love every drop anglianwater

December 2022

Draft WRMP24 Technical Document

Demand management preferred plan

Everything we do for today is for **tomorrow**

Utility Week AWARDS 2021 WINNER

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Demand Management Preferred Plan Table of Contents

1 Introduction

1.1 What is a Water Resources Management Plan?

We have a statutory obligation to produce a Water Resources Management Plan (WRMP) every five years. This strategic plan demonstrates how a sustainable and secure supply of clean drinking water will be maintained for our customers over the next twenty-five years.

To achieve this, we forecast the amount of water we will have available to use and how much water will be needed by our customers. When these forecasts are combined, we have our supply-demand balance which tells us if there is enough water to supply our customers.

If there is not enough water, demand management options can be implemented to reduce the amount of water used or lost in our network of pipes or in customers' homes. Examples include leakage reduction achieved by the optimisation of our water network and smart metering where customers have access to their usage data.

When demand management options alone cannot maintain a supply of water, new supply-side options are needed to produce additional water for us to use. These can include reservoirs which store raw water until needed by customers. and can have additional well-being and environmental benefits. Water reuse is also a supply-side option. This is when we take the water from our water recycling centres, clean it and put it back into the environment to be abstracted again.

Our WRMP sets out a long-term vision for the water environment, and how it will be protected and improved for generations to come. It aims to deliver wider societal benefits, looking beyond the simple economics of a 'least cost plan'. These benefits may include promoting tourism in a local area or increasing wildlife habitats.

A WRMP also needs to be affordable, which is something our customers and stakeholders have made clear to us. Our WRMP is produced in conjunction with our company Long Term Delivery Strategy and Business Plan for the period 2025-2030.

Our draft WRMP24 builds on our current WRMP which was published in 2019. WRMP19 promoted a twin track approach. It implemented an ambitious demand management programme, building on our already industry leading performance. A significant main laying scheme is also currently in progress. This will take water from an area of surplus to areas of deficit. These approaches will ensure our customers continue to have a secure, resilient water supply and will reduce the amount of water we take from precious environments.

Figure 1 Our WRMP19 twin track approach

1.2 Our draft Water Resources Management Plan

Our draft WRMP24 is for the period 2025 to 2050. As part of this plan, we have:

- complied with the relevant legislation
- considered what has changed since the development of our previous WRMP19
- forecasted how much water on a sustainable basis we have available

- predicted how much demand there will be for water each year for a minimum of 25 years
- allowed for uncertainty in calculations and forecasts
- identified options to reduce demand/and or increase supply to achieve a sustainable and secure supply of water
- outlined risks associated with our future planning
- produced a best value plan, which considers factors alongside cost and provides an overall benefit to the environment, customers and society, and
- explained how customers, stakeholders and Regional Plans have informed each stage of our draft WRMP24.

1.3 Strategic context of the draft WRMP24

Our draft WRMP24 aligns with our business goals, as well as other 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 draft WRMP24 submission, showing the importance of collaborative planning. Regional Plans led by Water Resources East and Water Resources North have been highly significant in shaping our investment priorities and requirements. For instance, Water Resources East has determined which strategic regional options (SROs) are needed for the East of England; these have been fed into our draft WRMP24 decision making.

WRMP24 will also help to shape our company investment strategy for the next Price Review submission (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.

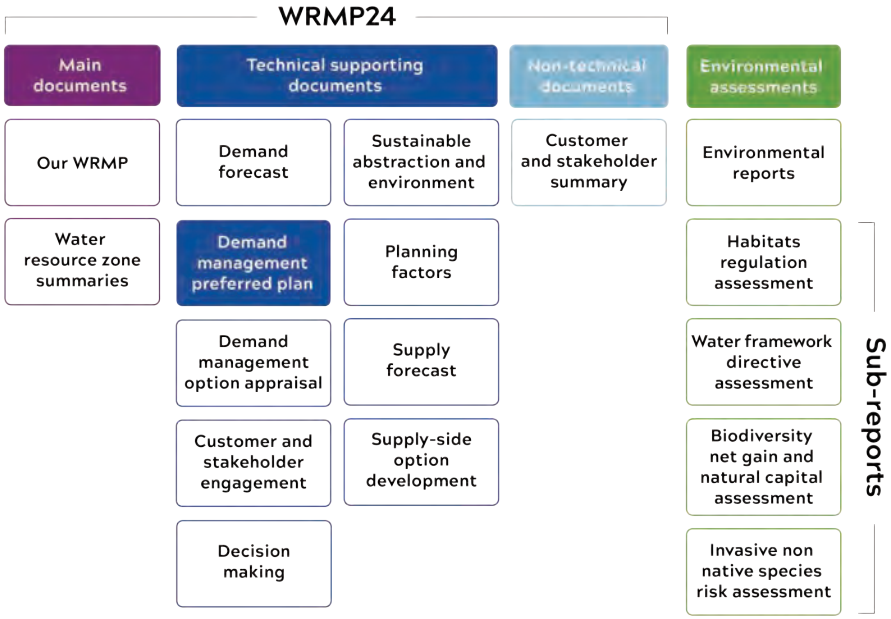
Collaborative cross company and partnership working has also enabled a successful start to the development of SROs, Fens and South Lincolnshire reservoirs. It is hoped that these reservoirs will allow many multi-sector benefits to be realised.

1.4 Guide to our draft WRMP24 submission

Our submission comprises a non-technical customer and stakeholder summary, our main report and ten supporting technical documents. Water resource zone summaries will also be available, as well as associated tables.

This technical document details the customer and stakeholder engagement that has been undertaken to inform the development of our draft WRMP24, and associated decision making.

Figure 2 Our draft WRMP24 reports



1.5 How customer engagement for draft WRMP24 interacts with the Regional Plan

Our customer engagement has been synthesised with the views of other companies and stakeholders in Water Resources East, ensuring their views are represented at a regional level.

These views have fed into the development of the Regional Plan, as well as during the decision-making process.

1.6 Next steps

Our customers and stakeholders have been informed and consulted with throughout the development of our draft WRMP24. This discussion will continue during the 14 week consultation for the plan, starting in December 2022*.

Details of our consultation, and how to respond, can be found at anglianwater.co.uk/wrmp.

Consultation responses will be reviewed prior to a Statement of Response being issued in June 2023, with our revised draft WRMP24 being published in the Autumn of 2023*.

2 Executive Summary

The challenge

It is anticipated that demand will increase by over 63Ml/d over the WRMP24 plan period (2025 to 2050), due to the effects of growth, from an additional 890K customers.

Our track record and commitment

We have an enviable historical track record in mitigating demand and now put less water into the supply system than in 1989, despite an increase of more than 40% in the households we serve.

Our leakage performance is industry leading, currently representing 15% of our total demand.

In the current year 2021/22, we have over 92% of household properties with installed meters and 83% of customers paying measured charges.

Developing our strategy

Given the scale of the challenges we will face in future (growth, climate change and environmental sustainability), we have collaborated extensively in the development of our draft WRMP24, utilizing our extensive customer engagement program to ensure that our customers fully understand demand related issues.

Generally, customers prefer options that are perceived to make best use of existing resource and infrastructure. Leakage continues to be a priority and an emblematic issue.

We understand that our strategy must underpin regional planned economic and housing growth in a sustainable manner. We have also been committed to our association with Water Resources East (WRE). WRE is a leading example of collaborative, multi-sector planning, working with partners to develop a long-term strategy for water stewardship in the East of England, stressing significant demand management interventions in our near and long term strategy.

Our preferred plan and our vision and future ambition

We plan to build upon our proven track record of delivering demand management savings, through both our leakage and metering programs and our ambitious strategy for smart metering and leakage reduction being implemented in AMP7.

Our ambitious program of demand management in AMP7 will act as the foundation for our new WRMP24 plan; one that provides economic benefits, delivers substantial water savings, and 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 (as demonstrated by our current meter penetration). Our ambition is to drive the next 'step-change' in demand management through technological innovation, enhanced communications, behavioural change and the implementation of 'industry leading' 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 in the near and medium term.

We expect that with our ambitious program for smart meters and water efficiency and the inclusion of impacts from government led interventions ('white good' and water utility labelling and mandatory design standards) our customers should achieve a per capita consumption of 110 l/h/d, in line with the National Framework target. Additionally, we expect to achieve a leakage level that exceeds the National Framework target at a National Level (without this implying a 50% reduction in leakage at a company level, with the massive costs that this would imply for Anglian Water). This is explained more thoroughly in the "leakage Section'.

Using new technology, behavioural understanding and innovation, our strategy will unlock estimated demand savings of up to 43Ml/d by the end of AMP8 (2030), and 64.5Ml/d by the end of the planning period (2050). Note that additional significant savings from our AMP7 smart meter roll-out are included in our base-line. The cost of our

demand management strategy is £240 million (totex) in AMP87 (2025-2030). We have undertaken an assessment of costs and benefits which shows that our strategy is cost beneficial.

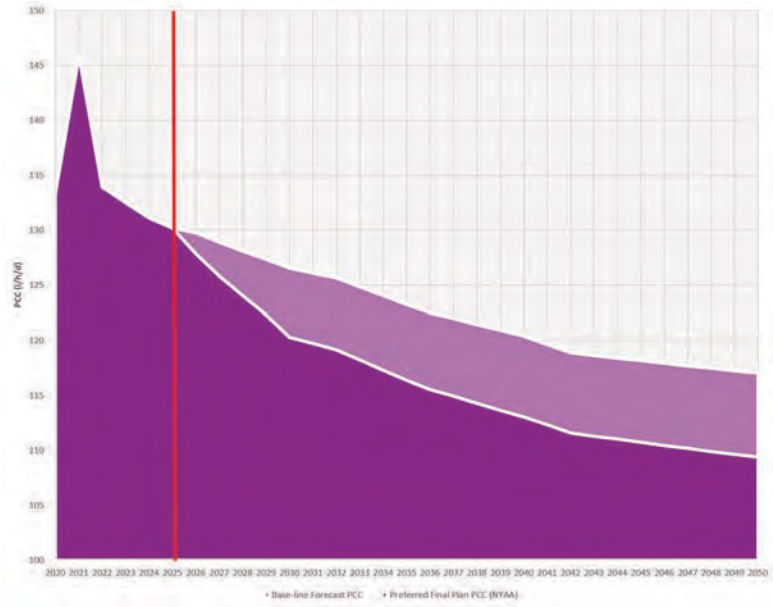
We have sought to develop our demand management plan using a holistic approach, utilizing innovative technologies, and extending our 'smart meter' AMP7 rollout. This will allow us to use the information we gain to prompt our customers to reduce their consumption, allowing us to fully realize the benefits that this system should facilitate. We are keen to complete this roll-out in AMP8 and develop the sophisticated communications systems for the benefit of our customers and to see the demand reductions which will be key to our environmental destination.

As part of our preferred plan we have included an innovation 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 fund will be used to identify and fill evidence gaps regarding water demand, customer behaviours and water efficiency programs. It will help inform future forecasting for our WRMP/WRE and PR submissions along with our Long-Term Delivery Strategy (LTDS).

With the implementation of our smart metering program (and other associated water efficiency measures) we expect PCC to decrease to a value of 111.6 l/h/d by 2050, for our DYAA forecast. The NYAA PCC value will be 109.4 l/h/d in line with the National Framework target of 110 l/h/d. This additional decrease in PCC, will be driven by our full smart meter rollout by 2030 and enhanced water efficiency options (linked with the opportunities arising from smart meters with respect to our water efficiency communications strategy).

Both the base-line and preferred plan forecasts include the impact of government led interventions ('white good' / water utility labelling and mandatory standards), which have a significant impact on PCC (approximately 11l/h/d by 2050).

Figure 3 Per capita consumption, base-line and preferred plan



3 Strategic need

Strategic challenges

Water resources in our region are expected to suffer very significant pressures from both demand and supply issues, including; increasing demand due to population growth, climate change, sustainability reductions (in order to achieve our environmental ambitions) and the need to increase our resilience to severe drought Additionally, our region has been classified by the Environment Agency as an area of serious water stress.

In particular our population is forecast to increase by 890K over the WRMP24 period (2025 to 2050), implying a potential increase in water demand of 63Ml/d (DYAA forecast).

This overall growth in base-line demand, is driven by the growth in population, but also includes reductions in per capita consumption due to the introduction of smart meters in the Anglian Water region in AMP7 (1.1M by 2025) and the influence of government led interventions ('white good' labelling and mandatory standards).

The assessment of growth in the region has been driven by our understanding of Local Authority Planning information as we have been keen to ensure that our strategy supports local growth and is carried forward in consultation with Local stakeholders.

These challenges are acute and they drive the need for investment on both demand management (and supply-side options), particularly in the short and medium-term.

To ensure that we can provide our customers with clean, safe water we have considered the widest range of options to secure our water supplies, using a 'twin track' approach, exploring options to increase our capacity to supply water, as well as options to reduce demand. By exploring both supply and demand options we can ensure a cost effective, secure supply-demand balance, whilst ensuring the environment is protected.

In particular, in developing our draft WRMP24, we have noted the stress placed upon demand management by Defra, as a preferred strategy to address anticipated growth and mitigate environmental impact.

We have taken special account of the Water Resources Guiding Principles;

'Government and regulators expect that all parts of demand are managed and, where possible reduced, while acknowledging that your demand is also influenced by your customers' behaviour[1].

and that;

'For companies, wholly or mainly in England, your forecasts should be aligned with the regional plans. You should demonstrate how you have collaborated at a regional level with neighbouring water companies and non-public water supply abstractors to generate your forecasts and have made use of best available data and information.[2].

Additionally, the National Framework states:

'In advance of the government's response to the consultation, the national framework senior steering group has agreed the case for making ambitious demand savings. Based on the best available evidence the group agreed to work to an initial planning assumption of reducing average per capita consumption (PCC) to 110 litres per person per day by 2050 nationally. This is the lowest PCC that can realistically be achieved without government action in addition to water company action. However, it can be achieved more cost effectively and at lower risk with action from government and the water industry[3].

This guidance has, consequently, been key to informing and developing our demand management strategy.

3.1 Government policy and regulatory guidance

Water Resources Planning Guidance

1 *Water Resources Planning Guidelines - Page 54*
2 *Water Resources Planning Guidelines - Page 30*
3 *Meeting our future water needs: a national framework for water resources - 16 March 2020 - Version 1 - Page 16*

The Environment Agency has updated the WRP Guidance for WRMP24. In this, they confirm that the WRMP24 must be closely aligned with the National Framework, Local Authority and Regional Plans (WRE) along with the Business Plan, Drought Plan, Drainage and Wastewater Management Plan and River basin management plans.

- *'National Framework (For companies wholly or mainly in England) - The National Framework sets out the challenge for water resources over the next generation. You are expected to work within and in regional groups to meet this challenge and work together to develop a cohesive set of plans that identify the best strategic options to meet the challenges we, as a country, face.*
- *Regional plans - For the first time, if you are wholly or mainly in England, your WRMP will be aligned to a new regional plan. Your WRMP should reflect the regional plan unless there is clear justification for not doing so. Given the close link between the regional plan and the WRMP we expect that this guidance will be also highly relevant for regional groups.*
- *Local Authority plans - Local authority plans set out future development, such as housing. Your WRMP should meet planned housing demand.'*[4]

It is stated that the Water Resources Plan (and consequently aligned WRE regional plan) should emphasize demand management, and the reduction of consumption, as a key strategy. Future forecasts should reflect demand management strategies and align this with the regional plan forecasts.

> *'There is a clear expectation from regulators and society that all parts of demand are managed and, where possible reduced, while acknowledging that your demand is also influenced by your customers' behaviour.*
>
> *For companies, wholly or mainly in England, your forecasts should be aligned with the regional plans. You should demonstrate how you have collaborated at a regional level with neighbouring water companies and non-public water supply abstractors to generate your forecasts and have made use of best available data and information.'*[5]

WRMP planning should also reflect the planning targets defined in the National Framework, as stated;

> *'account for future demand reduction planning assumptions and targets set out in the National Framework (England only) or set through government policy.''*

With respect to growth, it is indicated that the WRMP should reflect Local Authority projections and include strategic growth such as the OxCam Arc.

> *'Where your area includes major strategic housing and growth developments such as the Oxcam Arc or Garden Communities, you should include the planned growth in your plan.*

- *check whether the adopted or draft local plan contains and uses information on local housing need*
- *use whichever forecast has greater numbers of properties and population in your WRMP to*

> *You should demonstrate you have incorporated local council information (particularly in relation to their published adopted local plans) in England.'*[6]

It is also expected that both the WRMP and WRE scenarios should include the outputs of the Defra PCC consultation process (as detailed in the Artesia Report 2020) and should reflect the potential impacts from both water company demand management options and potential government interventions including mandatory standards and white good labelling.

> *'Your plan should also consider the results of water industry club project on 'Water Demand Insights from 2018 (Artesia 2020).'*[7]

The Environment Agency also stress that non-household demand management should be promoted more effectively in WRMP24 and included in forecast projections.

> *'You should work with the retailers to ensure they promote water efficiency and demand management with their customers and collect data on water consumption by non-households.'*[8]

4 Water Resources Planning Guideline for WRMP24 - Page 5
5 Water Resources Planning Guideline Working version for WRMP24 - Page 30
6 Water Resources Planning Guideline Working version for WRMP24 - Page 32/33
7 Water Resources Planning Guideline Working version for WRMP24 - Page 34
8 Water Resources Planning Guideline Working version for WRMP24 - Page 34

It is also stressed that forecasts for the WRMP and regional plans should be aligned.

> *'Your forecasts should be aligned with the outputs of regional plans. You should demonstrate how you have collaborated at a regional level with neighbouring water companies and non-public water supply abstractors to generate your forecasts and how you have made use of best available data and information. This could include:*

- *sharing consumption and segmentation data to increase sample sizes for modelling*
- *sharing sub annual data for seasonal peak analysis (including weather, economy and tourism driven factors)*
- *pooling data, expertise and modelling resources to assess a wider range of viable models i.e. allowing you to explore different modelling techniques.'*[9]

All these expectations are reflected in both the WRMP and WRE planning processes, as set out in this document.

3.1.1 Guidance

The EA and UKWIR provide detailed guidance with respect to the demand forecasting element of the Water Resources Management Plan:

- EA, NRW, Defra and Ofwat (2021) 'Final Water Resources Planning Guideline'
- Defra (2021) 'Guiding principles for water resources planning'
- Water Resources Long Term Planning Framework, Water UK (2016)
- Preparing for a drier future, England's Water Infrastructure Needs, National Infrastructure Commission (2018)
- Meeting our future water needs: a national framework for water resources - 16 March 2020 - Version 1
- Collaborating to secure England's future water needs: Our initial water resource position statement: March 2020
- UKWIR (2016) 'Population, household property and occupancy forecasting' - Guidance manual, supplementary report and worked example
- UKWIR (2016) 'WRMP19 methods - Household consumption forecasting' - Guidance manual and supplementary report
- UKWIR (2006) 'Peak water demand forecasting methodology'
- UKWIR (2016) 'WRMP19 methods - Risk based planning'
- UKWIR (2016) 'WRMP19 methods - Decision making process'
- UKWIR (2016) 'Integration of behavioural change into demand forecasting and water efficiency practices'
- UKWIR (2012) 'Customer behaviour and water use - A good practice manual and roadmap for household consumption forecasting'
- UKWIR (2013) 'Impact of climate change on water demand'
- UKWIR (2002) 'An improved methodology for assessing headroom

In developing the demand forecast for WRMP24, the EA recommends that the methodology balances simplicity and accuracy, and that more detailed analysis should be undertaken where there is vulnerability to growth within a given Water Resource Zone (WRZ).

Given the significance of growth across our region, we have reviewed our WRMP19 modelling, and enhanced our forecast model suite. Furthermore, we will fully align water and recycled water demand forecast modelling, in order to develop a coherent single demand forecast, for all growth related investment.

Due to the complexity of, and pressures on water resources in the East of England, a scenario lead approach has been used to provide much greater clarity in understanding future uncertainties and planning options.

3.2 Population and demand growth

The Anglian water region is forecast to experience significant growth over the planning period (2025-2050) in terms of both properties and more importantly for population (which drives demand).

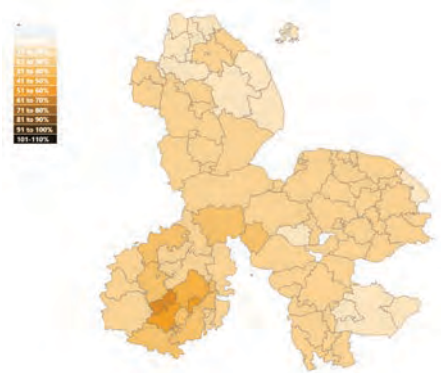
Growth Scenarios for AWS have been developed by Edge Analytics with strategic growth scenarios (OxCam) based upon a theoretical uplift in local housing, for relevant local authorities (whilst also accounting for Local Authority plans). For our draft WRMP24, we have taken a pragmatic approach to the inclusion of a conservative version of this strategic growth (higher than Local Authority Plan in the longer term), in order to minimize future risk from population growth in our region (Our OxCam1b scenario).

Our preferred growth scenario has been chosen to reflect Local Authority planning projections with an additional long term uplift to account for potential regional strategic growth.

9 Water Resources Planning Guideline Working version for WRMP24 - Page 35

- **Base-line Household Population 4.974M (2024/25)**
- **Base-line Properties 2.166M (2024/25 - excluding voids)**
- **Population is forecast to increase by 0.891M from 4.974M (2024/25) to 5.865M (2049/50), during the WRMP24 planning period.** Note that population is forecast to increase by 18% over the WRMP24 planning period, reflecting official ONS reducing occupancy rates (including a low variant of strategic growth).
- **Households are forecast to increase by 0.528M from 2.166M (2024/25) to 2.694M (2049/50), during the WRMP24 planning period.** Households are forecast to increase by 24% from over the WRMP24 planning period, reflecting LAUA planning projections and a low variant of strategic growth (Oxcam1b).
- **Note that there is an additional allowance for communal non-household population.** The consumption for this is accounted for in the Non-Household forecast.

Figure 4 Population Growth - % change from 2025-2050 (PZ detail)

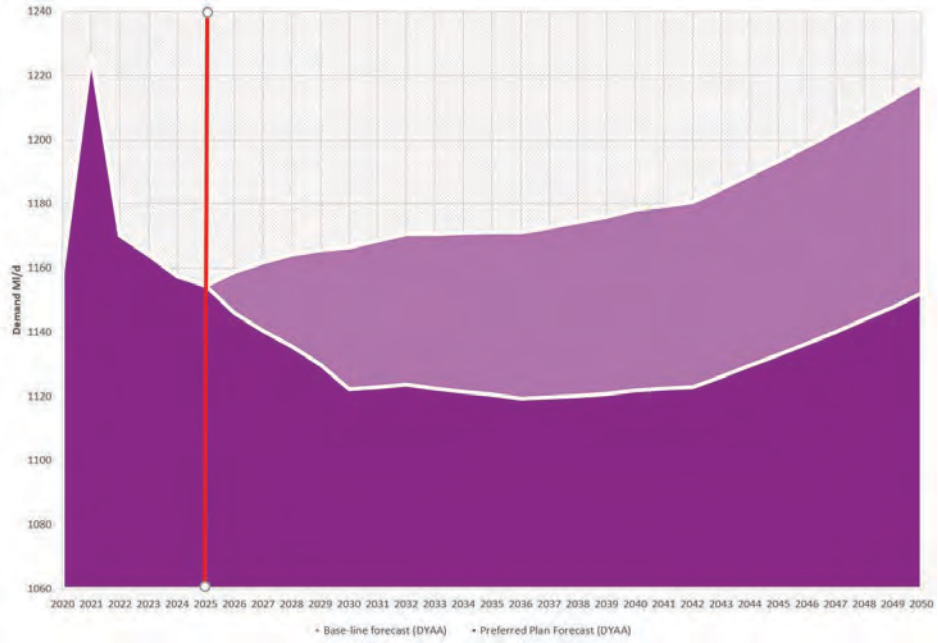


- **Dry year Annual Average (DYAA) Base-line (BL) Demand -** Is expected to increase from 1154.2Ml/d in 2025 to 1217.6Ml/d in 2050 in the base-line (BL) scenario (an increase of 63.4Ml/d), which includes our current smart meter strategy (1.1M meters), strategic growth and allowance for 'Government led interventions'.

These levels of growth will have a direct impact on the amount of water required for distribution input, in order to supply this growing population.

- **Dry year Annual Average (DYAA) Final Plan (FP) Demand -** For the preferred plan (FP) scenario, we expect demand to be 1153.1Ml/d in 2050 (very similar to the initial 2025 value of 1154.2Ml/d). For the preferred plan we see an initial decline in demand as demand management options take effect, with growth over-riding savings in the further future. Note that the spike in consumption due to the Covid19 pandemic can be seen in the pre-WRMP24 period.

Figure 5 DYAA demand for the base-line and final plan forecast (Ml/d)



- The relative (% increase) changes in demand can be shown geographically for the period 2025 to 2050, for both the base-line scenario and the preferred plan. The preferred plan scenario can be seen to significantly mitigate demand growth due to increasing population. This can be shown at Planning Zone (sub water resource zone) level as below (note growth in red, decline in blue).

Figure 6 Baseline - DYAA - Percent change in demand 2025-2050 (Planning Zone detail)

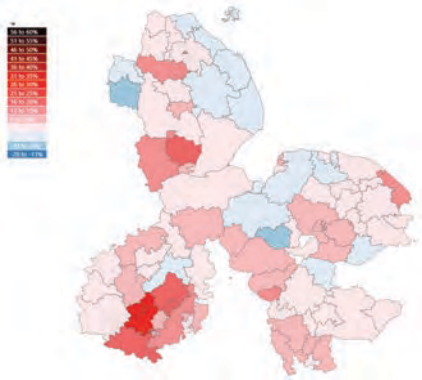
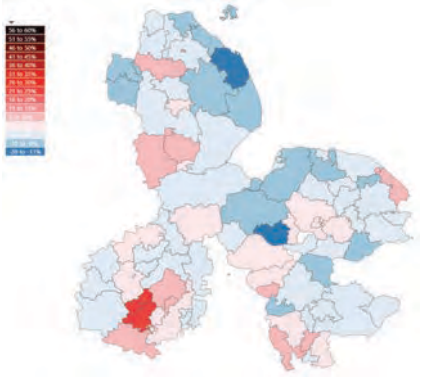


Figure 7 Preferred Plan with DMOs - DYAA - Percent change in demand 2025-2050 (Planning Zone detail)



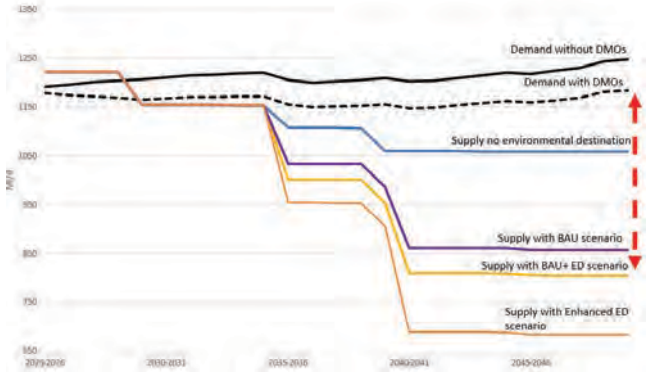
- Significant growth is expected in the south of our region over the planning period, especially around the Milton Keynes, Newport Pagnell, Bedford region, along with the Braintree, Colchester area.

3.3 Sustainability, climate change, drought resilience and our environmental destination

In addition to the impact on demand from population growth, significant changes and reductions are anticipated with regard to water availability (in order to maintain sustainable supplies for the foreseeable future). Our preferred environmental destination will enhance our environment, biodiversity and resilience to future climactic changes.

These changes will have a very significant impact in the way we maintain the supply of water to match forecast increases in demand: the supply-demand balance. Demand management will play a key role in our strategy to meet these challenges. As can be seen, the potential environmental destinations (described in more detail in our WRMP24 report 'Sustainable Abstraction and Environment') being envisaged will create significant challenges, which we aim to address in WRMP24.

Figure 8 Supply-demand balance showing environmental destinations



Our demand management strategy has, consequently, been designed to maximise the potential savings that might be achievable, as we build upon our smart meter program and shouldmitigate the increase in demand due to growth across our region, as far as possible, over the WRMP24 plan period (assisting with supply-demand issues in the near-term). However, sustainability reductions and our environmental destination, call for

significant longer term supply-side option development, whilst maintaining a keen focus on how we might extend and innovate our water efficiency and demand reduction programs in future.

The EA have recently revised their assessment of water stress in the UK, based upon WRMP19 data. As they note:

> *Water stress applies both to the natural environment and to public water supplies. Both will be affected by climate change. Public water supplies are under pressure from reductions in abstraction to make them more environmentally sustainable. There is also a need to make public water supplies more resilient to droughts and meet additional demands associated with development and population growth.*
>
> *The determination shows where we believe there are or, are likely to be, environmental impacts caused by public water supplies or the need for major water resources developments. It indicates where these could be reduced by improving water efficiency through metering.*[10]

As can be seen in the figure below, the entirety of the South east of England including the Anglian Water Region are deemed to be water stressed.

Figure 9 Water stressed classification

It is noted that companies within areas, which are deemed to be water stressed, should evaluate the potential for compulsory metering. Additionally local authorities should utilize the classification in order to drive the adoption of a standard of 110l/h/d for new-build development.

10 *Water stressed areas - final classification 2021 - page 4*

4 Customer consultation and planning framework

Our engagement

Given the scale of the challenges that we anticipate, we have actively collaborated and engaged extensively during the development of draft WRMP24. Additionally, we have actively participated with Water Resources East (WRE) to derive the regional plan in collaboration with major regional stakeholders. Customer engagement is central to both the daily running of our business and our long-term decision making processes. We continue to refresh our customer engagement strategy and embed it as a business as usual activity. Our enhanced strategy places greater emphasis on ensuring our engagement is meaningful to customers and explores differences of opinion, experience and behaviours between different groups of customers. We have also undertaken extensive work to understand the value that customers place on certain standards of service and different outcomes. We have used the outputs of these studies in our cost benefit analysis.

Key conclusions include:

- Customers are fully supportive of our 'core' responsibility in ensuring that supply meets demand in the Anglian Water region. Customers support investment to increase resilience and believe we should be planning for the long-term and taking preventative action to deal with foreseeable future challenges.
- Generally, customers prefer options that are perceived to make best use of existing resources, however, many customers also recognize our expertise and trust us to make complex investment decisions.
- Leakage continues to be a priority and an emblematic issue, with customers supporting our continued drive to reduce wastage.
- Although customers are prepared to accept bill increases for service improvements that they value, many customers are feeling under financial pressure and are concerned about future bill increases.

4.1 A collaborative plan

We believe customer engagement must be at the heart of all that we do as a company, not just for set piece consultations. We have, therefore, embedded it as a core 'business as usual' activity. Our on-going program of customer engagement is extensive, robust and innovative (see our WRMP24 report 'Customer and Stakeholder Engagement').

We have built upon the extensive engagement undertaken for the PR19 business plan, and for WRMP24/PR24 have refreshed our customer engagement strategy. From the outset we have involved customers in the co-creation of our strategy, to ensure that the engagement would be meaningful.

This has helped us to develop our understanding of the world from a 'customer's point of view', and has ensured that we have developed our initiatives, language and materials in a way that would best engage customers in the risks and issues we are facing. The development of these materials is also key to our communication strategies as we progress our smart meter rollout.

As part of our WRMP24, we have looked to combine our historical consultations with new engagement to form a rolling synthesis report. This has been compiled by an independent consultant This has also helped to identify whether newer sources confirm or potentially conflict with existing analysis, as well as adding in new insight to areas not previously covered.

The majority of insights suggest that there is a strong view to *'get your house in order'* first, focusing on demand management options. For a significant majority of customers this means fixing leaks. Leakage features, as the second most important thing we need to do, behind providing good quality water, consistently across research.

This view is driven by perception that leakage is just wasteful and unnecessary. However, we have noted for the synthesis, that there is some contradiction regarding the level of leakage repair that should be aimed

for, as some customers think that leakage should be done at any cost, while others suggest there should be a cost-benefit ratio (in line with our WRMP24 approach).[11]

Customer-side leakage, although less familiar to customers, is also supported. Reducing customer consumption generally, is seen as the next priority, with education being a key element of its delivery. There is, however, recognition that behavioural change and household demand reductions, may be difficult to achieve.[12]

Views on leakage are closely followed by metering considerations, with most customers seeing compulsory metering as a fair way to charge for water. The views on universal/compulsory metering seem to have shifted since PR19 with 79% of our customers agreeing that people should pay on the basis of the amount of water they use. [13]

Note that this figure closely aligns with our current metered/measured customer base, which stand at 82%. Customers have also shown real interest in smart meters, the information that these can provide and the benefits they can deliver, supporting our current and future roll-out..

Customer views on paying according to the amount of water used, can be summarized:

Table 1 Customers telling us their thoughts on paying according to the amount of water they use

Yes they should pay based upon usage	No, they should not pay based on usage	I am not sure
Fairness - pay for what you use	Difficult, as some find it challenging to pay their bills	People experience different circumstances
Other utilities use this method	Water should be free to all	Low income households/big households need support
Reduces water wastage	Don't believe meters are the way forward	Those with medical conditions use more water [14]

We have been mindful, with regard to these responses, in considering how we might further encourage customers to be billed on measured charges, whilst supporting our more vulnerable population.

We have also noted that there is significant frustration when bills increase and real concern for those who are financially vulnerable, indicating that we must protect those on lower incomes.[15]

We have also been extensively consulting with Non-household Retailers and their customers, whilst considering their attitudes to leakage reduction and water efficiency. These findings are being used to develop demand management options for the Non-household sector in liaison with our Retail colleagues.

While demand management programs tend to be prioritized by customers and have direct environmental benefit, these can prove costlier than alternative supply-side solutions and the potential savings can be less certain, particularly for initiatives where there is little or no UK experience. As a result, our customer engagement activities have included a focus on the development of water resources and demand management options, in a holistic fashion.

Overall we have found that customers support the principle of a ‘best value plan’ (not the cheapest, but the best for society and the environment). However, our customers want us to prioritise core business activities (such as protection of the environment, managing flood risk and drought resilience) over the ‘added value’ elements (boosting the local economy, consulting customers, and creating public amenities) [16]

Views have shifted slightly from PR19, with customers spontaneously mentioning the effects post-COVID-19 and the ‘cost of living crisis’, both of which are likely to be influencing their views. There is a core desire from customers for bills to be fair and affordable and a frustration when bills

11 Faldrax Consulting, May 2022, Anglian Water Customer Engagement Synthesis Report v4, page 25
12 Faldrax Consulting, May 2022, Anglian Water Customer Engagement Synthesis Report v4, page 25.
13 Faldrax Consulting, May 2022, Anglian Water Customer Engagement Synthesis Report v4, page 25
14 Emotional Logic, June 2022, Anglian Water: Customer Engagement Quantitative Research final report, page 51
15 Faldrax Consulting, May 2022, Anglian Water Customer Engagement Synthesis Report v4, page 50
16 Faldrax Consulting, May 2022, Anglian Water Customer Engagement Synthesis Report v4, page 30.

go up. There is real concern for those who are financially vulnerable. This 'citizen-focused' mentality shows customers feel it is important to protect those on lower incomes. [17]

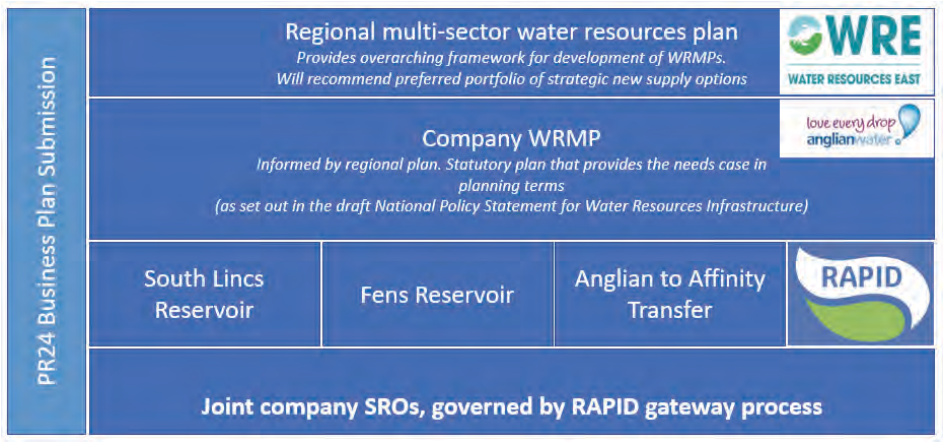
These findings are described in detail in our 'Customer and Stakeholder engagement - Draft WRMP24 Technical Document'.

4.2 Water Resources East and regional planning

The scale of the challenges we face from drought, climate change, population growth and meeting the needs of the environment are common to the South East, impacting neighbouring water companies, regional stakeholders, as well as to the other abstractors and users of water across the East Anglian region and adjoining regions.To ensure that we all have access to reliable, sustainable and affordable water supplies in the future, we are leading a number of collaborative water resource planning efforts.

This framework includes Water Resources East, which informs our WRMP24 and PR24 plans, along with the RAPID process for assessment of strategic supply-side projects (as shown below).

Figure 10 Planning framework



We helped establish and continue to drive the Water Resources East (WRE) initiative. WRE has been instrumental in developing a multi-company, multi-sector approach to analysing water resources. WRE brings together partners from a wide range of sectors, including water, energy, retail, the environment, land management and agriculture, to work collaboratively to manage water challenges and pioneer new approaches to planning and managing water resources.

Partners in our different collaborations also include representatives from, drainage, local government, business and finance sectors, other water companies, Defra, Ofwat, the Environment Agency and Natural England.

Analysis from WRE suggests that demand management is an essential component of any long- term, sustainable water resource strategy, for the region.

The WRE option appraisal process shows that a reliable, sustainable and affordable strategy depends upon a combination of demand management and supply-side solutions, as it has been previously concluded that uncontrolled growth in demand would drive a catastrophic failure of water resource and supply systems. Were demand to be left to grow unchecked, it would result in widespread deficits and service failures (including rota-cuts and standpipes) in the future.

We have also been actively involved with the:

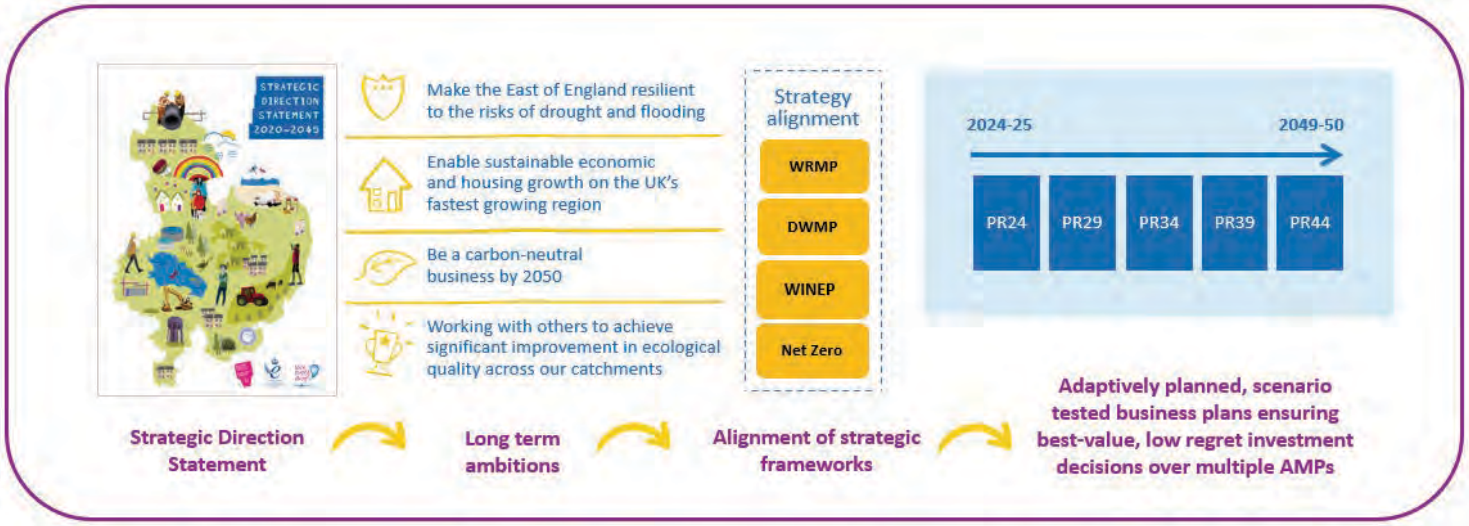
- Water efficiency strategy steering group and the customer leadership group working with Waterwise in both groups
- The Regulators' Alliance for Progressing Infrastructure Development (RAPID) (this has been formed to help accelerate the development of new water infrastructure and design future regulatory frameworks).
- Water UK Water Resources Long-Term Planning Framework (WRLTPF) and,
- Trent and Ouse Working Groups.

We have also actively liaised with Water Resources South East (WRSE) and have had regard to their projected outputs, in the development of our WRE and WRMP24 plans. The continuing purpose of these collaborations is to develop a common understanding of water resource planning issues and to identify cost-effective options for sharing available resources, including transfers and trading.

Additionally, we are aligning our WRMP24 planning outcomes with the PR24 Long Term Delivery Strategy (LTDS) and our other strategic outcomes (wastewater DWMP, nutrient neutrality etc.), with each 5 year business plan being developed, as stepping stones to longer term outcomes.

17 Faldrax Consulting, May 2022, Anglian Water Customer Engagement Synthesis Report v4, page 50.

Figure 11 Our business plans and long term strategy



As part of the development of our preferred WRMP24 plan and long term strategy, we have used multi-variant scenario testing to produce reactive outcomes, over the WRMP24 planning period.

For our W

RMP19 plan our adaptive strategy was to:

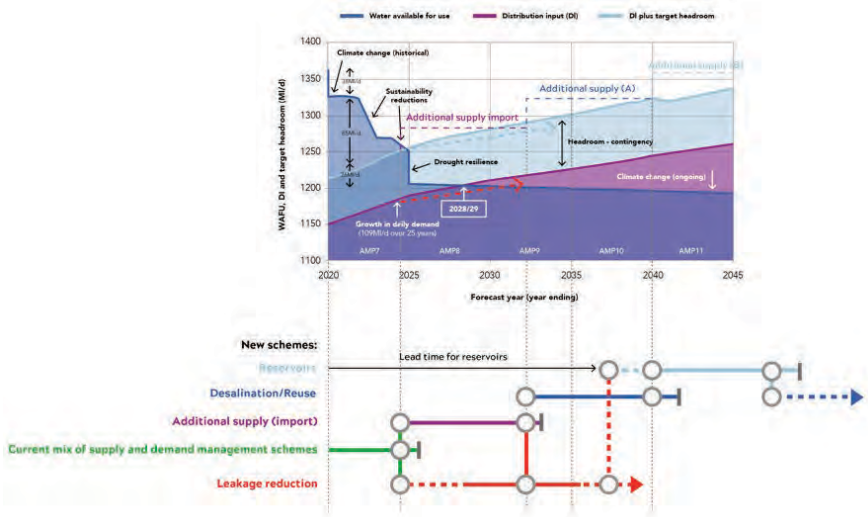
- better utilize existing resource through transfers
- implement demand management via leakage reduction and smart metering
- start planning for strategic options including reservoirs

For our WRMP24 adaptive plan we will balance:

- further demand management activities
- the continued development of selected strategic options
- the need for short-term supply options

As part of theWRMP24 planning process we intend show how the WRMP24 plan should adapt to changing conditions over time. Such adaptive plans might be visualised with trigger points, as below;

Figure 12 Adaptive planning processes



5 Our preferred plan

Our vision and future ambition

We plan to build upon our proven track record of delivering demand management savings, through both our leakage and metering programs and the ambitious strategy for smart metering and further leakage reduction, currently being implemented in AMP7. 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 communications, improved understanding of our customers and behavioural change, and the implementation of 'industry leading' initiatives. Note, also, that an additional significant saving from smart meters is now included in our base-line in order to account for our AMP7 rollout.

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 in the near and medium term.

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

Additionally, we expect to achieve a leakage level that exceeds the National Framework Target (as applied at a National Level (without this implying a 50% reduction in leakage at a company level (with the massive costs that this would imply for Anglian Water)). This is explained more thoroughly in the "Leakage Section'.

Our preferred portfolio

Our ambitious strategy will comprise three strongly interlinked programs:

Water metering program

- We intend to complete our current smart meter rollout which will replace our entire meter stock over 10 years (2 AMPs), noting that 1.1M smart meters will be installed by 2025.
- The information revolution resulting from 'smart metering' will help inform our customers regarding their water usage and will assist in our ability to influence this behaviour. It will also help with our ability to detect leakage, significantly reducing plumbing losses and customer supply pipe leaks, and understand our network.

Leakage reduction

- Our aim is to reduce leakage by more than 19Ml/d from 2025 to 2050 (Including 13Ml/d of CSPL reductions), building upon our ambitious program of leakage reduction in AMP7 (15% reduction of more than 30Ml/d by 2025). Note our leakage reduction program has to take into account our current frontier leakage position and cost/benefit analysis relating to this position.
- We are aiming to reduce leakage by targeting both losses in our distribution system and losses due to customer supply pipe leakage (noting that we also intend to reduce internal plumbing losses, which impact the per capita consumption metric).

Water efficiency measures

- 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 promotion of 'Smart' devices; further development of our Multi-utility web-portal; garden advice; support for vulnerable customers with plumbing loss and cspl; Community reward schemes.

- Enhancing our understanding of human behaviour with regard to water usage and the impact of our water efficiency strategies will be key to improving our WRMP demand forecasting in future.
- We are currently working with Retailers to develop demand management options and have made significant progress in identifying actionable options. We intend to continue the development of these options with our partners across the WRE region and will quantify them for inclusion in the Final WRMP24 plan.

5.1 Our preferred plan and the deployment of demand management options

The importance of managing demand has been emphasized in the 'National Framework for Water Resources', as stated: *'Water companies should plan to meet ambitious reductions in demand and leakage.'*

In addition, demand management forms an essential strategy in mitigating short-term environmental risks. Increasing our current abstractions to meet growth related requirements would represent a serious deterioration risk.

Additionally, there is envisaged to be a significant reduction in licensable water available to meet future demand, as we strive for environmental improvement over the WRMP24 planning period.

We, therefore, plan to use demand management strategies to off-set any growth in demand, mitigating these risks.

Demand management also has wider environmental benefits. It directly benefits our local environment, as we are saving water that would otherwise have to be abstracted and increasing the well-being and resilience of natural aquatic habitats. Avoiding the need for additional abstraction is particularly important in our region, which is home to many internationally important wetland ecosystems and is classified as an area of 'serious water stress' by the Environment Agency.

In addition, water saved does not need to be treated and distributed which reduces our operational energy consumption, making us more efficient and saving carbon, as we build towards our Net zero strategy.

Analysis from the WRE project also suggests that demand management should be an essential component of any long-term, sustainable water resource strategy for the region.

5.1.1 Reliability:

We will ensure that our system is resilient to the combined effects of severe drought (defined as an event with an approximate 1 in 200 year return period) and climate change, so that none of our household and non-household customers are exposed to an unacceptable risk of standpipes and rota-cuts.

5.1.2 Water Resource Sustainability:

We will ensure that there is enough water to meet forecast local authority growth projections.

We intend to meet all of our statutory environmental obligations, including restoring abstraction to sustainable levels and preventing deterioration in water body status.

We shall make the best use of available water resources, before developing new ones. This includes prioritizing cost-beneficial demand management and trading to share any available surpluses.

We will ensure that solutions for the WRMP24 are flexible enough to be adapted to meet unknown AMP8/9 needs (post 2025/30), including possible future exports to Affinity Water (Central) and Cambridge Water (South Staffs Water).

5.1.3 Affordability:

We will ensure our preferred plan represents 'best value' over the long-term, through rigorous analysis and sensitivity testing.

We will minimize the risk of delivering assets that become stranded or under-utilized in the longer term.

We will ensure that investment not driven by statutory requirements, is kept within a range of a affordability for all customers.

5.2 Cost benefit analysis approach

Our approach to the assessment of demand management options has been structured according to seven process steps (see figure below):

- Option 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 the full impact (i.e. costs and benefits) of each option. This step was carried out using bespoke Excel-based models.
- Option 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.

The approach is illustrated in the following diagram and described fully in our WRMP24 Demand management Option Appraisal: Technical Report:

Figure 13 Cost benefit analysis process

5.3 Options considered

Reflecting guidance and noting that our demand management measures need to be considered holistically, we have produced a number of variations of our strategic portfolios of options, including complementary elements of leakage, smart metering and water efficiency interventions. These have been based upon an initial assessment of our unconstrained list of potential options (see the 'Demand Management Option Appraisal Report').

For sensitivity testing we have produced a large number of scenarios (as detailed in our 'Demand Management Option Appraisal Report'). However, from these we have developed a number of core scenarios in order to evaluate and select our preferred demand management option portfolio.

These key scenarios are characterised as follows;

Base-line

- No additional leakage interventions beyond 2025. The base-line leakage level would initially be 161Ml/d rising to 164Ml/d by 2050, due to housing growth (associated cspl)
- Smart meter rollout to 2025 (1.1M meters). Smart meters would continue to operate through the WRMP24 plan.
- BAU water efficiency measures only.

Low Demand Management (Extended Portfolio)

- Reduction of leakage by 11Ml/d to 150Ml/d by 2030 (AMP8) and 19.4Ml/d to 145Ml/d by 2050 (AMP12), by a combination of leakage and smart metering strategies.
- Implementation of smart metering over a 3AMP (15 year) program to maximum feasible penetration (96%); 15Ml/d saving by 2030, 38Ml/d by 2050.
- Low - program of water efficiency strategies, saving 9Ml/d by 2030 and 10.7Ml/d by 2050
- Total Option savings from base-line - End of AMP8 (2030): 28Ml/d - End of AMP12 (2050): 60Ml/d

Medium Demand Management

- Reduction of leakage by 14Ml/d to 147Ml/d by 2030 (AMP8) and 28.5Ml/d to 135Ml/d by 2050 (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%); 26Ml/d saving by 2030, 38Ml/d by 2050.
- Medium program of water efficiency strategies, saving 10.9Ml/d by 2030 and 14.3Ml/d by 2050
- Total Option savings from base-line - End of AMP8 (2030): 46Ml/d - End of AMP12 (2050): 71Ml/d

High Demand Management (Aspirational Portfolio)

- Reduction of leakage by 14Ml/d to 147Ml/d by 2030 (AMP8) and 45.7Ml/d to 118Ml/d by 2050 (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%); 26Ml/d saving by 2030, 38Ml/d by 2050.
- High 'Aspirational' program of water efficiency strategies, saving 11.7Ml/d by 2030 and 15.7Ml/d by 2050
- Total Option savings from base-line - End of AMP8 (2030): 47Ml/d - End of AMP12 (2050): 90Ml/d

Preferred Portfolio (Extended Plus)

- **Reduction of leakage by 11Ml/d to 150Ml/d by 2030 (AMP8) and 19.4Ml/d to 145Ml/d by 2050 (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%); 26Ml/d saving by 2030, 38Ml/d by 2050.**
- **High - 'Aspirational' program of water efficiency strategies, saving 11.7Ml/d by 2030 and 15.7Ml/d by 2050**
- **Total Option savings from base-line - End of AMP8 (2030): 43Ml/d - End of AMP12 (2050): 64Ml/d**

Our 'Extended Plus' option allows us to innovate and deliver on our further ambitions for our demand management activities, while delivering a strong economic case.

The other strategic options do not strike the same balance, compared with our preferred 'Extended Plus' option. We do not believe that the less ambitious, 'Extended' option goes far enough in delivering the demand management that our customers and stakeholders expect. The 'Aspirational' option, however, is much more expensive (especially with regard to leakage) and the hoped for water savings are less certain.

Thus, our preferred option (Extended Plus) 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 2 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		

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

5.4 Best value planning and our preferred portfolio

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 rollout 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 WRP Guidance (see our 'Decision Making' Report), together with the outcomes 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.

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

A 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 (See the figure below).

Figure 14 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 83% of our customers receiving a measured bill, (and 92% having a meter 2021/22) with the associated behavioural savings (as customers switch from being unmeasured to measured status) already having been achieved.

We also now have >300K smart meters installed across the Anglian Water region (2021/22), 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 173.23Ml/d (2021/22).

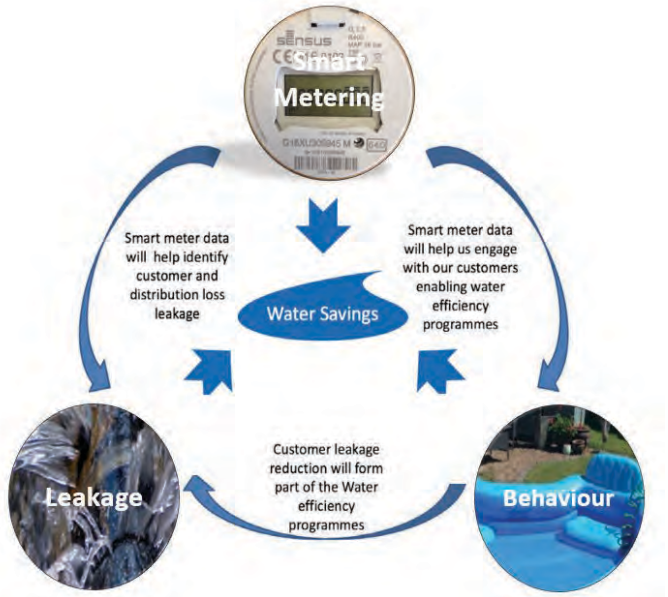
However, our ambition is to build upon our current position.

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.

5.4.1 Our preferred portfolio

Our ambitious program will comprise three strongly interlinked strategies, as described (This has been termed our 'Extended-Plus' Option):

Figure 15 Our holistic plan



This plan will include smart metering, leakage reduction and behavioural change options as detailed:

5.4.2 Metering

Our metering plan will consist of a continuation of our smart metering program, and will complete our replacement of our entire meter stock over 10 years, by 2030 (2 AMPs from 2020). We are currently progressing the rollout of our AMP7 program of smart meter installation of 1.1M meters by 2024/25 (We currently have >300K smart meters installed 2021/22).

The data resulting from 'smart metering' is helping our customers to better understand their water usage and is allowing us to more efficiently communicate messaging regarding water efficiency. It is also helping with our ability to detect leakage, speed up repair and understand our network.

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

We now estimate that the AMP7 (base-line) smart meters, will result in up to 5Ml/d demand savings due to behavioural change and up to 11Ml/d savings from quicker plumbing loss repairs (which impact PCC), with an additional 5Ml/d reduction from cspl repairs.

From 2025 to 2050, we estimate smart meters will result in an additional 9Ml/d of savings from behavioural change, 19Ml/d savings from quicker plumbing loss repairs, and up to 9Ml/d reduction from cspl repairs.

We also intend to encourage our customers who have a meter, but are not billed upon their usage, to switch to being measured customers. This should result in cost savings for the customer.

5.4.3 Water efficiency measures

We forecast that our additional water efficiency activities will result in savings of 11.7Ml/d by 2030 (the end of AMP8), and 15.7Ml/d by 2050.

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 the 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-time of 100 days (or below).
- 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 data), we are conducting significant 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'.

5.4.4 Leakage

Our target for AMP7 is to reduce leakage by 30Ml/d, from a value of 191Ml/d in 2020 (using the AMP7 revised regulatory calculation methodology) to 161Ml/d by the end of AMP7 in 2024-25. Taking 2017-18, as a base-year, we are targeting a reduction of 15.7% by 2024-25.

Our aim is to reduce leakage by an additional 19Ml/d by 2050 to a final figure of 145Ml/d (note, however, that by 2050 we expect base-line leakage will have naturally increased by 3.6Ml/d due to cspl, associated with additional new build properties).

This will represent a reduction of 24% 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 (2021/22) represents 14.9% of distribution input (DI) (173Ml/d leakage / 1156Ml/d DI) and will represent 12.7% of DI in 2050 (145Ml/d leakage / 1138Ml/d DI).

We are aiming to reduce leakage by targeting losses in our distribution system, 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).

5.5 A plan that best meets customer expectations

There is clear support from customers for us to continue with our ambitious demand management activities, with leakage reduction remaining a priority for our customers.

However, customers will not support demand management at any cost, especially where there are cheaper supply-side alternatives. Customers also value options that are reliable.

Our preferred plan best meets customer expectations of continued improvements in reliable demand management, at an affordable cost.

5.6 Striking the right balance between affordability and the environment

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.

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 'Extended Plus' plan, we are using demand management to offset any growth in demand, mitigating deterioration risks and assisting with near term supply/demand issues. Our 'Aspirational' option also offsets demand growth, but this option has a weaker business

case than ‘Extended Plus’ and is significantly more expensive. We believe that ‘Extended Plus’ strikes the right balance between protecting the environment and ensuring affordability.

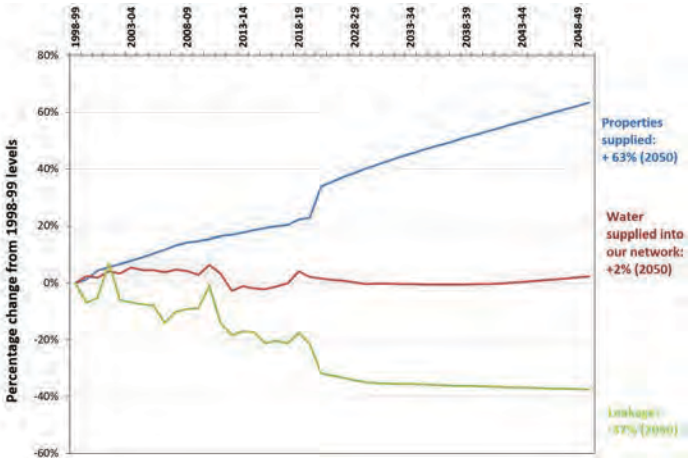
5.7 An ambitious, but achievable plan

The results of our analysis, show that we should be aiming to complete our smart meter program and further enhance our demand management activity to secure future water supplies.

Our ‘Extended Plus’ portfolio represents an ambitious extension to our existing demand management activities, completing our smart meter rollout and incorporating innovative initiatives to deliver further water savings. It will facilitate further leakage reductions, driving the performance frontier in the UK, and build upon our smart meter program to unlock a host of other activities to deliver water savings that can offset projected demand growth.

Our historic achievement can be seen as demand has remained relatively consistent since 1998 until the present (despite a >20% increase on properties and population). The scale of our ambition is illustrated below, as we intend to maintain demand at current levels, despite an increase in population of 890K (from 2025 to 2050). 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 revised WRMP24 projections.

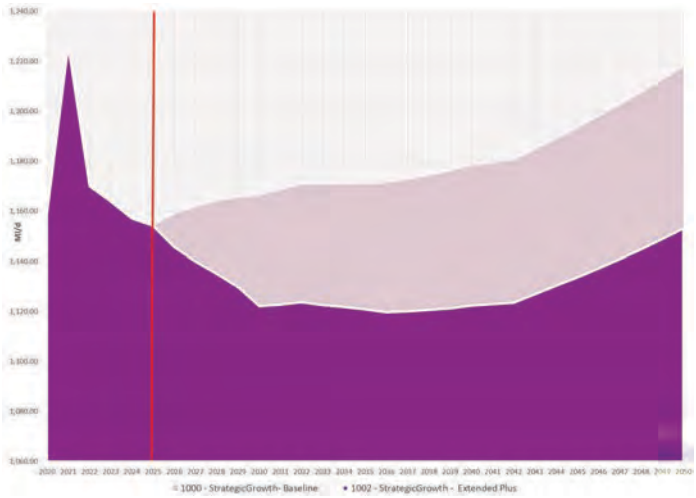
Figure 16 Demand management: past achievements and future ambition



In terms of actual demand, without demand management, consumption (Dry Year Annual Average - DYAA) is forecast to rise by 63Ml/d, from 1154Ml/d (2025) to 1217Ml/d (2050), noting that the base-line includes the savings from our current smart meter roll-out and both the base-line and final plan projections include impacts from Government interventions.

With our preferred ‘Extended Plus’ portfolio, this potential growth in demand is significantly mitigated, with consumption in 2050 set to be 1157ML/d an increase of only 3Ml/d from the initial 2025 value (1154Ml/d)

Figure 17 Demand - baseline and preferred plan 2020-2050



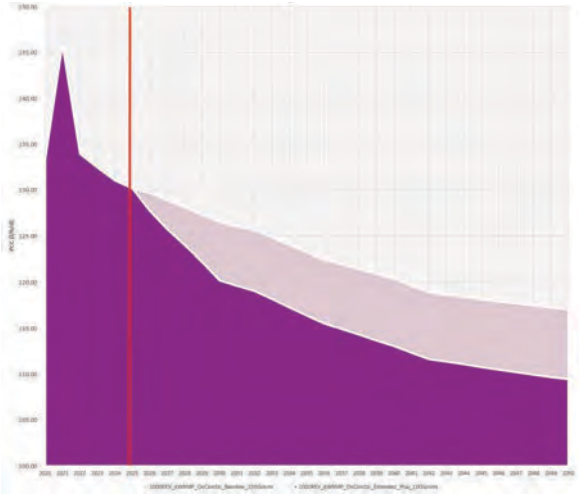
Bearing in mind, the National Framework Target for per capita consumption (PCC) of 110 l/h/d by 2050, the impact of smart metering and our demand management strategy on per capita consumption (PCC) is shown in the figure below.

Currently (2021/22) PCC is 135.99 l/h/d, having reached a peak of 146.7 l/h/d for 2020/21 due to the impact of the Covid19 pandemic and lockdown. However, we expect the implementation of our smart meter program and water efficiency measures to significantly influence PCC over AMP7 (to 2024/25).

By the end of the WRMP24 planning period (2050), we expect that our average PCC (Normal Year Annual Average - NYAA) will be 109.4 l/h/d, a reduction of 15% (20 l/h/d) compared with 2024/25 value of 130.2 l/h/d. For DYAA (Dry Year Annual Average), we expect that our average PCC will be 111.5 l/h/d, a reduction of 16% (21 l/h/d) compared with 2024/25 value of 132.8 l/h/d.

Note that both base-line and final plan include an allowance for PCC reduction due to Government led interventions ('White good' labelling and mandatory standards), which are expected to make a significant contribution to decreasing demand. For the purposes of WRMP24 we have chosen to adopt the lowest potential savings scenario from the Artesia/WUK/Defra research report. However, this still accounts for an 11 /h/d reduction in PCC by 2050 (a 68Ml/d reduction in household consumption). This outcome aligns our WRMP24 plan with national expectations, and is in accordance with our WRE partners.

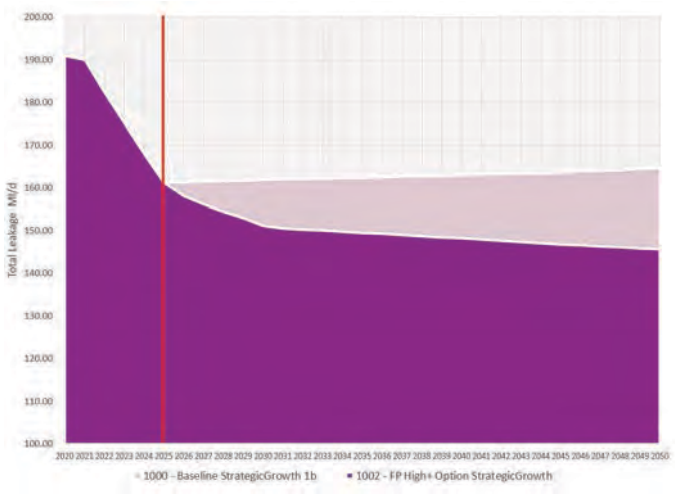
Figure 18 Per capita consumption (NYAA) baseline and preferred plan



We will also build upon our ambitious target for leakage in AMP7 (a 16% reduction from 2017/18). Leakage is expected to reduce from our 2017/18 value of 191Ml/d to 161Ml/d by 2025. However, we have had to consider cost implications of achieving the very low levels of leakage currently being envisaged and this has tempered future aspiration, due to the increasing costs required. We will, consequently, 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 applied at PWC level, once each company's current position has been considered.

Leakage in the AWS region will account for 13.9% of DI by 2024/25 and 12.6% of DI by 2050, a reduction of 19Ml/d from the baseline leakage in 2050 of 165Ml/d.

Figure 19 Leakage for the WRMP24 baseline and preferred plan



Our ambitious demand management strategy is made up of many activities within our control. However, in addition to this, we believe that, with the support of the government and other stakeholders, it will be possible for the UK water sector to deliver further significant demand management savings.

Through our engagement with the government and the National Infrastructure Commission we hope to support the development of the following measures:

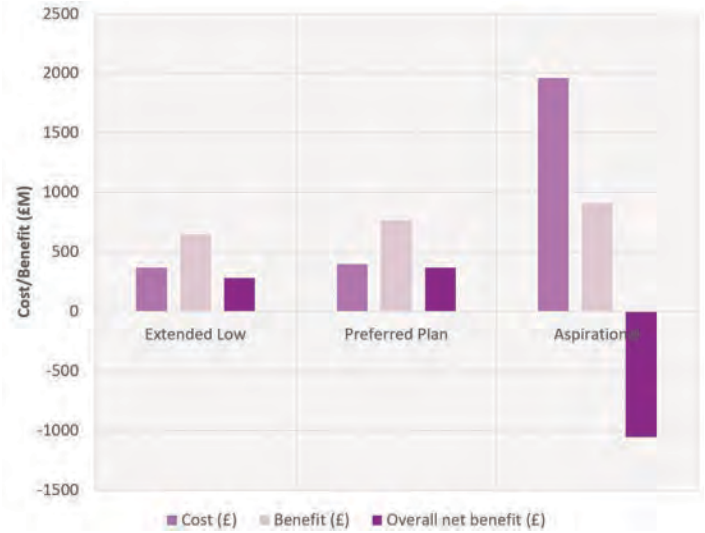
- For new homes, incentives for water efficient buildings could be supported by clear messaging from government as well as local authorities requiring increased water efficiency standards. These standards should facilitate significant reductions in PCC, below the current 125 l/h/d and 110 l/h/d current regulations, with the potential to introduce requirements for Grey/green water reuse systems.
- The introduction of a single water efficiency label covering bathroom, kitchen and garden products should be on a par with labelling of product energy efficiency ratings. As mentioned, we have used the findings of the WUK/Artesia project [18] to include a reduction in consumption due to the introduction of white good/water utility labelling from 2025. It is expected that, as products are replaced over the 25 year planning period these savings will accrue (currently we have included Artesia's low estimate of 11 l/h/d by 2050.
- New regulations have a part to play; in particular Water Fittings Regulations could further prevent waste, and higher bills for individuals that arise, from leaking toilets

5.8 Overall costs and benefits

Our preferred option is the most cost beneficial of the three strategic options that we have evaluated.

The costs and benefits of this option (Extended Plus) are shown in the figure below. It is clear that our preferred option is the most cost beneficial overall - this is partly driven by the level of water savings we will achieve, which allow us to offset supply side investment. The option remains cost beneficial under a number of sensitivity tests as described in our 'Demand Option Appraisal Technical Report'.

Figure 20 Total costs and benefits (25 year incremental NPV)



18 Water UK - Pathways to long-term PCC reduction - Project reference: 2346 - Report number: AR12862019-08-15

The cost of our enhancement for our demand management strategy is £240million (totex) in AMP8 (Excluding financing and including opex savings) with overall savings of 43Ml/d.

Costs and benefits can be shown for the 25 year period, as below;

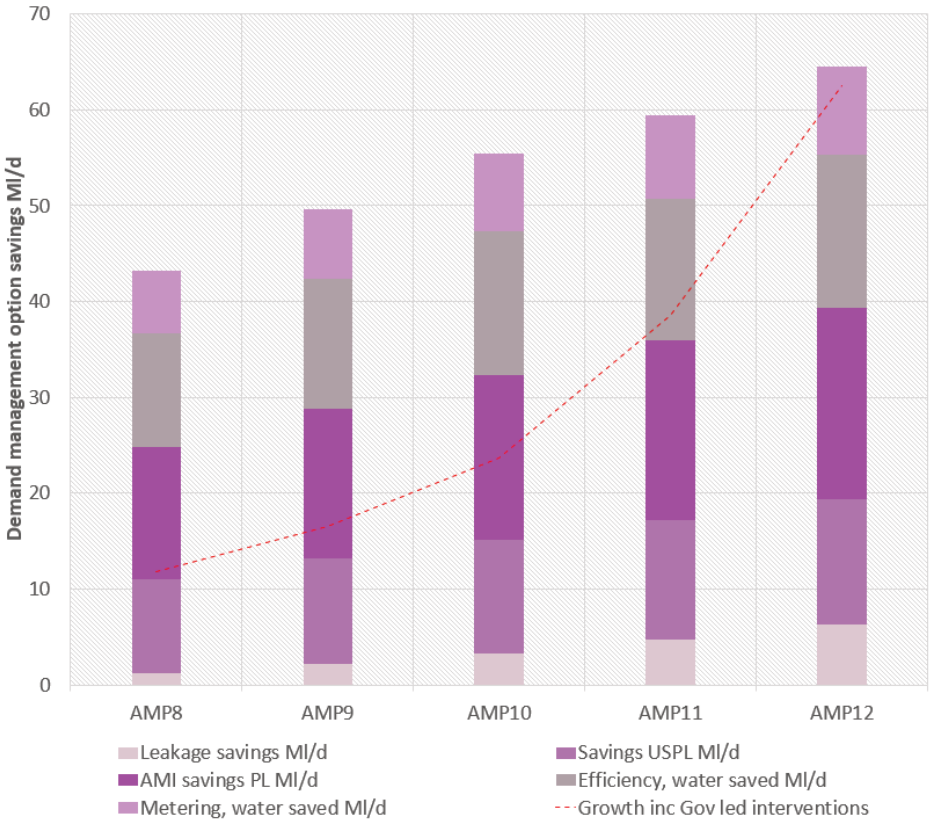
Table 3 Our preferred plan - Costs and benefits

	AMP8 - 2030			AMP12 -2050		
	Water Savings Final Year AMP8	Total Cost (Ex. Finance - Inc. Opex Savings)	Cost per Mld (AMP8)	Water Savings Final Year AMP12	Total Cost (Ex. Finance - Inc. Opex Savings)	Cost per Mld (AMP12)
Smart Metering (2AMP rollout)	26.57 Ml/d	£207.70M	£7.82M	38.27 Ml/d	£358.75M	£9.38M
Water Efficiency	11.75 Ml/d	£17.37M	£1.34M	15.68 Ml/d	£75.65M	£4.82M
Leakage	4.77 Ml/d without smart meter benefits (11.04 Ml/d with 2AMP rollout)	£14.87M	£3.16M	10.26 Ml/d without smart meter benefits (19.41 Ml/d with smart meter benefits)	£26.70M	£2.60M
Total savings for the preferred portfolio	43.09 Ml/d	£239.94M	£5.56M	64.19 Ml/d	£461.10M	£7.18M
PCC Out-turn	120.31 l/h/d AMP8 (NYAA)			109.37 l/h/d AMP12 (NYAA)		

Note that significant costs for our smart meter program are now considered as part of our base-line operation. Base-line costs for maintaining leakage levels at a given level 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.

Figure 21 Extended Plus DMO option savings (Not including Gov. led interventions)



Our preferred plan will focus on the following activities……

6 Smart metering

Smart metering, enhancing customer communication and the drive for behavioural change

The smart meter technological revolution is now progressing across the Anglian Water region, as we install 1.1M smart meters over AMP7. We currently have installed over 300K smart meters (2021/22).Under our preferred smart metering option for WRMP24, we intend to complete our installation of smart meters across our region (10 year roll-out), reaching the limit of feasible meter penetration (96.3%) by 2050.

Smart metering is fundamental in supporting our water efficiency behavioural change activities, through the provision of real time consumption data for both our customers and ourselves and we intend to build on our progress, as part of WRMP24. Data is being provided on a daily basis to customers through a dedicated website and 'customer portal' and we intend to develop these communication channels further over the WRMP24 planning period.

The central imperative, which drives our 'smart meter' roll-out, is the provision of information for our customers, so that they, and we, can understand their consumption and help encourage behavioural change. This will reinforce current water savings as customers become metered and measured and unlock the potential for additional water efficiency measures, in a mutually reinforcing way.

Smart metering is also enabling significant benefits for leakage reduction through the more efficient and timely identification of both 'plumbing loss' and customer supply side leaks. This identification of leakage will inform our home visits, adding significant value to our water efficiency activities. Consequently, the systems that we are investing in are robust and, critically, must be able to supply accurate and reliable data over the long term. This requirement has been foremost in our thinking regarding our original smart meter trials and in the selection of the current system being installed across the region.

By 2030 (the end of AMP8), we estimate that smart meters, combined with the behavioural change and the improvements in leakage performance that they enable, will result in 6.5Ml/d from behavioural change demand savings, 13.8Ml/d savings from plumbing loss reductions and up to a 6.3Ml/d from reductions in cspl (a total of 26.6Ml/d). Note this excludes AMP7 savings from smart meters, which are now considered as part of the base-line forecast.

By 2050, we estimate smart meters will result in 9.2Ml/d from behavioural change demand savings, 19.9Ml/d savings from plumbing loss reductions and up to a 9.1Ml/d from reductions in cspl (a total of 38.3Ml/d). Note this excludes AMP7 savings from smart meters, which are now considered as part of the base-line forecast. Overall it is expected that smart meters will reduce cspl by 70% as we achieve full roll-out.

This preferred option will give the greatest level of benefit to our customers, allowing us to develop individually tailored customer services.

6.1 Current position and overview

Anglian Water currently has one of the highest rates of meter penetration in the UK. In the current year 2021/22, we have over 92% of household properties with installed meters and 83% of customers paying measured charges.. This differential is related to our current policy of enhanced metering (installing meters where feasible whilst encouraging customers to switch to being measured) and to our current policy of not switching customers to measured charges on a compulsory basis, even when we have had the opportunity to install a meter. As such, if customers do not want to switch to measured charges we wait until there is a change in occupancy, or request to opt in, before changing the premises to measured charging.

However, we believe that metering is the fairest way to charge for water, because customers only pay for what they use. It has been found that customers who are metered and billed on their measured usage generally use less water than customers who pay an unmeasured estimated charge (this savings has been estimated to be 15%). We have consistently sought

to increase the number of customers who are metered and billed on their measured usage, without a compulsory metering program. Generally our customers agree that it is fairest to pay for what you use, but there is some resistance to making metering compulsory.

We currently still have 85% of our installed meters which are 'visual read' (that is they do not 'speak' or provide data remotely), so they have to be read manually (15% of meters are now smart, 2021/22). Manual reading requires significant operational input and staff, only allowing measurements to be collected over long periods (6 monthly). Consequently, only infrequent customer usage data is available. These delays in the gathering of data have led to low levels of engagement and have severely limited the potential of relaying price signals to customers. (i.e. indicating increased water usage and, therefore, increased cost). Additionally, the detection of customer supply pipe leakage and internal plumbing losses has only been possible on an infrequent basis (leading to long leak run-times). Hourly data also gives us an opportunity to identify very low level leakage, which would otherwise be undetectable, as it would be indistinguishable from consumption.

We have also, historically, trailed a limited number of radio meters, which are installed inside properties. These allow the possibility of gaining much more frequent data regarding consumption. These meters are read using drive by readers, installed in vehicles, at regular intervals (Hourly data read once every two weeks). Whilst we continue to maintain our current 'dumb' and 'radio' metering stock, billing our customers using measured charges at 6 monthly intervals, we will also continue to encourage our customers to switch to measured charges.

However, our key metering policy for AMP7 is the implementation of our smart metering program. We intend to install 1.1M smart meters across the Anglin Water region by 2025 and have already installed over 300K smart meters (2021/22) out of our total property base (15% of our meters are now smart). The key strategy of our preferred WRMP24 plan is to complete the rollout of smart meters to all our customers by 2030 (a 10 year program). Analysis of our long term (Newmarket and Norwich) trial data suggests that smart meters are saving approximately 2% with respect to behavioural change, 4% plumbing loss reduction and approximately 2.5% reductions in cspl.

Understanding that we have already achieved significant demand savings through our extensive 'dumb' metering program, further reductions in water usage and behavioural change require us to consider new and innovative approaches, based upon our smart meter program and communications technologies. It must also be noted that, although we have historically seen savings of the order of 15%, as customers switch from being unmeasured to measured, these savings might tend to diminish as we move forward.

6.2 Data, smart technologies and the future

'Smart' interconnected technologies and the remote collection and transmission of information are a rapidly developing area.

We, at Anglian Water, are now fully committed to upgrading our assets with smart technologies to capture data, improve our understanding of our customers consumption, our business and improve the productivity of our infrastructure.

The central imperative, which has driven our 'smart meter' option, is the acquisition of data. We understand how crucial data is as an enabler, building towards a new relationship with the customer, in which we can assist them to make informed choices regarding their behaviour and their water consumption. The collection of real time granular daily and hourly household consumption data is enabling us to build a much more dynamic relationship with our customers and radically change how we might influence behaviour.

We are currently developing our analytics and communications systems in order to efficiently communicate with our customers and intend to develop these processes in AMP8 and beyond, as we gain further understanding.

Figure 22 Data systems associated with smart metering

Additionally, the systems that we invest in must be robust and, critically, must be able to supply accurate and reliable granular data over the long term. This requirement has been foremost in our current thinking regarding the selection of systems able to collect and transmit this data, given the severe conditions that pertain to where and how data can be collected.

Thus, our preferred smart metering option will continue to be AMI meters ('Automatic Metering Infrastructure', monitored through a fixed network), which provide detailed granular daily usage data to our customers and for ourselves.

This abundance of data is the most important aspect of the the new smart metering world.

6.3 The preferred technological solution

The current development of smart meters has been primarily driven by their rollout in the energy (gas and electricity) sector. While the energy smart meter rollout has been informative, for the water industry, differences in the characteristics between water and energy metering mean that careful consideration is needed to determine the optimal solution.

- Particular challenges for water smart metering include the potential location of the meter, in that water meters are mostly placed outside of the home without a power source. Thus external meters require a power source, and the location may impede the transmission of data.

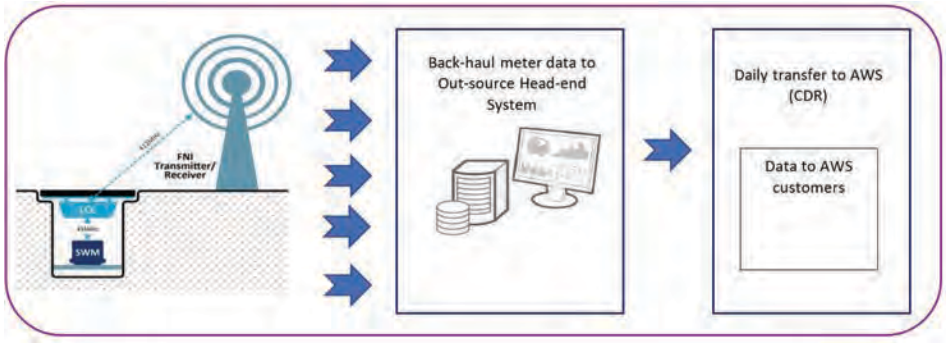
Our current (AMP7) solution involves smart meters and smart point transmitters. In this system, data is passed from the 'smart meter' to a 'smart point' on the under-surface of the meter box, which then transmits this via a radio mast network. This is necessary as many external meters can be located at depth, where signals would be lost.

Figure 23 Smart meter technologies - trialling

This technology (as tested in our trials) allows hourly readings from the customer meter. Under the current system, the data is being transmitted every 4 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, planned system improvement should facilitate as near 'real time' data as is feasible.

Figure 24 AMP7 Data transmission from the customer to Anglian Water



With regard to this data acquisition process, we are currently using a managed service from a proven supplier, as procured for the AMP7 rollout, for the WRMP/PR24 plan. Note that the key outcome of this is the data that we receive, not necessarily the final technical solution we use.

The network system is currently operated as a managed network (as in the Newmarket trial), in order to, minimize risks in terms of the quality of data and also, minimize the potential scale and disruption of the installation of the network systems required. This means that the network operator is responsible for all issues with the network (planning, installation, maintenance) and data transmission (quality and timing).

6.4 Our Smart Meter trials

To inform our decision making processes, we have conducted a number of trials using smart meters. This has allowed us to investigate types of technologies, installation issues, methods of data collection, data integrity and also new methods of communicating with our customers.These trials have been designed to inform our future business plans and help us identify an innovative, ambitious and achievable metering strategy.

The trials now give a long term view of smart meter impacts, as they have been running for 5 years, giving us a wealth of data for analysis.

These trial areas are now being complemented by the full roll out of smart meters to their respective Planning Zone (PZ) and Water Resource Zone (WRZ) areas.

- Colchester - Historically we trialled roughly 21,000 radio meters in this area which have been installed and targeted by a ‘mobile’ network of passive readers fitted to council refuse lorries. The data was collected weekly. Customers were provided information on their consumption through a web portal. This Automatic Meter Read (AMR) technology has been discounted, for future installation as the weekly drive by data did not provide the near 'real-time' information required.
- Newmarket - In this area around 6,000 ‘Advanced Meter Infrastructure’ (AMI) meters have been installed in 4 DMA (District Metering Areas).
- Norwich - This is a larger scale version of the Newmarket trial with a rollout of 12,000 AMI smart meters. This commenced in October 2017 and started to yield data from February 2018.

Meter readings are collected by the fixed network and transmitted daily to the cloud. Customers are currently provided with information on their consumption through a web portal. We are working on integrating the portal to customer billing information.

The Newmarket trial formed part of our wider ‘Innovation Shop Window’ trials taking place in Newmarket. Data has been collected from January 2017, which has allowed us to analyse customer data from the calendar years of 2016 to 2021 and make informed initial comparisons.The parts of Newmarket and Norwich used for the trials are very different demographically and have a differing mix of internal/external meters. Consequently, we feel that when combined together, they give a good representation of our wider region, giving confidence in the viability of the rollout and anticipated savings.

These trials have been vital in informing a metering strategy that is ambitious, engages customers and is cost effective.

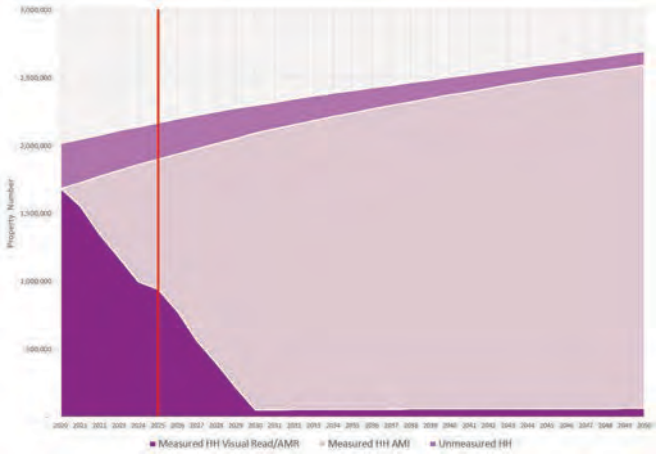
6.5 Smart meter installation rollout

Under our preferred smart metering option, we intend to continue our smart meter installation across our region (monitored through a fixed network), reaching the limit of feasible meter penetration by 2030 (the end of AMP8), in order to provide detailed granular daily usage data to our customers and for ourselves. This data is then provided daily to customers through a dedicated website or ‘customer portal’.

This preferred option will give the greatest level of benefit to our customers and will involve a major installation and replacement program, for all our current 'visual read' meter stock (approx. 2 million meters) with new 'smart meters' over a 10 year period. This program will build upon the 1.1 million smart meters that we are currently installing as part of WRMP19 by 2025. Currently (2021/22), we have installed over 300K smart meters across the region.

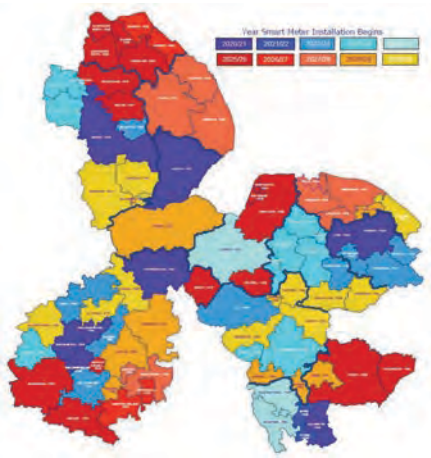
Additionally it will include the installation of meters in new developments (Currently projected to be approximately 132K new properties from 2025-2030). By 2030 we are currently projected to have 2.299M properties in the Anglian Water region.

Figure 25 Smart meter rollout trajectory for the preferred plan



The rollout has been devised (at planning zone level) to reflect a number of operational and risk based factors including; operational considerations (staffing), current meter penetration and population, expected growth and supply demand balance issues (SDBI). Additionally, it has been devised so that the network and meter installations will be completed area by area (Planning Zone (PZ) and Resource Zone (WRZ)) in order to prevent the potential for stranded assets as the installation program proceeds.

Figure 26 10 year - 2AMP - smart meter rollout



This will mean that:

- Benefits achieved in the near term by 2030 will greatly help our supply-demand balance (25Ml/d) and align with our leakage aims.
- All properties will be metered where feasible and we will encourage customers to switch to measured charging.
- Meters will be rapidly 'switched on' as they are installed (with meter installation and network mast installation being carried out in unison), meaning that benefits can rapidly be realized.
- Areas will be completed with similar technology, such that, as technologies improve they will not be randomly distributed across the region, so as not to leave stranded assets.
- WRZs will be completed in sequence, targeting higher risk areas as a priority.
- The installation rollout will be distributed evenly across the region, whilst maximizing the speed that the benefits can be passed to our customers.
- It will allow targeted customer engagement, area by area.

Obsolescence and technological change have been considered, in that the geographical rollout of contiguous areas will allow us to efficiently incorporate future technology improvements. Future changes in communication technology or in the smart meter itself will be able to be incorporated into the planned roll-out area by area, as it is progressed.

Each area network will be commissioned prior to the installation of the smart meters in order to enable our customers to instantly access their consumption data post installation.

The geographically based roll out will allow us to actively promote the smart meter program locally, tying in the local community water saving initiatives and benefits.

6.6 Determining realistic values for smart meter 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, therefore, been keen to review our original assumptions from WRMP19, on the basis of longer term analysis.

We have, therefore, conducted detailed independently verified, analysis of household data from both our Newmarket and Norwich trials. This represents a long term sample of consumption/leakage data for these properties, collected over the last 4 years and has allowed us to observe what might be termed a new normal for household consumption and leakage.

This analysis has allowed the determination of values for cumulative and year on year changes in ADC (Average Daily Consumption per property); comparing values from 2017 to 2021. Additionally the Newmarket trial data has been compared to our internal regional consumption monitoring data, as a 'control'.

6.6.1 Plumbing losses and customer supply pipe leakage

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. Thus, the availability of continuous flow' information allows the identification of flow when customer usage should be at a minimum or zero ,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 of £92/Ml.

Initial analysis, has been conducted to review leaks detected and repaired after smart meters have been installed. We have currently used the Newmarket/Norwich trial area, as this dataset gives us the longest period post installation (2017 to the present).

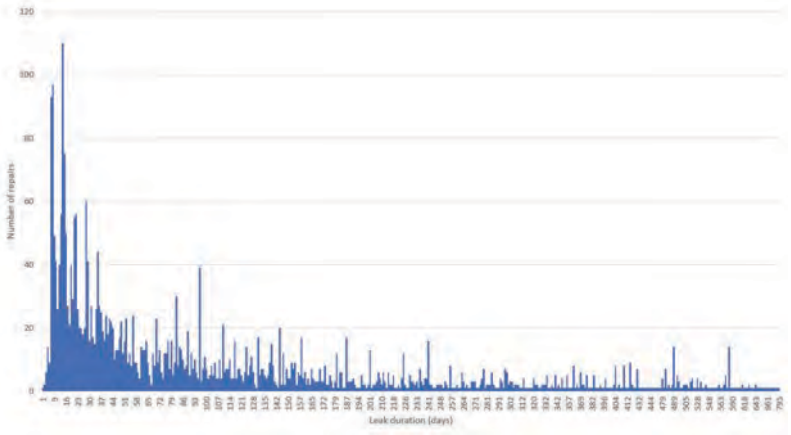
Long term data has been required for our analysis, in order to:

- 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 this long term Newmarket and Norwich data, has indicated that currently smart meter average leakage duration is approximately 112 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 small number of very long running leaks (with the vast bulk of leaks being fixed within 28 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 27 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. We have assessed leaks by the relative size, P1 to P4, where:

Table 4 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

Leak split (priority)	Volumes (litres/hr)	AWS action
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 112 day, and, therefore, increase savings. Based upon our current understanding of smart metering, potential future targets would yield savings as below:

Table 5 2025 Potential 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 current analysis from Newmarket/Norwich indicates that the average leak run time is 112 days and that the maximum run-time in the dataset was 795 days.*
- *** Note that the current 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 has led to the following analysis:

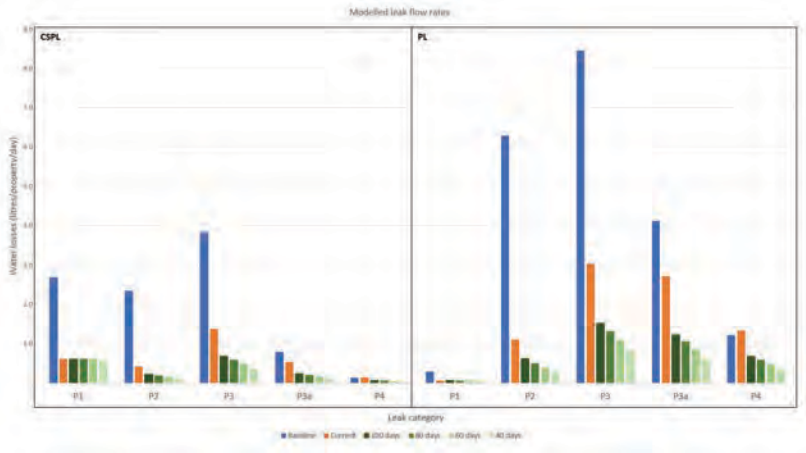
Table 6 Analysis of plumbing loss and cspl savings for differing run-time scenarios

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

Smart meter, cspl/plumbing loss leakage has been analysed for P1-P4 bands (based upon leak flow rate and duration (discovery to repair)). This analysis has allowed scenario testing for varieties of run-times for the various leak sizes (P1-P4) for either cspl (leakage) or 'plumbing loss' (PCC)

Currently smart meters are estimated to reduce cspl from 9.8 l/property/d to 3.1 l/property/d and plumbing loss from 20.4 l/property/day to 8.3 l/property/d, a significant total saving of 18.8 l/property/d.

Figure 28 Water losses for different run-time scenarios



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.

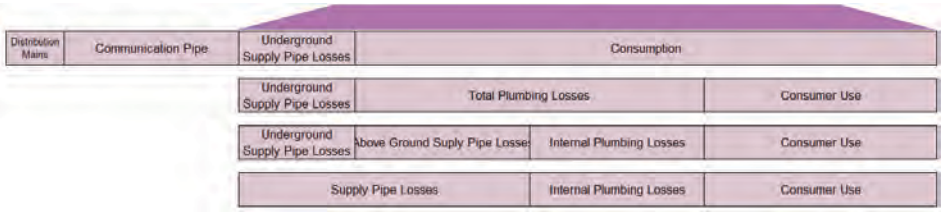
We have currently assessed savings for WRMP24 for smart meters plumbing loss and cspl reductions based upon the 112 day average run time (max run time 795 days).

However, we do not think this should be our final aim for WRMP24 and have developed 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.

6.6.2 The definition of leakage and customer consumption

The relationship between the expected leakage savings from the smart metering program and their impact on our leakage and consumption (PCC) targets is defined according to UKWIR Guidance (Components of demand described in 'Demand Forecasting Methodology Main Report Joint R&D WR-01/A' Pages 15-19), such that;

Figure 29 Consumption, customer supply pipe leakage, and plumbing losses; included in leakage or customer consumption



Both the leakage program and smart metering programs, will have an effect in reducing;

- leakage distribution losses,
- customer supply pipe leakage and,
- internal 'plumbing losses'

Consequently, the impact of this, will by definition, be attributed to:

- Customer consumption savings will include reductions in internal plumbing losses and above ground customer supply pipe leakage (cspl). This will affect our Per capita Consumption target.
- Leakage savings will include reductions in distribution losses, communication pipe losses and underground supply pipe leakage losses. This will affect our Leakage target.

6.6.3 Smart meters and behavioural change

Smart meter installation, is enabling a fundamental change in our understanding of customer consumption and in our ability to communicate with our customers. We are currently developing strategies to provide our customers with key information to help drive water efficiency, enabling more effective behavioural change programs and consequent reductions in demand.

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 customer service. It should also allow us to contextualize why saving water is so important for protecting the environment, as part of our WRMP24 plan.

The smart meter system, by it's nature, will generate significant volumes of data, necessitating a revolution in the way we engage with our customers.

- At the rate of one read per household per hour, this will generate over 20 billion reads per year, once we have completed the smart meter roll-out (excluding the duplication of reads for data validation, which will multiply this further)

In order to maximize the benefit our customers will gain from the detailed water usage data that will be available, we have been trialling a variety of methods of providing this information.

We originally considered and trialled display units for our customers (similar to energy smart meters), however, technologically this is difficult to facilitate with our external meter stock. Potentially, such display units could more easily be used with internal meters, but this could only be utilized by a proportion of our customer base. We will continue to investigate the potential integration of our customer data with other utility information, so that it can be presented in the home, as technology develops.

Currently, we have developed a standalone customer Web Portal and Mobile Application to deliver information to customers (This is termed 'MyAccount'). We have fully integrated the portal into our 'MyAccount' website, such that consumption and billing information are now combined.

For customers who have signed up for the service, consumption information is shared on a daily basis through the online portal or Mobile Application This allows customers to see their water use in more detail than ever before, noting there is a requirement for immediacy of read data to engage customers.

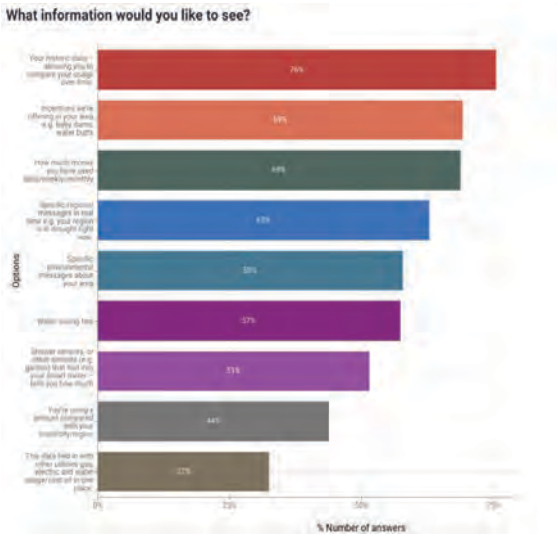
Smart metered customer engagement

To date, customers have reacted very positively to receiving consumption data and we haven't seen any negative comments about intrusion. Customers generally trust us to collect only the data that we need and see the benefit of what we're trying to do. However, we do understand that we will potentially see some customers who do not want us to collect this data as we roll out region wide.

"I am quite comfortable sharing personal data when there are clear benefits or rewards and I have given permission. I would stop sharing personal data if I found it was being resold or used without my permission."

We have also questioned our customers regarding their priorities for information which we might provide as part of our digital offering.

Figure 30 Customer preferences regarding available data



We are, therefore, concentrating on:

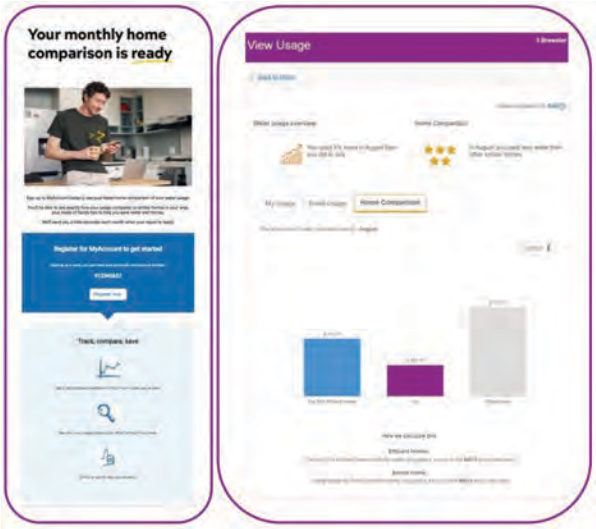
- identifying any 'usage' discrepancies, (these may be leakage)
- benchmarking to help understand where they need to make changes at home; comparing usage with similar homes
- setting targets to make it easy to track progress
- developing personalized incentives to help further savings
- making 'my usage' tangible to the amount I'm spending/saving in ££s

Customers have been asked to complete questionnaires, as part of their sign up to the MyAccount portal, in order to categorize their demographics and give an initial indication of whether the customer is a high/low/average user, in comparison to a similar cohort. We are working to ensure that these questionnaires are very focused on the key information that will help both our customers and our future engagement (helping to determine occupancy, no. of toilets, etc.).

Our current strategy stresses the following activities, as part of the customer smart meter journey:

- customer's are able to track their water usage over time,
- we offer water saving tips and advice, so that customers can modify their behaviour, including advice on garden usage.
- customers are able to compare their usage with similar households and groups, so that they can see how they are performing.

Figure 31 Customer consumption data



As we continue to develop our digital offering we will look to imaginatively include the information most helpful to our customers, whilst increasing and maintaining engagement and informing them as to why water efficiency is so important for our communities and the natural environment.

Alongside the information on their water usage, our customers will also be able to access tips on how to save water, pledge to change their water usage behaviours and track the effect of the changes on their water use.

6.6.4 Smart meter behavioural change savings

In addition to our re-evaluation of plumbing loss and cspl reductions, that should be facilitated by smart meters, we have reviewed long term trial data (from Newmarket and Norwich) to determine the additional benefit that we might expect due, purely to household behaviour changes.

Data from 2016 to 2021 suggests the following:

- Pre-smart meter introduction, Newmarket consumption was +6% above the baseline derived from our SODCON (Survey of Domestic Consumers) control group: Norwich consumption was +0.5%, above the baseline derived from our SODCON control group (measured tariff properties)
- Post-smart meter introduction, Newmarket consumption was -7% below the baseline derived from our SODCON control group: Norwich consumption was -7.5%, below the baseline derived from our SODCON control group (measured tariff properties)
  - The Covid19 pandemic was seen to have had a significant impact on behaviour and demand (changes in working from home, lockdown, 'stay-cationing')
  - Post Covid19: Newmarket consumption was -2.5% below the baseline derived from our SODCON control group: Norwich consumption was +0.3%, above the baseline derived from our SODCON control group (measured tariff properties)

Once plumbing loss and cspl reductions have been subtracted from the overall changes in consumption, the remaining difference indicates a reduction in demand due to behavioural change of approximately 2.5% to 3%.

This aligns with the original assumption used in WRMP19, 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 'visual read' metering to smart metering).

Figure 32 Newmarket, measured domestic consumption

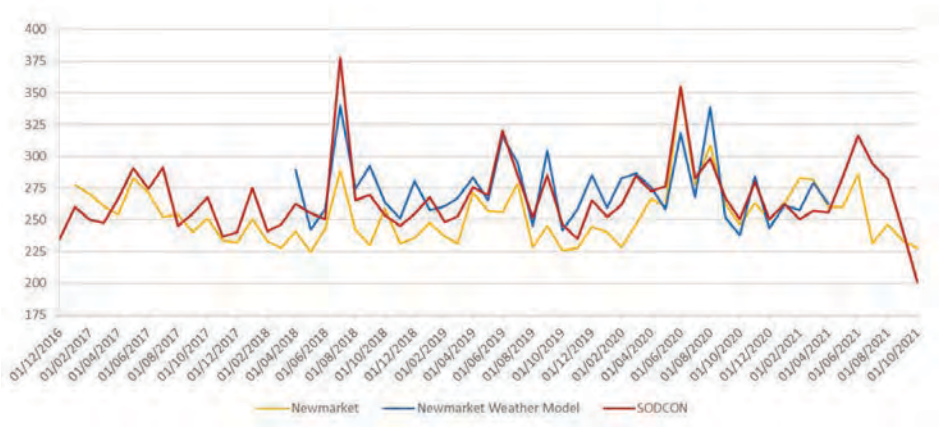
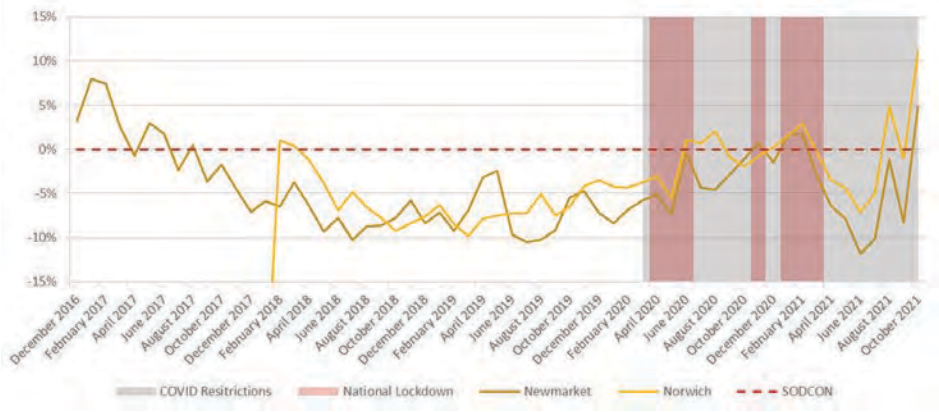


Figure 33 Measured domestic consumption average % above/below SODCON



6.7 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 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, 83% (in 2021/22) are metered and pay measured charges. Additionally, another 9% of our customers have a meter fitted (through our enhanced program), but are not billed upon their measured volume. In total we have 92% of our customers with a meter.

By the end of WRMP24 we expect 96.3% of our customers to be metered and measured, which we would consider as being close to our theoretical maximum meter penetration (our current absolute maximum meter penetration by 2050 has been estimated to be 98.6%). 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 (2021/22) measured customers have a PCC of 128 l/h/d and unmeasured customers have a PCC of 174 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/compulsory metering program, we have analysed a scenario which achieves a metered/measured penetration of 98.6% by 2050 as opposed to the 96.6% level achieved in our draft preferred WRMP24 plan.

- This higher scenario saves an additional 4.8Ml/d by 2050 (43.1Ml/d as opposed to 38.3Ml/d)
- However this scenario costs £390M as opposed to £358M for our preferred plan (Enhancement costs only, excluding finance and opex savings).

As part of the development of our Final WRMP24 we will 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 98.6% theoretical maximum meter penetration, would not be cost beneficial, however we do intend to implement compulsory metering in AMP8, such that all customers who have a meter to switch to pay a measured charge.

6.8 Smart Meter costs and benefits

For our enhanced program of smart meter installation from 2025 onward we anticipate the following reductions in demand for WRMP24.

Table 7 Savings attributable to SM behaviour change, plumbing loss and cspl - Enhanced smart meter roll-out post 2025

	2030 (AMP8)	2035 (AMP9)	2040 (AMP10)	2045 (AMP11)	2050 (AMP12)
Smart Metering behaviour change saving (Ml/d)	6.5	7.3	8.0	8.7	9.2
Smart Metering CSPL saving (Ml/d)	6.3	7.1	7.8	8.5	9.1
Smart Metering Plumbing Loss saving (Ml/d)	13.8	15.6	17.2	18.7	19.9
Total (Ml/d)	26.6	30.0	33.0	35.9	33.3

However, it must be noted that we also expect savings from our AMP7 (2020-25) smart meter rollout, as below. These savings will be included in our baseline demand forecast.

Table 8 Savings attributable to SM behaviour change, plumbing loss and cspl - base-line Smart Meter roll-out - Pre 2025 roll-out

	2030 (AMP8)	2035 (AMP9)	2040 (AMP10)	2045 (AMP11)	2050 (AMP12)
Smart Metering behaviour change saving (Ml/d)	5.3	5.2	5.1	5	5
Smart Metering CSPL saving (Ml/d)	5.4	5.4	5.4	5.4	5.4
Smart Metering Plumbing Loss saving (Ml/d)	11.8	11.8	11.8	11.8	11.8
Total (Ml/d)	22.5	22.4	22.3	22.2	22.2

External (distribution loss and external cspl) and internal leakage (plumbing losses) reductions will form a significant part of our anticipated demand reductions over the WRMP24 plan period.

Additionally we have calculated the costs associated with the metering program for WMRP24, as shown (showing AMP8 out-turn costs (2025-30) and AM12 out-turn costs (2025-50)).

Note that we have also calculated the baseline costs for our metering program (visual read and smart), which now includes the cost of the rollout for the 1.1M smart meters by 2025, the network installation costs and costs for maintaining data processing systems. (We have assumed that we would continue to provide the services associated with the initial 5 year, 1.1M smart meter rollout as part of this baseline).

Overall the smart meter enhancement program for WRMP24 will cost £207m between 2025 and 2030, and £359m (excluding finance costs and opex savings), over the 25 year WRMP24 plan period (to 2050).

The entire metering program, including the base-line will cost £383m, between 2025 and 2030, and will cost £1291m, between 2025 and 2050, (excluding finance costs and opex savings).

Table 9 Preferred smart meter program (costs and benefits)

	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
Costs and savings represent enhancement (AMP8 and AMP12)						
Fixed Capex/Opex inc - Finance	£225.76m	26.57 Ml/d	£7.82m	£447.05m	38.27 Ml/d	£9.38m
Fixed Capex/Opex pre - Finance	£210.31m			£383.31m		
Opex saving	£2.61m			£24.56m		
Baseline, full cost (AMP8 and AMP12)						
Fixed Capex/Opex inc - Finance	£220.36m	22.39 Ml/d	£7.85m	£1,129.09m	22.23 Ml/d	£41.93m
Fixed Capex/Opex pre - Finance	£179.58m			£950.83m		
Opex saving	£3.78m			£18.76m		
Option, full cost (AMP8 to AMP12)						
Fixed Capex/Opex inc - Finance	£446.13m	48.39 Ml/d	£7.93m	£1,576.13m	59.96 Ml/d	£21.53m
Fixed Capex/Opex pre - Finance	£389.88m			£1,334.14m		
Opex saving	£6.39m			£43.32m		

The preferred plan leads to the following installation trajectories and a metered/measured penetration of 96.3% by 2050.

Table 10 Measured/unmeasured customers - end of AMP status

	2030	2035	2040	2045	2050
Measured (000s)	2,094.2	2,243.7	2,374.0	2,494.2	2,593.8
Unmeasured (000s)	204.8	163.7	130.6	105.7	100.0
Meter penetration (000s)	91.1%	93.2%	94.8%	95.9%	96.3%

Smart meter installations will be as follows:

Table 11 Meter installation types - end of AMP status

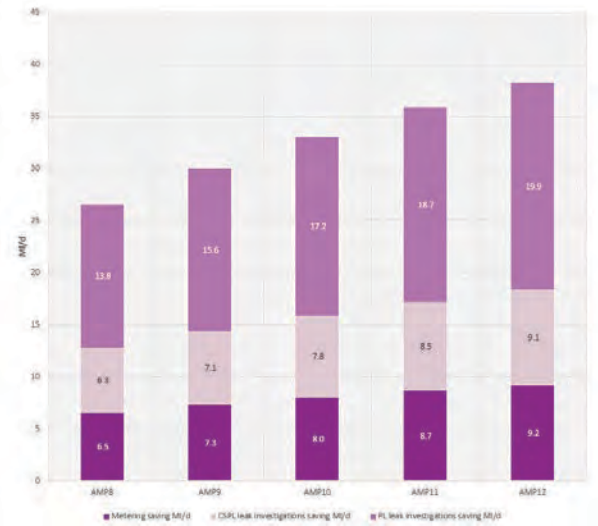
	2030	2035	2040	2045	2050
Visual Read (000s)	14.6	14.6	14.6	14.6	14.6
AMI Smart Meter (000s)	2,079.6	2,229.1	2,359.5	2,479.6	2,579.2
Unmeasured (000s)	204.8	163.7	130.6	105.7	100.0

New build additional installations will be as follows for the WRMP24 planning period.

Table 12 Meter installation types - end of AMP status

	2030	2035	2040	2045	2050
New Builds (000s)	132.87	108.46	97.24	95.18	93.95

Figure 34 WRMP24 smart meter savings 2025-250 (additional Smart meters only)



7 Household Water efficiency

Encouraging changes in behaviour

An important aspect of demand management is the empowerment of our customers to understand and reduce their water usage. This involves encouraging customers to use less of our retail product - a concept that some may find surprising. We have a dedicated water efficiency team which leads our work in this area and designs our communication strategies.

Key to our water efficiency strategy is the introduction of the smart metering program and our ability to communicate the reasons why demand and water efficiency are so important in achieving our goals for the environment and for the provision of sustainable clean water supplies.

Our current WRMP19 (AMP7) strategy (2020-25) includes the following options:

- a rewards scheme for signing up to the smart meter customer portal.
- 'Drop by 20' audits and home visits. These visits deliver water savings through retrofitting free water saving devices and, through the provision of advice, to encourage positive behaviour change.
- the continuation of our 'Drop by 20' campaign. 'Drop by 20' is a water efficiency campaign which we developed in response to the 2011-12 drought and we continue to offer it to customers when they request a meter.
- our campaign to assist customers with leaky loos via rebates (noting that a leaking loo can lose on average 478l/prop/d)
- trialing of smart water devices (including smart shower sensors) for a full rollout in WRMP24.
- we have also been developing our engagement with business water Retailers regarding demand management. This currently has included a dedicated section on our Wholesale website providing targeted information for Retailers and also content which can be directed towards their non-household customers.

These programs have been accelerated in order that we achieve our per capita Consumption (PCC) target for 2025.

Looking to the future

We are keen to build on our current momentum and the rapid deployment of smart meters across our region, while expanding our digital offerings to take full advantage of our smart future.

Our proposed portfolio represents our most extensive program of water efficiency and behaviour change activity to date.

Our ability to change customer behaviour and drive efficiency will be noticeably enhanced, as it is supported by our smart metering 10 year installation program. Smart metering is enabling innovative water efficiency interventions and allowing us to provide a platform for tailored customer engagement. Some of the options that are enabled by smart metering include customer campaigns and reward schemes through the smart meter usage portal and smart home device retro-fitting. These options will be included in our preferred portfolio.

The success of smart metering will also be influenced by our water efficiency activities. We understand that smart metering is a technological revolution and it needs to be accompanied by a behavioural revolution to unlock its full potential to help manage demand.

We are excited by the opportunities that the provision of timely consumption data from smart metering is having on our ability to change consumer behaviour and to promote the conservation of water.

7.1 Current and future engagement

We assess our success in encouraging water efficient behaviour by measuring average water per capita consumption. This is one of our ODIs (Outcome Deliver Incentives).

Our performance target is to reduce average per capita consumption by 7l/h/d from 2020 to 2025 (from 133l/d in 2019/20 to 126.6l/h/d by 2024/25 for the three year rolling average values). However, we have suffered a severe recent challenge, due to the Covid19 pandemic, which has significantly impacted behaviour. For 2020/21, when we experienced the lockdown, we saw average PCC increase from 133.3l/h/d to 146.9l/h/d. We are now seeing PCC returning to normal, but PCC is still higher than before the pandemic, as patterns of behaviour have moved to a 'new normal' .

This has made it even more imperative to understand and enhance our water saving activities, post pandemic. Water saving activities have, therefore, been maximized using our digital engagement, as well as working with key community partnerships to utilize their online channels. The biggest benefits for delivering water efficiency have been gained by making the changes within MyAccount, our online tool, for customers to engage with their smart metering data to help them to understand their consumption.

We have also been keen to ensure that customers understand the information being collected and are comfortable with sharing this information with Anglian Water. Key to our engagement is helping our customers understand the reasons why water efficiency is so important to our plans and environmental destination.

Customers maintaining frequent engagement with their consumption, helps them to take direct control of their usage by helping them to understand and change their behaviours. Customer side leakage (plumbing loss or cspl) accounts for the majority of reduction in overall PCC/Household consumption and has been quantified separately in the smart metering benefits.

There is a strong link between our work to address water affordability in our region and our water efficiency and metering activities. The provision of water efficiency advice to metered customers helps them reduce consumption and, consequently, their bills. Because of this, we coordinate our metering and water efficiency work to support customers and encourage them to reduce their water consumption. Our combined metering and water efficiency program divides the region into areas that are visited in turn, combining the offerings from all elements of the program delivered in the same place at the same time.

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.

We also believe that there are significant opportunities to work with land developers to promote sustainable developments and water efficiency.

Additionally we have been liaising with Local Authorities to encourage developers to meet much more stringent water efficiency standards for new developments. With regard to this, Local Authorities have been pushing housing developers to build homes to a standard of 110 litres per person per day.

As part of our vision for a sustainable future we are also focused on promoting our ‘green’ water initiatives and the wider concept of 'Water Neutrality' (Green water being designated as non-potable rainwater, storm-water, or recycled water). This involves, both the promotion of simple solutions (such as water butts to collect rainwater) and liaising with developers to install more complex ‘green’ water systems into new homes and businesses.

7.2 Our preferred portfolio

Our preferred water efficiency strategy includes a range of household water efficiency and behavioural change activities. Some of these are based upon the continuation of current activities and those we are developing alongside our smart meter rollout in AMP7.

Our preferred option also includes a significant number of new activities, such as incentives for customers to replace leaky toilets with more efficient brands and the installation of water butts. Further initiatives will draw upon insights from 'Behavioural Economics' and will be enabled by smart metering and our online platform, such as a rewards scheme that incentivizes water savings.

The assumptions, costs and benefits have been developed using our internal analysis and external experience, whilst understanding the interconnected nature of the options (especially with respect to smart metering) and the potential for double counting.

The selected option portfolio will include the following sub-options:

- Provision of smart water devices/sensors (shower sensors); investigating the potential to link smart sensors to 'MyAccount'; further investigation to link Smart devices to utility hubs, developments and communities.
- Continued development of 'MyAccount' App to provide easy access to data.
- Additional community based campaigns -hyper local and seasonal.
- Development of gamification and rewards schemes, digitally accessed.
- Provision of garden advice / garden kits for outdoor usage with higher levels of engagement on discretionary/seasonal water use.
- Personalized engagement on discretionary/seasonal water use through virtual assistants.
- Enhanced scheme to assist vulnerable customers with internal leaks.
- Leaky loo campaigns for traditionally metered customers.
- Development of customer leakage journey to achieve maximum target run-time of 100 days.
- Potential for smart communities; link smart systems to other utilities.

Some of these are based upon the continuation of our current activities, such as the 'Drop by 20' campaign (where we carry out free water saving home visits and install water saving devices), our retrofitting program and 'The Potting Shed' (where we provide water efficiency advice and free products to gardeners).

We are also actively developing options that will impact the non-household sector, as well as investigating the potential for water re-use for both domestic and industrial customers.

7.2.1 Smart Homes

We intend to exploit the fullest capabilities of the smart connected world by introducing additional smart devices into our connected network, currently being developed. These devices will allow us to target the most water intensive aspects of consumption, such as showering and bathing, by giving customers even more information about these specific activities.

We intend to provide a number of smart devices (particularly shower sensors, which record the duration of showers) in order to provide more information about shower volume and duration. Showering is a major component of household consumption, so that, if we can impact shower durations, this should have a significant overall impact on PCC. We will also trial sensors which are capable of being linked to our own smart meter system, providing information through our 'My App' system.

Communications will be tailored to inform customers of the impact of these activities and how making small lifestyle changes (reducing showering times by even a small amount) can reduce water usage significantly. We have also supported the use of other water saving devices, such as 'babydams' which reduce the water needed for infant washing (with our incentivization of these devices).

Figure 35 Smart devices

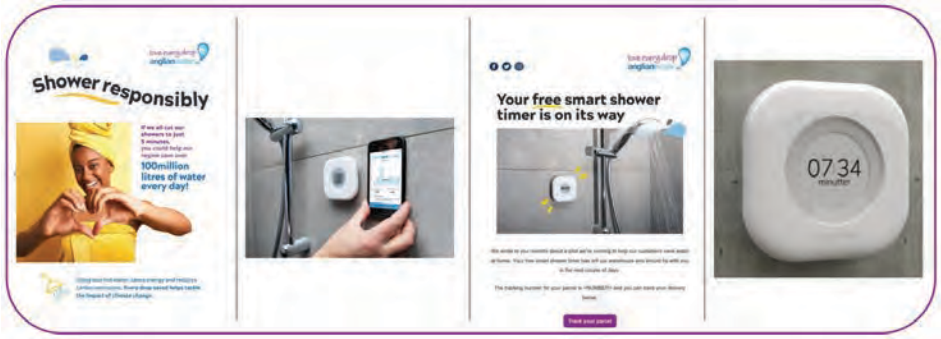


Figure 36 Baby bathing water saving

The options that have been developed for WRMP24 may be described as below:

Table 13 Smart homes

SECTION 1: SMART HOMES - layer smart sensors in the home to provide data on specific components such as white goods, taps, garden use or showers. Provide and fit the sensors then link into 'My Account' or their proprietary smart hub. Provide the ability to set targets within the home then set rewards linked to water saving. Nudge customers within their comparisons and ongoing engagement.	
1a	Provision of smart sensors (such as Aguardio Smart Shower Sensors). · Provision of other smart sensors and devices - trials to be completed in AMP7 where possible. In AMP8 we would look to ensure these devices/sensors feed into 'My Account' for customers who are registered and can also link their usage patterns to the rewards scheme. · Also AMP8 options will include monies to trial any new devices to market. Use sensors as a reward in the rewards scheme.
1c	Link up with other providers of energy data to provide a smart hub for the home showing all your energy and water consumption in one place. · Currently holding discovery sessions with HIVE as part of the AMP7 trial. Data from this trial will go into the PR24 submission.

7.2.2 Encouraging behaviour change

Continuous engagement with our customers will be essential in embedding and maintaining behavioural change over time.

We intend to build upon our current engagement, using all the available channels for communication (radio, publications, news-media, email, text and social platforms) in addition to our smart meter program and digital offering.

We also target our communications, during times of drought and peaks summer demand, so that our customers can more effectively use water during periods of hot weather.

Figure 37 Garden advice for our customers

We also use a mix of channels, as well as being present in communities to help customers understand the benefits of metering and how this can assist with bills and affordability for our vulnerable customers.

Figure 38 Examples of drought communications and vulnerable customer communications

We also intend to update our offering, with the ability to offer rewards to customers and/or their local communities. These rewards would be available when certain milestones are achieved. Additionally, we envisage that the customers would be involved with setting the level (and degree of difficulty involved) of the milestones and the potential level of reward.

We are currently reviewing the form that these rewards might take (they may range from a free coffee up to some water saving technology; community rewards may involve contributions to a local playground, for example).

We are conscious that developing and maintaining customer engagement, will be key to customer satisfaction and achieving the demand reduction goals we have set.

We will, therefore, be keen to ensure that the design and presentation of information to our customers (via the web-portal and mobile applications), should be clear and keep customers engaged. (facilitating the demand savings in the plan). This process will require continuous monitoring, validation and update, as the smart meter roll-out proceeds.

The options that have been included in the WRMP24 plan can be described in more detail as below:

Table 14 Encouraging behavioural change

SECTION 2: ENCOURAGING BEHAVIOURAL CHANGE - putting data at our employee's and customer's fingertips to help them save water and save money on their water and energy bills. Make the savings tangible to customers' bills.	
2a/b/d/f	2a: Continued development of the 'My Account' app to provide quick easy access to data and services: Usage, data comparisons, spotting customer side leaks, high consumption identification, personalized tips, proactive warnings. Improving graphics and display as new technology comes to market. · Keeping pace with app developments to ensure customers still rate it and use it: this relates to the 'My Use' element only and not to the 'My Account' App as a whole. · Any changes required, as a result of GDPR. 2b Further development of gamification within 'My Account'. · Continued support & development of rewards schemes to encourage water saving behaviours. · Ability to invest in new technology/functionality as it comes to market. · Setting of targets and challenges, which could include environmental/social/carbon rewards and therefore include additional benefit lines here. Include 2f - Efficiency messaging improvements from smart meter data. · Improved analysis of smart meter consumption data to fine-tune information sent to customers to maximize behavioural consumption reductions.
2c	Continued provision of garden advice, promotions on social media and garden kits to support reduction in discretionary use in the garden. · This is included because due to higher levels of engagement with their data, customers will want more help with controlling discretionary use. The option includes seasonal tips within 'My Account' for gardening linked to usage and personalized options linked to smart hubs/virtual assistants.
2d	Campaigns to support our key messages and brand (Hyper local and seasonal). Linked to smart data and includes drought messages and peak demand messaging. · Note this also links to Option 3b - Campaigns to support our key messages and brand (Hyper local and seasonal). Linked to smart data. Providing water saving tools to nudge customers to use less during peak summer demand.
2e	Development of tariffs using smart meter data to promote water saving. These will be considered once we have full smart meter rollout (so that all customers are in a position to take advantage of these offerings).
2g	Drop by 20 option - fitting of water saving devices by a plumber and giving water saving advice. This option is provided for non-smart customers still on a visual read meter.

7.2.3 Community action

We are keen to develop communication strategies, which are tailored to our customers and relate to the regional issues facing water usage, by referencing local conditions relevant to customers in that area.

In future we intend to use our smart meter communications strategies to encourage water efficiency locally, with community reward schemes. We are also keen to develop the idea of smart cities, linking water, energy and carbon efficiency programs in a holistic scheme.

Examples of our current localized communications strategy can be shown as the following:

Figure 39 Community presence and engagement to drive awareness and intent

Table 15 Community action

SECTION 3: COMMUNITY - promoting water saving as a community aligning to our hyper-local brand messaging.	
3a	We will work at a community level to encourage water savings with the results triggering a community reward. · This could also help with non-contact CMEX with the correct publicity and should be linked into our overall community strategy. · Link into Education and schools challenges with rewards linked to them: Pupils take home the challenge which has a very wide impact overall. Also potentially sponsor annual awards ceremonies (albeit virtual) to promote great ideas and gain additional publicity.
3c	Net Zero Project · Development of a smart city. Provide information into big data systems. Partner with a city in our region to promote and take this forward.

7.2.4 Leakage interventions

A key pillar of our smart meter program is the potential impact it will have on leakage reduction.

As described, smart meters mean that household leaks will be identified after 3 days of continuous night flow.

We are keen to develop our communications to help customers find and repair these leaks (either plumbing losses or customer supply pipe leaks) as fast as possible. We are also keen to help our most vulnerable customers with visits and incentives to fix these leaks as fast as possible.

Figure 40 Leakage communications

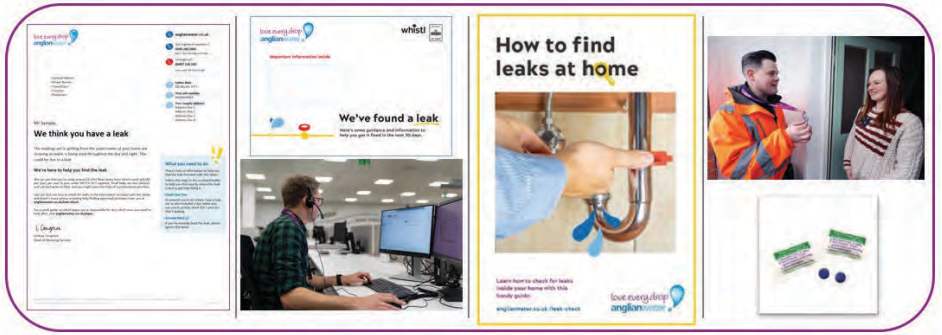


Table 16 Interventions (leakage)

SECTION 3: COMMUNITY - promoting water saving as a community aligning to our hyper-local brand messaging.	
4a	Scheme for customers in vulnerable circumstances and customers with affordability issues to fix leaky loos and leaky taps up to a capped value. If toilets cannot be fixed then provision of a small amount of toilet rebate vouchers again linked to vulnerability and affordability. Part of Drive to 100 day maximum target for leak run-time - For Plumbing Loss element
4b	Fix all customer side supply pipe leaks for all customers up to a value of £500 for P3 and above. Part of Drive to 100 day maximum target for leak run-time - For cspl reduction element
4c	Delivery of the the customer side leakage journeys relating to P1-P4 break out leaks. · Includes virtual and CSR customer side leakage visits for break out leaks, providing expert advice to customers through online and video assessments for potential internal leaks identified by smart metering. Offer of physical visit for customers who require it to help identify location of the leak particularly those in vulnerable circumstances.. Part of Drive to 100 day maximum target for leak run-time
4d	Leaky loos campaign (base option). This is a continuation of a service we offer in PR19 for non-smart, visual read customers
4f	Network leakage detection: sensor development to add pressure and noise sensors into smart meters to provide online network leakage monitoring and early warning.

7.3 A behavioural revolution

It is important to note the key role that smart metering will play in any future plan to change customer behaviour. Our water efficiency activities will seek to begin, and sustain, a behavioural revolution, based upon the technological revolution that the smart meters represent.

Our ability to show customers their water use, in near real-time, will allow a significant improvement in customer understanding of their consumption, allowing us to tailor water efficiency initiatives directly to their needs. The research is clear that some of the most effective behavioural interventions are supported by consumption information. We believe that smart metering linked to our water efficiency sub-options represents an opportunity to drive a further advance in demand management and water conservation.

Many of our water efficiency sub-options will be facilitated by the smart metering campaign, particularly those that involve the use of the customer portal.

7.4 Water efficiency costs and benefits

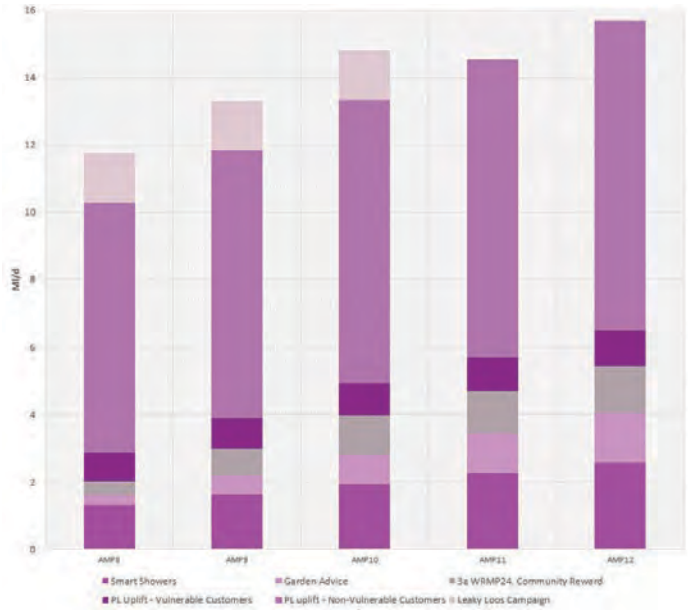
For our preferred portfolio of water efficiency measures we expect the following costs and benefits:

Table 17 Costs and benefits for our 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	1.31	£3,207,737	£133,126	2.56	£15,841,151	£1,452,484
Smart Hub	-	£	£	-	£	£
My Account	-	£2,935,450	£	-	£16,188,616	£
Garden Advice	0.30	£1,927,076	£29,879	1.47	£9,600,148	£644,922
3a WRMP24. Community Reward	0.40	£74,714	£40,457	1.40	£368,971	£741,995
PL Uplift - Vulnerable Customers	0.86	£444,969	£114,239	1.06	£3,000,260	£770,271
PL uplift - Non-Vulnerable Customers	7.41	£3,808,144	£986,346	9.19	£25,676,903	£6,650,563
Leaky Loos Campaign	1.48	£24,802	£198,321	-	£24,802	£748,239
Mandatory water labelling	-	£	£	-	£	£
Innovation Fund		£4,946,095			£4,946,095	
Totals	**11.75 Ml/d**	**£17,368,987**	**£1,502,367**	**15.68 Ml/d**	**£75,646,946**	**£11,008,474**

Savings have been calculated for each of the water efficiency measures and can be shown.

Figure 41 Water efficiency measure savings for the plan period



8 Leakage

Our ambition for leakage

Leakage is a particular concern for our customers, who see it as wasteful and a sign that we are not 'doing our bit' to conserve water and invest in infrastructure. This can be a strong disincentive to customers adopting more water efficient behaviours and customers often associate leaks with service interruptions. Our leakage performance is currently industry leading. We have cut leakage by more than a third since privatization in 1989 and it is now at record low levels; around half the national average based on the amount of water lost per kilometre of main.

Our three-year average has continued to fall from 191Ml/d at the end of AMP6 (2019/20 (using the revised methodology: note previous WRMP19 reporting methodology stated 182.4Ml/d). In 2021/22 we achieved a record low (for AWS) leakage level of 173.44Ml/d. Thus, we are taking significant steps towards our AMP7 target of 152Ml/d in 2024/25 (with a three year rolling average of 162.3Ml/d). The Leakage Outcome Delivery Incentive (ODI) mechanism for AMP7 uses a three-year average leakage figure to measure our performance against the performance commitment level (PCL). In year one the PCL required a drop of 1.4% from the baseline of 194.1Ml/d resulting in a three-year target level of 191.4Ml/d. In year two the PCL required a drop of 5.4% from the baseline of 194.1Ml/d resulting in a three-year target level of 183.3Ml/d. The three year rolling leakage is assessed at 182.4Ml/d, which is 0.9Ml/d below the PCL.

However, we do not believe it is good enough to stop at the targets set by our regulator, especially when reducing leakage is such an important issue for our customers and so vital for us in this dry part of the country. Consequently, we are setting a more ambitious target of reducing leakage even further for WRMP24, whilst being mindful of the National Framework Target and the costs for our customers associated with reducing leakage from our current frontier position.

Whilst developing our preferred plan we have reviewed the PIC (Public interest commitment) and NIC (National Infrastructure Commission) 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, without burdening our customers with significant additional costs. 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 significant mains replacement at a 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 23.7%, which still allows us to meet our NIC and PIC targets. To achieve our ambition we will need to use innovative techniques, as well as tried and tested methods. 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 23% of total leakage. 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 thermal imagining drones to detect leaking pipes and the use of satellite imagery to identify leakage. We continue to explore, for example through our research on smart networks as part of Ofwat's Innovation Fund and through our engagement with fellow water companies and smart water network pioneers Vitens in the Netherlands and Global Omnium in Valencia.

8.1 Current position and overview

Leakage is treated water lost from our distribution network system. It includes water lost from our mains and pipe networks (known as distribution losses) and losses from customers' supply pipes (known as customer supply pipe leakage, cspl).

Our record in reducing leakage has caused our leakage rate to improve dramatically in the last 20 years and we are currently a 'frontier' company, within the industry. We now lose approximately 25% less water through leaks than we did in 1998, despite the expansion of our pipe networks to connect to over 500,000 more properties.

Reflecting our customers' concerns about leakage, we are continuing to pursue our ambitious leakage reduction initiative for AMP7. As a company we committed to reduce leakage by 15% from the baseline of 191.0Ml/d value (2019/20 revised methodology: note previous WRMP19 reporting methodology stated 182.4Ml/d), to 162.3Ml/d by 2025 (3 year average).

Leakage is now assessed using the methodology set out by Ofwat in the reporting guidelines published during the PR19 process.

Leakage for 2021/22 has been assessed at 173.44Ml/d in-year against an in-year target of 175.3Ml/d. This represents an 8.97Ml/d decrease from 2020/21 (reported using a consistent methodology) and again is our lowest recorded annual leakage on record, building upon last year's record low. The Leakage Outcome Delivery Incentive (ODI) mechanism for AMP7 uses a three-year average leakage figure, to measure our performance against the performance commitment level (PCL). In year one the PCL required a drop of 1.4% from the baseline of 194.1Ml/d resulting in a three-year target level of 191.4Ml/d. In year two the PCL required a drop of 5.4% from the baseline of 194.1Ml/d resulting in a three-year target level of 183.3Ml/d. Three year rolling leakage is assessed at 182.4Ml/d, which is 0.9Ml/d below the PCL. Note that the forecast out-turn for our three-year average, based upon the updated methodology, is 162.3Ml/d.

Our AMP7 leakage strategy continues some of the themes that we started in AMP6, such as network optimisation and intensive leakage investigation. It is supplemented with new Smart strategies, such as permanent noise logging, smart metering and widespread pressure monitoring.

Our current and forecast leakage remains below our previously assessed level suggested by the Sustainable Economic Level of Leakage (SELL) methodology (211Ml/d). A key reason for setting a target beyond the level suggested by the SELL is that leakage is one of the most important issues for our customers. Through our customer engagement activities, customers have indicated that:

- Fixing leaks should be a top priority for additional investment
- Tackling leaks should be a core service, and,
- Fixing leaks should be an important element in delivering a value for money service.

The main parts of our strategy can be summarized:

Optimised Water Networks, in which bursts are prevented through better management of pressure in the pipes. The approach aims to deliver a 'calm' network that provides a reliable and resilient service through a reduction in leaks, low pressure and interruptions to supply, while improving serviceability and water quality.

- There have been 207 optimization schemes implemented this year delivering 5.18Ml/d leakage reduction. This was split between:
  - 138 schemes to optimize existing pressure management assets implemented and delivering 2.13Ml/d leakage reduction.
  - 65 schemes introducing first time pressure management implemented and delivering 2.68Ml/d leakage reduction.
  - 4 other schemes implemented and delivering 0.37Ml/d leakage reduction.

Intensive Leakage Detection Teams that track down hard-to-find leaks and target areas with ageing pipes. We have delivery teams split across three regional areas, a central control team and an engineering design and delivery team.

- We have expanded our team of detection technicians for AMP7, in order to meet our target for leakage reduction. The average number of full time employees for 2021/22 was 178.8 (FTE) (an increase of 22 FTE against base). This process has led to a leakage reduction of 3.40Ml/d in 2021/22. The teams have continued their approach to auditing historically high leakage zones and are also focused on gaining a better understanding of inoperable zones working closer with teams around the business.

An Integrated Leakage and Pressure Management System to bring together network information, making it easier to control leakage and target work. New and enhanced tools further improve our ability to target work in areas of the network with rising leakage and to plan our detection teams' activities.

Improved and extended metering across our network, including our raw water network and at reservoirs in order to help us to understand where leakage is occurring and enable us to take action to stop it.

- Leakage Sensors - In 2021/22, we now have 8,369 remote hydrophones installed across 285 DMA's in full monitoring mode (up from 5,143 and 227 DMAs in 2020/21). To date the SENSOR program has delivered 15,040 (up from 8,807 in 2020/21) leaks proactively and technician productivity has increased on average from 0.5 leaks per day to 1.0 leaks per day across all work streams when compared to 2020/21.

A reduction in customer supply pipe leakage (cspl) that will be facilitated by smart meters.

- Smart metering - our smart metering program now has an installed base of 331K meters by the end of 2021/22, up 186k from 2020/21. In 2021/22 we identified 62,062 properties with continuous flow greater than 1 l/hr. We saw 20,779 of these leaks fixed with no contact from us to the customers. Of the 40,133 leaks where we informed and worked with our customers to ensure that the issue was resolved by them, we saw 25,205 remediated. This has resulted in 7.21Ml/d of leakage or plumbing loss being resolved. In addition, during 2021/22, we also recorded 2,688 (intervention driven) fixes on leaks identified in 2020/21 totalling 1.82Ml/d.
- Customer supply pipe leakage/internal property leakage - We continue our process of working with customers to ensure that they repair leaks on their supply pipe or internally to the property in a timely manner.

We remain committed to our downward glide path towards meeting our ambitious goals for leakage reduction and our specific targets (for the end of this AMP) of reducing leakage by 15% (by 2025).

8.2 Looking to the future

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 [19], building upon Ofwat's methodology for the PR19 price review, which includes the stretching target for companies to reduce leakage by 15% by 2025.

As stated in the 'Leakage Routemap to 2050'

> *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*[20]

In accordance with these ambitions, we have committed to achieving a 15% reduction in demand for AMP7, and further reductions for WRMP24.

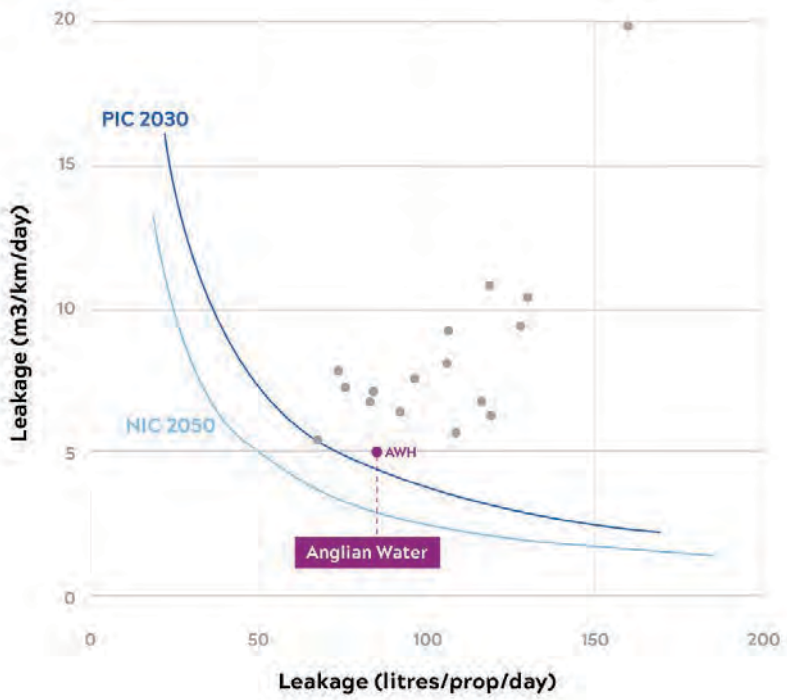
As part of this evaluation we have reviewed the current position of Anglian Water (and the other Water Companies) with respect to the Public Interest Targets and the National Infrastructure Commission Target of a 50% reduction. Note these targets have been converted into attainment curves, based upon a 50% reduction from the 2017/18 national base-line (total leakage) position.

This graph, as included in the 'Leakage Routemap to 2050' report[21], shows the wide range of current leakage positions, 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.

19 Meeting our future water needs: a national framework for water resources - Main Report - March 2020 - page 65
20 A Leakage Routemap to 2050 - Water UK- page 7
21 A Leakage Routemap to 2050 - Water UK - page 56

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 42 Relative positions of PWCs with respect to National Targets



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 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.

With our preferred plan we expect to be below the NIC target by 2030, reaching the very low levels of 3.5m³ per km of main/day or 49l/prop/day respectively, by 2050 These levels will be unprecedented across the industry.

Figure 43 NIC and PIC targets, with Anglian Water leakage forecasts

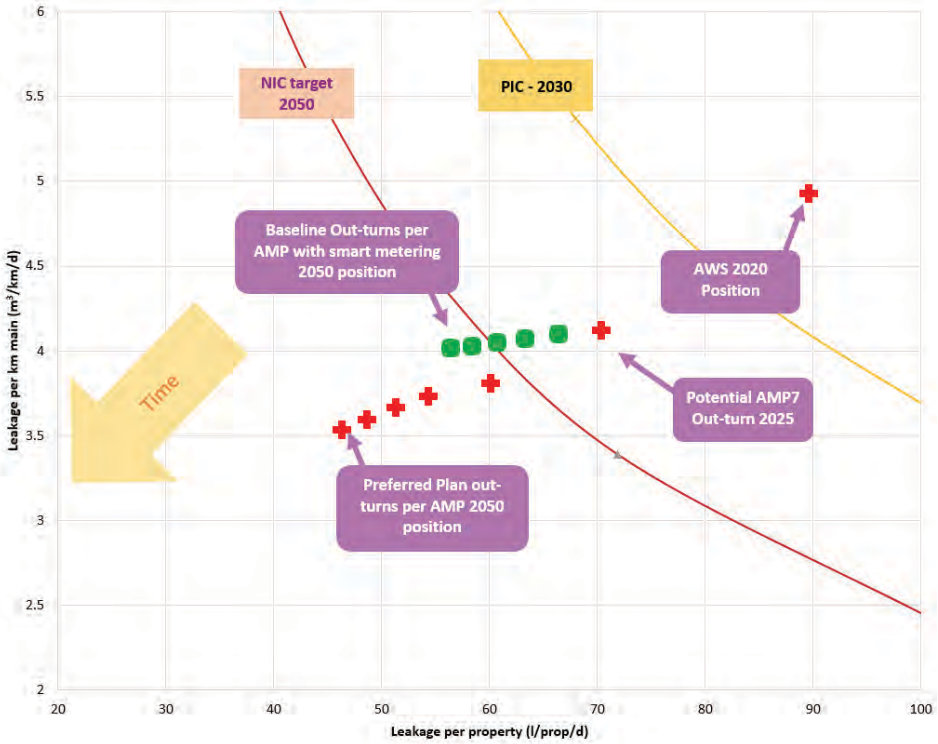
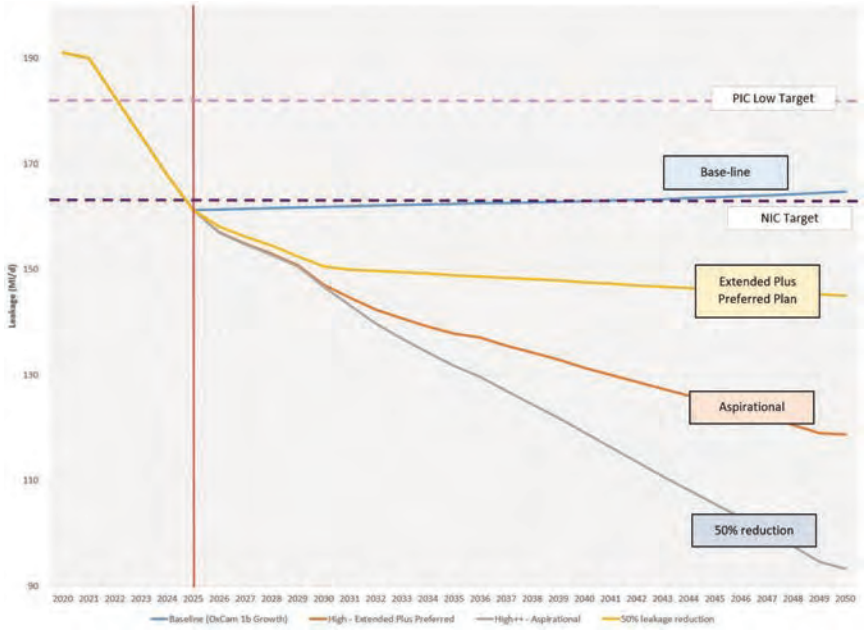


Table 18 Preferred plan AMP out-turn values

Preferred Plan	2025	2030	2035	2040	2045	2050	NIC Target
litres per property per day l/p/d	70.31	62.18	58.38	55.23	52.43	49.91	55.51
litres per km main - m3/km/day	4.1	3.9	3.7	3.7	3.6	3.5	4.39

Alternatively the key scenarios can be visualised, as below. This shows that the preferred scenario achieves both the PIC and NIC ambition, whilst also indicating the extreme nature of higher leakage reduction scenarios.

Figure 44 Leakage scenarios and NIC/PIC targets

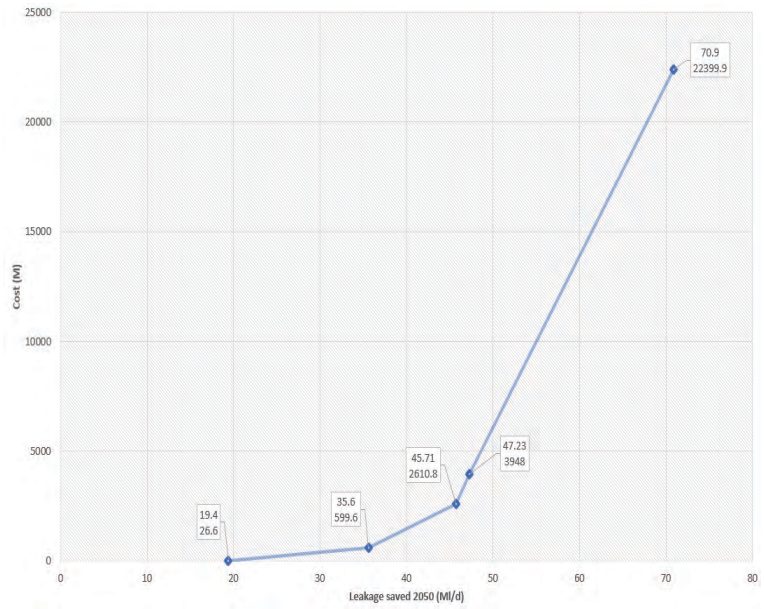


Leakage reductions have been modelled at a granular level using DMA geographies (District metering areas) to determine current leakage levels, zonal pressures and minimum leakage levels that might be achievable. Options have been modelled which would impact leakage including pressure management and network 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 realising this reduction (potentially being below our background leakage level) and the fact that we currently estimate that it would inflict huge costs on our customers (potentially a current estimation of £22 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 2025.

As can be seen, 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 45 Leakage enhancement costs and benefits beyond our preferred plan



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

- achieving the NIC and PIC targets.
- the current leakage position of each water company.
- 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.

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.

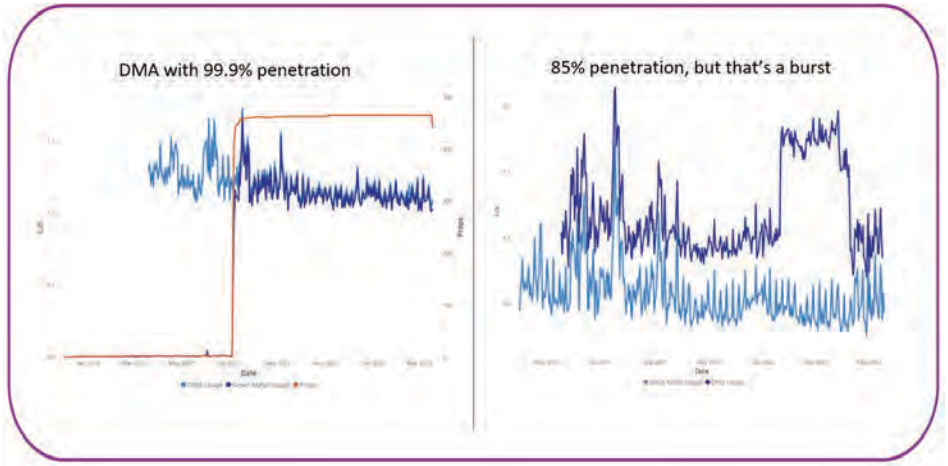
As part of our demand management strategy we have considered detailed activities that enable, support and sustain further leakage reduction. These include a mix of well understood interventions and others that are more innovative.

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 trialing technologies such as thermal imagining drones to detect leaking pipes and the use of satellite imagery to identify leakage.

Additionally, smart metering 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 46 Smart Meter DMA data showing leakage



Our intention is to 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, without burdening our customers with significant additional costs.

However, 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.

8.3 Preferred plan leakage options

As part of our leakage appraisal the following options have been considered and modelled in detail.

Pressure management

Pressure management options typically considered are:

- Leakage reduction via pressure management with new pressure reducing valves (PRVs).
- Leakage reduction through PRV upgrades where fixed outlet PRVs are changed to 2 stage or fully modulated valves.

The scope for new, additional or improved pressure management has been estimated by comparing control point (CP) pressures with an agreed pressure threshold, that will ensure that standards of service to customers would be unaffected. The differences between the current CP pressures and the threshold have defined the potential additional head drop that could be implemented and hence the potential reductions in average zone night pressures (AZNP). The current and potential AZNP values will be used within the FAVAD (Fixed and Variable Area Discharges) equation that relates pre and post AZNP values to leakage levels. Note that the bulk of our pressure management optimization program will be completed by 2025.

Increased 'find and fix' budgets - Fixed acoustic logging

Fixed (permanent) acoustic logging is a leakage localisation and pinpointing method, which involves the installation of permanent sensors along the distribution network. These sensors 'listen' for leak noises and allow a more accurate pinpointing of leaks, saving ALC (Active leakage control) effort and, therefore, time. This reduces detected leak run-times which leads to overall leakage reduction.

Permanent acoustic logging, therefore, reduces leak awareness times and its detection time, but may make it harder to locate leaks on the ground, it has, however, been proven to be overall net beneficial in the UK environment. This option may also reduce leak repair times if a company chooses to change its policy and shorten time between detection and repair.

Although many of these type of technologies deliver their best results when used on metallic pipes, there are some that can be used on plastic mains, for example using hydrophone sensors. This technology is used by Anglian Water and can be used on plastic and large diameter pipes.

Water main replacement

Water main replacement is one of the key methods for reducing physical water losses from the network. The main benefit of this method is that, if done correctly, it will 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.

UKWIR research has provided a relationship between the level of network renewal and the level of leakage achieved. A small number of companies have also carried out extensive network renewal while monitoring the effect on leakage levels and burst frequencies. The result of the UKWIR study is a relationship gained from regression analysis of DMA level data, linking nightline (NL) after network renewal to the NL before network renewal and the fraction of the network renewed. This has been used in our modelling processes.

Smart metering and shared supply cspl reduction

We have a number of properties that share a customer supply pipe. Identifying leaks on these systems is particularly difficult, but the process will be enhanced by the introduction of smart meters which will help identify continuous flows on these systems. We intend to follow this up with additional leakage investigation in order to rectify this leakage.

Smart metering and cspl leakage.

As discussed, smart meters are a key element in the identification of customer supply pipe leakage (detecting continuous flow). We are keen to develop our analytical systems and communications to help customers find and repair these leaks (either plumbing losses or customer supply pipe leaks) as fast as possible. We are also keen to help our most vulnerable customers with visits and incentives to fix these leaks as fast as possible.

As we identify customer-side leakage (both plumbing losses which impact per capita consumption (PCC), and customer supply pipe leakage (cspl)) we intend to initiate schemes to assist customers in vulnerable circumstances and customers with affordability issues, to fix these leaks. These will potentially take the form of:

- A scheme for vulnerable customers to fix leaky loos and leaky taps up to a capped value with potentially the provision of a small toilet rebate voucher (linked to vulnerability and affordability). (Note this will impact the PCC metric, not leakage).
- A scheme to find/fix customer side supply pipe leaks up to a given value, for larger leaks P3 and above (P3, P3a, P2s, P1s) for vulnerable customers. (this would impact the leakage metric directly.
- Improved delivery of our customer-side leakage journeys relating to P1-P4 break out leaks. This will include virtual and CSR customer-side leakage visits for reported leaks; providing expert advice to customers utilizing online and video assessments for potential internal leaks, identified by smart metering. We will also offer a physical visit for customers, who need this service.

For our preferred plan we have selected a number of these options. It is noted that we expect reductions from pressure management options to be exhausted by the end of AMP7 (as we achieve the 15% reduction in leakage). Additionally, we have modelled mains replacement in detail as part of our appraisal, but currently have excluded this option, due to the significant costs and uncertainties associated with the savings that might be gained.

We will however, include:

- Fixed acoustic logging.
- Shared supply cspl reductions.
- Smart metering and cspl leakage reductions.

8.4 Targeting leakage reduction

Leakage option development and targeting has been analysed at the District Metering Area level (DMA), with leakage levels being characterized, in order to understand average zonal pressures and minimum leakage levels. This process has been used to show how further leakage investigation and analysis might be applied and which solutions might be best implemented in each zone.

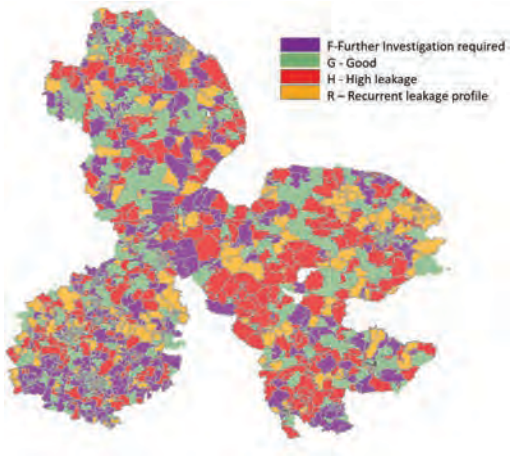
The DMAs have been characterized;

- F - requiring further investigation
- G - Good, low leakage areas
- H - High leakage areas
- R - Recurrent leakage areas

Leakage reduction options have been developed at DMA level and have then been selected for each portfolio from the list, choosing the least costly to the most expensive, dependent upon the level of leakage reduction selected.

Further work has then been carried out to align the targeted leakage options with the overall WRZ risk assessment.

Figure 47 Indicative DMA characterization



8.5 Leakage Costs and benefits

For our preferred leakage portfolio of options for leakage enhancement, we expect the following costs and savings (excluding those associated with smart metering).

Note that costs have been based upon a provisional 2022/23 cost base.

Table 19 Costs and benefits for leakage enhancement (AMP8 and AMP12)

	Cost 2030 (AMP 8)	Saving 2030(AMP8)	Cost per Ml/d 2030	Cost 2050 (AMP 12)	Saving 2050 (AMP12)	Cost per Ml/d 2050
Total financial (pre financing)	£14.87m	11.04 Ml/d	£3.12m	£26.70m	19.41 Ml/d	£2.60m
Total financial (with financing)	£15.64m			£29.02m		

In detail the options can be described:

Table 20 Detailed option costs and benefits (AMP8 and AMP12)

	Cost (AMP 8)	Saving (AMP8)	Cost per Ml/d saved (AMP8)	Cost (AMP 12)	Saving (AMP 12)	Cost per Ml/d saved (AMP12)
Pressure Management	£5.11m	0.47 Ml/d	£10.84m/Ml	£5.11m	0.47 Ml/d	£10.84m/Ml
Main Replacement	£0.00m	0.00 Ml/d	-	£0.00m	0.00 Ml/d	-
Find And Fix	£0.17m	0.76 Ml/d	£0.22m/Ml	£9.54m	5.86 Ml/d	£1.63m/Ml
CSPL leak investigations		6.27 Ml/d			9.15 Ml/d	
CSPL leak investigations (100d target)	£0.00m	0.00 Ml/d	-	£0.00m	0.00 Ml/d	-
CSPL - Shared Supplies	£4.60m	3.54 Ml/d	£1.30m/Ml	£7.06m	3.92 Ml/d	£1.80m/Ml
Innovation Fund	£5.00m		-	£5.00m		-
WRE Leakage Target	£0.00m	0.00 Ml/d	-	£0.00m	0.00 Ml/d	-
Financing Cost Mains Replacement	£0.00m			£0.00m		
Financing Cost Pressure Management	£0.30m			£1.14m		
Financing Cost Shared Supplies	£0.47m			£1.18m		
Financing Cost WRE Leakage Target	£0.00m			£0.00m		

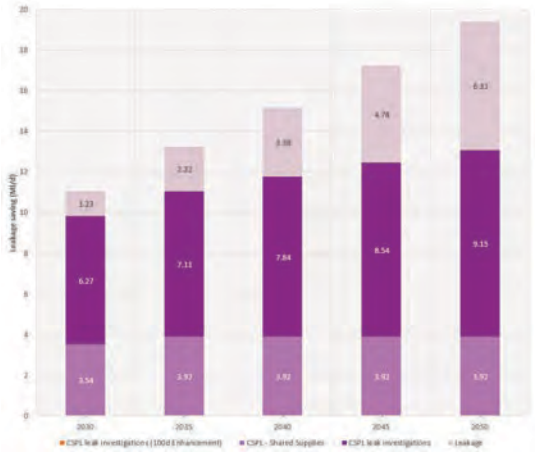
Detailed costs and benefits per AMP can be shown:

Table 21 Leakage enhancement costs per AMP

	AMP8	AMP9	AMP10	AMP11	AMP12
Leakage Saving per AMP (Final year value) - Ml/d	-11.04 Ml/d	-2.20 Ml/d	-1.90 Ml/d	-2.10 Ml/d	-2.17 Ml/d
Cumulative % Saving from 2025	6.85%	8.22%	9.39%	10.69%	12.04%
Fixed capex (£)	£9.70m	£0.83m	£0.62m	£0.64m	£0.37m
Financing cost	£0.77m	£0.99m	£0.43m	£0.09m	£0.04m
opex savings (Repair and detection)(£/AMP)					
opex savings (value of water saved)(£/AMP)	£0.58m	£0.96m	£1.15m	£1.37m	£1.62m
Opex(maintenance cost)(£/AMP)	£5.17m	£0.59m	£1.34m	£2.58m	£4.85m
Total all					
TOTEX - Total financial (pre financing)	£14.29	£0.46	£0.81	£1.85	£3.60
Total financial (with financing)	£15.06	£1.45	£1.25	£1.95	£3.64

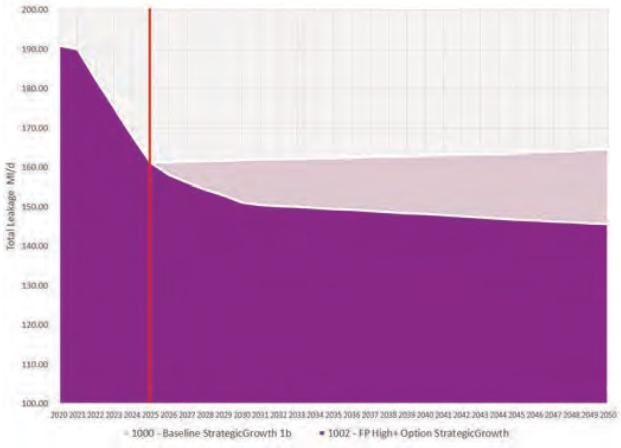
The leakage enhancement savings can be shown through the WRMP24 plan period.

Figure 48 Leakage savings per AMP 2030 to 2050



The baseline and preferred plan leakage forecast can be shown (including the significant reductions of AMP8 (2020-2025). Note that we expect baseline leakage to increase due to additional new build property cspl. (we expect an additional 528K properties over the 25 year plan period).

Figure 49 Leakage forecast, baseline and preferred plan (including AMP7).



We aim to reach a leakage level of 161Ml/d by 2025 (three year rolling average), a reduction of 15.7% from 2019/20 (similarly from 2017/18), and further to achieve 145Ml/d of leakage by 2050, a reduction of 24% from the 2020 baseline. Leakage will reduce from the current level of 15% (2021/22) of distribution input (DI) to approximately 12.5% of DI by 2050. This not only reflects our current position, but also takes into account the increasing difficulty of maintaining leakage levels and the exponentially increasing costs of achieving lower and lower levels of leakage.

9 Non-household water efficiency

Non-Household water efficiency option development

We are currently working in close collaboration with our Retailer partners and their customers, in order to understand business consumption in much more detail and to develop measures which will enable water efficiencies in the non-household sector.

We are actively working 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, process, irrigation etc.)
- ensuring that business customers understand the overarching need for reductions in demand as part of our environmental destination.

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.

Currently, our consultation suggests that there are two initial options that should be developed in more detail, between ourselves as water companies and our Retail partners.

- Reducing leakage (both internal plumbing loss and supply pipe leakage) for business customers, leveraging our smart meter introduction and the leakage notifications that the system enables.
- Enable businesses to reduce water usage, with self auditing systems, virtual visits and in-person visits to assist with retrofitting water efficient devices (for example, toilet cistern replacement).

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. This will potentially include:

- Encouraging and helping to enable businesses to adopt water recycling systems; providing advice on the installation of grey/green/blackwater re-use systems.
- Liaising with developers/local authorities to facilitate installation of water re-use systems as new-build projects are designed and constructed.

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 the options for full cost/benefit analysis. We have, therefore not currently assumed any reductions in forecast demand for the non-household sector, for our draft WRMP24. We expect to be in a position to quantify the savings for these options for our Final WRMP24.

9.1 Potential water efficiency options

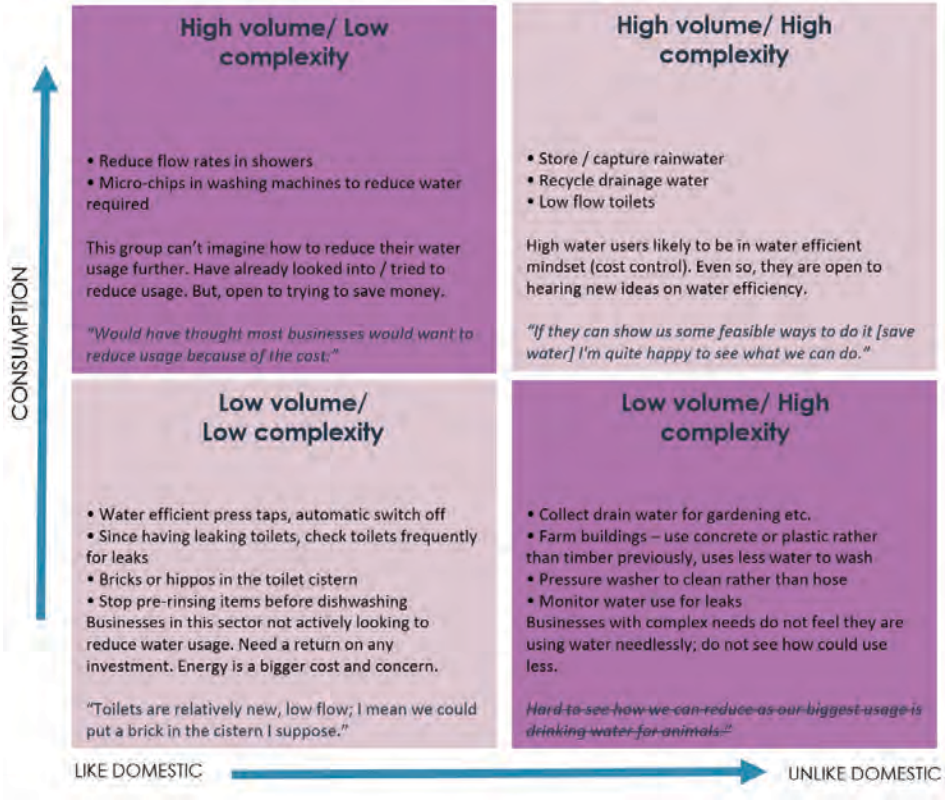
Our consultation has indicated that customers are currently unsure about the need to reduce water consumption and how they might become more water efficient. However, we found there is an appetite to engage with additional water efficiency measures, which will help business customers with their bills, 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.
- Develop actionable options that we can trial and then implement with our retail and business partners.

This can be visualised, as in the Blue Marble project:

Figure 50 Customer ideas and comments regarding water efficiency



Currently, our consultation suggests that there are two initial options that should be developed in more detail, between ourselves, as water companies, our Retail partners and their business customers.

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

- For this option we would need to be able to 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, we are considering incentivising this (potentially the first £100 of this service might be funded, dependent upon the leak size)
  - If the leak was found to be external, we will investigate the provision of a 'find and fix' service (it might be that £500 of the initial cost is funded, dependent upon the size of the leak)

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 suggested that assistance with reducing leakage, including notification alerts and incentivisation, would be appreciated. Businesses understood, the significant role that smart metering could play with respect to this.

Enable businesses to reduce water usage

- 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, cost and benefit data.
  - Additional 'virtual visits', where customers could be talked through this information should also be part of the service.
  - Part of this option should also involve the possibility of requesting 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.

This type of option would appear to be most suitable for targeting low complexity, high consumption businesses.

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. This will potentially include:

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 install 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 the options for full inclusion in our WRMP24 cost/benefit analysis. We have, therefore not currently assumed any reductions in forecast demand for our draft WRMP24. We expect to be in a position to quantify the savings for these options for our Final WRMP24.

10 Behavioural change, enhanced understanding and future forecasting

Overview

We recognise that developing our understanding of future demand, human behaviour and the potential for water efficiency, is a continual process.

As our smart metering program is implemented, it will give us unprecedented insight into water consumption and open up new avenues for interacting with and understanding our customers. Additionally, the data that smart metering will provide, will be key to monitoring, our demand management interventions in addition to demographic changes that will occur in the future. This will allow us to forecast future demand with ever greater accuracy for future WRMP plans.

Understanding customer attitudes, behaviours and societal influences with regard to their water usage, will be critical to the success of any future water efficiency objectives.

We intend to build upon our current understanding by:

- Conducting longitudinal studies into customer base, to understand long term changes in behaviour.
- developing innovative concepts of 'water neutrality' and 'smart communities' into strategic actions for implementation in future WRMPs.
- Researching new ways of understanding customer demographics and segmentation (cluster analysis and machine learning).
- Trialing water efficiency initiatives with key stakeholders (including non-household options; water re-use options with developers; innovative irrigation systems;)
- Development of our monitoring framework, in order to determine the long term benefits from our planned portfolio of water efficiency measures.
- Researching methods of achieving ever lower levels of leakage.

Enhancing our understanding of human behaviour with regard to water usage and the impact of our water efficiency strategies will be key to improving our WRMP demand forecasting in future.

10.1 'Water Demand Reduction Discovery Programme'

As part of our preferred plan we have included an innovation 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 Programme'.

This programme will be used to identify and fill evidence gaps regarding water demand, customer behaviours and water efficiency programs. It will help inform future forecasting for our WRMP/WRE and PR submissions along with our Long-Term Delivery Strategy (LTDS).

The additional knowledge generated will be key in facilitating our ambitions with respect to demand reductions, feeding into our adaptive planning processes. Demand reduction will be crucial for the sustainability and resilience of the water supply in the East of England, whilst maintaining Anglian at the forefront of water efficiency in the sector.

It is envisaged that the programme will support research into the long-term effectiveness of demand management interventions. It will enable rigorously designed trials into the effectiveness of different types of metering, technological and behavioural change interventions over a five-year period. It will enable the ongoing monitoring of our 'Enabling Water Smart Communities' project, answering important questions about how we might encourage new development to adopt an integrated water management approach and incorporate measures like localised water re-use (evidencing how these will be used by communities to reduce demand). The continuation of monitoring and evaluation of this innovation project should provide valuable evidence to support future local plan policies as well as demand options for future WRMPs.

Our intention is also that the programme should be used to evaluate water efficiency measures that we wish to implement with our Retail colleagues, for the non-household sector. These measures will include the provision of detailed consumption data and the incentivisation of water efficiency through audit, advice and the potential for device replacement. Additionally, leakage reduction in the non-household sector will be a priority, along with the potential for water re-use options. These options will all need trials and evaluation, before full implementation.

Water neutrality is both a risk and an opportunity which is quickly approaching our region. This programme will be used to help ensure that the region is better prepared for the potential impact of water neutrality on growth. It will be used to develop our understanding and expand our evidence base of multiple aspects of water efficiency, re-use and offsetting, which feed into water neutrality.

10.2 The potential for tariff development and price signalling

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 2021/22, 83% 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 tariffs and their 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 IBT's (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). 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 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, our engagement with customers via the web-portal, regarding 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 Fund' 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, may indicate possible supply pipe leaks.

10.3 Local Authorities, developers and design standards

We have been working collaboratively with developers and local authorities in order to ensure new housing developments are as water-efficient as possible.

We are actively supporting the development of Local Plan policies which require higher water efficiency standard as a means to reduce demand (110 litres/head/day) and we track the current level of standards across the region.

We will continue to work collaboratively with developers and local authorities in order to ensure new housing developments are as water-efficient as possible.

In order to assist with this we will liaise on the development of a blueprint for water efficient gardens, and update our Water Calculator (showing methods of meeting per capita consumption (PCC) standards of 110 l/h/d and 80 l/h/d.

We have also investigated trialing alternative water re-use solutions at a development scale (grey-water and/or rainwater harvesting technologies) in order to achieve 80 l/h/d potable consumption.

Our role out of smart metering will enable effective monitoring of water demand in new homes and inform the need for higher water efficiency standards in new homes and interventions to support existing customers to reduce their use of water.

Additionally, we have been liaising with government and local authorities in order to revise water building standards to reflect the risks within our region and support our path to net zero carbon by 2030.

10.4 The impact of Government led interventions on PCC

As part of the WUK/Defra project Artesia developed a number of demand management scenarios based around the potential impact of Government-led interventions on per capita consumption.

In particular they found that the introduction of water labelling and the slow change to more efficient white goods, along with a set of government led mandatory standards for new-build and retrofit properties might lead to very significant savings in the long-term (up to 27 l/h/d by 2050)

Given that the government has signalled their intent to introduce legislation to bring in labelling and promote more water efficient white goods, we have felt that it is prudent to include a reduction in the base-line demand profile and final plan forecast to reflect this.

We have, therefore, conservatively, included a reduction equivalent to the low 'white good' labelling scenario in our base-line; approximately 11l/h/d by 2050 or 68Ml/d.

It is noted that by 2050, this still has a very significant impact on demand (less so in AMP8 with a 1.35l/h/d saving by 2030), however, with smart metering and our other quantified water efficiency interventions this is instrumental in achieving the National Framework Target of 110l/h/d by 2050.

Table 22 Government led intervention scenarios

Scenario	2025	2030	2035	2040	2045	2050
G1. Mandatory water labelling|With minimum standards|Saving|Lower - l/h/d	-	2.83	8.71	16.15	20.63	23.15
G2. Mandatory water labelling|With minimum standards|Saving|Middle - l/h/d	-	3.33	10.25	19.00	24.27	27.23
G3. Mandatory water labelling|With minimum standards|Saving|Upper - l/h/d	-	3.83	11.79	21.85	27.92	31.32
G4. Mandatory water labelling|No minimum standards|Saving|Lower - l/h/d	-	1.35	4.16	7.71	9.85	11.05
G5. Mandatory water labelling|No minimum standards|Saving|Middle - l/h/d	-	1.59	4.89	9.07	11.59	13.00
G6. Mandatory water labelling|No minimum standards|Saving|Upper - l/h/d	-	1.83	5.63	10.43	13.33	14.95
Demand Saving Ml/d - (based upon Oxcam Population projection)	-	3.52	11.26	21.73	29.06	34.14

10.5 Water neutrality

Whilst forming our views with regard to water resources in future, we are also considering the concept of 'Water Neutrality'.

Water neutrality would require that for every new development proposed in the region, water demand would first be minimised, and that any remaining additional water demand would be offset. Total demand on the public water supply, in a defined area, would be the same after development, as it was previously.

There are three necessary steps to achieving water neutrality;

- reducing water use by making the new build as water efficient as possible,
- installing water reuse systems, such as rainwater harvesting or grey water recycling and,
- offsetting any remaining demand in the existing local region.

Water neutrality could be achieved over a set period, such as 10 or 20 years, and assessed at various stages of the build (e.g. planning and design, as constructed, and ongoing monitoring once the homes have been built and are occupied). Note, that water efficiency measures may deteriorate over time, so may need ongoing maintenance or replacement in order to maintain water neutrality.

Water offsetting is also a new concept which will require significant work in order to develop an understanding of how water saving units and a market might work and what the role of the water company might be in this process.

Water neutrality could present both a risk and an opportunity if implemented across our region. We consequently, will utilize the 'Reduction Discovery Fund' to help ensure that we develop our understanding and expand our evidence base of multiple aspects of water efficiency, re-use and offsetting which feed into water neutrality. Specifically we would potentially be interested in investigating:

- Utilizing spatial mapping to identify areas of supply/demand concern and potential locations where water neutrality might be enforced in the future.
- develop a clear evidence base of the cost of water re-use systems and monitor the benefits of these systems over time.
- Align with the Ofwat Innovation project “Enabling Water Smart Communities” to evaluate water reuse systems and behaviour change interventions.
- Explore potential developer incentive approaches, based on our experience with similar incentives in the past.
- Add to our understanding of peak demand and the behaviours associated with this,especially with regards to garden water usage. Understand what a drought resistant and integrated garden of the future might look like, and what water companies can do to promote this.
- Evaluate whether buildings built to 110l/h/d PCC are actually delivering this over time.
- Understand how water companies in liaison with developers might deliver water neutrality.
- Explore water saving offsetting options. Investigate whether water companies could provide this service via already established routes of water efficiency audits or whether a 'water saving units trading system/market' might need to be established.

10.6 Water smart communities

Water smart communities will combine complementary water management programs together with town planning and design to deliver multiple benefits for communities and the environment. These communities will use a more integrated approach to urban water management, with the aim of:

- Enhancing quality of life, by contributing to green streetscapes and high quality open spaces.
- Promoting the sustainable use of water resources and infrastructure to enable growth.
- Building resilience against the potential impacts of climate change and extreme weather events.
- Contributing to natural capital and biodiversity through multi-functional water features.
- Delivering water efficient homes to reduce household bills and support affordability.

We will also investigate radical approaches to water management, including the potential for concepts such as 'Water Smart Communities'. As part of this project, we will need to understand how people engage with new technologies (smart metering data, dual plumbing systems etc) and how this might affect consumption in future. In parallel we will need to understand how macro environmental factors, such as policy, planning and building practices will impact development of Water Smart Communities'.

10.7 Psychological approaches to behaviour change

As we progress our demand management program and smart meter installation, we are keen to develop our understanding of customer behaviour and how this might be influenced.

10.7.1 Psychology

We have, consequently, been involved in research into psychological approaches that might be applied to influence customer behaviour (and drive demand reductions). This research has specifically looked at social norms and how 'nudge' theory might impact demand.

- Work has been conducted by UEA to investigate the impact of water efficiency messaging in student accommodation. Surveys showed that

residents reported taking shorter showers and that this made them think more about water use in other contexts. Different types of messaging were tried (individual action, collective efficacy and conjunctive norms) with conjunctive norms showing the biggest impact. We are also following the University of Surrey, who are now conducting similar trials in residences and their hotel conference centre (with metered data).

- We have also been working with Aquafresh (in the forum, Norwich), where people were asked to brush their teeth and give feedback on the toothpaste. In this instance, the mirrors of the bathrooms had different messaging related to turning off the tap when brushing teeth. Microphones were used to detect whether taps were running or not. In this context, the results were not encouraging, however another study in Newmarket has shown that if customers are given 'toothbrushing kits' (comprising a toothbrush, cup and toothpaste which had a sticker on it with a collective efficacy message) water usage showed statistical differences to the norm.

Currently we are progressing additional research, regarding:

- messaging regarding outdoor usage (working with Cardiff University).
- messaging at key 'point of change' in customers lives. Theory suggests that there may be a correlation between effectively changing behaviours or forming new habits, when major life changes occur (moving house, having children). We are currently liaising with Cardiff/Bath University, in order to understand how effective interventions might be at some of these points (moving house); in this case, providing shower timers and advice and monitoring effectiveness with the shower timer data.

We will be keen to progress this type of research further as part of WRMP24, and intend to leverage the hourly consumption data now becoming available through our smart metering program.

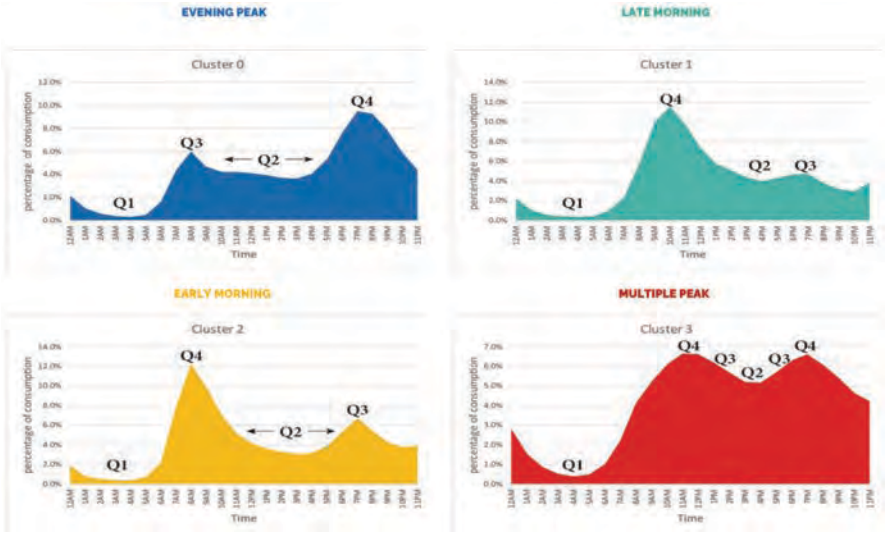
10.7.2 Cluster analysis and segmentation

We have already begun, with Cranfield University, to interrogate the hourly smart meter data, using pattern recognition and artificial intelligence systems (termed unstructured data mining), in order to begin to characterise consumers into different segments or clusters, based upon patterns of usage. This understanding, along with complementary demographic information, will be used in the future to design and target water efficiency programs and communications, in the most relevant ways.

This analysis has indicated that there are four distinct groups of consumers (although it is noted that members of these groups do not remain static):

- Early morning peak users
- Late morning peak users
- Evening peak users
- Multiple peaks users

Figure 51 Patterns of usage, characterised into segments



We will continue to pursue this type of analysis, for its' potential use in managing peak demand. Further work will explore the impact of different interventions on households in each segment. Note that this project has been published in various journals.

10.8 Future opportunities and longitudinal studies

With the implementation of the smart meter roll-out and the hourly data that is being generated, we see great opportunities in using the 'Discovery Fund' to enable very long term, longitudinal studies and evidence gathering, in order to understand customer behaviour in depth.

These could include:

- Furthering our understanding of how people engage with metering data.
- Understanding how long reductions in PCC last (decay rates) and how often interventions need to be refreshed.
- Understanding the key influences on PCC. (Does PCC impact other water behaviours).
- Implementing rigorously designed trials on different behavioural change interventions (i.e. 'nudge', 'behavioural-economics') so we fully understand their effectiveness over the short and long term.
- Monitoring and analysis of the EWSC demonstrators. alongside standard developments, retrofits, ‘normal’ existing housing

We, additionally, envisage the creation of an ‘Observatory’ on Water, which would allow us to explore how people engage with water generally and how we can use those insights, in the design and delivery of demand management strategies. This would parallel the energy 'Observatory': An observatory for public engagement with energy and climate change'.

11 Demand management and our drought plan

As we approach drought conditions and during a drought, we would look to build upon our current demand management strategies, by implementing additional demand-side drought management measures.

During a drought there are several demand-side management options that we can use that enable us to conserve water.

For WRMP24, we have developed potential extensions of demand management options that we intend to implement as part of our water efficiency plan. In addition, we have reviewed 'Temporary Use Bans' (TUBs) and Non-Essential Use Ban (NEUBs).

We have assessed savings based upon micro-component analysis and the UKWIR 'Drought and Demand' report. The UKWIR report aims to quantify the savings achieved from demand restrictions that have been imposed historically. These figures have been updated following the completion of a further report building on the lessons learned during the 2011-12 drought.

Savings are summarised below for comparison and are given as a range of percentage reductions in demand, dependent on the time of year that the restrictions are imposed. The savings are cumulative such that it is assumed that the preceding options will have been imposed to realise the total savings for the latter options. Note that we are currently working (in alignment with WRSE and WRE companies) to reassess savings associated with TUBs, NEUBs and drought specific demand management options.

These communications strategies, water efficiency measures and restrictions, will need to target both periods of drought and peak summer temperatures. For WRMP24 we have used the minimum percentage values from the ranges previously derived, so as not to double count savings with the additional options that have been assessed.

Table 23 Savings included in WRMP24 for TUBs, NEUBs

Demand Options	Drought Plan 2022
Communications Campaigns	3-10% - For WRMP24 3%
Temporary Use (hosepipe) Bans (TUBs)	3-10% - For WRMP24 3%
Non-Essentail Use Ban (NEUBs)	14-20% - For WRMP24 14%
Provision of rota-cuts	34-52% - For WRMP24 34%

In addition to these options, we have also assessed extensions of our portfolio of water efficiency measures, included in our preferred 'Extended Plus' demand management portfolio.

These options will include:

- communications and messaging campaigns at a regional and local level.
- uplifts to our introduction of smart devices (smart shower devices)
- additional home water efficiency visits
- additional focus on fixing leaky loos and assistance for customers in fixing cspl leaks.
- additional advice on garden usage and the provision of 'garden kits'

These options have been assessed for their cost and benefit at WRZ level.

These drought/peak usage options can be described as below:

Table 24 Extended demand management options for drought/peak conditions

Option	Uplift	Duration of activity	Duration of saving	Notes
1a - smart sensors	25% uplift	6 month duration	6 month duration	Smart showers - targeted by WRZ - uplift in short term installation - 1250 additional units
0h - Baby dams	25% uplift	6 month duration	6 month duration	additional 3000
$d - Leaky loos campaign - education/customer engagement, no fix	25% uplift	6 month duration	6 month duration	Leaky loos campaign (base option). This is a continuation of a service we offer in PR19. - additional 250.
2A,B,D,F - SM - Comms MyApp Comms - SM behaviour uplift	25% uplift	6 month duration	3 months summer saving	plus 25% for SM savings - 2% goes to 2.5% for the summer three months to reflect comms uplift through SM - Overall 2.125 over the year
2D inc above - Hyper local and seasonal messaging - community campaigns	-	6 month duration	3 months summer saving	included in above
3A inc above - Hyper local messaging drought messaging		6 month duration	3 months summer saving	included in above
2C - Garden advice - garden kits	25% uplift	3 month duration	3 months summer saving	Garden advice - garden kits - 25% uplift
4G (0f) -Drop 20 water visits	25% uplift	6 month duration	6 month duration	Home water efficiency visits
4A - Leaky loo assistance for vulnerable customers	25% uplift	6 month duration	6 month duration	Scheme for customers in vulnerable circumstances and customers with affordability issues to fix leaky loos
4B - Vulnerable customer cspl fix	target 80	6 month duration	6 month duration	Fix all customer side supply pipe leaks for all customers up to a value of £500? for P3 and above (P3, P3a, P2s, P1s). Vulnerable customer - Reduced runtime target 100 or below.
4C - cspl journey for non-vulnerable customers	target 80	6 month duration	6 month duration	Delivery of the the customer side leakage journeys relating to P1-P4 break out leaks. - Reduced runtime target 100 or below.

12 Links with our other Plans

Whilst developing the WRMP24 demand forecast and demand management plan, we have sought to ensure alignments with our other planning commitments. We have, therefore, considered how alignments, with regard to both the core demand forecast and preferred demand management plan should be reflected in:

- The DWMP (Drainage and Wastewater Management Plan).
- PR24 (Price Review 24).
- Ofwat LTDS (Long Term Delivery Strategy).
- WRE (Water Resources East Regional Plan).
- Drought Plan

12.1 WRMP24 and WRE alignment

As part of the development of our WRMP24 demand forecast and demand management plan, we have been keen to collaborate and share understanding with our regional PWC (Public Water Company) colleagues.

Whilst understanding that water companies are all at different points in the water efficiency and demand management journey, we have sought to share knowledge and where possible align methodologies and assumptions (being mindful of the competition framework). We have also sought to align the inclusion of influent factors (i.e. Covid19 impacts on demand) in our preferred plan scenarios. The current state of alignment can be shown, as below:

Table 25 WRMP24 alignment within WRE

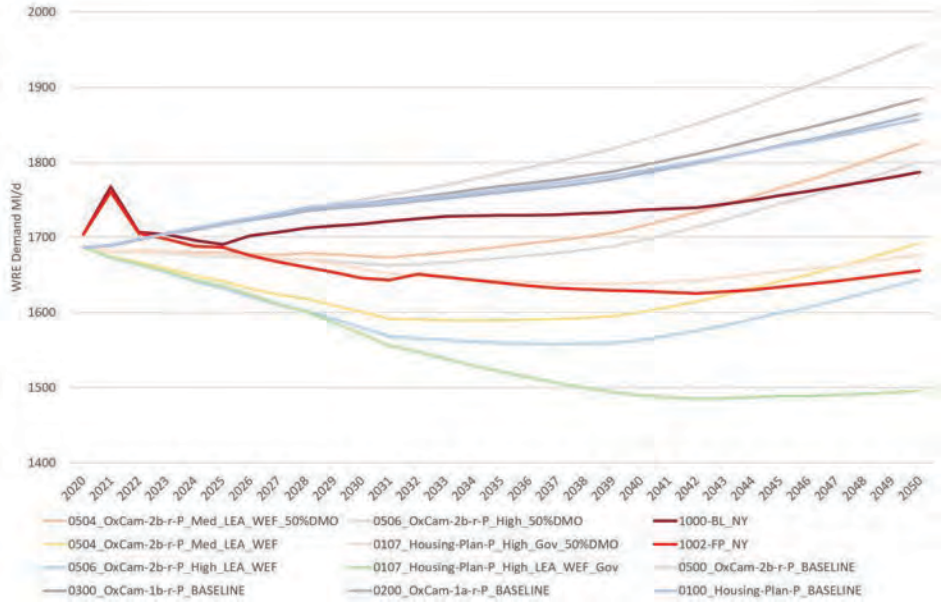
Parameter	Anglian Water	Essex and Suffolk	Cambridge
WRMP24 Preferred Growth	Edge - Local Plan (OxCam1b)	Edge - Local Plan	Edge - Local Plan
Low Growth Scenario	ONS18	ONS18	ONS18
Ofwat Scenarios	Aligned	Aligned	Aligned
DY/CP method	Aligned	Aligned	Aligned
Critical period	7 day	7 day	7 day
Gov led Intervention inclusion	Artesia Low Scenario 11l/h/d by 2050 inc. in BL/FP	Artesia Low Scenario 11l/h/d by 2050 inc. in BL/FP	Artesia Low Scenario inc. in FP only
Covid19 factor	Artesia analysis - 2.5% near term reducing to 1%	Artesia analysis - 2% uplift	2% end of AMP7 to 1% by end of AMP 8
Leakage Target	24% by 2050	40% by 2050	50% by 2050
PCC Target	110 l/h/d by 2050	110 l/h/d by 2050	110 l/h/d by 2050
Smart Meter Rollout	Full rollout by 2030	Full rollout by 2035	Full rollout by 2035
Smart meter savings assumptions	AMI - 2% Behaviour change - 4% plumbing loss - 2.5% cspl reduction	AMI - 3% behaviour change	AMI
Non-HH Forecast	Ovarro methodology	Ovarro methodology	Artesia NHH forecast

Parameter	Anglian Water	Essex and Suffolk	Cambridge
Non-HH DMO inclusion	No Non-HH DMO savings in draft plan - will be included in final plan	No Non-HH DMO savings in draft plan - will be included in final plan	9% reduction
Climate Change	UKCP09 climate projections UKWIR 'Impact of Climate Change on Water Demand methodology	UKCP09 climate projections UKWIR 'Impact of Climate Change on Water Demand methodology	cc circa 1%
WTU - DSOU as % of DI	WTU - 2% DSOU - 1%	0.02	DSOU >1%-
New NonHH major users	manual adjustment to include identified new NONHH users	BL NHH all new NHH requests included. FP?	No specific allowance for major users

As we progress toward the Final WRMP24 submission we will continue to work with our WRE partners as we gain further understanding regarding the plans.

As WRMP24 preferred plan projections have been generated by the participating PWCs, these have been combined and for submission into the WRE simulator for final analysis. As can be seen in the figure below the combined WRMP24 projections sit within the envelope of previously tested demand projections.

Figure 52 WRMP24 BL/FP demand projections with WRE scenarios



12.2 WRMP24 and the DWMP

As we have developed our WRMP24, we have sought to ensure alignment with the draft 'Drainage and wastewater management plan' was recently submitted to Defra. We have, therefore, ensured that long term planning for water supply and wastewater is based upon aligned growth forecasts, Per capita consumption and climate change assumptions.

As we continue the development of our WRMP we will continue to maintain alignments between the plans as appropriate.

12.3 WRMP24 and the Long Term Delivery Strategy (LTDS)

As we have developed our WRMP24 we have considered the Ofwat Long Term Delivery Strategy and Ofwat reference scenarios. We have, consequently, generated a number of scenarios in alignment with the Ofwat criteria. These are listed below.

Table 26 Ofwat scenario detail

Reference	Growth Variant	WRMP aligned Population Growth	Gov. interventions	Ofwat Technology Description	Aligned WMP scenario	Scenario Reference
Ofwat Scenario 1	HIGH DI GROWTH SCENARIO	LAUA Plan	No Gov. Intervention	LOW TECHNOLOGY Slower Technology Smart Network by 2040 Full SM by 2045	OxCam1b - No Gov - 3AMP AMI- Low WEF - Low leakage	3001
Ofwat Scenario 2	HIGH DI GROWTH SCENARIO	LAUA Plan	Includes Gov led interventions (Artesia Low in alignment with WRMP24)	LOW TECHNOLOGY Slower Technology Smart Network by 2040 Full SM by 2045	OxCam1b - 100% Gov - 3AMP AMI- Low WEF - Low leakage	1001
Ofwat Scenario 3	HIGH DI GROWTH SCENARIO	LAUA Plan	No Gov Intervention	HIGH TECHNOLOGY Faster Technology Smart Network 2035 (Not yet quantified) Full SM rollout by 2035 Internet of things	OxCam1b - No Gov - Aspriational - 2AMP - High WEF - High Leakage	3003
Ofwat Scenario 4	HIGH DI GROWTH SCENARIO	LAUA Plan	Includes Gov led interventions (Artesia Low in alignment with WRMP24)	HIGH TECHNOLOGY Faster Technology Smart Network 2035 (Not yet quantified) Full SM rollout by 2035 Internet of things	OxCam1b - 100% Gov - Aspriational - 2AMP - High WEF - High Leakage	1003

Reference	Growth Variant	WRMP aligned Population Growth	Gov. interventions	Ofwat Technology Description	Aligned WMP scenario	Scenario Reference
Ofwat Scenario 5	LOW DI GROWTH SCENARIO	ONS Trend	Includes Gov led interventions (Artesia Low in alignment with WRMP24)	HIGH TECHNOLOGY Faster Technology Smart Network 2035 (Not yet quantified) Full SM rollout by 2035 Internet of things	ONS 18-P -100%Gov - 2AMP highWEF - High++ Leakage	5003
Ofwat Scenario 6	LOW DI GROWTH SCENARIO	ONS Trend	No Gov Intervention	HIGH TECHNOLOGY Faster Technology Smart Network 2035 (Not yet quantified) Full SM rollout by 2035 Internet of things	ONS-18-P - No Gov - 2AMP highWEF - High++ Leakage	5503
Ofwat Scenario 7	LOW DI GROWTH SCENARIO	ONS Trend	Includes Gov led interventions (Artesia Low in alignment with WRMP24)	LOW TECHNOLOGY Slower Technology Smart Network by 2040 Full SM by 2045	ONS 18-P -100%Gov - 3AMP SM - Low WEF - Low Leakage	5001
Ofwat Scenario 8	LOW DI GROWTH SCENARIO	ONS Trend	No Gov Intervention	LOW TECHNOLOGY Slower Technology Smart Network by 2040 Full SM by 2045	ONS 18-P - No Gov - 3AMP SM - Low WEF - Low Leakage	5501
WRMP24 Preferred	HIGH DI GROWTH SCENARIO	LAUA Housing Plan Plan	Includes Gov led interventions (Artesia Low in alignment with WRMP24)	2 AMP Smart meter - High WEF - Low Leakage	OxCam1b - 100% Gov - Preferred - 2AMP - High WEF - Low Leakage	1002

As we progress the long term delivery strategy, we will further align scenarios with those already considered as part of the WRMP24 sensitivity testing process.

12.4 WRMP19 and 2020 to 2025 (AMP7) demand management options

The WRMP24 forecast has been developed based upon a 2019/20 base-line water balance (pre-dating the impacts of Covd19 lockdown and representing a more stable view of the water balance). Consequently, we have had to model the impacts of water efficiency measures that are being implemented in AMP7 (WRMP19), as part of our WRMP24 baseline forecast.

Post the pandemic options have been re-modelled to maximise their impact and help achieve our WRMP19 ODI targets, whilst accounting for post CMA alterations. Additionally, we have realigned savings from smart meters, in accordance with WRMP24, taking account of the additional information now available.

Note that the Covid19 pandemic significantly impacted our ability to pursue our water efficiency options.

Water Efficiency

We have included costs and benefits from the following water efficiency interventions, as listed below:

- **Multi-utility portal for smart metered properties:** working with gas and electricity to create a multi-utility portal e.g. HIVE. Trial approx. 1000 households as part of Shop Window
- **Toilet rebate:** 3,500 total visits in AMP7 (4 years).
- **Additional Leaky Loos Campaign**: the continuation of our current leaky lo campaign.
- **Smart homes with AMI meter:** 2,000 per year smart shower devices. Assumed savings 8 litres/person (based on 2 min average reduction in shower time per household)
- **Drop 20s:** Drop 20s - 13,000 per year with CSR (smart and dumb metering visits) - 52,000 y2-y5. Assumed savings 20 litres/prop, AMP7 option
- **Baby Dams:** Supply of baby dam devices to reduce the size of bath needed for infants. Number of devices in year 2 -120 number, year 3-5 53 number. Saving per bath 28litre, no. baths per day = 1

Table 27 AMP7 Water Efficiency Option Savings

Option	Unit	2021	2022	2023	2024	2025
Saving WEF: 0a. Multi-utility portal for smart metered properties	Ml/d		0	0.01	0.01	0.02
Saving WEF: 0b. Toilet rebate	Ml/d		0.42	0.84	1.25	1.67
Saving WEF: 0e. Smart homes with AMI meter	Ml/d		0.04	0.08	0.12	0.16
Saving WEF: 0f. Drop 20s	Ml/d		0.26	0.52	0.78	1.04
Saving WEF: 0h. Baby Dams	Ml/d		0.63	0.91	1.19	1.47
Saving WEF: 4d WRMP24. Leaky Loos Campaign	Ml/d		1.06	1.97	2.75	3.48
Grand Total	Ml/d		2.41	4.33	6.11	7.84

Smart Metering

The smart meter rollout has been re-profiled to take into account post CMA projections (Approx. 1 Million smart meters). Smart meter savings have been reassessed, based upon long term Newmarket and Norwich trial data, giving the following estimated savings.

Table 28 AMP7 Smart Meter Savings

Item	Unit	2020	2021	2022	2023	2024	2025
Saving Measured households - behaviour change	Ml/d		1.03	2.37	3.61	4.78	5.33
Consumption Saving MHH Plumbing loss	Ml/d		2.11	5.28	7.99	10.59	11.79
CSPL Saving MHH	Ml/d		0.97	2.44	3.71	4.89	5.44

Leakage

Leakage for AM7 has been modelled in order to achieve our stated aim of a 15% (30Ml/d) reduction over the 5 -year period. Leakage has been modelled at the DMA District Meter Area) level, accounting for current leakage levels and pressures to generate forecast savings. This includes savings from smart meter customer supply pipe find and fix. These reductions reduce the leakage level from 191Ml/d (new methodology) in 2020 to 161Ml/d in 2025.

Table 29 AM7 Leakage savings

Item	Unit	2020	2021	2022	2023	2024	2025
DL_Savings_AMP7	Ml/d			6.25	12.51	18.76	25.01
USPL_Saving_MHH_MET	Ml/d		0.97	2.44	3.71	4.89	5.44

The demand management savings outlined have been included in the baseline forecast for the WRMP24, with all water efficiency enhancements being included on top of these AMP7 interventions.

13 Risks and issues

Risks and issues

Whilst developing our program for future demand management, we have been keenly aware of the risks associated with implementing such an ambitious strategy.

We have, consequently, considered these risks, as an integral part of planning the demand management strategy.

These risks will be differentiated with regard to each element of the strategy, but might be characterized as being associated with the following issues:

- Our current understanding of potential behavioural changes as smart meters are introduced is at a very early stage. Significant research is currently underway in order to understand customer demographics and behaviours and the systems that we will need to develop in order to drive these behavioural changes.
- Whether we can realize the demand savings that have been anticipated in the plan for smart metering, leakage and our water efficiency program, will have direct implications for how we might need to adapt our plans in future.
- Issues associated with the scale of the roll-out of the smart meter network, and reaching our goal of full meter penetration (installing >2 million meters over 10 years).
- Deployment of new and innovative technologies, for leakage reduction, smart metering and water efficiency programs could prove problematic and challenging.
- Targeting the demand options to address WRZ supply-demand balance issues.

Risk Mitigation

These risks will be mitigated by setting up clear monitoring programs for both the installation of new technologies and the realization of benefits. Additionally, through the WRMP24, we have developed an 'Adaptive Planning Strategy' in order to have options available as a contingency to mitigate alternative outcomes. Monitoring will include:

- We are continuously reviewing processes for both AMP7 installation and rollout programs and the assessment of benefits from smart metering (and leakage). This re-assessment is currently informing the draft WRMP24 plan and will continue as we approach the Final WRMP24 submission.
- Metrics have been designed to allow continuous monitoring of the progress of installation and roll-out programs, and our customer engagement
- Analytical tools are being designed in order to assess current benefits and assess how we might achieve greater benefits.
- Trigger points and 'signposts' (leading up to WRMP24 and beyond) have been defined, as the demand management strategies are implemented, to track performance and indicate whether additional supply side options might be required or whether additional demand options should be considered. These trigger points will be integral to our adaptive planning processes.

13.1 Risk and uncertainty

Forecasting the future demand for water over the long term for a region the size of Anglian Water, is fraught with uncertainty, given the number of variables involved, especially considering that the key factors are human behaviour and our attitudes to water use. However, for our WRMP24 planning process we have attempted to mitigate these uncertainties, by;

- being pragmatic and conservative regarding forecast assumptions.
- making all the assumptions driving the forecast clearly visible and as simple as possible in their application.
- developing a scenario testing framework to explore sensitivities to different forecast assumptions.
- using Target Headroom to account for uncertainty in the WRMP24 planning submission.
- creating adaptive plan scenarios for future out-comes, such that, if forecasts (for example, demand management option savings) do not

materialise as expected, we will be able to account for these differences in our plan.

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) modelling system.
- 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.

In order to fully test our key portfolios ('Extended Low', 'Extended Plus' (Preferred) and 'Aspirational'), we have developed a large number of alternate scenarios. These alternates have been designed to test a range of outcomes dependent upon key influent factors including:

- alternate growth projections (plan, trend, strategic)
- alternate demand management option portfolios (high, medium, low option packages)
- alternate demand management options outcomes (higher, lower savings)
- the inclusion or non-inclusion of other influent factors (government led interventions)

Our newly revised modelling system has allowed cost benefit analysis for any, or all, of the scenarios, as described below. Note that, although we have tested all of these scenarios, the key CBA scenarios are highlighted.

Our newly revised modelling system has allowed cost benefit analysis for any, or all, of the scenarios, as described:

Table 30 Scenarios for CBA/EBSD sensitivity testing

Scenarios (EBSD - All) (CBA - Highlighted)			
LOW DMO Portfolio (Extended Low)	PREFERRED DMO Portfolio (Extended Plus) **with PLAN Growth (Housing_Plan_P)**	PREFERRED DMO Portfolio (Extended Plus) **with 3AMP Smart Meter Roll-out**	PREFERRED DMO Portfolio (Extended Plus) **with Lower Non-Household growth**
PREFERRED DMO Portfolio (Extended Plus)	PREFERRED DMO Portfolio (Extended Plus) **with Additional Leakage (40% reduction)**	PREFERRED DMO Portfolio (Extended Plus) **with 50% Gov led Interventions**	PREFERRED DMO Portfolio (Extended Plus) **with Non-Household DMO savings**
HIGH DMO Portfolio (Aspirational)	**PREFERRED DMO Portfolio (Extended Plus) with Additional Leakage (50% reduction)**	PREFERRED DMO Portfolio (Extended Plus) **with zero Gov led Interventions**	PREFERRED DMO Portfolio (Extended Plus) **with Higher DMO savings**
PREFERRED DMO Portfolio (Extended Plus) with TREND Growth (ONS_18_P)	PREFERRED DMO Portfolio (Extended Plus) **with Compulsory Metering**	PREFERRED DMO Portfolio (Extended Plus) **with Higher Non-Household growth**	PREFERRED DMO Portfolio (Extended Plus) **with Lower DMO savings**

In order to test our assumptions we have developed a comprehensive set of scenario variants as listed in detail below:

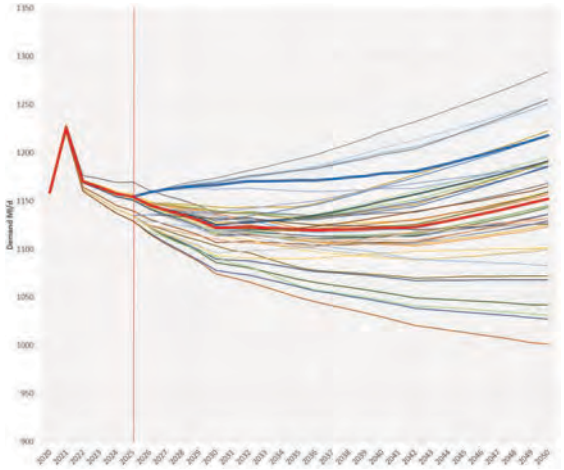
Table 31 WRMP24 Sensitivity testing scenarios

Package Name	Growth Forecast	DMOs portfolio	Variable	Gov led interventions inclusion
1000REV_dWRMP_OxCam1b_Baseline_100GovInt	OxCam_1b_r_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	Incl. Gov. interventions
1001REV_dWRMP_OxCam1b_Extended_Low_100GovInt	OxCam_1b_r_P Growth	Low DMOs - 3AMP SM	Low DMOs	Incl. Gov. interventions
1002REV_dWRMP_OxCam1b_Extended_Plus_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	Incl. Gov. interventions
1003REV_dWRMP_OxCam1b_Aspirational_100GovInt	OxCam_1b_r_P Growth	Aspirational	High DMOs	Incl. Gov. interventions
1002E_dWRMP_OxCam1b_Extended_Plus_Compulsory2AMP_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Compulsory metering	Incl. Gov. interventions
1002F_dWRMP_OxCam1b_Extended_Plus_Reduced_SM_Savings_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Reduced savings Same Costs	Incl. Gov. interventions
1002G_dWRMP_OxCam1b_Extended_Plus_3AM_SM_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	with 2% SM saving	Incl. Gov. interventions
1002H_dWRMP_OxCam1b_Extended_Plus_3percentWEF_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	3% SM WEF saving	Incl. Gov. interventions
1002J_dWRMP_OxCam1b_Extended_Plus_NonHH_DMOs_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	with NonHH DMOs	Incl. Gov. interventions
1002K_dWRMP_OxCam1b_Extended_Plus_HighNonHHgrowth_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Higher NonHH Growth +5%	Incl. Gov. interventions
1002L_dWRMP_OxCam1b_Extended_Plus_LowNonHHgrowth_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Lower NonHH Growth -5%	Incl. Gov. interventions
1002N_dWRMP_OxCam1b_Extended_Plus_High_Leakage_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	High Leakage 38% reduction	Incl. Gov. interventions
1002Q_dWRMP_OxCam1b_Extended_Plus_HIGH+leakage_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	High Leakage 1500km mains	Incl. Gov. interventions
1000AltBL_dWRMP_OxCam1b_ReducedAMP9PMX_100GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	No PMX past AMP7	Incl. Gov. interventions
1002T_dWRMP_OxCam1b_Extended_Plus_MaximumLeakage	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Feasible leakage 39%	Incl. Gov. interventions
1002U_dWRMP_OxCam1b_Extended_Plus_MaximumLeakage	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Leakage 50% reduction	Incl. Gov. interventions
2000REV_dWRMP_OxCam1b_Baseline_50GovInt	OxCam_1b_r_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	50% Gov. intervention
2001REV_dWRMP_OxCam1b_Extended_Low_50GovInt	OxCam_1b_r_P Growth	Low DMOs - 3AMP SM	Low DMOs	50% Gov. intervention
2002REV_dWRMP_OxCam1b_Extended_Plus_50GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	50% Gov. intervention
2003REV_dWRMP_OxCam1b_Aspirational_50GovInt	OxCam_1b_r_P Growth	Aspirational	High DMOs	50% Gov. intervention
3000REV_dWRMP_OxCam1b_Baseline_0GovInt	OxCam_1b_r_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	0% Gov. intervention
3001REV_dWRMP_OxCam1b_Extended_Low_0GovInt	OxCam_1b_r_P Growth	Low DMOs - 3AMP SM	Low DMOs	0% Gov. intervention
3002REV_dWRMP_OxCam1b_Extended_Plus_0GovInt	OxCam_1b_r_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	0% Gov. intervention
3003REV_dWRMP_OxCam1b_Aspirational_0GovInt	OxCam_1b_r_P Growth	Aspirational	High DMOs	0% Gov. intervention

Package Name	Growth Forecast	DMOs portfolio	Variable	Gov led interventions inclusion
4000REV_dWRMP_HousingPlan_Baseline_100GovInt	Housing_Plan_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	Incl. Gov. interventions
4001REV_dWRMP_HousingPlan_Extended_Low_100GovInt	Housing_Plan_P Growth	Low DMOs - 3AMP SM	Low DMOs	Incl. Gov. interventions
4002REV_dWRMP_HousingPlan_Extended_Plus_100GovInt	Housing_Plan_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	Incl. Gov. interventions
4003REV_dWRMP_HousingPlan_Aspirational_100GovInt	Housing_Plan_P Growth	Aspirational	High DMOs	Incl. Gov. interventions
4500REV_dWRMP_HousingPlan_Baseline_zeroGovInt	Housing_Plan_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	0% Gov. intervention
4501REV_dWRMP_HousingPlan_Extended_Low_zeroGovInt	Housing_Plan_P Growth	Low DMOs - 3AMP SM	Low DMOs	0% Gov. intervention
4502REV_dWRMP_HousingPlan_Extended_Plus_zeroGovInt	Housing_Plan_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	0% Gov. intervention
4503REV_dWRMP_HousingPlan_Aspirational_zeroGovInt	Housing_Plan_P Growth	Aspirational	High DMOs	0% Gov. intervention
5000REV_dWRMP_ONS_18_P_Baseline_100GovInt	ONS_18_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	Incl. Gov. interventions
5001REV_dWRMP_ONS_18_P_Extended_Low_100GovInt	ONS_18_P Growth	Low DMOs - 3AMP SM	Low DMOs	Incl. Gov. interventions
5002REV_dWRMP_ONS_18_P_Extended_Plus_100GovInt	ONS_18_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	Incl. Gov. interventions
5003REV_dWRMP_ONS_18_P_Aspirational_100GovInt	ONS_18_P Growth	Aspirational	High DMOs	Incl. Gov. interventions
5500REV_dWRMP_ONS_18_P_Baseline_zeroGovInt	ONS_18_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	0% Gov. intervention
5501REV_dWRMP_ONS_18_P_Extended_Low_zeroGovInt	ONS_18_P Growth	Low DMOs - 3AMP SM	Low DMOs	0% Gov. intervention
5502REV_dWRMP_ONS_18_P_Extended_Plus_zeroGovInt	ONS_18_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	0% Gov. intervention
5503REV_dWRMP_ONS_18_P_Aspirational_zeroGovInt	ONS_18_P Growth	Aspirational	High DMOs	0% Gov. intervention
6000REV_dWRMP_ONS_18_Low_L_Baseline_100GovInt	ONS_18_Low_L Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	Incl. Gov. interventions
6001REV_dWRMP_ONS_18_Low_L_Extended_Low_100GovInt	ONS_18_Low_L Growth	Low DMOs - 3AMP SM	Low DMOs	Incl. Gov. interventions
6002REV_dWRMP_ONS_18_Low_L_Extended_Plus_100GovInt	ONS_18_Low_L Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	Incl. Gov. interventions
6003REV_dWRMP_ONS_18_Low_L_Aspirational_100GovInt	ONS_18_Low_L Growth	Aspirational	High DMOs	Incl. Gov. interventions
7000REV_dWRMP_OxCam2b_Baseline_100GovInt	OxCam2b_r_P Growth	NO DMOs beyond AMP7	AMP7 Smart Metering and WEF only	Incl. Gov. interventions
7001REV_dWRMP_OxCam2b_Extended_Low_100GovInt	OxCam2b_r_P Growth	Low DMOs - 3AMP SM	Low DMOs	Incl. Gov. interventions
7002REV_dWRMP_OxCam2b_Extended_Plus_100GovInt	OxCam2b_r_P Growth	Preferred Plan 2AMP SM	Preferred DMOs - with 2% SM	Incl. Gov. interventions
7003REV_dWRMP_OxCam2b_Aspirational_100GovInt	OxCam2b_r_P Growth	Aspirational	High DMOs	Incl. Gov. interventions

These scenarios have been used to test a range of outcomes, dependent upon different growth forecasts, differing demand management option scenarios (including different smart meter rollout programs, leakage reduction and water efficiency measures) and the inclusion of alternate factors (government interventions, covid19 factors). The alternate demand forecast outcomes can be shown (with the preferred WRMP24 base-line (blue) and final plan (red) out-comes):

Figure 53 Scenarios with WRMP24 base-line and preferred plan.



Uncertainties with respect to the preferred plan forecast arise from the following areas:

- **The base-line water balance assessment of population, per capita consumption and the component s of demand.**
  - We will undertake a further review of our water balance data, as we move from our 2019/20 to a 2021/22 baseline for the Final WRMP24. This will include a further detailed review of property, population and occupancy attributions at the Planning Zone Level, in order to confirm PCC values with more certainty. We will also review the inter-year deviations over a period of time in order to ascertain the variability of our water balances over time, at our WRZ geographic level.
- **The achievement of our WRMP19 AMP7 out-turn reductions in demand from smart metering and leakage.**
  - We are currently pursuing aggressive measures with regard to our PCC and leakage targets for AMP7, despite the impact of the Covid19 pandemic, recent weather impacts (the driest summer in 2022 since 1976) and supply chain issues with regard to smart meter installation (we have installed over 300K smart meters in the past 2 years). We will review our AMP7 out-comes as part of our Final WRMP24.
- **The inclusion of savings from Government led interventions and their realization.**
  - We will review the inclusion and level of impact this factor in light of any new evidence which is presented before our Final WRMP24. We have rigorously tested scenarios, as can be seen, with and without this external impact on PCC, as part of our option appraisal. It is noted that in order to reach our goal of 110l/h/d, this factor is also required, as well as our full smart meter rollout.
- **Smart meter savings and their realization over the WRMP24 period, from our 2AMP smart meter installation program.**
  - We have initially based our understanding of smart meter savings on our long-term Newmarket and Norwich trial areas. This has currently informed the assumptions included in the plan. We are now (21/22) seeing the first evidence from our wider rollout regarding potential behavioural change savings and plumbing loss/cspl reductions (as customers are made aware of leakage). We will review our assumptions underpinning the smart meter forecast (and savings) once this data has been fully analysed.
  - We are at the beginning of the process of understanding customer behaviour, how customers respond to the introduction of smart meter technology and how we need to tailor our systems in order to maximise water efficiency, so we expect that our assessments will need to adapt over time as we build a much more complete view.
  - Further reviews of customer data and segmentation will form part of the update of the Demand Forecast Model as we move forward.
- **Leakage reduction over the WRMP24 planning period.**
  - Significant uncertainty is involved with leakage reduction and the maintenance of given leakage levels. We are already a frontier company, and significantly below our previously calculated SELL (Economic Leakage Level) and so achieving lower levels will prove more difficult. We are also beginning to exhaust traditional methods

of leakage reduction such as pressure management and so will need to develop innovative new methods to detect and repair leakage (noting that our smart meter installation program should have a significant impact with regard to the detection and repair of customer supply pipe leakage). We have, therefore, included a pragmatic ambition for leakage reduction in our preferred plan, but will continue to analyse leakage interventions for their costs and benefits

- **The long term impacts of the Covid19 pandemic.**
  - The Covid19 pandemic and associated lockdowns were seen to impact both household and non-household demand as, sections of the population worked from home, segments of the business sector were forced to shut and latterly as many people 'stay-cationed' in our region. We continue to review consumption patterns, post pandemic, in order to ascertain whether we have now entered a new normal, where home-working is seen as a more usual pattern of behaviour. We have included an initial assessment for future Covid19 impacts, and will review this prior to our Final WRMP24.
- **Property and population growth over the next 25 years.**
  - Property and population forecasts for the next 25 years, are also an area of great uncertainty. We have, therefore, modelled a number of high (strategic growth) and low (ONS trend) population projections, including Local Authority property and population projections in alignment with WRMP Guidance.
  - For our draft WRMP24, we have adopted a scenario (OxCam1b) that balances future risk from unexpected population growth in our region with the fact that the current Government position appears to have been revised with regard to the OxCam strategic plan development. The chosen scenario maintains near term Local Authority planned growth (higher than trend) beyond AMP7 (rather than returning to trend in the long term) in our known high growth areas. This would seem to be the most pragmatic approach, given recent growth in the areas covered by the Arc, and the fact that the East of England has experienced the highest growth rates in the UK since the 2011 census (>8%). This forecast has been aligned with our WRE partners and is in accordance with WRMP24 Guidance.
  - We will review our growth projections, as we finalise our WRMP24 submission.
- **Understanding customer cohort behaviours.**
  - Our smart meter program is facilitating a step change in our understanding of our customers and their consumption. However, we are only at the beginning of our research and analysis into how and when our customers use water and how these patterns of consumption change within the family unit over time. We are currently progressing analysis on our hourly customer consumption data and statistically analysing consumers to characterise them into meaningful cohorts (e.g. early morning users; all day users) to better understand the demographics of our customer base at WRZ level. As this analysis advances we will use it to produce more sophisticated forecasts and target demand management options in a more meaningful way.
- **Non-household, business sector demand.**
  - Our non-household forecast is based upon regression analysis and estimates of future population, GVA and employment, as applied to relevant non-household segments. This simple methodology can only produce forecasts that are relatively uncertain over the WRMP24 period. As stated we have sensitivity tested our central forecast with additional variants of future non-household demand. Additionally we can be called upon to supply specific volumes of water to Companies, which can have direct impacts at the WRZ level. Identifying when these requirements might be called upon, can cause issues within the planning process, however we are currently ensuring that these needs are identified and reflected in the WRMP24 plan.

Whilst considering all these risks and issues we also account for uncertainty in the WRMP24 plan using the concept of Target Headroom.

13.2 Target Headroom

As part of our forecast process, for our preferred plan projections we must consider uncertainty. One method of dealing with this, is the calculation of Target Headroom, in which an additional contingency volume of water that might be required. This Target Headroom is added to our preferred projections for both the base-line and final plan forecasts for our final calculations of supply-demand balance.

For the purposes of calculating Target Headroom, we use 'Monte Carlo' simulation. This process uses a number of demand variables (with pre-defined distributions), which are parametrised (producing high and low variants), so that when combined many scenario outputs can be generated.

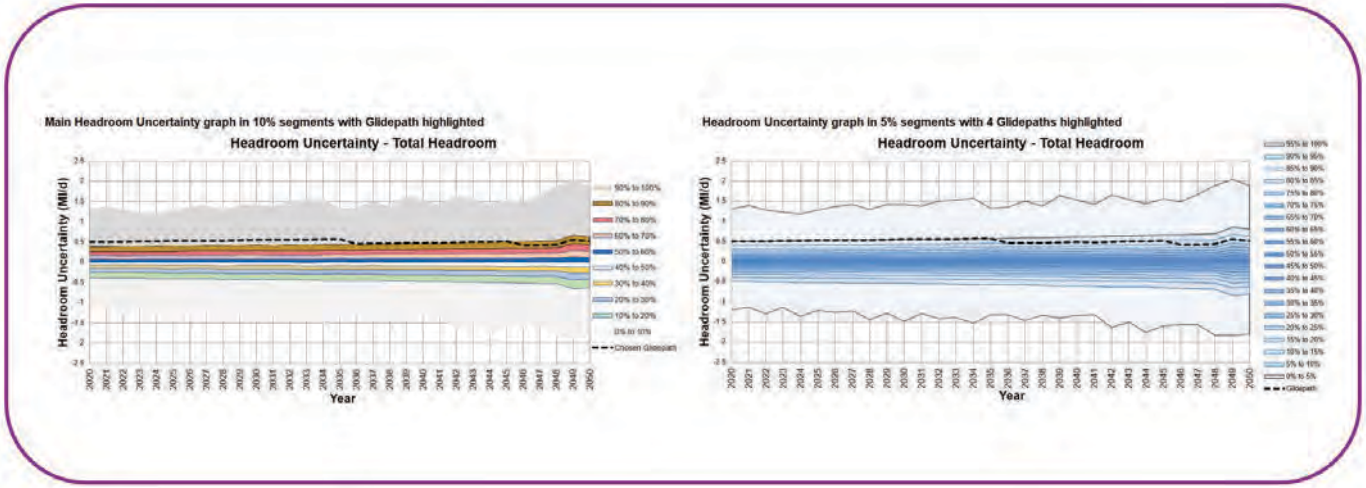
The parameters included in the model can be listed, as below:

Table 32 Component parameters used in Target Headroom analysis

Component Code	Component description	Distribution Type
D1-1	Accuracy of sub-component data - Overall HH (base year)	Normal/Alt
D1-2	Accuracy of sub-component data - Overall NHH (base year)	Normal/Alt
D1-3	Accuracy of sub-component data - Leakage (base year)	Normal/Alt
D2-1	Demand forecast variation - HH population	Triangular
D2-2	Demand forecast variation - HH PCC growth	Triangular
D2-3	Demand forecast variation - Overall NHH (subsequent years)	Triangular
D2-4	Demand forecast variation - Leakage (subsequent years)	Triangular
D3	Impact of climate change on demand	Triangular

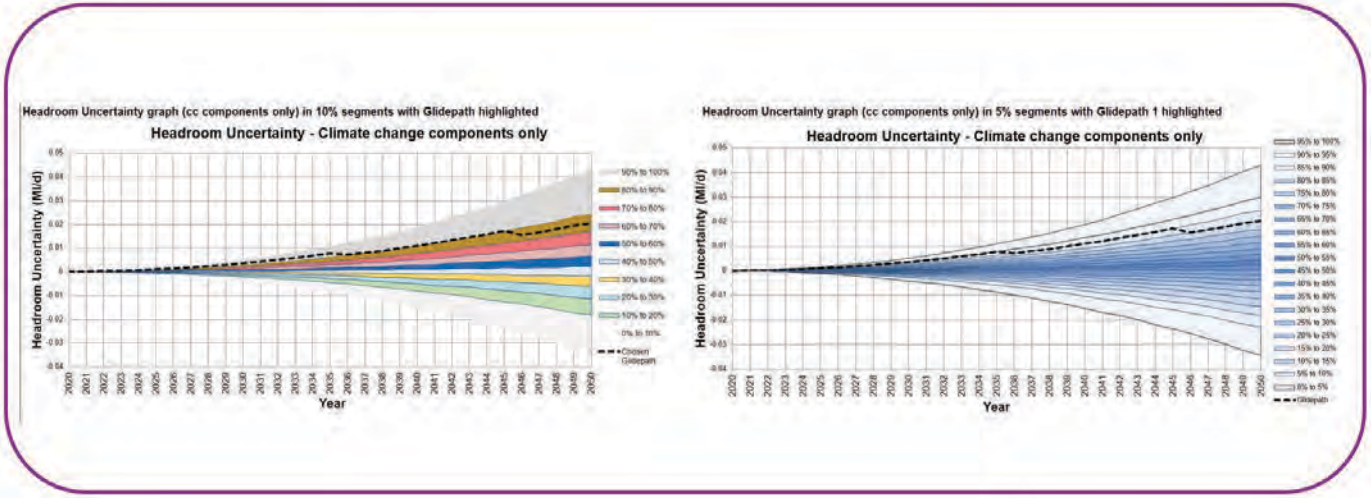
Using 'Oracle Crystal Ball'TM software, we have generated 30,000 scenarios per water resource zone. These have been used to generate a probability distribution of potential future outcomes, from which a glidepath has been selected. Modelled, glide-path outputs for a hypothetical WRZ, for all the parameters can be shown;

Figure 54 Target Headroom modelled glidepaths



Additionally, the climate change parameter trajectories can be visualized;

Figure 55 Target Headroom: climate change projections and glidepath



This analysis has generated the following demand contingency at WRZ level (expressed as a percentage of DI uplift). As part of our WRE liaison, we have agreed preferred glidepaths, in order to align with our neighbouring PWCs.

Target Headroom is described in more detail in the 'Planning Factors' Technical Report.

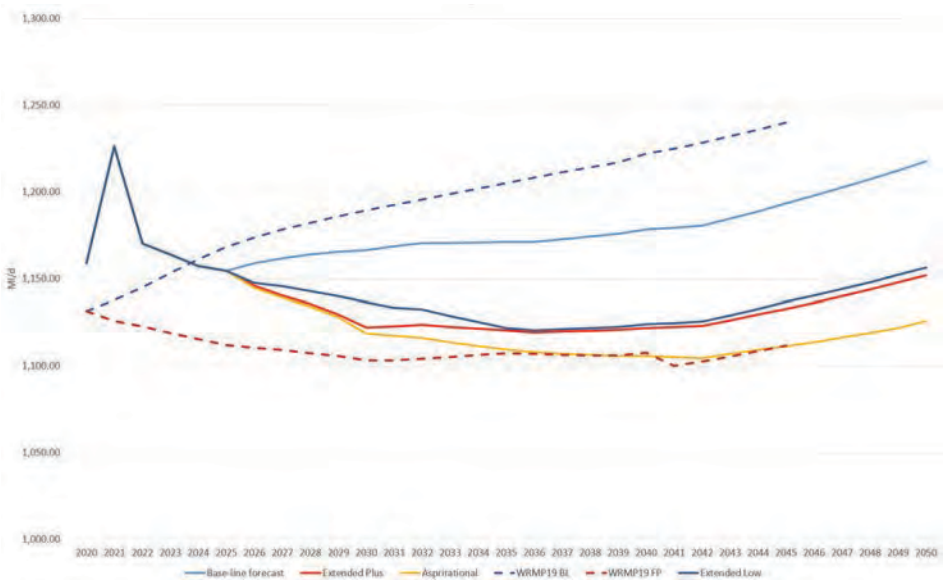
13.3 WRMP19 forecast comparison

As part of our evaluation of WRMP24 scenario out-comes, we have been mindful that they should also be considered in the context of our WRMP19 submission.

This comparison with our WRMP19 forecast, has been conducted in order to assess the deviation from previous estimations and check that revised forecasts sit within acceptable boundaries and tolerances of the forecast envelope.

These historic and current projections can be shown, as below. As can be seen the WRMP24 projections (even including some strategic growth) sit within the envelope set by WRMP19. The reduced base-line forecast reflects the inclusion of government led interventions. As can also be seen, our preferred plan (Extended Plus) projects that demand will be slightly higher than WRMP19, due to a more realistic view regarding smart meter savings and leakage reduction.

Figure 56 WRMP24 and WRMP demand projections (Ml/d)



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