love every drop
anglianwater

December 2022

Draft WRMP24
Main Document

Our Water Resources Management Plan 2024

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

UtilityWeek AWARDS 2021 WINNER

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WRMP24 Main Report Table of Contents

1 Executive summary

Water is vital to health and wellbeing, to the economic prosperity of the East of England, and to maintaining a thriving natural environment that we can all enjoy. Yet we face growing challenges to supply from population growth in our region and the escalating climate emergency.

We also recognise the special responsibility we hold as a monopoly provider of an essential public service, and want to ensure that we deliver long-term value for our customers, our region and the communities we serve, whilst seeking positive outcomes for the environment and society. This is summed up in our Purpose:

"To bring environmental and social prosperity to the region we serve through our commitment to Love Every Drop".

This purpose epitomises why we do what we do. It ensures we are constantly challenging ourselves to be the best company we can be, and to make a real and meaningful impact for our customers, communities and the planet. Which is why, in 2019, we enshrined purpose into the fabric of our business by changing our Articles of Association. This locked public interest into the way we run our business now and for future generations.

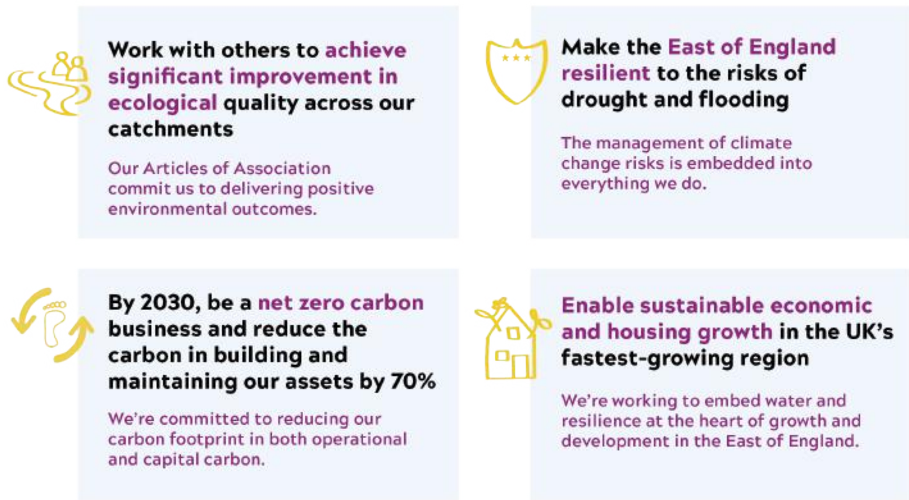
Central to delivering our purpose is planning for the long term. We have an excellent track record in long term planning, first setting out our 25 year ambitions in 2007 through our Strategic Direction Statement (SDS). In this, we set out four ambitions that still remain our priorities today, 15 years on. These ambitions are shaped to deliver our purpose, and we are constantly striving to improve how we perform against them.

Our SDS ambitions are underpinned by our Long Term Delivery Strategy (LTDS). This will formalise what we have done so well for years: building on our purpose, redefining our ambitions as a company for the next 25 years and, crucially, setting out our core pathway to achieve these.

By doing this, our LTDS will bring together our strategic planning frameworks and statutory environment programmes to maximise the potential of what our company delivers. One of these strategic planning frameworks is the Water Resources Management Plan (WRMP), which details how we will ensure resilient water supplies to our customers over the next 25 years.

The LTDS and WRMP both look for low regret investments for our region, giving flexibility to adapt to future challenges and opportunities such as technological advances, climate change, demand variations and abstraction reductions.

Figure 1 Our Strategic Direction Statement ambitions



But, even with these strategic planning frameworks, our ambitions and the regional investment we have put in place, it is getting harder to maintain a supply-demand balance. That's why this WRMP is pivotal in the next stage of our company's story, ensuring our region continues to have a safe, resilient supply of water for future generations.

1.1 The challenges we face

Climate change

Whilst our historical and ongoing investment in resilience is proving beneficial, and is exemplified by the way we were able to handle the recent drought without a hosepipe ban and with similar amounts of water into supply, our weather patterns continue to alter.

We are experiencing hotter, drier summers and warmer, wetter winters. Drought is also expected to become increasingly common. This changing weather means there is less opportunity to replenish the groundwaters and river catchments we take water from, reducing the amount of water we have available.

Voluntarily reducing the amount of water we take from the environment

Our commitment to bring environmental prosperity to the region saw us, in our WRMP19, become the only water company to volunteer caps to our abstraction licences by 2025. This will reduce our deployable output by 5.6% (an 85 million litre reduction in our abstraction licences) , the highest impact seen in the water industry.

We continue to work with our regulator, the Environment Agency, to further reduce the amount of water we take from sensitive environments. By doing this, we will help restore unique environmental features that are known and loved in our region.

Limited water supplies

Taking less water from sensitive environments is absolutely the right thing to do but we also need to find alternative ways to maintain our water supplies. This is becoming increasingly difficult as there are limited opportunities for us to increase output from our existing water sources or optimise our water network further. Instead, we need to develop significant infrastructure such as new raw water storage reservoirs and water reuse, both of which have long delivery timescales. Until we can deliver these options, we will utilise our industry leading demand management to manage sustainable growth and ensure no deterioration to the environment, which is very important to us.

Population growth

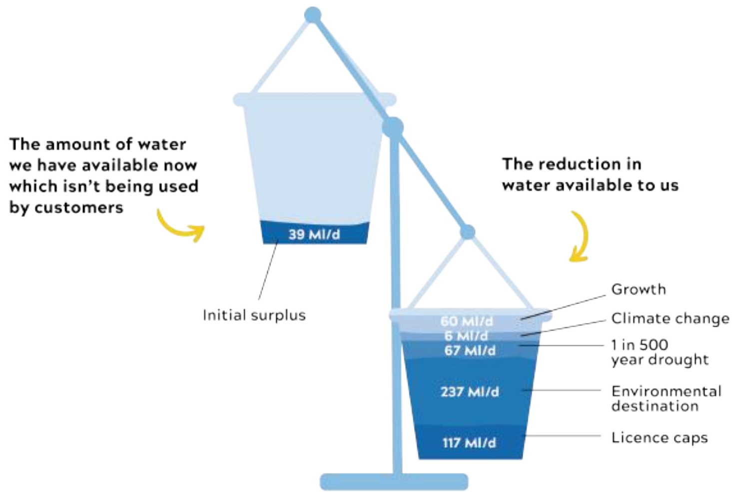
The East of England has experienced the highest growth rates in the United Kingdom since the 2011 census. We expect this to continue with an additional 890,000 people predicted to be living in our region by 2050.

This is great for our region, as it becomes increasingly prosperous, but it means we have to increase the capability of our water and water recycling facilities. As we want to ensure we make the right investments, and not put our environment at risk of deterioration, we liaise closely with local authorities and regulators to promote sustainable growth.

A step change in demand management

Our track record offsetting the impact of growth is good. We put the same amount of water into supply now as we did back in 1989, despite a 30% population increase in that time. However, opportunities for reducing water usage and leakage are becoming increasingly limited, as we have invested heavily in leakage reduction since privatisation and remain at the forefront of the industry in this field. With one of the highest levels of standard metering in the country, and on course with an equally ambitious smart meter programme which will see full smart meter coverage by 2030, we must turn towards more innovative methods to drive the next step change in reducing demand. These measures will ensure we manage sustainable growth, ensuring we do not take any further water out of the environment than we do now.

Figure 2 The impact of the expected challenges for our WRMP24

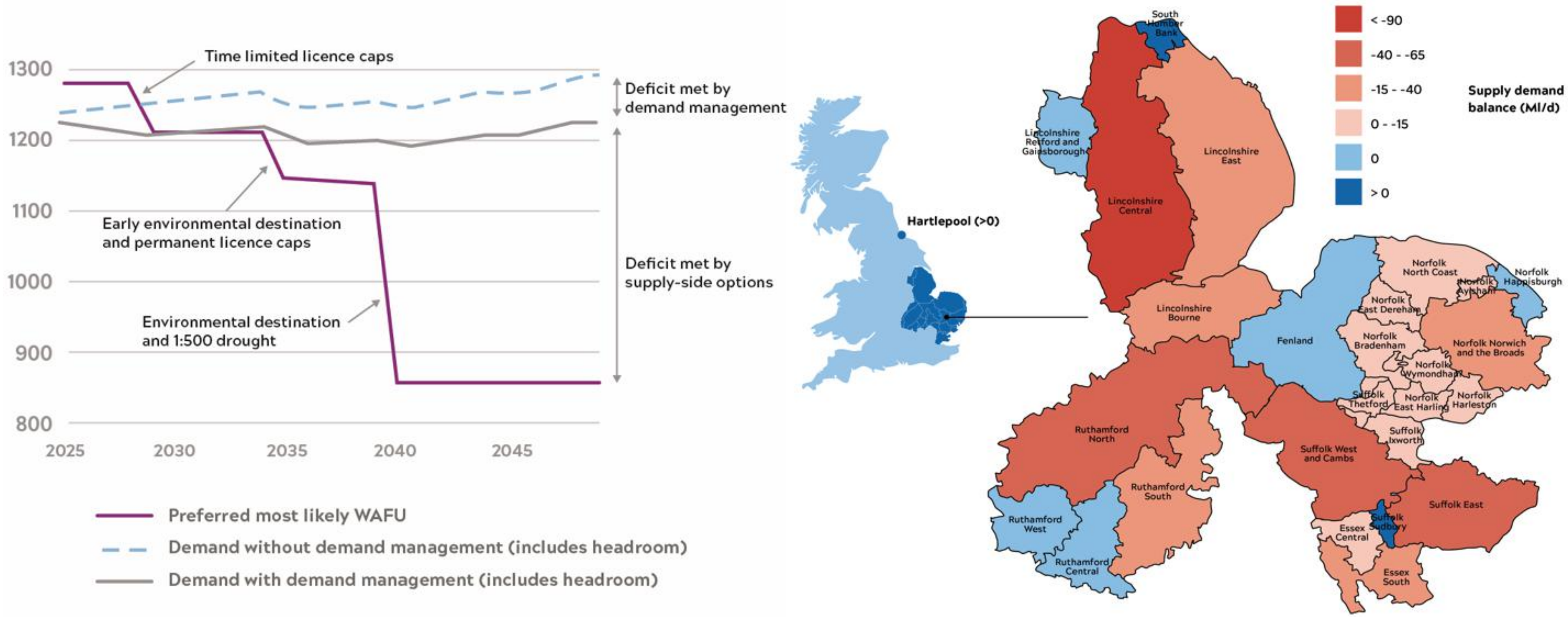


[Figure 2](#) shows how these challenges impact the volume of water we have available to use. The figures are alarming. Thirty percent of our water supplies will be lost by 2050. We face a stark reality. Despite building a reputation as a frontier company for managing growth and avoiding increased abstraction, there is simply not enough water to supply our customers in the future.

Our supply-demand balance in Figure 3 shows the overall amount of water we will have available to use in the future (purple line), known as WAFU. WAFU is a measure of the actual water we can use within a water resource zone (WRZ) to meet demand. This is what is left after we have exported water to other companies through our bulk export arrangements, transferred to other water resource zones through our interconnectors and deducted an allowance for outage to carry out maintenance.

We also forecast our expected demand (blue dashed line), which includes the water needs of an additional 890,000 people in our region by 2050. We then layer in the benefits of demand management options (grey line) such as smart metering and behavioural changes. These demand management options ensure that we maintain the same amount of water going into our network despite significant growth.

Figure 3 Our supply-demand balance in 2050 without any intervention, and its impact on WRZs



The gap between the supply line and the demand line with demand management options applied shows that we will experience a deficit if we take no further supply-side action. The figure on the right shows the areas impacted.

We are clear on what we need to do. We must start planning now for significant new infrastructure which will meet the future water needs of our region, whilst continuing to build on our industry leading demand management strategy.

We will achieve this by continuing to reduce leakage, building on our sector leading smart metering programme and seeking out further opportunities, such as non-household water savings, to reduce water usage further.

But, we can't achieve this on our own. We need our stakeholders and customers help at both local and regional levels.

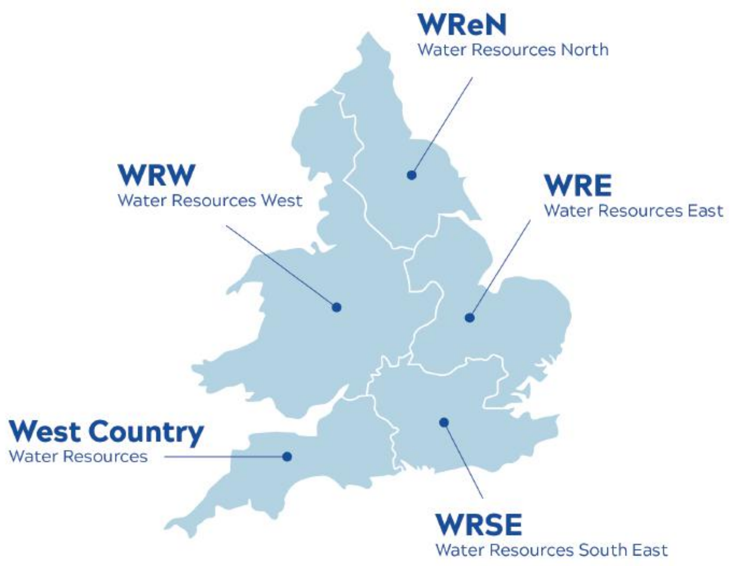
1.2 Leading at a Regional level

As a business, we believe in partnerships and working with others to break down siloes to achieve greater outcomes than any organisation can alone. That's why we set up Water Resources East (WRE) in 2014. We wanted to use the opportunity to learn from international best practice to develop a more collaborative approach to water resource management, as we recognised that our region had significant challenges.

Since then, Water Resources East has gone from strength to strength as a regional planning group, becoming an independent legal entity in 2018. With a new multi-sector Board of Directors, WRE now provides a forum for nearly 300 organisations. These are a mixture of regulators, as well as companies and individuals with interests in the water, agricultural, power and environmental sectors.

The importance of this multi-sector cooperation has been heightened by the National Framework for Water Resources, led by the Environment Agency. As part of this framework, five regional planning groups (see Figure 4) were established or given a formal remit in 2019, with the aim of developing Regional Plans that ascertain the future wate resource needs of their region (both public and non-public water supply) and establishing how these needs will be met.

Figure 4 Regional Planning groups

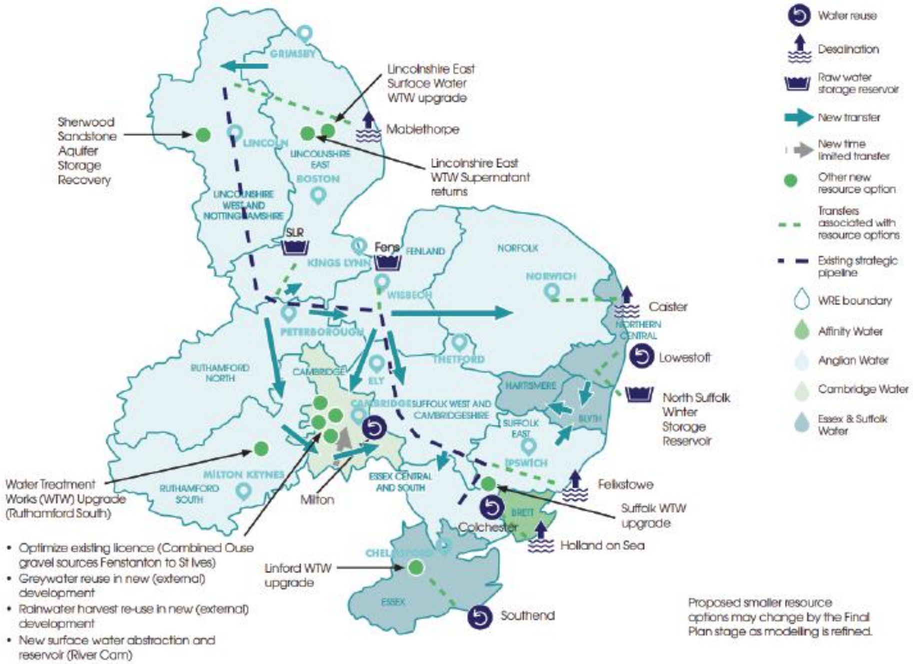


We have led the development of this Regional Plan, evolving the methodologies for the technical process as well as chairing Task and Finish groups charged with their implementation. We have also coordinated a weekly alignment meeting with our fellow water companies and WRE, ensuring consistency in our approaches. This regular engagement also means we have been able to liaise extensively with WRE stakeholders, gaining their wider views on our approaches and decision making.

By producing regional best value plans, the five planning groups have been able to work together to meet the national need for water by exploring inter-regional transfers and the sharing of resource [1]. The results of this are particularly important to us, as the Water Resource Planning Guideline states that we should reflect the regional plan (shown in Figure 5) in our WRMP.

1 National_Framework_for_water_resources_summary.pdf (publishing.service.gov.uk)

Figure 5 WRE's regional plan



And, we are particularly proud of WRE's Regional Plan, in which WRE has focussed on low-regret supply-side options, co-creating with a wide and diverse range of stakeholders. These stakeholders include environmental regulators, national environmental charities, local river groups, county councils, as well as agricultural and energy organisations. Their discussion and challenge has enabled us to think harder about our strategy than ever before, ensuring we look beyond the boundaries of our supply area and sector.

The stakeholders of WRE have also determined our region's environmental destination. This is the long-term vision to bring environmental improvement to our area, with a particular focus on abstraction reduction. WRE is also promoting catchment discussions, which will feed into our Water Industry National Environment Programme (WINEP) for AMP8, enabling us to understand and support our region's environment like never before.

1.3 A best value plan

We have taken this regional learning and developed it further to produce our WRMP. This is our WRMP24, covering the planning period 2025 to 2050. This long-term view, allows us to plan an affordable pathway to achieving a sustainable and secure supply of clean drinking water, whilst meeting the considerable challenges we face.

We are also proud to say that our WRMP24 is a best value plan, which is one that looks beyond cost. It will help us deliver a benefit to customers and society, as well as the environment whilst listening and acting on the views of our customers and stakeholders.

We have used these views to create and refine our best value planning framework. This identifies the outcomes that we wish to achieve in our WRMP24, such as ensuring a flourishing environment. These outcomes are aligned with our strategic outcomes for customers from our SDS.

Figure 6 Our best value plan objectives

Underneath these outcomes are our objectives, which we need to achieve in order to satisfy our outcomes. For example, we need to deliver long-term environmental improvements to achieve a flourishing environment. These outcomes and objectives are shown in Figure 6.

We discuss our best value plan throughout our WRMP24, which consists of a main report, complemented by technical supporting documents and an independent set of environmental assessments. These can all be found at anglianwater.co.uk/wrmp.

1.4 Working with our customers

Our customers helped us build our best value plan framework, and they have aided us throughout the the development of our whole WRMP. They have shared their views on key questions we identified from our WRMP24 problem characterisation, shown in Figure 7. The insight gained has been independently synthesised and used in our decision making.

Figure 7 Our key engagement questions for WRMP24

Not only have we carried out targeted research to engage with customers, we've also woven it throughout our day-to-day interactions with them, enabling us to draw on a rich pool of feedback to inform our plans. Our Price Review 2019 (PR19) customer engagement was the only A rated in the industry, and the effectiveness of our engagement with customers on water efficiency messaging can be seen in the stable water consumption levels experienced this summer.

Smart meters are also enabling us to engage with customers like never before. A customer can now see the amount of water they use daily, enabling them to make more informed choices about how they use water. In return, we are able to provide tailored water efficiency advice and tips, share service messages with them and, crucially, alert them if we believe they have a leak on their property. This is particularly important to us as we estimate that nearly a quarter of our leakage figure is attributable to leaks on customers' supply pipes.

Continued engagement with our customers is fundamental to our WRMP24 strategy.

1.5 Tryptic approach

Best value planning sees us taking a three-tiered approach to tackle the challenges of WRMP24:

- Demand management
- Two new raw water storage reservoirs
- Utilising other sources of water, such as water reuse, desalination and transfers

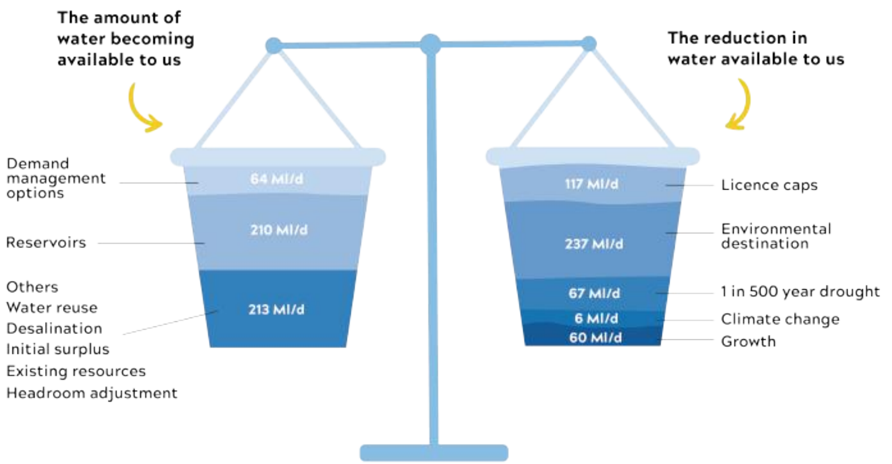
This tryptic pathway puts our industry leading demand management and two pivotal new reservoirs at the heart of our long-term water resources strategy, with other sources and water transfers being used to resolve any remaining deficits.

Other sources we will utilise include treatment processes such as water reuse and desalination. We will prioritise water reuse over desalination as our customers have consistently told us this is their preference. But, desalination will be required towards the later stages of our planning period with the extent and locations remaining flexible.

It is important we maintain this flexibility when the future is invariably uncertain as it ensures we can respond to future challenges and capitalise on future advantages that may present themselves. This adaptability is important as it means we can use desalination to respond to the findings of environmental investigations that will be conducted between 2025 and 2030. These WINEP studies will determine which sensitive environments we should focus on and the abstraction reduction required to provide most benefit. Using desalination in an adaptive manner also means that our customers will not receive a high bill impact for an option that may not be fully utilised if built and operated earlier in the planning period.

Figure 8 demonstrates how we will use these three approaches to balance the challenges we are experiencing.

Figure 8 Meeting our challenges for WRMP24



1.6 Producing more water

To meet these future needs, we need to produce alternative supplies of water. Simply put, we have very limited surplus water within our current water sources. To achieve any significant new deployable output, we have considered supply-side options such as raw water reservoirs, desalination, water reuse and water transfers.

After discussions with our stakeholders, customers and WRE, we have chosen to plan for two new raw water storage reservoirs. This decision has been informed, and proven robust, by three independent modelling processes. As such, it fits our 'least regret' principle.

Raw water reservoirs are already an invaluable asset for our region. Existing reservoirs like Alton Water in Suffolk and Grafham Water in Cambridgeshire show that reservoirs are sustainable ways of producing resilient, safe drinking water supplies to our customers as they take from river catchments which have surplus water. They also provide an invaluable leisure resource for thousands of visitors and local communities, providing the ability to improve the mental and physical wellbeing of those who visit. And, with visitors, comes tourism opportunities for the local community.

Many of our existing reservoirs have thriving habitats and have become so established that they are now designated sites. An example of this is Rutland Water which has a thriving nature reserve and has designations such as being a Site of Special Scientific Interest, a Special Protection Area site and a Ramsar site. They also have the benefit of having low operational carbon, which supports our net zero strategy and our commitment to improve the environment.

Figure 9 Alton Water in Suffolk

Our experience with these sites over decades, means we are confident we can unlock further, unexplored benefits from the new reservoirs. We know they can restore environments further away from the reservoir site, such as chalk streams and rivers, as they will enable reduced, even ceased, abstraction from these sensitive areas. We also believe in a multi-sector approach, where the reservoirs will support agriculture by facilitating a supply for crops, and help alleviate flooding.

Water reuse, desalination and transfers simply do not offer these additional benefits. Furthermore, transfers of water between regions, which we have evaluated for the regional plan and our WRMP, are subject to a number of constraints. These include availability of water, ecological risks of construction and moving water, high energy and carbon emissions, as well as cost. In summary, reservoirs are the preferable option and sit at the heart of our plan.

1.6.1 Fens and South Lincolnshire reservoirs

The Fens and South Lincolnshire reservoirs were identified as strategic supply-side options for WRMP19. To develop the concept of these further than the feasibility studies undertaken for WRMP19, we commissioned a detailed assessment in 2020 which looked for areas within the WRE region to determine if there were any suitable locations for a new raw water reservoir. A high-level analysis was conducted, based on considerations such as:

- proximity to available water supplies and demand centres
- suitability of underlying bedrock and superficial geology
- seeking to avoid existing developments and essential infrastructure
- seeking to avoid environmentally sensitive and heritage protected sites, and
- resilience to climate change

These findings led us to start developing the concept of two new reservoirs- the Fens and South Lincolnshire Reservoirs. But in parallel, we had to ensure they would meet the needs of our region and customers better than other supply-side options.

1.6.2 The regional need for reservoirs

As part of the Regional Plan, an advanced stakeholder decision making process was undertaken. The aim of this was to determine which supply-side options would be low regret, robust solutions to meet the challenges faced by water resource planning in the East of England.

To achieve this, new supply-side options (such as raw water reservoirs, desalination and water reuse) were tested against differing hydrological and environmental scenarios. Varying levels of water savings associated with demand management were also applied. Stakeholder input was crucial to this process.

As part of this process, it was established that the Fens and South Lincolnshire reservoirs are low-regret, strategic regional options that are pivotal to WRE's Regional Plan. In accordance with the Water Resource Planning Guideline, we have reflected these strategic regional options as 'must do's' in our own WRMP.

To ensure robustness, we have conducted our own sensitivity testing as part of WRMP24 to determine what would happen if modelling assumptions change. For example, what would happen if population growth in our region was lower than predicted or if environmental destination was higher. Stress testing to ensure resilience to different scenarios has also been undertaken, for example if we undertook a higher level of abstraction reductions.

An independent national model, the Water Resources of England and Wales water resources model, also identified the need for and value of both the South Lincolnshire and Fens Reservoirs. This modelling also confirmed that they are resilient against uncertainty in supply and demand.

We are satisfied that all three modelling processes have determined that the Fens and South Lincolnshire reservoirs are low-regret, robust options for both the Regional Plan and our WRMP. So, we have continued to develop our concepts of them at pace, mindful of their long lead times and crucial role in securing long-term water supplies for our region.

1.6.3 South Lincolnshire Reservoir

The South Lincolnshire reservoir option has, until recently, been progressed with Affinity Water. From November 2022, it will solely be progressed by Anglian Water, as inter-regional discussions between WRE and Water

Resources South East agreed that there were no new feasible transfers out of WRE's region. Affinity Water is also able to progress with other schemes to meet their water needs.

Hydrological modelling has determined that the South Lincolnshire reservoir will take surplus water from the River Witham, when flows allow. It will also be supported by the River Trent. A 55 million cubic metre reservoir will store 50 million cubic metres of usable water, which is a sufficient capacity to meet the required output whilst being resilience to extreme drought. The reservoir will be similar in size to our existing reservoir at Grafham and will yield 166 megalitres a day of water.

Once commissioned, the water from the South Lincolnshire reservoir will supply 500,000 households in Lincolnshire and the south west of our region.

1.6.4 Fens Reservoir

We also continue to progress the Fens Reservoir in conjunction with Cambridge Water. This is situated in the Cambridgeshire Fens.

The reservoir will take surplus water from the River Great Ouse and the River Delph, near the Great Ouse Washes, when flows allow. The water will then be stored in a 55 million cubic metres reservoir, providing 50 million cubic metres of usable storage. This will provide sufficient capacity to meet the required output whilst being resilience to extreme drought. The reservoir will be similar in size to our existing reservoir at Grafham and will yield 87 megalitres of water a day, shared equally between the two companies.

The water will be distributed to up to approximately 125,000 households in Cambridgeshire and Norfolk, as well as customers in Cambridge Water's supply area.

1.6.5 Benefits that reservoirs can bring

We believe reservoirs are a great asset to our region and will meet its needs. They are tried and tested ways of storing and treating water and have environmental benefits too. For instance, taking water sustainably from the rivers Witham, Trent, Delph and Great Ouse will allow us to stop taking water from environmentally sensitive areas, such as chalk streams and rivers.

We also know the two reservoirs have the potential to deliver more than this, which is why we are working with the Fens Water Partnership and South Lincolnshire Water Partnership to look for opportunities to provide additional benefits to communities, the environment and society. We equally recognise the impact that reservoirs will have on the local environment and communities, and will work hard to minimise the impacts associated with developing these reservoirs.

Our partnerships have a breadth of local expertise and interests, ranging from agricultural stakeholders to environmental bodies. These organisations have utilised their local knowledge and passion to feed into the development and design of the reservoirs, as well as exploring funding opportunities for the elements that are not essential to water supply. Examples of the possible benefits that could be realised are shown in Figure 10.

Figure 10 Possible benefits that the reservoirs could bring

The reservoirs also have benefits over the other supply-side options available to us. For instance, reservoirs have low operational carbon which supports our drive to net zero. We will seek opportunities to reduce this further by incorporating renewable energy opportunities such as solar installations. The amount of discharges generated by reservoirs are also minimal, unlike desalination where brine discharges to the environment need to be carefully managed.

And whilst the construction of reservoirs will create capital carbon, we have considered this during the site selection process. This focus will continue throughout the life of the projects. As most of the capital carbon emissions are associated with the pipelines transferring raw and treated water, and the reservoir earthworks, we will build on the successful application of PAS:2080, the global standard for reducing carbon in infrastructure which we helped to create. This will see us carefully optimising the length, diameter, wall thickness, and material of pipelines. Waste will also be minimised, and we will maximise the use and re-use of excavated material within the construction site.

We are also aware that diesel-powered plant is traditionally used to lay pipes and to carry out the reservoir earthworks. To reduce these carbon emissions, the construction industry is moving towards sustainably sourced biofuels, as a 'bridge' in the transition towards using plant and machinery powered by electricity and cleaner fuels. We are working with the construction industry to develop a 'zero diesel sites route map', and the learning from this will be applied to these projects.

The opportunities and benefits these reservoirs offer our region are rare, especially as we continue to reduce our greenhouse emissions. And we believe that they are fundamental to our company purpose of bringing environmental and social prosperity to the region we serve.

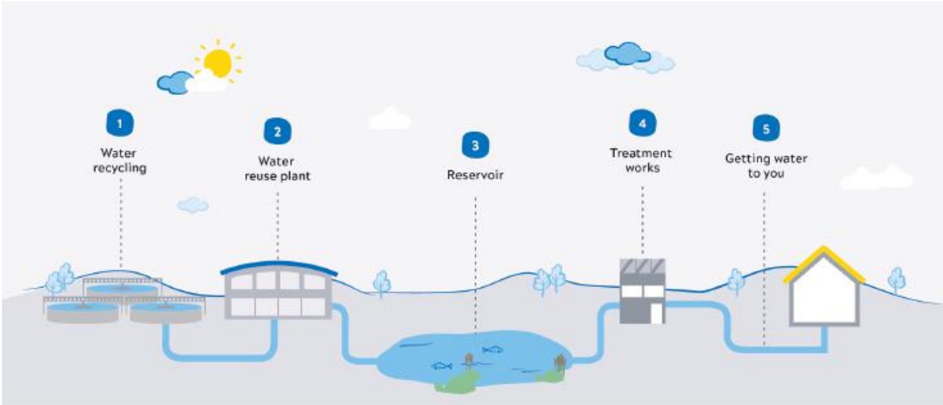
1.6.6 Colchester water reuse

Our two reservoirs are the heart of our plan. They are options we won't regret, even if circumstances change. However, a reservoir takes a considerable time to bring to fruition and realise. Planning, construction and filling timeframes mean, even with the significant early work done, the Fens Reservoir will not come online until 2035, and the South Lincolnshire Reservoir in 2039. These dates are highly ambitious. We will continue to monitor their progress and use our demand management strategy to adapt as needed for our final WRMP24.

We will have a short-term regional deficit until the reservoirs are in supply. This is driven by licence capping and climate change, as our demand management strategy will offset growth in the region. In order to address the shortfall of water left by climate change and licence capping, we need to plan for a new supply-side option before the reservoirs are available. As we have little to no opportunity to utilise any surplus ground or surface water, we have looked to directly utilise other existing resource. We will do this by building a water reuse plant in Colchester, an area that already has a tight supply-demand balance.

Rather than discharge the treated effluent from Colchester WRC to the estuary, we will treat the cleaned effluent again using membrane technology. We will then monitor it against strict water quality standards before discharging and storing it in a raw water storage reservoir where it will mix with river water.

Figure 11 How we will utilise water reuse



Because the water has already been cleaned to such a high standard, it could make the storage reservoir an improved habitat for wildlife. It is also possible that it may reduce the likelihood of treatment issues we may experience, such as blue green algae.

1.6.7 Desalination

Our current planning shows that we will need desalination in the long-term future. Whilst we recognise the benefits of desalination, our customers have told us they prefer reservoirs and water reuse as supply-side options, and from our analysis, we know that these options have smaller bill impacts than desalination. Desalination may also have environmental impacts that require mitigation, something we are working with our regulators and research partners on.

The need and scale of this desalination will be determined by the WINEP environmental investigations previously mentioned in this executive summary. These will look to define our long-term environmental destination strategy. Once we have the results of these WINEP investigations, we will incorporate this target into our planning for our next WRMP (WRMP29), aided by the adaptive planning approach we have taken for WRMP24.

1.6.8 Transfers

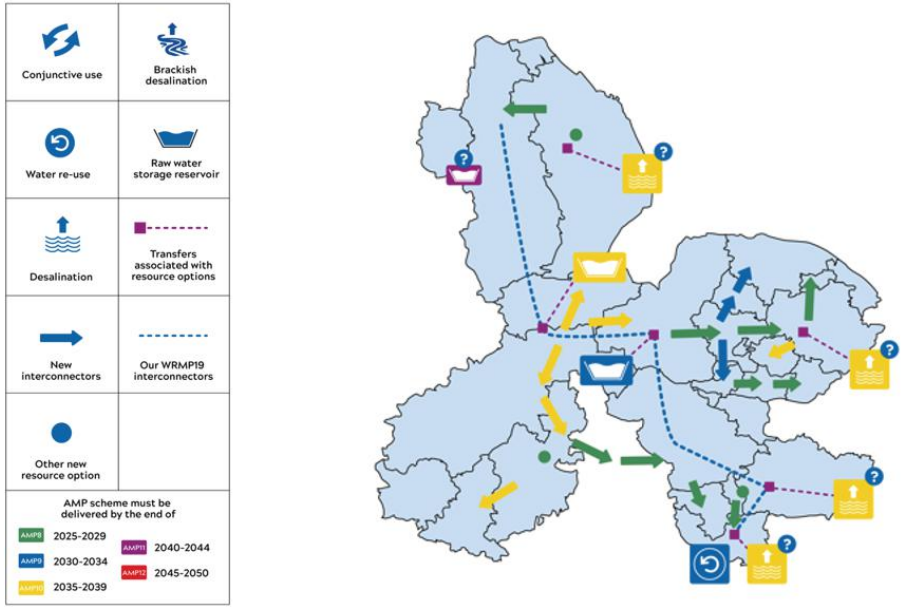
We will build on our WRMP19 strategy to add interconnectivity between our water resource zones. This will allow water to be moved from areas of surplus to areas of deficit. They will also allow integration of the new supply-side options into existing infrastructure. This approach will also ensure that we mitigate any risk of deterioration to waterbodies.

As our WRMP19 implementation of our strategic interconnectors continues, we are gaining better insight into the practicalities and costs of such large scale main laying activities. We will continue to monitor and reflect on this, to ensure that our final WRMP24 encompasses this learning in our strategy.

1.6.9 Our supply-side strategy for 2025-2050

Our supply-side strategy for WRMP24, shown in Figure 12. We know this is an ambitious strategy but we are confident it is the right one- reflecting our regional challenges, commitment to the environment and customer preferences. It will safeguard water supplies and the environment for future generations.

Figure 12 Our WRMP24 supply-side strategy

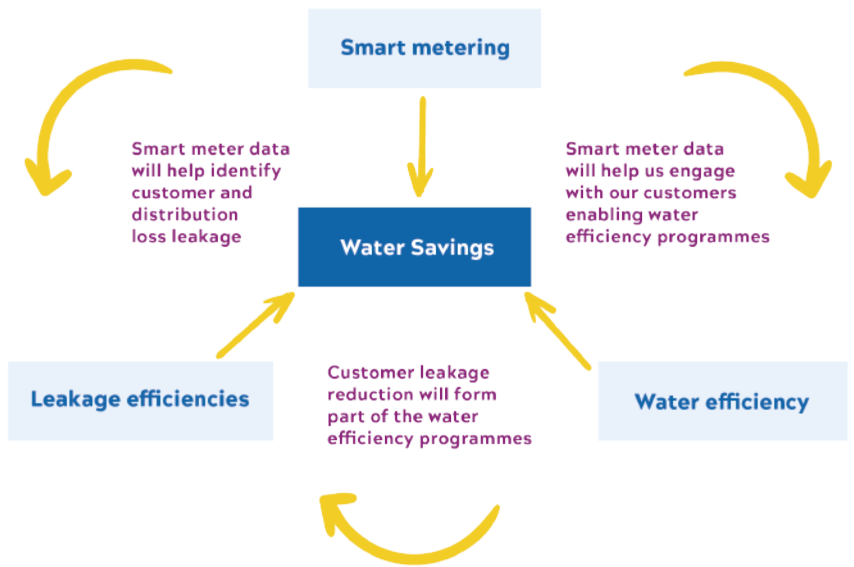


1.7 Reducing water use and wastage

We know it isn't just about building new infrastructure. We need to make the most of what we already have, ensuring we do the best for the environment and our customers. Our history of utilising existing resource is strong, and our ongoing investment in demand management means that our leakage rates are industry leading.

We continue to build on this achievement, and have developed a three pillar approach for our WRMP24 demand management strategy, as shown in Figure 13. This will see us continue our pivotal smart metering programme, working with customers to improve their water efficiency and continuing to reduce leakage by reducing leaks on hardware in homes, such as leaky loos.

Figure 13 Our three pillars of demand management



1.7.1 Smart metering

Smart metering is pivotal to our WRMP24 strategy as it will enable the next step change in demand management. For WRMP24, we will build on our leading WRMP19 foundations. This will see us concentrating on using smart meters to enhance our communication with customers, based on their known daily water usage. Smart meters will also enable us to alert customers to potential leakage on their property.

Our metering record

We have one of the highest rates of meter penetration in the United Kingdom's water industry. In 2021/22, 92% of our household properties have meters installed with 83% paying according to what they use (known as measured charges). The 9% of customers who have a meter but are not paying measured charges have opted not to switch, choosing to stay on our standard tariff. This means they pay the same amount of money regardless of their usage.

Smart metering strategy

For WRMP24, we will build on our WRMP19 strategy by finishing the smart meter roll-out across our region by 2030. By doing this we will achieve maximum feasible smart meter penetration. This will help us:

- Achieve significant demand savings of 25 Ml/d by 2030, giving us time to build new supply-side options such as the reservoirs and Colchester water reuse.
- Understand our network and the demand of our customers like never before, helping us to target specific areas and pinpoint leakage which may have otherwise been undetectable.

Unlocking communication with our customers

Our innovative WRMP19 smart meter programme has already enabled a fundamental change in our understanding of customer consumption, as well as creating more options to communicate meaningfully with them.

As customers with smart meters are now able to engage with their water usage, they can craft their own water saving journey. For WRMP24 we will further unlock this pathway by engaging with our customers to:

- show them how much water similar homes use
- help customers understand how and where they could make water efficiencies
- potential to explore innovations such as trialling alternative tariffs

- develop personalised incentives to help future savings, and
- identify any usage discrepancies, which may be leakage.

It is expected that this will save us 9.2 Ml/d of water by 2050.

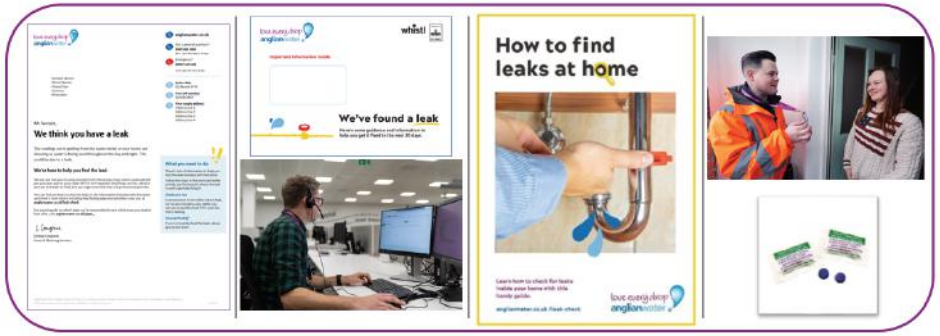
Customer supply pipe leakage and plumbing losses

We estimate that 23% of our leakage total is attributable to leaks on customers' supply pipes. In addition, a proportion of household and non-household consumption is actually plumbing losses (for example, leaky loos). With our smart meter roll out and the additional help we will provide those in vulnerable circumstances, we are projecting we can reduce this leakage and plumbing loss rate significantly by 2050.

This reduction will be achieved by alerting our customers within three days of identifying possible leakage on their property. This will be established by analysing continuous flow, and then alerting the customer when we see unusual flows. In our smart meter trial areas, we found that leakage identified in this way took on average 112 days for the customer (with our assistance) to repair, rather than the average 210 days repair for a standard meter, representing a significant saving of water. The nature of the repair, for instance a new section of customer supply pipe or a new toilet ball valve, represents a sustainable water saving as these items usually have a long lifespan.

As part of WRMP24, we will develop further options to reduce customer supply pipe leakage repair times, as well as looking at how we can continue to help customers in circumstances which may make them vulnerable.

Figure 14 Communicating possible leakage to our customers

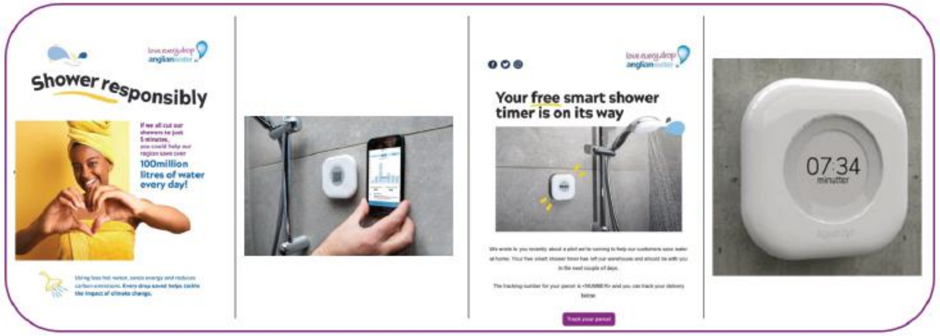


1.7.2 Water efficiency

We are good at engaging with our customers on a day to day basis. And we know that continuing this approach is key to promoting prolonged behavioural change. For WRMP24 strategy we will do this by:

- providing a number of smart devices, such as shower sensors to record the duration of showers
- continuing to promote behavioural change by encouraging our customers to reduce their shower times to five minutes
- building on our targeted communications, for instance during times of drought or peak summer demand
- tailoring our communications to the local area
- asking our customers to set their own water saving targets
- developing an innovation fund to increase our understanding of customer behaviours and future water efficiency initiatives, and
- working with the non-household sector to explore how we can help them save water.

Figure 15 Promoting water efficiency



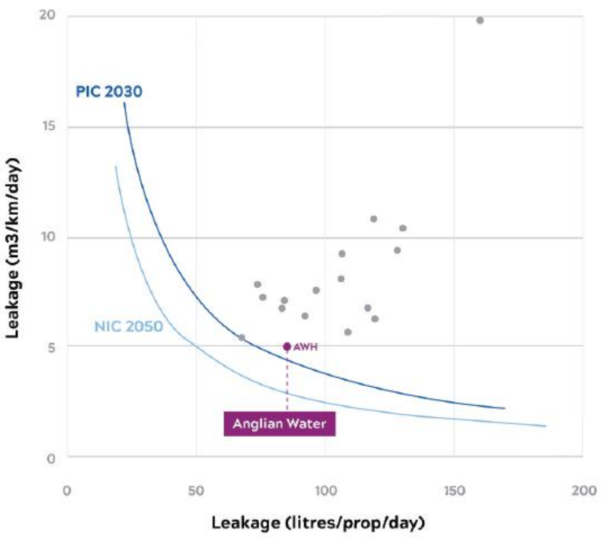
This communication, and working with our customers, will help us achieve a per capita consumption of 110 litres per head per day by 2050. We are also expecting government-led intervention to help achieve this landmark water efficiency. This intervention is expected to be in the form of white goods labelling, for instance highlighting to consumers how much water a dishwasher uses, something we have been advocating for some time.

1.7.3 Leakage reduction

As part of the development of our WRMP24, we have reviewed our current position (and that of other water companies) in relation to the Public Interest Commitment (PIC) Targets which were produced by the water industry under our joint leadership with Portsmouth Water. This is shown in Figure 16. We have also shown our position compared to the National Infrastructure Commission (NIC) target. This aims to achieve a 50% national leakage reduction by 2050.

As a company with one of the lowest leakage rates in the United Kingdom, we know that leakage is important. And, our intention is to make a fair and equitable contribution to the overall national leakage target of a 50% reduction in leakage from the 2017/18 base-line for England and Wales.

Figure 16 Our company position compared to other companies for NIC and PIC

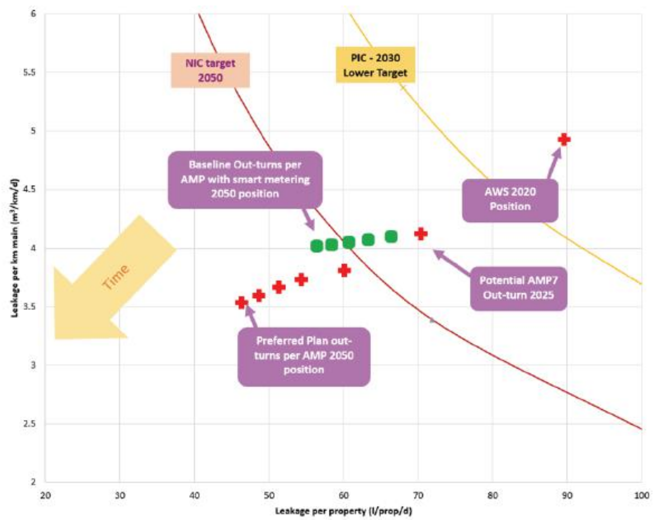


To achieve a 50% reduction in our leakage levels we would need to replace 10,387km of water mains, which is equivalent to 27% of our existing network. We would have to conduct this mains replacement because we have already invested heavily for several decades in leakage solutions such as network optimisation, smart metering and leakage detection. These options are now becoming exhausted which leaves us with mains replacement which will come at a cost of over £20 billion.

We currently consider £20 billion to be an unrealistic financial burden upon our customers and have consequently settled upon a leakage reduction of approximately 23.7%, which still allows us to meet our NIC and PIC targets by 2025 and 2030 respectively and make a sizeable contribution to the industry total. This is shown in Figure 17, where the attainment curves for PIC and NIC were created for the National Leakage Roadmap by aggregating the water company leakage values to a national value, halving them and then creating a set of equivalent figures for the combined metrics of leakage per kilometre of main and leakage per property.

By comparison, we could spend £3 billion developing the and South Lincolnshire reservoir and our share of the Fens reservoir to deliver 210 Ml/d of water to our customers, as well as providing significant benefits to local communities and the environment.

Figure 17 Achieving the PIC and NIC targets



However, our leakage targets will remain adaptive and will be reassessed for every WRMP so we can quickly respond to new innovative technology. We continue to explore, for example through our research on smart networks as part of Ofwat's Innovation Fund and through our engagement with fellow water companies and smart water network pioneers Vitens in the Netherlands and Global Omnium in Valencia[2].

Ultimately, our commitment to reduce leakage remains strong. We will continue to fix leaks in our network and utilise our smart meter roll-out to identify customer supply pipe leakage and plumbing losses. We will also utilise fixed acoustic logging to pick up the secondary, quieter leaks that are often the ones that lose the most water.

But, we will not aim for reducing leakage by 50% by 2050. We believe we must act in our customers' best interests, and it is only fair that other water companies with higher leakage levels invest as significantly in leakage as we have since privatisation.

1.7.4 Compulsory metering

We are in an area of serious water stress and we are constantly striving to reduce water demand. As part of this, we need to consider the 9% of our customers who have chosen to stay on an unmeasured charge rather than pay according to the amount of water they use. We understand that these customers may choose to stay on an unmeasured charge as it isn't a priority for them. Or, they wish to maintain flexibility in managing their consumption, even though their bills would be lower if they were paying measured charges.

These unmeasured customers use, on average, 174 litres per head per day compared to the 128 litres per head per day used by our measured customers. That's equivalent of an extra four and a half buckets of water a day. That's why we believe all of our customers should pay on the basis of what they use. And the majority of our customers agree with this, believing it to be fair.

Whilst we will achieve some natural movement towards customers on measured charges by opting in or house move, we will not achieve our goal of having all of our customers on measured charges by 2050. That's why we will implement compulsory metering to close the gap. By doing this, and our smart metering initiative, we expect 91.1% of our customers to be metered and measured by 2030. By 2050 we expect 96.3% of our customers to be metered and measured, our economic level of meter penetration.

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

We understand that the idea of compulsory metering may be alarming for some of our unmeasured customers, especially at this volatile time, and without support may cause affordability issues for some customers. Unmeasured metered customers already receive information with their unmeasured bills, showing what they would pay on a metered basis based on consumption.

As we move toward compulsory metering, we will reinforce how we can support these customers if they have affordability concerns. For instance, we have a dedicated team of agents that provide advice to customers as to the support that is available in their specific circumstances. This includes budgeting and payment support, eligibility for income-related state benefits and eligibility for a discounted tariff.

Our focus is to be proactive in raising awareness of the support available, but we will also data-match with available Department of Work and Pensions records so that we target support automatically where we believe customers may be eligible. We will also continue to work with customers in circumstances that may make them vulnerable, so we can understand their needs and any additional help we can give. We are currently working with Scope and a host of other partners to achieve this.

1.7.5 Further opportunities

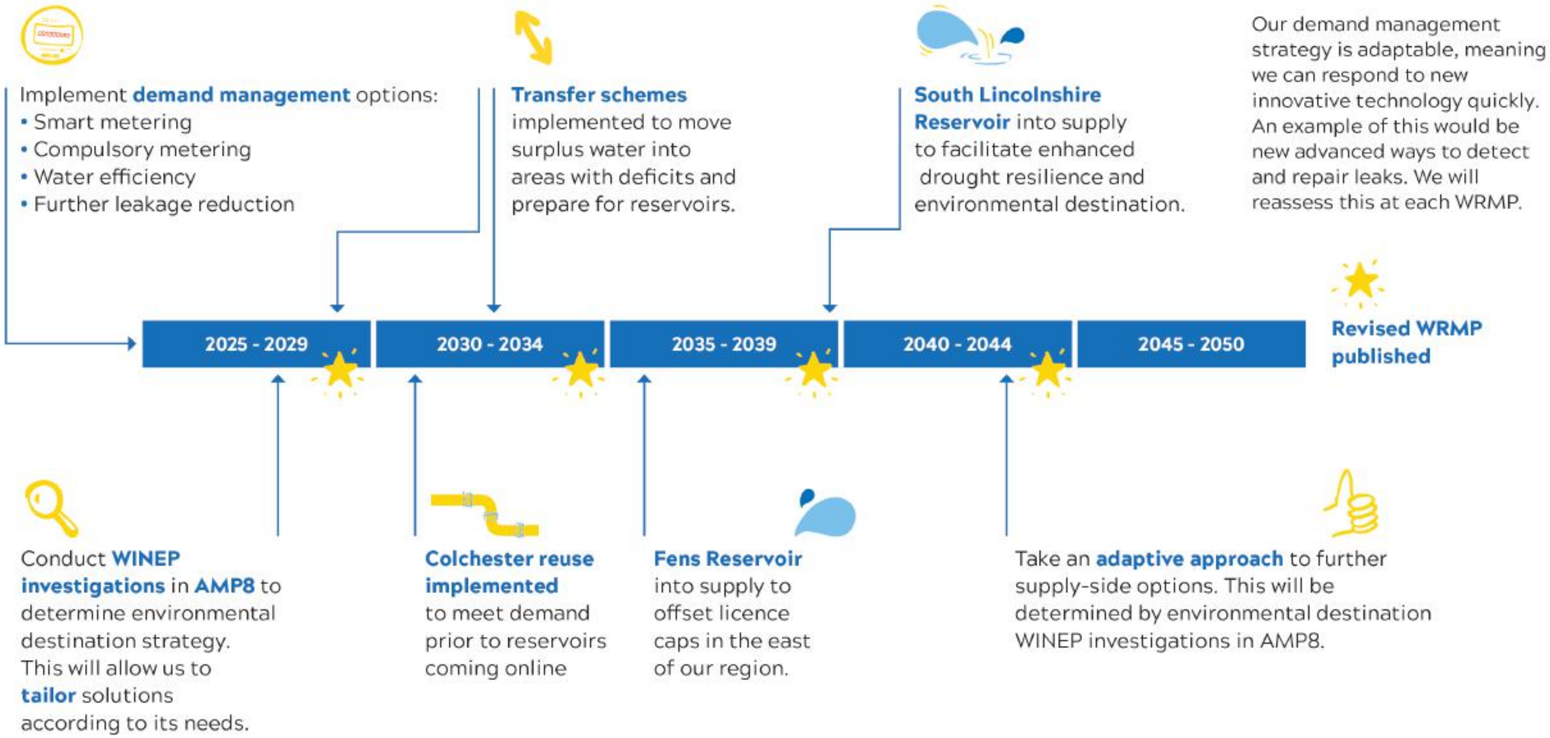
We have built a demand management strategy that is achievable and affordable. But, we still think we can achieve more and that's what we are continuing to explore. For instance, savings associated with compulsory metering have not been included in our forecast nor have any water efficiency savings associated with the non-household sector.

2 https://www.anglianwater.co.uk/siteassets/household/about-us/five-point-plan-for-innovation-acceleration-2022.pdf

We believe these two areas could provide us with great benefit and also enable us to react quickly and decisively if our reservoirs are delayed in planning or construction. We will continue to explore them, along with the benefits of tariffs, as we progress this WRMP.

1.8 Our WRMP24 strategy

This is our long term vision for our region. It will keep our customers with a safe, resilient supply of water whilst improving the environment for future generations.



1.9 A best value plan for the region

- Our customers and stakeholders want us to make the most of the resource we have.
- We will do this by:
  - Implementing a comprehensive package of demand management options.
  - Achieving a record breaking per capita consumption of 110 litres per head and leakage reduction of 24% (2017/18 base-line).
  - Investing in water reuse treatment.
- Planning for the Fens and South Lincolnshire reservoirs.

- Reservoirs will provide positive impacts for communities overall.
- We will continue to work with our customers to help and support those in circumstances that may make them vulnerable.
- We will promote innovative behavioural changes and look to incentivize for doing so.
- An innovation fund will look at opportunities to link demand management with sustainable drainage systems.

- Our innovative demand management strategy delivers the most benefits for the least cost.
- All of our customers will be billed on their actual usage (or an estimate of this), which is proven to improve water efficiency.
- We will minimise unnecessary bill increases by delaying investment in high operational cost options until the need and benefits are better understood.

- Our WRMP24 ensures all of our customers have a safe, secure supply of water.
- Our networks will be more resilient as smart metering will help us understand them better than ever before.
- We will achieve 1 in 500 year drought resilience by 2040, underpinned by the South Lincolnshire reservoir.

- Smart metering means we will have fewer vans on the road.
- Supply-side options higher in operational carbon are timed towards the end of our planning period, allowing for further advances in technology and more utilisation of renewable energy.

- Our demand management programme will be regularly reviewed so new innovative technology can be easily included into our highly adaptive strategy.
- We will use our environmental investigations in 2025-2030 to inform the scale and locations of future desalination.

- We are planning for a 'restore' environmental destination scenario, timed to allow us to conduct environmental investigations between 2025 and 2030 and target catchments most in need.
- Supply-side options that may have a higher environmental risk have not been included in our best value plan.
- The Fens and South Lincolnshire reservoirs will provide opportunities for improving habitats and biodiversity.
- Our demand management measures will manage growth, avoiding the need for further abstraction from the environment, mitigating the risk of deterioration.

Our customer engagement has told us that we need to balance costs, environmental and carbon impacts. We are confident our best value plan has achieved this.

2 Introduction

In this section we will:

- Provide an introduction to Anglian Water, what a Water Resource Management Plan (WRMP) is and how it is developed.
- Discuss what best value planning is and our framework for it.
- Detail links with other plans, such as the Drought Plan and its Levels of Service.
- Give an overview of regional planning, strategic regional options and how they interact with the WRMP.
- Provide a summary of our net zero strategy.
- Summarise the customer and stakeholder engagement we have undertaken.

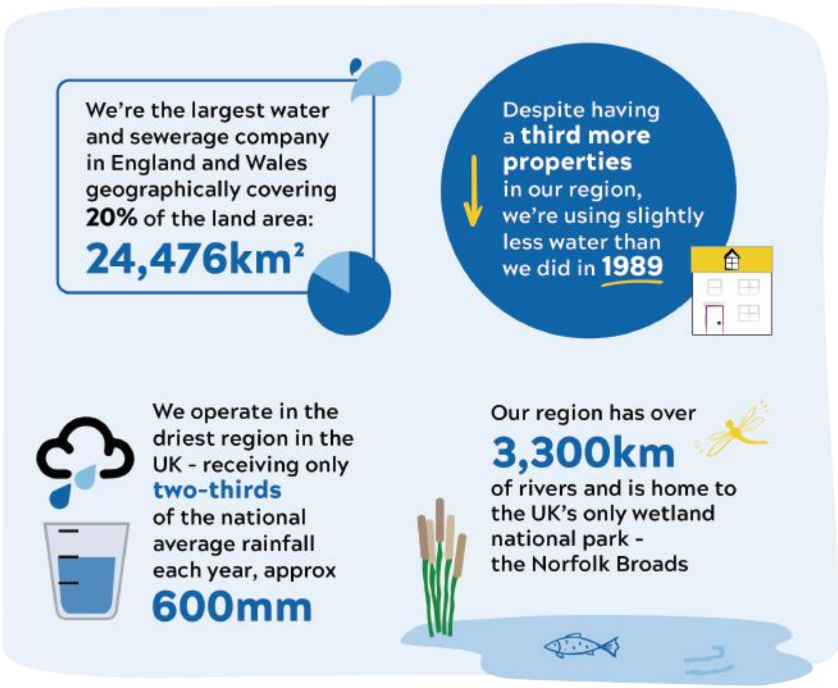
Here at Anglian Water, water is precious. It is vital to the health and wellbeing of our customers and to maintaining a thriving environment that we can all enjoy. Water also enables economic prosperity, allowing vital services to be provided. This is why we included the purpose of bringing environmental and social prosperity at the heart of our Company constitution by enhancing our Articles of Association in 2019.

This social and environmental purpose, along with our commitment to love every drop, has seen us investing billions of pounds into our region. Operating in the driest region in the United Kingdom, with an ever growing population, this long-term strategy has ensured a safe, secure supply of water to our customers' taps. New water treatment works, the laying of strategic pipelines to take surplus water to areas in deficit and improving the connectivity of our region have all contributed to this.

But we know it isn't just about building new infrastructure. Our customers want us to make the best use of the resource we already have. And, we agree. We have prioritised demand management measures since privatisation, ensuring the amount of water going into our water network has remained constant despite there now being a third more properties in our region. Our leakage rates per kilometre of water main are half the industry average, despite operating in the driest region with soils susceptible to movement. We continue to improve on this, with our pivotal smart metering programme helping to reduce customer supply pipe leakage as well as plumbing losses.

Reducing leakage means that we can leave more water in the environment, a core principle for us. We currently take groundwater from 425 boreholes and surface water from eight reservoirs and nine rivers. We know that, if not managed carefully, these abstractions can have a detrimental impact on the environment. That's why we are the only water company to pledge to voluntarily cap our abstraction licences to maximum peak levels by 2025. We continue to work with our stakeholders on further reductions.

Figure 18 About our company



Whilst these measures have ensured we remain an ever-exploring utility company, the challenges we face are becoming more significant. Weather patterns are changing as we are experiencing hotter, drier summers and warmer, wetter winters; giving our aquifers and river catchments less time to replenish. The rain we do experience is becoming more intense, which isn't as effective at replenishment.

These weather impacts and the increasing risk of drought, coupled with unsustainable abstractions for both public and non-public water supplies, means we need to continue to collaborate and act with others to secure water supplies whilst protecting and improving the environment for our increasing population.

Our long-term strategy is clear. We must build on our previous plans and act now to ensure our customers keep receiving the standards of service they are used to whilst protecting the environment. Our WRMP24 sets out how we will achieve this.

2.1 Water Resources Management Plans

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

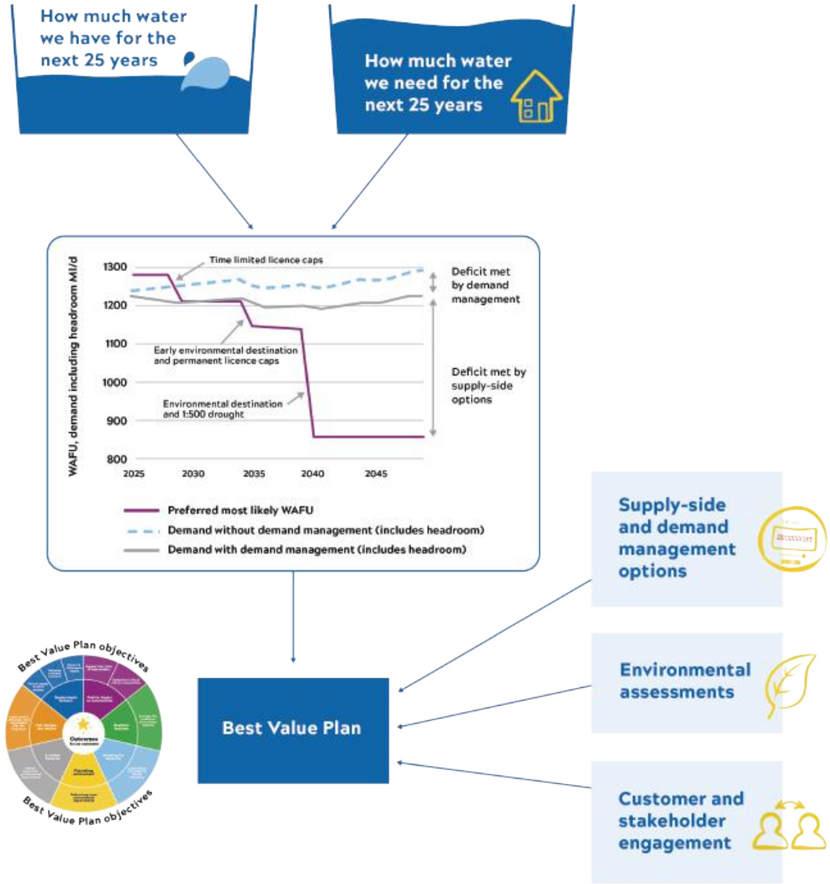
Our WRMP focusses on the period 2025 to 2050. We have developed it by following the Water Planning Guideline (WRPG)[3], as well as other relevant guidance, in order to meet statutory requirements. This has ensured our WRMP24:

- Provides a sustainable and secure supply of clean drinking water for our customers.
- Demonstrates a long-term vision for reducing the amount of water taken from the environment, and shows how we will protect and improve it.
- Is affordable.
- Maintains flexibility by being able to respond to new challenges during the five yearly planning cycle.
- Complies with its legal duties.
- Incorporates national and regional planning.
- Provides best value for the region and its customers.

2.1.1 Developing our WRMP

Our WRMP24 has been progressed following processes detailed in the WRPG, as shown in Figure 19.

Figure 19 Our process for producing the WRMP24



3 https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline

We start by developing our forecasts for the period 2025 to 2050. These establish the amount of water available to use (supply forecast) and the amount of water needed (demand forecast). When these forecasts are combined, a baseline supply-demand balance is created. This tells us whether we have a surplus of water or a deficit.

An appraisal for both demand management options and supply-side options is also undertaken, starting with an unconstrained list of possible options which progress through various assessments until a final constrained list of options is determined, along with the amount of water they either save or produce.

Demand management options aim to reduce the amount of water being used by our customers and/or lost in our water network. Examples include smart metering and the promotion of water efficiency measures, such as reducing shower times. We also develop supply-side options which provide additional water to supply to customers. Examples include developing new raw water storage reservoirs, like those already seen at Grafham Water in Cambridgeshire and Alton Water in Suffolk, or water reuse treatment works.

We environmentally assess these options so we can understand their potential environmental impacts and what could be put in place to mitigate them. Sometimes, there are no mitigations so the option is placed on a rejection register.

What is a best value plan?

A best value plan considers factors alongside cost, achieving an outcome that provides benefit to customers, the wider environment and society as a whole. This is for both short and the long term.

The next step is for the water savings associated with the chosen demand management options to be added into our baseline supply-demand balance. If the demand management options savings do not solve the deficit, supply-side options are added into the modelling process. This is undertaken in our Economics of Balancing Supply and Demand (EBSD) model which conducts numerous modelling runs, creating a range of plans that meet various objectives.

From these different model runs, we develop a best value plan. This looks beyond cost, encompassing the views of our customers and stakeholders who have been consulted throughout the plan's development. This has seen our customers actively involved in the co-creation of our best value plan objectives, telling us their thoughts on the trade-offs we have encountered and finally their opinions on a series of initial plans.

2.1.2 Best value planning

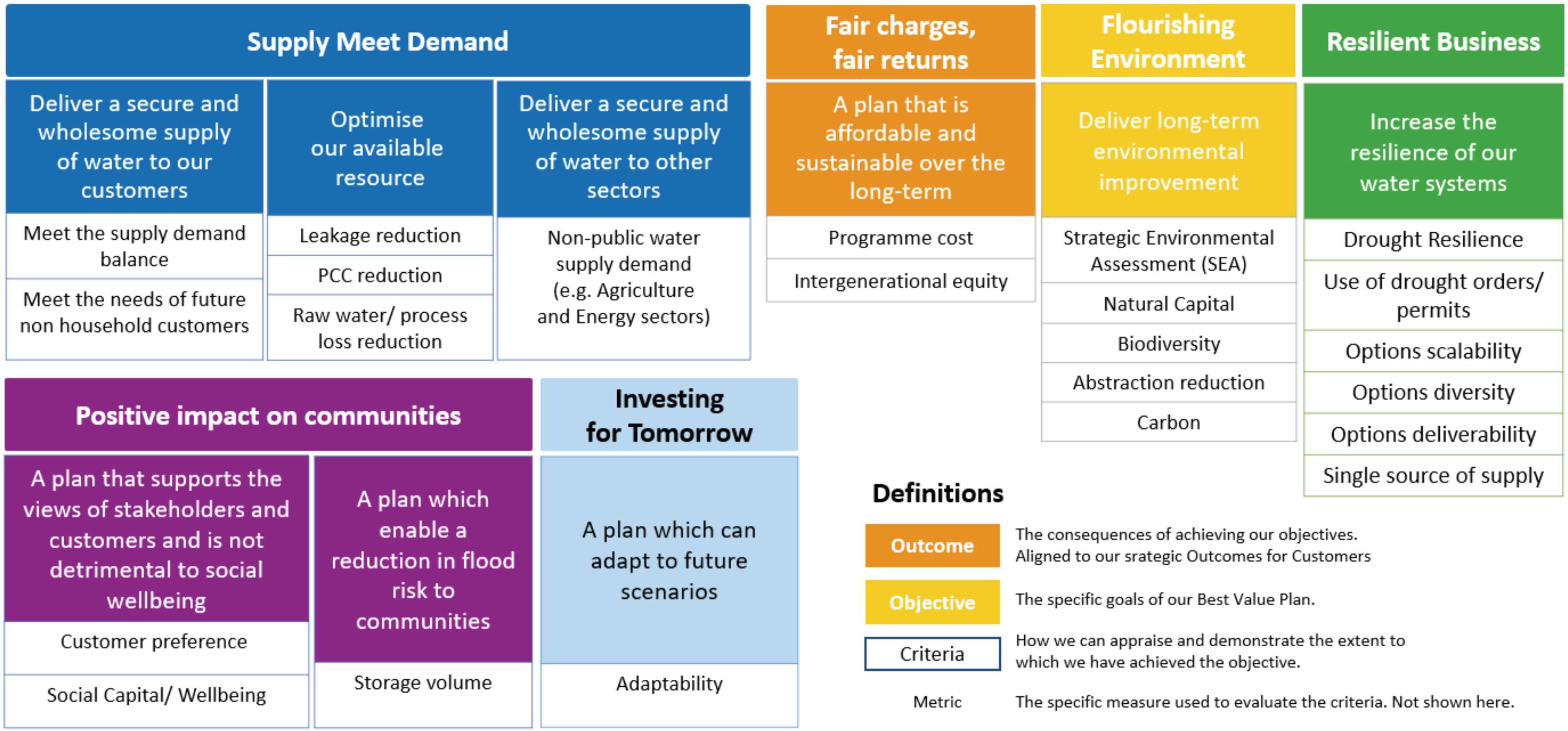
We used this feedback to create and refine a best value planning framework, identifying the outcomes that we wish to achieve. These best value plan outcomes are aligned with our strategic outcomes for customers as shown in Figure 20. An example of one of our outcomes is the ambition to achieve a flourishing environment.

Figure 20 Best value plan objectives aligned to our outcomes for customers

Below these outcomes sit the objectives for the plan which are the specific goals we need to accomplish in order to achieve our outcomes. For example, we need to deliver long-term environmental improvements to meet our outcome of a flourishing environment, whilst also meeting our statutory water supply obligations.

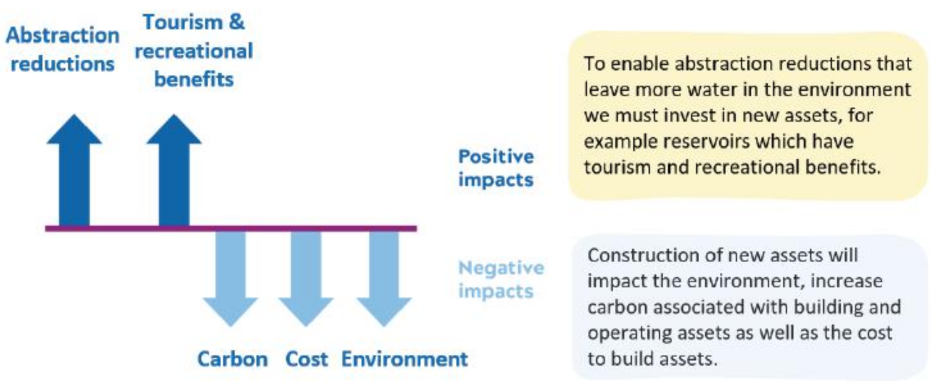
Beneath each objective sit the criteria we use to demonstrate the extent we have achieved the objective. In this example, the amount of abstraction reduction achieved is a criteria for delivering long-term environmental improvements. The criteria, objectives and outcomes in our best value planning framework are shown in Figure 21. We also use a range of metrics (not shown) to evaluate the criteria. These can be quantities, monetised values or qualitive assessments.

Figure 21 Our best value planning framework



We recognise that it is not possible to maximise all of the criteria in our best value planning framework, so there will be trade-offs between objectives. An example of this is shown in Figure 22 which shows how maximising abstraction reduction can affect other criteria in a negative way.

Figure 22 An example of a best value plan trade-off

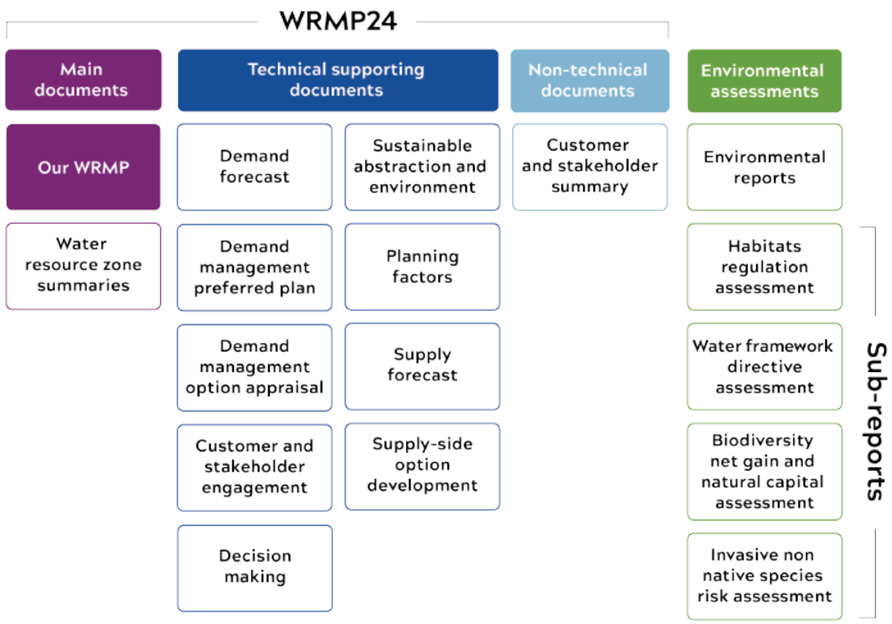


Consequently, a best value plan must balance the trade-offs between objectives in order to deliver the best outcome to customers, stakeholders and the environment. This will be discussed in further detail in section nine.

2.1.3 Our WRMP24 reports

An overview of our best value plan and its development is featured in this main document. Further detail can be found in our suite of supporting technical documents which are shown in Figure 23.

Figure 23 Our draft WRMP24 reports



2.2 Links to other plans

Our WRMP24 is influenced by the following plans and strategies. These include but are not limited to:

- The Government's 25 Year Environment Plan[4]
- River Basin Management Plans[5]
- Government Policy on demand management

Our WRMP24 is also central to many of our company's plans and strategies, including:

- The Fens Reservoir and South Lincolnshire Reservoir RAPID gate submission[6]

4 Defra (April 2018), 'A Green Future: Our 25 Year Plan to Improve the Environment'
5 Draft river basin management plans: 2021 - GOV.UK (www.gov.uk)
6 Investing in two new reservoirs (anglianwater.co.uk)

- Regional Planning[7]
- Future Fens: Integrated Adaptation[8]
- Our net zero strategy to 2030[9]
- Our Business Plans for 2020-2025[10] and 2025-2030
- Our Drainage and Wastewater Management Plan[11]
- Our LTDS
- Our Drought Plan[12]

These interactions will be referenced throughout this document and supporting technical documents.

2.2.1 Our Drought Plan and Levels of Service

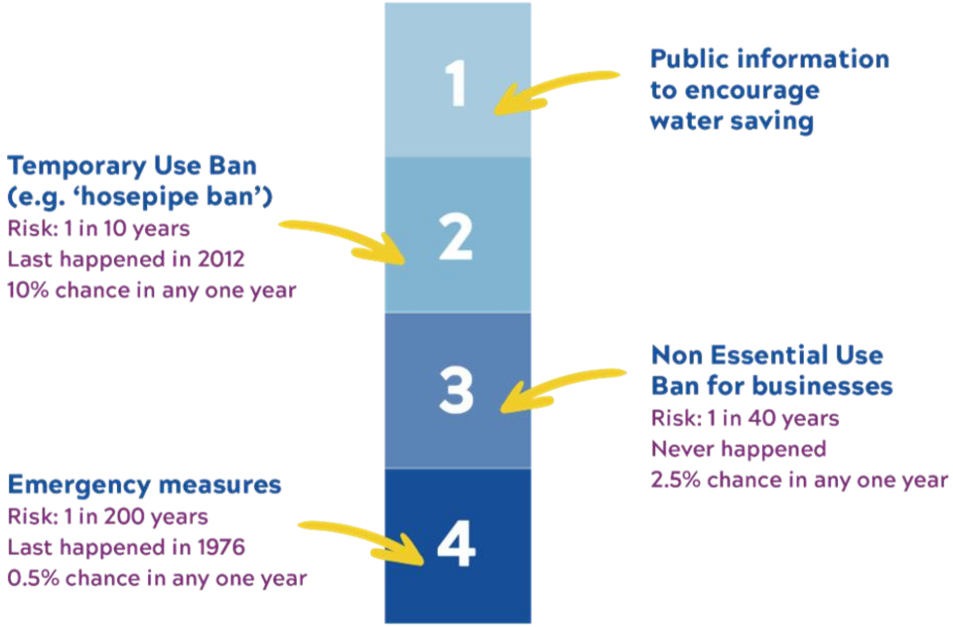
We published our drought plan in April 2022. This sets out how we will protect public water supplies in the event of a drought occurring between 2022 and 2027. This includes the Levels of Service we provide to our customers, as shown in Figure 24.

We consulted extensively with our customers on our Levels of Service as part of the formation of our SDS, as well as for previous business plans and WRMPs. For this WRMP24, we again carefully considered these Levels of Service and spoke to our customers to determine if they felt they were still acceptable.

Our engagement shows that 72% of our customers feel that a 1 in 10 year risk of temporary use bans is acceptable. This means there is a 10% average annual risk of us implementing a hosepipe ban, during which time customers would not be able to use a hosepipe to water their garden or wash their car.

Seventy-three percent of customers felt the probability of a non-essential use ban is also acceptable. A non-essential use ban means that a business could not conduct activities such as filling a non-domestic swimming pool or using a mechanical vehicle washer. Our Level of Service for a non-essential use ban is 1 in 40 years, equivalent to a 2.5% annual average risk.

Figure 24 Our Levels of Service from 2025



Following customer feedback for WRMP19, we put investment plans in place to become resilient to a 1 in 200 year drought by 2025[13]. This will reduce the chances of customers being subject to emergency measures during a severe drought. Examples of emergency measures include rota cuts where customers experience no or low flow to their taps at certain times of day or have to use standpipes to collect water. We strongly believe this increased resilience is essential to our sector, and to our region as we know being prepared for drought is more cost effective than

7 https://wre.org.uk/wp-content/uploads/2022/01/WRE-Emerging-Plan.pdf
8 Future Fens: Integrated Adaption (anglianwater.co.uk)
9 net-zero-2030-strategy-2021.pdf (anglianwater.co.uk)
10 Anglian Water (September 2018), 'PR19 Our Plan 2020-2025'
11 Anglian Water (June 2022), 'Draft Drainage and Wastewater Management Plan'
12 Anglian Water (April 2022), 'Drought Plan 2022- Final Version'
13 We are currently 1 in 100 year drought resilient

implementing expensive emergency measures. It also ensures we lessen the chances of our customers having a restricted water supply. This is an approach echoed by the National Infrastructure Commission[14].

We discussed this 1 in 200 year risk with our customers as part of our WRMP24 engagement and found 54% of 1489 household customers felt it was an acceptable risk. We then asked the same customers how they felt about moving to an enhanced drought resilience of 1 in 500 years. A higher percentage of customers (67%) told us they felt moving to an enhanced drought resilience of 1 in 500 years would be a more acceptable level of risk. The implementation of this enhanced drought resilience has formed a significant element of our draft WRMP24.

These levels of service have been integrated into our supply forecast modelling.

2.2.2 Regional planning

Regional planning has also formed an integral part of our WRMP24 methodology. The National Framework for Water Resources[15] provides a mandate for five regional planning groups, shown in Figure 25. These groups bring together abstractors from public and non-public water supply, as well as regulators and environmental groups. These stakeholders work together to form a long term strategy for how water will be supplied to households, industry and agriculture across their region. The regional planning groups then work together to ensure a coherent, efficient national water strategy.

We are active participants in WRE, the regional planning group for the East of England. Representatives for agriculture, energy, councils and environmental groups are also key stakeholders, as well as our fellow water companies Essex & Suffolk Water, Cambridge Water and Affinity Water (as part of its Brett Zone).

We have led the task and finish groups for the technical programme, as well as developing the technical methodologies for the processes. We have also held weekly alignment groups with the other water companies in WRE, ensuring consistency in approach.

Figure 25 Regional Planning groups

What is a low regret option?

A low regret option is one that we won't regret even if assumptions change.

WRE is focussed on developing low regret, robust strategic supply-side options for the region's water users. It uses a Multi-Objective Robust Decision-Making process and stakeholder participation to achieve this. These strategic supply-side options have been reflected in our WRMP24. We have also

14 Preparing for a drier future (nic.org.uk)
15 Environment Agency (March 2020),'Water Resources National Framework Appendix Two: Regional Planning'

undertaken our own modelling for WRMP24, with the aim of confirming the robustness of the Regional Plan, making sure it truly offers best value to our customers.

The regional groups also set an environmental strategy for their region, otherwise known as its environmental destination. This aims to define a long-term 25 year vision for the environment, rather than just focussing on what can be achieved in a five year planning cycle. This destination will inform how the region will reduce the potential impact of abstractions, allowing waterbodies to be restored, protected and enhanced.

Our WRMP also includes a WRZ for Hartlepool Water which is part of the Water Resources North (WReN) planning group. Hartlepool WRZ is consistent with WReN's strategy.

2.2.3 RAPID and Strategic Resource Options

In our WRMP19 we recognised that new supply-side solutions are complex to deliver and have long planning timescales, meaning it would be difficult to implement them quickly if a near term challenge occurred. Through our WRMP19 modelling and decision making, we identified schemes that would require pre-planning activity so that they could be 'shovel ready' earlier.

Some water companies received additional funding to investigate and develop options like these through a gated process overseen by Ofwat, the Drinking Water Inspectorate and the Environment Agency. These regulators have formed an alliance called the Regulators' Alliance for Progressing Infrastructure Development, otherwise known as RAPID. It aims to help accelerate strategic water infrastructure so it can meet the long-term needs of the country.

We have two strategic resource options (SROs) in the RAPID process- the Fens (known as North Fenland in WRMP19) and South Lincolnshire reservoirs. These are two new 55 million cubic metre raw water storage reservoirs, with each having 50 million cubic metres of usable water. The sizing has been determined by the WRE decision making process, WRMP24 supporting modelling and site constraints. The need for these reservoirs has been determined in three processes:

- A multi-objective decision making process undertaken by WRE. New supply-side options (such as raw water reservoirs. desalination and water reuse) from WRE water companies were tested against differing hydrological and environmental scenarios. Stakeholder input allowed best value metrics to be applied to the portfolios generated. The Fens and South Lincolnshire reservoirs were determined to be low regret regional options as part of this process.
- An independent national model, the Water Resources of England and Wales water resources model, also identified the need for and value of both the South Lincolnshire and Fens reservoirs. This modelling also confirmed that both reservoirs are resilient against uncertainty in supply and demand over the long-term.
- Our WRMP24 modelling confirmed the need for the reservoirs as, in unconstrained model runs, both reservoirs were picked when looking over a 50 year time frame. This is due to desalination having higher operational costs than reservoirs.

The South Lincolnshire Reservoir was initially developed in partnership with Affinity Water, but it has been confirmed at a regional level that there will be no new transfers of water out of the WRE region. Therefore, Affinity Water have developed their plan to meet their needs utilising other sources of water.

This approach is supported by the regional reconciliation process, where the Water Resources South East (WRSE) and WRE plans were aligned to ensure that the Affinity Water decision not to progress with the South Lincolnshire reservoir and their transfer (the Anglian to Affinity transfer) is consistent with both draft regional plans. To reflect this, we have modelled the costs and benefits for the South Lincolnshire reservoir as 100% of the resource being retained within our region.

The Fens reservoir is being developed in partnership with Cambridge Water, and the resource will be shared equally. To reflect this, we have modelled the costs and benefits for the Fens reservoir as 50% of the total.

Further information on the reservoirs can be found at

https://www.anglianwater.co.uk/environment/investing-in-the-future-of-water/two-new-reservoirs/

2.2.4 Interactions between WRMP24, Regional Plan and SROs

WRMP24, WRE's Regional Plan and the RAPID process are all essential components of water resources planning.

The aims and decision making of each stream is shown in Figure 26. We also detail how best value planning is applied in each process.

Figure 26 Water Resources Planning decision making framework

Decision making framework

	Regional plan	Water Resource Management Plan*	Strategic Resource Options
Decision making complexity	Extremely complex	Very complex	Fairly complex
Principal guidance	National Framework for Water Resources	Water Resource Planning Guideline	Regulators Alliance for Progressing Infrastructure Development
Aims	Produce a resilient, long-term water resource plan for the region	Achieve a secure supply of water for customers and a protected, enhanced environment	Progress strategic infrastructure to meet the long-term needs of the region(s)
What it determines	Environmental destination and ambition for the region Additional inter-regional transfers Strategic supply-side options and timings SRO need Non-PWS options	Confirm environmental destination and ambition for the company Company supply-side options and their timing Demand management options and their timing 1:500 Drought resilience timing Licence cap timing Confirm SRO need SRO sizing** and timing of need	Location of SROs SRO delivery date Multi-sector opportunities Design and progression of scheme
How is best value applied	Reflects multi-sector aims and needs, as well as looking at inter-regional transfer capability Trades off multiple stakeholder objectives through a high-level large set of search and tracked metrics	Reflects company environmental and societal outcomes and aligns with strategic direction and LTDS Integrates stakeholder and customer views	Aligned with regional plan and company WRMPs Decision making criteria for site location Cost and technical elements of concept design, following design principles

*Statutory document **Determined by regional modelling

These planning streams have been developed in parallel, requiring an iterative approach to reconcile and refine them. For instance, the WRPG requires that our WRMP24 reflects WRE's Regional Plan, unless there is a clear justification for not doing so. We have done this, taking the strategic supply-side options determined at regional level and making them 'must dos' in our plan, after testing them for robustness in our own modelling. This ensures that the outputs from the Regional Plan provide best value for our customers and region.

Demand management options are determined by WRMP24, as well as the timing of enhanced drought resilience and licence capping. WRMP24 also determines if and when any smaller scale supply-side options that are required, as illustrated in Figure 27.

Figure 27 WRMP24 reflecting the Regional Plan

The environmental destination set by the region has also been placed at the heart of our WRMP24. This means we will conduct environmental investigations between 2025 and 2030 in order to inform our environmental destination for WRMP29. These investigations will focus on establishing which environments need help the most and what that action should be.

2.2.5 Our net zero strategy

We will achieve net zero operational carbon emissions by 2030. Achieving net zero means we will reduce the greenhouse gas emissions from our operations as far as possible. Any residual emissions that we cannot avoid or reduce will be counterbalanced from 2030 by an equivalent sequestration of gases. This means that, overall, we will have no impact on greenhouse gases in the atmosphere.

We will achieve this by:

- maximising energy efficiency and renewable energy generation and storage
- procuring green electricity
- managing our process emissions
- developing our offsetting strategy
- opting for alternative fuels
- decarbonising our fleet, and
- maximising the value of our biogas

We are also actively managing the capital carbon impact of our business. We have set a target to reduce capital carbon by 65% by 2025 and 70% by 2030 against a 2010 baseline. At the end of 2021/22 we are proud to have achieved a 63.1% capital carbon reduction against our 2010 baseline. This has been achieved by a four step hierarchy:

1. No build
2. Reuse assets
3. Optimise design
4. Change materials to low carbon alternatives

Our capital carbon reduction is also being driven by a rigorous delivery gateway process where capital carbon is assessed at every stage. An example of how we reducing carbon is shown in the development of our strategic pipeline.

Reducing carbon in construction

The strategic pipeline we are currently building is one of the biggest infrastructure projects in the UK. Its capital carbon baseline is larger than the whole of our 2015-2020 construction programme.

Our Strategic Pipeline Alliance (SPA) recognised the earlier that carbon is challenged, the greater is the opportunity.

SPA partners and suppliers were engaged to update our existing carbon models and to create new models. These models, part of SPA's Digital Twin Strategy, were then used alongside a forecast of future grid emissions to enable whole life carbon modelling. This meant the delivery route could identify and evaluate thousands of pipe, pump, storage, and control options.

The Solutions Team established that the outcomes could be met with a solution which re-uses 67km of existing pipework to avoid laying new pipe. It would also require 45% less new pumping capacity, 72% less new storage capacity and use lower carbon materials and techniques.

We also expect, although subject to uncertainties, that technological advances will enable lower carbon construction techniques and materials for schemes further along our planning horizon. We believe that our WRMP will give confidence to future suppliers that they should be committing to investing in low carbon technology development, knowing there are large infrastructure projects which will need such techniques.

We have considered our greenhouse gas emissions as part of WRMP24 by evaluating how our plans perform for both operational and capital carbon. We have also reviewed the phasing of our higher operational options, such as desalination.

Further detail on our carbon approach can be reviewed in section nine and the WRMP24 Decision Making technical supporting document.

2.3 Stakeholder and customer engagement

Engagement has been central to shaping, informing and challenging our plan. Through WRE we have made new stakeholder relationships and furthered existing ones. The Fens Water Partnership and South Lincolnshire Water Partnership have also been instrumental to the development of our water resources strategy.

We continue to maintain close links with our regulators, meeting monthly with the Environment Agency to discuss the development of our WRMP. We have also liaised with Ofwat, the Drinking Water Inspectorate, Natural England, Historic England and the Marine Management Organisation.

For pre-consultation we held three webinars, with the aim of informing stakeholders about our WRMP24 and its challenges. We discussed our supply and demand forecast methodologies, the demand management and supply options appraisal process and our best value plan framework. Questions were asked via a web app or email.

Since our webinars, we have continued with one to one stakeholder engagement, using the opportunity to inform of any developments in the plan making process, as well as using the opportunity to ask for opinion and insight. For instance, we held local workshops with Natural England and the Environment Agency. The feedback received enabled us to further constrain our supply-side options and become more aware of any inherent risks.

We have also built on our day to day engagement with customers. We aim to make life better for our customers every single day, whether that be through our contact centre or water saving campaigns. So, it was important to us that they were actively involved in the development of our plan. Further details on how this was achieved can be reviewed in our WRMP24 Stakeholder and Customer Engagement technical report, as well as throughout this report.

3 WRMP19 and new challenges for WRMP24

In this section we will:

- Provide an overview of our WRMP19 strategy, focussing on leakage reduction, our strategic pipeline, our smart metering programme and our investment in the environment.
- Discuss the new challenges we are experiencing for WRMP24.
- Show water resource zone changes since WRMP19, and subsequent problem characterisation.

Our current WRMP was published in 2019. WRMP19 promoted a twin track approach which has seen us implementing an ambitious demand management programme, building on our already industry leading leakage performance. This approach is helping us understand our water network better than ever before, increasing our ability to pinpoint localised leakage and unlocking more effective communication with our customers.

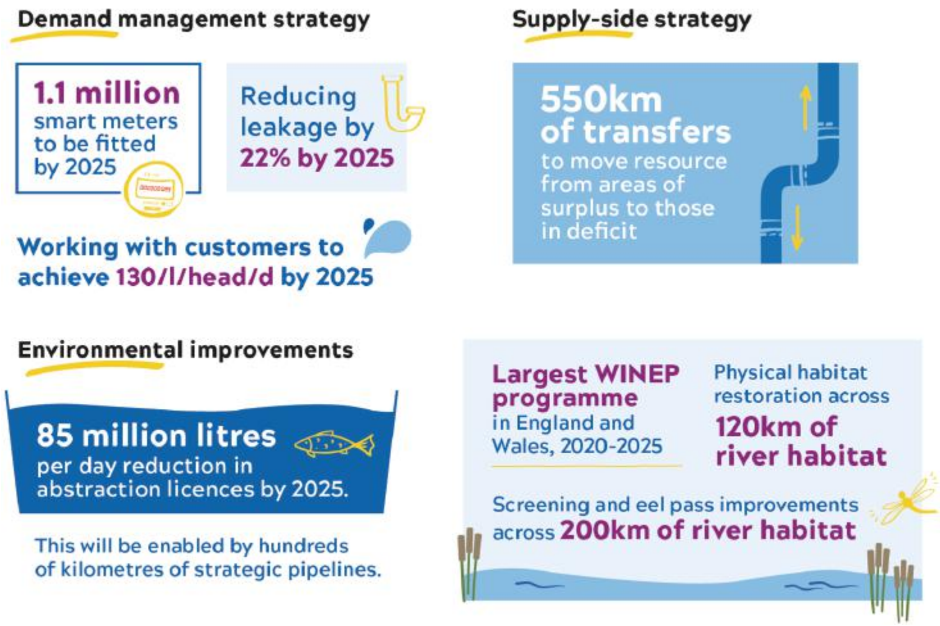
We also promoted a significant main laying scheme to take water from areas of surplus to areas of deficit. We will build on this pipeline for our WRMP24 strategy.

This new connectivity is enabling us to reduce abstractions from our most sensitive environments, and will see us cease or reduce abstraction from certain sensitive environments by 2025.

We have also developed our adaptive planning programme, recognising that certain supply-side options take significant amounts of development time. This has been used to further develop our understanding of water reuse, desalination and aquifer storage and recovery. We also developed the Fens reservoir as part of this programme, before it entered RAPID at gate one.

An overview of our strategy is shown in Figure 28.

Figure 28 Our WRMP19 strategy



We have experienced significant challenges during the delivery of our WRMP19 strategy, including:

- Brexit.
- The Covid-19 pandemic where our per capita consumption increased.
- The Ukraine war which disrupted our supply of steel for our strategic pipeline.
- Supply chain issues, with items such as processing chips in short supply.

Despite these challenges, we have made great progress delivering our WRMP19 strategy but it has made us even more aware that we need to be resilient and flexible to further challenges that may arise for WRMP24.

An overview of our progress is provided in Figures 30 to 33.

Figure 29 Tackling leakage for WRMP19

WRMP19 Focussing on leakage

Our track record on leakage is one of our proudest achievements as a business. We've reduced leakage in our region by 40% since privatisation in 1989. Our leakage level per kilometre of pipe is the lowest in the industry and we've exceeded our leakage targets for more than ten years in a row.

We committed to reduce leakage by 22% in AMP7. We are tackling this by leveraging innovative technology to detect leaks and react faster than ever. We're installing a network of fixed noise sensors which listen to the network and pick up sounds when a new leak occurs.

A key part of our strategy is to optimise our network by installing devices that reduce absolute water pressure in the water network. These also protect the network from additional bursts.

Targeted asset replacement also continues, replacing small sections of mains pipes that are leaking.

We committed to reduce leakage by 22% in AMP7. We are tackling this by leveraging innovative technology to detect leaks and react faster than ever.

Figure 30 Moving water to supply our customers

WRMP19 Strategic Pipeline

Alongside our partners in the Strategic Pipeline Alliance, we're creating a network of new interconnecting pipelines to help us move water freely around the region. It's the largest infrastructure programme in Anglian Water's history and one of the largest infrastructure projects in the UK.

Driven by systems thinking, this new way of approaching our water resource challenge joins up our region's water supplies like never before.

The new pipelines will allow us to divert water from areas of relative abundance in the north to areas in the south and east of the region, where water isn't as readily available.

The new pipelines will help secure water supplies for future generations and reduce the number of homes and businesses that rely on a single water source.

By 2025, we'll have hundreds of kilometres of pipelines, with total investment around £400 million.

It's the largest infrastructure programme in Anglian Water's history and one of the largest infrastructure projects in the UK.

Figure 31 Improving our environment

WRMP19
Investing in our environment

As part of our ongoing commitment to our region's rivers and precious environments, such as sites of special scientific interest (SSSIs) and chalk streams, we are continuing to drive a reduction in the volumes of water that we abstract in AMP7 (2020-25).

We're investing over £15 million to improve our network connectivity in East Norfolk. This will allow abstraction to cease near the Ant Broads and Marshes SSSI. This means more than 4 million additional litres of water will remain in the aquifer every day, supporting the unique features and species of the area.

Up to 117km of chalk streams and sensitive rivers will receive £7 million investment. This will reinstate lost habitats, features and processes that allow rivers to function naturally, supporting thriving wildlife, and be resilient to the challenges of climate change.

An additional £12.5 million will be spent supporting lowest flows in these rivers, ensuring that the restored habitat is maintained with flow during the driest summers that we will experience.

Up to 117km of chalk streams and sensitive rivers will receive £7 million investment.

Figure 32 WRMP19 smart metering strategy

WRMP19
Customer visibility

We are installing over 1.1 million smart meters by 2025. These give our customers the visibility to understand their water usage, and modify their behaviours if they choose to. This can lead to financial benefits such as reduced water and energy bills.

The data from smart meters can help us identify plumbing losses and supply pipe leaks. It can also help us understand when and where water is used across our network. Since 2020, more than 67,000 customer leak investigations have been carried out.

As smart meters are read remotely, we have fewer vans on the road reading meters. This is reducing our carbon footprint and helping towards our net zero carbon commitment.

Understanding our demand for water will also enable us to forward plan better, as well as help us target water efficiency measures.

Since 2020, more than 67,000 customer leak investigations have been carried out.

3.1 New challenges for WRMP24

Whilst we are responding well to WRMP19's challenges, we have significant new considerations for WRMP24. These are shown in Table 1.

Table 1 A comparison of WRMP19 and WRMP24 challenges

Impact		WRMP19	WRMP24
Growth	Baseline growth	✓	✓
	Growth associated with OxCam		✓
	Impact of Covid-19 on demand		✓
Sustainability reductions	Sustainability reductions (AMP7 WINEP)	✓	
	Sustainability reductions (AMP8 WINEP)		✓
	Additional caps for no deterioration		✓
	Further reductions to enhance the environment (environmental destination)		✓
Climate change	Historic climate change	✓	✓
	Future climate change	✓	✓
Extreme drought	Reduce reliance on drought permits		✓
	Increase resilience to 1 in 200 years	✓	
	Increase resilience from 1 in 200 to 1 in 500 years		✓

A brief summary of these challenges is now provided.

3.1.1 Growth

The East of England has experienced the highest growth rates in the United Kingdom since the 2011 census. We expect this to continue with an additional 890,000 people predicted to live in our region by 2050. Further detail is available in section five and the WRMP24 Demand Forecast technical supporting document.

3.1.2 The Oxford Cambridge Arc

The Oxford Cambridge Arc (known as the OxCam Arc) is a potential strategic growth corridor that could increase the amount of water needed in our area. The extent of its growth is currently uncertain; however we have included an element of strategic growth in our WRMP. Please refer to section five or the WRMP24 Demand Forecast technical supporting document for further information.

3.1.3 Covid 19

Covid 19 changed our lives and work habits. During the lockdown periods we saw a 10% increase in household demand for water across our region. This demand has now reduced but not to pre-Covid levels. We are currently developing our understanding of what this means for long-term demand for water, especially with new hybrid ways of working. Please refer to section five or the WRMP24 Demand Forecast technical supporting document.

3.1.4 Sustainability reductions

We want our abstractions to be environmentally sustainable. For WRMP19 we voluntarily committed to maintain all of our groundwater abstractions below maximum peak abstraction rates, ensuring there would be no risk of deteriorating the health of a waterbody.

Since our commitment in WRMP19, the Environment Agency has signalled that further abstraction licence reductions are required. It is proposed that abstraction licences are restricted to recent actual average abstraction levels rather than maximum peak levels. This will reduce the amount of water we have available, leaving us with a significant short-term risk as a large percentage of our licences are time-limited. For further detail, please refer to section four, the WRMP24 Supply Forecast technical supporting document and the WRMP24 Sustainable Abstraction and Environment technical supporting document.

3.1.5 Environmental destination

Environmental destination is also a new consideration. We support it wholeheartedly as it promotes a long-term vision to deliver greater environmental improvement to the country. It does this by challenging abstractors to consider changes to water abstractions that are above and beyond their statutory obligations.

To support these discussions, different environmental destination scenarios have been created in our regional planning group, WRE. These scenarios vary in the extent of environmental improvement achieved, their associated abstraction reductions and what infrastructure is needed to facilitate it. Further detail on how environmental destination has shaped our WRMP24 can be found in section four, the WRMP24 Supply Forecast technical supporting document and WRMP24 Sustainable Abstraction and Environment technical supporting document.

3.1.6 Climate change

Our climate is becoming undoubtedly hotter and weather patterns are changing. We are expecting droughts to become more severe in the future and have to plan for this. Further detail can be found in section four and the WRMP24 Supply Forecast technical supporting document.

3.1.7 Drought resilience

In WRMP19, we planned to become resilient to a 1 in 200 year drought by 2025. This is equivalent to a 0.5% chance of a severe drought occurring in any given year. The WRPG states we need to increase our robustness to drought further by becoming resilient to a 1 in 500 year drought which is the equivalent of a 0.2% chance of a severe drought occurring in any given year.

This enhanced resilience means we will be able to maintain supply to our customers during drier periods, without resorting to emergency measures such as rota cuts or standpipes. The WRPG states this needs to be achieved by 2039. Further detail can be reviewed section four and in our WRMP24 Supply Forecast and Decision Making technical supporting documents.

3.1.8 Drought permits

When drought occurs, we may need to ask the Environment Agency to implement a drought permit. We don't include drought permits in our baseline forecasts as the water is not always available in periods of low flow.

What is a drought permit?

A drought permit is granted by the Environment Agency. Its aim is to secure additional water resources by modifying or suspending conditions on an abstraction licence.

The WRPG has signalled that water companies should reduce their reliance on drought permits. We support this premise but recognise it could leave us less resilient to drought until we can implement new supply-side measures which may have significant lead times.

3.1.9 Availability of supply-side options

The amount of water we can take is decreasing. This means that there is limited opportunity for building new conventional treatment options, leading us to look at schemes that need significant infrastructure. These options include new raw water storage reservoirs, water reuse plants and desalination. None of these options can be delivered quickly as they can include significant planning processes, big construction programmes or new technology. In some cases, all three can be factors. Please refer to section seven and the WRMP24 Supply-Side Options Development technical supporting document for further information.

3.1.10 Cost efficiency of demand management options

We have invested significantly in demand management, with some of our options nearly exhausted until new technology is available. This means that we now have to consider significant mains laying, which is very expensive.

3.2 Water resource zone changes since WRMP19

> **What is a water resource zone?**
>
> A WRZ represents the largest area in which all resources can be shared effectively. They are usually self contained and defined by their infrastructure connectivity and geographic or physical boundaries. Customers in an WRZ share the same overall risk of water supply failure.

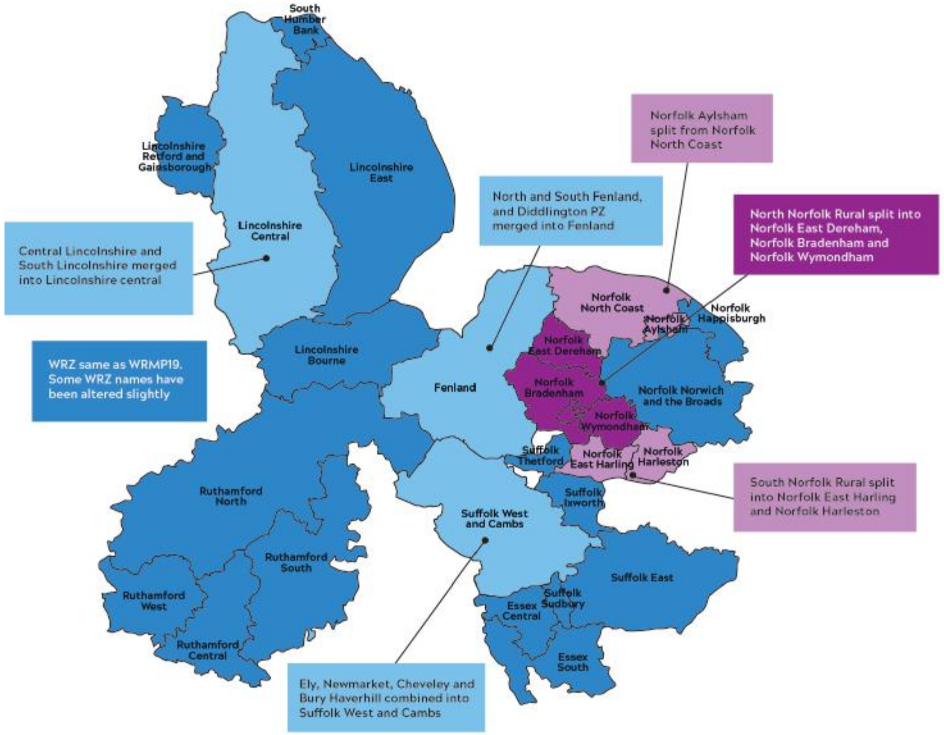
When we started developing WRMP24, we assessed the integrity of the 28 Water Resource Zones (WRZs) used for WRMP19. WRZs are the principle building blocks used by water companies to develop their supply-demand balance. As a water company, it is our responsibility to divide up our region into WRZs.

For WRMP24, we needed to confirm that our WRMP19 WRZs were still suitable. Using early supply and demand forecasts, the assessment explored potential scenarios (for instance, environmental destination, growth and licence capping) to test their integrity. When this scenario testing exposed discrete areas of deficit within a large WRZ, it was divided it into two smaller zones to allow the discrete deficit to be included in our WRMP24 modelling.

Investment for WRMP19 has also allowed us to combine some of our WRMP19 WRZs, so we have new interconnectivity between these zones. The changes are shown in Figure 33.

Our WRZ integrity assessment concluded that 16 of our WRMP19 WRZs would remain unaltered, with the remaining 12 WRZs being either split or combined into 11 new WRZs. This has resulted in a total of 27 WRZs for WRMP24, including Hartlepool.

Figure 33 Changes to our WRZs for WRMP24



3.3 WRMP24 problem characterisation

Following on from the development of our new WRMP24 WRZs, we conducted a problem characterisation assessment. This problem characterisation, following the UKWIR Decision Making Process, determines which modelling approach should be undertaken for WRMP24. There are two parts to this assessment:

1. Strategic needs- how big is the problem?
2. Complexity factors- how difficult is it to solve?

These two questions are used to determine the level of concern for each of the seven geographical areas used to carry out the assessment. The problem characterisation is summarised in Figure 34.

Figure 34 Summary of WRMP24 problem characterisation

Area	Water Resource Zones	Total Needs Score	Total Complexity Score	Level of Concern
1	Lincolnshire WRZs	4	12	H
2	Ruthamford WRZs	6	20	H
3	Fenland WRZ	3	14	M
4	Norfolk WRZs	5	16	H
5	Essex and Suffolk East WRZs	6	17	H
6	Suffolk and West Cambridgeshire WRZs	4	16	H
7	Hartlepool	0	1	L

Recognising the high level of concern, we have undertaken a complex decision making approach. This has been achieved by using WRE's Multi-Objective Decision Making model, our EBSD model and our best value planning framework. This approach has been used for all of our WRZs, reflecting their interconnected nature. This is a change from WRMP19 where we only utilised the Economics of Balancing Supply and Demand model and best value criteria.

We model Hartlepool WRZ separately as it has a low level of concern.

4 Water availability

In this section we will:
- Give an overview of how we developed our supply forecast.
- Discuss what has changed since WRMP19.
- Provide an overview of sustainability reductions and how moving to actual average impacts our supply demand balance.
- Detail what environmental destination is, how it has been developed and how it has impacted WRMP24.
- Show the impact of climate change and moving to 1 in 500 year drought resilience.

Half of our water supplies come from groundwater sources, with the rest coming from surface water such as reservoirs or rivers.

To understand how much water we have available from these sources we produce a supply forecast, detailing how much water we have available from 2025 to 2050.

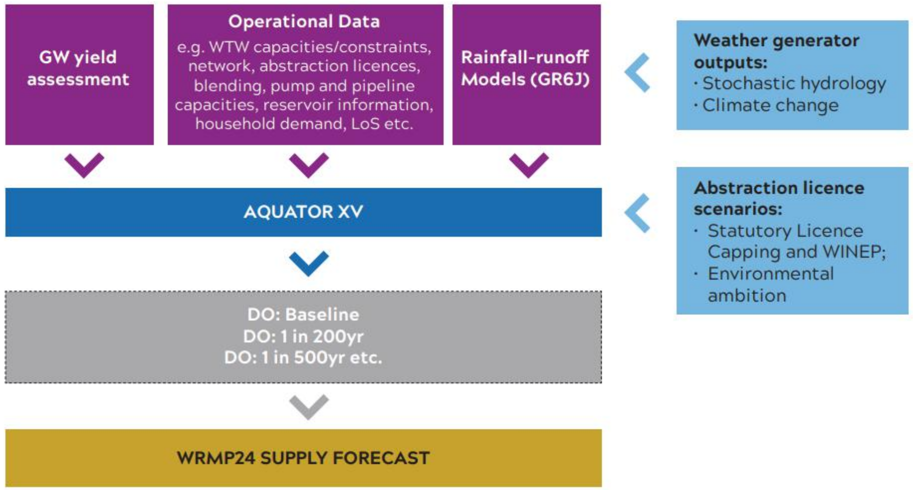
4.1 Developing the supply forecast

What is deployable output?

It is defined as the annual average output that can be reliably supplied from a commissioned source or group of sources within a WRZ, during a design drought, with current infrastructure.

The supply forecast is developed using AQUATOR, a water resource simulation software. This systems based approach provides a more accurate and advanced method for calculating deployable output compared to the traditional spreadsheet method. Figure 35 shows the main inputs to AQUATOR and the supply forecast.

Figure 35 The supply forecast process



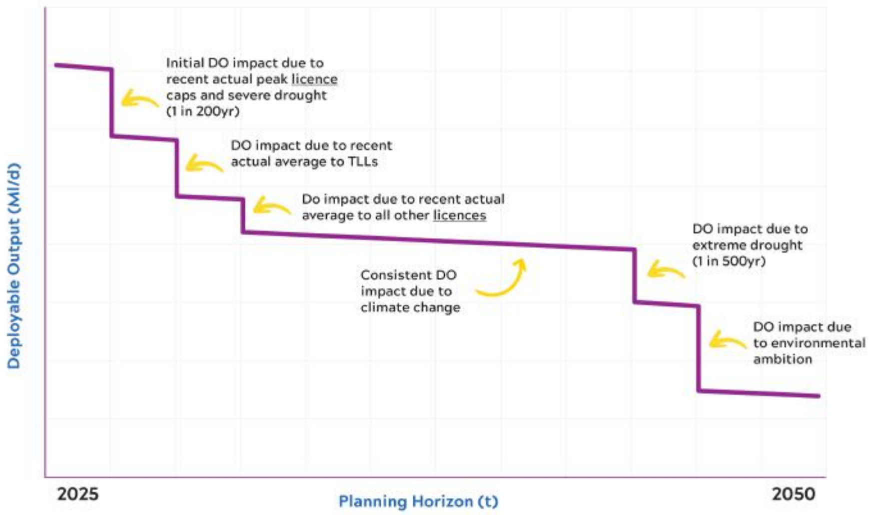
4.2 What has changed since WRMP19?

We have continued to improve our supply forecasting by introducing new models and datasets. This has helped us provide robust forecasts showing how deployable output has been impacted by:

- sustainability reductions to recent maximum peak volume
- sustainability reductions to recent actual average volume for time-limited licences
- sustainability reductions to recent actual average licence caps for all licences
- climate change
- the implementation of 1 in 500 year drought resilience, and
- environmental destination.

To avoid double counting these deployable output impacts at the same sources, we have applied an order of impact. This is demonstrated over the 25 year planning period in Figure 36, using an example WRZ.

Figure 36 Order of impact for deployable output impacts



We will now discuss each of these challenges and our approach to them.

4.3 Sustainability reductions

Since 2000, we have proactively assessed the impact of our abstractions on the environment, working closely with the Environment Agency and Natural England to maintain the balance between environmental need and public water supply. This work has been driven and informed by legislation such as the Water Framework Directive (WFD) 2000, the Habitats Directive 1992 and the Wildlife and Countryside Act 1981.

As part of this ongoing environmental programme, we have investigated and reviewed mitigative options for water sources where it has been confirmed or is likely that an abstraction is having an impact. The solutions developed may see a reduction in the abstraction licence volume (known as a sustainability change), a mitigative option (such as river restoration) or a combination of both. It is important to note that a reduction in licensed volume does not necessarily result in a reduction in deployable output.

Reductions in deployable output that are caused by sustainability changes are referred to as 'sustainability reductions'.

4.3.1 Sustainability reductions in WRMP19

At WRMP19, we chose to accelerate environmental improvements across our region, focussing on abstractions that were having, or likely to have, an environmental impact. We also committed to prevent deterioration of the status of all bodies of surface water and groundwater. This is an objective from the Water Framework Directive, often referred to as WFD No Deterioration.

This WRMP19 pledge saw us plan to cap all groundwater abstraction licences, where reasonably practicable, to recent maximum peak abstraction volumes. We were the only company to chose to complete this by 2025, even though it reduced our deployable output by 5.6%, the highest impact seen in the water industry.

What is recent maximum volume?

This is the maximum amount of water we actually abstracted from the environment in any one year over a defined historic reference period (typically defined by the Environment Agency as 2005-2012).

The schemes needed to facilitate these licence caps are in delivery now. Their completion by the end of 2025 will result in a 85 million litres reduction in abstraction licences.

4.3.2 Sustainability reductions for WRMP24

Since WRMP19, there has been a significant shift in expectations for abstraction licensing. Recent guidance from the Environment Agency details that abstraction

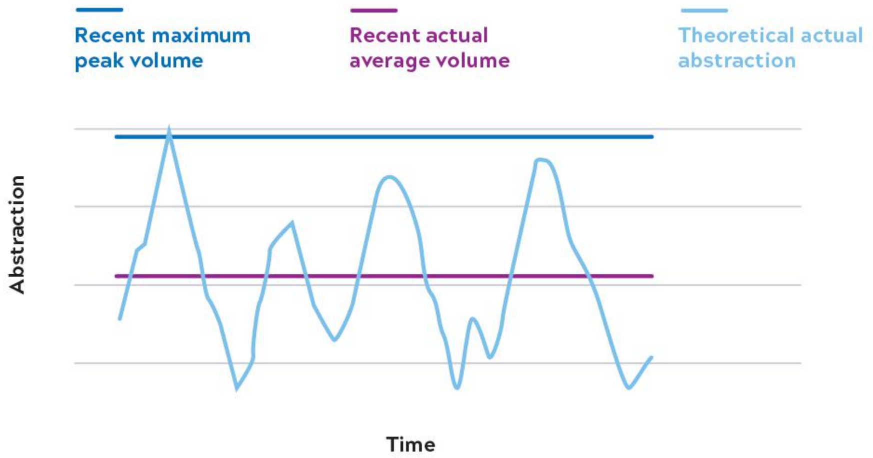
What is recent actual average volume?

This is the total volume of water abstracted during the representative recent actual period divided by the number of years in that period.

licences in certain environmental scenarios will need to be capped at recent actual average volumes. This effectively restricts abstractions further than capping at recent maximum peak volume.

Figure 37 shows how the two different capping scenarios impact a theoretical actual abstraction.

Figure 37 A theoretical example of the impacts of the different types of licence caps



The general challenges of moving from peak maximum to actual average

Whilst our abstractions typically operate at recent actual average volumes, hot summers can create high demand in our network. During these events we need to send more water into our network to keep taps flowing. If we were to operate some of our abstractions under recent actual average volume conditions at this present moment in time, without any additional supply-side infrastructure, we would either exceed our abstraction licences or have customers without water.

We also conduct essential maintenance on our treatment works, to ensure they remain in good condition. Sometimes this means we need to take an asset offline. When we remove such an asset from supply, we move water around from other areas to ensure we keep a constant supply to customers. If our abstraction licences are reduced to recent actual average volumes, we lose this flexibility and our ability to maintain our assets is greatly reduced without significant investment.

Headroom is also important to us. By moving to recent actual average volume, we lose headroom in our network so there is no water available to take if there is an emergency. To re-establish this headroom, we will need to invest in other sources which are likely to have long lead times.

What is headroom?

This is an allowance we hold in our supply-demand balance to cater for uncertainties, for instance if we experienced a water quality issue at one of our water treatment works.

The impact on our time-limited and permanent licences

Through liaison with the Environment Agency, we have determined it is likely that the majority of our abstraction licences will move to recent average actual volumes. This will impact both time-limited and permanent abstraction licences.

What are the different types of abstraction licences?

A **time-limited licence** has a specified expiry date. Unsustainable abstraction can be addressed at the point of expiry or licence renewal.

A **permanent licence** does not have an expiry date. Unsustainable abstraction can be addressed through statutory processes.

We have 54 time-limited licences due for renewal in 2022. This is within our planning period for WRMP19, where we committed and planned mitigation for capping our abstraction licences to recent maximum peak volumes.

Modelling shows that moving to recent average actual volumes on these 54 licences in 2022 reduces the supplies from this group of licences by 30 Ml/d. This is in addition to the abstraction reductions we set out in WRMP19. So, if recent actual average volume licence caps were to be implemented to our time-limited licences prior to 2025, we would be left with a headroom deficit in our supply-demand balance. This would put us in breach of our duty under Section 37 of the Water Resources Act 1991, which is the duty to maintain a water supply to our customers.

Why are we so impacted by this policy change?

We have a high proportion of time-limited licences compared to other companies. Out of 202 abstraction licences, 124 are time-limited (61%). Of these time-limited licences, 76 will expire before WRMP24 is implemented.

This leaves us with no time to develop, design and construct any new supply-side options (for example, 7 years for a water reuse plant) that could mitigate the reduced abstraction volumes.

Moving to recent actual average volumes also impacts our other time-limited licences due to expire between 2024 and 2030. Our permanent licences will also be impacted when we apply, in line with our WRMP19 strategy, to reduce them to recent maximum peak volumes by 2025. Our modelling shows that this could result in the loss of an additional 63 Ml/d.

In total, it is possible we will have a total loss of 93 Ml/d from our abstraction licences by 2025, none of which was planned for at WRMP19. This takes us to an actual supply-demand deficit which will impact our ability to ensure resilient water supplies to customers by 2025 and to meet our statutory obligations.

Table 2 The amount of supplies that will be lost on implementation of recent actual average volumes

	Agreed WRMP19 and PR19 AMP7 Sustainability Reductions (capping at peak)	Implementing recent actual average volumes on time-limited licences	Implementing recent actual average volumes on time-limited and permanent licences
By 2022	52 Ml/d	An additional 30 Ml/d to WRMP19 sustainability reductions	An additional 30 Ml/d to WRMP19 sustainability reductions
By 2025/26	33 Ml/d	An additional 11 Ml/d to WRMP19 sustainability reductions	An additional 63 Ml/d to WRMP19 sustainability reductions
Total	85 Ml/d	An additional 41 Ml/d to WRMP19 sustainability reductions	An additional 93 Ml/d to WRMP19 sustainability reductions

Assessing the impact of recent actual average volume licence caps in WRMP24

Given these challenges, we continue to work with the Environment Agency on the best way to deliver these sustainability reductions. For WRMP24, we have modelled a series of scenarios to test if we can deliver recent actual average licence caps by different target dates (2022-2024, 2025, 2029 or 2035) whilst ensuring we can still provide our customers with a resilient water supply.

The scenarios shown in Table 3 were selected following consultation with the Environment Agency and internal stakeholders. These scenarios allow the range of variability in sustainability reductions to be explored, both in terms of residual deficit created and the supply-side options selected to mitigate the impact.

The implementation of the sustainability reductions is delayed as we move through scenarios 1 to 5, with scenario 6 being a variation of scenario 1. Scenario 7 is a variation of scenario 4.

Table 3 Licence capping scenarios and dates of implemention

Licence Cap Scenario	Capped at Peak	Capped at Average	
	Time Limited Licences	Time Limited Licences	All other Licences
1	-	2022-2024	2025
2	2022-2024	2025	2025
3	2022-2024	2025	2029
4	2022-2024	2029	2035
5	2022-2024	2035	2035
6	-	2022-2024	2029
7	2022-2024	2029	2032

Our WRMP19 commitment to capping to maximum peak licence caps remains planned for 2025.

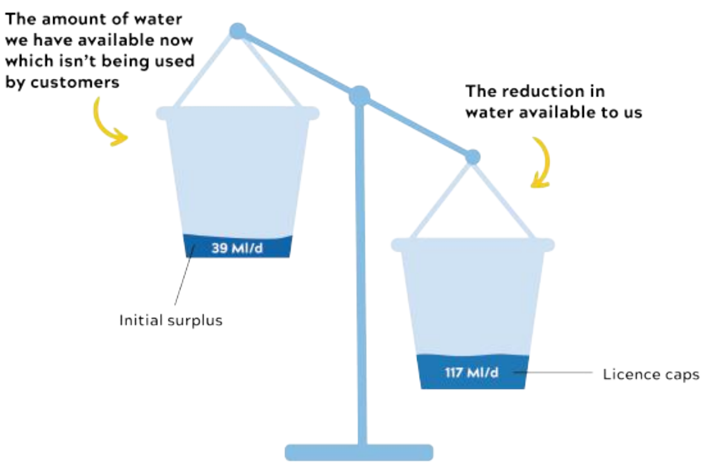
Overriding public interest cases

We are confident that our demand management measures will ensure that we can accommodate sustainable growth at a water resource zone and regional level, whilst ensuring no deterioration for our environment. We know this is achievable as our distribution input remains the same as it did in 1989, despite a 30% population increase in that time. We have accomplished this by investing significantly in demand management measures, most recently installing smart meters which are allowing us an understanding of our network like never before.

However, we do appreciate that the East of England has experienced the highest growth rates in the United Kingdom since the 2011 census, and we expect this to continue with an additional 890,000 people predicted to be living in our region by 2050. So, we have conducted modelling to determine how many water resource zones are expected to have an increase in demand by 2049/50, taking into account the water savings associated with our demand management options.

This modelling found that only two of our twenty seven water resource zones would experience an increase in demand, which could be managed by the implementation of new strategic interconnectors and new (non-groundwater) supply options in the longer-term, thus showing there is no risk of deterioration to water bodies. However, if needs were to change, it is possible that a small number of our abstraction licences would need to remain at max peak for a short time (rather than actual average volume) in order to safeguard water supplies to our customers. If this were to happen, a case would be made on the grounds of overriding public interest, as detailed in the Water Framework Directive Regulation 19. An overriding public interest case can be sought if there is a danger to public health, and no other alternative solutions can be implemented.

4.3.3 Total impact of sustainability reductions



4.4 Environmental destination

Since the development of WRMP19 there has been a step-change in the nation's environmental ambition. This is illustrated by the 25 Year Environment Plan and the Government commitment to be the first generation to leave the environment in a better state than we found it.

Highlighting the need for long-term sustainable abstraction, the Environment Agency produced its National Framework for Water Resources in 2020. This promotes a vision of regional planning groups exploring multi-sector approaches to water resource planning, focussing on ensuring resilient water supplies and improving the environment by setting an environmental destination.

Our regional planning group, WRE, operates in a region that contains many important environmental and biodiversity sites, including Sites of Specific Scientific Interests (SSSIs), Ramsar Sites and the only water-based National Park, The Broads.

The region's environmental destination seeks to define a long-term vision for these special environments, most notably focussing on reducing the impact of abstraction. By doing this, waterbodies can be restored, protected and enhanced. We have worked with other abstractors (public and non-public) in WRE to develop this strategy.

4.4.1 Developing a regional Environmental Destination

In October 2020[16], the Environment Agency shared guidance on Environmental Destination, highlighting the need for:

- Regional groups to be responsible for proposing the shared long-term environmental destination for water resources to 2050.
- Utilising the environmental destination scenarios from the National Framework as a starting point and reviewing them in order to explore different levels of environmental protection.
- Using these reviewed scenarios to identify catchments at risk of not meeting environmental objectives in the future due to abstraction pressure.
- Engaging with stakeholders, including water companies, other abstractors, regulators and environmental non-governmental organisations to identify abstraction pressures
- Testing proposed long-term environmental destination with regulators and agree abstraction changes to be included in plans

For this round of WRMPs and Regional Plans, a top-down approach has been undertaken to further refine the Environment Agency's scenarios, creating bespoke scenarios for the East of England. These scenarios were developed by:

- Establishing the licence baseline as a starting point, for instance whether the groundwater was capped to maximum peak or recent actual average, as well as other reductions such as AMP7 WINEP.
- Determining the required environmental flows in waterbodies to support a healthy ecology (based on the Environmental Flow Indicator).
- Investigating the impact of fully licenced abstraction on flows.
- Deriving the necessary licence changes to achieve sustainable abstraction in each scenario.
- Apportioning the reductions proportionately across the different sectors, with water companies and agricultural abstractions accounting for the majority of these.

Figure 38 One of the wetlands we have developed

16 Environment Agency, Long-term water resources environmental destination, October 2020

4.4.2 Applying Environmental Destination Scenarios for WRMP24

The bespoke environmental destination scenarios that were created within WRE are shown in Table 4 . These have been used to inform our WRMP24 supply forecast.

Table 4 Environmental destination scenarios for WRMP24

Business as usual (BAU)	Business as usual plus (BAU+)	Enhanced
Achieves flows to support 'Good Ecological Status' under the Water Framework Directive	Achieves flows to support 'Good Ecological Status' under the Water Framework Directive	Achieves flows to support 'Good Ecological Status' under the Water Framework Directive
Excludes uneconomic waterbodies (as assessed by the Environment Agency's Abstraction Plan by 2027)	Excludes uneconomic waterbodies (as assessed by the Environment Agency's Abstraction Plan by 2027)	Includes uneconomic waterbodies (as assessed by the Environment Agency's Abstraction Plan by 2027)
	Further protections for European Protected Sites (riverine and Groundwater Dependent Terrestrial Ecosystems)	Further protections for European Protected Sites (riverine and Groundwater Dependent Terrestrial Ecosystems)
		Further protection for chalk streams, sensitive headwaters and Sites of Specific Scientific Interest

As the BAU+ scenario meets the requirements of the guidance from the Environment Agency regarding the ‘most likely’ scenario, it has been included in our WRMP core pathway. The BAU and Enhanced scenarios are consistent with the requirements of Ofwat’s Common Reference Scenarios for environmental destination so have also been modelled.

The projected impacts of these on our abstraction licences are shown below in Table 5, along with projected returns to the environment in an average year [17].

17 These projected returns will be less than the licence changes in an average year due to the system deployable output assessment

Table 5 Licence impacts of Environmental Destination scenarios for Anglian Water

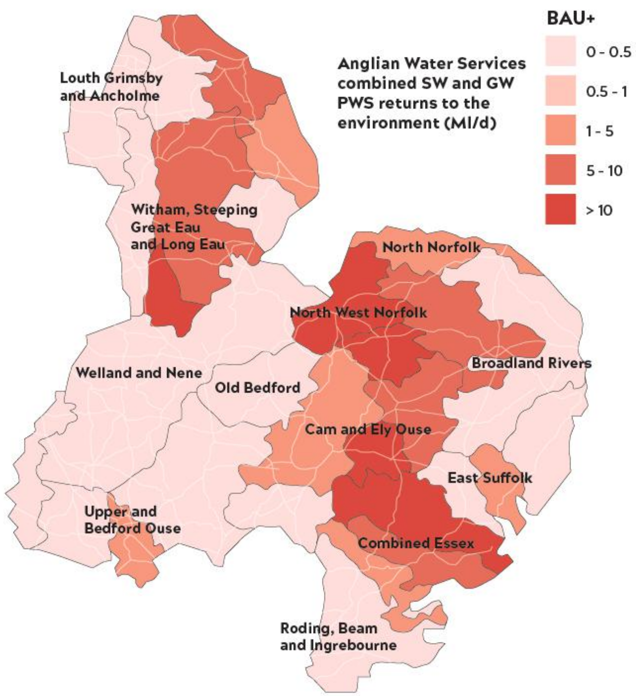
	Business as Usual	Business as Usual Plus	Enhanced
Licence reductions	168 Ml/d	214 Ml/d	384 Ml/d
Returns to environment in an average year (indicative based on future predicted abstraction)	90 Ml/d	157 Ml/d	287 Ml/d

Approximately 90% of these environmental destination abstraction reductions impact groundwater sources as they are considered to be the main cause of deterioration to flow in our region. Surface water abstractions already have existing licence constraints such as Hands-Off Flow and Minimum Residual Flow.

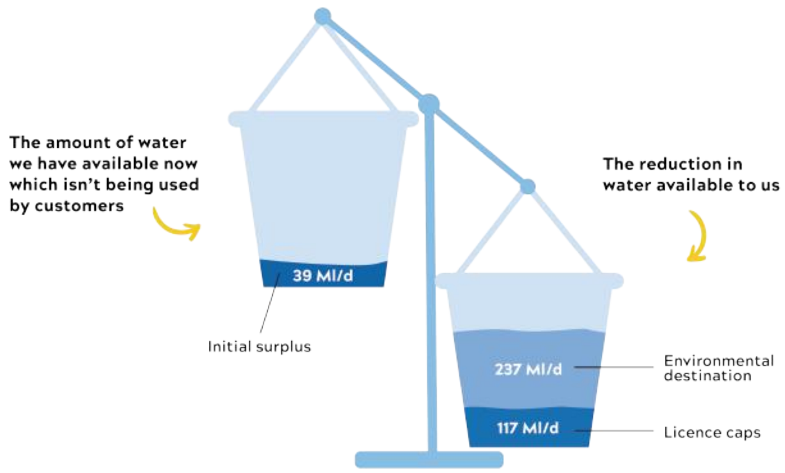
The key areas identified as part of WRE's revised environmental destination scenarios are shown in Figure 39. This shows that the main areas of environmental need is focussed on the eastern side of our supply in the Norfolk catchments, Cam and Ely Ouse, Essex and East Suffolk, as well as some sensitivity in Lincolnshire.

We will continue to work with other abstractors through WRE to explore and understand how an integrated approach to water management can both secure the provisions of water for all sectors, and meet the needs of the environment through the adequate protection of flows. This will be further informed by our AMP8 WINEP investigations.

Figure 39 Key hotspots by operational catchment for environmental destination (BAU+ scenario)



4.4.3 Total impact of environmental destination



4.4.4 AMP8 WINEP informing our Environmental Destination

Whilst WRE's initial Environmental Destination scenarios have enabled abstractors, regulators and stakeholders to understand the types of interventions required to achieve varying degrees of sustainable abstraction, there is still a lot of uncertainty. Solution deliverability and associated benefits remain unknown due to the relatively simple technique by which abstraction reductions have been modelled to date. As a result, further investigations in AMP8 are needed to ensure that we promote and focus on reducing abstractions in areas that need them most, rather than blanket sustainability reductions.

We are currently developing the AMP8 framework for these investigations which will inform the scale of sustainability reductions needed, as well as determining short, medium and long term priorities. The investigations will consider environmental features such as:

- Ground Water Dependent Terrestrial Ecosystems (e.g. wetlands) that are environmentally sensitive, possess important environmental features or have protected status.
- Chalk streams.
- Long reaches of rivers with special protections, such as the River Wensum and the River Nar.
- Special wetlands with protections under the Ramsar Convention.
- Many Sites of Special Specific Interests (SSSI), Special Areas of Conservation (SACs), Special Protected Areas (SPAs) such as marshes, meadows, fens, lakes and woods.
- Estuaries and coastal sites also with special protections.
- Stressed management catchments.
- Sensitive headwaters for rivers and streams that are groundwater fed and considered to be over abstracted.

The size and type of supply-side solutions required to deliver these abstraction reductions will also be considered. It is expected that the decisions relating to the costs and benefits of these solutions will be incorporated into WRMP29, with the AMP8 investigations featuring prominently in our LTDS and PR24 Business Plan.

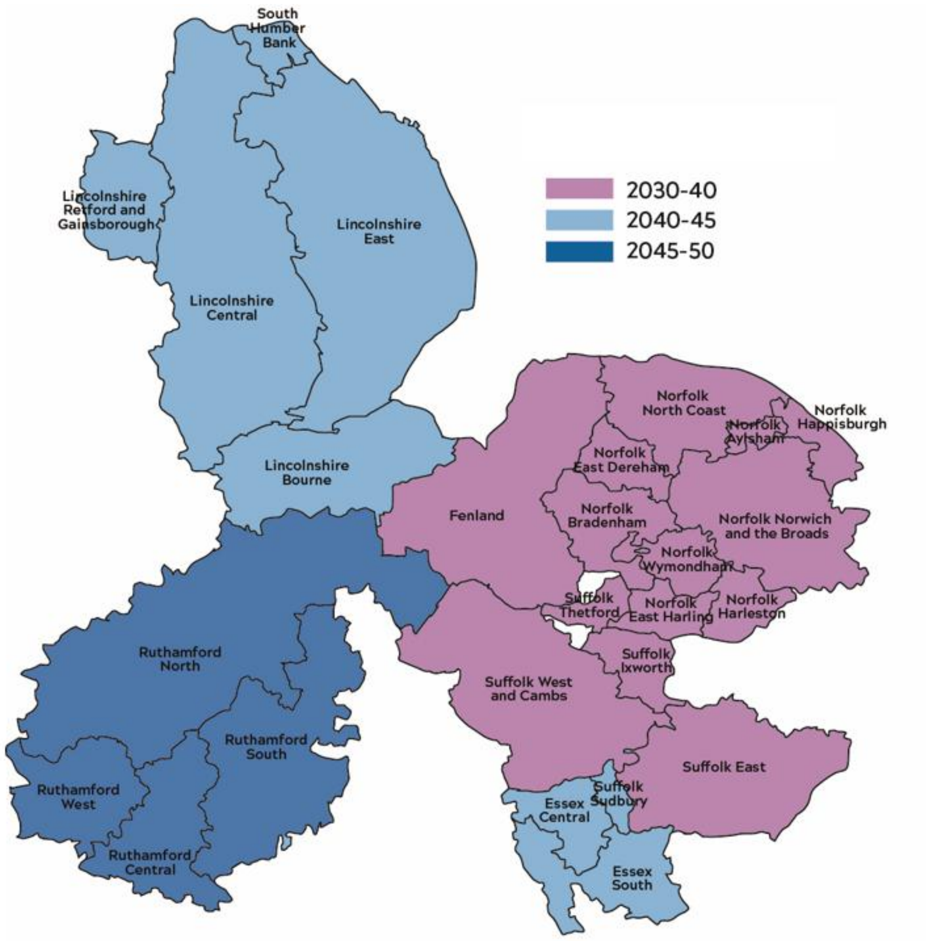
Further detail can be viewed in the WRMP24 Sustainable Abstraction and Decision Making technical supporting documents.

4.4.5 The timing of Environmental Destination

As well as our Environmental Destination strategy, we also need to set our Environmental Ambition. This is our ambition for when we should achieve our environmental destination. The National Framework states that it should be achieved by 2050 but does not say how fast it should be undertaken.

For our modelling, we prioritised key WRZs, shown in Figure 40, according to their proximity to certain environmental features and where reductions in abstraction could potentially improve the environment. These were used to create a bespoke scenario, referred to as our initial most likely scenario which was used as the starting point for our modelling.

Figure 40 Prioritisation of environmental destination for initial modelling



4.4.6 Impact of WINEP AMP7 investigations

For AMP7 (2020-2025), the Environment Agency identified several waterbodies which had a potential risk from abstraction pressures on flow. We have investigated these and developed the solutions in Table 6. These will be delivered in AMP8.

Table 6 Preferred options for WINEP AMP7 investigations

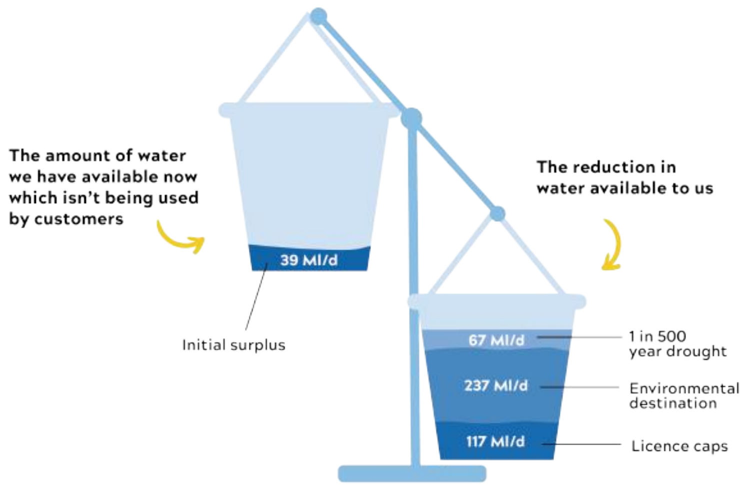
Investigation	Option type	Option description
River Stiffkey	River Support (using existing source)	Refine our groundwater source at Houghton St Giles to increase operation of river support. This will remain within licence limits.
River Gipping	River Restoration	An optimised combination of river restoration options on two reaches of the river. Reaches considered most effective in mitigating impacts from abstraction in this waterbody.
River Colne	River Support (using existing source) & River Restoration	River support from Great Yeldham (at current daily licenced quantity) and river restoration.
River Pant	River Support (using existing source)	Use existing river support from licenced headroom at Hawkspur Green source first and supplement with support from Ely Great Ouse to Essex Transfer Scheme.
River Brett	River Support (using existing source)	River support from a combination of three licences - Lavenham (EA), Semer (Anglian Water) and Shelley (Affinity Water).
Skerne Magnesium Limestone (Hartlepool Water region)	N/A	The groundwater modelling results indicate that most of the water bodies in the Skerne are compliant with WFD low flow screening thresholds. It was agreed with EA that a full options appraisal is not required for the Skerne catchment water bodies.

It is anticipated that these will not result in large WRMP24 supply forecast reductions.

4.5 1 in 500 years drought resilience

For WRMP19 we planned to be resilient to a 1 in 200 year level of drought by 2025. The National Framework and the WRPG for WRMP24 stipulates that a 1 in 500 year drought resilience must be achieved by 2039, with the phasing determined by us. Moving to this enhanced resilience reduces the amount of water we have available by 67 Ml/d.

4.5.1 Total impact of 1 in 500 year drought

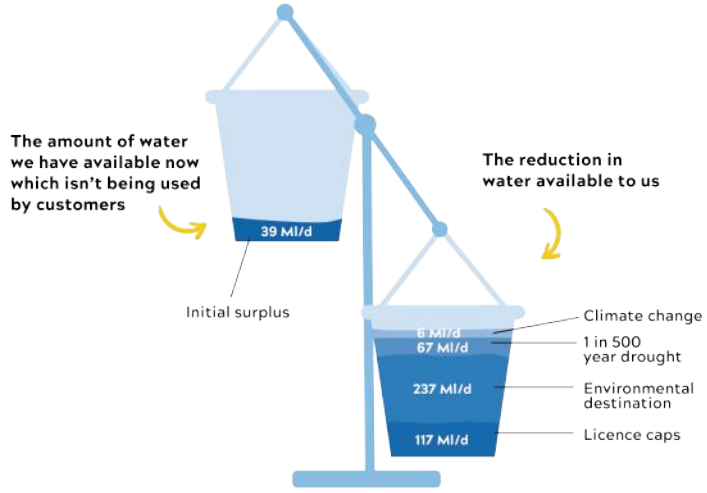


4.6 Climate change impacts

Our region is the driest and lowest lying in the UK, more vulnerable than most to the effects of climate change. This is giving us hotter, drier summers and warmer, wetter winters. It is also causing sea level rise. To ensure a robust assessment of this impact, we conducted the most robust level of climate change assessment (Tier 3 in the WRPG supporting guidance). As part of this, a new climate change assessment was carried out for our whole system and modelling undertaken to understand the impact.

From this we have determined that climate change will reduce the amount of water we have available by 6 Ml/d.

4.6.1 Total impact of climate change



5 The need for water

In this section we will:

- Discuss the methodology used for the demand forecast.
- Highlight how strategic growth could impact our region.
- Look at household trends.
- Provide a summary of the impacts of Covid-19 on demand.
- Show how growth will impact our supply demand balance.
- Give an overview of our baseline leakage figures.

Recently released data from the Office of National Statistics shows that over the past ten years, the East of England has experienced a population growth of 8.3%, the highest level in the United Kingdom. This is equivalent to an increase of approximately 488,000 additional residents.

In addition to this already significant growth, we are anticipating further demand in our region. This is led by more housing, an ageing population and a reduction in the average household size. More houses and more people means an increase in the demand for our water and water recycling services.

The National Framework and the National Infrastructure Commission have emphasised how important it is to understand the demand for water. We agree with this, which is why we have implemented our smart metering strategy to help us understand our network and customers' usage further.

To also increase our understanding of the demand for water, we have improved our water balance and demand forecast methodology for WRMP24. This has allowed us to integrate consumption forecasts for household and non-household properties, as well as our leakage and demand management options forecasts into a single unified system, as show in Figure 41. It has also helped us consider other impacts on water demand, such as:

- How water use behaviour will change in the future
- The changing design standards of water using devices
- Improvements in technology and practices for leakage detection and repair
- The impact of demand management options
- The effect of climate change and weather patterns
- Potential strategic growth, such as the Oxford Cambridge Arc
- The long-term impacts of Covid19

Figure 41 The elements of the demand forecast

Full details of how the demand forecast is developed and used are available in the WRMP24 Demand Forecast technical supporting document.

5.1 Peaking factors

We have produced our demand forecasts for dry year annual average and for the critical period. Dry year annual average demand is considered to represent a period of low rainfall and unrestricted demand, whilst the critical period forecast highlights short-term weather related variation. We have defined our peak period as any three days which relate to observed demand peaks.

We investigated the potential for using a seven day peaking factor on the basis that we may see longer periods of peak water consumption in the future. We have chosen to continue using a three day peak following discussions with our operational teams as it is more consistent with our peak supply forecast values.

5.2 HH methodology

The WRPG states that forecasted population and property figures should be based, when possible, on local authority plans. As local plans are at different stages of publication, we commissioned a specialised demographic analysis company to engage with local authorities to ascertain their plans and gain their knowledge of their area.

This information was collected and household build trajectories produced for all of the 65 Local Authorities in our region. Where plan-based data for property development has been used, plan based derivations of population have also been generated for each Local Authority, based upon the revised household projections and trend derived occupancy rates.

As local plans forecast to fifteen years in the future, Office of National Statistics data has then been used to inform the time frame beyond this. This level of growth is lower than forecast by Local Authority Plans. ONS data was also utilised to determine trend-based household occupancy rates.

5.3 NHH methodology

Non-household consumption accounts for approximately 26% of our overall demand. Non-household population projections have been determined for all Local Authorities in our region using WRZ apportioned Census data. This includes estimates for residents in non-household properties such as hospitals, nursing homes and hotels. For WRMP24, we have estimated that it will show a similar growth trend to that shown for household population.

5.4 Strategic growth scenario development

Strategic growth areas are also anticipated in our region, most notably the OxCam Arc. To capture and plan for this, strategic growth variants have been generated in alignment with government expectations. These have also been aligned with participating WRE and WRSE companies.

A low variant of this strategic growth has been used in our plan, reflecting our current understanding of Local Authority Planning development. We will continue to monitor this and remain adaptive in our future planning to allow for any changes.

5.5 Household trends

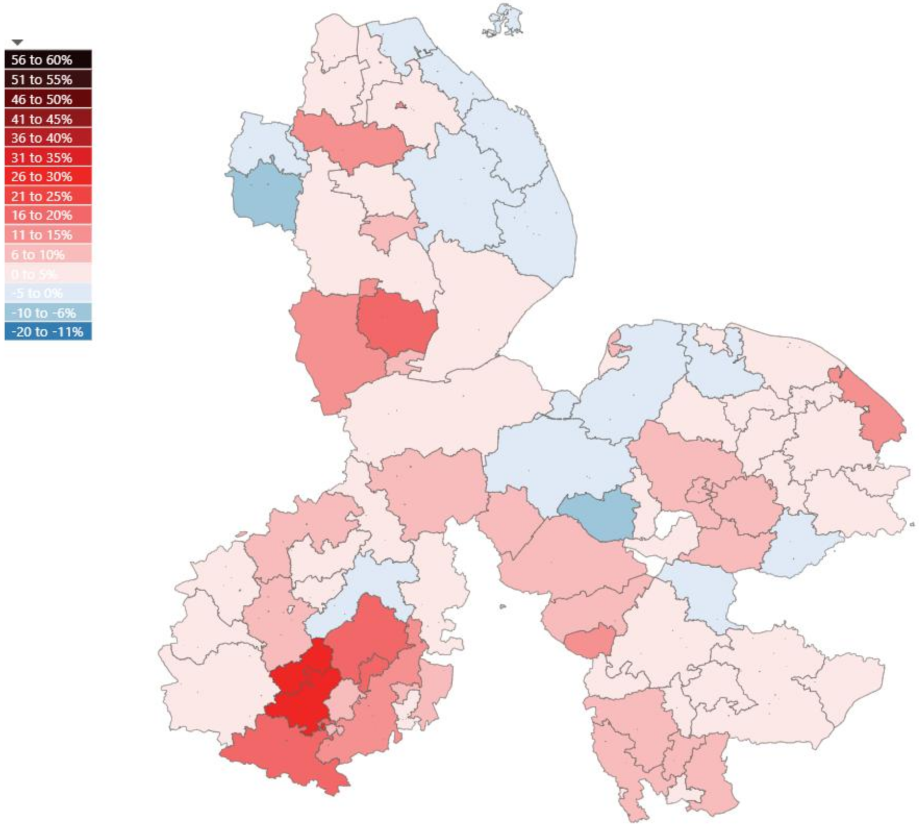
Using local authority plans to 2040 and the Office of National Statistics data for the remainder, we are forecasting that our region's population will grow from 4.974 million in 2024/25 to 5.865 million in 2049/50, an increase of 891,000 people. The highest level of growth between 2025 and 2050 is seen in our Ruthamford region, specifically:

- Newport Pagnell (53%)
- Milton Keynes (49%)
- Bedford (41%)
- Clapham (40%), and
- Corby (25%).

The lowest growth areas are seen in Hartlepool and Lincolnshire with a 3.9% growth in population expected in Hartlepool and 6.3% in Scunthorpe North.

These levels of growth will have a direct impact on the amount of water required, with it being anticipated that the amount of water into our network needs to increase from 1154 Ml/d in 2025 to 1217 Ml/d by 2050. This is highlighted in Figure 42 which shows the percentage change in demand for the baseline forecast for 2050, without demand management.

Figure 42 Percentage change in demand between 2025 and 2050



The increasing demand into our network also reflects reducing occupancy rates. The overall household occupancy rates for our water resource zones lie within the range of 1.7 to 2.5. It is forecast that occupancy rates will decrease over the planning period with the lowest rates being seen in Norfolk Happisburgh, Fenland and the North Norfolk Coast. The highest rates are expected in Suffolk Thetford, Essex South and Ruthamford West.

5.6 The impacts of the Covid-19 pandemic

The overnight closure of business premises in March 2020 and immediate switch to homeworking, had a significant impact on water demand, with increases in consumption in the years 2020/21 and to some extent 2021/22. This was more evident in the areas of our region that are home to London commuters.

This increase in household water demand could be attributable to:

- The transferring of work from the workplace to home.
- Potential changes in behaviour, such as increased hand washing.
- The hot weather spell in the spring of 2020.
- Consumers 'stay-cationing' throughout 2020.

We also witnessed changes in how and when customers used water throughout the day.

As the pandemic has subsided, consumption remains approximately 2.5% higher than previous levels. This potentially reflects new practices, such as hybrid working. We have included uplift factors in our WRMP24 to account for this.

We have seen non-household consumption levels return to pre-pandemic levels.

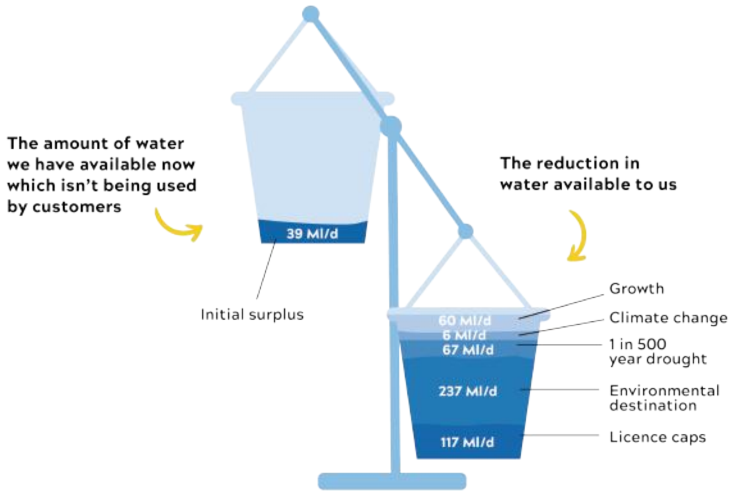
5.7 Baseline leakage

To create our demand forecast, we assessed leakage using the methodology set by Ofwat in the reporting guidelines published during the PR19 process. This means that our calculated leakage level has increased compared to what was reported in WRMP19.

We continue to reduce this leakage rate by recruiting additional resources to detect leaks, as well as installing 8,369 remote hydrophones. We have also rolled out a significant smart meter installation programme which has enabled us to refine night-flow records in our forecasting processes.

Consequently, we are projecting that our WRMP24 baseline leakage will be 162.3 Ml/d for 2024/25 and that this will reduce to 145.7 Ml/d by 2050. This represents a 23.8% leakage reduction from the National Framework base year of 2017/18, which was 191.0 Ml/d.

5.8 Impact of growth



6 Demand management option appraisal

In this section we will:

- Show how we developed our demand management options.
- Discuss our strategic portfolios, and why we develop these.
- Give an overview of our demand management options:
    - Smart meters
    - Leakage options
    - Water efficiency measures
    - Compulsory metering
    - Tariffs

We have a strong track record of delivering demand management. It has enabled us to keep our demand relatively constant since privatisation in 1989 until the present day. We have achieved this by setting ambitious and demanding targets for reducing leakage in our network. This, combined with our other sector leading demand management options such as water efficiency, provides a robust, integrated and deliverable demand management strategy.

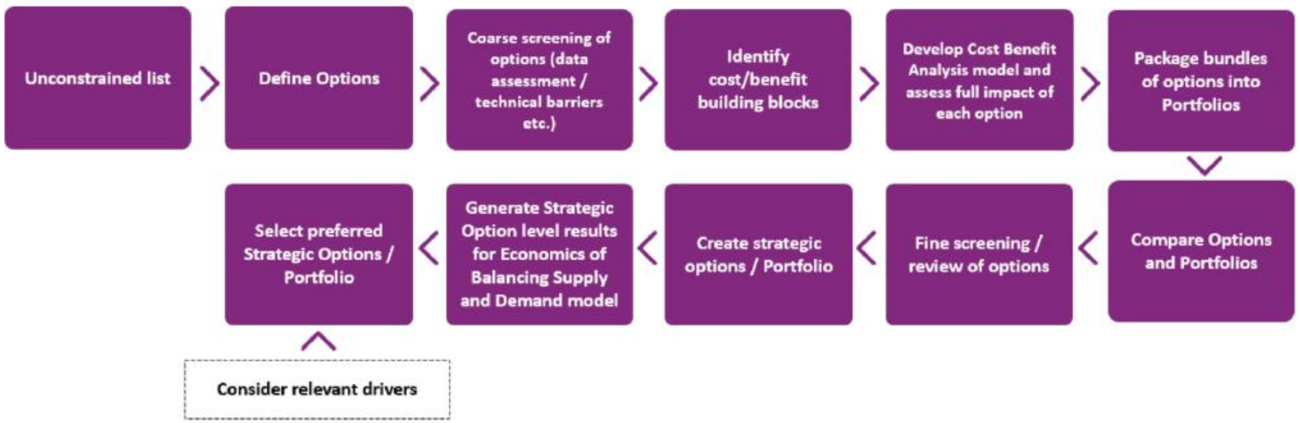
We plan to continue this for WRMP24 and we are having to become more innovative to achieve further water savings. This means we have focussed on unlocking the potential from our smart metering programme, as well as looking at initiatives that are relatively untested in the water industry in the United Kingdom.

This section will set out how we have appraised these demand management options and how, due to the interconnected nature of demand management, we have built portfolios which comprise different combinations of demand management options.

6.1 Option development

A detailed development process has been undertaken for our demand management options. This is shown in Figure 43.

Figure 43 Demand management option appraisal process



Initially a diverse range of demand management options were explored. This unconstrained list drew upon:

- Our current business practices and how we could improve them.
- Current practices and plans of other UK water companies.
- Practices in other sectors that encourage demand management and behaviour change.
- How other countries manage water scarcity.
- Opportunities provided by technology and innovation.

These unconstrained options were defined and assessed by our subject matter experts to determine if they were feasible options or not, and if they would provide any water saving benefit.

Each feasible option was then developed further. For smart metering options, roll-out trajectories were defined, any customer interaction and supporting technologies detailed and all associated installation, maintenance and back office costs noted. These were developed by our subject matter experts to become quantitative 'building blocks' which were included into a multi-criteria assessment. Examples of a quantified building block include:

- The projected reduction in costs for customers as consumption is lower.
- The amount of money saved by reducing treatment and pumping costs.
- The money saved by deferring capital investment for expensive supply-side solutions.
- The reduction in CO2 emissions due to pumping less water around our network.

As well as quantitative benefits, qualitative benefits were captured. Examples include:

- Leaving more water in the environment as less water is pumped around our network.
- Improving resilience in our systems.
- Offsetting or mitigating the impacts of climate change.

We built these building blocks using our own data, expertise and experience, as well as published and unpublished information available to us through industry research groups and academic research. They will continue to be refined and reviewed as our demand management strategy and learning progresses.

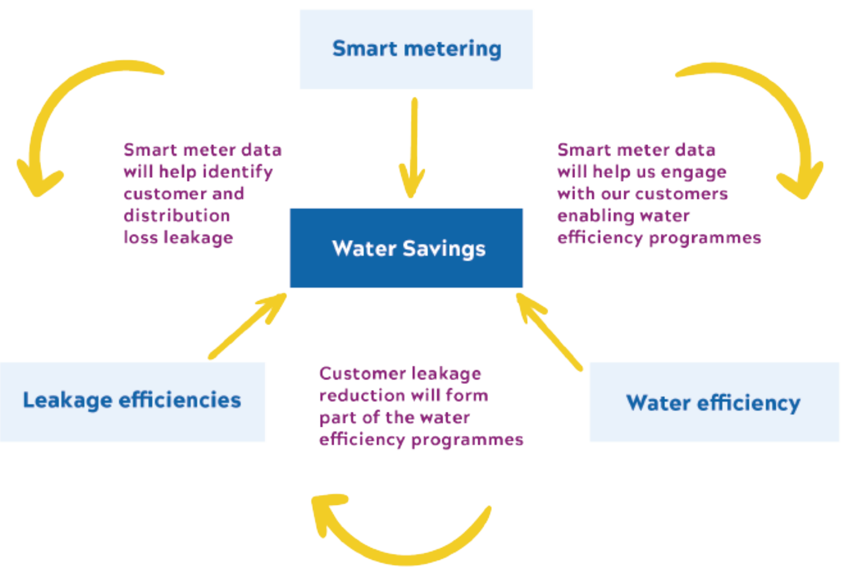
Cost categories were also captured for each option. A full list of benefits, cost categories and societal valuation information can be referred to in the WRMP24 Demand Management Option Appraisal technical supporting document, as well as detailed societal valuation information.

6.2 Strategic portfolios

These feasible options were then allocated into strategic portfolios. We adopt this approach as we believe it is important to consider demand management options holistically, as there are significant synergies between leakage reduction, smart metering and water efficiency activities.

Consequently, each strategic portfolio consisted of a smart meter rollout, additional leakage reduction and water efficiency sub-options, as shown in Figure 44. These three initiatives, our strategic pillars of demand management, have all been built from the bottom-up, at a water resource zone geographic level.

Figure 44 The three pillars of our demand management portfolios



The portfolios were then scrutinised and our aspirations for WRMP24 developed. Portfolios were then further refined to establish the ones to be taken forward to cost benefit analysis and multi-criteria decision making. Following this process, the preferred demand strategy was taken through internal governance groups, discussed with the Environment Agency and then approved by our Main Board.

6.3 Our demand management options

We explored a wide array of demand management options, so we could ensure we remained at the forefront of demand management. An overview of the options we looked at is given here, with further detail available in the WRMP24 Demand Management Option Appraisal technical supporting document.

6.3.1 Smart metering

We are well on our way to installing 1.1 million smart meters by 2025. Continuing this strategy could help realise benefits such as:

What is a smart meter?

A smart meter is another name for an Advanced Meter Infrastructure meter and its transmission network.

These meters transmit data via a radio mast network, allowing hourly readings from the customer meter.

Currently the previous day's data is available for customers to view, via our MyAccount website.

- A 2% long-term consumption reduction, due to behavioural change, compared to a visual metered/measured property. This is reduced from the 3% projected for WRMP19 as we have attributed more savings to customer supply pipe leakage repair, rather than simply smart meter installation.
- Improved engagement with the customer as they receive more accurate information in a timely manner, allowing them to understand their water usage better.
- The customer being made aware of leakage on their supply pipes, as well as plumbing losses within their property. This is undertaken by using continuous flow data (where use is usually minimal or zero) to identify any unusual usage or spikes.
- More efficient meter reading, reducing the amount of vans we have on the road, as well as our carbon emissions.
- Enabling us to optimise our network operations as we gain further understanding of consumption patterns.

6.3.2 Leakage options

What is leakage?

Leakage is how we describe the water that escapes from our pipes and our customers' pipes. Whilst we can experience significant bursts due to changing weather conditions (such as extreme hot or cold weather when the ground moves), the majority of the leakage we experience is difficult to find due to small volumes. Examples can include seepage of water out of pipework joints.

We are determined to improve on our excellent record of leakage reduction. We know it is a key priority for our customers, and it is for us too. It also has the benefit of leaving more water in the environment, ensuring that habitats can flourish and be enjoyed by local communities.

We support the NIC target of achieving a 50% reduction in leakage for the whole of England and Wales by 2050. We have also actively been involved in making a Public Interest Commitment with our fellow English water companies to triple the rate of sector-wide leakage reduction by 2030.

As we are already industry leading for leakage reduction, the cost of reducing it becomes more significant as leaks become smaller and smaller. This means we have need to turn to state of the art technology to reduce our leakage further.

6.3.3 Water efficiency measures

There is a clear desire from our customers to save water. To help this we could offer targeted advice or install water saving devices into customers' homes.

We identified a number of options for water efficiency as part of our demand management option appraisal process. These include:

- the provision of smart water devices/shower sensors
- development of gamification and rewards schemes
- linking smart devices to hubs, developments and communities
- enhancing schemes to assist vulnerable customers with internal leaks

What is water efficiency?

Being water efficient means taking simple steps to reduce water usage. This may involve utilising water saving technologies.

Reducing water usage in the home saves both energy and money. It also retains more water in the environment, protecting important aquatic flora and fauna.

Increased water efficiency has the benefits of reducing water and energy costs for customers. And, we believe that continued, effective communications is the key to maintaining that behaviour.

6.3.4 Compulsory metering

As we are in an area of serious water stress, we have an obligation to consider the costs and benefits of compulsory metering. The results from our customer engagement shows that customers are generally supportive of the principle of paying according to the amount of water used.

Ninety two percent of our customers already have a meter fitted. Of those, eighty three percent (in 2021/22) pay measured charges which means they pay according to what they use.

Our current modelling projections indicate that we will still have a number of metered/unmeasured customers at the end of the WRMP24 planning period, if there is no further intervention such as compulsory metering.

We are also mindful that analysis shows that unmeasured customers tend to use more water than our measured customer base. Currently (using 2021/22 figures) measured customers have a PCC of 128 litres per head per day and unmeasured customers have a PCC of 174 litres per head per day.

6.3.5 Tariffs

As part of WRMP24 demand management options appraisal, we have reviewed the potential for applying tariffs and price signals. The majority of household customers pay their water bill based on a simple two part tariff structure, with a fixed charge and a uniform unit charge for volumetric usage.

In order to assess the feasibility of more complex tariff options, we commissioned the University of East Anglia Centre for Competition Policy to review the international experience of price and non-price approaches to manage water demand. This research suggested that, before tariffs with differentiated price signals can be implemented successfully, certain pre-conditions must be met. These include, but are not limited to:

- Customers need to be able to understand their consumption and engage positively in managing their demand, otherwise introducing tariff changes may have, unintended, adverse consequences both to customer bills and to demand.
- Access to near real-time information is key to informing the customer of the relationship between usage and cost, and thus, the impact on bills of particular behaviours.

Additional consideration also needs to be given to the following:

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

7 Supply-side option appraisal

In this section we will:

- Detail the supply-side option development process.
- Discuss our strategic regional options.
- Provide an overview of the supply-side options available to us:
  - Water reuse
  - Desalination
  - Water transfers
  - Aquifer storage recharge
  - Sea tankering
  - Supernatant return
  - Conjunctive use
  - Reservoir

7.1 Supply-side option development process

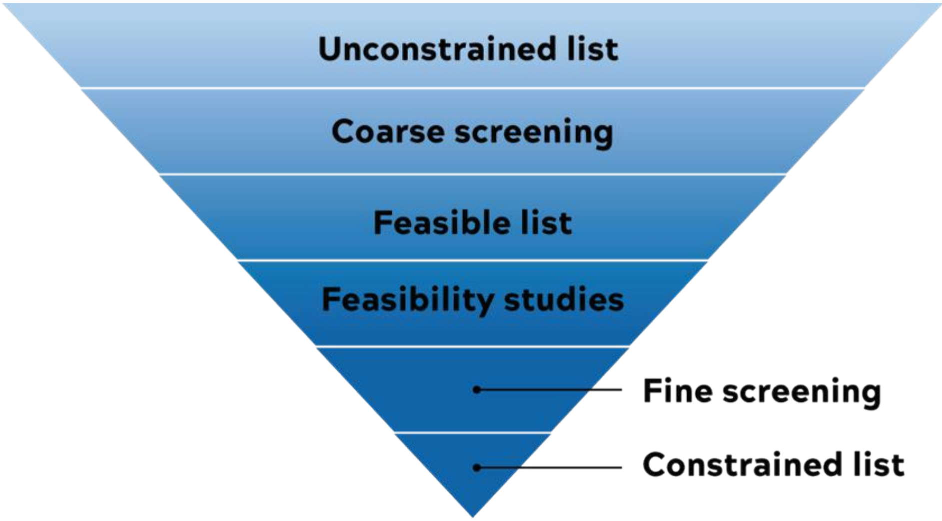
We completed a rigorous appraisal of available supply-side options. As the amount of water we take from the environment is reducing, we have explored sustainable ways of supplying water, mindful of environmental impacts. The process we use for this is shown below in Figure 45.

7.1.1 Coarse screening

For our unconstrained list, we compiled a list of all possible options that could reasonably be used in our plan. These may not be completely free from environmental or planning issues but are considered technically feasible.

The unconstrained options were then pre-screened against a list of criteria such as checking the validity of a previous rejection reason. Options that passed this then had an initial environmental assessment. Any options that did not meet the coarse screening criteria were rejected.

Figure 45 Supply-side options appraisal process



7.1.2 Feasible screening

Options that progressed past coarse screening were subject to a suite of feasibility studies. The option set was also further refined (and some options rejected) following on from the various environmental assessments and stakeholder input.

Further detail can be found in the WRMP24 Supply-side Options Development technical supporting document.

7.2 Strategic Resource Options

We have progressed two schemes, the Fens and South Lincolnshire reservoirs, through the RAPID gated process. These are raw water storage reservoirs which take surplus water when it is available from the environment, likely to be in winter, and store it until needed by customers. These schemes featured prominently in our WRMP19, recognising the need to plan long-term for our region's future water needs.

When we looked at where reservoirs would be best sited within the region, we identified rivers with surplus water in Lincolnshire and the Fens.

The River Great Ouse and River Delph will supply the Fens reservoirs at abstraction rates of 300 Ml/d and 400 Ml/d when flows allow. This will provide a yield from Fens Reservoir of 87 Ml/d, half of which will supply our area and the other half to Cambridge Water.

The South Lincolnshire Reservoir will be abstracted from the River Witham at an abstraction rate of 400Ml/d when flows allow, supported via a 300Ml/d transfer from the River Trent. This will provide a yield of 166 Ml/d to our customers.

The output from these two reservoirs combined will provide 43% of the water we need to ensure we maintain a supply-demand balance. They are essential if we are to meet projected growth and achieve resilience to drought and climate change for years to come. The water, taken sustainably from rivers, will also allow us to reduce our abstraction from sensitive areas of the environment, protecting it for future generations.

Both reservoirs are deemed to be Nationally Significant Infrastructure Projects (NSIP) and will require a Development Consent Order (DCO). We are currently developing construction timelines for these projects, but it is expected that DCOs will be applied for in 2025.

As well as securing sustainable water supplies for our region, both reservoirs have the potential to generate environmental, social and economic benefits both locally and regionally. Details are still being developed, but the most significant benefits identified at this stage for further analysis are:

- Facilitating the reduction of abstractions in environmentally sensitive areas, such as chalk streams in Cambridgeshire. This gives an opportunity to restore their ecological health.
- Fens reservoir has the potential to reduce flooding in the Middle Level Catchment.
- Increased irrigation through conjunctive use and farm storage reservoirs.
- Carbon sequestration through woodland creation and peatland restoration around both reservoirs.
- Social benefits through the provision of amenities and recreational opportunities through country parks, footpaths and walkways around the reservoirs.

Further detail can be referred to in WRE's Regional Plan[18] and the RAPID Gate 2 submissions for Fens and South Lincolnshire reservoirs [19].

7.3 Water reuse

Utilising the resource we already have is important to us. So, we instigated a study to determine which of our 1000+ Water Recycling Centres (WRC) could be suitable for water reuse options. The criteria we used to determine the suitability of a WRC's effluent were:

- It should be able to provide a meaningful output. Due to advanced water reuse treatment, the process losses can be significant. All WRCs with a licenced Dry Weather Flow of under 10 Ml/d were rejected on this basis.
- The flow from WRCs can support river flow so we needed to ensure any development of a scheme would not deprive sensitive rivers of flow. Any sites identified as supporting these river flows were removed.

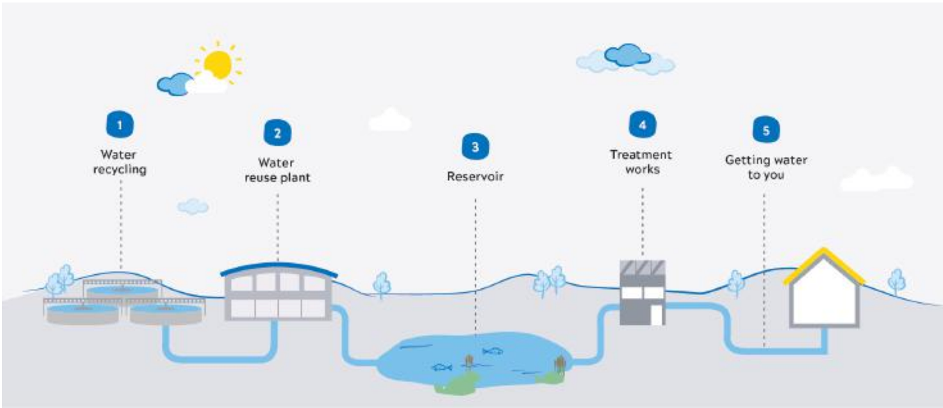
When assessed against these criteria the number of viable WRCs reduced significantly. These are shown in Figure 46.

18 https://wre.org.uk/projects/the-regional-plan/
19 https://www.ofwat.gov.uk/regulated-companies/rapid/.

Figure 46 Constrained water reuse options

We explored a number of reuse options with different process configurations and treated water discharge locations to the environment. These discharge locations included both reservoirs and rivers. An example of a discharge to reservoir is shown in Figure 47.

Figure 47 Water reuse via reservoir



Following discussions with the Drinking Water Inspectorate, the Environment Agency and Natural England, we removed options that transferred cleaned water via a river from our modelling and focussed on using reservoirs as the receptors for the cleaned water. The latter is less impactful for carbon as it does not require as much pumping capacity.

7.4 Desalination

We evaluated our coastline and estuaries for feasible desalination locations. From this evaluation, three alternative types of desalination were identified:

- Coastal - an onshore desalination plant with intake and outfall to sea.
- Estuarial (brackish) - a desalination plant located at an estuary with intake and outfall to the estuary system.
- Floating - a desalination plant located on a barge, moored off shore then piped inland.

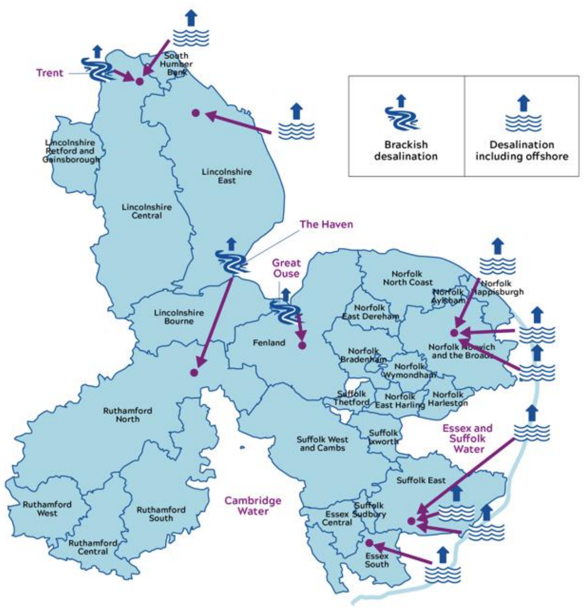
Some of these desalination options contained a conjunctive use element which means there is a possibility of working with another party to share water.

Our unconstrained options were subject to further screening, such as water depth and environmental designations. Following on from further assessment and discussions with regulators, it was identified that seawater desalination was preferable to estuarial, due to the potential impacts of discharging waste products into a estuarial environment.

Floating water desalination was also rejected as we concluded that there were some residual risks associated with these options that would be complex to resolve and, whilst this didn't make the options technically unfeasible, they demonstrated no benefit over the onshore equivalent options.

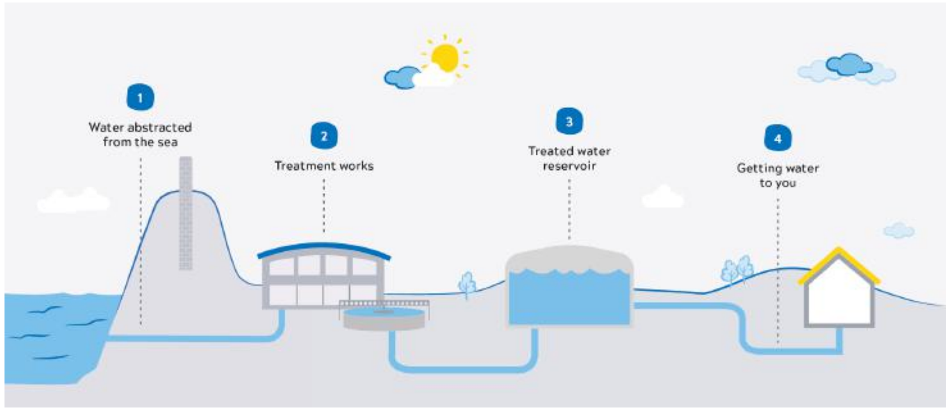
The desalination options taken forward for modelling are shown in Figure 48.

Figure 48 Constrained desalination options



An example of a desalination process is shown below in Figure 49.

Figure 49 Seawater desalination process



7.5 Relative impacts of the high yielding supply-side options

Reservoirs represent the lowest capital carbon and ongoing power consumption of our main new resource option types. This is largely down to the relatively low pumping costs associated with abstraction and treatment.

Reservoirs also represent efficient use of resource. The conventional abstraction and treatment associated with surface water reservoirs result in very low waste, meaning almost all of the water abstracted can be put into supply. The waste stream associated with these conventional treatment techniques are generally inert and have low environmental impact.

Our desalination and water reuse options rely on ultra-filtration membrane and reverse osmosis technologies. A lot of the operational cost of these options is associated with pumping, as very high pressures have to be generated to push water through the membranes. These processes also have a high rejection rate due to the amount of contaminants in the source water, which leads to the production of a lot of waste. For instance, less than half of the water abstracted from the sea for desalination will be available as potable water to put into our supply network. The waste streams associated with these options are complex to deal with too.

Membrane cleaning chemicals and concentrated brine have to be discharged to the environment. This will have to be carefully managed and more work is needed to understand how to deal with these issues minimize the ecological impact of the discharges.

7.6 Transfers

An unconstrained list of transfer options was developed from the WRMP19 list and consideration to the strategic pipeline currently being constructed.

Figure 50 WRMP24 transfer options

Additional routes were also identified through internal workshops with operational teams, alignment with the WRE options set and any needs highlighted by the modelling process.

The transfers were then developed using a route optimisation tool developed by our consultants. This aims to minimise the capital expenditure and total expenditure of a transfer route, as well as avoiding key land use and environmental constraints. It does this by evaluating topographical data along a route and carries out hydraulic calculations, adjusting route outputs to minimise pumping costs.

An overview of the pipeline routes developed can be seen in Figure 50.

7.7 Other feasible options

We also looked at other options. These are mainly options with less water available. However, they could be useful to resolve local deficits.

7.7.1 Aquifer storage and recovery

Aquifer storage and recovery (ASR) is a technique used to replenish and store groundwater in aquifers for subsequent abstraction and supply.We don't currently operate any ASR schemes, and there are only limited operational examples in the UK.

7.7.2 Sea tankering

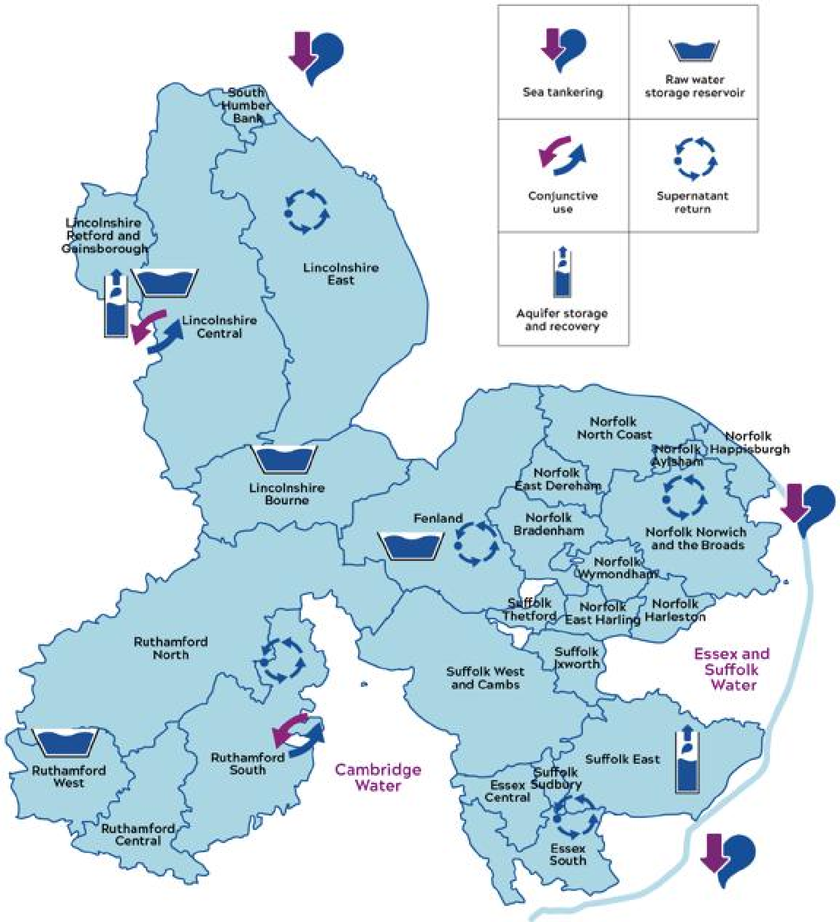
The process of sea tankering involves importing potable water from outside of the UK into UK ports by sea tanker. The option could be used to guarantee water resilience at times of high demand in water networks or during drought events. The water is delivered from the tanker to a service reservoir then on to an existing WTW.

The sea tankering options were developed based on a supplier proposal which has since been withdrawn.

7.7.3 Supernatant return

Supernatant return involves cleaning filter backwash water and returning it to the head of a water treatment works to be treated again, rather than discharged to the environment or sewer. The amounts associated with such returns are generally small and can have impacts on water treatment processes.

Figure 51 Other feasible WRMP24 options



7.7.4 Conjunctive use

Conjunctive use is when we share resource between us and other companies. There are a number of instances where a power company possesses a consumptive abstraction licence that is not being fully utilised. We could purchase the unused volume of these licences, abstract and treat it, to support our own supply needs.

We are, however, treating these options with caution. Rising wholesale energy unit prices and the move to new power sources mean that energy production is likely to increase. This could result in decreased unutilised water being available at the locations we have identified. At present these options remain technically feasible, but more work is needed to understand the long term risks associated with trading licences with the energy sector.

Where a desalination plant is located near to a power plant there is the option for power sharing, whereby we have the potential to buy power. Additionally, there may be the potential for brine waste from the desalination plant to be discharged into an existing power plant outfall, which could be a significant capital expenditure saving. We will continue to refine desalination options over the coming years.

7.7.5 Reservoirs

A small number of additional reservoirs were carried through to the feasible list. These are limited due to the limited amounts of surface water available for abstraction and are not classes as strategic resource options.

7.8 The timing of our supply-side options

As we have limited options for developing conventional treatment options, many of our feasible supply-side options have long delivery times. This is due to a number of factors, such as planning approval and design of technologies not historically used in the United Kingdom, for instance seawater desalination is typically used in the Middle East and Australia, not the North Sea.

A summary of the timescales we are planning to and the reasoning behind them is provided below in Table 7. These implementation timeframes are used in our modelling process to determine realistic, deliverable plans.

Table 7 Feasible option implementation periods

Option Type	Time to investigate, plan, design and implement option (years)	Earliest start date	Notes
Desalination	7-10	2032-2035	It has been assumed that design and construction of the treatment process could be completed within 4 years but several years of planning, testing and stakeholder engagement would be required.
Potable water transfer	3-5	2028-2030	Due to the planning, enabling works, environmental issues, large number of land owners and procurement these transfers have been assumed to be deliverable within 3-5 years depending on the complexity and length of the pipeline.
New reservoir	15+	2035-2040	As the reservoirs options are >30Mm^3 they are considered as Nationally significant infrastructure projects[20] (NSIPs) and would be subject to the Development Consent Order (DCO) process that accelerates the planning process.
New reservoir (with raw water transfer)	15+	2035-2040	See above.
Water reuse for potable water use	7-10	2032-2035	Delivery would be 4-5 years but would require up to 5 years for stakeholder engagement prior to delivery.
Water reuse for non-potable use	7-10	2032-2035	Significant stakeholder and customer engagement required prior to delivery to understand complex and diverse needs of industry.

20 Planning Act 2008

Option Type	Time to investigate, plan, design and implement option (years)	Earliest start date	Notes
Conjunctive use with treatment	5	2030	Planning and licence trade negotiations would take 2-3 years followed by 2 years construction and commissioning.
Aquifer Recharge	10	2035	Complex planning and permitting issues and includes time to recharge the Aquifer.

7.9 Costing our feasible supply-side options

Our feasible options were costed in C55, our investment optimisation model. This has ensured a consistent approach to costing and data collection, allowing a fair comparison between options.

For WRMP24, the gate one data for Fens and South Lincolnshire reservoirs was used which provides a consistent basis for comparison with other options. We are expecting refined estimations for gate two as the schemes develop; these will be fed into our modelling for our final WRMP24.

8 Our demand management strategy

In this section we will:

- Provide an overview of our strategy.
- Discuss our decision making process.
- Show the results of our cost benefit analysis.
- Deep dive into our smart metering strategy, specifically:
    - Customer engagement
    - Reducing plumbing losses and customer supply pipe leakage
- Detail our consideration of compulsory metering.
- Discuss how we can reduce water usage by promoting household water efficiency through smart homes, encouraging behaviour change and our innovation fund.
- Highlight how we will continue to reduce leakage by focussing on the shared supply customer supply pipe leakage and fixed acoustic logging.
- Show how we are engaging with the non-household sector to promote water efficiency.

Our customers have told us we should utilise the resource we have before building new supply-side solutions. We have achieved this for decades with our demand management strategies, adapting as needed to an ever changing political and social environment.

These proactive strategies have kept the amount of water we put into our network at the same levels, despite the amount of properties in our region increasing. We have achieved this by having one of the highest levels of meter penetration in the United Kingdom, with the majority of our customers paying on the basis of what they use.

We have also focussed on leakage throughout our business planning periods. This means our leakage rates per kilometre of water main are half the industry average. Reducing the amount of water escaping from our network has also delivered wider environmental benefits, helping to keep more water in the environment.

8.1 An ambitious strategy

This continued commitment to demand management means there is limited potential to achieve further water savings through tried and tested demand management activities. This WRMP24 sets out our ambition to drive the next step change in demand management through technological innovation, enhanced communications and the implementation of industry leading initiatives.

Our WRMP24 will achieve this by developing the three pillars: **smart metering**, **water efficiency** and **leakage reduction**.

We will finish our pivotal smart meter programme. This will allow us to engage with our customers like never before about water efficiency.

Smart metering will also unlock better communication with our customers about water efficiency, as well as incentivization. It is also expected that government led interventions such as white good and water utility labelling will reduce the amount of water our customers use.

We will achieve a leakage level that exceeds the NIC target at a national level, but not at a company level. This is because we can provide better value for our customers by investing in other demand management measures and supply-side strategies. To put it simply, we have already spent millions reducing the leakage in our network to industry leading levels. To reduce our leakage to the 50% target would mean investing £22 billion to deliver 70Ml/d of additional water saving. Instead, we can invest elsewhere to achieve more benefit, which will be fairer on our customers' pockets.

These three pillars, combined with new technology, innovation and enhanced behavioural understanding will unlock estimated demand savings of up to 43Ml/d by 2030, and 64.5Ml/d by the end of the planning period (2050). The savings achieved by 2050 will offset the projected water demand of our expanding population, meaning we only need supply-side investment for challenges such as drought resilience and licence capping.

A PCC of 110 litres per head per day by 2050 will also be achieved, in line with the National Framework target. This PCC forecast includes the projected 11 litres per head per day saving from government intervention, i.e. the labelling of goods to show water efficiency.

The cost of this demand management strategy is £240 million total expenditure for 2025 to 2030. We have undertaken an assessment of costs and benefits which shows that our strategy is cost beneficial to our customers.

8.2 Decision making

As part of our demand management options process we produced a number of demand management strategic portfolios, each with complementary elements of leakage, smart metering and water efficiency interventions. Please refer to section six and the WRMP24 Demand Management Option Appraisal supporting technical document for further information.

From this large number of options we chose a number of core scenarios in order to evaluate and select our preferred demand management option portfolio. These scenarios were:

Table 8 Demand Management Option portfolios

Demand management option	Date savings achieved	Extended Low	Extended Plus	Aspirational
Leakage reduction (combination of leakage and smart metering strategies)	2030	11 Ml/d	11 Ml/d	14 Ml/d
	2050	19.4 Ml/d	19.4 Ml/d	45.7 Ml/d
Smart metering	-	Roll out finished by 2035	Roll out finished by 2030	Roll out finished by 2030
	2030	15 Ml/d	26 Ml/d	26 Ml/d
	2050	38 Ml/d	38 Ml/d	38 Ml/d
Water efficiency strategies	2030	9 Ml/d	11.7 Ml/d	11.7 Ml/d
	2050	10.7 Ml/d	15.7 Ml/d	15.7 Ml/d
Total options saving (net)	2030	28 Ml/d	43 Ml/d	47 Ml/d
	2050	**60 Ml/d**	**64 Ml/d**	**90 Ml/d**

8.2.1 Assessment against best value plan objectives

We put these three portfolios through a multi-criteria assessment to help determine our preferred demand management option portfolio. This saw us use a number of criteria, based on our best value planning objectives, to score the portfolios against. This was conducted on a Red Amber Green (RAG) basis. The results of this assessment are shown in Table 9.

.As part of this assessment, we found that the Extended Plus scenario allowed us to innovate and deliver on our future ambitions for demand management activities, whilst delivering a robust economic case. The Extended Low option was felt not to be ambitious enough in delivering the demand management that our customers and stakeholders expect. The aspirational portfolio was not affordable due to the leakage ambition included. It was also recognised that the associated water savings are less certain.

From this analysis, the Extended Plus scenario was determined to be the most favourable as it performs best against our best value planning objectives. And most importantly, retains our strong focus on demand management in our region.

Table 9 Comparison of options against selection criteria

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

Red	Unlikely to meet criteria
Amber	May meet criteria
Green	Will meet criteria

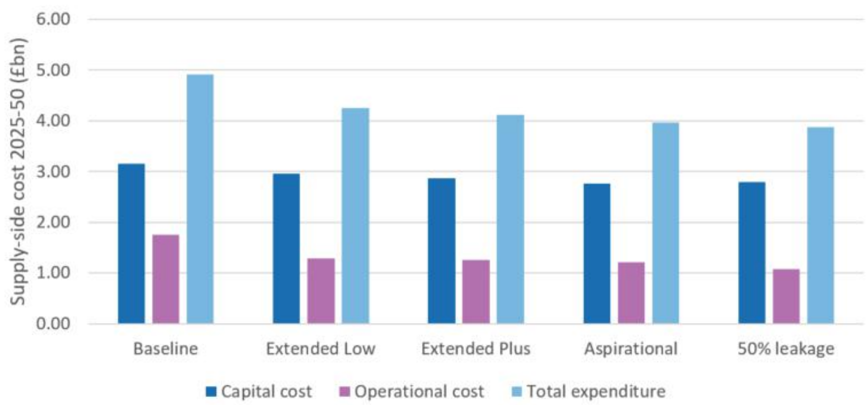
8.2.2 Deferred supply-side investment modelling

As part of our decision making process, we looked at deferred supply-side investment. This ascertains how much investment in supply-side options is deferred due to the implementation of the demand management options portfolio.

The baseline for this was the projected AMP7 out-turn for leakage, with no further smart meter installation and water efficiency measures beyond 2025.

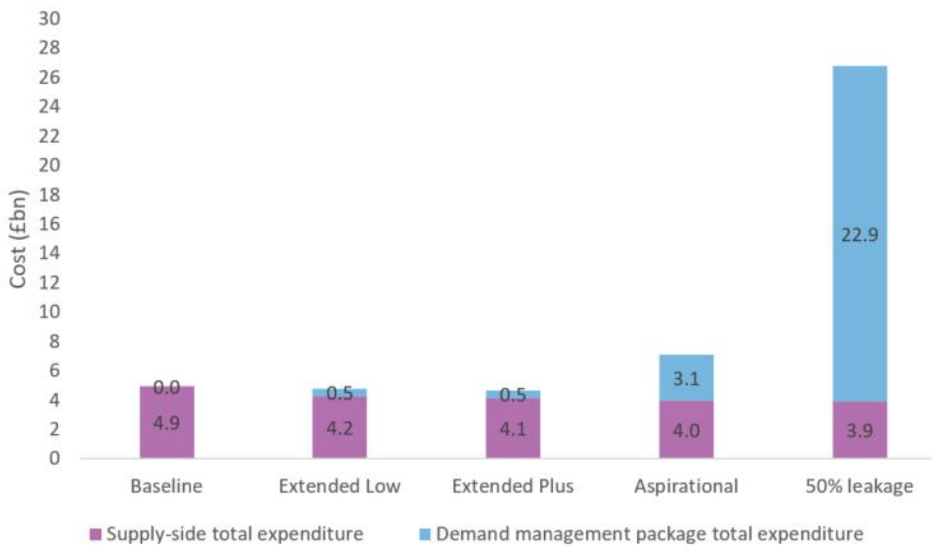
The model then chose the supply-side options required in addition to the demand management options so that a supply-demand balance was maintained. The cost data for these supply-side options is shown below in Figure 52.

Figure 52 Costs data for supply-side options selected in addition to the different demand management packages



The total expenditure was then combined with the cost of the demand management option portfolio to ascertain the total expenditure of the supply-side investment needed to maintain a supply-demand balance. This is shown in Figure 53, which highlights that the Extended Plus portfolio offers the lowest overall cost.

Figure 53 Total expenditure for both supply-side and demand management options in order to maintain a supply-demand balance

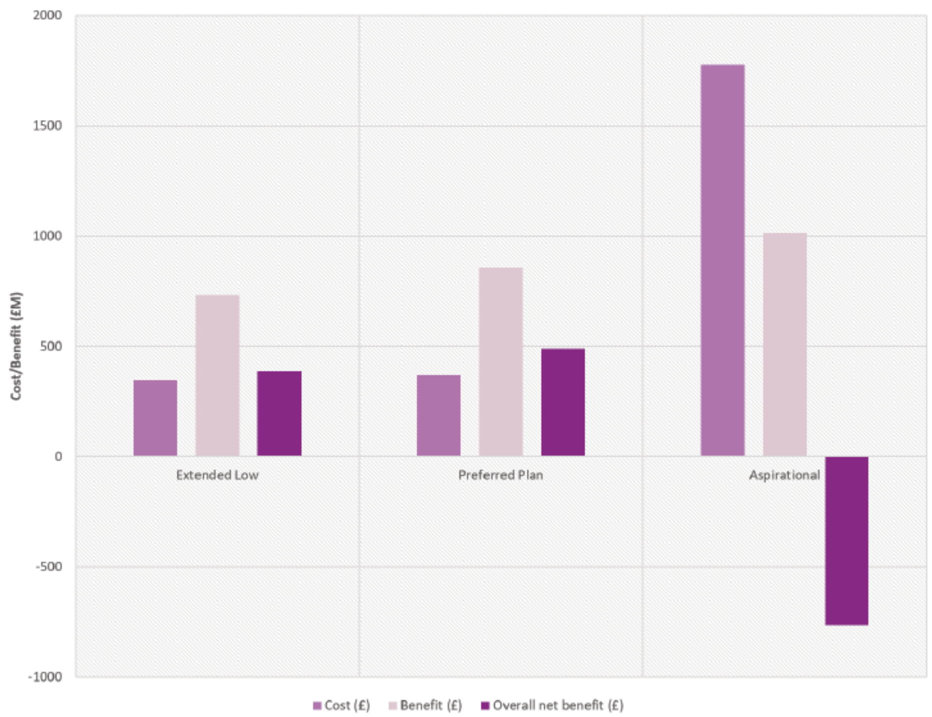


These values were then fed into the demand management options cost benefit analysis.

8.2.3 Cost benefit analysis

We conducted a cost benefit analysis of three portfolios. The results are shown in Figure 54

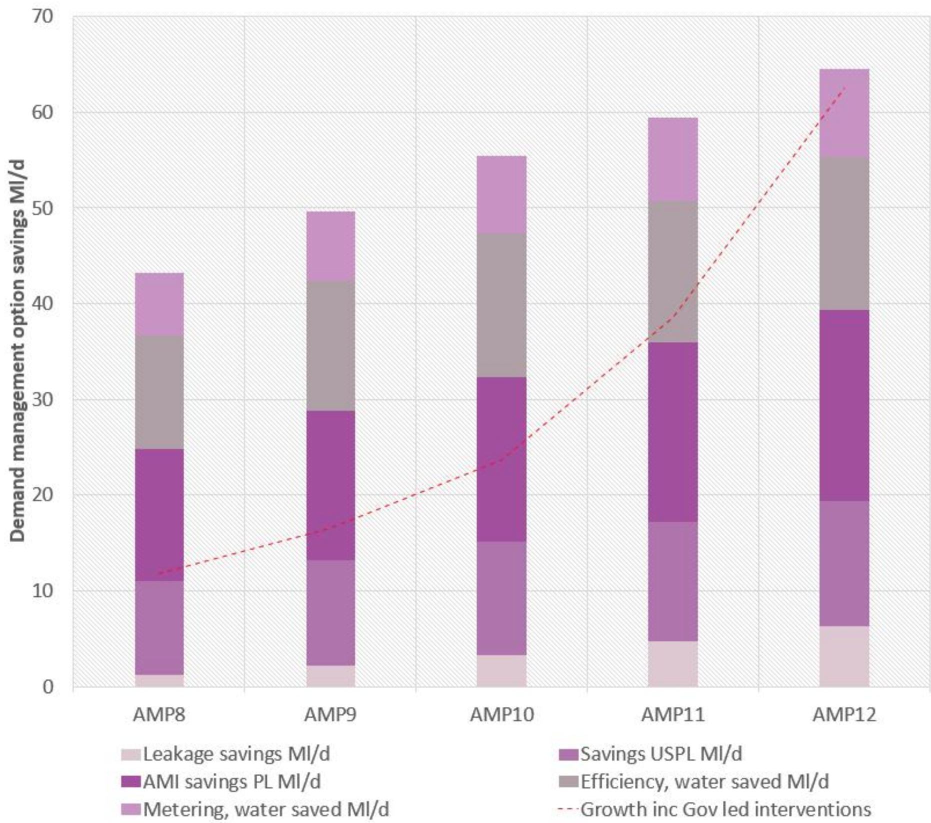
Figure 54 Total costs and benefits (25 year incremental NPV)



From this analysis, the Extended Plus portfolio is the most cost beneficial overall. This is partly driven by the level of water savings that will be achieved, allowing us to offset supply side investment. The portfolio also remains cost beneficial under a number of sensitivity tests as described in the WRMP24 Demand Option Appraisal supporting technical document.

The demand management savings associated with this preferred portfolio are shown in Figure 55 with it effectively mitigating the growth impact we will experience.

Figure 55 Extended Plus Demand Management Option savings (not including government led interventions)



8.3 Our preferred portfolio

From this decision making process, it was determined that the preferred demand management portfolio was the Extended Plus. This is because:

- It is the best performing against our best value planning objectives.
- It offers the lowest overall cost when considered with supply-side options.
- It is the most cost beneficial portfolio overall.

This demand management portfolio is our next step in pushing the frontiers of demand management, based on the three pillars of smart metering, leakage reduction and water efficiency.

8.4 Smart metering strategy

As part of WRMP19, we promoted the installation of smart meters across our region with 1.1 million due to be installed by 2025. For WRMP24, we will continue this investment across our region, reaching the maximum feasible meter penetration by 2030. This continuation of the WRMP19 smart metering strategy into WRMP24 means that:

- We will achieve significant demand savings (25 Ml/d) by 2030 which will help our supply-demand balance whilst we build new supply-side infrastructure.
- We will understand our network and demand more than ever before, enabling us to target specific areas and pinpoint leakage.
- All properties will be metered where feasible.
- Meters will be rapidly ‘switched on’ as they are installed, meaning that benefits can be immediately realised.
- Areas will be completed with similar technology so as technologies improve, we will be able to implement upgrades efficiently.
- It will enable us to target higher risk WRZs as a priority.
- Customer engagement can be targeted, area by area, working with local community water saving initiatives and benefits.
- Customers will have up to date information on their water usage, allowing us to talk to them about water efficiency and promote behavioural change.

8.4.1 Smart meters helping us engage with our customers

Our smart meter installation programme is currently enabling a fundamental change in our understanding of customer consumption and our ability to communicate with customers.

For WRMP24, we will continue to encourage customers to engage with their water usage via their smart meter data. This will enable them to craft their own water saving journey. It will also allow us to tailor individual customer services, contextualising what is happening in their local area and why saving water is so important to us, to them and the environment around us.

Customers will be able to access their water usage on a daily basis through a web portal or mobile application. We will use these communication channels to engage with our customers by:

- Showing how much water similar homes are using.
- Helping our customers to understand how and where they could make changes to their water usage, and then help set targets for them to track progress.
- Developing personalized incentives to help further savings.
- Making usage tangible to the amount that is being spent/could be saved in financial rather than volumetric measures.
- Identifying any usage discrepancies, which may be leakage.

8.4.2 Smart metering reducing plumbing losses and customer supply pipe leakage

The continuation of the smart meter roll out will also help our customers save money by promptly detecting leakage on their property, either from customer supply pipes or plumbing losses, such as leaky loos.

We will contact the customer within 3 days of identifying possible leakage on their property. This prompt identification and subsequent repair will significantly reduce our leakage rates as customer supply pipe leakage currently accounts for 23% of our figures.

In our Newmarket and Norwich smart meter trial areas, we found that leakage identified via a smart meter took on average 112 days to be repaired. This is lower than the average 210 days leakage repair time for visual read meters. For WRMP24, we will develop further options that should assist in reducing leak run-times further with an aim to achieve a maximum run-time of 100 days.

We will also look to enhance the help we can give to vulnerable customers who may have leaks on their property.

8.5 Compulsory metering

As we are in an area of serious water stress, we have an obligation to consider the costs and benefits of compulsory metering. Whilst we actively try to engage with those who are metered but not billed on their measured value, 9% of customers still choose to remain unmeasured.

Customers are currently switched to being metered and measured upon request or automatically when moving into a house with a meter. We will use our WRMP24 innovation programme to understand how we could better engage with our metered and unmeasured customers, so we can demonstrate the benefits of being on measured charges more effectively.

The majority of our customers believe, as do we, that it is fair to pay on the basis of amount of water used. So, as part of the development of our final WRMP24 we will investigate how to pursue a compulsory metering strategy to be implemented by 2030. We will also introduce assessed charges for customers without a meter.

We recognise that compulsory metering could be detrimental to some households, particularly large low-income families and customers in circumstances that may make them vulnerable. We will work with these groups to determine how can we help with this.

We are also aware that compulsory metering may result in a loss of customers' goodwill but will work with our customers to educate them as to why we are doing it.

8.6 Household water efficiency

We are good at engaging with our customers, day to day. We know that this engagement will be key to promoting prolonged behavioural change with our customers.

8.6.1 Smart homes

Continuing to drive the next step change in demand management will see us exploit the fullest capabilities of technology by introducing additional smart devices into our connected network. These devices will allow us to target the most water intensive aspects of consumption, such as showering and bathing, by giving customers even more information about these specific activities.

For WRMP24, we will provide a number of smart devices so our customers have more information about their shower volume and duration. Showering is a major component of household consumption, so reducing shower durations will have a significant overall impact on PCC. We will also trial sensors which are capable of being linked to our own smart meter system, providing information to customers through our 'My App' system.

We will tailor communications to inform customers of the impact of these activities and how making small lifestyle changes, such as reducing shower times to five minutes, can reduce water usage significantly. We will also continue to support and incentivise the use of other water saving devices, such as 'babydams' which reduce the water needed for a baby's bath.

8.6.2 Encouraging behaviour change

Continuous engagement with our customers will be essential in embedding and maintaining behavioural change over time. For WRMP24, we intend to build upon our current engagement by using all available channels for communication in addition to our smart meter programme and digital offering. We envisage that community engagement will also play a major part in this day to day strategy, ensuring that we include the digitally disadvantaged and customers in circumstances that may make them vulnerable.

We will also continue to target our communications, for instance during times of drought and peak summer demand, so that our customers are aware of water scarcity and can choose to use water more effectively during these periods.

Incentivisation will be at the heart of our WRMP24 strategy, with the ability to offer rewards to customers and/or their local communities when certain milestones are achieved. We want our customers to be involved with setting milestones and their potential level of reward. We are currently reviewing the form that these rewards might take. They may range from a free coffee up to some water saving technology. Community rewards may involve contributions to a local playground, for example.

We are conscious that developing and maintaining customer engagement will be key to customer satisfaction and achieving the demand reduction goals we have set. To that end we will ensure that the design and presentation of information to our customers will be clear and engaging. This will require continuous monitoring, validation and update.

8.6.3 Community action

We know our customers care for their local communities and environment, so we will tailor our communications to relay local information to them. This may be the current level of the local reservoir or ongoing investments in the area.

We are also keen to develop the idea of smart cities which will link water, energy and carbon efficiency programs in a holistic scheme.

8.6.4 Innovation fund

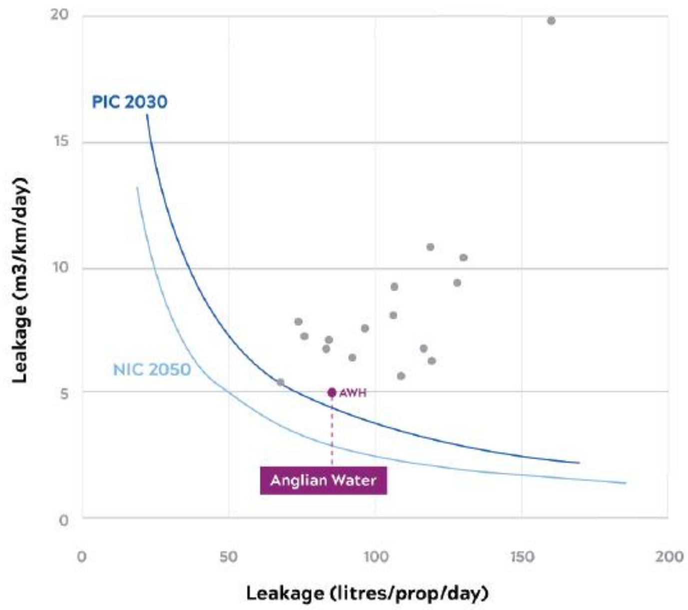
As part of our WRMP24 demand management strategy we have included an innovation fund, the 'Water Demand Reduction Discovery Fund'. We will utilise this to increase our understanding of customer behaviours and explore future water efficiency initiatives. It will also help inform future forecasting for our WRMP/WRE and PR submissions along with our LTDS. It is currently envisaged that the fund will:

- Support research into the long-term effectiveness of demand management interventions.
- Fund rigorously designed trials into the effectiveness of different types of metering, technological and behavioural change interventions over a five-year period.
- Enable the ongoing 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.
- Evaluate water efficiency measures that we wish to implement with our Retail colleagues, for the non-household sector. These measures could include the provision of detailed consumption data and the incentivisation of water efficiency through audit, advice and the potential for device replacement.

8.7 Leakage

As part of the development of WRMP24, we have considered our current position (and that of other water companies) in relation to the PIC of tripling the rate of sector-wide leakage reduction by 2030. We have also reviewed the NIC's target of a national 50% reduction in leakage by 2050. These targets have been converted into attainment curves by the National Leakage Roadmap, shown in Figure 56. This shows the wide range of current leakage positions and that we are one of the frontier companies for leakage reduction, recognising that the challenges experienced by each company are different. However, it does indicate that a national 50% reduction in leakage will only be achieved by some companies reducing their leakage values by a much larger amount than forefront companies such as us.

Figure 56 Our company position compared to other companies for NIC and PIC



As a company with one of the lowest leakage rates in the United Kingdom, we know that the costs for finding and repairing smaller and smaller leaks are significant. We are also aware that we have achieved low levels of leakage by implementing a significant proactive pressure reduction programme, focussing on pumping regimes and improvements. These reduce the levels of leakage by making the network smoother and better managed. This pressure reduction programme will finish in 2025 with limited opportunities for further improvement until new technology is forthcoming.

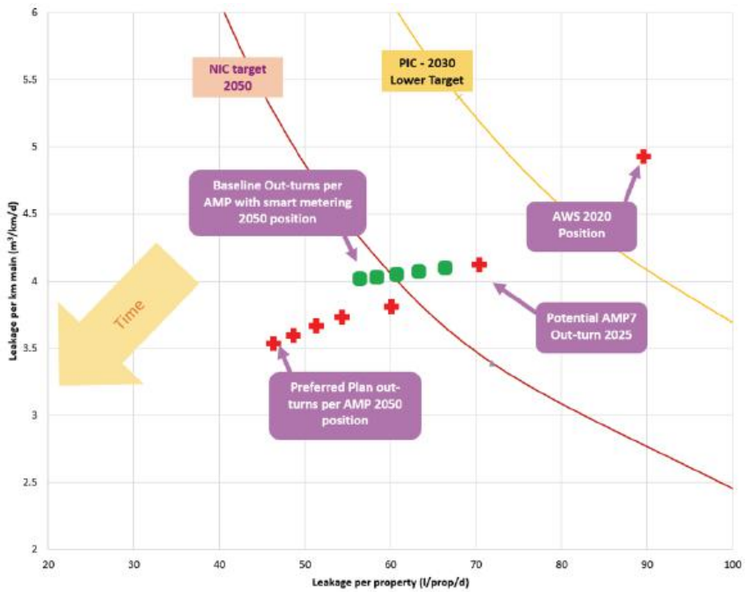
To quantify these concerns, we undertook a cost benefit analysis to determine how much it would cost us to achieve a 50% leakage reduction from our 2017/18 position. We found that it would cost £22 billion to deliver an additional 70 Ml/d of water saving beyond that included in WRMP24 for AMP8. This would achieve a leakage level equivalent to 90 Ml/d in 2050 from the 17/18 National Framework baseline, more than a 50% saving.

This means that we could spend £22 billion to save 70 Ml/d or a projected £3 billion investment for the South Lincolnshire reservoir and our share of the Fens reservoir. These reservoirs will supply 210 Ml/d of water to customers.

The high cost for leakage reduction is due to the amount of new main laying that will required to achieve the 50% target. We have calculated that we would need to replace 10,387km of water mains, which is equivalent to 27% of our existing network. We are continuing research on background leakage, which will help us to target mains replacement. This will also inform further assessment of mains replacement rates, costs and leakage reduction benefits.

This confirms our belief that achieving a 50% target and passing on these significant costs to our customers is unfair considering they have already paid for significant leakage reduction in the region. Instead, we feel that more benefit would be achieved by other companies achieving the leakage levels we have achieved already.

Figure 57 Achieving NIC and PIC targets



Our leakage levels have already significantly contributed to reducing leakage in the United Kingdom. This is shown in Figure 57 which maps our different levels of leakage reduction against the attainment curves for the PIC and NIC targets. This shows that with our current leakage and smart metering approach, our leakage levels will be below both PIC targets by 2025 and below the NIC target by 2040 without further action. We will improve on this with our WRMP24 strategy which will see us below the NIC target by 2030, reaching the very low levels of 3.53m3 per km of main/day or 46l/prop/day by 2050. These levels will be unprecedented across the industry.

For WRMP24, we will continue to actively explore how the use of state-of-the-art technology can help us to achieve further reductions. This is why the concept of 'zero leakage and bursts' is one of the seven goals of our Shop Window initiative. We also continue to actively trial technologies such as thermal imagining drones to detect leaking pipes and the use of satellite imagery to identify leakage.

We will remain adaptive in our approach and will continuously review innovative approaches such as fibre optic leakage protection.

8.7.1 Fixed acoustic logging

WRMP24 will see us utilise fixed (permanent) acoustic logging. This is a technique for pinpointing leakage. It is undertaken by installing permanent sensors along the distribution network which 'listen' for leak noises. These will help reduce detected leak run-times, leading to overall leakage reduction.

A recent UK large-scale trial carried out by Affinity Water on fixed acoustic logging indicated savings in the region of 70% of volume of water lost through a single leak due its quicker detection and repair.

Additionally, and perhaps more importantly, permanent logging offers another advantage. The loudest leaks i.e. those most detectable using more traditional methods, are not necessarily the biggest ones. A pipe under pressure with a small hole in it will make a louder noise than a pipe that is split in two, but more water is being lost in the second case. A permanent device is the best way of picking up these secondary, quieter leaks.

8.7.2 Shared supply customer supply pipe leakage reductions

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

8.7.3 Smart metering and customer supply pipe leakage reductions

Smart meters are a key element in the identification of customer supply pipe leakage as they detect continuous flow. For WRMP24, we are keen to develop our analytical systems and communications to help customers find and repair these leaks (either plumbing losses or customer supply pipe leaks) as fast as possible.

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

- Schemes to enable vulnerable customers to fix leaky loos and taps up to a capped value.
- Finding and fixing customer side supply pipe leaks up to a given value, for vulnerable customers.
- Improving the delivery of our customer-side leakage journeys by including virtual and customer-side leakage visits for reported leaks.
- Providing expert advice to customers, by utilizing online and video assessments for potential internal leaks or by offering a physical visit for customers.

8.8 Non-household water efficiency

We are working in close collaboration with our WRE wholesale colleagues, as well as our Retailer partners and their customers to understand business consumption in much more detail. This collaborative engagement has indicated that customers are currently unsure about the need to reduce water consumption and how they could achieve this. However, we found that there is an appetite for additional water efficiency measures, if we can assist with the process.

Our engagement suggests that there are two initial options that should be developed in more detail. Firstly, we could assist with the reduction of leakage. To do this we would need to leverage our smart meter expertise and the data that is available from them. Just like with household customers, we could identify when there are continuous night flows or irregularities in consumption and send notifications that there is a potential leak.

Business customers could also have the option to 'self-audit' in order to assist with the identification and repair of the leak. If the leak is internal and a plumber is required, we could incentivise this. If the leak was found to be external, it may be possible to offer a 'find and fix' service.

We will also explore enabling businesses to reduce their water usage. This could be achieved by developing online web based self-auditing systems. We could provide usage comparison data to allow for benchmarking, as well as cost and benefit data. Additional virtual visits, where customers are talked through this information could also be part of this service.

Whilst it should be possible to develop these options for most of the business customer base, more complex interventions may well be necessary for the largest non-household consumers. This could potentially include encouraging businesses to adopt water recycling methods.

We intend to develop these options for trial and full implementation in our WRMP24. We expect to be able to quantify the savings for these options for our Final WRMP24 Plan.

8.9 Optimising our own operations

We also continue to look for ways we can use water more efficiently in our construction and day to day activities. One example of this is on our strategic pipeline where our Strategic Pipeline Alliance has trialled low water commissioning methods like air swab washing and disinfection to reduce the overall water footprint. Recent trial results show a 86% reduction in water usage. This also achieves other benefits, such as:

- reduced time on site
- less disruption to landowners
- carbon reduction
- developing new technologies for future projects, and
- less water taken out of supply, increasing resilience.

Using traditional methods, our new strategic pipeline would take approximately 1.5 billion litres of water to commission.

8.10 The potential to further our demand management

Our demand management strategy has always been key to our success as a company. And this will continue with our WRMP24 strategy, as we recognise that these water savings will manage sustainable growth in our region and also mitigate against deterioration of water bodies.

We will continue to seek further water savings from our demand management throughout the WRMP24 process as we recognise there are other opportunities to key into. One of these, as discussed in section 8.8 are water savings from the non-household sector. As of yet, we have not attributed any savings to this sector, and we are currently working with retailers and other water companies to unleash these opportunities, for instance via incentivisation. We hope to quantify these for the revised draft.

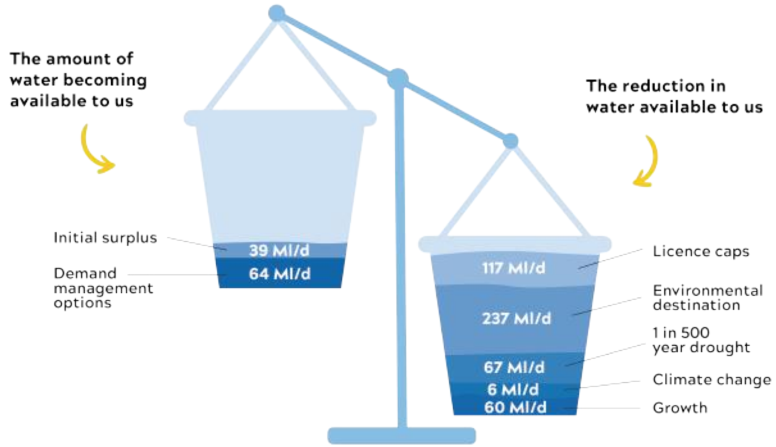
We will also implement compulsory metering by 2030. As of yet, we have not attributed any water savings to compulsory metering but will for our revised draft.

Leakage is something we remain committed to and will continue to explore the latest innovations in leakage reduction. We expect to achieve further savings in this area. We will also reduce leakage by helping and/or incentivising customers with leaky loos and pipework repairs. These repairs will bring further water efficiencies.

We may also explore tariffs, to encourage the sensible use of water during periods of high demand.

This determination to drive down water usage and wastage in the East of England will ensure that we remain industry leading and, furthermore, will provide us with resilience and protection for the environment by mitigating against deterioration if our supply-side options are delayed.

8.11 The impact of our WRMP24 demand management strategy



9 Supply-side decision making

In this section we will:

- Discuss the modelling approaches undertaken for our WRMP24 and WRE.
- Articulate our decision making approach, and the policy decisions we have made.
- Show how we developed least cost plans to use as a benchmark for comparing plans.
- Highlight the process for developing alternative plans and the ones taken forward to the best value framework assessment.
- Provide an overview of the sensitivity and stress testing undertaken.
- Show how the plans performed against the best value plan framework and detail what our best value plan is.
- Discuss adaptive plans and pathways.

The three water resource planning workstreams (regional plan, WRMP and RAPID) detailed in section two work in parallel, requiring an iterative approach to ensure best value plans are achieved for the region and for our customers.

9.1 Modelling approach

We used our problem characterisation assessment to select our modelling approach, with the most complex decisions assessed within the regional plan. Moderate concerns such as local/smaller scale supply-side options have been assessed as part of our WRMP24 modelling.

We must also ensure that our modelling approach provides the justification to accept WRE's decisions, giving the confidence and evidence that the regional plan is also best value for our customers.

9.2 Decision making approach

We have used the UKWIR *Deriving a best value water resources management plan* as the basis of our approach. This report recognises that there are a variety of methods and approaches that may equally arrive at a best value plan but recommends multi-criteria decision analysis (MCDA) as one of the appropriate tools.

We have adopted the core principle of multi-criteria assessment including the use of metrics. However, some aspects of the approach can be very complex and the decisions arrived at can be difficult to articulate. The WRPG requires us to be transparent in our methods, data, assumptions and decisions so that customers, stakeholders and regulators can understand and comment on our plan. Consequently, we have chosen to use our customer and stakeholder priorities to shape the plan, as we feel this is more transparent than using scores and weights.

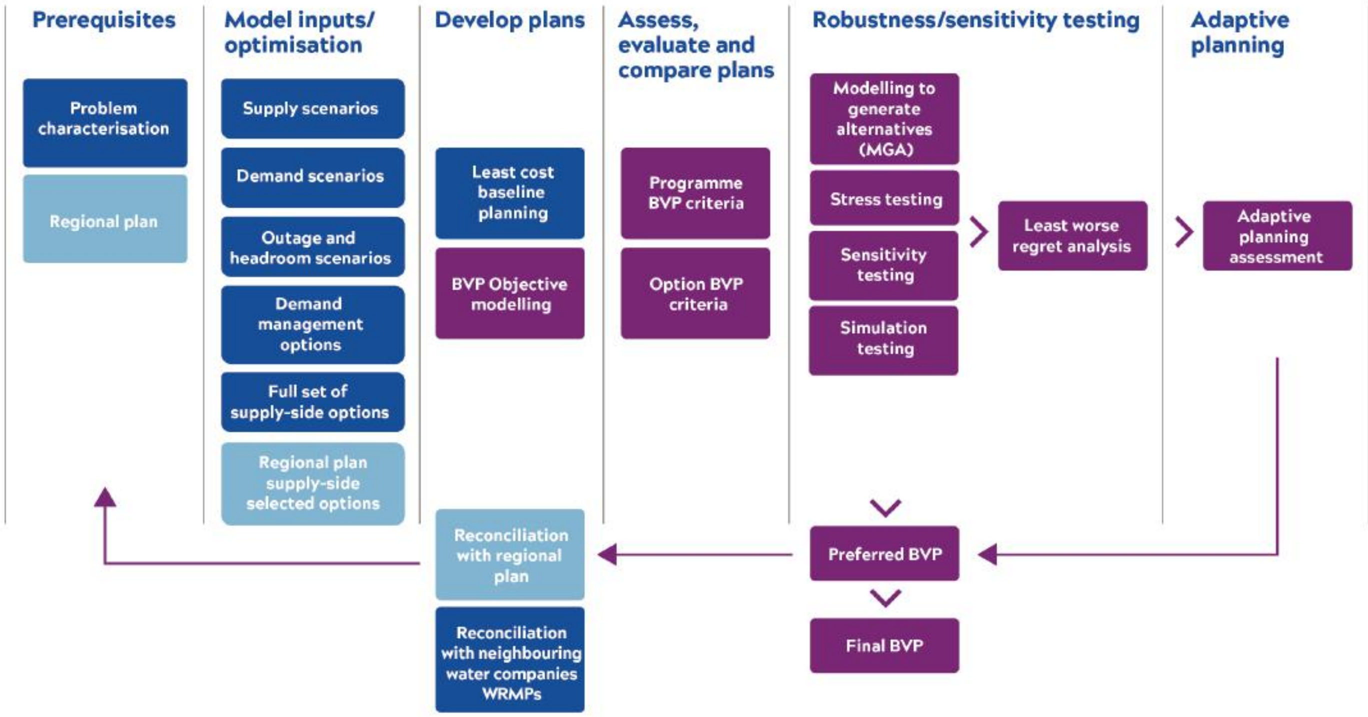
Our approach to decision making is shown below:

- Step 1: **Structuring the Problem** by using our problem characterisation and supply and demand forecasts to establish the scale of the water resource problem we need to plan for.
- Step 2: **Defining best value,** as detailed in our best value plan framework in section two and how we can demonstrate our plan provides best value.
- Step 3: **Undertake effective engagement to shape alternative plans** with our customers, stakeholders and regulators throughout the development of the plan. This is used to inform our decisions to shape our best value plan.
- Step 4: **Modelling to develop alternative plans** including a least cost plan to benchmark against.
- Step 5: **Testing plans to future uncertainty,** so we know how they are impacted by our assumptions changing.
- Step 6: **Applying the best value planning framework to evaluate and compare plans** including our least cost plan and the best for the environment plan.

- Step 7: **Selecting our best value plan** by using the outputs from steps four to six to identify the one which will provide best value to customers, the environment and society whilst being efficient and affordable to deliver.
- Step 8: **Adaptive planning assessment** so we understand how easily we can adapt the preferred plan if the future differs from our original assumptions.
- Step 9: **Final alignment with regional plans and other water company plans** to ensure the best value plans at regional and water company level remain aligned.

This process is set out in Figure 58, demonstrating that it is an iterative process and some stages are repeated and refined as the plan is developed.

Figure 58 Our supply-side decision making process



9.3 Policy decisions

The WRPG sets out the requirements for developing our plan. Some of these requirements are not fixed in the guidance and can be optimised through the decision making process. There are captured in five key policy decisions:

1. What **level of demand management** should be undertaken and how should it be rolled out.
2. The **timing of licence capping** for sustainability reductions.
3. How we will **time 1 in 500 year drought resilience** in order to meet the requirement of 2039.
4. What **level of environmental destination** should be undertaken.
5. The **timing of our environmental ambition**, which we have to achieve by 2050.

We model variations of each policy decision to determine how to represent these in our initial most likely scenario. We use the best value framework at this initial stage but it is focussed on the criteria that our stakeholders and customers have identified as being the most important. The variations of policy decisions we have assessed are shown in Figure 59.

Figure 59 Variations of policy decisions to include our initial most likely scenario

	Policy Decisions							Decision used in other scenarios
1. Level of demand management	Baseline	Extended low	Extended plus	Aspirational	50% leakage			Extended plus
2. Licence Capping	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 4
3. Timing of drought resilience	2025	2030	2035	2039	2045			2039
4. Environmental Destination	None	BAU	BAU+	Enhance				BAU+
5. Environmental Ambition	2030	2035	2040					2035

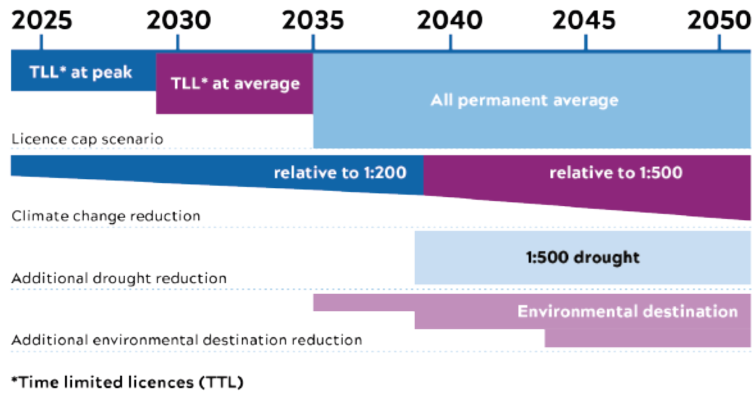
9.4 Structuring the problem to define our initial most likely scenario

We use our EBSD model as the basis for our decision making. This optimises the options for a single scenario of the future.

To start our decision making process, we need to determine a baseline scenario as a starting point to compare all other variations against. This is called our initial most likely scenario.

To help us achieve this, we separate each of the supply impacts so that we understand the relative impact of each reduction. This allows us to compile different scenarios, ensuring we are not double counting impacts. Figure 60 shows how we can layer impacts to create different supply scenarios.

Figure 60 Layering supply impacts to create scenarios

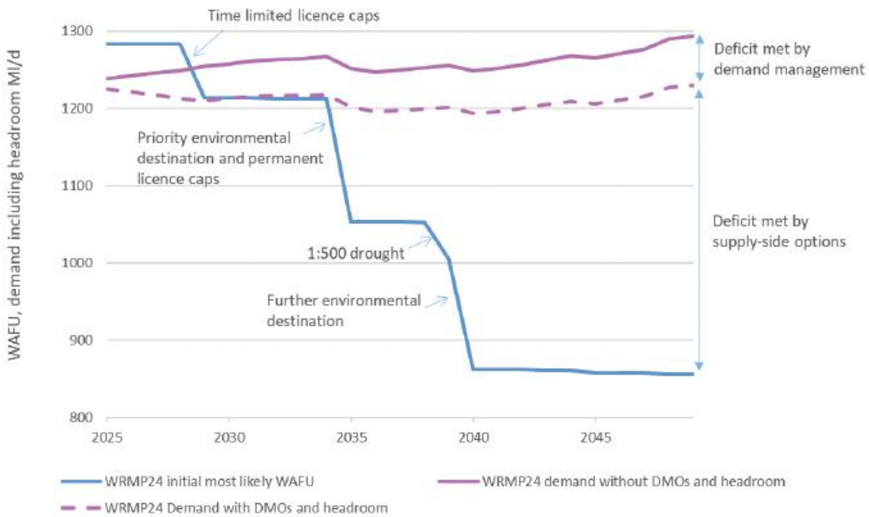


We have used the output from each of the policy decision analysis to develop our initial most likely scenario.

From this analysis we determined that we would use the following in our initial most likely scenario (also shown in Figure 61):

1. The **Extended Plus** demand management scenario, as determined in the WRMP24 Demand Management Preferred Plan technical supporting document.
2. **Scenario 4** for licence capping to recent actual average by 2029 for the time limited licences and 2035 for the permanent ones.
3. For moving to 1 in 500 year drought resilience, we used **2039**.
4. **BAU+** for environmental destination.
5. For environmental ambition, we **prioritised areas by sensitivity**. This means we phased Norfolk and Suffolk to start in 2035, Essex and Lincolnshire in 2040 and Ruthamford in 2045.

Figure 61 Our initial most likely scenario



Details of how we developed this initial most likely scenario are described in the following section.

9.4.1 Extended Plus demand management scenario

Please refer to section 8 for the decision-making methodology for determining the use of Extended Plus.

9.4.2 Licence capping

Five initial scenarios were developed for our draft WRMP24, with an additional two added through consultation with the Environment Agency. The seven scenarios all differ in when abstraction licences are capped to prevent deterioration, whether that be peak max or annual average.

Table 10 Licence capping scenarios

Licence Cap Scenario	Capped at Peak	Capped at Average	
	Time Limited Licences	Time Limited Licences	All other Licences
1	-	2022-2024	2025
2	2022-2024	2025	2025
3	2022-2024	2025	2029
4	2022-2024	2029	2035
5	2022-2024	2035	2035
6	-	2022-2024	2029
7	2022-2024	2029	2032

Licence capping baseline used

We have agreed with the Environment Agency to use scenario 6 as our licence capping baseline to compare our scenarios against. This scenario modelling seeks to gain an understanding of the following:

- Is it feasible to meet the baseline scenario; for instance, are there adequate new supply-side options that can be delivered within the timescales of the baseline scenario?
- If it isn't feasible to meet the requirements of scenario 6, what other licence capping scenarios are available?

- If it isn't feasible to meet scenario 6, what scale of potential risk is associated with this?
- Which feasible scenario offers the best value?

Licence capping scenario modelling

To undertake the licence capping scenario modelling, the model included the preferred demand management strategy and had the WRE 'no regret' options as a 'must do', with the ability to choose when to deliver the latter. All of the other supply-side options were unconstrained, including the smaller supply-side options available from AMP8. The supply forecast used includes an allowance for environmental destination in 2040, and it was assumed that 1 in 500 year drought resilience would commence in 2039.

Results of the licence capping scenario modelling

The modelling found that the change from maximum peak to recent actual average licences (for both time limited licences and permanent licences) creates a deficit in all the scenarios. For some scenarios, including the baseline, there are deficits at the start of the planning period. This is shown in Table 11.

Figure 62 Baseline regional supply demand balance for each of the modelled scenarios

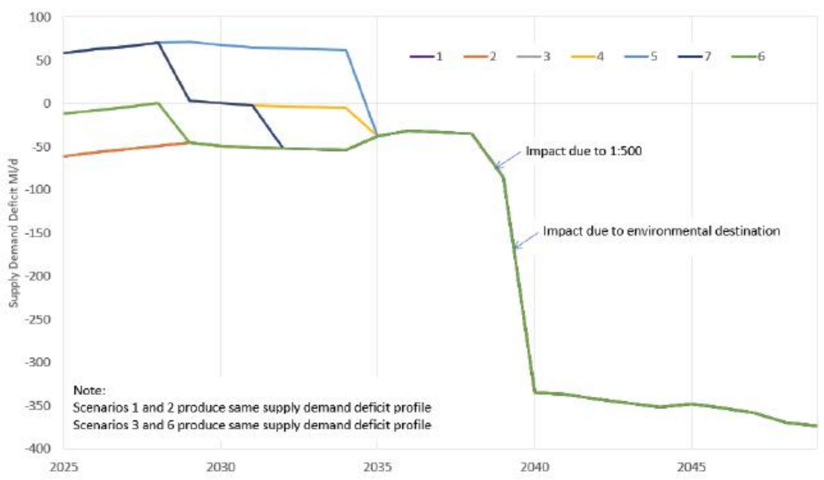


Table 11 shows the supply demand balance including the benefit from the supply-side options selected by the model. Where there are deficits, denoted by -, this shows that there are not enough feasible supply-side options available to resolve the abstraction reductions associated with the licence capping scenario. This is despite the inclusion of our significant demand management strategy and a number smaller supply-side options.

Table 11 Regional supply demand balance with supply-side options selected by model

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1	-61.1	-56.8	-53.5	-48.9	-20.3	-23.8	-26.3	37.2	36.4	35.2	51.6
2	-61.1	-56.8	-53.5	-48.9	-20.3	-23.8	-26.3	37.2	36.4	35.2	51.6
3	-12.0	-7.7	-4.4	0.2	-20.3	-23.8	-26.3	37.2	36.4	35.2	51.6
4	58.2	62.5	65.8	70.4	11.3	10.8	13.3	12.6	11.8	10.6	9.9
5	58.2	62.5	65.8	70.4	72.5	69.0	69.1	68.4	67.6	66.4	9.9
6	-12.0	-7.7	-4.4	0.2	-20.3	-23.8	-26.3	37.2	36.4	35.2	51.6
7	58.2	62.5	65.8	70.4	11.3	14.5	12.0	37.2	36.4	35.2	51.6

This analysis shows that scenarios 1, 2, 3 and the agreed baseline licence capping scenario, result in residual supply demand deficits. This is due to there being insufficient supply-side options available early in the planning period, for instance the delivery timescales for water reuse and desalination mean that these supply-side options are unavailable until 2032. When these larger supply-side options become available, all deficits are resolved for all of the licence capping scenarios.

As we have a legal requirement to maintain a supply demand balance without any final planning deficits, ensuring our customers remain on resilient water supplies, we excluded the licence capping scenarios 1, 2, 3 and 6 from further analysis as they fail this requirement.

We also explored the scale of the impacts, in deployable output, of not capping licences to recent annual average compared to the baseline of scenario 6. This is shown in Table 12, and shows that scenario 4 falls between scenarios 5 and 7 in terms of risk to deterioration.

The only scenarios that mitigate all potential risk are scenarios 1 and 2, but these are unfeasible as they leave unresolvable supply demand deficits. Prior to 2029, scenario 6 presents a potential residual deterioration risk of 56.5 Ml/d.

Table 12 Scale of residual deployable output impacts of not capping licences to annual average

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
4	13.7	13.7	13.7	13.7	56.5	56.5	56.5	56.5	56.5	56.5	0
5	13.7	13.7	13.7	13.7	70.2	70.2	70.2	70.2	70.2	70.2	0
7	13.7	13.7	13.7	13.7	56.5	56.5	56.5	0	0	0	0

Choosing the licence capping scenario for the initial most likely scenario

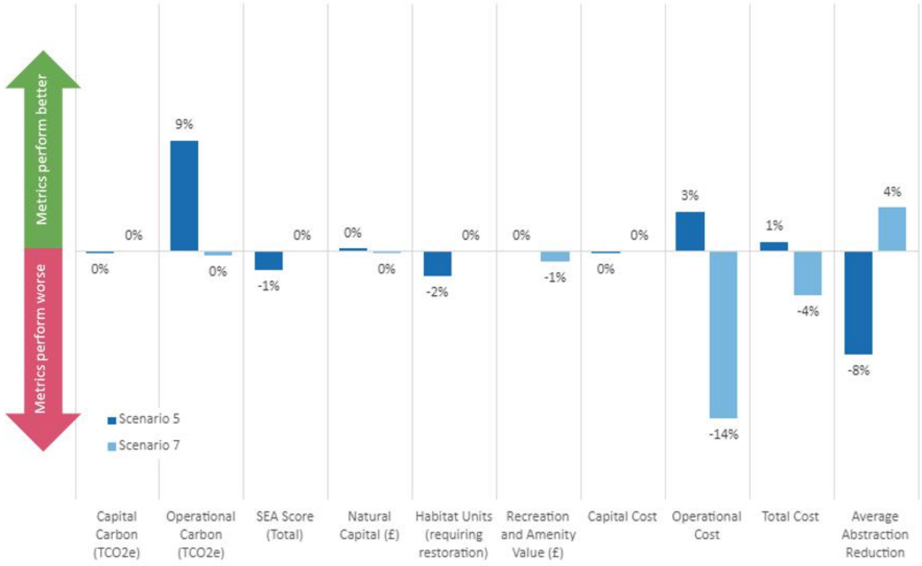
In order to choose the best licence capping scenario to use for the initial most likely scenario, we compared the best value plan metrics for scenarios 5 and 7 against scenario 4. Figure 63 shows where scenarios 5 or 7 perform better or worse as a percentage.

We found that scenario 5 performs best in the operational cost metrics as this meets all average licence caps later, in 2035, so there is less operational cost and carbon within the analysis. There is minimal difference between capital cost and carbon metrics.

In scenario 7, water reuse and desalination options are required as soon as possible which delays the need for the Fens and South Lincolnshire reservoirs. This reduces the adaptability of the plan as we have to commit to delivering large scale options (notably desalination) right at the start of the plan.

Scenario 7 delivers benefits earliest, which is reflected in the average abstraction reduction metric, but this comes with increased operational carbon and cost. This, combined with the reduction in adaptability, means that customers may end up funding significant infrastructure, with little benefit compared to reservoirs, in AMP8 and AMP9 which isn't needed following the results of the WINEP AMP8 environmental destination investigations.

Figure 63 Best value metrics for scenarios 5 and 7against scenario 4



Therefore, we believe scenario 4 is the optimal scenario to be included in our initial most likely scenario. It is more ambitious than scenario 5 and is more cost effective and flexible compared to scenario 7. We are also confident that we can manage the risk of deterioration with scenario 4.

Summary of licence capping scenarios

A summary of the results from the licence capping scenario modelling is shown below.

Table 13 Summary of findings from our licence capping scenario modelling

Scenario	The feasibility to meet the baseline scenario	Which scenarios are feasible?	Scale of potential no deterioration risk- without considering the benefits of demand management at WRZ level	Scale of potential no deterioration risk- considering demand management benefits to offset growth at WRZ level	Which feasible scenario offers best value?
1	N/A	No	None	None	N/A
2	N/A	No	None	None	N/A
3	N/A	No	Low	None	N/A
4	N/A	Yes- adequate supply-side options to meet deficits.	Medium	None	Yes- more ambitious than scenario 5 and more cost effective and flexible compared to scenario 7.
5	N/A	Yes- adequate supply-side options to meet deficits.	Medium	None	No- provides lower costs and carbon but delivers licence reductions later.
6 (baseline)	Not feasible as insufficient supply-side options available	No	Low	None	N/A
7	N/A	Yes- adequate supply-side options to meet deficits.	Medium	None	No- provides licence reductions earlier but is less cost effective and flexible to adapt compared to scenario 4.

Managing the risk of deterioration

Abstraction licence caps are required by the Environment Agency to avoid the risk of deterioration, as defined under the Water Framework Directive, to the water bodies we currently abstract from. The risk of deterioration to water bodies comes from abstracting more than we have historically, within the current licence conditions, by using the headroom within the licence. An increase in demand due to growth could require a licence to be used above historical abstraction.

We have always used demand management to prevent the risk of deterioration associated with growth, evidenced by the amount of water being put into supply being the same as 1989, despite a 30% population increase in that time. This remains our strategy for WRMP24 with our demand management options providing water savings that will offset the increase in demand due to growth. This means that we will not abstract any more water from water bodies due to growth, mitigating the risk of deterioration.

To confirm this, we have conducted modelling using distribution input (the amount of water we put into supply) as a simple proxy for deterioration risk within water resource zones. We compared the distribution input, including the water savings from our demand management strategy, of the last year in WRMP24 (2049/50) against measured distribution input from 2020/21.

The analysis showed that only two water resource zones experience increased demand over the planning period. These are Ruthamford Central in 2033 and Norfolk Happisburgh in 2048. Both of these water resource zones have no sources themselves and are supplied by interconnectors supported by surface water. If growth were to arise in these water resource zones, we would have our new strategic interconnectors and new supply-side options which do not rely on groundwater abstraction. This shows there is no risk of deterioration at the water resource zone level for the scenarios that deliver licence caps later than the baseline scenario.

By reviewing this modelling and analysis, we have determined that the licence capping scenario 4 is the most suitable for our initial most likely scenario as our modelling shows that our WRMP24 will mitigate the risk of deterioration by continuing our historical performance of not increasing overall abstraction despite significant growth in our region. We have a strong track record in achieving demand management savings, as well as voluntarily committing to abstraction licence capping whenever feasible.

9.4.3 1 in 500 year drought resilience

Our WRMP24 must deliver resilience to a 1 in 500 year drought event by 2039, with the subsequent aim of minimising the use of drought permits and emergency drought orders except in extreme events.

Results of the 1 in 500 year drought resilience scenario modelling

As part of our scenario modelling, we have investigated the optimum timing for increasing drought resilience by considering the costs and benefits of alternative approaches. To achieve this, we modelled five alternative dates for achieving 1 in 500 year drought resilience, as shown in Table 14.

Table 14 Alternative dates for meeting drought resilience to 1 in 500 years

Year 1 in 500 year drought resilience achieved	Years of additional resilience (vs 2039 baseline)
2025	14
2030	9
2035	4
2039	N/A
2045	-6

Transitioning to a 1 in 500 year drought resilience creates a deficit in our supply forecast. Table 15 shows the water resource zones impacted. The scale of the impact is independent of its timing, and therefore remains the same in each scenario.

Table 15 Impact of 1 in 500 year drought resilience on deployable output by water resource zone

Water resource zone	Impact of 1 in 500 year drought resilience on baseline deployable output (Ml/d)
Essex South	-3.3
Ruthamford North	-31.5
Ruthamford South	-29.1
Suffolk East	-3.3
Suffolk West & Cambs	-0.3
Total	**-67.4**

The residual regional supply demand balance was then determined after the supply-side options had been added into the model. This is shown in Table 16.

Table 16 Regional residual supply demand balance (Ml/d) scenario comparison

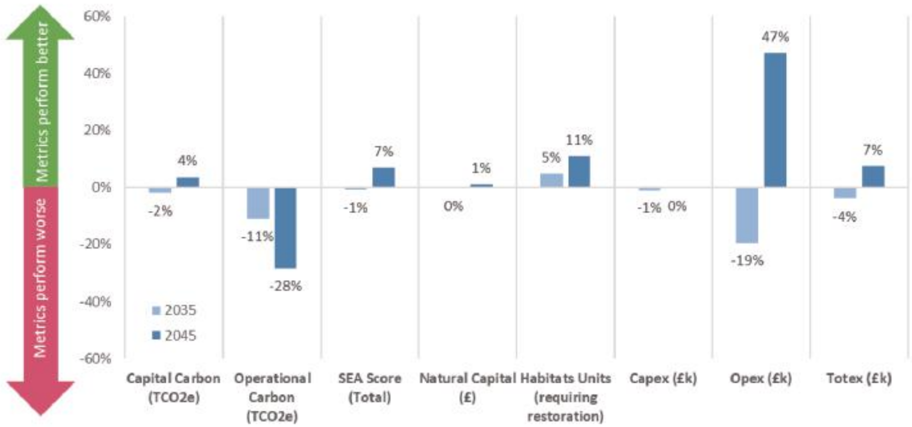
Drought resilience year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
2025	4	8	11	14	-20	-22	-26	21	23	22	10
2030	54	57	60	63	11	-22	-26	21	23	22	10
2035	54	57	60	63	21	19	16	15	14	13	15
2039	50	54	56	60	18	15	12	12	11	34	22
2045	50	54	57	60	21	19	16	15	14	13	27

Analysis of the modelling results showed that delivering drought resilience early in the forecast, in 2025 and 2030, results in residual supply demand deficits. These deficits occur because there are insufficient supply-side options available early in the planning period. The deficits are resolved by 2032 in all scenarios, as this is when larger and more complex supply-side options such as desalination and water reuse become available within the model.

As our WRMP24 must maintain a supply demand balance without any final planning deficits, delivering drought resilience by 2025 and 2030 are excluded from further analysis as they do not meet this requirement.

In order to choose the best drought scenario to use for the initial most likely scenario, we compared the best value plan metrics for delivering enhanced drought resilience in 2035 and 2045 against the baseline of 2039. This is shown in Figure 64.

Figure 64 Percentage difference in best value metrics compared to baseline scenario of 2039



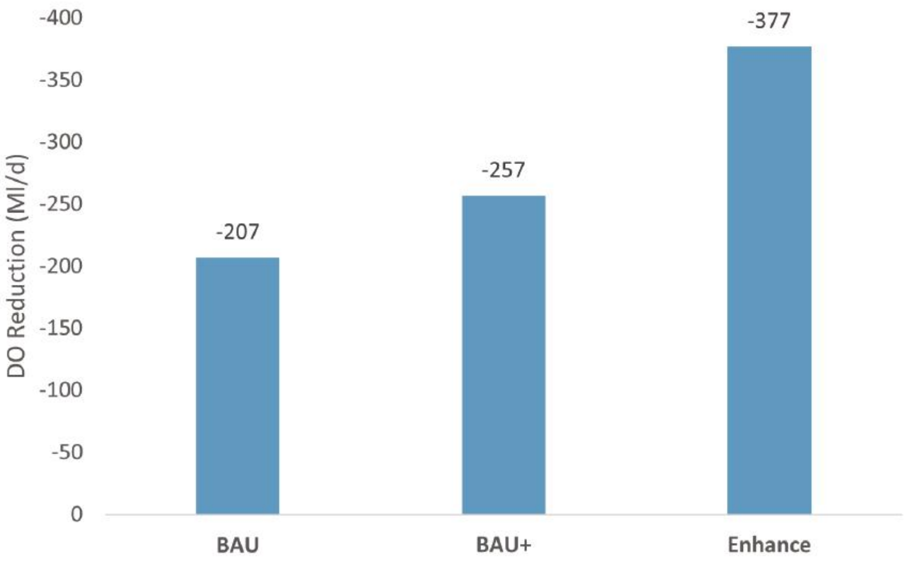
This analysis shows that delivering drought resilience sooner, in 2035, requires schemes to be delivered earlier and therefore this increases the operational carbon and cost over the planning period. Operational cost and carbon are less when the drought impacts are postponed. We found that the supply-side options required to deliver drought resilience are relatively similar between all scenarios.

We need to meet the requirements of the Water Resource Planning Guideline, and our customers have told us they feel the 2039 date is about right for delivering 1 in 500 year drought resilience. We therefore chose to use 2039 in our initial most likely scenario.

9.4.4 BAU+ environmental destination

We modelled three levels of environmental destination with varying start dates and profiles to meet the full destination date by 2050. These levels, and their impacts in terms of changes to deployable output are shown in Figure 65.

Figure 65 Reductions to our supply forecast as deployable output from the environmental destination scenarios



Our analysis shows that the trade-off for greater abstraction reduction is poorer performance in expenditure as we need to build more new resources to replace those lost. The lowest cost scenario in terms of total expenditure is BAU with a later implementation date (from 2040 onwards) as this requires the lowest capital cost to replace the lost abstraction and has fewer years of operational costs included in the total expenditure.

Through the regional planning it has been agreed to use BAU+ as the environmental destination scenario in the regional plans.

9.4.5 Environmental ambition

Based on our analysis of environmental destination, we will use the environmental ambition profile where higher-priority water resource zones have abstraction reduced in 2035 and then lower priority ones in 2040 and 2045. This bespoke scenario allows for early reductions where they are needed the most, whilst delaying the negative environmental impacts of investments required to meet reductions in less sensitive zones. This scenario is based on profiling impacts for whole water resource zones in specific regional areas of our supply system rather than individual sources within a zone, see Table 17.

Table 17 Initial dates for starting environmental destination

Region	Environmental ambition starting date
Norfolk and Suffolk	2035
Essex and Lincolnshire	2040
Ruthamford	2045

This approach is suitable for the initial most likely scenario, but more detailed assessment would be required to confirm locations of where to prioritise abstraction reductions. This will be achieved through our AMP8 WINEP Environmental Destination investigations.

9.5 Developing a least cost plan for the initial most likely scenario

Using this initial most likely scenario, we developed a series of least cost plans. Through our ongoing liaison with the Environment Agency, we agreed to use the 'regional plan low regret options plan'. This plan reflects the outputs of the regional plan (i.e. Fens and South Lincolnshire reservoirs) but their timing in the EBSD model is not constrained.

We also wanted to understand if the regional plan options would be selected if our modelling was totally unconstrained. This is called our 'supply options least cost plan', which is the least cost combination of supply-side options to meet the needs of our customers only, rather than on a regional basis. This plan reflects our preferred demand management strategy but the outputs from the regional plan are not 'must dos'.

When EBSD ran our 'supply options least cost plan', optimised over 25 years, large capacity desalination options were selected from 2035 and the South Lincolnshire reservoir from 2039. Fens reservoir was not selected.

When the timeframe was extended over 50 years, the Fens reservoir was selected in preference to desalination. This is due to desalination having higher operational costs over the longer timeframe, meaning it is no longer a preferred option compared to a reservoir.

This confirms that the least cost plan including the regional plan options as a 'must do' is suitable as the initial least cost plan.

9.6 Developing alternative plans including best for environment (abstraction)

After we had produced a least cost plan for the initial most likely scenario, we developed an alternative plan based on:

- Reflecting the emerging regional plan
- Using feedback from customers, stakeholders, regulators and internal colleagues
- Aligning with neighbouring water company plans

We sequentially applied each factor in an individual model run so the impact of each stage is explicit in how it shaped the plan. These iterations, shown in Figure 66, enabled us to adjust the initial most likely scenario to maximise best value planning objectives. This refined supply scenario is referred to as our preferred most likely scenario.

We also consider the environment and society as we want to ensure our plan delivers a protected and improved environment and provides benefit to society. We apply our strategic environmental assessment, biodiversity net gain and natural capital assessments in our best value planning framework to assess and compare all our plans.

Figure 66 Schematic of the iterations to shape plan using feedback from engagement

We have also explored developing a plan which emphasises our environmental objective to 'Deliver long-term environmental improvement' to understand the trade-offs. This resulted in our best for the environment (abstraction) scenario which is based on the following supply impacts:

- The highest environmental destination scenario of Enhance, to be implemented by 2035
- Capping abstraction licences on the basis of scenario four: time limited licences reduced to average recent actual by 2029, all permanent licences by 2035.
- Increase drought resilience to 1 in 500 years by 2039

9.7 Best value planning iterations

The iterations used to form our best value plan, as shown in Figure 66, are detailed below.

1. **Reflect the regional plan**

- The preferred demand strategy used in model.
- Fens and South Lincolnshire reservoirs as 'must do's' in model with timing unconstrained.
- All other supply-side options unconstrained.

The Fens reservoir was selected in 2035, triggered by capping abstraction licences to recent actual average and environmental destination. South Lincolnshire Reservoir comes in 2039, aligned to the timing of enhanced drought resilience to 1 in 500 years.

2. **Remove high risk options**

- Workshops with the Environment Agency and Natural England identified several supply-side options which could potentially have a high risk of causing environmental impact.

Options with potentially high risk of causing environmental impact were removed from this version of the modelling but not the feasible options set. If we believe some of these higher risk options provide better value, they will be investigated further.

3. **Maximise low-regret investment**

- There is uncertainty with the location and scale of environmental destination.
- Regional planning concluded there would be a series of WINEP investigations between 2025 and 2030 to determine the required locations and scale of reductions.

Environmental destination (and associated new resource options) delayed to 2040 to allow outcomes of WINEP investigations to inform the plan.

4. **Maximise utilisation of surplus resource**

- Construction of new resource options can provide an initial surplus until full utilisation is required later in the planning period.
- Customers and stakeholders informed us we should seek to utilise all surplus resource and look for opportunities to accelerate licence reductions.

Delaying 1 in 500 year drought resilience in Ruthamford North and South by a year creates a surplus in Fenland (from Fens Reservoir). This surplus could be used for five years to meet other supply reductions earlier.

5. **Deliver environmental destination earlier**

- Customers have told us we should choose to deliver environmental destination supply reductions in preference to enhanced drought resilience.

We have used the surplus water from step four to deliver environmental destination in some of our Norfolk zones, which are known for environmental sensitivity.

6. **Integrate desalination options into existing network**

- We have engaged with the Drinking Water Inspectorate and companies with desalination experience to understand potential water quality issues with introducing desalinated water into our existing networks.
- We also consulted with our wider business to gain a perspective on whether it would be easier to integrate more smaller desalination plants into our network or fewer larger plants.

Smaller desalination plants with an approximate capacity of 50% of a WRZ were deemed most suitable and implemented in the model so they can blend with existing waters.

7. **Align with other water companies**

- We have been working closely with other water companies to ensure our strategies are aligned.
- Essex & Suffolk's modelling often selects Lowestoft reuse which is closer to their demand zone than our Norwich demand zone.

Lowestoft reuse was removed from our model.

8. **Water reuse in preference to other new resource options**

- Customer engagement showed a preference for developing water reuse options rather than desalination as they feel it is making the best use of existing resources.
- Colchester reuse is the most-cost effective water reuse option as it makes use of existing capacity at the water treatment works.

Colchester reuse selected in model for 2032.

9. **Further options to deliver environmental destination earlier**
    - Bringing forward Colchester reuse to 2032 means we have additional surplus water.

Environmental destination brought forward in Ruthamford South (with flexibility to change locations once WINEP investigations are concluded).

10. **Least cost plan to deliver the preferred scenario**

- Model run with the preferred most likely scenario (enhanced drought resilience by 2039/40 for everywhere apart from Ruthamford North and South in 2040/41, scenario 4 sustainability reductions, medium climate change and environmental destination of BAU+ starting in 2040 everywhere apart from specific WRZs).

Least cost plan for preferred most likely scenario produced.

9.8 Plans taken forward to best value framework assessment

To select our best value plan, we use our best value planning framework to assess the four alternative plans, these are:

- Plan A: Initial least cost plan based on the initial most likely scenario (as detailed in Section 9.5)
- Plan B: Alternative plan based on preferred most likely scenario (as detailed in Section 9.6, stage 9)
- Plan C: Least cost plan based on preferred most likely scenario (detailed in Section 9.6, stage 10)
- Plan D: Least cost plan based on best for environment (abstraction) scenario (detailed in Section 9.6)

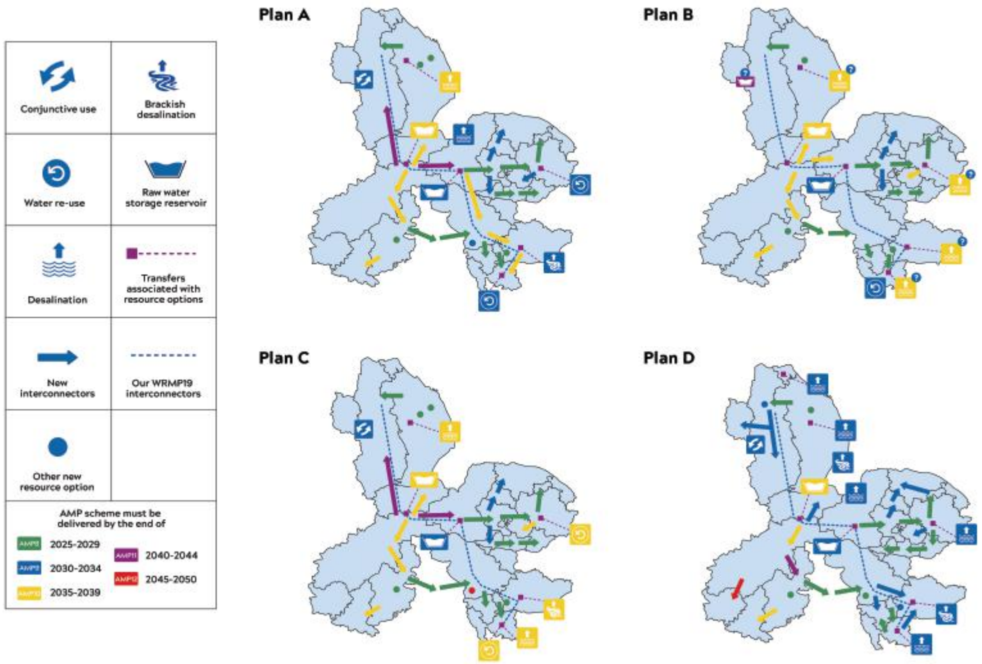
The alternative plans are based on three scenarios. The scenarios present different timing and scales of abstraction reduction.

- **Initial most likely:** This is based on achieving BAU+ environmental destination starting in 2035 and profiled over time by prioritising the most sensitive areas of our region. However, by delivering large reductions early, opportunities for the plan to be adapted based on the outcome of WINEP investigations are limited. In this scenario we achieve 1 in 500 years drought resilience by 2039.
- **Best for the environment (abstraction)**: The largest level of environmental destination reductions based on the Enhance scenario are met as early as possible within the planning period. This prevents the ability for the plan to be adjusted to suit the outcomes from WINEP investigations. Drought resilience to 1 in 500 years is achieved in 2039.
- **Preferred most likely**: Based on BAU+ this scenario profiles the reductions to allow the later part of the plan to be informed by the

WINEP investigations. It maximises opportunities to utilise early surplus within the plan to deliver environmental destination reductions in the most sensitive areas. To enable these earlier reductions, we must delay drought resilience to 1in 500 years by one year to 2040. This scenario has been shaped by our customer and stakeholder engagement.

9.8.1 The supply-side plans

Figure 67 Four plans taken forward to best value framework assessment



We have developed the route of one of our transfer options to go via Cambridge Water's system. This link will allow us to support Cambridge Water ahead of Fens reservoir being available, using spare capacity within the new transfer. This would be dependent on developing a new drought permit/curve at our Ruthamford South surface water treatment works in AMP8 to support the transfer.

9.9 Sensitivity testing

For the sensitivity testing we explore what happens if the assumptions put into our model change. This produces a new least cost version for each scenario based on the different input data which we compare against the original least cost plan.

We model changes to the following components,

- Supply forecast
- Demand forecast
- Options - supply-side and demand
- Planning factors including risk profiles

The sensitivity runs are based on the preferred most likely scenario and therefore are assessed against Plan C, which is the least cost version of this scenario. We only change one element of the preferred most likely scenario in each run as this ensures we can understand the impact of that change in assumption.

As our sensitivity analysis aims to identify tipping points in our plan, it focuses on the options selected, supply-demand balance and associated cost, rather than the full suite of best value planning criteria.

Conclusions

- Varying the climate change scenario does not significantly impact the plan. WRMP19 included the large step change of historical climate change. In WRMP24, the climate change impact has been recalculated to the base year of 1990, following updated guidance and data, and is assessed with and without severe and extreme droughts. As a result, we are only looking at future impacts which are relatively small in comparison to the other supply reductions, drought resilience, licence capping and environmental destination.
- All plans need an element of desalination capacity. When we excluded desalination there were insufficient alternative options to meet the need. The reservoirs options could be replaced with desalination but at considerably higher opex. The fact that desalination is scalable makes this a very adaptable option that can be sized to meet the need.
- If the strategic resource options (Fens and South Lincolnshire reservoirs) were delivered later than planned, an alternative new resource would be required temporarily, this could be achieved by focussing further on our demand management strategy, ensuring that we are gaining maximum water efficiencies.
- Extending the length of the planning period from 25 years to 50 years has the following impacts:
  - For least cost plans Plan A and Plan C, larger desalination options are developed earlier on in the plan.
  - Plan B remains stable when extending the horizon, it just builds upon the existing 25 year plan. From 2055 smaller transfers (10Ml/d) are added to the network, along with an additional water reuse scheme (14Ml/d) and desalination (50Ml/d).
  - Plan D remains almost identical over the longer planning horizon, due to the fact that all of the need is met by 2039 with only one additional transfer option needed in 2063.

  Please refer to the WRMP24 Decision Making technical supporting document for further information.

9.10 Stress testing and least worst regrets analysis

We also conducted stress testing and least worst regrets analysis to ensure our plans were robust for the long-term.

9.10.1 Stress testing

The stress testing establishes how stable plans are or if an adaptive approach is more suitable. We use this stage to understand if we commit to investing in new options in the early years of the plan, will our plan be adaptable if the future varies from our original forecast. These options are modelled as fixed/‘must do’ in our stress testing runs, the model is then free to choose the options later in the plan to meet the various scenarios.

The scenarios we use to stress test the plans include the eight Ofwat common reference scenarios, plus others we have developed to test particular areas of plans.

For the stress testing we only change the relevant element of the model input data, this ensures we can clearly understand the impact of varying individual assumptions.

9.10.2 Least worst regret

We use least worst regret analysis as a tool to minimise regret across all scenarios analysed, where regret can be considered as the difference between a decision and the optimal decision.

We use this method to assess if we commit to the options required at the start of each plan and the future varies, how much additional investment is required to meet the future need. We then identify the plan with the minimum additional spend (the optimal decision) and compare against the other plans. The plan with the least regret is the version that requires the lowest additional spend compared to the other plans.

9.10.3 Conclusions

The stress testing shows that the largest variation is the deficit caused by environmental destination. Our preferred most likely scenario has been developed to be adaptive to the level and location of environmental destination by delaying most of the reductions to allow the WINEP investigations to inform the plan, whilst prioritising those is the most sensitive areas.

All the plans include the SRO reservoir options which, through the regional plan, have been identified as the most robust and low regret options. However, Plans A and D require desalination capacity to meet the earlier supply reductions which makes the South Lincolnshire reservoir an additional or ‘top up’ option to meet the needs of environmental destination.

For Plan A most of the low or benign scenarios, such as low climate change or growth, fall within the reservoir capacity and therefore there is a risk that if these scenarios were to occur, we may have surplus resource. Plan D is more severe where the South Lincolnshire reservoir capacity is only required to meet the most extreme scenario of Enhance environmental destination.

Plans B and C are both based on the preferred most likely scenario which shifts the preference to deliver reservoirs earlier to meet the more certain need and builds desalination later in 2040.

Desalination is the most adaptive option where the scale and location can be adjusted to meet the need once confirmed through the WINEP investigations. This is also reflected in the least worse regret analysis which shows Plans B and C having the least regret.

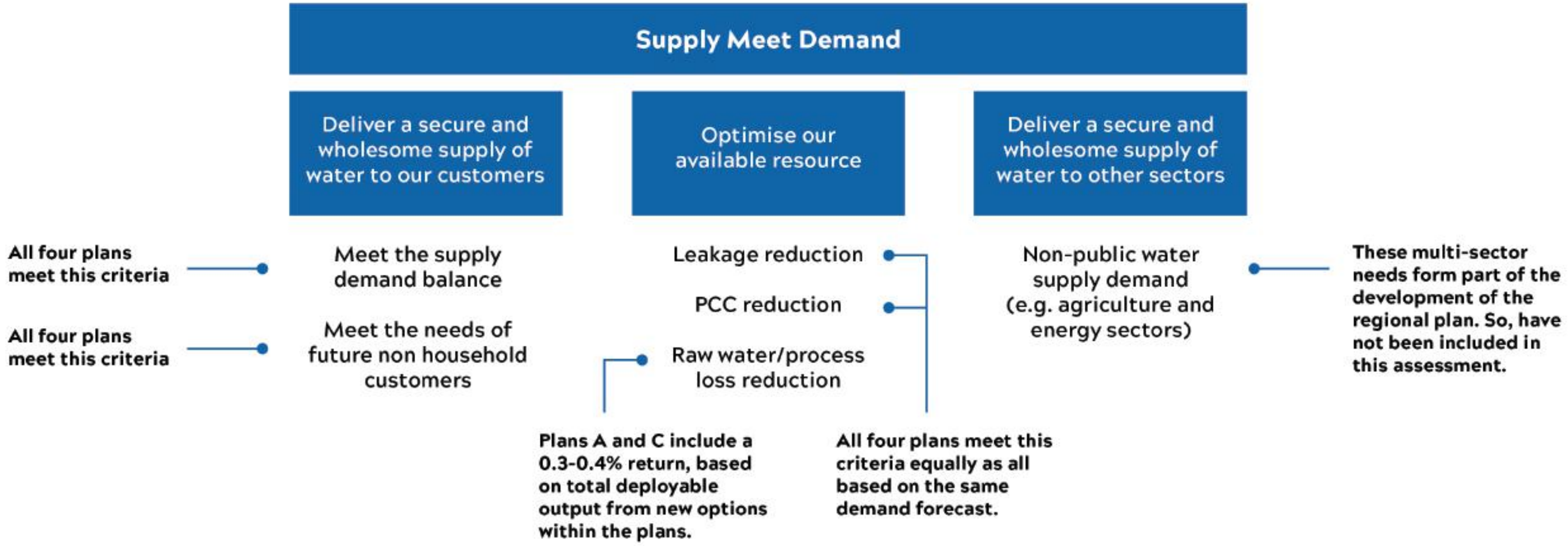
Plan D has the highest portfolio costs across all scenarios. When compared to the minimum cost required to resolve the stress test scenarios, Plan D has the greatest overall ‘regret’ at £1.84bn. Therefore, Plan D is the worst performing on this metric.

Plans B and C are the best performing, with a worst regret of £0.1bn for Plan C, and £0.28 bn for Plan B. The main difference between these plans is that Plan C has a less constrained options set to select from. This contains the more cost-effective but higher risk environmental options such as brackish desalination.

9.11 Applying the best value plan framework

After carrying out stress and sensitivity testing, we then applied the best value framework to the four alternative plans. The performance against our objectives is summarised below. Further detail is available in the WRMP24 Decision Making technical supporting document.

9.11.1 Outcome: supply meets demand



- All four plans meet our Levels of Service criteria, ensuring the supply demand balance is maintained.
- All of the plans are based on the Extended Plus demand management portfolio, which meets the needs of future household customers. It also achieves leakage reduction of 23.7% from a 2017/18 baseline and a PCC reduction to 110 l/h/d by 2050, from 136 l/h/d currently.
- There is a small reduction in raw water/process loss reduction in Plans A and C due to supernatant return supply-side options.
- We have not included any future demand for non-public water supply as these multi-sector needs form part of the development of the regional plan.

9.11.2 A plan that is affordable and sustainable over the long-term

A best value plan should be efficient and affordable with distributional impacts, as well as societal and intergenerational equity.

We use the cost of all the options within each plan to assess how they perform against our objective to create a plan that is affordable and sustainable over the long term. We include both the capital costs needed to construct the options and the costs to operate the options over the planning period of 25 years. We combine these to evaluate the total investment costs, known as total expenditure.

We also consider both the total and the distribution of expenditure across the five AMPs in the 25-year planning period. All the plans contain the same demand management activities and as such the costs for these have not been included in this stage of the assessment.

Fair charges, fair returns

A plan that is affordable and sustainable over the long term

Programme cost

Total expenditure

Plan D has the highest total expenditure as it delivers greater abstraction reductions and therefore requires more investment to develop new resources to offset this.

Plan B and C have similar total expenditure, with Plan C having slightly lower operating costs due to having brackish rather than seawater desalination.

AMP expenditure profile

Plans A and D have significantly higher costs in AMP9.

The AMP expenditure profiles for plans B and C are similar.
All plans require similar expenditure in AMP8.

Bill increases

Plan D creates a significantly higher bill increase compared to the other plans.

Plans A and D require larger bill increases towards the start of the planning period which reflects the higher expenditure needed in AMP9 to meet earlier supply reductions.

Intergenerational equity

In average household bill terms, customers in the early period of the planning horizon are expected to pay significantly less than those later on in the plan once infrastructure has been constructed.

This is consistent with the greater benefits in terms of sustainable abstraction, drought resilience and recreation and amenity opportunities that would be available for customers later in the plan.

We have also looked at how each plan will contribute to future customer bills. We have completed this using Ofwat's guidance to develop our calculation of long-term bill impacts[21]. For our analysis, we have forecasted the average bill increases per household over a period of 50 years, reflecting that the capital cost elements within our options will be subject to long-term financing arrangements. It is important to note that the bill increase metric does not represent an absolute bill increase.

When we consider costs, we do this within the context of intergenerational equity. This is the concept of fairness between generations, where meeting today's requirements must not compromise the ability for future generations to meet their needs. But intergenerational equity is more than just cost and we consider this concept when comparing other metrics such as the environmental ones, timing of impacts, adaptability and carbon.

Further detail can be found in our WRMP24 Decision Making technical supporting document.

9.11.3 Outcome: Flourishing Environment

One of our key objectives of our WRMP24 is to deliver long-term environmental improvement. The four plans offer different scales and timing of environmental improvement by reducing abstraction. Plan D is based on providing the greatest level of this improvement (Enhance) as soon as possible.

We have also assessed the plan by using the results of our SEA assessment. This assesses all the supply-side options and provides scores that reflect the construction and operational negative and positive impacts.

It was important to us that our plan contributes to, as well as enhances, the natural environment. This could be achieved by providing opportunities for biodiversity net gain and enhancement. We can achieve this through either increasing the amount of biodiversity habitats or improving existing habitats through better management. We have used the number of habitat units predicted to require restoration as an indication of the scale of investment needed to meet the biodiversity net gain targets. Therefore, portfolios requiring more biodiversity restoration perform less well than those requiring less.

It should be noted that the requirements set out in the Environment Act, the secondary legislation for which is expected to come into force in autumn 2023, will mean that all supply options delivered during the planning period will need to deliver 10% biodiversity net gain.

We have also considered ecosystem services, based on a monetised quantification of the ecosystem services such as food production, carbon storage, natural hazard management and air pollution removal.

Carbon reduction is also at the heart of our decision making. The Government has committed to reducing greenhouse gas emissions to net zero by 2050. We, along with our fellow water companies, have committed to net zero operational carbon by 2030.

To understand the carbon impacts of our plan, we have considered both the carbon associated with the construction of new options, known as capital carbon, and that which is produced during operational activities, known as operational carbon. The numbers we have used are calculated using current carbon emission factors.

21 Ofwat (2022) PR24 and beyond: Final guidance on long-term delivery strategies (https://www.ofwat.gov.uk/wp-content/uploads/2022/04/PR24-and-beyond-Final-guidance-on-long-term-delivery-strategies_Pr24.pdf)

Deliver long-term environmental improvement

Strategic Environmental Assessment (SEA)

The positive benefits for both construction and operational are similar for all plans.

The biggest difference is the negative impacts where Plan D performs worse, followed by Plan A.

Natural Capital

All of our plans show a negative natural capital impact as water resource supply options are typically constructed on farm land, requiring a land use change away from food production.

The benefits associated with the potential irrigation support being discussed with stakeholders on the SRO projects has not been included in this assessment.

Biodiversity

Plan D and Plan A require the most habitat units to be restored.

Plan B requires the least amount of habitat to be restored.

Abstraction reduction

Plan D provides the greatest level of environmental improvement (equivalent to environmental destination scenario of Enhance), and delivers it as soon as possible.

The other plans deliver the same level of abstraction reduction (equivalent to BAU+).

Carbon

Plan D has the highest operational and capital carbon.

Plan C has the lowest operational and capital carbon followed closely by Plan B.

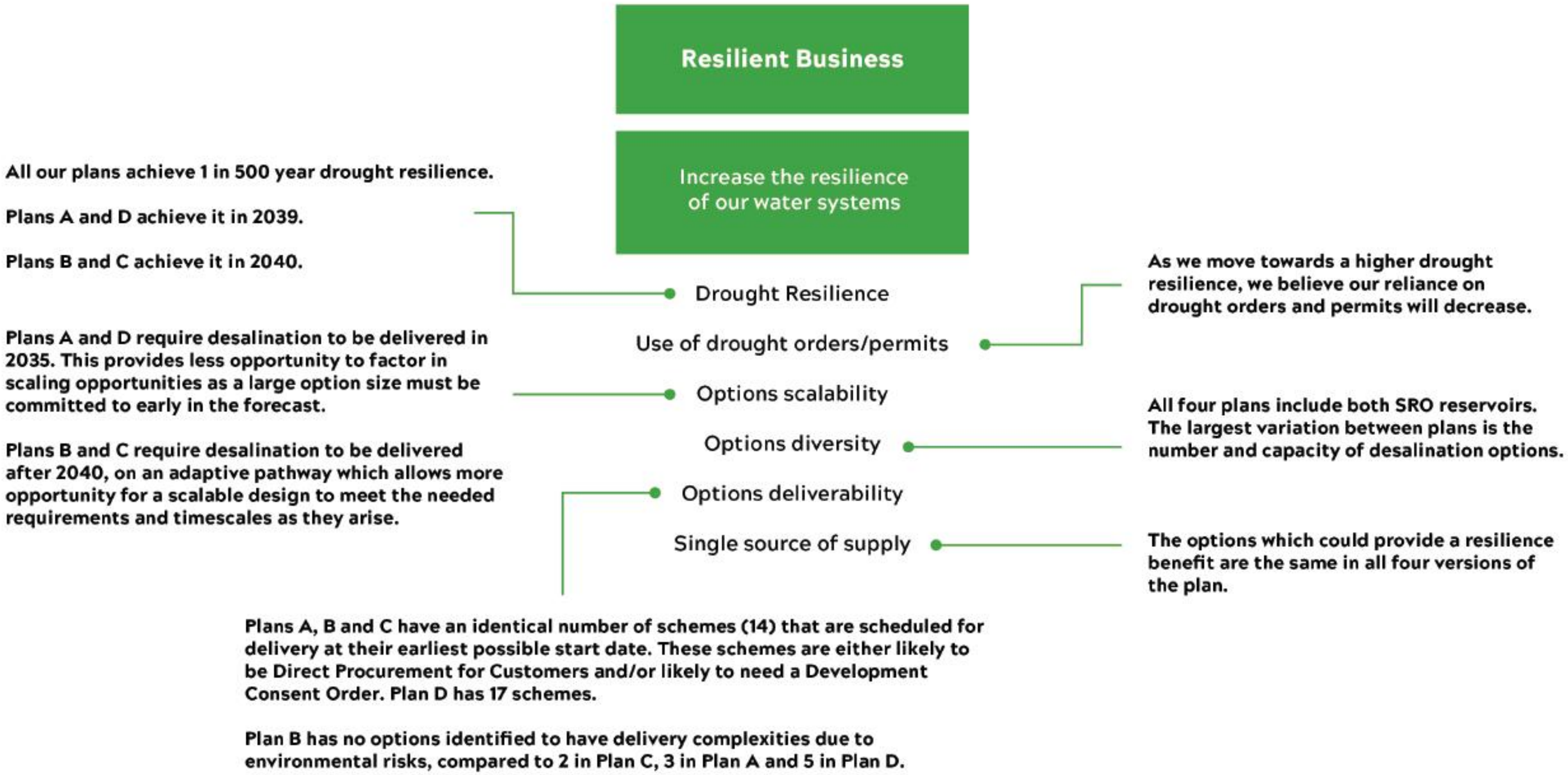
Plan B has the lowest operational carbon profile at the start of plan and would require less energy from renewables up to 2040.

9.11.4 Outcome: Resilient Business

To ensure our WRMP24 is resilient, we modelled how we should achieve 1 in 500 year drought resilience. We engaged heavily on this with our customers, with them telling us 2039 felt right.

We also considered the type of options in each plan. The Fens and South Lincolnshire reservoirs were present in both but the amount of desalination varied, which effects how scalable the plan is.

We also considered how deliverable the plan is, taking into consideration if the option was likely to be subject to Direct Procurement for Customers or Development Consent Orders.



9.11.5 Outcome: Positive Impact on Communities

We want to make a difference to the communities in our region. We can do this by listening to our customers' preference, whether that be through targeted engagement or by our business as usual communications. We feel that we have listened to our customers and stakeholders and tailored our plan to their preferences. Where we haven't, we have explained why.

We appreciate that we can provide significant mental and physical wellbeing benefits to our customers, whether through reservoir facilities or by ensuring a safe, resilient supply of water.

We also appreciate that our region is prone to flooding and we already work with partners to try and alleviate it. We will continue this work.

Positive impact on communities

A plan that supports the views of stakeholders and customers and is not detrimental to social wellbeing

Customer preference

One to one stakeholder engagement and workshops have been held.

At one of these workshops, several options were identified as potentially having a high risk of causing environmental impact. These options remain technically feasible but there is a chance they could not be promotable due to environmental risks. For Plan B, we removed these options.

Please refer to Table 8 for customer engagement.

Social capital/wellbeing

Recreation and amenity benefits are mainly associated with the reservoir options only, which have the possibility of providing multiple opportunities for benefits.

All plans have a net positive benefit, with Plan A and Plan D having slightly higher overall recreational.

Plan B is the only plan to not include Orwell desalination, so avoids the small recreation disbenefit associated with it.

A plan which enables a reduction in flood risk to communities

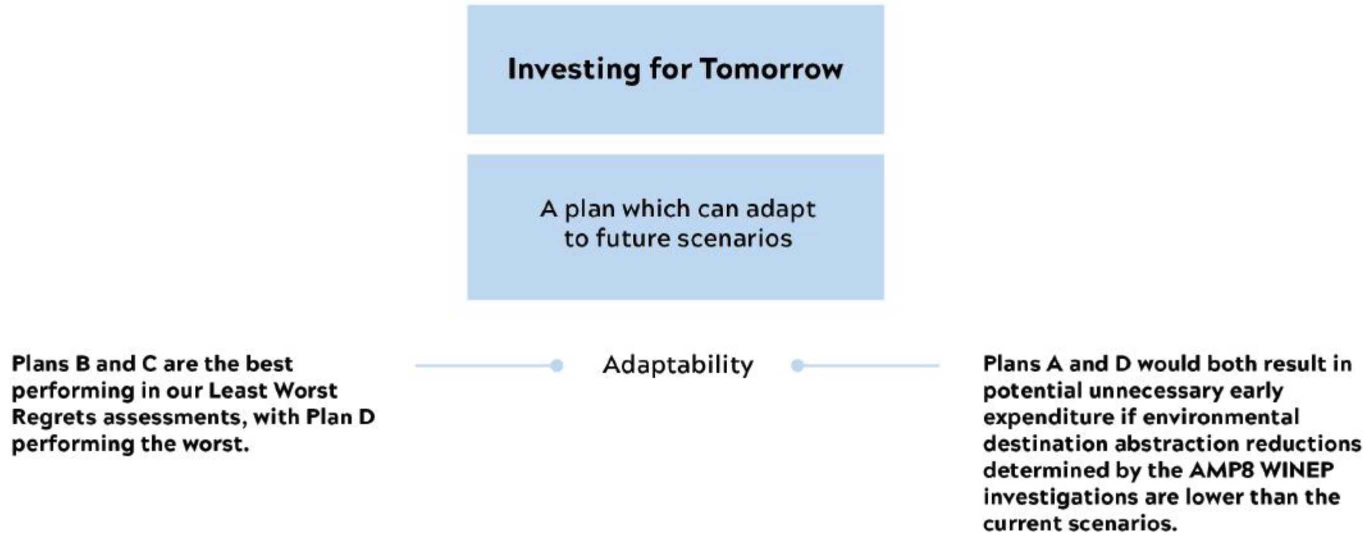
Storage volume

Both the SROs have flood alleviation opportunities. These are still being appraised so have not been included in this assessment.

9.11.6 Outcome: Investing for Tomorrow

We know that the social and political climate changes rapidly, as seen with the recent pandemic and soaring cost of living. So, we don't want to get tied into a plan that cannot adapt to these changes. We must build in this flexibility and, for those options we need to develop over long timeframe, we need to ensure they are low regret options.

We have conducted analysis using Ofwat's common reference scenarios as a guideline. We have also completed least worst regrets analysis.



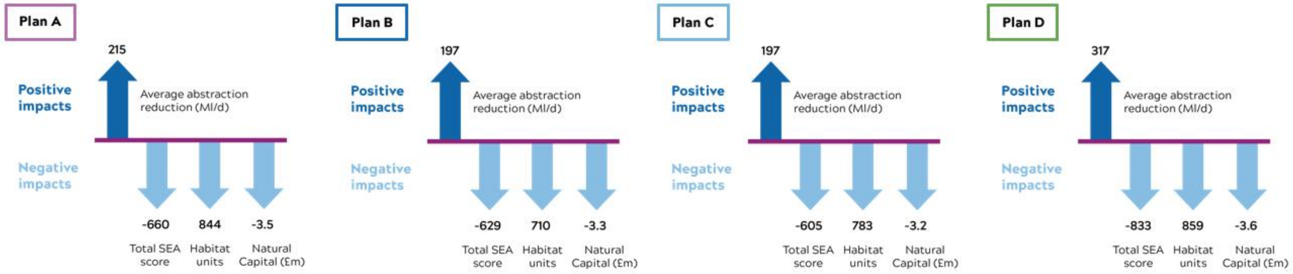
9.12 Trade-offs

The assessment has highlighted key trade-offs where one criterion may perform well at the expense of another.

9.12.1 Average annual abstraction against environmental metrics

The scale and timing of environmental destination affects the environmental metrics as the less you abstract, the more you need to build to ensure secure water supplies. This is shown in Figure 68.

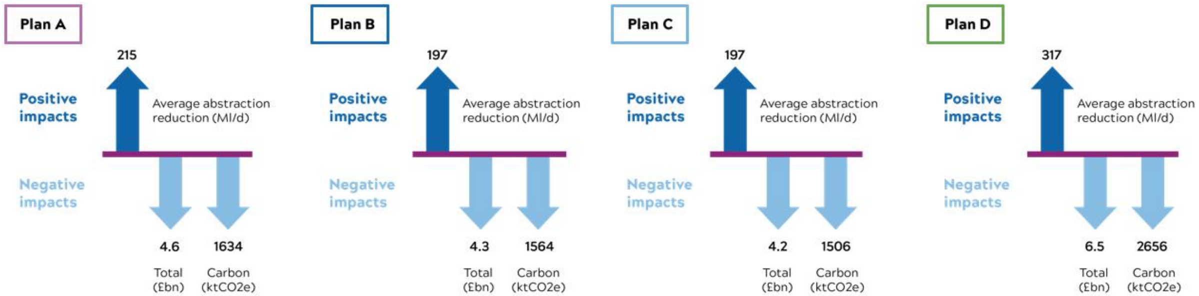
Figure 68 Average annual abstraction against environmental metrics



9.12.2 Average annual abstraction against cost and carbon metrics

Delivering environmental destination earlier requires plans to contain more desalination or water reuse options, as these are the only larger scale new resource options available. This results in higher operational costs over a longer period within the planning horizon, increasing operational cost, carbon and creates higher total expenditure. This trade-off is demonstrated in Figure 69, where Plan D provides greatest abstraction reductions but also has the highest total investment and whole life carbon.

Figure 69 Average annual abstraction against cost and carbon metrics



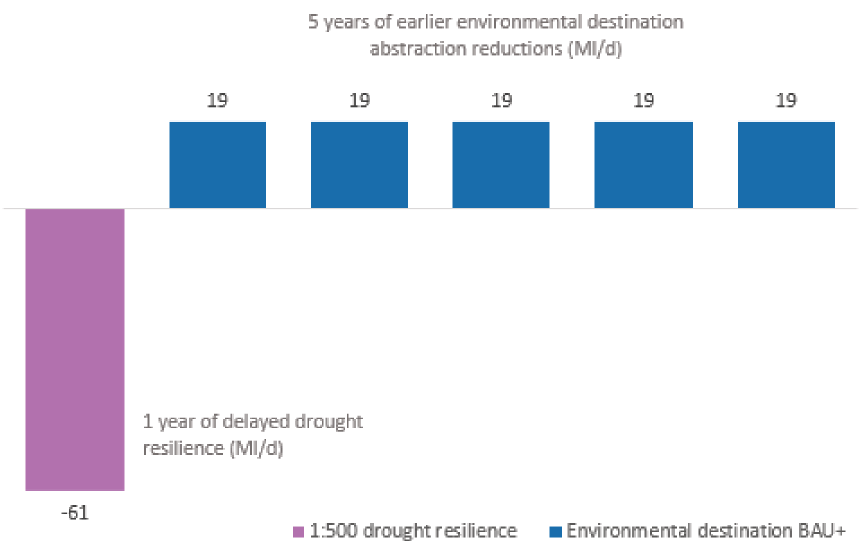
Achieving the larger scale of environmental destination, requires more alternative resources to be developed to off-set the resource lost. This increases capital costs and carbon, which creates the highest total expenditure, see Figure 69. This trade-off is also reflected in Figure 68 where Plan D based on the Enhance scenario performs worse on all the environmental metrics as well as cost and carbon.

On balance Plans B and C perform best when considering these trade-offs.

9.12.3 Delivering drought resilience later to enable environmental destination to occur sooner

Another trade-off is whether to use the initial surplus from the larger new resource options to deliver increased drought resilience to 1 in 500 years earlier or use this to achieve environmental destination sooner. Through the iterations to develop Plan B and C we took this further and assessed the choice of delaying drought resilience by one year to enable abstraction reductions to be brought forward by five years. See Figure 70.

Figure 70 Delaying drought resilience to enable environmental destination earlier



Our preferred most likely scenario delays drought resilience in two of our water resource zones to enable efficient use of surplus resource to meet environmental destination needs. This scenario, used for Plans B and C, was shaped by our customer and stakeholder engagement, where customers state that they feel drought resilience by 2039 was about the right timescale but their preference is to deliver environmental improvements earlier. This scenario delays the need for the South Lincolnshire reservoir by one year.

9.13 The Best Value Plan

Our WRMP24 must maintain the **supply demand balance** without any final planning deficits. Therefore, we discount any plans which do not meet the supply demand balance. All four of the plans meet this criteria. The plans also meet the demand criteria equally as they are all based on the same demand forecast, the Extended Plus demand management portfolio.

We have considered drought **resilience** in the trade-off discussion, but this outcome also includes resilience associated with the supply-side options in terms of delivery and diversity. All four plans include both SRO reservoirs. The largest variation between plans is the number and capacity of desalination options. Desalination is the best option in terms of scalability to match the need. However, there must be adequate time for the WINEP investigations to inform the scale of the need before we commit to constructing new assets. This is the basis of our preferred most likely scenario and therefore Plans B and C perform best for this criteria.

We also assess the **delivery risk** of plans; we base this on the number of options required on the earliest available date they could be delivered by. Plans A, B and C all share the risk. However, one of the iterations for developing Plan B involved removing the options with higher environmental risk, therefore overall Plan B performs best. These options were identified as potentially having a high risk of causing environmental impact through a series of workshops with stakeholders including Natural England and the Environment Agency. These high risk options included brackish desalination options, where abstraction and brine discharge are some distance up an estuary / river, posing more potential of having unresolvable environmental impacts than equivalent marine versions. The options are technically feasible and have not been removed from the feasible options set, but there is a chance that they would not be promotable due to the environmental risks. Therefore, overall Plan B performs best.

All the plans include the SRO reservoirs which provide the largest net **positive impact on communities.** Plan B performs slightly better as this is the only plan that does not contain a higher risk environmental option that has a negative impact for this metric, therefore Plan B performs best.

We consider how adaptive the plans are for the **investing for tomorrow** objective. All the plans include the strategic resource options reservoirs, which through the regional plan have been identified as the most robust and low regret options. Plans B and C are both based on the preferred most likely scenario which delivers reservoirs first to meet the more certain need and builds desalination later in 2040. Desalination is the most adaptive option where the scale and location can be adjusted to meet the need once confirmed through the WINEP investigations. Plans B and C are based on the preferred most likely scenario and therefore perform best.

All plans align with the concept of **intergenerational equity**, in that their financial costs correspond to the timings where benefits such as reductions in unsustainable abstractions, 1 in 500 year drought resilience and recreation and amenity benefits are enabled. Plans B is best for intergenerational equity, as it reduces the possibility of customers funding assets with less certain benefits. For example, desalination options which might not be required depending on the outcome of AMP8 WINEP investigations and options which our key stakeholders have advised may not be feasible.

Based on the evidence of our best value planning assessment, Plan B offers best value for our customers and stakeholders whilst providing benefits to society and protection to the environment.

9.14 Why is Plan B our Best Value Plan?

We believe that Plan B is our best value plan. It:

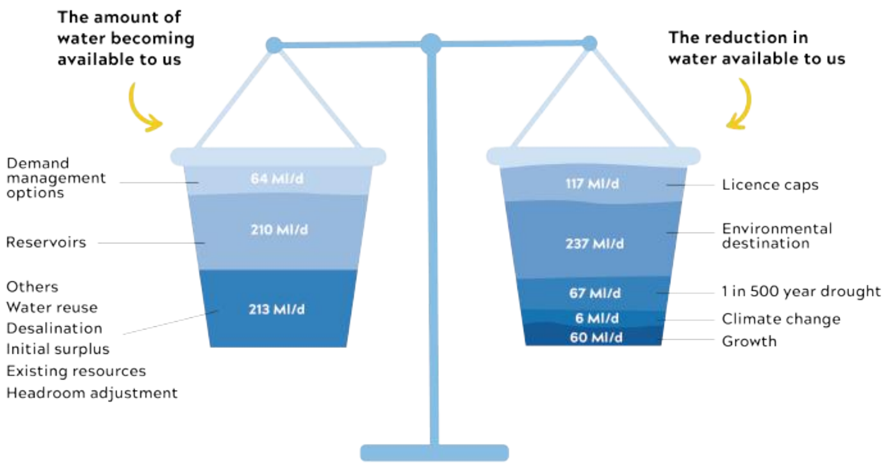
- Delivers a secure and wholesome supply of water to our customers, ensuring a supply demand balance without any final planning deficits.
- Optimises our available resource.
- Meets our BAU+ environmental destination scenario.
- Allows the WINEP investigations to inform the environmental destination strategy, ensuring efficient costs, carbon and environmental metrics later in the plan when there is the greatest uncertainty.
- Does not contain higher risk environmental options which may be difficult to promote, unlike Plan C.
- Meets enhanced drought resilience to 1 in 500 years in 2039 but delays some areas until 2040, as we will use surplus water for environmental improvements
- Plans for two reservoirs, which provide the largest net positive impact on communities
- Takes advantage of the scalability of desalination, allowing flexibility for future challenges
- Is shaped by customer engagement, reflected in Table 18.

Table 18 Customer preference

Outcome	Key insights from customers and stakeholders engagement	Plan A	Plan B	Plan C	Plan D	Comments
Flourishing environment	We need to achieve our environmental targets as they are crucial for the future of the planet.	✓	✓	✓	✓	All the plans include abstractions reductions for environmental destination.
	The environmental destination of BAU+ is the preferential scenario at present. This view is driven by financial security and concerns over affordability.	✓	✓	✓	✓	Plans A, B and C are based on BAU+ and Plan D is Enhance. Plan A delivers BAU+ earlier but at greater cost.
	The majority feel we should achieve our environmental destination sooner than 2050.	✓	✓	✓	✓	All the plans deliver environmental destination earlier than 2050. Plans A and D deliver the biggest benefits earliest in the planning period.
Resilient business	Our levels of service for temporary use bans and non-essential use bans are acceptable. However, they did welcome moving to a higher level of severe drought resilience.	✓	✓	✓	✓	All the plans achieve 1:500 drought
	Achieving higher level of severe drought resilience by 2039 was largely seen as the right time scale by our customers.	✓	✓	✓	✓	The plans deliver drought resilience by 2039 or 2040.
	Making the most of what we have remains a priority with demand management measures being seen as the preferential way of tackling deficits.	✓	✓	✓	✓	All the plans include our preferred demand management options.
	Reservoirs and water reuse were the most preferred supply-side options.	✓	✓	✓	✓	All the plans include both reservoir options. Plans B and C include a water reuse early in the plan. Plan A contains desalination options early and water reuse. Plan D is all desalination and no water reuse.
Fair charges, fair returns	Customers support the principle of a best value plan, but there is a core desire from customers for bills to be fair and affordable	✓	✓	✓	✓	Plans A and D are more expensive to deliver and will have greatest impact on customer bills. Plans B and C provide the best balance of cost verses environmental improvements.

✓ Plan achieves customer preference	✓ Plan meets customer preference but is not best performing plan	✓ Plan partially meets customer preference but is worse performing plan

9.15 The impact of Plan B



9.16 Adaptive Plan

Our testing for uncertainty has shown that the most significant areas to consider for creating an adaptive plan are:

- Large range in deficit within the medium term due to the scale and location of environmental destination.
- The WINEP investigations at the start of the period will provide clarity on the level of environmental destination.
- We cannot deliver a plan without any desalination, as there are not adequate alternative resource options.
- Desalination is scalable and can be sized up or down to meet the need once the deficit has been confirmed.
- The SROs are triggered by supply reductions; Fens is needed to meet capping permanent licences to average and South Lincolnshire Reservoir is drought resilience and environmental destination.
- Due to the lead time of the reservoirs and the medium term impacts that drive the need for the SROs we need to commit to investment to further develop these at the start of the plan.
- If either of the reservoirs did not progress through a gate process, we would need to replace them with desalination and/or water reuse options.
- The modelling to generate alternatives shows that many of the options needed early in each of the four plans considered are consistent across plans.

Using these outputs from the testing uncertainty stage we have compiled an adaptive version of our preferred plan, Plan B.

9.16.1 Uncertainty, decision and trigger points

The biggest level of uncertainty is from the scale and location of environmental destination which will be confirmed by the WINEP investigations. The outputs from these studies will be available towards the end of AMP8 and will be used to inform WRMP29. This creates the following key points:

- **Decision point 1**: Scale and location of environmental destination
- **Trigger point 1**: Plan has to adapt to meet the outcome from decision point 1

We use these key points to develop pathways. At the trigger point pathways deviate from each other as either different sets of options or different scales/capacity of the same options are chosen based on the outcome of the decision point.

9.16.2 Pathways

An adaptive plan contains a core pathway and adaptive pathways.

Our core pathway is based on the investment we need to commit to in AMP8, this includes the SROs due to the length of time to plan, design and construct them. From our testing for uncertainty the options within Plan B's core pathway were selected in all MGA alternatives and across other plans too. The core pathway includes,

- Transfers needed in AMP8 to connect water resource zones to the WRMP19 interconnectors.
- Smaller options where we are making upgrades/improvements to maximise output from existing resources.

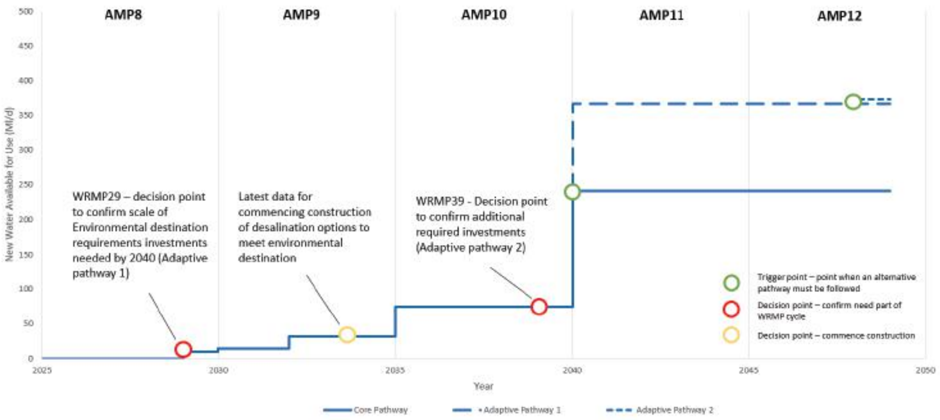
- A water reuse scheme required in AMP9, but development/design must start in AMP8.
- The two SROs, Fens and South Lincolnshire reservoirs.

These investments are required in all the stress testing scenarios, including the Ofwat reference scenarios.

The trigger point is 2040 when the large environmental destination reductions feature in our preferred most likely scenario. At this point we need to develop other new resource options that provide a supply benefit in addition to those in the core pathway. Our plan is based on desalination at this stage. Desalination is scalable and can be sized up or down to meet the need once the deficit has been confirmed at decision point 1 using the output form the WINEP investigations.

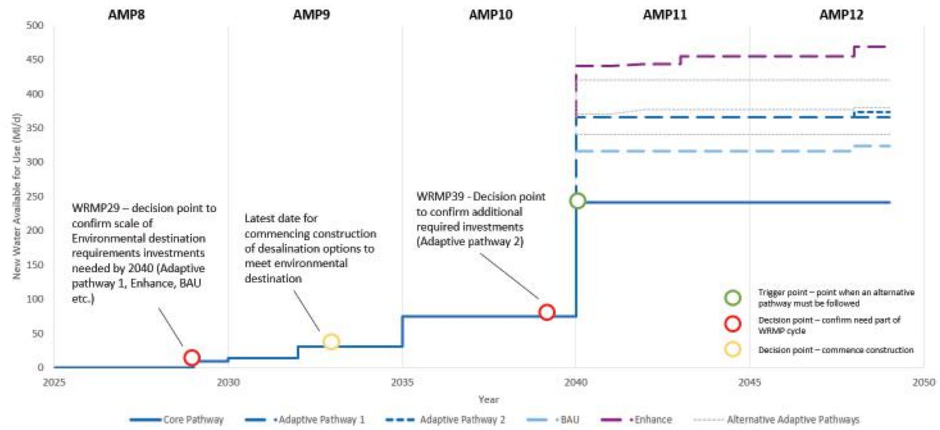
The adaptive pathway is triggered in 2040 and contains the desalination plants needed to meet environmental destination needs. The plan includes a small reservoir extension at our water treatment works in Lincolnshire in 2048, the need for this scheme will be confirmed as part of WRMP39. We have represented this last scheme as an alternative adaptive pathway. Figure 71 shows the pathways to meet the preferred most likely scenario.

Figure 71 Adaptive pathways for Plan B for preferred most likely scenario



We can also demonstrate how the plan would adapt to the range of scenarios tested, including the Ofwat reference scenarios. These are shown on Figure 72.

Figure 72 Adaptive pathways for Plan B showing all pathways for range of scenarios



For the pathways to meet the range of scenarios tested the trigger point remains in 2040 based on the output from the WINEP investigations at decision point 1.

9.16.3 Monitoring plan

We have developed a monitoring plan. This provides us with the information we need to make decisions on which future pathway we need to follow. Our monitoring uses some of the metrics developed in best value planning framework and allows us time to make decisions.

Though our plan is adaptive to future uncertainty it is relatively simple in terms of decision and trigger points. The decision points will form part of the five year cycle of water resource planning and feature in WRMP29 and WRMP34. This process will include updates to forecasts for external influences such as population growth and climate change.

The WINEP investigations in AMP8 will provide the clarity on the scale and location of environmental destination. The output from these will be captured in WRMP29.

We will continue to monitor and assess the effectiveness of demand management strategy throughout AMP8, the findings will be reflected in our WRMP29 update to the plan.

10 Environmental assessments

We need to be mindful that our future demand management and supply-side options, whether alone or combined across the plan (and other plans and programmes), have the potential to cause unintended environmental consequences. There is also opportunity to deliver wider enhancement.

We have undertaken a suite of assessments to help inform the development of our plan. These provide information on the likely environmental consequences, both positive and negative, from risks associated with potential new options to the predicted effects of the draft WRMP and alternatives to it.

This approach to our plan-making process is in line with the Environment Agency's National Planning Policy Framework and the WRPG. The environmental assessments undertaken alongside the development of our WRMP24 are:

- Strategic Environmental Assessment (SEA)
- Habitats Regulation Assessment (HRA)
- Water Framework Directive (WFD) assessment
- Invasive Non-Native Species (INNS) assessment
- Biodiversity Net Gain (BNG) assessment
- Natural Capital Approach via Ecosystem Services Assessment (NCA via ESS)

The suite of assessments and general methodological approach taken to this work also aligns with the approach that has been applied by WRE in the process they have termed as Integrated Environmental Assessment (IEA). This has been undertaken to deliver a consistent approach to the assessment and their findings to enable more efficient cross comparison between our WRMP and the Regional Plan.

The options assessed include supply-side options on the WRMP24 constrained list and portfolios of demand management options. WINEP options were also assessed. This ensured that all options being considered for inclusion in the WRMP24, or its alternatives, had been considered by the environmental assessments. Findings, whether as metrics or advice, have then been included in the decision making process.

These environmental assessments have been conducted independently by the consultancy Mott MacDonald, who also undertook the work on WRE's IEA. This is designed to further aid consistency in methodological application between the assessment of our WRMP plan-making process and that of the Regional Plan.

The following plans were assessed for their effects as a whole, and for cumulative effects:

- Draft WRMP24 (also known as the best value plan)
- Least cost
- Least cost best value
- Best for the Environment (reduced abstraction)

Figure 73 A six-spot burnet moth

A concise version of the approach to and findings of our environmental assessment process is set out in our Environmental Assessment Report Non-Technical Summary, alongside this document. Beyond this is a full suite of detailed reports, the primary document being the Draft WRMP's SEA Environmental Assessment Report, with three sub-reports related to the HRA, WFD, INNS and a final sub-report covering both BNG and NCA via ESS findings.

These reports, and their appendices, can be accessed at: anglianwater.co.uk/wrmp

10.1 Influence

We have used our environmental assessments to inform our decision-making process, as we have sought to avoid risks to the environment with our WRMP24. The assessments have fed into many stages including:

- Helping to shape our constrained list of supply-side options by applying a high-level environmental screening tool to options being considered for inclusion. This process highlighted where an option included undue direct interaction with sensitive environmental receptors leading to unacceptable environmental risks. The process also helped to provide advice to improve the environmental performance of supply options that were carried forward into the constrained list.
- Application of the six environmental assessments to the supply-side options on our constrained list. This provided information on the predicted environmental consequences of each option to understand their direct risks and where they could interact with other options being considered for inclusion in the plan. The process also outlined environmental mitigation needed to help avoid or reduce predicted negative environmental effects, allowing us to consider these in option design development and option costings.
- The SEA, BNG and NCA via ESS findings enabled the environmental assessment process to contribute environmental performance metrics into the tools and modelling that shaped the draft plan and its alternatives (least cost, least cost-BVP and best environment).
- Findings from the environmental assessment process have been used to aid discussions with statutory environmental bodies, including the Environment Agency, Natural England and Historic England to help contribute more local knowledge. The outcomes of these discussions combined with environmental assessment findings was also used to support decisions regarding appropriate combinations of options that helped define our draft WRMP.

10.2 Findings

Whilst a WRMP does not set out policy on environmental protection, as an organisation Anglian Water is committed to minimising the risks that our WRMP24 may pose to the environment, whether this be biodiversity, water, air, soil or the historic environment. We will also seek to maximise the benefits our plan, and its implementation, can co-deliver to the environment and communities.

Figure 74 Construction of our strategic pipeline

The WRMP must also maintain a supply-demand balance to 2050 and, as discussed in Section 8, demand management, although crucial, only forms part of the answer. Alongside those actions new supply-side infrastructure will be needed.

Figure 75 A solar array at one of our reservoirs

In any plan that is required to propose substantial new infrastructure, in our case water supply installations and transfer pipelines, it is not possible to avoid all risks to the environment from their construction and operation. As such, the environmental assessment findings identify where risk can be avoided or reduced for each new supply option we have considered and whether additional risks are likely to emerge when an option is combined with others to be included in a plan.

The results of our assessments show that **WRMP24 is likely to deliver reliable and sustainable water supplies that are flexible to cope with future changing growth and demand.**

Due to the substantial new infrastructure required to meet our demand and supply forecast, the SEA of the best value plan and reasonable alternatives show an overall potential negative effect of the options. However, due to the precautionary and high-level nature of the assessment, this allows us to ensure appropriate mitigation and enhancement can be applied in our future development of the options. Some strategic environmental assessment objectives show positive outcomes for the best value plan, including:

- the delivery of biodiversity net gains to our supply areas'
- increased availability and resilience of water supplies for human use
- increased availability of water within the natural environment thus increasing resilience, benefiting water dependent ecological sites, and maintaining an attractive natural landscape
- reducing the need for future water supply infrastructure, and
- allowing customers to understand their water usage.

Where negative effects were identified in the options assessment, these have been mitigated where possible through the options design process by re-routing pipelines or proposing the use of directional drilling under sensitive sites and rivers in the case of construction effects. Or, they have been investigated further through the HRA and WFD processes where the risk of operational effects are either identified or uncertain. The use of best practice construction methods has also been assumed to minimise any effects during the construction phase.

The SEA process undertook a qualitative assessment relating to greenhouse gas emissions, which identified all construction options had negative effects. In terms of operational effects, the energy needs associated with the need to abstract, treat and deliver public water supplies related to each option were considered to pose a negative risk, as the source of this energy and any associated emissions cannot currently be guaranteed.

It should be noted, however, that Anglian Water is planning to be Operational Net Zero by 2030, as such, the SEA's qualitative findings on greenhouse gas can be seen to present a precautionary finding to challenge us to meet our stated goals. A separate tool to consider quantified greenhouse gas emissions of options considered in the WRMP decision making process is already built into Anglian Water investment model (known as C55); as such, the environmental assessment process did not seek to duplicate this activity.

10.2.1 Biodiversity net gain

The overall effect of the draft WRMP is predicted to generate biodiversity net gain by increasing the habitat units across the region compared to the current baseline situation. This is driven by the proposed benefits of our new reservoirs, in particular the South Lincolnshire reservoir.

Figure 76 A family of Osprey

Other supply-side options included in the draft WRMP lead to localised losses but, in line with legislation and our commitment to improve the environment, we will deliver a 10% biodiversity net gain from all options included in the WRMP when development is predicted to lead to an initial loss of habitat units.

The need for such habitat replacement and net gain will not occur until individual schemes move forward to construction. At each design phase, each option will seek to avoid and reduce any such losses and maximise gains. Where biodiversity gain is still required we will seek to deliver this locally and integrate it with developing Local Nature Recovery Strategies to further enhance the overall biodiversity gains associated with the plan.

This will be guided by Systematic Conservation Planning (SCP). SCP has been used by WRE to develop a natural capital plan for Eastern England. It is a stakeholder led process which seeks to identify where natural capital action should be prioritised across the landscape in order to deliver positive outcomes for nature, water and society. The approach promotes managing nature in a holistic way, as it considers many different elements of natural capital at the same time, rather than separately in a piecemeal approach.

SCP has been used in the development of the South Lincolnshire reservoir.

10.2.2 Habitats Regulations Assessment and Water Framework Directive

The supply-side options included in our WRMP are at a strategic stage of their design, especially compared to the level of detail that would be required to enable a project to seek development consent, such as planning permission from a local authority. This means that in many cases it is not possible to rule out risks of direct or indirect impacts, to designated habitats within the National Site Network or to WFD water bodies, to the satisfaction of the precautionary principle applied within the related environmental regulations.

This relates to operational, and in some cases construction, risks from proposed supply options and in understanding the combined risk that multiple supply options could have either from those within the WRMP or with those included in other plans (such as the WRMPs of other water companies).

Where potential combined risks have been identified we have discussed them with other water companies, regional water resource planning bodies, and environmental regulators, especially noting locations where the operation of proposed supply schemes might collectively impact river, coastal and estuarine habitats. We are committed to continuing such discussions as the WRMP plan making process continues and, where found to be required, into the plan's implementation period. In terms of geographic areas, we have already recognised the potential for risks of combined effects in a number of locations, including:

- River Trent, in relation to combined risks both from options within our WRMP/its alternatives and with schemes that affect the Trent within Severn-Trent Water's draft WRMP, which we anticipate will include the Minworth SRO.

- Humber Estuary, in relation to combined risks both from options within our WRMP/its alternatives and with schemes that may pose risk to designated sites within the Humber estuary, including those with the forthcoming draft WRMPs of Severn Trent and Yorkshire Water.
- Southern North Sea Special Area of Conservation, in relation to combined risks both from options within our draft WRMP / its alternatives and with schemes that may pose risk to this designated site within Essex & Suffolk Water's draft WRMP.
- The Wash, in relation to protected sites and waters from combined risks potentially resulting from the SRO reservoir options within our WRMP / its alternatives, which are regionally important strategic schemes identified by WRE's Regional Plan. A separate study relating to the Gate Two RAPID submissions for the SRO reservoir options is currently underway to provide a better understanding of the potential combined effects of these options on the Wash.
- The Outer Thames Estuary Special Protection Area, in relation to combined risks both from options within our WRMP / its alternatives and there is the potential with schemes that may pose risk to this designated site that will be included within Essex and Suffolk Water's WRMP.

We recognize the depth and detail of this environmental assessment work will be revisited to both better understand these risks and seek to avoid them. The majority of these future investigations will link to the development of the detailed design of each option, with priority therefore focusing on schemes with planned delivery dates in the near term or those with long lead time to enable their implementation. This is likely to include new research and environmental data collection to build a strong evidence base that would ultimately support an application for planning permission or a Development Consent Order.

The findings set out in the HRA and WFD Reports that accompany the draft WRMP24 specify the particular aspects and activities of each option that requires further investigation in relation to specific aspects of the environment in a designated site or water body.

Where such cumulative and/or combined risks exist, we will work with the relevant parties and environmental bodies such as the Environment Agency and Natural England to define the scope and requirements to undertake what are likely to be more complex investigations.

10.2.3 In-combination risks

We also recognise that, in some cases, more than one option included within our plan poses risk to the same protected site and/or waterbody and in these cases in-combination risks are considered. Due to the strategic scale of assessment, we have had to assume that all such potential interactions from operational supply schemes carry a risk of likely significant effects, and thus will require more detailed investigation. In some cases, such as in relation to the river Trent and the protected habitats in the Humber Estuary, such in-combination risks also exist between our draft WRMP and future projects contained in other plans, for example Severn Trent's draft WRMP.

Where such cumulative and / or combined risks exist, we will work with the relevant parties and environmental stakeholders, including the Environment Agency and Natural England, to define the scope and requirements to undertake what are likely to be more complex investigations.

Figure 77 The River Trent

10.2.4 Likely significant effects

We recognise that our environmental assessment process has found the potential for likely significant effects risks across the larger scale supply options either to sites protected by the Habitats Regulations and / or water bodies protected by the Water Framework Directive. This included all reuse and desalination options identified on our constrained options list.

We could not have a presented a draft WRMP24 without including these supply-side options which we appreciate have an on-going uncertainty around their risk of resulting in likely significant effects to such protected natural assets.

10.2.5 Environment Agency and Natural England engagement

We have engaged with Natural England and the Environment Agency to exclude the selection of option types that were considered to have the most substantial risk of unresolvable likely significant effects to the National Site Network of protected habitats. This resulted in brackish desalination options being removed from the selection process for the BVP, as there are concerns that such confined locations would prove more difficult to resolve any risks related to the potential impact of operational brine discharge.

We will continue to engage closely with these bodies, as well as other local groups, to work through the results of the environmental assessments.

10.2.6 Further information

Further information can be found in our Environmental Assessment Report (EAR), and its related sub-reports, covering other positive and negative effects predicted to occur in relation to the proposals set out in our draft WRMP24. These reports also set out proposals for mitigation measures related to environmental impacts, which we are committed to delivering and have taken account of within our cost modelling in relation to the plan.

The findings of the environmental assessment are also available in a non-technical summary of the EAR, designed to provide a more accessible version of this detailed component of our plan-making process.

11 Our best value plan

- Our customers and stakeholders want us to make the most of the resource we have.
- We will do this by:
    - Implementing a comprehensive package of demand management options.
    - Achieving a record breaking per capita consumption of 110 litres per head and leakage reduction of 24% (2017/18 base-line).
    - Investing in water reuse treatment.
- Planning for the Fens and South Lincolnshire reservoirs.

- Reservoirs will provide positive impacts for communities overall.
- We will continue to work with our customers to help and support those in circumstances that may make them vulnerable.
- We will promote innovative behavioural changes and look to incentivize for doing so.
- An innovation fund will look at opportunities to link demand management with sustainable drainage systems.

- Our innovative demand management strategy delivers the most benefits for the least cost.
- All of our customers will be billed on their actual usage (or an estimate of this), which is proven to improve water efficiency.
- We will minimise unnecessary bill increases by delaying investment in high operational cost options until the need and benefits are better understood.

- Our WRMP24 ensures all of our customers have a safe, secure supply of water.
- Our networks will be more resilient as smart metering will help us understand them better than ever before.
- We will achieve 1 in 500 year drought resilience by 2040, underpinned by the South Lincolnshire reservoir.

- Smart metering means we will have fewer vans on the road.
- Supply-side options higher in operational carbon are timed towards the end of our planning period, allowing for further advances in technology and more utilisation of renewable energy.

- Our demand management programme will be regularly reviewed so new innovative technology can be easily included into our highly adaptive strategy.
- We will use our environmental investigations in 2025-2030 to inform the scale and locations of future desalination.

- We are planning for a ‘restore’ environmental destination scenario, timed to allow us to conduct environmental investigations between 2025 and 2030 and target catchments most in need.
- Supply-side options that may have a higher environmental risk have not been included in our best value plan.
- The Fens and South Lincolnshire reservoirs will provide opportunities for improving habitats and biodiversity.
- Our demand management measures will manage growth, avoiding the need for further abstraction from the environment, mitigating the risk of deterioration.

Our customer engagement has told us that we need to balance costs, environmental and carbon impacts. We are confident our best value plan has achieved this.

12 Consultation

How you can help continue shaping our strategy

We have worked with our stakeholders and customers to develop, inform and scrutinise our plan. This includes members of our reservoir partnerships, individual water companies, WRE stakeholders, regulators and catchment groups.

Help play a part in planning for your future resources by commenting on our draft WRMP24.

This can be done by emailing Defra at **water.resources@defra.gov.uk** or writing to them at:

Defra
Water Resources Management
Plan Water Services
Department for Environment, Food and Rural Affairs
Seacole 3rd Floor
2 Marsham Street
London, SW1P 4DF

Please state that your consultation response is related to Anglian Water's draft WRMP24.

You have until Wednesday 29th March 2023 to respond to the consultation.

We will then review all comments and feedback from customers and stakeholders before issuing a Statement of Response in June 2023, and a revised draft WRMP24 later in 2023.

Click here to visit our website **anglianwater.co.uk/wrmp** for further information on our draft WRMP24, as well as a dedicated consultation document.

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