Our PR24 Enhancement Strategies

Part 4: Enabling sustainable economic and housing growth

October 2023

PR24 Enhancement Strategies Part 4: Enabling sustainable growth

Enabling sustainable economic and housing growth

1 Overview

This document sets out the enhancement investments that we propose to make to help us achieve the ambitions set out in our Strategic Direction Statement. In particular, this expenditure is linked to enabling sustainable economic and housing growth.We've looked at how our whole business, across both water and water recycling can contribute to this ambition. Our enhancement proposals help to achieve this ambition through:

- Reducing the demand for water that economic and housing growth places on the environment through completing the rollout of smart meters across our region (section 2), reducing leakage beyond our frontier position in the industry (section 3) and implementing additional water efficiency measures (section 4)
- Responding to the need for additional water recycling capacity (section 5)
- Protect coastal and inland bathing waters from the impacts that growth can place on the environment (section 6)

1.1 Guide to our enhancement strategies

Each of the enhancement strategies aligns relates to costs presented in our data table submissions. the table below sets out how each section of our enhancement proposals presented in this document maps to enhancement cost tables.

Table 1 Our PR24 'Enabling Sustainable Economic and Housing Growth' Enhancement Strategies

Enhancement strategy	Costs data table references
Metering (section 2)	CW3.60-CW3.62 (New meters requested by existing customers (optants)) CW3.69-CW3.71 (Replacement of existing basic meters with AMR meters for residential customers) CW3.72-CW3.74 (Replacement of existing basic meters with AMI meters for residential customers) CW3.87-CW3.89 (Smart meter infrastructure) CW3.136-CW3.137 (LARS meters)
	CW17.69-CW17.71 (Replacement of existing basic meters with AMI meters for residential customers) [Part - £3.56m - is enhancement]
Leakage improvements (section 3)	CW3.47-CW3.49 (Leakage improvements delivering benefits in 2025-2030)
Demand-side improvements (section 4)	CW3.44-CW3.46 (Demand-side improvements delivering benefits in 2025-2030 (excl leakage and metering))
Growth at water recycling centres (section 5)	CWW3.153-CWW3.155 (Growth at sewage treatment works (excluding sludge treatment))
Microbiological treatment (section 6)	CWW3.88-CWW3.90 (Microbiological treatment - bathing waters, coastal and inland) CWW17.88-CWW17.90 (Microbiological treatment - bathing waters, coastal and inland)

The structure of each individual enhancement strategy is aligned to Ofwat's enhancement criteria set out in chapter A1 of appendix 9 of the Final Methodology (Setting expenditure allowances). The table below sets out how each sub-heading maps across to the enhancement criteria. Our enhancement strategies should should be read alongside chapter 7.3 of our business plan which sets out an overview of how we have approached our enhancement investment plan overall.

Table 2 Enhancement strategy structure

Enhancement strategy sub-section heading	Enhancement assessment criteria
Delivering for the long term	**A1.1.1 Need for enhancement investment**
Investment context	a) Is there evidence that the proposed enhancement investment is required (ie there is a quantified problem requiring a step change in service levels)? This includes alignment agreed strategic planning framework or environmental programme where relevant.
Scale and timing	b) Is the scale and timing of the investment fully justified, and for statutory deliverables is this validated by appropriate sources (for example in an agreed strategic planning framework)?
Interaction with base expenditure	c) Does the proposed enhancement investment or any part of it overlap with activities to be delivered through base, and where applicable does the company identify the scale of any implicit allowance from base cost models?
Long term context (historic)	d) Does the need and/or proposed enhancement investment overlap or duplicate with activities or service levels already funded at previous price reviews (either base or enhancement)?
Long term context (future)	e) Is the need clearly identified in the context of a robust long-term delivery strategy within a defined core adaptive pathway?
Customer support	f) Where appropriate, is there evidence that customers support the need for investment (including both the scale and timing)?
Cost control	g) Is the investment driven by factors outside of management control? Is it clear that steps been taken to control costs and have potential cost savings (eg spend to save) beenaccounted for?
Unlocking greater value for customers, communities and the environment	**A1.1.2 Best option for customers**
Option consideration	a) Has the company considered an appropriate number of options over a range of intervention types (both traditional and non-traditional) to meet the identified need?
Cost-benefit analysis	b) Has a robust cost-benefit appraisal been undertaken to select the proposed option? Is there evidence that the proposed solution represents best value for customers, communities and the environment over the long term? Is third-party technical assurance of the analysis provided?
Environmental and social value	c) In the best value analysis, has the company fully considered the carbon impact (operational and embedded), natural capital and other benefits that the options can deliver? Has it relied on robustly calculated and trackable benefits when proposing a best value option over a least cost one?
Investment benefit	d) Has the impact (incremental improvement) of the proposed option on the identified need been quantified, including the impact on performance commitments where applicable?
Managing uncertainty	e) Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed - including where forecast option utilisation will be low?
External funding	f) Has the scale of forecast third party funding to be secured (where appropriate) been shown to be reliable and appropriate to the activity and outcomes being proposed?

Enhancement strategy sub-section heading	Enhancement assessment criteria
Direct procurement	g) Has the company appropriately considered the scheme to be delivered as Direct Procurement for Customers (DPC) where applicable?
Customer view	h) Where appropriate, have customer views informed the selection of the proposed solution, and have customers been provided sufficient information (including alternatives and its contribution to addressing the need) to have informed views?
Cost efficiency	**A1.1.3 Cost efficiency**
Developing costs	a) Is it clear how the company has arrived at its option costs? Is there supporting evidence on the calculations and key assumptions used and why these are appropriate?
Benchmarking	b) Is there evidence that the cost estimates are efficient (for example using similar scheme outturn data, industry and/or external cost benchmarking)? d) Is there compelling evidence that the additional costs identified are not included in our enhancement model approach? e) Is there compelling evidence that the allowances would, in the round, be insufficient to account for evidenced special factors without an enhancement model adjustment? f) Is there compelling econometric or engineering evidence that the factor(s) identified would be a material driver of costs?
Assurance	c) Does the company provide third party assurance for the robustness of the cost estimates?
Customer protection	**A1.1.4 Customer protection**
	a) Are customers protected (via a price control deliverable or performance commitment) if the investment is cancelled, delayed or reduced in scope? b) Does the protection cover all the benefits proposed to be delivered and funded (eg primary and wider benefits)? c) Does the company provide an explanation for how third-party funding or delivery arrangements will work for relevant investments, including how customers are protected against third-party funding risks?

Naturally, some of the information we highlight is relevant to more than of these enhancement criteria, and so each enhancement investment should be read as a whole. In some sub-sections we go beyond the specific enhancement assessment criteria to provide additional relevant context where needed. For example, in some 'Long-term context (historic)' sections, we highlight not just the expenditure from previous price reviews, but also the activities and performance delivered in previous AMPs.

2 Metering

Overview

- Our metering strategy includes:
  - Rollout of a further 1.2 million smart meters on top of the 1.1 million installed up to throughout AMP7.
  - A smart meter fixed data network for the areas where we will install smart meters
  - Collection and use of additional smart meter data to identify customer side leakage.
  - With significant experience of delivering smart meters now, we have seen PCC reductions of 2.4 l/h/d, and customer side leakage reductions of 1.3 l/h/d (Note that we expect these savings to increase over time, [1]) . 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 an additional 5.3Ml/d from behavioural change demand savings, 8.8Ml/d savings from plumbing loss reductions and up to a 4.0Ml/d from reductions in customer supply pipe losses (CSPL) (a total of 18.1Ml/d).
- We also include investment for Licensed Abstraction Reporting System (LARS) meters, reflecting the new requirement to reduce the tolerance levels on these meters. .

Table 3 Investment Summary

PR24 costs (£m)	
Capex	113.5
Opex	23.9
Totex	137.4
Benchmarking	
Method	Scheme outturn costs Ofwat cost data and models Market testing of costs
Findings	For replacement of visual read meters with smart meters (which make up the bulk of our costs) our costs were found to be efficient. For new installation the differential with the benchmark is explained by exogenous factors.
Customer Protection	
Price Control Deliverable	Smart metering
Performance commitment	Leakage Per Capita Consumption Business Demand
Ofwat data table	
CW3.60-CW3.62 CW3.69-CW3.71 CW3.72-CW3.74 CW3.87-CW3.89 CW3.136-CW3.137 CW17.69-CW17.71	New meters requested by existing customers (optants) Replacement of existing basic meters with AMR meters for residential customers Replacement of existing basic meters with AMI meters for residential customers Smart meter infrastructure LARS meters Replacement of existing basic meters with AMI meters for residential customers [Part - £3.56m - is enhancement]

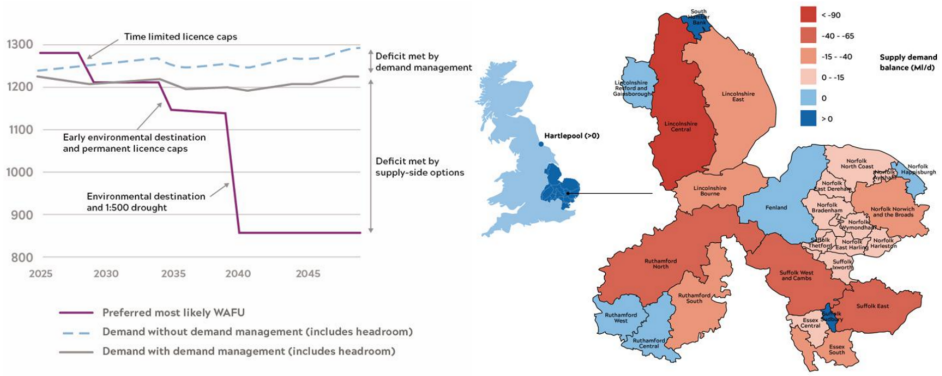
2.1 Delivering for the long term

2.1.1 Investment context

Our PR24 metering investment is informed by, and aligns with, our Water Resources Management Plan (WRMP). Without any intervention the Anglian region will be in a water balance deficit during the next 25 years. This deficit is shown in the figure below.

1 Revised draft WRMP24 demand management preferred plan technical supporting document: Section 6.6

Figure 1 Our supply-demand balance in 2050 without any interventions and its impact on our WRZs



This gap between supply and demand is driven by a number of factors including:

Licence caps

- Additional sustainability reductions required as signalled by the Environment Agency will reduce the water available by 134Ml/d.

Environmental destination

- Abstraction reductions to support the improvements to the environment. This follows the Environment Agency's National Framework for Water Resources, reducing water available for use by 241 Ml/d.

1:500 year drought

- The National Framework for Water Resources and Water Resources Planning Guideline (WRPG) sets out that resilience to a 1 in 500 year drought must be achieved by 2039. Resilience to this level of drought increases the demand reduction/ additional supply required by 70 Ml/d.

Climate change

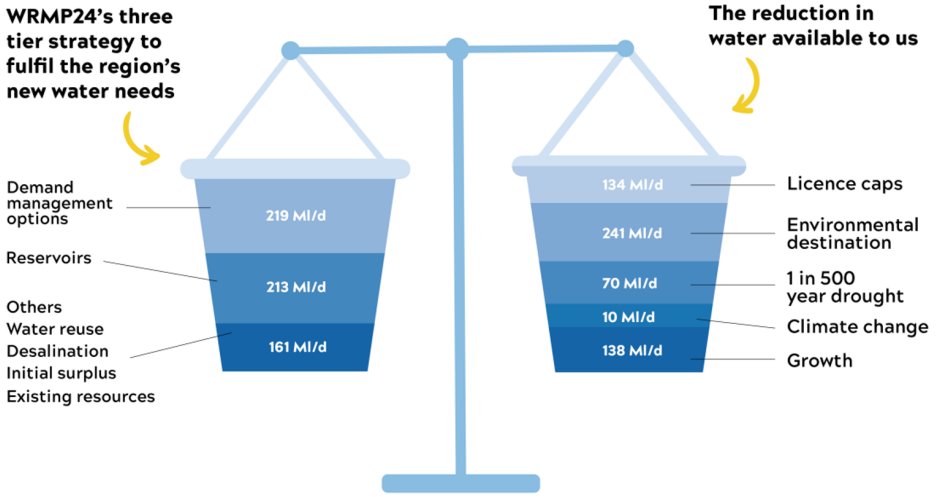
- The climate change assessment carried out for our whole system has determined that hotter, drier summers and warmer, wetter winters will reduce the amount of water we have available by 10Ml/d.

Growth

- Growth in demand for water will increase in the Anglian region by 138Ml/d (2025-2050) due to population growth and the ongoing impacts of societal changes following the Covid-19 pandemic (during which we saw an increase in household demand by 10% due to factors such as an increase in working from home, behavioural changes (e.g. more handwashing) and greater stay-cationing). Consumption remains approximately 2.5% higher than pre-pandemic which we have factored into our WRMP24 uplift.

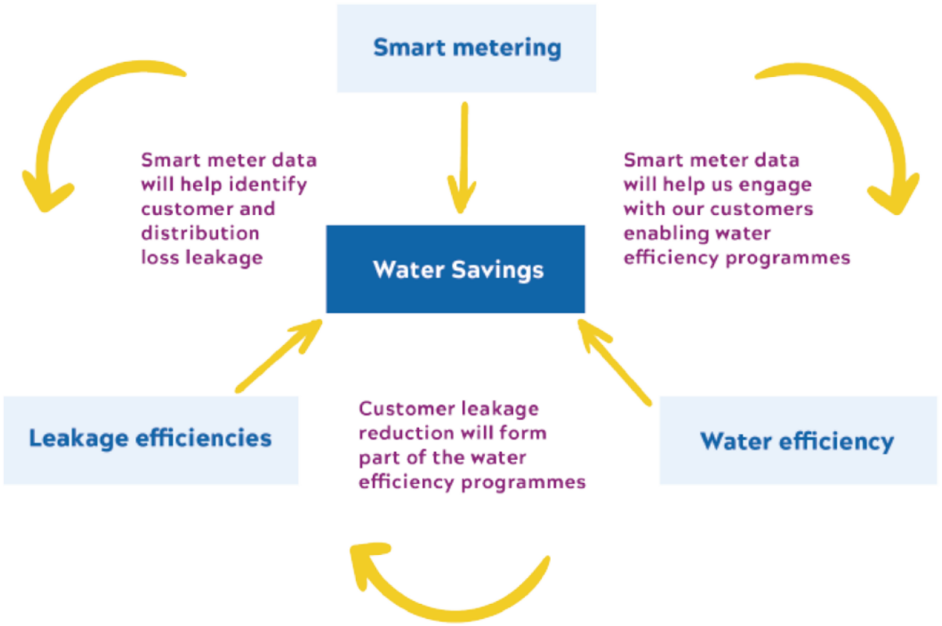
As shown in our WRMP we have identified the need for both demand reductions and increases in supply to play a role in reducing this deficit over the next 25 years. The diagram below sets out how we plan to meet the challenges for WRMP24 utilising both demand and supply-side measures.

Figure 2 Meeting our challenges for WRMP24



Our demand management options include reductions in usage due to metering, reducing leakage and other water efficiency measures. All three play an important role in delivering the 219Ml/d demand reduction required for our WRMP. Our measures are designed to save 134Ml/d by 2050, with the additional 85Ml/d being delivered by Government-led interventions (which have been included in alignment with WRPG direction). Our smart metering strategy for AMP8, consequently is fundamental in underpinning a significant amount of the benefit delivered through our three demand management approaches.

Figure 3 Our three pilllars of demand management



We have started the journey of rolling out smart meters to our customers in AMP7 and it is vital that we continue to carry this rollout into AMP8. The benefits that smart metering can bring at scale is reflected in our transition programme with 60,000 smart meters to be funded through PR24 being delivered in AMP7 as part of the Accelerated Infrastructure Delivery programme.

We currently have one of the highest rates of meter penetration in the UK.This has been driven by the challenge of balancing supply and demand in the driest part of the country. Our experience shows that customers on meters use less water than customers whose water usage is unmeasured (averaging 123.1 l/h/d and 174.8 l/h/d respectively (2022/23), and customers who have smart meters use even less (120.7 l/h/d). In 2022/23, we had over 90% of household properties with installed meters and 84% of customers paying measured charges. We have consistently sought to increase the number of customers who are metered and billed on their measured usage, without a compulsory metering programme. We are now at a level of meter penetration which is very near to the maximum feasible level (where installing new meters would be more costly and difficult to install) and so reducing demand through an increase in meter rollout is not an option available to us. We therefore need to identify ways to deliver further demand reduction benefits from metering through smart metering.

Manual reads of visual-read meters, take place at intervals of 6 months. Consequently, only infrequent customer usage data is available to both us and our customers. More frequent collection of customer usage data can;

- Increase awareness of water usage, helping to improve water efficiency
- Improve the detection of customer supply pipe leakage and internal plumbing losses (reducing leak run-times at customer properties).
- Allow us to understand in far greater detail usage at sub-DMA level. This allows us to more effectively balance the network, allowing us to best utilise our existing network and help build further resilience through greater visibility of demand.

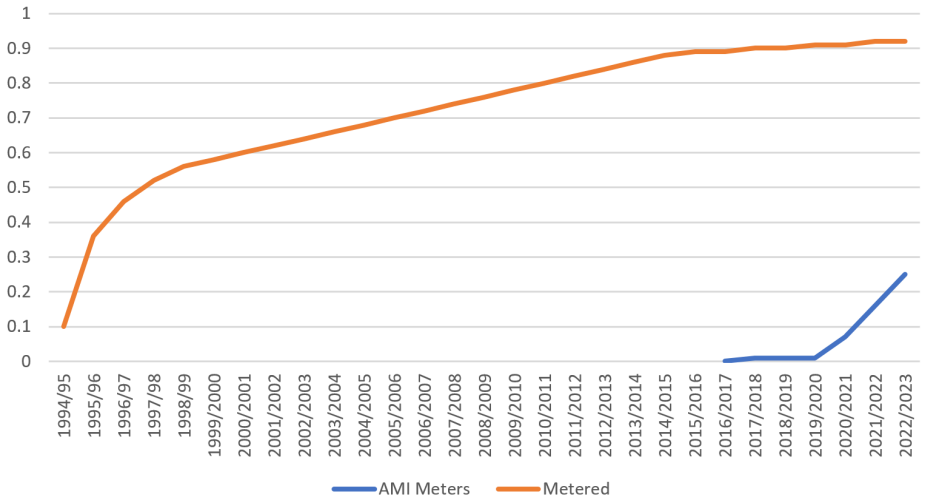
These all serve to deliver our improvements to the environment by reducing the need to abstract from water sources.

Smart metering is therefore fundamental in supporting the delivery of the demand reduction needs identified in our WRMP, through the provision of real time consumption data.

The enhancement investment in smart metering forms part of our long term strategy that we have been carrying out for over thirty years. This started in the 1990s when we began the large scale rollout of metering. In 2020, we began the large scale rollout of smart meters (following earlier trials) with half of meters being replaced by smart meters in AMP7, plus an additional 60,000 smart meters being accelerated into AMP7 through the Accelerated Infrastructure Delivery (AID). Our AMP8 plan sees the completion of this long-term approach with investment to upgrade every meter in our region to a smart meter.

The smart meter rollout is already progressing across the Anglian Water region, as we install 1.1m smart meters over AMP7, in line with our commitment at PR19. As of August 2023, we have installed over 625,000 smart meters. This comes on top of the investment we have made over multiple AMPs to reach one of the highest levels of meter penetration in the industry. This is shown in the chart below.

Figure 4 Meter penetration 1995 to 2023



2.1.2 Scale and timing

The scale and timing of investment is fundamentally driven by the expected supply-demand deficits. If no action is taken, we expect the region to be in a supply-demand deficit before 2030, driven primarily by the removal of time limited licence caps. It is therefore imperative that supply-demand beneficial investments are delivered in AMP8. Given that supply-side measures have a longer lead-in time, there is a need to deliver a significant proportion of the demand-side measures in the first five-year period of the WRMP, building on our work in AMP7.

As alternative options for how this demand reduction is delivered in AMP8, we considered the costs and benefits of rolling out a 2-AMP programme (finishing in 2030) versus a 3-AMP programme (finishing in 2035). Our 'Revised draft WRMP24 Demand management option appraisal technical supporting document: Section 3, 3.20' and the 'Revised draft WRMP24 Demand management preferred plan technical supporting document: Section 6' sets out our analysis of the costs and benefits delivered for each rollout strategy.

In summary, a 2-AMP rollout delivers an additional 11Ml/d saving by 2030 relative to a 3-AMP rollout. A 3-AMP rollout would therefore require a greater deficit to be resolved by 2030 through additional leakage reduction, which given our frontier position in the industry and exhaustion of lower cost leakage reduction options would have a high unit cost for customers. Further, this would delay the wider benefits that customers get from having a smart meter.

Given the above, we have concluded a 2-AMP rollout of our smart metering programme (50% in AMP7 and 50% in AMP8) would be the most appropriate for customers and the environment and aligns with our WRMP. Delaying smart metering would also impact the water efficiency measures that we would be able to deliver (impacting PCC reduction) and reduce our capability to identify and solve customer supply pipe leakage, given the key enabling role that smart meters play in these programmes.

2.1.3 Interaction with base expenditure

We have considered the base activities and any implicit base allowance associated with each part of our metering enhancement plan. This enhancement includes investments to :

- upgrade 1.2 million visual-read meters to smart meters;
- deliver a fixed network to collect the data from these smart meters and allow more regular updates on usage; and
- installation new meters at properties that do not currently have a meter.

In each case we set out below where we have considered costs to be included in Ofwat's base allowances and therefore are not included as part of our enhancement costs.

Upgrading visual read meters to smart meters

Where there is an existing meter at a property, we would expect these meters to be replaced every 15 years in line with the expected asset life of the meter. Where we are upgrading a meter to a smart meter it is possible that we would have been replacing the meter like-for-like anyway as it had reached the end of its asset life or fails early.

We note that there is no direct or indirect driver included in the base models to reflect this, which could make companies with a high meter penetration look artificially inefficient. We note that some companies have included symmetric cost adjustment claims relating to meter penetration in their early submission which we consider could help to correct this in botex allowances. For the purpose of this enhancement investment, as at PR19, we have assumed that efficient costs for replacing a meter like-for-like will be included in botex costs.

The geographical nature of the rollout of smart meters means that in some instances we will be replacing basic meters before they reach the end of their asset life. Where possible, we have maximised the asset life of existing meters to ensure this is not the case (e.g. not scheduling in the proactive like-for-like

replacement of a basic meter if it is due to be replaced with a smart meter in the following year). Given that we expect all meters to be smart meters by the end of AMP8, we will no longer install visual read meters. If there is a reactive meter failure in an area that is not yet geographically rolled out, a smart meter will be installed ready for the arrival of the telephony network which will unlock the full usability and data of the smart meter. This planned approach ensures the most efficient rollout for customers.

The costs for replacing the meters that have not yet reached the end of their asset life would not be included in botex allowances even if it did reflect meter penetration and the expected asset lives of meters. In line with the CMA's findings on the issue at PR19, we recognise that an additional allowance for the like-for-like replacement costs of these could risk double-funding of these costs, and so have not included the full costs of these replacements as either base or enhancement costs as part of this business plan. It should be noted that whilst in line with the CMA's findings these costs will be recovered in the medium term, over a single AMP these additional replacements serve to increase our base costs due to factors unrelated to inefficiency. We welcome Ofwat's guidance on how to apportion such costs to enhancement and we have followed this guidance.

Following the guidance that was issued by Ofwat in June 2023 on the apportionment of botex vs enhancement for early end-of-life replacement of visual read meters, we have identified where we will be replacing existing visual water meters prior to the end of their 15 year asset life. We have netted off the remaining asset life in whole years to enhancement, with the remaining proportion being apportioned to base. This resulted in the following apportionment of costs for early meter replacements.

Figure 5 Smart meter replacement

Smart Uplift (Enhancement)	This is the cost as part of Ofwat's guidance for the additional enhancement uplift for turning a dumb meter to a smart meter with associated data and telephony
Remaining Asset life (Enhancement uplift)	This is the cost as part of Ofwat's guidance for the additional enhancement uplift for replacing a water meter prior to the end of its 15 year asset life
Dumb for Dumb (Capital maintenance)	This is the cost as part of Ofwat's botex models for the periodic replacement of dumb for dumb meters

Below is a table demonstrating the allocation to base, enhancement from remaining asset life, and smart for smart enhancement uplift as totals across AMP8. In the cost breakdown presented in the 'cost efficiency' section of this chapter below, these costs are reflected in the 'PMX early start smart meters' line.

Table 4 Proportion of investment, base, enhancement

Base - Visual for Visual (£m)	Enhancement - Remaining Asset Life (£m)	Enhancement Smart Uplift (£m)
22.637	13.984	17.624

Fixed data network

In addition to the physical installation of a smart meter, an important component of the programme which is not reflected in base costs is the running of the fixed data network. This network is required to realise the benefits from installing smart meters at properties, helping us to drive down leakage, and allows us to production plan and continue with our wider suite of demand management activities. As at PR19, we have included the costs of operating the fixed data network as part of our enhancement costs.

Installation of new meters at properties without a meter

In line with the approach taken in previous AMPs, where a new smart meter is installed at a property where previously there was no meter we have attributed all costs to enhancement. This is because, unlike where a meter is replaced and upgraded, all costs of installing a new meter are associated with an additional benefit to customers that they did not have before.

Smart replacement like for like

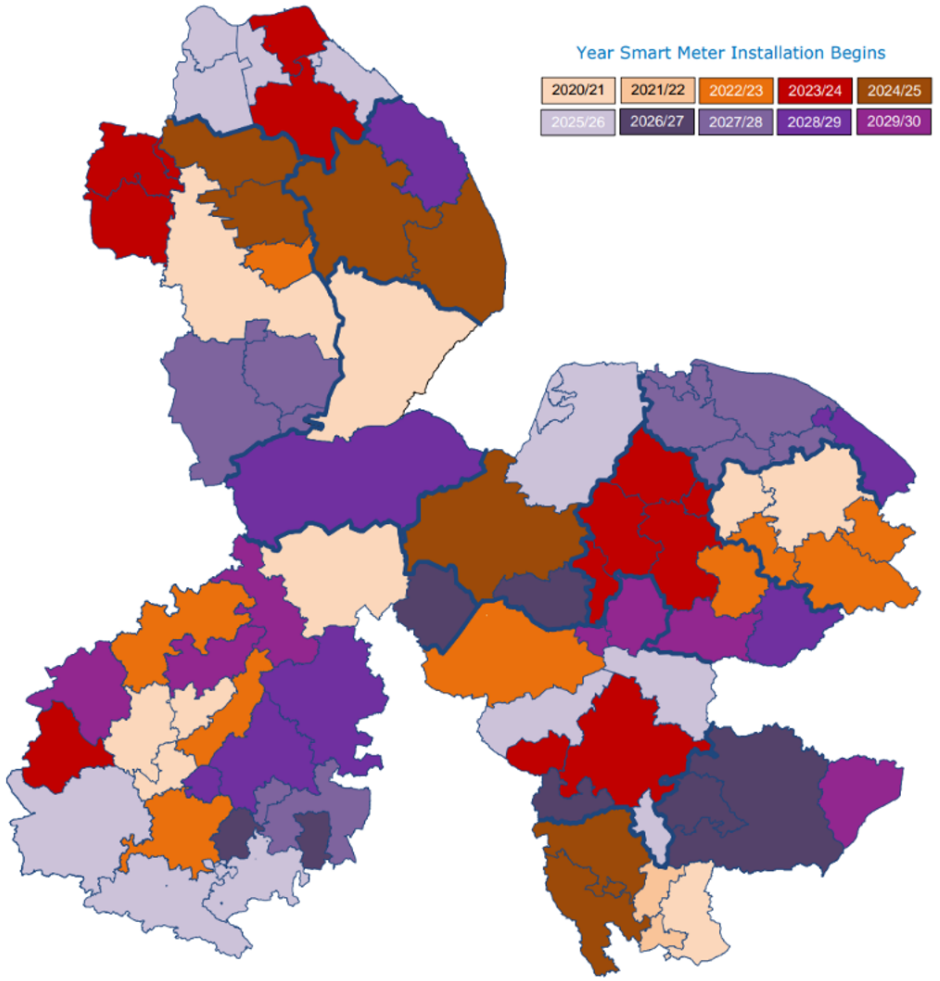
In addition to the clarifications above, we have not included the cost of meter replacements where a meter is replaced like-for-like (e.g. AMI with AMI). We have also not included the additional costs we are facing and expect to increase associated with the need to replace meter boundary boxes which we have submitted as a separate base cost adjustment claim and propose as an uncertainty mechanism.

2.1.4 Long term context (historic)

The investments included in this enhancement investment build upon our multi-AMP strategy to our smart meter rollout. The proposed investment in smart meters is in addition to those installed at AMP7. At PR19, our enhancement plan included the installation of smart meters at 1.1 million properties. We are currently on track to deliver these smart meter installations despite delays early in the AMP due to Covid-19 lockdowns and supply chain issues leading to smart meter chip shortages.

Our PR19 plan set out that this investment would deliver the first half of that smart meter rollout, and our PR24 plan delivers the second half. This will mean that after AMP8, we do not expect to require any additional enhancement allowance to upgrade basic meters to AMI meters. The map below shows our expected 2-AMP rollout plan. The benefits (including an 11 Ml/d reduction) that this 10 year plan delivers for our customers and region is set our in section 2 (scale and timing) above.

Figure 6 10 year smart meter roll-out (Planning Zone and Water Resource Zone)



2.1.5 Long term context (future)

We are committed to our SDS ambition to enable sustainable economic and housing growth within our region, of which metering forms a crucial way to achieve this. Our water resources LTDS sub strategy comprises a core pathway of low

regrets investment that enables us to achieve our ambition. Our AMP8 metering enhancement programme is low regret as it is an enabler for meeting our ambition for a full smart meter network by 2030 and long-term WRMP24/LTDS ambitions. As captured in our WRMP, demand management will be essential to ensure sufficient water supply whilst accommodating growth within our region. Without the demand management benefits associated with the our AMP8 metering programme, we will be unable to ensure supply in line with projected growth. Sufficient demand management is also essential to manage environment WFD deterioration risk, because it reduces the total volume of water we need to abstract. Our demand management strategy is subject to a cost-benefit test.[2]

Our AMP8 investment is low regret in all tested scenarios, and remains low regret if adverse abstractions or climate change alternative pathways are triggered. The improved capability of our smart metering network will play a crucial role in meeting our PCC, leakage and business demand long term targets, which underpins our WRMP and management of long term supply demand.[3]

2.1.6 Customer support

We have used a variety of engagement methods and audiences to understand customers' views on metering.

On the rollout of meters, our engagement has highlighted that:

- 80% of customers consider that people should be billed based on the amount of water they use;
- Across different audiences 70-87% of customers support universal or compulsory metering;
- 70% of customers feel prioritising demand management is key to maintaining future supplies, but 30% feel there's a limit to the amount of water customers are able to save. Many customers also feel that managing demand lies mainly in water companies' hands (e.g. to implement methods such as metering) and non-household customers particularly engage with solutions where water companies provide attractive incentives to reduce demand.

Regarding customer views on universal and compulsory metering, we recognise that we need to take into account the views of all customers, recognising that:

- We are already very close to our feasible maximum metering level;
- 90% of customers already have a meter and represent most of the customers within our engagement;
- Customers need to be treated as far as possible on the same billing basis;
- There will be some customers where billing based on usage would present significant affordability concerns.

On this basis, our plan increases the number of customers with a meter, but we have not opted for universal metering as part of our plan.

The most common feedback from customers is that they don't actually know how much water they are using (even though they may feel they watch their usage). This creates a gap in knowledge - there is a need first and foremost to inform them how much they use and how far off that is from what constitutes 'good' or 'efficient-enough' usage. Sending regular metrics on their exact usage (or estimated) compared to others in the area or to similar properties and households would help motivate customers to try to limit use.

On smart metering we have engaged with both our overall customer base and those who have a smart meter to inform the nature of the smart metering rollout. Most who have a non-smart 'visual read' meter state that being metered and measured was an influence in addressing and implementing changes in daily usage. Many feel they need a smart meter in their home to easily track usage and keep it more top of mind. Those with a smart meter say it has enabled their water bill to be reduced as they can easily view their usage.

Overall, our customers support the further rolling out of smart meters, to support the potential for them to reduce their bill as well as to allow them to do more to reduce demand and help support the supply-demand position of the region.

2.1.7 Cost control

Our smart metering investment is fundamentally driven by the supply-demand deficits reflected in our WRMP. These deficits are driven by several factors outside of management control including climate change and population growth. It is also driven by a number of statutory drivers which are outside of management control such as the environmental destination and 1-in-500 year drought requirements.

Our optioneering process has carefully considered the most cost effective way to deliver the demand management reduction required. This process is described in full in our 'Revised draft WRMP24 Demand management option appraisal technical supporting document' (Section 3).

Smart metering offers demand management alongside lasting benefits for customers through, for example, having greater control and visibility over their water usage, and the ability to detect customer side leaks early to limit the potential impact of leaks which go unspotted for a long period of time. There are significant synergies between leakage reduction, smart metering and water

2 https://www.anglianwater.co.uk/siteassets/household/about-us/wrmp/rdwrmp24-demand-management-preferred-plan-technical-supporting-document-.pdf
3 For more detail, please refer to section 2.2.2 'Water resources' in our LTDS.

efficiency activities, with smart metering playing a critical role in enabling other demand reduction activities (behavioural change, leakage identification). As part of our WRMP24 option appraisal programme we developed a number of portfolios in order to perform a cost/benefit and Economics of Balancing Supply and Demand (EBSD) analysis.

2.2 Unlocking greater value for customers, communities and the environment

2.2.1 Option consideration

Our metering investment is largely driven by the need to see greater demand reductions following the near universal rollout of basic meters in our region. This requires an investment plan which upgrades meters to allow demand to be reduced further and/or identify additional leakage. We also have the option to further rollout meters to the small minority of properties in our region which do not yet have a meter.

For upgrading meters we have had ongoing trials for over 6 years which have informed the costs and benefits of different options. We have also considered the relative merits of AMR and AMI meters. We have engaged with the market for smart meters to understand the range of potential options available to us. Each of these points are considered in turn below.

Trials

We undertook trials of different smart meters in AMP6 to inform our long-term approach to smart metering. 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.

These trials continue to inform our understanding of the long-term benefits that can derive from smart metering, complemented by the full roll out of smart meters to their respective Planning Zone (PZ) and Water Resource Zone (WRZ) areas.

In AMP6 we undertook two trials to help us determine which frequency of returned data provided the best cost benefit. The two trials were an AMR trial in Colchester and an AMI trial in Newmarket.

- Colchester - We installed 21,000 Automatic Meter Read (AMR) devices. We then trialled collecting data on a weekly basis by a 'mobile' network of passive readers fitted to council refuse lorries. Customers were given information on their consumption through a web portal. We quickly determined that data collection was infrequent via the refuse lorries as they were unable reliably to get close enough to the meters to passively collect the data. More importantly, weekly data did not deliver the anticipated level of benefit for our customers and for our network operations.
- Newmarket - In this area around 6,000 'Advanced Meter Infrastructure' (AMI) meters were installed in four DMAs (District Metering Areas). This trial involved replacing all the existing meters within each DMA at the same time. We explored whether it was more efficient to replace the meter or retrofit the existing meter to upgrade it to an AMI meter. We quickly determined that it was more efficient, both in terms of time and ease of installation as well as from a whole life cost perspective, to replace the meter.
- Norwich - This was 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. We undertook this trial to validate the findings from the trial in Newmarket. This trial confirmed our initial findings.

Retrofitting would create a future where we would actually visit the property more frequently to replace the meter or AMI transmitter, greatly increasing our maintenance costs. It also took significantly longer to retrofit the equipment as opposed to replacing the meter.

For both of these trials we then undertook different customer engagement strategies aimed at measuring the respective reductions in demand delivered through behaviour change and customer side leakage reduction.

From this we concluded that hourly data, in near real time, delivers the biggest demand reductions. To maintain this, data reliability is essential. Delivering regular hourly data is critical in enabling customers to understand their water use.

AMR v AMI

Building on our previous learning and industry precedent, we have selected AMI as the most appropriate solution for our smart metering rollout. We found in our AMP7 AMR trials in Colchester that around 50% of meters were read every week and 75% were read every four weeks. These results did not give us confidence that we could use this method of data retrieval for our customers. It would not be able to meet the customer expectation of a regular and reliable reading. Even if the data were reliable and comprehensive, the data cannot be used to track down leaks on the network which would require more frequent meter readings

Advanced Metering Infrastructure (AMI) 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.

Figure 7 Smart meter technologies - trialling

AMI technology (as tested in our Newmarket/Norwich trials) allows hourly (or 15 minute for larger customers) readings from the customer meter. These multiple reads (and data redundancy) are key to ensuring data accuracy and consistency, as the data is processed and analysed. This frequency and quality of data increases the ability of the customer to understand their usage and the impacts of changes in their behaviour by giving them the ability to match water use to specific activities, as well as providing them the ability to identify leaks in the home and in supply pipes which would not necessarily be the case where an AMR meter is used.

Thus, in line with our AMP7 smart meter rollout and AID investment, we will install AMI meters (monitored through a fixed network) to provide detailed granular daily usage data to our customers and for ourselves.

AMI options

Once we had determined that an AMI smart meter solution was most appropriate, we considered different options and different suppliers for the delivery of the AMI solution.

As part of the work we undertook in developing our WRMP in 2019 we considered a number of different delivery models for AMI metering. Our meter penetration was circa 90% so we knew that meter replacement, not new meter installation, would be the main opportunity for us to install an AMI meter. We would be upgrading our customers' meters as opposed to installing a meter for the first time.

The first option we considered was whether it was better to upgrade existing meters at the end of their life or whether it was better to upgrade all the meters in an area at the same time, irrespective of their age. Historically, most of our meter installation had been customer driven through our Meter Option programmes and growth in new housing. We had previously also undertaken some compulsory metering through our Enhanced Metering programme but this was at much smaller volumes and had tended to be in smaller areas with historic lower meter penetration.

We have opted for a whole area delivery model. The trials in Norwich and Newmarket had shown that upgrading all of our meters in one location at the same time was most beneficial for a number of reasons. Only upgrading meters at the end of their life would:

- see us return to the same area in every AMP creating operational inefficiencies
- only be able to engage with customers once their meter was upgraded, denying some customers the chance to make changes for a number of years.
- limit our ability to engage effectively with the wider community
- restrict the operational benefits we would be able to realise in terms of effective leakage and network operations
- require a suitable network installed across our whole region in AMP7 to ensure we can receive data from the upgraded meters.

We then considered the speed of the rollout and included 10 year (2-AMP) and 15 year (3-AMP) options within the development work for our WRMP.

This running order of PZs was then delivered over either 10 or 15 years depending on the option. Both would see us upgrade all existing meters (Household and Non-household) at the same time as well as ensuring an AMI meter was installed on any new installations. The running order considered the operational resources we would need to upgrade the meters and was designed to keep these resources actively employed for the duration of the rollout, removing the need for expensive periods of recruitment over the 10 or 15 years.

2.2.2 Cost-benefit appraisal

We have undertaken a robust cost-benefit appraisal process on the options set out above to arrive at the proposed approach in this plan. To support the delivery of our AMP7 smart meter programme we undertook an integrated smart meter, data and AMI network procurement exercise. We invited companies to create partnerships where necessary and then bid for the supply of the smart meter alongside the provision of the smart meter data for the life of the meter (15 years) via an AMI network. We assessed the bids across a range of criteria; we initially assessed each bid's ability to meet our technical requirements such as life of the meter, ability to provide hourly data, manufacturing capacity etc, alongside their network technology. In addition, we wanted to assess the installation of the meter to ensure it was compatible with our existing meter estate. We did not prescribe

a specific technology or meter, we wanted to assess each bid on its own merits and understand how each bidder would deliver their solution to meet our requirements. We also asked for case studies which we could reference to demonstrate where their respective solutions have been installed previously.

Based on the above we selected four bids from an initial 27 applicants and asked them to provide a detailed rollout plan for our programme together with the costs to supply the smart meters, build and maintain an AMI network and provide us with smart meter data for 15 years. We then assessed the rollout plan and costs to assess which submission met our requirements for the best cost.

Extracting the best value out of data

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.

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.

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 in order to minimise risks in terms of the quality of data and minimise 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).

For the purposes of our cost benefit analysis, we have assumed that the same or similar technology as is currently being implemented for our company wide roll-out is to be utilised. We have, therefore, used data from the current smart meter roll-out to inform our analysis, with regard to both costs and demand reduction savings. Further detail can be found in our 'Revised draft WRMP24 demand management preferred plan technical supporting document' and 'Revised draft WRMP24 demand management option appraisal technical supporting document'

Scheme out-turn costs from AMP7 have been used to develop all the options, including all costs for below ground meter installation, internal installation, customer contacts and data systems. Estimates for the cost of the communications network have been provided by our chosen partners for our current smart meter rollout. These costs have been developed to reflect our future annual rollout plans.

2.2.3 Environmental and social value

Our value framework

We have considered the environmental and social value of our metering investments as part of our options consideration process.[4]

Having completed 50% of the smart metering roll out in AMP7, we are in a strong position to understand the holistic benefits and challenges associated with smart metering. This learning has fed our WRMP in terms of benefits realisation which we have included as part of our PR24 investment.

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

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

To ensure we developed the right solution for our region's water needs, we have focussed on 'best value'. This looks beyond costs and seeking to deliver a benefit to customers and society, as well as the environment, whilst listening and acting on the views of our customers and stakeholders.

Carbon impact

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

4 For more information on our value framework see chapter 7 Driving cost efficiency in our plan 2025-2030

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

The carbon impacts of the options we have considered are set out in 'Revised draft WRMP24 demand management option appraisal, section 8.6' of our WRMP24.

Natural capital and other benefits

By helping to enable demand reductions, smart meters provide significant environmental benefits. In particular they are mitigating demandncreases attributable to growth (due to the anticipated population increase of 911K by 2050), reducing the amount of water abstracted from the environment and potentially off-setting the need for additional supply side investments (which often have larger environmental impacts and costs). Additionally, in mitigating demand, smart metering and our new methods of engagement, will help improve the resilience of our services to extreme events.

There is also great potential for smart metering to encourage customer engagement, making them part of the 'water saving' journey, and allowing us to produce an individually tailored service. Moving from estimated bills, or annual meter reading, to more accurate and timely consumption and billing information will assist our customers to understand their water usage (as well as helping to identify leaks). By providing more online functionality, we are enabling customers' access to a more modern service, which is in line with current digital expectations. Additionally, the data which is now becoming available from smart metering is providing 'peace of mind' for customers, as they can be confident that the meter is recording consumption hour by hour and that any leaks will be identified in a timely manner.

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

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

2.2.4 Investment benefits

The central imperative driving our smart meter roll-out, is the provision of information for our customers, so that they, can understand their consumption and help encourage behavioural change. 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 savings captured in the table below. This excludes savings from the AMP7 smart meters, which are now considered as part of the base-line forecast.

Table 5 End of AMP8 potential water savings from smart meters and associated behavioural change and leakage improvements

Behavioural change demand savings	Savings from plumbing loss reductions	Reductions in customer supply pipe losses (CSPL)	Total savings
5.3Ml/d	8.8Ml/d	Ip to a 4.0Ml/d	Approx 18.1 Ml/d

By 2050, we estimate smart meters will result in 7.7Ml/d from behavioural change demand savings, 16.6Ml/d savings from plumbing loss reductions and up to a 7.7Ml/d from reductions in CSPL (a total of 31.9Ml/d). Overall, it is expected that smart meters will reduce CSPL by 70% as we achieve full roll-out.

We have accounted for this benefit when calibrating our PCC performance commitment PCLs for the 2025-30 price control period. For more detail please refer to the PCC PC narrative in the OUT table commentary.

Our assumptions regarding reductions in customer usage have been informed by previous experiences of metering programmes in the UK (including our AMP7 rollout), data from our Newmarket/Norwich trials and the experience to date from

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

2.2.5 Managing uncertainty

We have been able to learn significantly from our AMP7 experience about the uncertainties of costs and benefits associated with smart metering rollouts. There are investment benefits from using a modular solution rolled out on a geographical basis. Rolling out smart meters in this way maximises the utilisation of the data network in the rollout areas and means that customers can see the benefits of having a meter installed sooner than if a less modular solution was used.

For costs, we anticipate the major uncertainties to be the impact of competition and supply chains on smart meter availability. Early in AMP7 we experienced significant delays in the rollout of smart meters initially due to the impact of Covid-19 lockdowns, and subsequently due to the global micro chip shortage which meant that smart meters could not be supplied to us at the rate we had anticipated. The shortage of micro chips was caused by the supply chain being impacted by the Covid-19 global pandemic which saw the supply of both the raw materials and the manufactured components being disrupted by local lock downs and changes in workforce availability. This has now stabilised and we now have a more stable supply chain.

However, we may still see shortages going forward due to the increase in demand that we expect to see for smart meters, driven by the wider rollout of smart metering across the industry. To mitigate this we have worked with our meter supply chain to ensure we continue to receive the required volume of meters and with the wider sector in sharing the collective industry ask for smart meters in AMP8.

On the certainty of benefits, ultimately the level of leakage and demand reduction benefits we have set out are estimates based on the best available data we have. As we are one of the first companies to be rolling out smart meters at a large scale we face additional uncertainty to those companies that will follow as we have less data available from previous rollouts and information on lessons learned. The benefits that we have set out on leakage and per capita consumption are both reflected in common performance commitments and ODIs. This means that should the benefits be less than we have assumed, this will be reflected in ODI performance penalties. If the benefits are greater, then customers will experience the greater benefits, and this will also be reflected in ODI rewards (or reduced penalties).

2.2.6 External funding

Where within our control, we have sought to ensure that the costs of our smart metering programme are reflected where the benefit is seen. As set out above, the benefits of the smart meter rollout are many; much of the benefit (and the main driver for us in rolling out smart meters) is the supply-demand benefit which their installation and the data from them enables. By its nature, metering customers allows individual benefit to be tied to individual cost through the impact of reducing personal consumption on bills. Smart meters enable additional funding to reduce demand other than through customer bills by exposing leaks on customer supply pipes. As these pipes are privately owned, we actively support customers in raising awareness of these leaks and helping customers to identify how these leaks can be resolved privately. However, the affected customers pay for the leak to be repaired. Collectively, these activities help to ensure that the relevant parties fund the appropriate activities to reduce demand.

2.2.7 Direct procurement

On the basis of Ofwat's guidance that large programmes of small, low value assets would not be appropriate for delivery through DPC, we do not consider the smart metering programmes to be suitable for delivery through DPC.

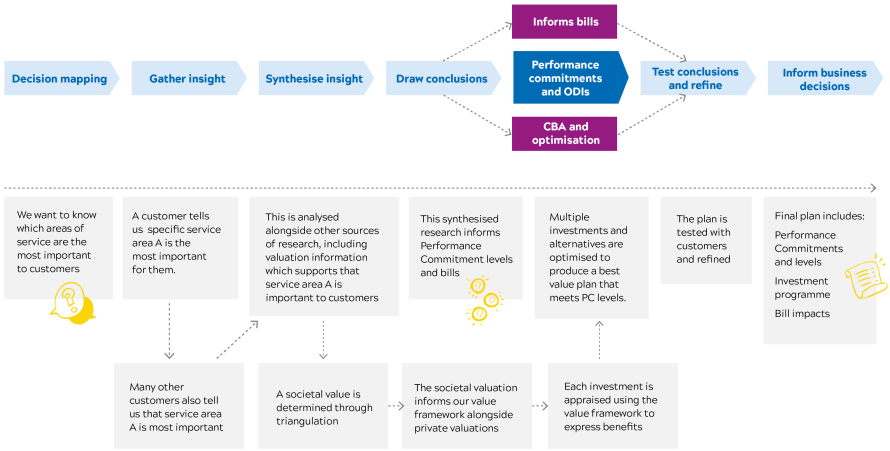
2.2.8 Customer view

Given the scale of the challenges that we anticipate, we have actively collaborated and engaged extensively during the development of our revised draft WRMP24.

- 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.[5]

5 For more information on customer insight see chapter 3 Customer engagement in our plan 2025-2030

Figure 8 How customer insight fits into our business planning process



Customers have shown that they are supportive of our smart metering rollout to help them save water.

LARS (Licensed Abstraction Reporting System) meters

Separate to the smart metering rollout programme, we have also included investment in our plan on LARS meters.

Historically LARS Meter tolerance has been 5% according to the Environment Agency (EA) good metering practice manual. However, an Abstraction Compliance metric will be introduced into the Environmental Performance Assessment (EPA) from April 2023 which will reduce tolerance to 3%. If the EA identified during an audit that our meters were out of tolerance, they would record a breach of our Abstraction Licences and impact our EPA score. Therefore, investment is needed in AMP8 to ensure Anglian Water complies with the regulatory requirements and to prevent deterioration in the EPA score.

During AMP7, the maintenance of LARS meters was covered by maintenance of approximately £300k per year. This was covered by maintenance expenditure because it is the result of existing legislation. There is now an enhancement investment programme for AMP8 to cover the impacts of new legislation and a second programme for the continuation of the maintenance spend to cover any actions not generated because of the new legislation (for which we are not requesting enhancement expenditure).

The options considered for this programme are any that will comply with the regulatory requirements of operability and accuracy. The sites selected are those that do not currently comply with the new legislation. There are three elements to the enhancement programme for LARS meters:

- LARS Meters outside of 3% Accuracy - 75 Sites for investigation and replacement as required.
- Upgrading LARS Meters to comply with the new legislative requirements. - 152 meters.
- Broken Compensation LARS Meters - 14 meters
    - Scole - (River Waveney)
    - Laceby STW - (Laceby Beck)
    - Barnoldby borehole 2 - (River Freshney)
    - Debenham STW- (River Deben)
    - Dunston Common - Stoke Holy Cross - (River Tas)
    - Houghton borehole 3 - (River Stiffkey)
    - Gt Yeldham - (River Colne)
    - Balkerne - (River Colne)
    - Aldham - (River Colne)
    - Coldham Hall - (Ditch system adjacent to River Bure)
    - Cley Hall Farm borehole - (Cley Hall Marshes)
    - Bowthorpe borehole 1 - (West Earlham & Bowthorpe Marshes)
    - Bures Road - (Cornard Mere)
    - Cut-Off Channel - (River Wissy)

The cost of a meter is primarily dependant upon the meter size.

2.3 Cost efficiency

2.3.1 Developing costs

The development of the metering costs in our plan follows our cost efficiency 'double lock' approach set out in chapter 7 in our business. plan. Through this approach we have ensured that are costs are efficient in their bottom-up build up, and this is cross-checked through external benchmark approaches. This section sets out how we have ensured cost efficiency of our metering investments through step one of our double lock approach. Step 2 is explored in Section 7.1 of chapter 7 of our business plan.

We have taken a robust approach to developing our metering costs, building on our experience of delivering similar schemes into the bottom-up development of costs (before external cost benchmarking challenges are applied in step 2 of our 'double-lock' approach). The detail of the cost development approach is set out below, along with a breakdown of costs we provide in table CW3.

Cost estimation methodology

Detailed analysis has been carried out with regard to each element of the meter rollout programme. The costs for each element of the smart metering programme reflect:

- PMX - Proactive replacement of meters as they reach the end of their life with new Smart Meters based upon geographical roll out
- Early PMX - Proactive replacement of meters which have not reached the end of their life with new Smart Meters based upon geographical roll out
- RMX - Reactive replacement of meters. Meters which have malfunctioned and are replaced with a new smart meter
- Meter Options - Customer driven smart meter installation programme at the request of customers who do not currently have a meter.
- Selective - Company driven smart meter installation programme at properties where the current method of charging is not appropriate (e.g. the Rateable Value no longer valid)
- Enhanced Metering - Company-driven smart metering installation programme at unmeasured properties. The customer then has the option to switch to measured charges.

In the table below we have provided the full breakdown of the forecast number of installations in each programme type. In order to ensure economies of scale in the estimation of each programme cost we have considered the total number of meters to be installed as part of our unit cost consideration.

Table 6 Customer meter type, volume, and costs

			Installation type (volume)										
Enhancement Metering activities	Investment Name	Scope	Carriageway	Footway	Internal	Screw Fit	Unmade	Other	AMP7 CAPEX (£m)	AMP8 CAPEX (£m)	AMP8 OPEX (£m) (25-30)	AMP7 BASE (£m)	AMP8 BASE (£m)	AMP8 Base & Enhancement TOTEX (£m)
New Meter Installations	Meter Option Smart Meters	Installation of option meters	118	2,464	14,738	7,764	2,346			9.86				9.86
	Selective Smart Meters	Installation of Selective meters	5	15	120	1,072	75			0.22				0.22
	Hartlepool Meter Option	Installation of Option meters in the Hartlepool area	102	1,864	371	543	508			0.84			0.99	1.83
	Hartlepool Selective	Installation of Selective meters in the Hartlepool area	4	88	16	25	25			0.07				0.07
	Hartlepool Enhanced Metering	Installation of Enhanced meters in the Hartlepool area	304	6,086	5,782	761	2,282			7.76				7.76

			Installation type (volume)											
Enhancement Metering activities	Investment Name	Scope	Carriageway	Footway	Internal	Screw Fit	Unmade	Other	AMP7 CAPEX (£m)	AMP8 CAPEX (£m)	AMP8 OPEX (£m) (25-30)	AMP7 BASE (£m)	AMP8 BASE (£m)	AMP8 Base & Enhancement TOTEX (£m)
Renewals of basic meters to smart meters	Hartlepool RMX	RMX smart meter installation	5	80	525	675	80	30		0.04			0.39	0.44
	Reactive Meter Exchange Smart Meters	Reactive smart meter installations	365	4,180	48,315	68,210	3,255	670		2.03			32.83	34.86
	Proactive Meter Exchange Smart Meters	Installation of Proactive meters	170	5,090	66,930	464,605	3,470		3.56	30.78		4.18	36.13	74.66
	PMX Early Start Smart Meters	Installation of PMX Early Start meters	30	585	50,515	355,973	275			31.61			22.64	54.25
	Customer Side Leak Investigation	Identification of customer side leakage	-	-	-	-					0.74		1.53	2.27
Data Storage	AMP8 Smart Meter Network	Data Storage roll out	-	-	-	-				23.35				23.35
Data Storage	AMP8 Smart Meter Data	Data Storage management	-	-	-	-					22.70			22.70
	Total	-	1,103	20,452	187,312	899,628	12,316	700	3.56	106.57	23.43	4.18	94.52	236.44

The table below shows how the overall unit rate for each installation type. The unit rate for renewals includes the overall efficiency achieved by estimating the full programme, including replacement.

The unit cost of the metering programme is mainly driven by the volume to be delivered of each type of installation under each programme. Owing to the high metering penetration, the overall unit rate for new meter installations is higher than the rate for the renewal programme. This is because it includes a higher proportion of internal and footwayinstallations while the renewal programme includes more of the cheaper screw fit type of installation.

Table 7 PR24 Overall unit rate per installation type

New Meter Installations					Renewals of basic meters to smart meters			
Installation type	volume	% volume	Total cost £m	PR24 Overall Unit Rate	volume	% volume	Total costs £m	PR24 Overall Unit rate
Carriageway	533	1.12%	0.46	858	570	0.05%	0.57	1007
Footway	10,517	22.15%	6.51	619	9,935	0.93%	6.94	699
Internal	21,027	44.29%	7.65	364	166,285	15.48%	44.16	266
Screw Fit	10,165	21.41%	1.56	153	889,463	82.82%	108.05	121
Unmade	5,236	11.03%	2.58	492	7,080	0.66%	3.87	546
Other					700	0.07%	0.62	883
Total	47,478	100%	18.76	395	1,074,033	100%	164	153

Table 8 Licensed Abstraction Rates (LARS) Meters

Investment ID	Investment Name	Scope	AMP8 Capital Cost £m)	OPEX Cost £m (25-30)
I034731	LARS Meters - Tolerance Non-Compliance pt 1	Lar Meter investigation out of tolerance	-	0.271
I034845	LARS Meters - Tolerance Non-Compliance pt 2	88 Lar Meter Replacements (150-1200 mm)	0.784	0
I039129	Abstraction Licences to EPR - Upgrades	152 Lar Meter upgrades (150-1200 mm)	1.256	0.113
I039190	Treated Water Dist.-Expansion of Res Act	Increased Inspections of 38 Reservoirs	0.813	0.024
I039197	WR/Raw W Storage -Expansion of Res Act	Increased Inspections of 2 Reservoirs	0.567	0.013
	Total		3.420	0.420

2.3.2 Benchmarking

In stage 2 of our cost efficiency 'double-lock' on metering, we used a variety of methods to assess, benchmark and challenge the costs in our plan. The benchmarking has focussed on using the available Ofwat data and models on meter renewals and installations. For the data network we have utilised market testing to build competitive costs into our plan.

Ofwat cost data and models

Since PR19, there has been a significant increase in the availability of comparative cost data on metering and smart metering including through the additional data collections requested by Ofwat, as well as market data from our AMP7 rollout and the competitive tender process that this involved.

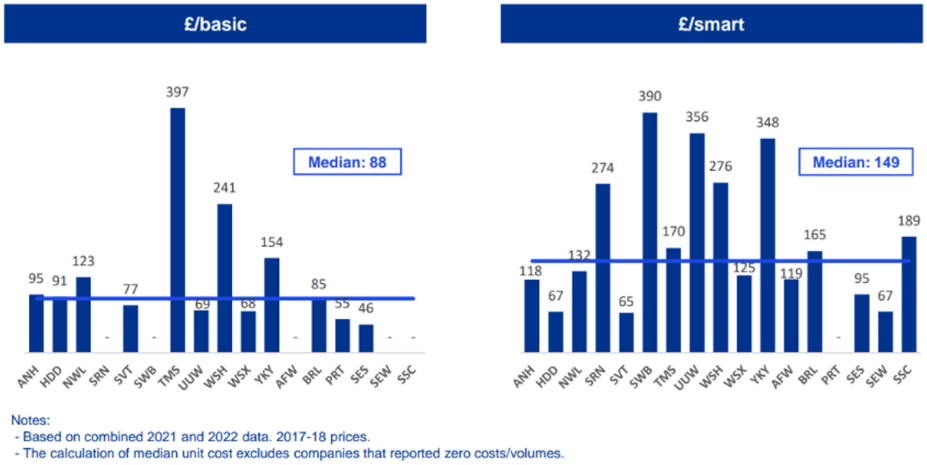
To support the understanding of the efficiency of our costs we have worked with KPMG to analyse this cost data to arrive at estimated efficient cost assumptions for smart meter rollouts and basic meter installations.

Meter Renewals

For upgrading meters to smart meters the benchmark we have used indicates and a median industry unit cost benchmark of £176 per visual-read meter replaced with a smart meter, and £72 for just the uplift component of this.

This has been derived from the additional data on meter and smart meter renewal costs from the APRs for 2020/21 and 2021/22. The charts below show the industry unit costs for replacing a visual read (basic) meter like-for-like (£88 in 2017/18 price base), and with a smart meter (£149 in 2017/18 price base). The median benchmark for the 'uplift' component is therefore £61 in 2017/18 price base. Converted into 2022/23 price base, this is £72 uplift per meter.[6]

Figure 9 Basic and smart meter comparison



The table below summarises the findings of this benchmarking when converted to 2022/23 price base. The unit costs we have included in our plan are lower than the median benchmark for both the overall rate (including base costs) and for the uplift component (enhancement) only.

Table 9 Summary of benchmarking findings converted to 22/23 price base

	Benchmark (£) (2017/18 price base)	Benchmark (£) (2022/23 price base)	Unit rate in our plan (£) (2022/23 price base)
Replacement of visual read meter with an AMI smart meter (total unit cost) (£/meter)	149	176	153 [7]
Replacement of visual read meter with an AMI smart meter (uplift cost only) (£/meter)	61	72	63 [8]

New meter installations

For new meter installations, we found the most reliable approach to benchmarking was to utilise the PR19 metering models with updated outturn data up to 2021/22. The results of these models showed an increase in costs compared to the PR19 allowances which was larger at smaller volumes and reduced as installation volumes increased. We have assumed that as at PR19, Ofwat will treat all installations (whether basic, AMR or AMI) the same in this approach. This analysis is shown in the chart and table below:

6 We note that in this analysis, our AMI installations have a smaller uplift differential with our basic meter replacements. This is because our smart meter replacements are predominantly made up of cheaper screw-fit installations. Our basic meter installations include many more of the more expensive installation types meaning that the respective unit costs are skewed.

7 total cost of replacing meter with an AMI meter (£164m) divided by the total number of meters to be replaced (1,074,033))

8 enhancement cost only of replacing visual read meters with smart meters (£68m) divided by the total number of meters to be replaced (1,074,033))

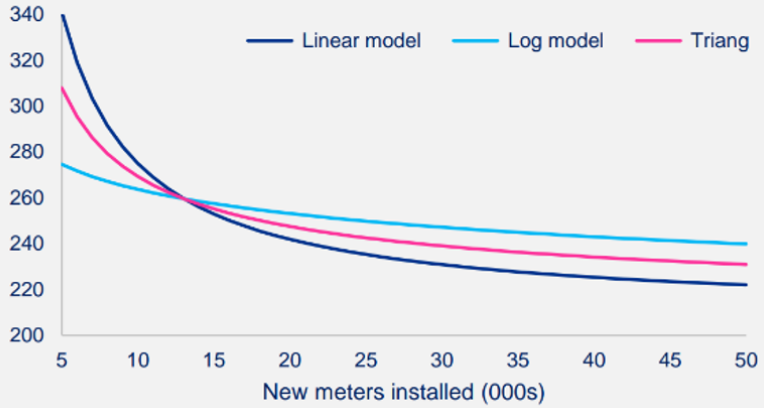
Figure 10 Meter benchmarking

All prices are in 2017-18 CPIH real.

Benchmarks for new meter installations

Benchmarks for new installation are **the same for all meters**: basic, smart, residential and business.

New meters (000s/year)	Total cost (£m)	Unit cost (£/meter)
10	21.5	269
20	39.6	247
30	57.3	239
40	74.9	234



Our average annual meter installation is forecast to be 9,500 units per year. The above graph shows an average overall benchmarking unit rate of £270-£280/meter (2017/2018 prices). This equates to £319-£331/meter in 2022/23 price base.

Our new meter installation programme assumes 47,478 new meter installations at existing properties (meter optants, selective and enhanced installations), with an average unit rate of £395/meter. We note that this unit rate is greater than the industry benchmark and considered whether factors other than cost efficiency could explain this variance. As highlighted in table 8 above, new meter installations consist of a much higher proportion of footway and internal installations than is typical (where the majority of installations are cheaper screw-fits). Given that the unit costs for footway and internal installations (£619 and £364 respectively) are much greater than those for screw-fit installations (£153) we consider that it is this, rather than genuine cost efficiency that explains the difference between our new installation unit cost and the industry benchmark.

Market testing of costs:Fixed data network

We have now undertaken two separate procurement exercises for the provision of smart meter data. The most recent exercise was completed in April 2023. Both procurements include the provision of the data for an AMI network as well as the supply of smart meters. We have used the costs from these as the basis for our AMP8 investments.

Based on the benchmarking activities carried out across our smart metering programme (renewals, fixed data network and new installations) we have confidence that the costs included in our plan for the smart metering programme are efficient.

2.3.3 Assurance

The build-up of costs in our cost estimation tool (C55) has been assured by Jacobs, and our cost benchmarking has been carried out independently by KPMG.

2.4 Customer protection

Customers are protected through the following mechanisms should the investment in this area be cancelled, delayed or reduced in scope:

- Underperformance payment under the leakage, per capita consumption and business demand common PCs
- The smart metering price control deliverable, which will return funding to customers if meters are not delivered.

3 Leakage improvements

Overview

- Reducing leakage is particularly important to us, both to maintain a resilient supply-demand balance in the driest part fo the country (in line with our WRMP) and to enable sustainable economic and housing growth in our region by balancing the increased demand that comes from this growth.
- Leakage is a particular concern for our customers, who see it as wasteful and a sign that we are not doing enough to conserve water and invest in infrastructure. This can be a strong disincentive for customers to adopt more water efficient behaviours. Customers also often associate leaks with service interruptions. However, our leakage performance is currently industry leading. We have cut leakage by more than a third since privatisation in 1989 and it is now at very low levels; around half the national average based on the amount of water lost per kilometre of main.
- Leakage has continued to fall from 191Ml/d at the end of AMP6, to an Anglian record low in 2021/22 of 173.44Ml/d. Leakage for 2022/23 increased to 182.6Ml/d, reflecting the challenges we faced due to the extreme summer heat (>40◦C) and multiple winter freeze/thaw events. However, underlying leakage (3-year rolling) is at a record low.
- Nonetheless, we want to go even further in reducing leakage, especially when reducing leakage is such an important issue for our customers and so vital for us in this dry part of the country. Additionally, we have considered the wider national context and consultation responses for our revised draft WRMP24.
- Consequently:
  - We are a frontier performer (already at Public Interest Commitment 2030 level)
  - We expect to achieve the National Framework target for 2050 before 2030.

Table 10 Investment Summary

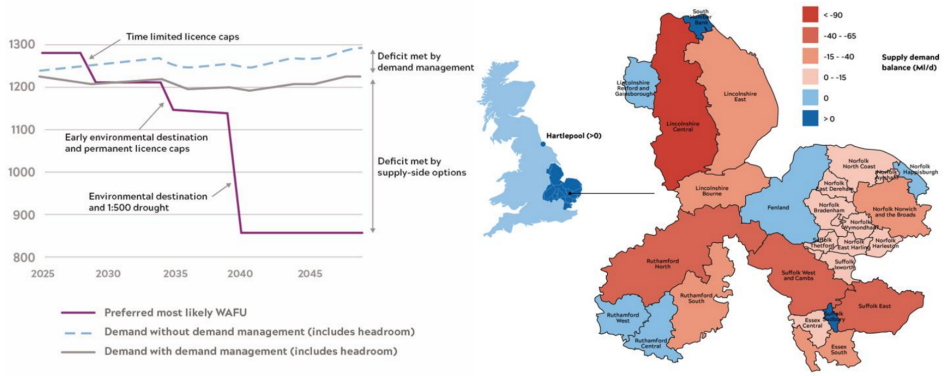
PR24 costs (£m)	
Capex	31.5
Opex	3.4
Totex	34.9
Benchmarking	
Method	Scheme outturn costs Ofwat data and cost models Industry cost models from TR61
Findings	Benchmarking showed our costs to be more efficient than the industry benchmarks (mains renewal). Where costs are higher than the benchmark (shared supply smart metering) the differential can be explained by exogenous factors.
Customer Protection	
Performance commitment	Leakage
Ofwat data table	
CW3.47-CW3.49	Leakage improvements delivering benefits in 2025-2030

3.1 Delivering for the long term

3.1.1 Investment context

Our leakage enhancement investment fully aligns to our WRMP. Our WRMP sets out the need for investment to resolve the supply-demand deficits which we see both over the 25 year and the 5-year time horizon. Maintaining a frontier position in leakage is integral to our demand management strategy alongside working with our customers to reduce consumption and wastage supported by our smart meter rollout.

Figure 11 Our supply demand balance in 2050 without intervention and its impact at WRZ level



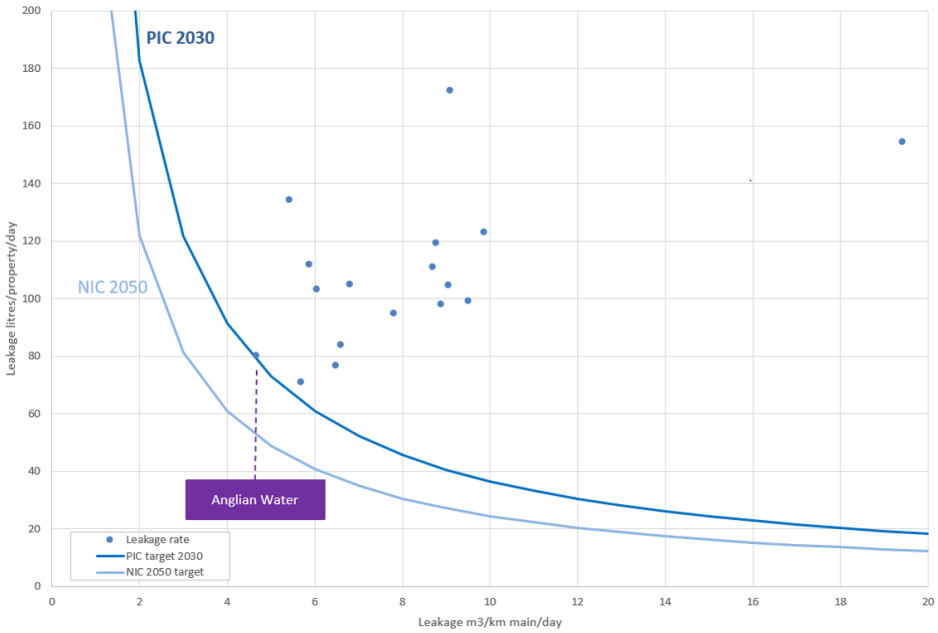
3.1.2 Scale and timing

The scale and timing of our leakage enhancement investment is fully aligned with our WRMP. The scale and timing of investment has been refined by striking the right balance between supply, demand, interconnectors and other options, informed by customer views and the financial, environmental and social costs and benefits of these options. In the short term (before 2030) we face an immediate supply-demand deficit challenge for which we are reliant upon demand side (and limited supply-side) options which can deliver more immediate benefit than major supply-side schemes which require a long lead-in time.

The leakage reduction in the plan has been set in the context of the long-term need to reduce leakage by 28% over the WRMP24 25 year plan period. This represents a 38% reduction from the National Framework 2017/18 base-line.

As a frontier performer on leakage, we have fewer low-cost options to reduce leakage available to us than other companies. Our current performance is already beyond the Public Interest Commitment target for 2030, and with the investments included in our PR24 plan, we expect to cross the industry-wide 2050 target before 2030.

Figure 12 Relative company positions with regard to PIC/NIC targets (expressed as attainment curves)



Given our relative position in the industry, we have not made an assumption of a 50% reduction in our own leakage level from the 2017/18 baseline by 2050. The overall target of a 50% reduction nationally should not necessarily mean a 50% reduction in each individual company area, rather leakage reduction should be prioritised where leakage is highest and/or reductions can be achieved at the lowest unit cost. We utilise a range of advanced technologies to achieve our frontier position, including extensive pressure management, acoustic sensors and high frequency pressure monitoring. We have already reduced leakage by 40% since 1990 and our ambition is to reduce leakage by 50% from 1998/99 levels to 2050. Further details regarding this assessment can be found in the 'Revised draft WRMP24 demand management preferred plan technical supporting document, Section 8.2'.

3.1.3 Interaction with base expenditure

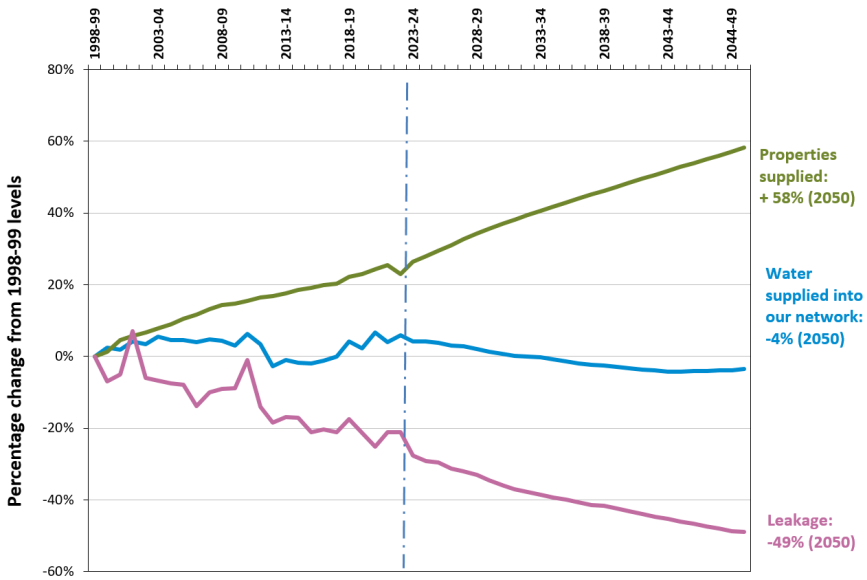
Our enhancement allowance will facilitate the additional activities required to help us reduce leakage in AMP8 beyond the level that we will achieve in AMP7. This contrasts with the activities delivered from base allowances which are focussed on maintaining the level of leakage that customers already experience. As a frontier company on leakage performance, following the approach taken at PR19 and the conclusions drawn by both Ofwat and the CMA, we have assumed there is no incremental performance improvement within our base allowance.

The base allowance included in our plan for leakage includes that which is implicit from the base models, plus a base cost adjustment claim to reflect the additional costs of maintaining leakage at our industry leading level. To ensure that this cost adjustment claim does not overlap with either the implicit base allowance or enhancement, it was informed only by the base costs (not enhancement costs) provided by companies to Ofwat and is based on a symmetric adjustment around Ofwat's implicit allowance.

3.1.4 Long term context (historic)

As set out in our WRMP, the nature of our region means we there is a particular need for us to conserve water and drive demand management approaches. We have a strong track record on leakage reduction going back decades (see chart below showing leakage performance since 1998/99) and have the lowest leakage per km of main in the industry (see chart of industry performance in section 3.1.2).

Figure 13 Water delivered, population growth and leakage (historic and future)



When looking to the enhancement allowance required to reduce leakage levels further, we have focussed solely on those additional activities in AMP8 which will allow us to reach lower levels of leakage than we will reach in AMP7. The activities we expect to deliver through enhancement are separate to the activities we were funded for through base and enhancement allowances in AMP7. In the event that we do not deliver on the activities we were funded to achieve in AMP7, we will return this to customers through the leakage outcome delivery incentive which incorporates the PR19 allowance for leakage [9]. This essentially removes any risk of duplication of enhancement funding.

The additional base allowance we were granted at PR19 was to maintain leakage at frontier levels. It is evident that there will be no duplication of this allowance through leakage enhancement because our performance in AMP7 has shown that we have maintained our AMP6 performance and enhancement allowances have built upon this performance.

9 It should be noted that a penalty may also apply where we have delivered on the PR19 investment in full but underperformed against the performance commitment due to factors outside of our control, such as severe weather.

3.1.5 Long term context (future)

We are committed to our SDS ambition of enabling sustainable economic and housing growth. Our LTDS water resources sub strategy sets out how we will achieve this ambition through progressive efforts and investment timed over multiple AMPs.

Our AMP8 leakage investments are low regret as they form part of this integrated multi-AMP strategy to reducing leakage to maintain the supply-demand balance as identified in the water resources sub strategy. These investments will be beneficial for supply-demand balance and remain low regret even if alternative pathways are triggered. Types of strategic interventions we have considered for future AMPs include additional leakage detection and repair. Although we are already the best in the industry at managing leakage, we know we can always do more; however, we need to ensure it is good value for customers to pursue leaks as the volume of water lost to leakage continues to decline. Our AMP8 investment doesn't preclude this opportunity if pursued in later AMPs.[10]

3.1.6 Customer support

As part of the engagement with our online community, we asked 118 customers to tell us their thoughts on whether we should continue to drive down leakage in WRMP24, and if so, whether there should be a stopping point on driving down leakage. Around 70% of customers in this engagement felt that we should continue to drive down leakage although most are aware there is a limit to what we can do and there is a point at which it is no longer viable to reduce leaks. This point comes when it becomes financially unviable to fund methods of reducing leaks.

> *"Leakage prevention/stoppage has to be AW's prime target in reducing this wastage. It will never be possible to reduce this to zero, but the work should continue until the cost of it and the savings made come into balance"*. - Comfortable and Caring

Whilst technically this would support reaching the sustainable economic level of leakage, we have gone further than this given the importance of reducing leakage in securing the supply-demand balance in the Anglian region. We have aligned our investment with the principle of ensuring that we should look to reduce leakage even further whilst also ensuring that the supply-demand balance is maintained in a way which provides value for money. We are particularly mindful of this given that we are the frontier performer on leakage and further reductions are likely to come at a unit cost higher than companies which are performing at higher leakage levels.

We have also engaged with retailers and non-household customers through multiple iterations of research conducted by Blue Marble in association with Water Resources East (WRE). This engagement highlighted their support for water efficiency and leakage reduction to 'play their part' in using less water with our assistance to help deliver this.

As a result of this, we have designed an initial assessment of smart meter identified leakage reduction for non-household and WEF water efficiency audits.

3.1.7 Cost control

The driver for leakage reduction is the supply-demand balance of our region, which is based on factors such as abstraction licence reductions, growth and climate change which are outside of management control.

We have taken a twin track and long-term approach to consider the most appropriate and cost effective measures to ensure security of supply across our region. This means balancing investment in leakage with other areas of demand management, interconnectors and supply-side options.

We have also driven the frontier leakage position over multiple AMPs. In doing so, we have made sure to prioritise the leakage reduction activities which offer best value to customers first, before moving on to alternative options which are more uncertain and/or have a higher unit cost (the detail of this is set out in Section 3.2). Alongside this, we have continuously driven and supported innovation in leakage to expand the range of options available to ourselves and other companies in future. An example of this is where we have worked with our supplier to minimise installation costs for our network of fixed hydrophones. Initially we had to install the equipment in dedicated new boundary boxes which was expensive and time consuming to do. We worked with the supplier to design a smaller variant of the equipment that fits in an existing boundary box between the meter and the valve, thus avoiding the need for additional infrastructure to be created.

3.2 Unlocking greater value for customers, communities and the environment

3.2.1 Option consideration

We have assessed a wide range of options, as we have considered how to drive the leakage frontier down even further. We have employed a wide variety of options in the past which has helped us to reach our leading level of leakage performance. This gives us a lot of experience with different options, but also limits the number of remaining options available to us as many options have already delivered the maximum feasible level of leakage reduction we could get from them. The table

10 Please refer to Section 2.2.2. 'Water resources' in our LTDS for more detail.

below sets out the range of options we have considered to meet the need for leakage reduction in AMP8. It should be noted that smart metering investments are not covered here and are instead reflected in the 'Metering' chapter. The exception to this is smart metering on shared supply properties, as these meters are installed primarily for the purpose of leakage reduction in the network.

The table below sets out where we have considered an option as part of our unconstrained option assessment and as a feasible option (each marked with an 'x' where this is the case).

Table 11 Unconstrained leakage options list

No.	Option	Description	Unconstrained	Feasible
1	Shared supply smart metering	Installation of smart meters at shared supply pipes to support the identification of leakage on these pipes and inside customers properties. These smart meters are not part of our smart metering rollout (see metering section) as they do not support individual customers with their own consumption but do give us improved visibility of CSPL and plumbing losses.	X	X
2	Targeted mains renewal for leakage	Renewal of high leaking mains with renewed distribution mains which are less likely to leak. These mains will be identified by using step tests and other techniques to quantify potential levels of leakage on specific sections of main and within DMAs. It is separate from burst cluster removal or from the climate vulnerable mains work.	X	X
3	New and optimised pressure management Type 1 - Lower Variance Higher Range of Pressure.	Creation of new optimised network areas by installing new and sometimes automated boundary valves, thus creating a discrete, but dynamic area, together with the installation of pressure control equipment with advanced sensing/monitoring points and advanced anomaly detection systems.	X	
4	New and optimised pressure management Type 2 - Higher Variance Higher Range of Pressure.	Creation of optimised network areas by removing areas of high head-loss and reducing higher pressures.	X	
5	New and optimised pressure management Type 3 - Higher Variance Lower Range of Pressure.	Creation of optimised network areas by recovering head-loss and managing resultant pressures and demands. Understanding the likely lengths of main and assets in order to configure and manage pressures within the area.	X	
6	Increased leakage 'Find and fix' activity	An increase above current levels of resources to find and fix leaks above current levels including more frequent surveying to reduce leakage and keep leakage at lower levels.	X	
7	Permanent noise logging.	Installation of noise loggers across the network which can detect potential leaks through changes in the sound transmitted through pipes.	X	

3.2.2 Cost-benefit appraisal

We considered the feasibility, costs and benefits of all of the leakage options highlighted above to ensure the final investments included in the plan present best value to customers, communities and the environment. As set out in the table below, there are a number of options that are not feasible because the option has been exhausted to reach our current level of leakage level.

The table below sets out how we assessed each option and why each one has/ hasn't been included in the plan.

Table 12 Leakage option assessment

No.	Option	Feasible option (Y/N)	Justification
1	Shared supply smart metering	Y	CSPL and plumbing loss benefits from smart meters have been proven by our Smart meter trial areas and subsequent wider rollout. Can expect similar savings from these unmeasured properties
2	Targeted mains renewal for leakage	Y	Small volume of targeted interventions after detailed zone investigation confirms issue
3	New and optimised pressure management Type 1 - Lower Variance Higher Range of Pressure.	N	All practicable schemes have already being completed with feasible cost per Ml/d benefit & network based constraints.
4	New and optimised pressure management Type 2 - Higher Variance Higher Range of Pressure.	N	All practicable schemes have already being completed with feasible cost per Ml/d benefit & network based constraints.
5	New and optimised pressure management Type 3 - Higher Variance Lower Range of Pressure.	N	All practicable schemes have already being completed with feasible cost per Ml/d benefit & network based constraints.
6	Increased leakage 'Find and fix' activity.	N	Already have high numbers of find and fix resource. Increasing team numbers would see progressively less benefit and increase in costs
7	Permanent noise logging	N	We have 24% of our properties already covered by loggers. These are targeted to be in our highest leakage DMAs meaning that to extend further will see progressively less benefit.

In undertaking the cost-benefit appraisal of our leakage options we have considered both the appropriate level of leakage reduction we aim to deliver in AMP8 (as part of the pathway to deliver our WRMP24/LTDS ambitions) and the options we should take forward to deliver that level of leakage reduction. Both of these considerations are linked as the level of leakage reduction we deliver depends on costs and benefits of the options we have available, and the options we propose to take forward will depend on the level of leakage reduction required to deliver on our WRMP24 and LTDS programme.

As a frontier company on leakage performance with low and reducing levels of leakage, we have already delivered on the most effective leakage reduction activities in previous AMPs to prioritise activities which deliver best value for customers. This means that now we are more dependent upon innovation (the outcomes of which are inherently of higher risk with more uncertain outcomes) and options which have a lower benefit per unit cost than options available to us previously. A wider range of lower unit cost options will be available to other companies; some will have been pioneered by us.

In conducting a cost-benefit appraisal of leakage reduction investments, and considering the six capitals in our optioneering process, we have sought to ensure we are delivering a plan which represents best value for customers, communities and the environment over the long-term. We have done this by performing a 'bottom

up' assessment of leakage options and making the best deliverable and holistic plan which aligns to our WRMP supply/demand challenge, and the financial efficiency of driving down leakage further.

As a sector-leading innovator in the area of leakage, the technology that we pioneer within AMP8 may form the basis for AMP9 leakage investments, helping to provide innovative pathways as part of our LTDS and form the longer term core leakage activities of the sector.

We are currently working as part of the Leakage National Test Centre, funded by the Ofwat Innovation Fund. This allows us to work with the wider sector to continue to pioneer new technologies and collaborate with leading suppliers to develop innovative solutions to leakage detection, control and repair. Building on the foundations of world-leading fixed network leakage monitoring, we continue to develop satellites and drones (UAV's) to identify leakage across rural networks and trunk mains. Future phases include adapting this technology to detect pollutions on the waste networks. We are a key collaborator and technical advisor to two of the largest Ofwat innovation funded projects: Safe Smart Systems and; The National Leakage Research Test Centre. These collaborative projects will enable future smart technology-based solutions and bring the industry closer together to focus on downstream repair and demand management innovation.

3.2.3 Environmental and social value

We have developed a Value Framework, structured by the Six Capitals, which allows us to express benefits and dis-benefits in a common language (£) for use in cost-benefit analysis and to inform our investment decisions.[11]

The impact values within our Value Framework are made up of both private costs (e.g. costs to resolve an incident) and societal costs. Societal costs are derived through a robust Societal Valuation Programme considering a broad range of sources where customers' views, preferences and priorities are canvassed, analysed and incorporated into the values through a triangulation process.[12]

For our leakage targeted mains renewal investments, we have taken knowledge around previous mains renewal activities to establish the noise and traffic implications of delivering our proposed investment. The leakage benefit attributed to this investment has been generated from an in-depth DMA-by-DMA review of available leakage for mains renewal.

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

We develop a best value plan from these different model runs and environmental assessments, encompassing the views of our customers and stakeholders who have been consulted throughout the plan's development.This looks beyond cost and seeks to deliver a benefit to customers, society and the environment, whilst listening and acting on the views of our customers and stakeholders.These views have helped build our best value framework.

3.2.4 Investment benefits

We expect the benefits from our proposed investments under the leakage programme will be to reduce leakage by a total of 6.53Ml/d. In addition to these benefits, there will also be a leakage benefit from the metering enhancement programme (considered in a separate chapter) of 4.04Ml/d. This gives a total leakage impact of 10.57Ml/d for AMP8. This is reflected in our leakage performance commitment level, discussed in our Outcomes table commentary.

There is an interdependency between the benefit delivered through this enhancement investment and the base allowance. This benefit assumes that there is an appropriate base allowance to maintain leakage at current frontier levels. We have submitted a cost adjustment claim to reflect the efficient additional costs we experience as a result of maintaining this frontier position. Should any of our base allowance (from what is implicit within base models combined with the cost adjustment claim) fall short of what is needed to maintain current performance, this will have a negative impact on the leakage benefit we expect to deliver in AMP8.

It should be noted that whilst this leakage enhancement includes the installation of smart meters to both domestic properties and shared supplies, we do not expect shared supply metering to have an impact on per capita consumption (PCC). These smart meters are being installed on shared supplies and so will not be used to provide individual customer level data that can drive behavioural changes and identify leaks within properties that will help to reduce PCC. The domestic smart meters delivered through our metering enhancement investment will have an impact on PCC and this is set out further within the metering enhancement strategy.

3.2.5 Managing uncertainty

The key uncertainties we face in this part of our plan in relation to costs are in relation to the costs of smart meters and mains renewal. In both areas we have faced cost challenges in AMP7. For smart meters, we have seen microchip shortages which have had an impact on the availability of meters. Looking ahead into AMP8, there is potential forfurther cost uncertainty as more water companies roll out

11 For more information on our value framework see chapter 7 Driving cost efficiency in our plan 2025-2030
12 For more information on customer insight see chapter 3 Customer engagement in our plan 2025-2030

smart metering and place greater demand on these supply chains. On mains, we have seen a significant increase in the cost of delivering our interconnector programme due to the Covid pandemic and Russia-Ukraine conflict. Given that these are factors which are outside our control, there are limited steps we can take to mitigate these risks. Mitigation of such risks can be supported through regulatory frameworks including cost sharing, and the flexibility of viewing the totex plan as a whole entity when putting in place PCDs, rather than as individual investment areas.

On benefits, there is uncertainty about the benefits to be delivered from smart metering as they depend on the assumptions that we make about the leaks that these meters are likely to detect. We have mitigated these risks by using smart meter CSPL savings that have been updated to reflect our wider smart meter rollout and the initial Newmarket/Norwich trial.

Similarly, the benefits assumed to be delivered from our targeted mains renewal programme are based on assumptions that we have seen from previous mains schemes and detailed knowledge of the DMAs where we intend to intervene. As part of this investment, we are renewing both the distribution pipe and the communication pipe between our distribution main and the customer's boundary box/stop tap.

For leakage overall, the major uncertainty is the weather. We have seen that particular weather events, such as rapid changes in temperature, have the effect of increasing leakage. These are outside our control and appear to be increasing in frequency (although in any individual year, the number and severity of these events is highly uncertain). Ultimately, the level of leakage we observe will be a combination of the investment we are able to make and external factors such as extreme weather. This means that the leakage reduction we see in any one year could be higher or lower than expected compared to the situation if we were to consider the impacts of our totex investment alone.

We have sought to maximise option utilisation through the solutions we have put in place. The shared supply smart meters that we put in place will be utilised 24/7, as they will allow data on demand for that shared supply to be provided at higher frequency so any new leaks which occur will be detected more quickly. This makes these meters a low regret, high utilisation option.

The mains renewals we have included in our enhancement plan are based on prioritising the DMAs with the highest level of leaks for mains renewal and renewal to customer communication pipes. This gives high confidence that these mains renewals will give a leakage benefit and be a low-regret investment.

3.2.6 External funding

Where smart meters (either on shared supply pipes included in this investment, or for individual customers included within the metering enhancement investment) are installed, they allow us to detect where a leak appears to be taking place. The enhancement investment that we propose to deliver will allow us to identify these leaks, but we have not included costs in this plan to fix them (other than some incentivisation for vulnerable customers (see water efficiency options)). The primary benefits of this investment area are to the customer through reduced water loss, and avoidance of leak-related damage. We benefit from a reduction in consumption, aiding our supply capability. The leak reduction in these instances will be paid for by the affected customer rather than all customers through bills.

3.2.7 Direct procurement

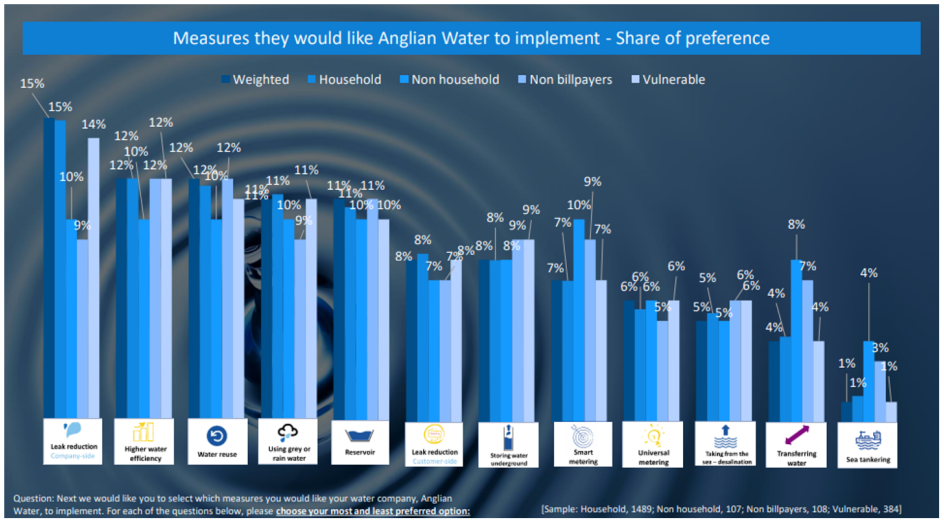
We have considered whether our leakage improvements could be delivered as DPC. Following the Final Methodology and subsequent guidance on which schemes we should deliver through DPC, we note that the individual assets that will be installed as part of this enhancement investment (smart meters and renewed mains) fall below the threshold of £5-10m for consideration as a DPC scheme. The investment also falls far short of the £200m threshold to be considered DPC by default, and is investment which is heavily integrated into the existing network rather than being discrete standalone assets. We have therefore determined that the leakage enhancement investment is not suitable for delivery via DPC.

3.2.8 Customer view

Customers' views have been central in informing the scale of leakage reduction investment we propose to undertake in AMP8 and over the next 25 years (see 'customer support' section above).

We sought customer views on the prioritisation of different supply and demand side options to inform our overall WRMP. This took place via online surveys (1,489 sample size) and walk ins (250 sample size). This showed that customers prioritised leak reductions as the most important activity to address supply-demand. This is consistent with previous research and engagement and is part of the reason we have invested historically to continue pushing the frontier of leakage reduction in England and Wales.

Figure 14 Customer views



The options included in our proposed solution have been driven by delivering the leakage that customers would like to see and that align with the WRMP, in the most cost effective way. In practice this means we have sought to maximise the leakage we can deliver from options that have a lower unit cost or deliver additional wider benefits before we start deploying leakage reduction methods with a higher unit cost. We have delivered this by maximising the leakage reduction that can be delivered through shared supply smart meters (£2.17m/Ml/d) before leakage reduction from targeted mains renewals (£15.17m/Ml/d).

3.3 Cost efficiency

3.3.1 Developing costs

The development of the leakage costs in our plan follows our cost efficiency 'double lock' approach set out in chapter 7 of our business plan. Through this approach we have ensured that are costs are efficient in their bottom-up build up, and this is cross-checked through external benchmark approaches. This section sets out how we have ensured cost efficiency of our leakage investments through step one of our double lock approach. Step 2 is explored in section 3.3.2 (Benchmarking) below.

We have taken a robust approach to developing our leakage costs, building on our experience from delivering similar schemes into the bottom-up development of costs (before external cost benchmarking challenges are applied in step 2 of our 'double-lock' approach). The detail of the cost development approach is set out below, along with a breakdown of costs we provide in table CW3.

Cost Estimation Methodology

We follow a common cost development methodology across our enhancement investments in a three phase process:

1. Establish cost and carbon models
2. Input the cost drivers into the model (including location specific factors)
3. Data validation, internal challenge and assurance.

In phase 2, we derived our total cost estimate for each scheme by gathering location-based data which influences the cost estimates for each scheme, including:

- hydraulic modelling
- historic leakage records at DMA level used to assist with the smart metering roll out programme.

The table below provides a breakdown of our leakage enhancement costs.

Table 13 AMP8 Investment costs and benefits

Investment ID	Investment name	Scope	Capital Cost (£m) AMP8	OPEX cost (£m) AMP8	AMP8 leakage reduction (Ml/d)	Average cost (£m/Ml/d)
I034532	Regional Shared supply pipe leakage	9,336 Meters	6.476	1.592	3.72	2.169
I041183	Leakage Mains Renewal - Enhancement	44km Water Mains renewal 2,545 Comms pipes	25.036		1.65	15.173
Various	Smart Meter Investigation visit	4,000 Investigations per year		1.780	4.04	N/A

Investment ID	Investment name	Scope	Capital Cost (£m) AMP8	OPEX cost (£m) AMP8	AMP8 leakage reduction (Ml/d)	Average cost (£m/Ml/d)
Total			31.512	3.372		

The first two lines in the above table represent the leakage reduction delivered through those activities represented in this enhancement investment area. The 4.04Ml/d is principally to be delivered through the smart metering enhancement programme, whose costs are presented in section 2 of this document. Only the investigation visits are considered to be leakage enhancement expenditure covered by our leakage improvement plan.

3.3.2 Benchmarking

In stage 2 of our cost efficiency 'double-lock' on leakage , we used a variety of methods to assess, benchmark and challenge the costs in our plan.We have utilised three sources of benchmarking to assess the efficiency of our costs:

- Similar scheme outturn data.
- Ofwat data and cost models
- Industry cost models from TR61

One potential source of benchmarking would be to simply compare the unit cost of our overall leakage reduction program with those of other companies. However, we have considered that this would be inappropriate. Different leakage reduction activities will need to be carried out by each company as each will have different options available to it. For example, a company which has a higher level of leakage is more likely to have a wider range of leakage reduction options available to it - and therefore utilise those which deliver leakage at the lowest unit cost - than companies with lower leakage for whom these lower unit cost options are no longer available. This was recognised in the CMA's leakage enhancement cost assessment at PR19:

"The use of an upper quartile-based unit cost measure may not allow for differences in circumstances between companies, which could be significant as companies are starting with different leakage levels and have different scope for pursuing low cost option"[13]

We have therefore focussed on benchmarking using a bottom-up approach of assessing the efficient unit rate of the specific leakage reduction activities included within our enhancement plan.

Similar scheme outturn data

We have embedded cost efficiency in the bottom-up build up of costs by reflecting the costs of similar schemes delivered by us in previous AMPs into our leakage enhancement costs.

Ofwat data and cost models

For the investment associated with installing smart meters to identify leaks on shared supply pipes we have considered the cost benchmarking carried out by KPMG on the cost to install new meters. This used cost and driver data submitted by companies through the APR, and so compares our installation costs with other companies in the industry.

As highlighted in our metering cost benchmarking chapter (section 2.3.2 of this document) the current median of the industry for smart meter installations is circa £320-£330 per meter.Our installation of smart meters on shared customer supply pipes programme assumes 9,336 installations, with an average unit rate of £651/meter. Given the differential between our costs and the benchmark we have explored the reasons for this. There are are two significant factors that influence this.

One is the meter installation type. As set out in the table below, every shared supply meter we will install is a footway or unmade installation. These have a higher cost than other, less complex forms of installation (e.g. screw-fit and internal) which make up the majority of our smart meter installations.

Second is the nature of the rollout. The rollout of our smart meter programme benefits of economies of scale from installing smart meters at all properties over a geographical area, whereas our leakage shared supply rollout is smaller and more geographically dispersed. This explains why the unit costs are £682 and £559 per meter for footway and unmade installations respectively (rather than £619 and £492 per meter as set out in the metering enhancement strategy). This split is shown in the table below.

13 CMA PR19 final redetermination para 8.124

Table 14 Meter installation types, volumes and rates

Installation type	Volume	% volume	Total cost (£m)	Unit rate (£/meter)
Footway	7,002	75	4.77	682
Unmade	2,334	25	1.30	559
Carriageway	0	0		
Internal	0	0		
Screw fit	0	0		
IT investments to allow use of digital twin capability			0.4	
Total	9,336	100	6.48	651

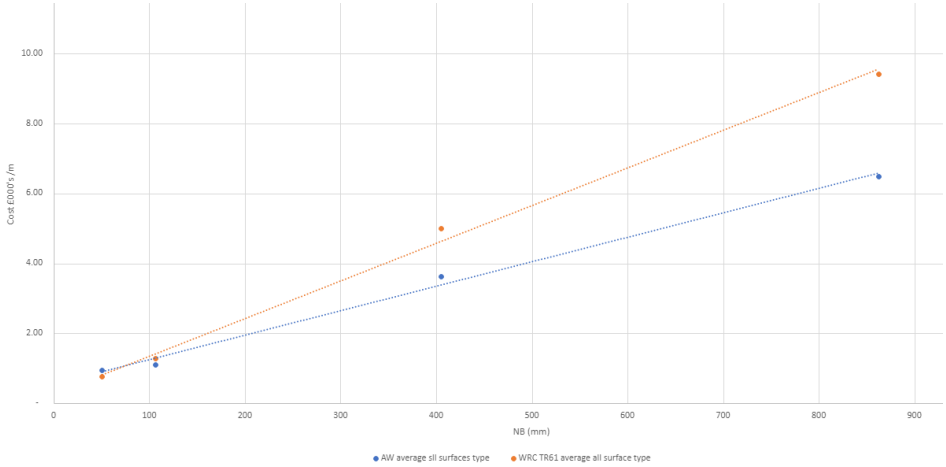
We consider that the differential between our shared supply smart meter unit costs and the cost benchmark set out in Ofwat data and cost models are explained by the two exogenous factors set out above, and so consider our costs for this investment to be efficient.

Industry cost models from TR61

For the mains renewal element of our leakage improvement program, we have sought external benchmarking from the WRC TR61 data set which uses cost data for similar activities from nine water companies.

From this benchmarking we were able to benchmark 90% of the water main costs. The water mains account for 66% of the total asset direct cost for this programme. The benchmarking found that our costs was 14% less expensive than the TR61 average across the programme.

Figure 15 Leakage improvement direct cost of PE water main benchmarking



Therefore, across both of metering and mains renewal activities we have confidence that the costs included in our plan are efficient due to the combination of basing the bottom-up build-up of costs on scheme outturn costs, and cross checking this with top-down external benchmarking evidence on both sets of activities.

3.3.3 Assurance

The bottom-up development of our investments within our C55 cost estimation systems has been externally assured by Jacobs. The external cost benchmarking we have compared our costs with for shared supply smart meter installations has been carried out independently by KPMG.

3.4 Customer protection

Customers are protected against changes to this investment through the common performance commitment on leakage. The performance commitment level for leakage is aligned with the level we expect to achieve through a combination of base and enhancement expenditure. Therefore, if any of our enhancement investments are not delivered, customers will be repaid through a higher penalty (or lower reward) than would otherwise be made had we not delivered the investment.

4 Demand-side improvements

Overview

Our demand-side improvements (excluding metering and leakage) represents our most extensive programme 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 meter 10 year installation programme. Smart meters are now facilitating 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 (MyApp Account) and smart home device retro-fitting.

The success of smart metering will also be directly related to 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.

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 the 'MyAccount' App to provide easy access to data
- Additional community based campaigns including hyper local and seasonal messaging
- 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 the customer leakage journey, to achieve maximum target run-time of 100 days
- Potential for smart communities; link smart systems to other utilities.

Additionally, we have recognised the importance of demand management with regard to the retail and non-household sector. We have consequently designed a portfolio of non-household options which are expected to save 10Ml/d of water by 2029/30 and 50Ml/d by 2049/50.

We have also been mindful of the Defra/EA 9% target for non-household demand reduction by 2037/38 and the 15% reduction by 2049/50. We have therefore developed a number of non-household options which will need to be delivered in collaboration with, but mainly via our retail partners.

In total, these options help us achieve approximately 8% reductions by 2037/38 and 15% by 2049/50.

Table 15 Investment Summary

PR24 costs (£m)	
Capex	0.0
Opex	21.7
Totex	21.7
Benchmarking	
Method	Scheme outturn costs Market testing of costs
Findings	Competitive costs from venders and suppliers, as well as similar scheme outturn data have been incorporated into our costs to ensure efficiency.
Customer Protection	
Performance commitment	Per Capita Consumption Business Demand
Ofwat data table	
CW3.44-CW3.46	Demand-side improvements delivering benefits in 2025-2030 (excluding leakage and metering)

4.1 Delivering for the long term

4.1.1 Investment context

This demand management (water efficiency) enhancement investment has been developed to fully align with our revised draft WRMP24. Our WRMP sets out that we need further demand management reductions, including through improving water efficiency, to ensure security of supply into AMP8 and beyond. Demand management is considered to be a key element of our WRMP24 strategy, driven by the need to counter increases in demand due to growth, maintain sustainability and resilience with regard to supply and demand and meet our environmental destination targets for abstraction reduction.

4.1.2 Scale and timing

Our WRMP24 sets out how this package of demand-side improvements forms part of our plan to ensure supply meets demand over the next 25 years. We also face deficits within AMP8 if immediate investments are not made to reduce demand, given the lead-in time we face with larger supply side options.

4.1.3 Interaction with base expenditure

We undertake some demand management measures as part of our base activities. The investment described here is intended to be additional to that which is covered from base to deliver further demand reductions in AMP8 and beyond. The table below shows how we have separated out base and enhancement activities.

Table 16 Base and enhancement demand management activities

Base	Enhancement
	Household Water Efficiency
To support achieving our per capita consumption targets a communication programme regarding water usage will continue to be funded through base expenditure. Current schemes include:	Provision of smart sensors (such as Smart Shower Sensors).
a rewards scheme for signing up to the smart meter customer portal	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.
'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	Development of the 'My Account' app to provide quick easy access to data and services

Base	Enhancement
	Household Water Efficiency
our campaign to assist customers with leaky loos via rebates (noting that a leaking loo can lose on average 478l/prop/d).	Provision of garden advice, promotions on social media and garden kits to support reduction in discretionary use in the garden.
	Campaigns to support our key messages
	Work at a community level to encourage water savings with the results triggering a community reward.
	Scheme for customers in vulnerable circumstances and customers with affordability issues to fix leaky loos and leaky taps up to a capped value.
	Delivery of the customer side leakage journeys relating to P1-P4 break out leaks
	Non-Household Water Efficiency
	Water Efficiency Visits
	Smart Meter identified Plumbing Loss Fix
	Smart Meter identified cspl Fix

4.1.4 Long term context (historical)

This investment builds on the water efficiency investments made in previous AMPs and is intended to help us to deliver further demand reductions, driving towards our goals of achieving 110l/h/d for PCC by 2050 and reducing non-household demand over the WRMP24 planning period.

The AMP7 learnings have allowed us to develop enhanced options that add significant value and build upon our previous water efficiency activities rather than duplicate. A key area of our water efficiency program within AMP7 has been to connect customers with their consumption data through our online portal so that the gap between perception versus actual usage can be reduced. The proposed enhancements build on this approach by utilising smart devices to offer increased levels of consumption data to customers in increasingly accessible formats tailored to their specific engagement needs, water footprint and motivating factors.

Our AMP7 mass awareness campaigns have focussed on educating customers about the challenging water resources situation and how individual customer action can create meaningful change. Our enhanced options for AMP8 develop an acceleration in customer engagement on water efficiency by increasing opportunities for frequent messaging to create deeper engagement in a way that's relevant to them. The ability for our customers to build intent to use less water will aim to stimulate further savings and develop sustainable behaviour change with long term results.

The opening of the Business Retail Market and the subsequent Retail Exit Code Regulations in 2017 materially changed our relationship with Business Customers. Retailers now own the direct relationship with their customers. We now expect to work collaboratively with retailers to help business customers reduce their water usage.

4.1.5 Long term context (future)

Our water resources LTDS sub strategy comprises a core pathway of low regrets investment that enables us to achieve our ambition. Demand side solutions form a vital component of this core pathway. [14]

Our AMP8 demand side options are low regret as they support us in reaching our long-term supply/demand balance targets.

We have considered the potential for water efficiency strategic interventions in our core and alternative pathways. Our LTDS recognises there is a clear desire from our customers to save water. To help this we could offer targeted advice or

14 This is set out in Section 2.2.2 'Water resources' in our LTDS.

install water saving devices into customers' homes. We expect to use emerging technologies, and the data we already have as effectively as possible to inform our customers.

'Water Demand Reduction Discovery Fund'

We currently find ourselves in a unique position, driven by the imperative nature of our supply/demand constraints:

- We will achieve full AMI smart meter roll-out by 2030, which will enable innovative behavioural change initiatives
- We currently are in a frontier position with respect to leakage and will have exhausted several techniques for leakage reduction (e.g. pressure management) in the near term, meaning that we may have to rely on mains replacement programmes in future
- Due to abstraction reform, we face challenges in meeting growth (especially with respect to non-household growth)
- We are now in a position to investigate tariff trials (summer usage tariffs).
- We face significant challenges with regard to resilience, sustainability and climate change.

We, therefore, consider it prudent, as part of our preferred plan, to include a 'demand reduction' fund, 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 programmes. 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 to 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 supplies in the East of England, whilst maintaining Anglian Water 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 and technological and behavioural change interventions over a five-year period. It will enable on-going monitoring of our 'Enabling Water Smart Communities' project, answering important questions about how we might encourage new developments 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). Continuous 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. Further detail is available in the 'Revised draft WRMP24 demand management preferred plan report: Section 10.1'

The Water Demand Reduction Discovery Programme, as part of our WRMP24, is materially different from both the Ofwat Innovation fund, and newly formed Ofwat Water Efficiency Fund, and is critical to us meeting our supply demand challenges within AMP8. Schemes that will be promoted as part of our Water Demand Reduction Discovery Fund are likely to be small in size financially, and be explicit to the ongoing interactions within our business and corporate systems, rather than a smaller number of larger value projects which would be suitable for Ofwat innovation or water efficiency funding. We are expecting to leverage both the Ofwat innovation and water efficiency funds within AMP8, as we have done successfully in AMP7, for higher risk, collaborative, large value projects with multiple stakeholders.

4.1.6 Customer support

Customer views on demand management have helped to shape the scale of the demand management programme. Our engagement with 122 customers in our Online Community found that around 70% of customers feel prioritising demand management is key to maintain future supplies. 30% of customers, however, feel that there is a limit to the amount of water customers are able to save.

On non-household demand, retailers are positive about working with wholesalers to achieve water efficiency, but this involves:

- Capability - enable retailers to promote with good ideas; work to improve data accuracy and accessibility (make it easy for retailers)
- Opportunity - identify where investing time/money will be fruitful
- Motivation - create a commercial motivation through incentives or reputational accreditations.

Our non-household retail and customer engagement 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 an industry we need to:

- Ensure that businesses understand why water efficiency is important in the context of the regional water resource strategy

- Convince businesses that there may be water to be saved and that this will be beneficial, both for the regional environment and for their own business resilience
- Develop actionable options that we can trial and then implement with our retail and business partners.

Our consultation suggested that there are two main option types that should be initially developed, and we have now quantified these for inclusion in the revised draft WRMP24. These two main option types concentrate on the following: leakage reduction and water efficiency visits (reference 'Revised draft WRMP24 demand management preferred plan technical supporting document: Section 9).

Our demand management programme aims to maximise the water that customers are able to save by identifying new efficiency measures which could be applied in homes and businesses. We additionally aim to leverage the installation of smart meters for all non-household customers to identify both internal and external leakage (and have designed options to deliver these leakage reductions).

4.1.7 Cost control

This investment is driven by the requirements of our WRMP to balance supply and demand. In developing our WRMP, we have sought to optimise the supply and demand options to help us promote the most efficient supply and demand management options which aligns with the rest of our WRMP. As part of our demand management strategy, reducing customer consumption is a far more cost effective method of maintaining our supply/demand balance than looking at supply-side options which will require additional abstraction from the environment.

We have taken all of our investments in the round and looked at the most cost effective way to suppress demand as much as possible. Often for customer demand, this involves soft investments e.g. social media promotion, home visits, home water saving equipment and changes to the way that customers interact with their online accounts. This is markedly cheaper than looking at "hard" construction supply-side investments which would be required to match the delta if these investments were not promoted.

As part of our cost benefit analysis we have reviewed the overall costs per Ml/d saved for all of the feasible options and portfolios, with the water efficiency portfolio estimated to cost £1.3million per Ml/d and the non-household options £0.48million per Ml/d. These values represent the most beneficial elements of our demand management portfolio which has an overall portfolio cost of £3.59million per Ml/d. Consequently, we have maximised these activities as far as possible as part of our demand management strategy (whilst understanding that the full smart meter roll-out fundamentally underpins the majority of these water efficiency measures).

4.2 Unlocking greater value for customers, communities and the environment

4.2.1 Option consideration

We have considered a wide range of demand management options as part of our WRMP. Metering and leakage options are addressed in separate chapters. Note that, not only have we considered different types of options, as listed, but we have also considered the scale of impacted cohorts in order to develop high, medium and low version of options as appropriate. The table below sets out the range of other demand management options we have considered.

Table 17 Unconstrained option list

No.	Option	Description	Unconstrained	Feasible
1	SECTION 1: 1a - SMART HOMES - Provision of Smart Shower Sensors.	Provision of Aguardio Smart Shower Sensor on the proviso that the current trial is successful in AMP7. Provision of other smart sensors and devices - trials to be completed in year 2 of AMP7 where possible. Hydrao shower head and Amphiro insert are the only ones we know on the market currently and we hope to start a trial soon to provide data to PR24. 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 option will include monies to trial any new devices to market. Use sensors as a reward in the rewards scheme.	Yes	Yes
2	SECTION 1: 1c - SMART HOMES - Link up with other utilities to provide a smart hub for the home showing all your data in one place.	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.	Yes	Yes

No.	Option	Description	Unconstrained	Feasible
3	SECTION 2: 2a - BEHAVIOURAL CHANGE - Continued development of the My Account app to providequick easy access to data and services.	Continued development of the My Account app to provide quick easy access to data and services. Usage, data comparison, spotting customer side leaks, high consumption, personalised tips, proactive warnings.	Yes	Yes
4	SECTION 2: 2b - BEHAVIOURAL CHANGE - Further development of gamification within My Account.	Further development of gamification within My Account. Continued support & development of rewards scheme to encourage water saving behaviours. Ability to invest in new technology / functionality as it comes to market. Setting of targets and challenges. Could include environmental/social/carbon rewards and therefore include additional benefit lines here.	Yes	Yes
5	SECTION 2: 2c - BEHAVIOURAL CHANGE - Continued provision of garden advice, promotions = and garden kits.	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. Middle option includes seasonal tips within My Account for gardening linked to usage. High option to include personalised options linked to smart hubs/virtual assistants.	Yes	Yes
6	SECTION 2: 2d / 3b - BEHAVIOURAL CHANGE - Campaigns to support our key messages and brand. Hyper local and seasonal.	Campaigns to support our key messages and brand. Hyper local and seasonal. Linked to smart data. Includes drought messages and peak demand options.	Yes	Yes
7	SECTION 2: 2f - BEHAVIOURAL CHANGE - Efficiency messaging improvements from smart meter data.	Efficiency messaging improvements from smart meter data. Improved analysis of smart meter consumption data to fine-tune information sent to customers to maximise behavioural consumption reductions. Real time data. Includes water saving and driving network leakage from smart data- see 4f also for Network losses.	Yes	Yes
8	SECTION 3: 3a - COMMUNITY - Work at a community level to encourage water savings with the results triggering a community reward.	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 an annual awards ceremony (albeit virtual) to promote great ideas and gain additional publicity.	Yes	Yes
9	SECTION 3: 3c - COMMUNITY - Development of a smart city. Provide information into BIG data.	Development of a smart city. Provide information into BIG data. Partner with a city in our region to promote and take this forward.	Yes	
10	SECTION 4: 4a INTERVENTIONS - Scheme for vulnerable customers to fix leaky loos and leaky taps up to a capped value.	Scheme for customers in vulnerable circumstances and customers with affordability issues to fix leaky loos and leaky taps up to a capped value. If toilet can not be fixed then provision of a small amount of toilet rebate vouchers again linked to vulnerability and affordability.	Yes	Yes
11	SECTION 4: 4c INTERVENTIONS - PL uplift - Non-Vulnerable Customers	Scheme to assist non-vulnerable customers with internal leak repairs. Leaky Loos.	Yes	Yes
12	SECTION 4: 4d INTERVENTIONS -Leaky loos campaign (base option). This is a continuation of a service we offer in PR19.	Scheme for customers in vulnerable circumstances and customers with affordability issues to fix leaky loos and leaky taps up to a capped value. If toilet cannot be fixed then provision of a small amount of toilet rebate vouchers again linked to vulnerability and affordability.	Yes	Yes
13	SECTION 4: 4e INTERVENTIONS -Activity alarms for vulnerable customers - potentially a narrative piece	Activity alarms for vulnerable customers - assessment of the applicability of lack of water/or continuous use as an early warning to carers for vulnerable individuals. Enhanced leakage alerts. Provision of data to power of attorney/carers/parents	Yes	

No.	Option	Description	Unconstrained	Feasible
		Audio and visual functions linked into our customer side leakage journeys Spending warnings Holiday mode - ability to flag consumption to customers and provide alerts. Checklist of vulnerability risk factors when installing the meters giving customers a chance to ask questions that directly affect them Help with smart devices such as taps, showers, Sure Stop, Remote activated stop taps		
14	SECTION 4: 4g - INTERVENTIONS -High consumption virtual visits (no continuous flow).	High consumption virtual visits (no continuous flow on the property)	Yes	
15	SECTION 5: SMART DEVELOPMENTS - 5a Work with developers on trials of grey water reuse on large new developments. - Adaptive Plan	Work with developers on trials of grey water reuse on large new developments. Optional schemes available to our developer customers. Reused water to be measured and shown on My Account. Trial of new tariffs for end user domestic customers.	Yes	
16	SECTION 5: SMART DEVELOPMENTS - 5b Promote and provide services to smart large housing developments fitted via Alliance partners	Actively promote and provide services to smart large housing developments fitted via Alliance partners or Self Lay/NAVs. Fit sensors at time of laying mains and services. Create smart hubs in the houses by working with developers. Link to My Account.	Yes	
17	SECTION 5: SMART DEVELOPMENTS - 5c In large housing developments create a community smart hub linked to rewards within their local community	In large housing developments create a community smart hub linked to rewards within their local community	Yes	
18	SECTION 5: SMART DEVELOPMENTS - 5d Incentivising Developers to install rainwater harvesting - single development	Incentivising developers to install rainwater harvesting - single development	Yes	
19	SECTION 5: SMART DEVELOPMENTS - 5e Incentivising Developers to install rainwater harvesting - communal development	Incentivising developers to install rainwater harvesting - communal development	Yes	
20	SECTION 5: SMART DEVELOPMENTS - 5f Incentivising developers to install Water butts	Incentivising developers to install water butts - generic	Yes	
21	SECTION 6: 6a Work with retailers to incentivise reductions in irrigation water usage:	Work with retailers to incentivise reductions in irrigation water usage: · provide specific soil moisture sensors to irrigators and councils. Provide a plug in to the retailer to include within their digital offerings to the customer to assist with water management. · Info on trickle irrigation vs spray · Smart irrigation	Yes	
22	SECTION 6: 6b Work with retailers and end customers on trials of grey water reuse retrofit schemes.	Work with retailers and end customers on trials of grey water reuse retrofit schemes. Provide data to the retailers via our smart meters for inclusion in their digital offerings and tariff structures.	Yes	

No.	Option	Description	Unconstrained	Feasible
23	SECTION 6: 6e Introduce grants or rebates to incentivise retailers and end customers to introduce water efficiency measures / leakage fix	Introduce grants or rebates to incentivise retailers and end customers to introduce water efficiency measures / leakage fix - use incentive	Yes	Yes
24	SECTION 6: 6f Work with retailers to provide digital and simple water saving devices to small NHH customers.	Work with retailers to provide digital and simple water saving devices to small NHH customers.	Yes	Yes
25	SECTION 6: 6g Work with retailers to provide an option to repair leaky loos - plumbing loss - Toilet rebate - Incentivisation	Work with retailers to provide an option to repair leaky loos - plumbing loss - toilet rebate - Incentivisation	Yes	
26	SECTION 6: 6h Work with retailers to provide an option to repair leakage / cspl - smart meter linked	Work with retailers to provide an option to repair leakage / cspl - smart meter linked	Yes	Yes
27	SECTION 6: 6k Targeted water efficiency advice for industrial/commercial users	Targeted water efficiency advice for industrial/commercial users	Yes	Yes

Water Demand Reduction Discovery Fund

We currently find ourselves in a unique position, driven by the imperative nature of our supply/demand constraints:

- We will achieve full AMI smart meter roll-out by 2030, which will enable innovative behavioural change initiatives
- We currently are in a frontier position with respect to leakage and will have exhausted several techniques for leakage reduction (e.g. pressure management) in the near term, meaning that we may have to rely on mains replacement programmes in future
- Due to abstraction reform, we face challenges in meeting growth (especially with respect to non-household growth)
- We are now in a position to investigate tariff trials (summer usage tariffs).
- We face significant challenges with regard to resilience, sustainability and climate change.

We, therefore, consider it prudent, as part of our preferred plan, to include a 'demand reduction' fund, 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 programmes. 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 to 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 supplies in the East of England, whilst maintaining Anglian Water 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 and technological and behavioural change interventions over a five-year period. It will enable on-going monitoring of our 'Enabling Water Smart Communities' project, answering important questions about how we might encourage new developments 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). Continuous 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. Further detail is available in the 'Revised draft WRMP24 demand management preferred plan report: Section 10.1'

The Water Demand Reduction Discovery Programme, as part of our WRMP24, is materially different from both the Ofwat Innovation fund, and newly formed Ofwat Water Efficiency Fund, and is critical to us meeting our supply demand challenges within AMP8. Schemes that will be promoted as part of our Water Demand Reduction Discovery Fund are likely to be small in size financially, and be explicit to the ongoing interactions within our business and corporate systems, rather than a smaller number of larger value projects which would be suitable for Ofwat innovation or water efficiency funding. We are expecting to leverage both the Ofwat innovation and water efficiency funds within AMP8, as we have done successfully in AMP7, for higher risk, collaborative, large value projects with multiple stakeholders.

4.2.2 Cost-benefit appraisal

From the wide range of options we have considered and have set out above we have considered the feasibility and costs and benefits of each option to develop our final plan. The table below sets out where we have included or excluded the options set out above in our plan and why we have done so.

Table 18 Water efficiency option feasibility

No.	Option	Feasible solution	Justification
1	SECTION 1: 1a - SMART HOMES - Provision of Smart Shower Sensors.	Yes	Water savings appear to be significant, and this option builds upon the smart meter roll-out
2	SECTION 1: 1c - SMART HOMES - Link up with other utilities to provide a smart hub for the home showing all your data in one place.	Yes	We have included the development of aligned utility data provision in our preferred plan (with the potential to leverage water savings in unison with energy efficiency). We will look to trial this as part of the 'Water demand reduction discovery fund').
3	SECTION 2: 2a - BEHAVIOURAL CHANGE - Continued development of the My Account app to provide quick easy access to data and services.	Yes	2a-2b-2d-2f have been combined as one option and included in WRMP24. Developing our communications strategies associated with our smart meter roll-out and leveraging the enhanced potential for water efficiency messaging.
4	SECTION 2: 2b - BEHAVIOURAL CHANGE - Further development of gamification within My Account.	Yes	2a-2b-2d-2f have been combined as one option and included in WRMP24. Developing our communications strategies associated with our smart meter roll-out and leveraging the enhanced potential for water efficiency messaging.
5	SECTION 2: 2c - BEHAVIOURAL CHANGE - Continued provision of garden advice, promotions = and garden kits.	Yes	Advice with regard to gardening and discretionary water consumption has been included as a water efficiency option in WRMP24.
6	SECTION 2: 2d / 3b - BEHAVIOURAL CHANGE - Campaigns to support our key messages and brand. Hyper local and seasonal.	Yes	2a-2b-2d-2f have been combined as one option and included in WRMP24. Developing our communications strategies associated with our smart meter roll-out and leveraging the enhanced potential for water efficiency messaging.
7	SECTION 2: 2f - BEHAVIOURAL CHANGE - Efficiency messaging improvements from smart meter data.	Yes	2a-2b-2d-2f have been combined as one option and included in WRMP24. Developing our communications strategies associated with our smart meter roll-out and leveraging the enhanced potential for water efficiency messaging.
8	SECTION 3: 3a - COMMUNITY - Work at a community level to encourage water savings with the results triggering a community reward.	Yes	Community rewards have been determined to be another method of encouraging water efficiency, with incentivisation focused at a local level.
9	SECTION 3: 3c - COMMUNITY - Development of a smart city. Provide information into BIG data.		There is not enough information currently available to include this option (investigation to be included in the ‘demand reduction discovery fund’).
10	SECTION 4: 4a INTERVENTIONS - Scheme for vulnerable customers to fix leaky loos and leaky taps up to a capped value.	Yes	This option was deemed to be feasible as a method of assisting customers with vulnerabilities to find and fix internal leaks.
11	SECTION 4: 4c INTERVENTIONS - PL uplift - Non-Vulnerable Customers	Yes	This option is designed to continue our progress in utilising smart meters to reduce continuous flow run-times for plumbing losses.
12	SECTION 4: 4d INTERVENTIONS -Leaky loos campaign (base option). This is a continuation of a service we offer in PR19.	Yes	This option is designed to continue ‘leaky loo’ campaign for customers without a smart meter (a reducing number) and reduce continuous flow run-times for plumbing losses.

No.	Option	Feasible solution	Justification
13	SECTION 4: 4e INTERVENTIONS -Activity alarms for vulnerable customers - potentially a narrative piece		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
14	SECTION 4: 4g - INTERVENTIONS -High consumption virtual visits (no continuous flow).		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
15	SECTION 5: SMART DEVELOPMENTS - 5a Work with developers on trials of grey water reuse on large new developments. - Adaptive Plan		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
16	SECTION 5: SMART DEVELOPMENTS - 5b Promote and provide services to smart large housing developments fitted via Alliance partners		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
17	SECTION 5: SMART DEVELOPMENTS - 5c In large housing developments create a community smart hub linked to rewards within their local community		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
18	SECTION 5: SMART DEVELOPMENTS - 5d Incentivising Developers to install rainwater harvesting - single development		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
19	SECTION 5: SMART DEVELOPMENTS - 5e Incentivising Developers to install rainwater harvesting - communal development		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
20	SECTION 5: SMART DEVELOPMENTS - 5f Incentivising developers to install Water butts		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
21	SECTION 6: 6a Work with retailers to incentivise reductions in irrigation water usage:		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund'). Note that we are currently trialling this at the moment.
22	SECTION 6: 6b Work with retailers and end customers on trials of grey water reuse retrofit schemes.		There is not enough information currently available to include this option (investigation to be included in the 'demand reduction discovery fund').
23	SECTION 6: 6e Introduce grants or rebates to incentivise retailers and end customers to introduce water efficiency measures / leakage fix	Yes	This option has been developed into our: Non-Household Option - 1. Water Efficiency Visits - Low size customer (Retailer driven) Non-Household Option - 2. Water Efficiency Visits - Medium size customer (Retailer driven) Non-Household Option - 3. Water Efficiency Visits - Large size customer (Retailer driven)
24	SECTION 6: 6f Work with retailers to provide digital and simple water saving devices to small NHH customers.	Yes	This option has been developed into our: Non-Household Option - 1. Water Efficiency Visits - Low size customer (Retailer driven) - 3000 visits per year
25	SECTION 6: 6g Work with retailers to provide an option to repair leaky loos - plumbing loss - Toilet rebate - Incentivisation	Yes	This has been developed into our options:

No.	Option	Feasible solution	Justification
			Non-Household Option - 4. Water Efficiency Visits - Retailer Incentive - plumbing loss reduction (Retailer driven) Non-Household Option - 5. Smart Meter identified Plumbing Loss Fix
26	SECTION 6: 6h Work with retailers to provide an option to repair leakage / cspl - smart meter linked	Yes	This has been developed into our option: Non-Household Option - 6. Smart Meter identified cspl Fix This option targets non-Household customer supply pipe leakage (cspl) repairs for properties identified to have continuous flow (through smart metering).
27	SECTION 6: 6k Targeted water efficiency advice for industrial/commercial users	Yes	This option has been combined with our water efficiency visit options: Non-Household Option - 1. Water Efficiency Visits - Low size customer (Retailer driven) Non-Household Option - 2. Water Efficiency Visits - Medium size customer (Retailer driven) Non-Household Option - 3. Water Efficiency Visits - Large size customer (Retailer driven)

Once fully assessed, we included our high portfolio of options to target the most ambitious (high version) relevant cohorts in order to maximize water efficiency savings, noting overall cost benefit comparisons.

We have also included our 'Demand reduction discovery fund' which is described in detail in the 'Revised draft WRMP24 demand management preferred plan technical supporting document: Section 10.1'. Further, in alignment with the WRPG, we have also included an assessment of the impact of government led interventions (in alignment with the WUK/Artesia report). This is described in 'Revised draft WRMP24 demand management preferred plan technical supporting document: Section 10.5'.

4.2.3 Environmental and social value

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

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

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

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

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

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

As part of our WRMP24 appraisal we have also conducted environmental assessments of our demand management portfolios as described in our associated 'Consultant Report'.

4.2.4 Investment benefits

The main impact of this investment is the reduction in demand that we expect it to deliver. We expect the investments made, particularly in smart metering to continue to support our reductions in leakage and PCC as well as starting to help us further understand business demand through the new performance commitment. We have reflected the expected benefit for these activities within our PCL for the two water demand performance commitments.

4.2.5 Managing uncertainty

The key uncertainty that we face with the demand management costs and benefit delivery is the assumptions that we make in relation to the benefits that the options will deliver. The benefits assumptions that we have made for each of the options has been informed by our WRMP24 cost benefit analysis process and future forecast modelling. Savings have been assessed for our draft WRMP24 and reassessed for the revised draft using the latest smart meter data outputs, as well as expert judgement regarding individual sub-options. These processes and key assumptions are detailed fully in the following documents: Revised draft WRMP24 demand management preferred plan technical supporting document, Revised draft WRMP24 demand management option appraisal technical supporting document and the Mott Macdonald WRMP24 Demand management options report for Anglian Water (September 2023)

Should it become clear that the benefits associated with any individual demand management measure differ significantly from our assumptions, we would look to change the portfolio of demand management measures we apply accordingly. As we are currently instituting our demand management monitoring framework (and it is only recently that we have had smart meter data available for analysis), we are mindful that our assumptions regarding water efficiency and leakage reduction will develop over time. We will, therefore, adapt our strategies, as new findings become apparent. We have developed our WRMP24 Adaptive Planning process in light of this.

We also face some uncertainty from the impacts that external events could have on customer demand, which may serve to dampen or exaggerate the demand reduction benefits we see from our investments. A key example of this in AMP7 has been the impact that the Covid-19 pandemic has had on consumption (through, for example, increased home working and greater usage from increased hand-washing) and the legacy this continues to have (e.g. through greater household consumption as more of the population of our region continues to work from home). In this instance we have been able to work with Ofwat to consider potential adjustments to the PCC performance commitment levels to reflect these external factors. We consider that the impacts of external factors can be mitigated through a continued open dialogue on how to address such issues as and when they arise.

4.2.6 External funding

No third-party funding has been secured for this investment area.

4.2.7 Direct procurement

We have considered whether our demand-side improvement investments could be delivered as DPC. In doing so we have followed Ofwat's guidance. We have concluded that these investments would not be suitable for delivery through DPC as they do not align with the guidance set out by Ofwat. For example, the enhancement is primarily opex focussed, and does not result in the delivery of assets. Furthermore, the individual activities that the investment funds are considerably below the £5m threshold that Ofwat has stated would be the minimum required to be considered suitable for DPC.

4.2.8 Customer view

We have engaged with customers on the methods of delivering the demand management programme. The key messages we have seen from both household and non-household customers is the need to improve both awareness and the ease with which customers can make changes to reduce their consumption. 69% of customers support increasing water savings campaigns to educate customers on how to reduce water waste. For non-household customers, cost control is particularly important. The largest non-household customers are more aware of the need for water savings, whereas smaller businesses have become more exposed to this with focussed discussions and appear responsive to nudges.

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 consistently across research as the second most important thing we need to do, behind providing good quality water.

Reducing customer-side leakage, although less familiar to our 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.

These insights have supported our preferred plan portfolio selection of:

- Behavioural change initiatives linked to the smart meter roll-out and the real-time consumption data this provide, and;

- Non-household options linked to our smart meter roll-out

More detail can be found in our Revised draft WRMP24 demand management preferred plan technical supporting document: Section 4' and 'Revised draft WRMP24 customer and stakeholder engagement technical supporting document'.

4.3 Cost efficiency

4.3.1 Developing costs

The development of the water efficiency costs in our plan follows our cost efficiency 'double lock' approach set out in chapter 7 of our business plan. Through this approach we have ensured that are costs are efficient in their bottom-up build up, and this is cross-checked through external benchmark approaches. This section sets out how we have ensured cost efficiency of our water efficiency investments through step one of our double lock approach. Step 2 is explored in the Benchmarking section below.

We have taken a robust approach to developing our water efficiency costs, building on our experience from delivering similar schemes into the bottom-up development of costs (before external cost benchmarking challenges are applied in step 2 of our 'double-lock' approach). The detail of the cost development approach is set out below, along with a breakdown of costs we provide in table CW3.

Cost estimation methodology

For WRMP24/PR24, all options have been characterised considering of a number of cost drivers

The cost drivers that have been considered are:

Table 19 Cost driver assessment

Cost Impact	Description
Asset capex cost	Capital expenditure associated with purchasing/acquiring the equipment and assets required to realise an option.
Asset replacement cost	Capital expenditure associated with reactive/proactive replacement of the assets (faulty; at the end of asset life).
IT Systems expenditure	On-going costs associated with back-office systems (which includes the IT systems for billing and the data management system).
Telecommunication Opex (IT)	Operational expenditure for communications, such as data costs, on-going licence fees and maintenance.
Customer engagement cost	Cost of awareness campaigns and customer education, including postage
Customer portal running cost	Cost of on-going activity to maintain the running of customer web portals and/or smartphone applications.
Asset installation cost	Cost of installing the assets both during the initial roll-out and when they are replaced as they reach the end of their useful life.
Operating cost	On-going cost associated with operational activity, e.g. meter reading for metering options, active leakage control (ALC) for leakage, incentivising developers or logistics/storage of equipment for water efficiency options.
Maintenance cost	Cost of maintenance activities, e.g. repairs.
Increased plumbing losses (PL) repair costs	Cost of additional repairs carried out by AWS following implementation of an option that allows identification of plumbing losses in a more efficient manner allowing for improved leak detection productivity.
Increased customer supply pipe repair costs	Cost of additional supply pipe repairs incurred by customers following implementation of an option that allows identification of leaks in a more efficient manner allowing for improved leak detection productivity.

Modelling of costs

Costs are modelled based on number of devices fitted, with costs assessed on current information.

Table 20 Smart showers - parameters used in modelling of costs

Item	Value
Cost of initial device/equipment purchase	£78.00
Cost of single installation, including visit (if required)	£2.50

The table below sets out the detailed breakdown of costs for our water efficiency enhancement programme.

Table 21 Water efficiency costs and savings

Investment ID	Investment Name	Scope	OPEX cost (£k) (25-30)	Option saving Ml/d
I034742	WRMP24 - Demand Management - Shower Timer	*Provision of Aguardio Smart Shower Sensor for 8000 households per year across 5 years *assuming 33l per properties per day saving.	3,296	1.32 Ml/d

Investment ID	Investment Name	Scope	OPEX cost (£k) (25-30)	Option saving Ml/d
I038767	WRMP24 - Demand Management - Garden Advice	*Provision of garden advice, promotions on social media and garden kits to support reductions in discretionary use for the garden. * For 60,000 households per year across 5 years. *Saving is 1l per property per day sustained saving.	1,593	0.30 Ml/d
I038769	WRMP24 - Demand Management - My Account	*Continued development of the My Account app to provide quick easy access to data and services. *Individual campaigns to support our key message and brand. * Efficiency messaging improvements from smart meter data. *60% of smart meter properties engaged over a 5 year period (2030) totalling 1.247 million households.	2,968	(savings included in smart meter savings)
I038770	WRMP24 - Demand Management - Community Reward	*Work at a community level to encourage water savings with the results triggering a community reward. *30000 households per year over a 5 year period. *1l per property saving	75	0.41 Ml/d
I038771	Demand Management-PL-Vulnerable Customers	*Scheme for customers in vulnerable circumstances and customers with affordability issues to fix leaky loos and leaky taps up to a capped value. *12% of all properties with a breakout leak per year over a 5 year period.	447	0.60 Ml/d
I038773	Demand Mgmt-PL-Non-vulnerable customers	*Delivery of the customer side leakage journeys relating to P1-P4 break out leaks. *87.2% of all properties (12.8% characterised as vulnerable) with a breakout leak per year over a 5 year period.	3,827	5.22 Ml/d
I038775	WRMP24 - Demand Management - Leaky Loo	*Leaky loos campaign (base option). This is a continuation of a service we offer in PR19. *1455 households per year over a 5 year period. *Savings calculated based on leak run time and size 478l per properties per day.	33	1.51 Ml/d
I038777	Demand Management - Demand Reduction Discovery	* Innovation funding in order to further our understanding of customer behaviours and the potential for future water efficiency initiatives. *This programme will be used to identify and fill evidence gaps regarding water demand, customer behaviours and water efficiency programmes	5,000	-
I040338	Demand Management - Non-Household cspl repairs	*Non-Household cspl repairs for properties identified to have continuous flow (through smart metering) *Savings currently estimated to be 9l/prop/day, based upon most recent Smart meter data.	91	0.13 Ml/d

Investment ID	Investment Name	Scope	OPEX cost (£k) (25-30)	Option saving Ml/d
I040344	Demand Management - NonHH_Option_PL SM repairs	*Non-HouseholdpPlumbing loss repairs for properties identified to have continuous flow (through smart metering) *Savings currently estimated to be 230l/prop/day, based upon most recent Smart meter data.	292	3.6 Ml/d
I040345	Demand Management - NonHH_PL100_Incentive	*Additional option to incentive PL repairs with a £100 incentive to the retailers in order to further impact longer running leaks. *3,000 properties per year targeted *Expected to potentially save another 59L/prop/day,	1,500	0.89 Ml/d
I040352	Demand Management - NonHH_WEF_Visit_Upper	*Specialist WEF Water Audit Visits with find and fix for larger consumers *Based upon 108 visits per year	1,404	1.15 Ml/d
I040355	Demand Management - NonHH_WEF_Visit_Lower	*Non-household Water Efficiency Audit for smaller customers with lower estimated PHCs. *It is expected to target approximately 3000 properties per year.	675	2.13 Ml/d
I040740	Demand Management - NonHH_WEF_Visit_V_Upper	*Specialist WEF Water Audit Visits with find and fix for very large consumers *Based upon 10 visits per year	520	2.19 Ml/d
		Total	**21,720**	**21.64 Ml/d**

4.3.2 Benchmarking

In stage 2 of our cost efficiency 'double-lock' on water efficiency , we used a variety of methods to assess, benchmark and challenge the costs in our plan. The nature of the water efficiency investments means that direct cost benchmarks are unavailable, we have therefore sought to provide an external check on our cost efficiency through using:

- Scheme outturn costs
- Market testing of costs

Scheme outturn costs

To develop the costs for our demand side improvement investments, we have used similar scheme out-turn data including the impacts of economies of scale to ensure that our cost estimates are efficient.

Market testing of costs

As part of our option characterisation we have also considered alternative vendors (where appropriate). We have also engaged with alternative suppliers for water efficiency visits for non-household to ensure competitiveness.

4.3.3 Assurance

Our costs for this investment were developed in our C55 cost estimation system, which has been independently assured by Jacobs.

4.4 Customer protection

In the unlikely event that the demand management improvement investment is cancelled, delayed or reduced in scope, customers are protected through the per capita consumption (PCC) and non-household demand performance commitments. Under these PCs, if we do not deliver the investments included in this enhancement area, this will reduce our performance against the PCC and non-household demand PCLs, meaning we will return money to customers through underperformance payments. Furthermore, should the investment be reduced, delayed or cancelled, this will necessitate further investment in other supply/demand measures in order to ensure we maintain a supply-demand balance.

5 Growth at water recycling centres

Overview

All of our Water Recycling Centres (WRCs) have been reviewed against the current view of growth to understand whether they will be able to manage with the additional demand within the next AMP period. Where a risk has been identified we have used a tiered approach to solutions, aiming to manage the risk through no or low cost solutions where possible. Therefore a range of solutions have been identified and to meet the demands of growth in our region, the most common ones are:

- Managing the risk through optimisation of the site, such as adjusting how the site is run, or small scale upgrades.
- Investigating levels of unaccounted for flow, and reducing where feasible through methods such as sewer relining.
- Upgrading the capacity of the WRC through additional processes like extra settlement tanks, aeration tanks or tertiary treatment.
- Applying for new environmental permits, with or without additional processes to meet the new permitted limits.
- Transferring sewage between catchments to utilise available capacity across our system.

Updating WRC risk from DWMP to PR24:

- Catchments reviewed with lower projection of growth.
- Catchments reviewed with the most up to date flow and population data.

Table 22 Investment Summary

PR24 costs (£m)	
Capex	161.2
Opex	3.1
Totex	164.3
Benchmarking	
Method	Scheme outturn costs Industry cost models from TR61
Findings	Our costs were found to be more efficient than the industry benchmark.
Customer Protection	
Price Control Deliverable	Growth at WRCs - New connections to water recycling network
Performance commitment	Discharge Permit Compliance
Ofwat data table	
CWW3.153-CWW3.155	Growth at sewage treatment works (excluding sludge treatment)

5.1 Delivering for the long term

5.1.1 Investment context

Strategic review

Under Section 106 of the Water Industry Act 1991 customers are provided with a ‘right to connect’ foul and surface water into the sewerage system. Over the next 25 years will see significant population growth within the East of England, alongside more intense rainfall due to climate change. The capacity of WRCs is limited by hydraulic capacity (measured by their Dry Weather Flow) and biological capacity. WRCs in catchment areas where significant growth occurs will run out of headroom if no action is taken, leading to non-compliance with permits and/or impeding further housing and business growth.

Our DWMP assessed the risks to our WRCs due to growth across the period 2025-30, using a growth demand forecast model aligned to WRMP 2024 (Water Resources Management Plan) and WRE (Water Resources East) regional plans. These forecasts are both based upon a unified foundation of Local Authority Planning data (collated by the external consultant, Edge Analytics) and ONS data.

During the DWMP development, to establish long-term implications of population growth and other factors, we undertook Baseline Risk and Vulnerability Assessments (BRAVA) to review the impact of growth and additional challenges against 10 planning objectives, including two under Water Recycling Centre (WRC) compliance: Dry Weather Flow (DWF) and quality. DWF is a statistical assessment of the amount of flow a WRC treats by taking into account the daily flow received by the works over a year's period, with the 90th percentile the measure for DWF compliance. The DWF is stated on the WRC environmental permit. The quality planning objective looked at the ability for the WRC to meet the permitted quality standards within the permit.

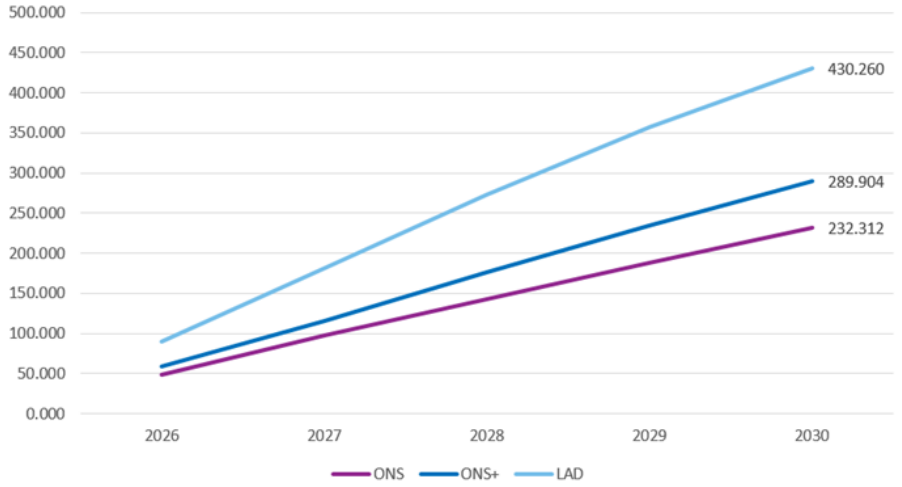
While all objectives saw increased risk levels, DWF compliance at WRCs was identified as one of the greatest risks if no action is taken to address growth and climate change. This is due to the historic utilisation of available capacity, ensuring we only delivered investment where required.

DWMP to PR24

The DWMP gave us a point in time view of risk using the growth forecast as outlined. This was reviewed for PR24 as there are various methods to forecast future growth. The method used by the DWMP gives a middle ground view of risk, similar to the line called ONS+ in the growth chart below. Other methods are to use the Local Authority Planning (LAD) data, which usually gives a more ambitious forecast.

For the purpose of PR24 we re-looked at the risk to WRCs with an ONS forecast, and used our DWMP solutions to propose investment needs around those sites which were triggering as a risk. The ONS data is a conservative view of growth. Using the lowest growth forecast leaves us with an unfunded risk which is why we have proposed a two-sided PCD, as discussed in section 5.4 (Customer Protection) below. Ultimately we will monitor the actual growth throughout the AMP period, and adjust plans to reflect the current situation.

Figure 16 Growth projections



Environmental constraints

The Environment Agency (EA) has set limits on the quality and quantity of treated effluent at WRCs to avoid an unacceptable impact on the environment. The EA has indicated that the consequence of DWF non-compliance at WRCs will be tightened, introducing penalties where WRCs are non-compliant for three out of five years. Additionally they may put in an objection to the growth at planning stages for developments within affected catchments.

Alongside the impact of growth, tightened permit limits driven by WINEP drivers will bring the reduction of permitted ammonia and phosphorus levels at some sites down to technical achievable limits (TAL), reducing headroom at a number of WRCs and in some cases removing the option for free or low cost solutions. Where a WRC has a permit at TAL the Environment Agency is unlikely to be able to allow a permit for an increase in DWF to address the increased risk from growth. Whilst we're pleased to support the environmental needs, these factors make ensuring WRC compliance increasingly challenging when combined with expected levels of population growth. We currently have at least 12 sites where this is potentially an immediate issue. We are actively working with the Environment Agency to identify alternative solutions within these catchments as a collaborative approach will be the only way to achieve both environmental protection and housing growth.

Summary

The level of growth in our region, alongside a historic utilisation of available capacity and increased environmental pressures are leading to a requirement of investment at a targeted selection of WRCs where catchments are observing high levels of growth and potential tightening of permits. A range of solutions have been considered to ensure that headroom is being increased through the most appropriate within that catchment, avoiding creating a barrier to economic and housing growth within the region.

5.1.2 Scale and timing

The scale and timing of our PR24 growth programme is informed by our 25-year approach to ensure the resilience of our water recycling functions whilst supporting economic and housing growth within the East of England. Future population numbers have been compared against the calculated design capacity at each planning horizon (2025, 2035 and 2050) to assess the potential impact of population growth on WRC performance.

As outlined in our DWMP, this strategic framework outlines our long-term strategy for water recycling and has informed our Long-Term Delivery Strategy and our PR24 investments. In the short term (2025-30), our PR24 investments must also consider wider business needs and affordability constraints. Therefore, although the DWMP provides an indication of when solutions may be required, this has been considered as part of the development of our PR24 business plan against the ONS forecast and LTDS.

During the LTDS we used the Common Reference Scenarios to establish what investment is required now, and what can be delayed until later in the timeline. Part of this was to review the DWMP within the context of the wider enhancement programme to ensure the strategy is both affordable and deliverable, which has scaled down the investment required for AMP8; although the long-term strategy as identified in the DWMP remains the same.

We have outlined the differences between the final DWMP and PR24/LTDS submission in chapter 5 Aligning our strategic frameworks and note at future price reviews the DWMP may fully align with business plans depending on stakeholder expectations and affordability considerations.

5.1.3 Interaction with base expenditure

The proposed investment is only driven by an increase in population leading to an enhanced need on the existing WRCs. Where there are separate maintenance needs already on site which would need to be fixed alongside the growth investment, for example a failing screen, this has not been included as part of the cost build up.

5.1.4 Long term context (historical)

The proposed investment is to address growth which we are predicting will occur in our region between 2025-2030.

Historically we have managed our risk within the allowance granted by Ofwat, including being proactive with our monitoring to ensure we invest in the right place at the right time. This means we have, and will continue to, utilise available capacity before implementing a solution. During AMP7 we are undertaking a significant investment to enable sustainable growth including investigations, optimisation, infiltration removal, applying for new permits, and on site upgrades. This investment has allowed us to remain compliant whilst also seeing a predicted increase of 435 thousand people between 2020-2025.

5.1.5 Long term context (future)

The outputs of the DWMP have fed into our delivery of the Long Term Delivery Strategy (LTDS). We have used the long-term lens of the LTDS to consider ways to expand on our DWMP, setting ambitious targets to further improve our performance in these areas. Within our LTDS drainage and water recycling strategy we will contribute to this overarching ambition by:

- Meeting, and in some areas exceeding, the challenging targets set by the government's Storm overflows reduction plan.
- Meeting our performance commitments for sewer flooding and pollutions.
- Working towards eradicating escapes from our assets and systems, including sewer flooding, pollutions and storm overflows.
- Continuing to maintain 100% compliance at our WRCs.

Our LTDS outlines the risk that growth and economic development present for our water recycling services if we fail to make sufficient investment in growth schemes, including increased flows and load (which is also exacerbated by climate change) and potential breach of discharge consents. To ensure we are able to facilitate growth up to 2050 without detriment to our customers or the environment, our Drainage and Water Recycling sub strategy core pathway sets out our strategy for ensuring we have sufficient biological and flow capacity at our WRCs to meet increased demand which should permit us to meet our ambition in this area under a broad range of scenarios.

Our AMP8 investment to accommodate growth at WRCs is low regret as in the short to medium term (AMPs 8 and 9) we are focusing on addressing well-understood and imminent risks using tried and tested solutions, modular where possible, that offer outcome certainty and future proofed for adaptability.

Alongside this we will be reviewing and improving our modelling techniques to refine our understanding of risk, and setting the foundations for our longer-term strategy by investing in new technologies. [15]

5.1.6 Customer support

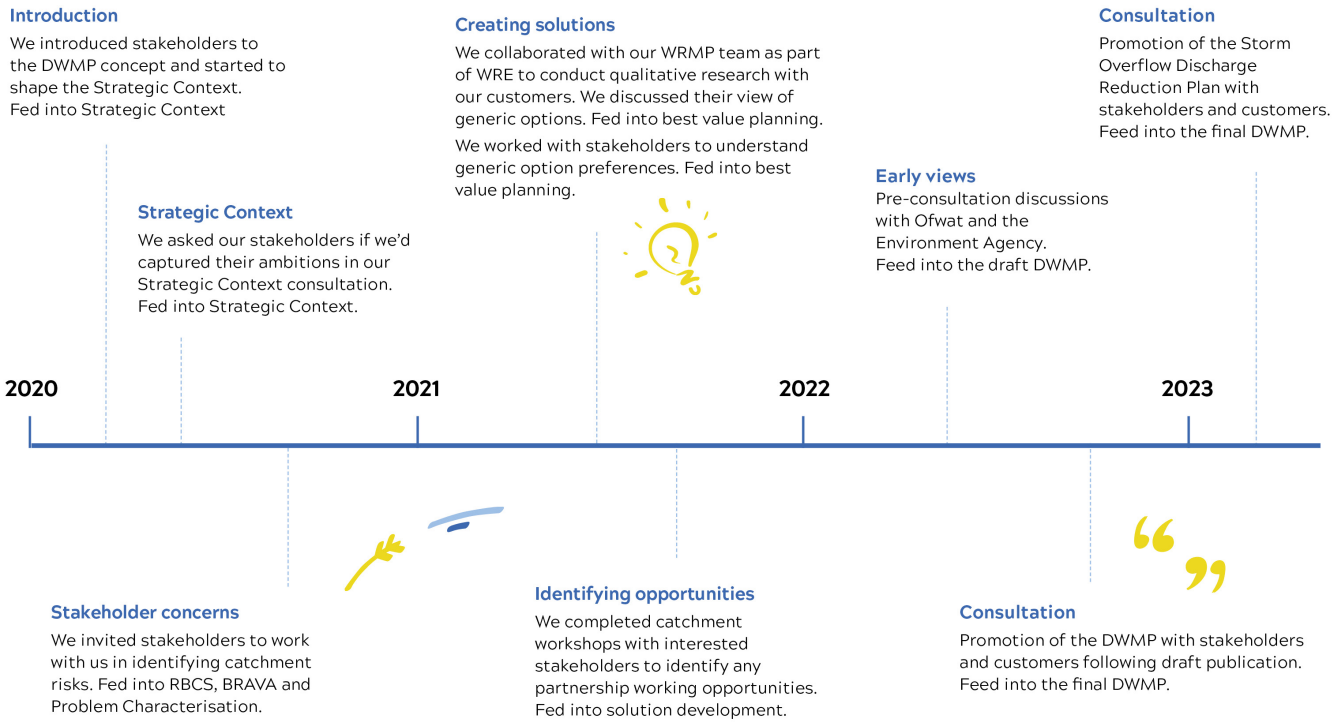
This investment is primarily driven by the need to accommodate growth within the region. As part of our dDWMP consultation we engaged with customers through a series of customer engagement sessions focused on water recycling and associated challenges to ensure that decisions made in our strategies are informed by them.

We also engaged extensively with stakeholders throughout the process of developing the strategic plan to shape and co-create our DWMP. More detail on our stakeholder engagement is available in section 4 of our final DWMP.

15 Please refer to 2.2.5 'Drainage and water recycling' in our LTDS.

Figure 17 DWMP customer and stakeholder engagement timeline

Customer and stakeholder engagement



In addition to the customer engagement conducted specifically on shaping our DWMP, we conducted more research focused on PR24. The Customer Investment Priorities (phase 1) research conducted by Trinity McQueen found that 'Investing to ensure we are meeting the demands of continuous population growth' came 9th out of 18 investment priorities for us to invest in in both 2025-30 and 2025-50 time horizons. However later iterations of this research (phase 4) found that planning for growth was not a top customer priority for the PR24 business plan. We have scaled and timed our PR24 investments accordingly, reducing the scale of investment from that set out in the DWMP to reflect customer preferences.

5.1.7 Cost control

This enhancement investment is closely related to the housing market, the speed that developers build and sell properties. As outlined above, our forecast is based on the ONS figures which is the most conservative forecast of growth. We will regularly review the risks across our region and prioritise sites for investment.

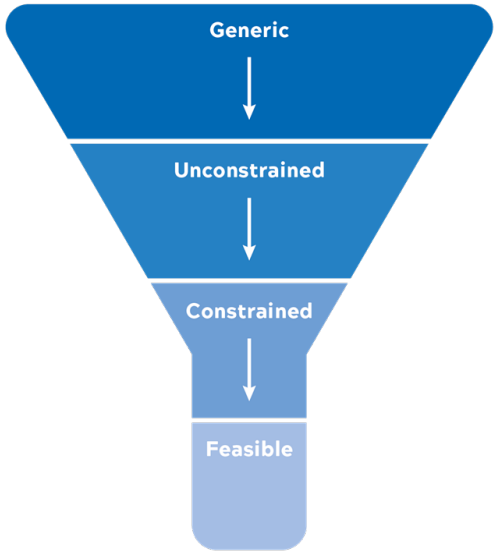
Historically we have controlled costs by utilising available capacity. We have found we are now at a tipping point where many of our WRCs are shortly about to reach their maximum capacity, resulting in a larger programme than we have historically required.

5.2 Unlocking greater value for customers, communities and for the environment

5.2.1 Option consideration

Once the risk related to growth at WRCs was identified in the BRAVA stage of the DWMP process, the optioneering process helped us find the best way to address this challenge through considering a wide range of options before choosing a best-fit solution that optimises resources. We used a four-step process, shown in the funnel diagram below.

Figure 18 Option development process



As outlined in the DWMP guidance, the generic options phase consists of identifying all potential solutions to the range of risks. This was the process for solutions across all of the catchment risks assessed within the DWMP, both treatment and network. We considered 45 different solution types falling under one of five categories: customer side management, combined foul and sewer systems, surface water management, wastewater treatment or other.

The unconstrained options stage assigns the solutions to the potential risk it could support, for example whether it is appropriate for WRC compliance, a network risk, or both.

Constrained and feasible stages takes the unconstrained options and reviews them against the location to identify whether it is a suitable approach for that area. All feasible options are then taken forward for cost benefit assessments.

Generic options

The generic options are outlined below:

Table 23 Generic investment options

Group	Option	Further details
Customer side management	Water efficiency - household customers.	Water efficiency measures can be installed within buildings to help reduce water consumption. This can benefit the wastewater system because it reduces the dry weather flow passing through the sewer network and through the WRCs.
	Water efficiency - business customers.	
	Rainwater harvesting - household customers.	Removing surface water from the system and making it available to re-use. By installing measures which collect and store rainfall before it lands and is lost as runoff. Rainwater harvesting reduces the amount of flow that needs to be moved through the sewer network during a storm. This in turn reduces the likelihood of sewer flooding or spills to watercourses.
	Rainwater harvesting - business customers.	
	Customer education - household customers.	A roll out of an education programme to improve understanding of the importance of reduced flows and the impact this has on the environment and sewerage system. This could include, but isn't limited to, awareness of existing incentives for removing surface water, removal of misconnections, or pollution prevention through keep it clear.
	Customer education - business customers.	
	Greywater re-use - household customers.	Install systems to treat and re-use household water (excluding toilets) for flushing toilets and gardening use. Either at property level or larger scale to reduce both flow and load to the system. The treatment levels considered vary from treatment for potable use (water that is safe to drink), to pre-treatment for discharge into the combined or foul sewer network.
	Greywater re-use - business customers.	
Combined foul and sewer systems	Property level resilience - above ground.	Provide physical barriers.
	Property level resilience - below ground.	Install non return devices at property level. This will stop water returning back.
	Proactive maintenance - cleaning.	Network cleaning regime at expected hotspots.
	Proactive maintenance - rehabilitation.	Network replacement regime at expected hotspots.
	Intelligent operation.	Use forecasting tools and real time information to control assets.
	Increased conveyance - infrastructure.	Pass forward a greater flow by increasing pump rate.
	Increased capacity - attenuation.	Build additional capacity through storage tanks. This will create additional volume to reduce storm impact.
	Transfer within catchment.	Avoid pinch point by diverting sub-catchment flows to another area of the catchment.
	Transfer between catchments.	Transfer flows from sub-catchments or the whole catchment to another sewerage catchment.
	Reduce infiltration.	Reline the sewer and/or manholes to remove infiltration.
Surface water management	New foul sewerage.	Create new sewerage pipes for foul flows only.

Group	Option	Further details
	New surface water sewerage.	Create new sewerage pipes for surface waters only.
	SuDS - public.	Variety of potential SuDS options, including swales, attenuation ponds and green roofs.
	Surface water source control - rural.	Re-directing land flows away from sewers.
	Rainwater harvesting - public.	Removing surface water from the system and making it available to re-use. By installing measures which collect and store rainfall before it lands and is lost as runoff. Rainwater harvesting reduces the amount of flow that needs to be moved through the sewerage network during a storm. This in turn reduces the likelihood of sewer flooding, or spills to watercourses.
	Exceedance pathways.	The need to provide safe movement (as opposed to storage) for floodwater during an extreme rainfall event (when the capacity of the sewer network is exceeded).
	Exceedance storage.	Storage of flood water to be used at a later time.
	Partnership funding.	Work with a third party to deliver a scheme with multiple benefits.
	SuDS - household.	Water butts and/or local rain gardens to reduce/slow the flow into the sewerage system.
	SuDS - business.	
Wastewater treatment	Improved maintenance.	Fixing assets when a maintenance need arrives.
	Process optimisation.	Adjusting our processes to get the most out of our existing assets.
	Increased capacity - new streams.	Build multiple additional process tanks at a WRC.
	Increased capability - new process.	Build a new process tank at a WRC.
	New treatment works.	Build a whole new WRC.
	Relocate outfalls.	Move the discharge point to another watercourse.
	Water reuse - non potable.	Direct the WRC discharge (effluent) for a non-potable use instead of discharging into the watercourse.
	Water reuse - potable.	Direct the WRC discharge (effluent) to a water treatment works (WTW) for potable use instead of discharging into the watercourse.
	Smart consenting.	Work with the Environment Agency to permit at a catchment level rather than individual WRCs
	Catchment management - flows.	Work with users who discharge into the watercourse to collectively reduce high flows.

Group	Option	Further details
	Catchment management - quality.	Work with users who discharge into the watercourse to collectively reduce poor quality.
	Wetlands.	Create a wetland for treatment of effluent.
	Treat / pre-treat trade effluent.	Improve the quality of trade effluent before accepting it into the sewerage system.
	Proactive maintenance - non-infrastructure.	WRC maintenance regime at expected hotspots.
	Increased conveyance - non-infrastructure.	Pass forward a greater flow by increasing flow to full treatment (FFT) - the maximum flow a WRC can treat.
Other	Investigate.	Complete work to understand the problem better.
	Wait and see.	Monitor.

As not all generic options were relevant for each risk type, the risks were assessed against the generic options which may provide a potential solution. Generic options were compared against the planning objectives to identify whether the option was appropriate to address the risk. This initial review provided the unconstrained assessment of options for each catchment.

Table 24 Unconstrained options list

Group	Option	Planning Objectives
Customer side management	Water efficiency - household.	WRC DWF compliance
	Water efficiency - business.	
	Rainwater harvesting - household.	Escape from sewers
	Rainwater harvesting - business.	
	Customer education - household.	WRC DWF compliance Pollutions
	Customer education - business.	
	Greywater re-use - household.	WRC DWF compliance
	Greywater re-use - business.	
Combined Foul and Sewer Systems	Property level resilience - above ground.	Internal/External/1 in 50 flooding
	Property level resilience - below ground.	
	Proactive maintenance - cleansing.	Pollutions

Group	Option	Planning Objectives
	Proactive maintenance - rehabilitation.	WRC DWF compliance Escape from sewers
	Intelligent operation.	Internal/External/1 in 50
	Increased conveyance - infrastructure.	Escape from sewers
	Increased capacity - attenuation.	
	Transfer within catchment.	
	Transfer between catchments.	All planning objectives
	Reduce infiltration.	
Surface Water Management	New foul sewerage.	Escape from sewers
	New surface water sewerage.	
	SuDS - public.	
	Surface water source control - rural.	
	Rainwater harvesting - public.	
	Exceedance pathways.	Internal/External/1 in 50
	Exceedance storage.	
	Partnership funding.	Escape from sewers Environment and Wellbeing
	SuDS - household.	Escape from sewers
	SuDS - business.	
Wastewater Treatment	Improved maintenance.	WRC compliance
	Process optimisation.	WRC compliance Spills
	Increased capacity - new streams.	
	Increased capability - new process.	

Group	Option	Planning Objectives
	New treatment works.	
	Relocate outfalls.	WRC compliance
	Water reuse - non potable.	
	Water reuse - potable.	
	Smart consenting.	WRC compliance Spills
	Catchment management - flows.	WRC compliance
	Catchment management - quality.	
	Wetlands.	
	Treat / pre-treat trade effluent.	
	Proactive maintenance - non-infrastructure.	
	Increased conveyance - non-infrastructure.	
Other	Investigate.	All
	Wait and see.	

The following final criteria were used to identify feasible options.

Table 25 Constrained list of options available at 2030, 2035 and 2050

Group	Option	Rules/Prompt
Customer Side Management	Water efficiency - household.	Can reducing water usage help us meet permit?
	Water efficiency - business.	
	Customer education - household.	Would a local campaign bring flows down low enough?
	Customer education - business.	
	Greywater re-use - household.	Can we work with developers to promote greywater re-use in new homes/commercial buildings?
	Greywater re-use - business.	

Group	Option	Rules/Prompt
Combined Foul and Sewer Systems	Proactive maintenance - rehabilitation.	Does anything suggest sewer deterioration?
	Transfer between catchments.	Is there a catchment with spare capacity within 3km? Is the site at/near technically achievable limit?
	Reduce infiltration.	Are unaccounted for flows >25%?
	Improved maintenance.	Could this be managed through increase maintenance?
Wastewater Treatment	Process optimisation.	Can we adjust the operation of the works slightly?
	Increased capacity - new streams.	Do we need to meet a new FFT?
	Increased capability - new process.	Are there any capacity bottlenecks?
	New treatment works.	Is the WRC in poor condition? Or, would it be better suited to serve the growth elsewhere?
	Relocate outfalls.	Is the site at/near technically achievable limit? Does the WRC discharge into or upstream of a sensitive watercourse? Can we relocate to a less sensitive watercourse?
	Effluent reuse - non potable.	Is there a potential user for non-potable water?
	Effluent reuse - potable.	Is there a large treatment works nearby?
	Smart consenting.	Is the site at/near technically achievable limit? Can we work to catchment permit the waterbody?
	Catchment management - flows.	Can we work with abstraction licences to increase dilution?
	Catchment management - quality.	Can we work with partners to improve river quality?
	Wetlands.	Is the site suitable for a wetland?
	Treat / pre-treat trade effluent.	Are there high trade flows? Could working with traders support here?
	Proactive maintenance - non-infrastructure.	Are there potential early interventions?
	Increased conveyance - non-infrastructure.	Review pumping station capability
Other	Investigate.	Do we need to find out more to make the decision?
	Wait and see.	Is the risk sufficiently low enough?

5.2.2 Cost-benefit appraisal

Following the review of constrained and feasible options, a Best Value Plan (BVP) assessment was undertaken to fully understand the benefits of each option. Jacobs undertook technical assurance of the DWMP best value planning process as part of the development of this strategic plan. Jacobs found that the BVP included a balance of solution costs, customer expectation, climate change scenarios and environmental and social benefits.

When we did the wider review of affordability we reviewed all of our solutions again against the ONS forecast to ensure we had assessed all feasible options. Feasible options were costed alongside the benefits they would provide, and run through our cost benefit assessment tool at a catchment level. This was then taken through an external technical assurance completed by Jacobs. As outlined in our DWMP response from regulators received in August 2023, it was noted that we provided a detailed statement of response, as well as Board and external assurance.

5.2.3 Environmental and social value

Our Value Framework covers a wide range of categories and incorporates environmental and social measures (such as Biodiversity net gain, carbon, traffic disruption and noise) alongside traditional measures such as flooding, interruptions to supply and pollution. This enables us to consider a broader range of benefits and disbenefits of our investments and their alternatives, leading to investment decisions that more holistically consider value and the impacts our actions may have on the environment, customers, and communities.

In this investment area particular consideration was given to:

- **Carbon -** The capital and operational costs of the schemes.
- **Permit failures and discharges** - an understanding of whether there is a risk to permit compliance, and the scale of the failure if no investment is made.
- **Biodiversity net gain** - The amount of biodiversity net gain we would be losing through doing the scheme, and from this the amount we will be increasing biodiversity to counteract the impact.

5.2.4 Investment benefits

Each option is assessed from a benefits perspective using our Value Framework.

A baseline position is established that captures any current or expected impacts to service, customers, the environment, safety etc (and their respected likelihoods).

Each alternative (i.e. option) is appraised to establish a residual position, with updated impacts and likelihoods. This residual position also considers any additional benefits and disbenefits that may apply as a result of the intervention.

These could be permanent (e.g. visual impact) or temporary (traffic disruption during construction) and consider a range of environmental and social measures including both capital and operational carbon.

This programme of work primarily provides benefits for, and supports our performance commitment of treatment work compliance.

Overall we expect to provide enough capacity to address the increase of people by 2030, whilst remaining compliant, providing excellent service to customers and protecting the environment.

5.2.5 Managing uncertainty

Due to the nature of the housing development process, the pace and exact location of housing growth is uncertain. Population changes due to development and internal/external migration also need to be understood. We operate a data led approach, based on construction and planning authority data which aids our understanding of growth and its impact on asset performance, and consequently the forecasted need for investment on our assets. We engage developers and get notification of developer start dates for their proposed developments. We generally expect to see first flows approximately 12 months from this date. We have reviewed the impact of a differing demand pathway through the Long Term Delivery Strategy.

Our plan is low regrets, meaning we have created a strategy with solutions which are adaptable, focussing on solutions which can be scaled. For example, infiltration removal projects could be in one street or expand to a whole catchment, modular such as building one tank now and leaving the ability to build a second one in the future, or deferred where we feel the level of risk is acceptable.

5.2.6 External funding

As identified in our DWMP, we recognise securing long-term resilience for our water recycling centres will be driven by collaborative efforts from companies and stakeholders, and will seek alternative approaches to engage with third parties through elements of our DWMP strategy. However we do not anticipate that we will secure third-party funding for this activity. There are no explicit or implicit developer contributions for WRC growth.

5.2.7 Direct procurement

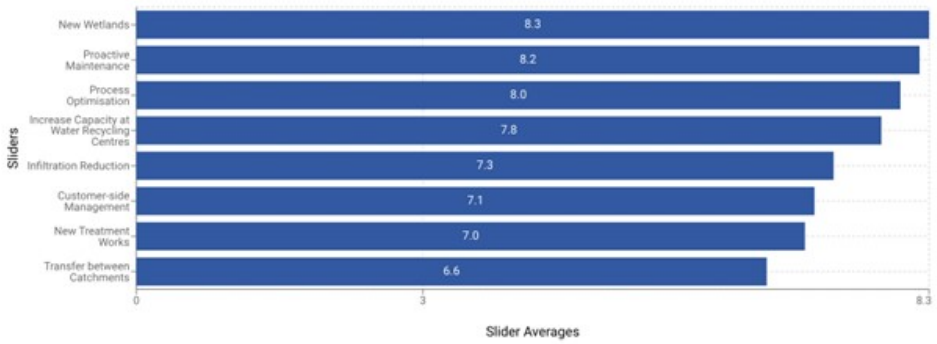
The investment does not meet the size criteria for consideration as a DPC scheme on an individual or collective basis. Accordingly it has been discounted from further consideration for DPC.

Further, the works required involve improvements to existing assets, which are not discrete due the operational and commercial complexities involved were two parties to construct and/or operate simultaneously on live operational assets.

5.2.8 Customer view

We completed customer engagement on solution types through the DWMP engagement. The outputs from the WRC engagement can be found below. Wider customer engagement has been completed through PR24 and LTDS.

Figure 19 Customer solution preference - WRC



Customer Views

"Wetlands where space allows, and where they can cope with the additional water levels, seems to be a win win - more natural water processing, better for the environment than just building more processing plants." 35-44, Suffolk

"We need to use all possible solutions in moderation to achieve the improvements required." 65-74, Norfolk

*"I think all these options need to be integrated based on balancing cost and green/neutral benefits."*45-54, Norfolk

"I do not like the idea of building new treatment works or transferring between catchments. These seem like options that are less 'green' and will have negative environmental consequences." 45-54, Bedfordshire

5.3 Cost efficiency

5.3.1 Developing costs

The development of the WRC growth costs in our plan follows our cost efficiency 'double lock' approach set out in chapter 7 of our business plan. Through this approach we have ensured that are costs are efficient in their bottom-up build up, and this is cross-checked through external benchmark approaches. This section sets out how we have ensured cost efficiency of our WRC growth investments through step one of our double lock approach. Step 2 is explored in the Benchmarking section below.

We have taken a robust approach to developing our WRC growth costs, building on our experience from delivering similar schemes into the bottom-up development of costs (before external cost benchmarking challenges are applied in step 2 of our 'double-lock' approach). The detail of the cost development approach is set out below, along with a breakdown of costs we provide in table CWW3.

Cost estimation methodology

We follow a common cost development methodology across our enhancement investments in a three phase process:

1. Establish cost and carbon models
2. Input the cost drivers into the model (including location specific factors)
3. Data validation, internal challenge and assurance.

We derived our total cost estimation for each scheme through the following process by gathering location based data which influence the cost estimates for each scheme, including:

- review of historic and forecasted flows using the ONS growth forecasts;
- DWF sites;
- capacity of sites;
- current site operability, capacity and connection to existing assets;
- site specific requirements and;
- assessment of construction constraints such as SSSI areas.

Project construction elements are broken down into major work elements such pumps, tanks, pipes, with high levels design parameters. The costs for these are estimated individually by using cost models and the on-site design information and then aggregated it to inform our cost estimation for PR24.

The table below provides the breakdown of site costs for our WRC growth investments:

Table 26

Investment ID	Investment name	Scope	Capital cost (£000s) AMP8	OPEX cost (£000s) AMP8
I039128	Frampton WRC Growth DWF Capacity	*Inlet works-flow 2856m3/d *Primary tank-79m3 *Storm Tank-163m3 *Inline PS-8kW *BAF Plant-flow 1428 m3/d *Aeration tank-241m3 *Final Tank-111m3 *Ancillaries (Telemetry ,kiosk, boundary fencing, Landscaping)	7.43	0.12
I034494	Melbourn WRC Growth DWF Capacity	*Inlet works -flow 20456 m3/d *Aeration,1575m3 *Humus Tanks, Circular - 710m3 *Cont Sand Filtration-Flow 10228m3/d *Final Effluent PS - 56KW *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)	9.25	0.07
I034489	Spalding WRC Growth PE Capacity	*Primary Tanks Desludging-117m3 *Aeration -7204m3 *Final Tanks Circular-164m3 *Standby Generation -750kW *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)	8.65	0.06
I040015	Stradishall WRC Growth DWF Compliance	*Inlet Works, flow 6240m3/d *Primary Tanks-volume 190m3 *Aeration, volume 799m3 *Interprocess Pump-18kW *UF Membrane Filters-6864 m3/d *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)	9.74	0.08
I033405	Tuddenham Growth / DWF Compliance	*Sewer Gravity -Relining of 2900m (in filed 2338m, , in verge 401m, path 161m), 250mm dia *Inlet works in M&E-flow 10,700 m3/d	10.54	0.08

Investment ID	Investment name	Scope	Capital cost (£000s) AMP8	OPEX cost (£000s) AMP8
		*Primary tank, Circular--280m3 each *Raw Sewage Pump-28KW *Aeration, -820m3 *Final Tank, Circular civil and M&E-193m3 *Sludge drum Thickener M&E-268 TDS/Y *Interprocess PS -28Kw *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)		
Various	4 Specific site locations	Site specific process required incl *Primary Tanks, Circular *Storm Tanks *Inline pumping *Aeration *Final Tanks, Circular *Cont Sand Filtration *Standby Generation *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)	22.34	0.25
Various	21 Specific site locations	Site specific process required incl *Storm tanks *Primary tanks *Final tanks *Continuous Sand Filtration *Interprocess Pumping station *Standby Generators *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)	27.03	1.24
Various	4 Specific site locations	Site specific process required incl *Inlet works *Primary Tanks *Final Tanks	10.49	0.50

Investment ID	Investment name	Scope	Capital cost (£000s) AMP8	OPEX cost (£000s) AMP8
		*SAF plant *Standby Generation *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)		
Various	22 Specific site locations	Site specific assets required incl; *Sewers *Manholes *Rising Main *Inline Pumping station *Ancillaries (Roads , Telemetry , Kiosk, Landscaping)	34.12	0.63
Various	New Permit Application at 9 sites DWF compliance	Melton WRC, Lt Totham WRC, Langham (Norfolk) WRC, Highwood WRC, Halstead WRC, Gt Samford WRC, Foulden WRC, Earls Colne WRC, Ditchingham WRC	0.03	0.06
I034542	Clacton WRC Growth DWF Compliance	*Appraisal/Study of the Clacton, Jaywick and Walton catchments to define a long term proposal for treatment sites in relation to ongoing growth, DWF compliance and WRC coastal erosion / flooding	0.46	0.00
I041321	Cambridge re-location contribution	*Adjustment: estimate difference between 270k and 230k PE	21.14	0.00
		Total	**161.21**	**3.09**

5.3.2 Benchmarking

In stage 2 of our cost efficiency 'double-lock' on WRC growth, we used a variety of methods to assess, benchmark and challenge the costs in our plan. We have utilised:

- Scheme outturn costs; and
- Industry cost models from TR61

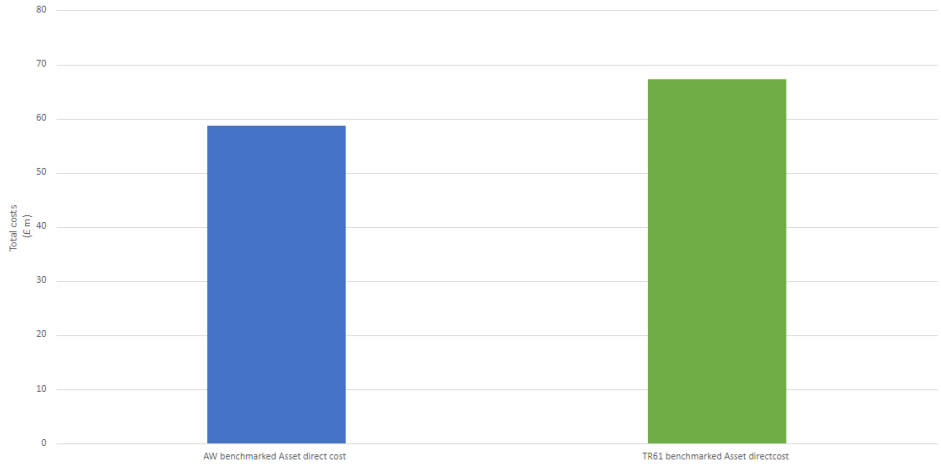
Scheme outturn costs

To develop the costs for our WRC growth investments, we have used similar scheme outturn data including the impacts of economies of scale to ensure that our cost estimates are efficient.

Industry cost models from TR61

To further cross check our cost efficiency, we have identified cost benchmarking data for the main processes required to expand the capacity of a WRC to treat the increased load through cost models built by WRC's TR61. These include continuous sand filtration, BAF /SAF plants, and primary/final tanks. Of the total programme value of £161m, we found reliable comparative benchmarking for a £59m sample of investment. The comparison below of our costs versus the benchmark, show we are 4% more efficient than the industry benchmark.

Figure 20 Growth at WRCs - asset direct scheme costs benchmarked to industry data WRC TR61



In light of the evidence presented above we have confidence that the costs we have estimated for our programme present an efficient rate.

5.3.3 Assurance

The build up of the costs presented above has been assured by Jacobs.

5.4 Customer protection

In the event of our WRC growth enhancement investment being cancelled, delayed or reduced in scope, our customers will be protected through the Growth at Water Recycling Centres Price Control Deliverable that we have included within our PR24 business plan. They will also be protected by the Discharge Permit Compliance performance commitment which could be impacted if investment to meet growth is not made in a timely fashion.

The purpose of this investment is to ensure that our WRCs have enough capacity to deal with population growth. We believe that this measure should focus on the outcome of the investment as there are different solutions as to how we can mitigate this issue. The CMA examined this issue in detail as part of their redetermination in 2021[1], and decided that using connections was a suitable metric for their expanded Developer Services Revenue Adjustment (DSRA) mechanism, given that connections positively correlates with growth costs. We propose to retain the CMA's precedent for this PCD. The PCD is therefore based on the number of new connections to the water recycling network.

By linking the customer protection mechanism to the number of new connections, we ensure that the protection is focussed around making sure that our plan contains adequate investment to meet the growth needs of the region (i.e. should the number of new connections be lower than our expectation, funding will be returned to customers, reflecting the reduction in the need for the investment).

6 Microbiological treatment

Overview

- We will invest £38m to meet new or tightened permit conditions for microbiological parameters at coastal or inland bathing waters or to address shellfish bed quality, driven predominately by statutory WINEP obligations.
  - We will install Ultra Violet (UV) disinfection at 10 Water Recycling Centres
  - At 11 locations (shellfish or bathing water catchments) we will invest to reduce spills, where this links to the quality of the receiving bathing water or shellfish waters. This will include action across multiple overflows to ensure targets of <2spills or <10spills are met.
- To keep costs down and only spend when necessary, we have kept a further 8 locations out of our plan and requested a bespoke Uncertainty Mechanism to allow us to invest at these sites as and when they are successfully designated as bathing waters
- We partnered with Mott Macdonald and Aecom to compare our costs with comparable schemes across the industry. Our capital direct costs are in-line with the cost benchmarks.

Table 27 Investment Summary

PR24 costs (£m)	
Capex	35.3
Opex	2.4
Totex	37.7
Benchmarking	
Method	Scheme outturn costs Industry cost models from TR61 Asset level cost comparison with other companies
Findings	Our costs were found to be more efficient than both the TR61 benchmark and the asset level comparison with other companies.
Customer Protection	
Price Control Deliverable	WINEP obligations
Performance commitment	Bathing Water quality PCL
Ofwat data table	
CWW3.88-CWW3.90 CWW17.88-CWW17.90	Microbiological treatment - bathing waters, coastal and inland Microbiological treatment - bathing waters, coastal and inland

6.1 Delivering for the long term

6.1.1 Investment context

This investment relates to the delivery of WINEP schemes to meet new or tightened permit conditions for microbiological parameters at coastal or inland bathing waters. Where our operations have an impact, investment is required to reduce contributions to the microbial load at designated bathing waters and shellfish beds by improvements / disinfection of Final Effluent from water recycling centres and reducing spill frequency of storm overflows from our assets to <10 per year or <2 per bathing water season in designated bathing water. The need for investment stems from statutory WINEP obligations under driver codes BW_ND/IMP or SW_ND/IMP as determined by the Environment Agency. In addition, where it relates to the quality of the bathing water downstream, storage solutions to reduce spills are also required in conjunction. All investments included in PR24 for coastal bathing and shellfish waters are statutory, with 11 bathing/shellfish water catchments receiving improvement action in AMP8.

Where we anticipate that an inland water may be designated in the 2025-30 period, we have included enhancement investment for investigations and improvement of assets impacting these locations. We are aware of 11 potential inland bathing waters emerging in AMP8 (including 3 reservoir sites and 8 river sections). Investment in potential inland bathing waters is a non-statutory WINEP requirement, and has therefore been included under an uncertainty mechanism and not included as part of this enhancement strategy. This recognises that if the inland bathing water achieves designation, investment will be required under a

statutory WINEP driver. This regulatory process has been demonstrated through PR24 WINEP development, with drivers for the river Deben and Rutland Water being changed to statutory drivers by the EA following formal designation.

Access to high quality bathing waters aligns with our Get River Positive pledge to create more opportunities for everyone to enjoy our region's rivers, with a commitment to ensure 90% of our population will live within an hour's drive of a designated bathing site.

6.1.2 Scale and timing

The scale and timing of this investment is driven to align with our statutory WINEP obligations as specified by the Environment Agency. Determined by investigations undertaken within AMP7, the schemes delivering microbiological treatment improvements for shellfish waters and bathing waters are required to be delivered by the middle of AMP8 to comply with obligations.

Priority action is required for shellfish and bathing waters, particularly where there is a risk of environmental deterioration. For that reason, a significant proportion of enhanced microbiological treatment will be completed by 2027, to align with the strategic regulatory priority given to these high-value, sensitive environments.

The Environment Agency requires action to be taken in AMP8 for all statutory drivers, with phasing opportunities explored for all investments included in PR24. Non-statutory drivers for undesignated inland bathing waters have not been included as part of our proposed enhancement investment. Instead, they are reflected in an uncertainty mechanism, such that investment at these sites would only be allowed if these sites become designated. If Ofwat do not accept the uncertainty mechanism then after our Draft Determination we would need to include these investments in our plan and expand the Price Control Deliverable (PCD) to return funding if they are not required.

6.1.3 Interaction with base expenditure

This investment is enhancement expenditure as it enhances the quality of coastal bathing waters and shellfish waters through the installation of additional treatment or storage facilities. Meeting new or tightened limits requires a step-change in our performance above our previous investment to address bacteriological loading to the required level in previous AMPs. Disinfection equipment is extremely expensive to install and operate and cannot be accommodated within base expenditure.

6.1.4 Long term context (historic)

Our microbiological treatment investment builds upon our PR19 investigations programme. For bathing waters and shellfish waters, this is driven by AMP7 investigations generating obligations to be delivered by the middle of AMP8. Investment was allowed in AMP7 for a limited number of microbiological treatments schemes.

The following table sets out the schemes allowed as part of our AMP7 and AMP8 programmes:

Table 28 AMP7 and AMP8 schemes

AMP7	AMP8
Cleethorpes BW- spill reduction, network management and storm storage	**Blackwater SW** - disinfection (UV) and spill reduction
Jaywick BW- spill reduction, network management and storm storage	**Cleethorpes BW**- spill reduction (additional assets identified on top of AMP7 delivery)
Lowestoft BW- spill reduction, network management and storm storage	**Crouch and Roach SW**- disinfection (tertiary lagoon) and spill reduction
Southwold BW- disinfection (alternative PFA dosing trial implemented instead)	**Deben Inland BW**- disinfection/spill reduction (as identified through investigation)
Walton and Frinton BW- spill reduction, network management and storm storage	**Hunstanton BW**- spill reduction
	Leigh Bell Wharf BW- spill reduction
	Mundesley BW- spill reduction
	Rutland Inland BW- disinfection/spill reduction (as identified through investigation)
	South East Wash SW- disinfection (UV) and spill reduction
	Southend BW- spill reduction
	West Wash SW- disinfection (UV) and spill reduction

Our AMP7 obligation to install UV disinfection at Southwold WRC was deferred from AMP7 to AMP8 by the Environment Agency, recognising that additional action would be required following the AMP7 trial. The AMP7 action was to permit a trial of PFA disinfection at this site, for comparison with UV alternative to determine the feasibility of rolling out PFA at scale during AMP8. Additional enhancement expenditure has not been requested to deliver this improvement in AMP8, as this was previously funded at PR19.

6.1.5 Long term context (future)

Given the increasing public and political pressure on bathing waters, as well as increasing ecological interest in these downstream environments from regulators, we anticipate additional enhancement investment being required in AMP9 and beyond, however it is not possible to yet quantify this. In the short-term (future), we anticipate an increase in number of designated inland bathing waters, which will need to be investigated and actioned to achieve good/excellent bathing water status in successive AMPs. We are currently aware of 11 areas of inland bathing water interest from working with our partners/catchment stakeholders across the region, however this number is likely to continue to rise throughout AMP8 and into AMP9.[16]

Significant overflow action planned under the Environment Act will undoubtedly benefit shellfish and bathing water areas, and there is therefore strong alignment with the anticipated enhancement expenditure in this programme going forward.

Wider investment will likely be required following the investigation of the Marine Conservation Zone (MCZ) in the Blackwater estuary, however it is not yet clear what this investment will be. There is an opportunity in the Blackwater catchment to work in partnership with Essex and Suffolk water and other partners to deliver action across the catchment in AMPs 9&10, and we will be looking to explore how our A-WINEP approach can be incorporated in PR29 optioneering for this catchment.

6.1.6 Customer support

Bathing water quality has seen increasing attention from customers, government, and the media alike. Our customer insight as captured in our Customer Synthesis Report shows that there are concerns from customers regarding the water quality used for recreational use. Research conducted by Incling with our Online Community showed that 42% of participants use bathing waters recreationally. Of those participants that stated that they see water quality as being of high importance for recreation, many had concerns about the risk to health for swimmers (ie infection, disease).

This investment is also required to benefit the environment and biodiversity, in particular shellfish waters. As identified in our Customer Synthesis Report our customers have a strong preference for avoiding deterioration in service levels for environmental outcomes such as bathing water quality. Customers across our engagement were keen for us to take action to benefit wildlife across the region including at bathing waters, and there was desire for outdoor recreation spaces given recognition of benefits for physical and mental wellbeing.

We are working with several campaign groups across the region supporting designation of these sites. In addition, we are aware of government support for the schemes, for example the joint opinion artical written by Professor Chris Whitty Chief Medical Officer with Ofwat and the EA in 2022[17]

6.1.7 Cost control

This investment is driven by the obligations set out in the WINEP for coastal bathing waters and shellfish waters, and it is therefore outside management control to defer to later AMPs. Where there is uncertainty relating to schemes that could potentially become statutory within AMP8 (undesignated bathing waters), costs have been managed through a proposed uncertainty mechanism and not included in this enhancement investment. This enhancement investment and uncertainty mechanism ensure that customers are only paying for statutory expectations in AMP8. Action in PR24 builds on investments made in PR19, and offers efficiency in ensuring environmental outcomes are met, without duplicating investment on assets that contribute to bathing/shellfish water quality. Our understanding of the interaction of our assets with these priority sites is increasing all the time, and collaboration is positive with the Environment Agency to ensure that enhancement investments deliver value to customers and the environment.

16 More detail is available in Section 2.2.2 'Environmental Enhancement' in our LTDS.
17 Sewage in water: a growing public health problem - GOV.UK (www.gov.uk)

6.2 Unlocking greater value for customers, communities and the environment

6.2.1 Option consideration

In considering which options to include in our plan we first considered the widest reasonable range of options.. The following table sets out all the options considered throughout our optioneering process, including those which were discounted:

Table 29 Options appraisal assessment

No.	Option	Description	Unconstrained	Constrained	Feasible
1	Construct additional storage to reduce CSO spills	Traditional & green options considered under the overflows programme	Yes	Yes	Yes
2	Tertiary UV disinfection of WRC final effluent and storm overflow	Traditional delivery extended into network operations	Yes	Yes	
3	Tertiary UV disinfection of WRC final effluent	Traditional solution	Yes	Yes	Yes
4	Tertiary PerFormic Acid (PFA) disinfection of WRC final effluent	Innovative technology	Yes	Yes	
5	Tertiary constructed wetland treatment of WRC final effluent	Innovative technology	Yes	Yes	Yes
6	Tertiary membrane treatment of WRC final effluent	Traditional solution	Yes		
7	Tertiary ozone treatment of WRC final effluent	Traditional solution	Yes		
8	Nano Filtration treatment of WRC final effluent	Traditional solution	Yes		
9	Improvements to existing lagoons on WRCs	Optimisation solution	Yes	Yes	Yes
10	Improvements to WRC Final Effluent to reduce solids and reduce bacteriological loading	Optimisation solution	Yes	Yes	Yes
11	Do nothing		Yes		

6.2.2 Cost-benefit appraisal

The table below sets out the assessment of these options against six criteria we used to assess each option. Those options which were considered to meet the required outcome and were technically feasible (first two columns) were explored in further detail as constrained options.

Table 30 Unconstrained option assessment

No.	Option	Required outcome	Technical feasibility	Wider environmental outcomes	Customer support	Risk and uncertainty	Environmental risks
1	Construct additional storage to reduce CSO spills						
2	Tertiary UV disinfection of WRC final effluent and storm overflow						
3	Tertiary UV disinfection of WRC final effluent						
4	Tertiary PerFormic Acid (PFA) disinfection of WRC final effluent						
5	Tertiary constructed wetland treatment of WRC final effluent						
6	Tertiary membrane treatment of WRC final effluent						
7	Tertiary ozone treatment of WRC final effluent						
8	Nano Filtration treatment of WRC final effluent						
9	Improvements to existing lagoons on WRCs						
10	Improvements to WRC Final Effluent to reduce solids and reduce bacteriological loading						
11	Do nothing						

The remaining options where then assessed against a further set of criteria:

Table 31 Constrained option assessment

No.	Option	Feasibility	Risk	Performance	Engineering	Cost & benefit	Environmental
1	Construct additional storage to reduce CSO spills	Meets statutory obligation	Residual risk has been considered	Yes - proven to reduce spills under previous WINEP schemes	Complex	Cost combined for all proposed investments for SW_ND £30.6m Benefit combined of all proposed investments for SW_ND £109m	Assessed using WINEP Wider Environmental and Social Impact
2	Tertiary UV disinfection of WRC final effluent and storm overflow			Yes - proven to effectively reduce FIO loadings on FFT, but not storm water when higher turbidity would be likely to reduce performance			
3	Tertiary UV disinfection of WRC final effluent			Yes - proven to effectively reduce FIO loadings			
4	Tertiary PerFormic Acid (PFA) disinfection of WRC final effluent	No - not currently approved by the Environment Agency and unknown impacts to shellfish beds		Yes - proven to effectively reduce FIO loadings during Southwold trial (but viral efficacy not yet proven)	Moderately complex		
5	Tertiary constructed wetland treatment of WRC final effluent	The primary use of Constructed Wetlands in Wastewater treatment is not for reduction in bacteriological loading, however, there is some evidence that it can lead to reductions	The primary use of Constructed Wetlands in Wastewater treatment is not for reduction in bacteriological loading, however, there is some evidence that it can lead to reductions.	No - constructed wetlands may indirectly lead to a reduction in bacteriological load but that isn't their design purpose	Complex		
9	Improvements to existing lagoons on WRCs	The primary use of Lagoons in Wastewater treatment is not for reduction in bacteriological loading, however, there is some evidence that it can lead to reductions	The primary use of Lagoons in Wastewater treatment is not for reduction in bacteriological loading, however, there is some evidence that it can lead to reductions.	No - improvements to lagoons may indirectly lead to a reduction in bacteriological load but that isn't their design purpose	Moderately complex		
10	Improvements to WRC Final Effluent to reduce solids and reduce bacteriological loading	Yes - improvements to FE at WRCs can lead to reductions in bacteriological loadings. This will not achieve the same levels of reductions as disinfection systems.	Residual risk has been considered	Possible - improvements to FE at WRCs can lead to reductions in bacteriological loadings. This will not achieve the same levels of reductions as disinfection systems			

The constrained and feasible options assessment led to an assessment of whether each potential option was feasible for inclusion in the plan. This assessment is summarised in the table below.

Table 32 Feasible options

No.	Option	Feasible option (Y/N)	Justification
1	Construct additional storage to reduce CSO spills	Y	Feasible solution and meets required need
2	Tertiary UV disinfection of WRC final effluent and storm overflow	N	Not proven to be effective for storm water when higher turbidity would likely reduce performance
3	Tertiary UV disinfection of WRC final effluent	Y	Feasible solution and meets required need
4	Tertiary PerFormic Acid (PFA) disinfection of WRC final effluent	N	Not currently approved by the EA and unknown impacts to shellfish beds. We note that we previously trialled this technology at Southwold WRC during AMP7 - although we received positive stakeholder feedback from this trial, we have not proposed this option for PR24 due to the EA's feedback.
5	Tertiary constructed wetland treatment of WRC final effluent	Y	Feasible solution and meets required need
6	Tertiary membrane treatment of WRC final effluent	N	Does not meet statutory outcome required as this is not an accepted disinfection treatment by the EA due to unproven viral efficacy.
7	Tertiary ozone treatment of WRC final effluent	N	Does not meet statutory outcome required as this is not an accepted disinfection treatment by the EA due to unproven viral efficacy.
8	Nano Filtration treatment of WRC final effluent	N	Does not meet statutory outcome required as this is not an accepted disinfection treatment by the EA due to unproven viral efficacy.
9	Improvements to existing lagoons on WRCs	Y	Feasible solution and meets required need
10	Improvements to WRC Final Effluent to reduce solids and reduce bacteriological loading	Y	Feasible solution and meets required need
11	Do nothing	N	Does not meet any criteria including required outcome.

6.2.3 Environmental and social value

As captured within the relevant ODR, this investment provides benefits for the following areas as measured through the EA value metric:

- Potential benefit: Biodiversity
- Potential benefit: Water purification by habitats
- Strong benefit: Food - shellfish

6.2.4 Investment benefits

We expect this investment to provide a benefit for public amenity and the Bathing Water Quality status performance commitment. This benefit, as well as other improvements to be delivered from enhancement, has been reflected in the calibration of the PCL for the Bathing Water Quality performance commitment.

6.2.5 Managing uncertainty

This investment is based on confirmed obligations as defined in the WINEP on 3 July 2023. Any further investment requirements introduced by the EA following the confirmation of WINEP24 or submission of the business plan will be covered by the bespoke uncertainty mechanism we are proposing for inland bathing waters, or via the over-performance payments we are proposing in our Price Control Deliverable for WINEP delivery

We consider the statutory investment included within this enhancement area to be fully deliverable.

6.2.6 External funding

As this investment addresses a statutory obligation, we do not consider third party funding feasible for this investment.

6.2.7 Direct procurement

We have applied the DPC criteria against each of our enhancement investments to assess suitability for delivery through DPC. The table below illustrates the areas we have considered.

Table 33 DPC assessment

DPC criteria	Microbiological treatment
Whole life cost (>£200m)	No
Discreteness	No - works on existing assets are not discrete because they create commercial and operational complexities around the responsibility for the operation and ownership of new vs existing assets.
Suitable for DPC	No

On this basis we have not assumed that any of the microbiological treatment investments will be delivered through DPC.

6.2.8 Customer view

Customer views on the options we have considered within this investment have formed part of the unconstrained options assessment summarised above and in the Options Development Report which formed part of our WINEP submission.

6.3 Cost efficiency

6.3.1 Developing costs

The development of the microbiological treatment costs in our plan follows our cost efficiency 'double lock' approach set out in chapter 7 of our business plan. Through this approach we have ensured that are costs are efficient in their bottom-up build up, and this is cross-checked through external benchmark approaches. This section sets out how we have ensured cost efficiency of our microbiological treatment investments through step one of our double lock approach. Step 2 is explored in the benchmarking section below.

We have taken a robust approach to developing our microbiological treatment costs, building on our experience from delivering similar schemes into the bottom-up development of costs (before external cost benchmarking challenges are applied in step 2 of our 'double-lock' approach). The detail of the cost development approach is set out below, along with a breakdown of costs we provide in table CWW3.

Cost Estimation Methodology

We follow a common cost development methodology across our enhancement investments in a three phase process:

1. Establish cost and carbon models
2. Input the cost drivers into the model (including location specific factors)
3. Data validation, internal challenge and assurance.

Phase 2; We derived our total cost estimation for each scheme by gathering location based data on the factors that influence cost estimates, including:

- modelling of storage required
- Full Flow to treatment (FFT m3/d)
- topography and surface types (i.e. roads, field, verge)
- construction techniques and applicable materials
- current site assets configuration and capacity
- operability and connection to existing assets
- site specific requirements and
- assessment of construction constraints such as SSSI areas.

The EA has only accepted processes to reduce bacterial discharges to the water bodies by ultraviolet (UV) radiation plants installed on the final effluent discharges. It does not accept other possible innovations such as Performic Acid (PFA) dosing, Ozonation, Membrane solids separation and chlorine dosing.

In this programme, a set of further investigations and modelling is required to inform future investments in a set of catchment areas. Due to the nature of this type of activity, cost models are not suitable, and therefore, the Investigations third party unit costs for modelling (where previously successful) and on site surveys (including sampling, tracer surveys and Source Apportionment Studies) have been used to enable us to collate data on other bathing water and shellfish water bodies.

In addition, in order to ensure efficiencies are achieved whenever possible, for the sites that are required to meet more than one obligation (multidriver scheme), we have planned for all solutions to be delivered at the same time, therefore, ensuring efficiencies on site set up, management and preliminaries can be achieved.

The following table summarises the scope designed for each projects and the capital and operational cost forecast in AMP8 for the chosen option proposed .

Table 34 AMP8 investment summary

Investment ID	Project Name	Scope	Capital Cost (£k) AMP7	Capital Cost (£k) AMP8	OPEX Cost (£ks) (25-30)
I031776	Easton WRC ESTNST Disinfection	*Inlet works 315m3/d *Interprocess PS 5kW *UV disinfection unit 315 m3/d *Ancillaries (road, fence, telemetry)		1,942	28
I033697	Maldon WRC MALDST Disinfection	*Interprocess PS 45 kW *UV disinfection units for Final Effluent FFT Storm flow 17,703 m3/d and Storm flow 25,698 m3/d *Ancillaries (road, fence, telemetry)		4,684	156
I034035	Maldon WRC Shellfish Beds	*Lagoon upgrade 1,360 m3		277	-
I031906	Melton WRC MELTST Disinfection	* Storm Tank 1,766 m3 *Interprocess PS 8 kW *UV disinfection units 3,483 m3/d *Ancillaries (road, fence, telemetry)		2,958	296
I040871	Oakham WRC OAKHST Disinfection	*Storm Tank 4,873 m3 *Interprocess PS 12 kW *UV disinfection units 8,899 m3/d *Ancillaries (road, fence, telemetry)		4,317	59
I034033	Paglesham WRC Shellfish Beds	*Reed Beds 300 m2 *Interconnecting pipework *Ancillaries (road, fence, telemetry,)		478	34
I031837	Tollesbury WRC TOLLST Disinfection	*Storm Tank 473 m3 *Interprocess PSs 8 kW *UV disinfection units 1,560 m3/d *Ancillaries (road, fence, telemetry)		2,402	42
I033941	Walton TPS Outfall Bathing Water	*Outfall 540 mm dia		27	-
I031905	Woodbridge WRC WOODST Disinfection	*Interprocess PSs 12 kW *UV disinfection units 8,880 m3/d *Ancillaries (road, fence, telemetry)		2,205	325

Investment ID	Project Name	Scope	Capital Cost (£k) AMP7	Capital Cost (£k) AMP8	OPEX Cost (£ks) (25-30)
I031886	Boston WRC BOSTST Disinfection **Multidriver scheme, only 30% is allocated in these lines**	*6 Storm Tanks 2,010 m3 each *Interprocess PS 45 kW *UV disinfection units 27,113 m3/d *Ancillaries (road, fence, telemetry)	1,220	1,640	319
I031443	Kings Lynn STC KLYNST Disinfection **Multidriver scheme, only 74% is allocated in these lines**	*Offline storage 1,660 m3 *Interconnecting Gravity sewers and Rising main *Interprocess pump 60 kW *UV disinfection unit 64,800 m3/d *Ancillaries (road, fence, telemetry)	2,318	3,116	891
I031762	Southwold WRC SWOLST Disinfection	*Interprocess PS 8 kW *UV disinfection units for Final Effluent FFT Storm flow 4,680m3/d and Storm flow 12,960 m3/d *upgrade primary and secondary treatment to treat to the standard needed for UV treatment to be effective *washwater system *Ancillaries (road, fence, telemetry)		6,585	211
I040849	River Deben Bathing Water Investigation	Inland Bathing investigations		675	
I040854	Rutland Water BW Investigation			457	
		Total	**3,538**	**31,765**	**2,361**

6.3.2 Benchmarking

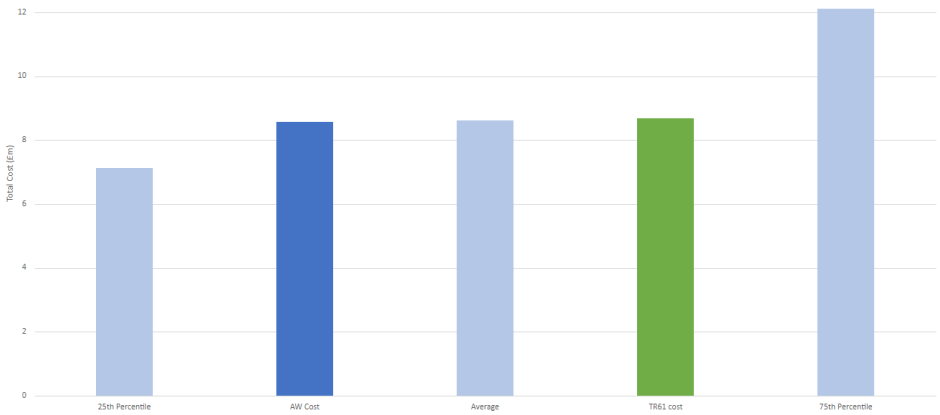
In stage 2 of our cost efficiency 'double-lock' on microbiological treatment , we used a variety of methods to assess, benchmark and challenge the costs in our plan. We principally sought to check the efficiency of our costs through utilising:

- Scheme outturn costs
- Industry cost models from TR61
- Asset level cost comparison with other companies

To ensure the costs we have proposed are efficient, we partnered with Mott McDonald and AECOM to compare our costs for this investment with comparable schemes across the industry. Our benchmarking partners considered four representative schemes of the programme representing over £8 million of costs. To further cross-check we have also benchmarked against the cost models available from WRCs TR61.

Through this, we found that our costs were lower than the Motts/ Aecom average benchmark, and the TR61 benchmark, and within the second quartile overall.

Figure 21 Microbiological treatment direct asset cost benchmarking



The use of historic scheme outturn data and the benchmarking of this gives us confidence that efficient cost estimations have informed the costs included in our plan.

6.3.3 Assurance

The development of our costs has been carried out through our C55 cost estimation approach, which has been assured by Jacobs. Our external benchmarking was carried out and assured Mott Macdonald and Aecom.

6.4 Customer protection

Customers are protected through three separate mechanisms should the investment in this area be cancelled, delayed or reduced in scope:

- Enforcement action from the EA for failure to deliver an obligation
- Underperformance payment for the Bathing Water Quality common PC. Our rate is set at £2.71m and is uncapped.
- The WINEP price control deliverable, which will return funding to customers if and when and WINEP obligations included within the plan are not delivered.

Further to this, our plan protects customers for investments which are not currently statutory but could be included after business plan submission. For these areas we have not included investment in our plan, and instead included an uncertainty mechanism, so customers only pay for the investment if and when it becomes statutory.

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