figure 53 Medium preferred demand management scenario savings

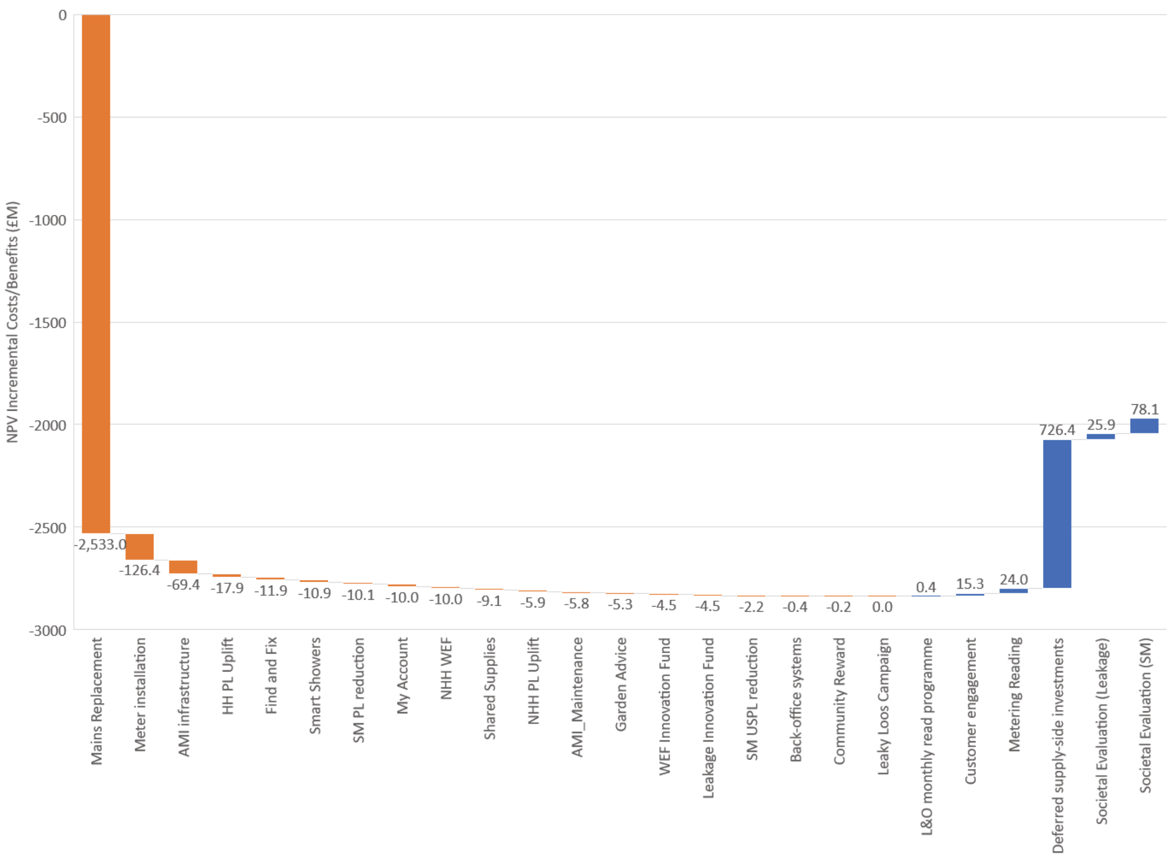


- *Note that the graph also shows the impact of government led intervention savings (in the water efficiency category). Including a 81.19Ml/d saving in 2049/50.*

8.19 Aspirational scenario (Preferred Plan) analysis

The Aspirational strategic option builds on the previous options with the 2AMP smart meter roll-out (as in Extended Plus), our maximum water efficiency program, non-household options and our maximum feasible leakage reduction (38% from the 2017/18 base-line). The figure below presents the aggregate results of our 25 year CBA for this strategic option (Figure 54).

Figure 54 Totex NPV (2025/26 to 2049/50) - Aspirational (Preferred Plan)



Despite this option not being deemed to be cost beneficial over the long term (25 years), we have considered this option to be our preferred plan in light of 'best value' planning analysis, as this is the most beneficial with regard to achieving:

- household demand reductions and a PCC value of 110l/h/d by 2049/50 (in alignment with EA/Defra targets),
- a leakage reduction of 30%. Our maximum feasible reduction contributing towards the Defra/EA 50% reduction target,

- a non-household demand reduction of 9% by 2038 and 15% by 2050 and,
- our environmental ambition (whilst offsetting supply-side options).

However, it should be noted that the plan is cost beneficial for the AMP8 period, as discussed in Section 8.15 (8.15).

This option includes our highest feasible reduction in demand and leakage. As discussed, we have designed the program, such that the bulk of the costs associated with leakage reduction (mains replacement) will impact beyond 2030, giving us the opportunity to investigate further technological innovation to mitigate these potential costs.

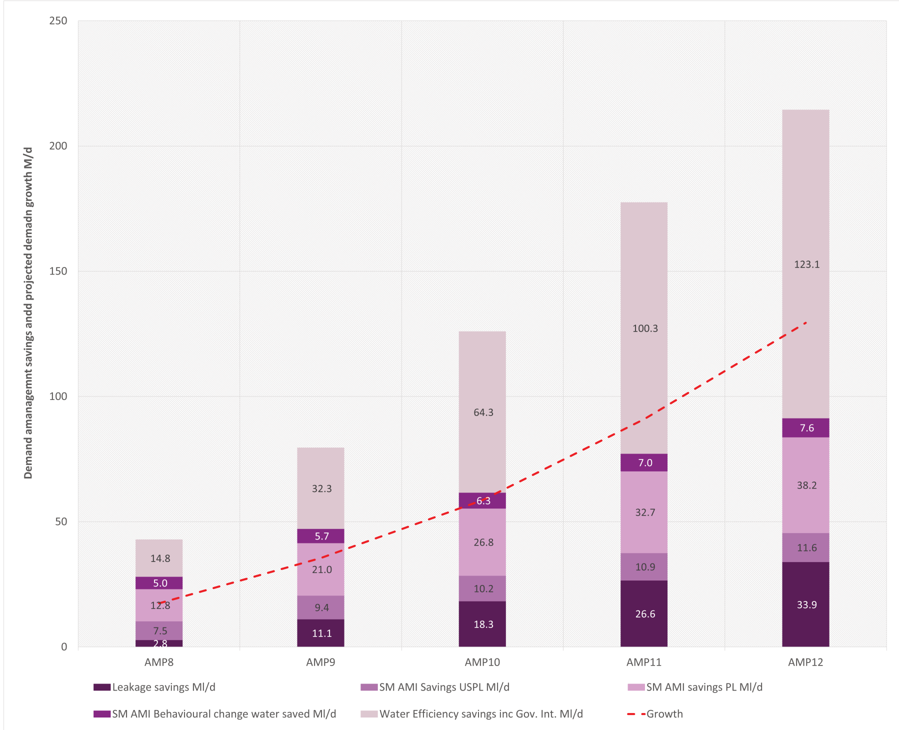
This plan indicates our level of ambition for demand management, and will allow us to more than offset any growth in demand, mitigating deterioration risks and assisting with near term supply/demand issues.

We believe that despite the significant long term costs associated with the 'Aspirational' option, it strikes the right balance between protecting the environment, maintaining a sustainable and resilient future, offsetting supply side investment and ensuring affordability for our customers.

With regard to this option we have, additionally, undertaken a program of sensitivity analysis, testing. See Section 9.

Savings (and demand growth) for this preferred Aspirational option can be shown (Figure 55) .

Figure 55 High demand management scenario savings (Aspirational)



- *Note that the graph also shows the impact of government led intervention savings (in the water efficiency category). Including a 81.19Ml/d saving in 2049/50.*

9 Preferred portfolio selection process

Our decision making process regarding the chosen demand management portfolio is one of the key 'policy decisions' set out in the decision making framework, alongside 1:500 drought timing and Environmental Destination.

For investment modelling purposes, policy decisions must be selected early within the best value planning' process to ensure that refinements of variables for the future 'Best Value Plan' (BVP) can be assessed against a stable 'most likely' base-line scenario.

9.1 Decision making process

We have modelled four demand management portfolios consisting of complementary elements of leakage, smart metering and water efficiency interventions (both household and non-household).

As previously described, our base-line scenario is one in which:

- we aim to reduce leakage to 164Ml/d,
- have no additional installations of smart meters beyond the AMP7 installation of 1.1M smart meters and,
- have no further water efficiency measures beyond our current programme for AMP7

Note that our smart meter program now includes an additional 60,000 meters installed by 2024/25, as part of the Accelerated Infrastructure Delivery (AID) program.

This provides the benchmark with which all other portfolios are compared.

We have developed our future demand management programmes through the development of 'strategic portfolios'. Each strategic portfolio includes the completion of our smart metering roll-out, additional leakage reduction and water efficiency sub-options (household and non-household), and has been built from the bottom-up, at Water Resource Zone level (actual modelling is conducted at the Planning Zone level, and aggregated to Water Resource Zones). We use our problem characterisation to decide upon the geographical focus of each strategic option.

Note that, for this assessment, each scenario has been based upon the WRMP24 selected growth forecast, 'OxCam1b_r_P'. This growth forecast for properties and population has been based upon Local Authority planning data and includes a reflection of growth associated with the potential Oxford Cambridge strategic growth corridor. Additionally, it should be noted that all scenarios, excluding the base-line, include savings attributed to government led interventions. These interventions lead to significant savings by the end of the WRMP24 planning period (84Ml/d).

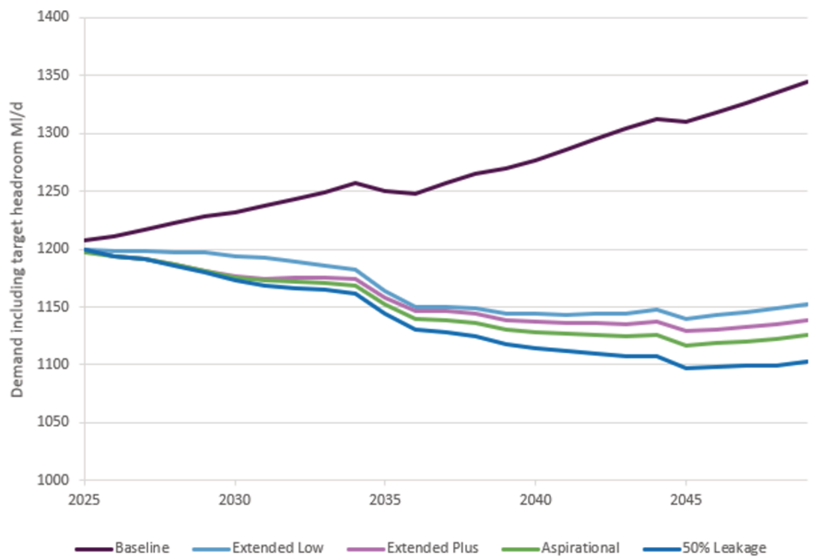
The table below (Table 50) shows the costs and benefits in terms of water savings for each package of demand management and figure 1 shows the profiles of the different portfolios.

Table 50 Key portfolio costs and benefits

Demand management portfolio	Water savings by 2049/50 (Ml/d)	Total expenditure cost (inc. opex savings) £bn
Base-line	0	0
Extended Low	107Ml/d	£0.3
Extended Plus	122Ml/d	£1.0
Aspirational	134Ml/d	£4.6
50% Leakage reduction	158Ml/d	£20.7

The forecast projections for these four key scenarios can be shown: (Table 51)

Figure 56 Key portfolio demand projections



The table below (Table 51) shows the components of each portfolio. The key differences between portfolios is the level of leakage reduction.

Table 51 Key scenario components

Demand management portfolio	Government interventions	Leakage	Metering	Water Efficiency	Non-household DMOs
Base-line	Not included	AMP7	AMP7	AMP7	None
Extended Low	Included	24%	3 AMP	Low	Medium
Extended Plus	Included	31%	2 AMP	High	Medium
Aspirational	Included	38%	2 AMP	High	Medium
50% leakage Reduction	Included	50%	2 AMP	High	Medium

The decision making process has involved the following:

- Model the alternative demand management portfolios developed in order to understand deferred supply-side investment.
- Analyse the effect of alternative demand management portfolios on our best value framework criteria and metrics.
- Confirm our preferred demand management portfolio.

9.2 Modelling approach

For each model run, the WRMP24 EBSD model was set up with the following fixed inputs:

- Licence cap scenario 4
- WRMP24 supply-side unconstrained options set for all options, including the SRO options.
- Environmental destination BAU+ from 2040
- WRMP24 baseline headroom and outage
- Medium climate change
- 1:500 drought impact in 2039

The 2040 date for the environmental destination has been chosen, as it ensures the large impact from environmental destination is accounted for, but avoids this impact dominating the scenario and influencing the results which could occur if included earlier in the planning horizon. The timing of environmental destination is explored separately.

9.2.1 Application of Best Value metrics

We use prioritised 'Best Value Metrics' which our stakeholders and customers have identified as most important, to determine our most likely scenario.

The table below (Table 52) shows the metrics which were applied.

Table 52 Best value plan metrics

Criteria	Metric
Strategic Environmental Assessment (SEA)	Net assessment score
Natural Capital	Ecosystem Services (£) over 25 years forecast
Biodiversity	Habitats Units (total restoration) BNG 10% Net Gain (Habitat Units)
Abstraction reduction	Total volume reduced by 2050 (Ml/d) Average annual reduction over 25 years (Ml/d)
Carbon	Quantity of capital carbon (TCo2e) Quantity of operational carbon (TCo2e/yr)
Programme Cost	Capex (£) Opex (£) Bill impact (£/year)

9.3 Decision making outcomes and recommendations

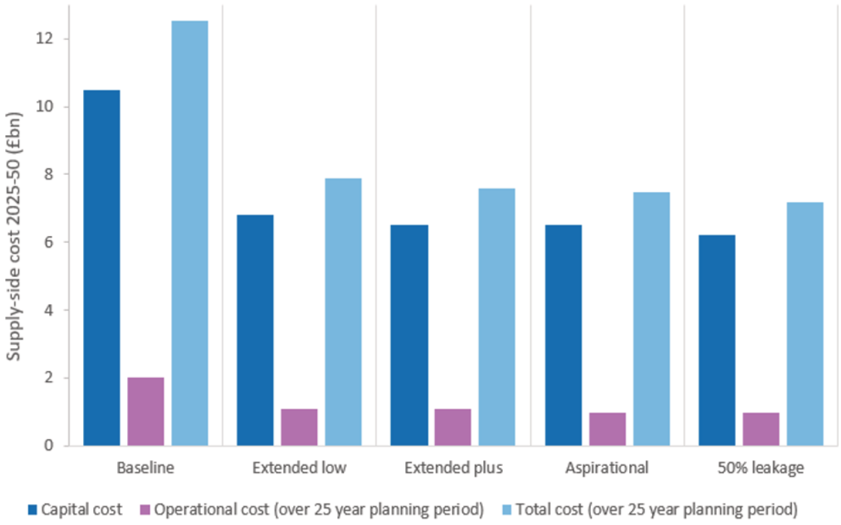
9.3.1 Baseline supply demand balance

The 'Base-line' and 'Extended low' scenarios result in residual deficits, where there are not adequate supply-side options available to make up this deficit. The 'Base-line' scenario creates a deficit of approximately 48Ml/d in 2030/31, for the low DMO portfolio the deficit reduces to 12Ml/d.

9.3.2 Deferred supply-side investment

The figure below (Figure 57) shows the costs for the supply-side options required with each demand portfolio.

Figure 57 Supply-side investment required with each demand management portfolio



As can be seen the 'Aspirational' and '50% Leakage' options incur the least costs for additional supply-side investments.

The deferred supply-side investment for each demand management portfolio compared to the base-line is shown below (Table 53).

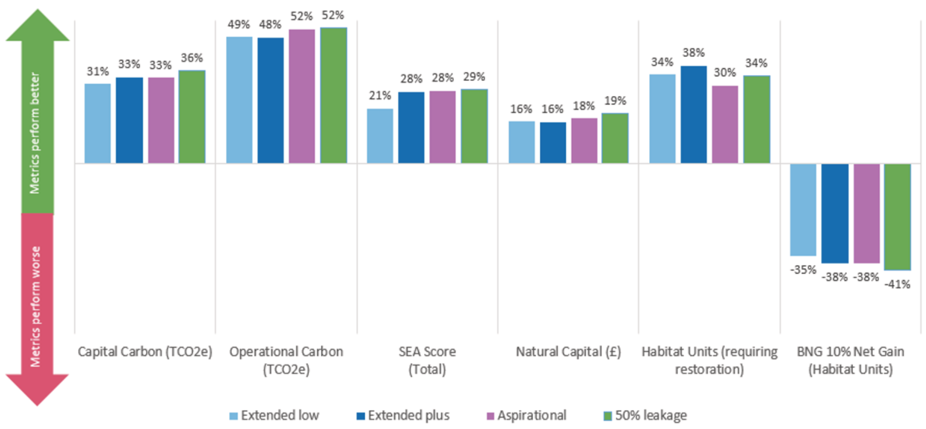
Table 53 Deferred supply-side investment

Demand management portfolio	Deferred supply-side total investment £bn
Base-line	0.0
Extended Low	-4.6
Extended Plus	-4.9
Aspirational	-5.0
50% leakage reduction	-5.3

9.3.3 Best Value metric comparison

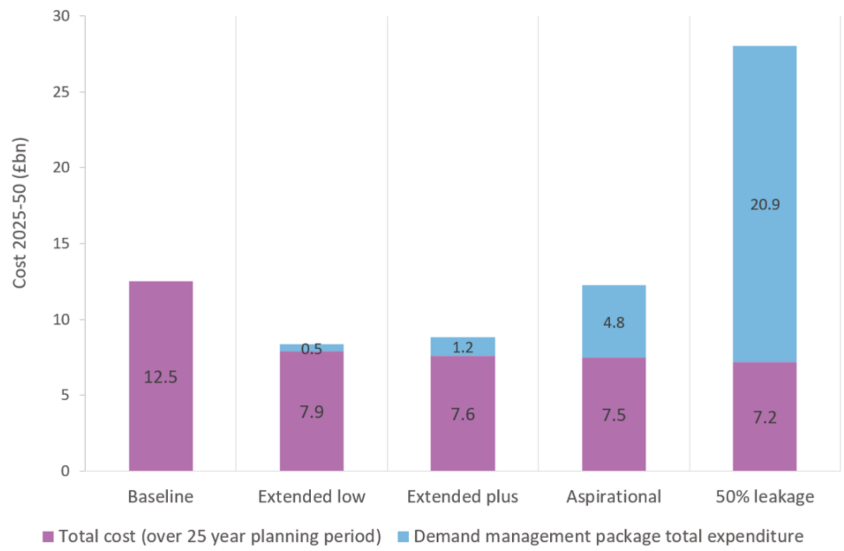
The best value planning framework has been applied to the EBSD results for all portfolios. The figure below (Figure 58) compares best value metrics associated with the supply-side options against the baseline of no demand management. It shows where portfolios performs better or worse as a percentage.

Figure 58 Comparison of best value metrics against baseline of no demand management



The figure (Figure 58) shows that all the demand management portfolios perform better than no demand management. All portfolios are very close, because the benefit they provide in terms of supply demand balance is small in proportion to the size of supply-side options needed.

Figure 59 Comparison of combined demand and supply costs



The figure above (Figure 59) provides the combined supply-side options and demand management option costs. The baseline and Extended low scenarios do not satisfy the full supply demand balance and leave residual deficits. The remaining three portfolios all satisfy the supply demand balance, but the demand management costs increase sharply compared to the supply-side option costs which only slightly decrease.

9.3.4 Conclusion

The results demonstrate that only the 'Extended Plus', 'Aspirational' and '50% Leakage Reduction' portfolios are feasible, without causing residual deficits which are unacceptable with the WRMP24 planning process.

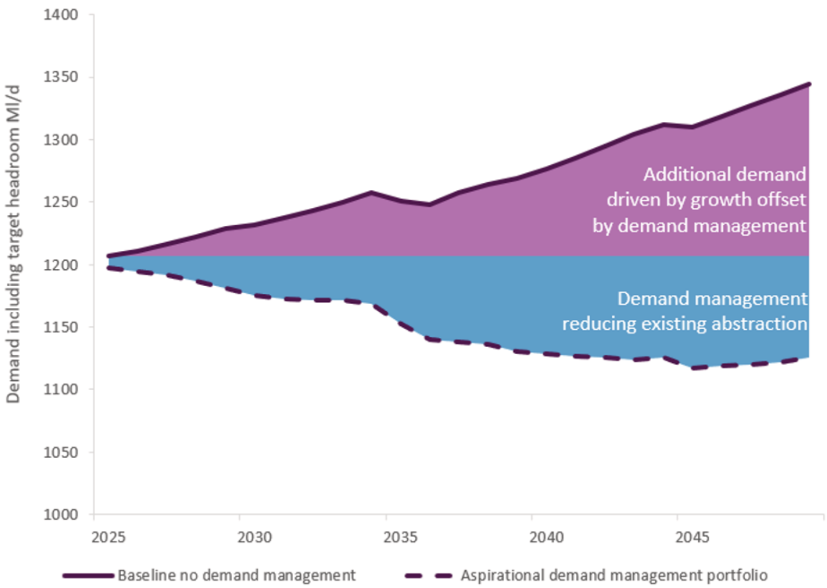
The comparison of portfolios across the best value metrics demonstrates that increasing the amount of demand savings only marginally reduces the investment in supply-side options, but this comes with significant increase in cost for the delivery of the demand management package. This is reflected in the other environmental metrics associated with the supply-side options which do not vary much between portfolios.

For our policy decision making process, we have chosen the 'Aspirational' portfolio of demand management measures. This is more ambitious than 'Extended Plus' and includes a higher percentage of leakage reduction. This portfolio will indicate our ambition to contribute to the national target of 50% leakage reduction. Although, this option does imply significant cost (for mains replacement), the vast bulk of the cost will be incurred in AMP9 and beyond, and so will be revisited as part of our WRMP29/PR29 planning process.

The 50% leakage goes further towards the national target, but it is not cost beneficial as the costs to deliver the additional leakage is disproportionately significant. The 'Aspirational' portfolio is to be included in the initial most likely scenario.

The figure below (Figure 60) shows how the 'Aspirational' portfolio offsets the additional demand from growth and contributes to sustainable abstraction by reducing existing abstraction.

Figure 60 How the Aspirational demand portfolio reduces demand driven by growth and contributes to sustainable abstraction



10 Conclusion

As described, for our WRMP24, we plan to build upon our proven track record of delivering demand management savings, through our leakage reduction strategy, ambitious smart metering program and innovative water efficiency initiatives. We will extend our ambitious program of demand management options, in order to support our new WRMP24 plan; one that provides economic benefits, delivers substantial water savings, but is also achievable.

Our previous success, however, does mean that there is limited potential to achieve further savings through 'tried and tested' demand management activities.

Our ambition is to drive the next 'step-change' in demand management through:

- technological innovation,
- enhanced communication strategies,
- improved understanding of our customers behaviour, and
- the implementation of 'industry leading' water efficiency initiatives.

Savings from our smart meter program, leakage reduction and water efficiency options, in combination with government led interventions are expected to more than compensate for regional increases in demand due to population growth during the WRMP24 planning period.

With our ambitious program for full smart meter installation and associated water efficiency measures, our customers should achieve a per capita consumption of less than 110 l/h/d, in line with the 2050 National Framework Target. Note that this includes a significant impact from government led interventions ('white good' and water utility labelling and mandatory design standards).

Additionally, we expect to achieve record low levels of leakage that exceed the National Framework Target, as applied at a National Level, without this implying a 50% reduction in leakage at a company level (noting the significant cost that this would imply for Anglian Water).

We have also recognised the importance of demand management with regard to the Retail and non-household sector. We have consequently designed a set of non-household water efficiency options to help us achieve these targets (with individual targets set at 9% and feasible target cohorts). In total, these options help us achieve approximately 8% reductions by 2037/28 and 15% by 2049/50, but these reductions can only be achieved relative to the non-household demand position, including demand growth. Non-household options will need to be delivered in collaboration with, but mainly via, our Retail partners.

Anglian Water has a key role to play in protecting the natural environment. It is a priority for us to act as stewards of our local eco-systems and to be leaders in environmental protection. As discussed, through our Best Value Planning Framework, in collaboration with our customers and in partnership with our WRE colleagues, we have sought to develop a WRMP24 plan that successfully achieves these aims of maintaining high quality water supplies, with environmental enhancement and biodiversity net-gain.

Demand management will be essential in mitigating short-term environmental risks and longer term population growth. Increasing our current abstractions to meet growth related requirements, would represent a serious environmental deterioration risk.

By choosing our preferred 'Aspirational' plan, we are using demand management to more than offset any growth in demand, mitigating deterioration risks and assisting with near term supply/demand issues.

Our analysis shows that our 'Aspirational' plan is cost beneficial in AMP8 and we believe that despite the significant long term costs associated with the 'Aspirational' option, it strikes the right balance between protecting the environment, maintaining a sustainable and resilient future, and ensuring affordability for our customers.

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