WATER for LIFE®

Draft Water Resources Management Plan 2024

Technical Report

October 2022

from Southern Water®

Contents

Contents continued

Contents continued

Contents continued

Contents continued

Figures

Contents continued

Figures

Contents continued

Figures

Contents continued

Tables

Contents continued

Tables

Glossary

Acronym	Term	Definition
	Abstraction	The removal of water from a source e.g. river
ADO	Average deployable output	Annual average deployable output from a source
AFW	Affinity Water	Water only company serving more than 3.83 million people in parts of Bedfordshire, Berkshire, Buckinghamshire, Essex, Hertfordshire, Surrey, the London Boroughs of Harrow and Hillingdon and parts of the London Boroughs of Barnet, Brent, Ealing and Enfield. Also supply water to the Tendring peninsula in Essex and the Folkestone and Dover areas of Kent
AMP	Asset Management Plan	Water company business plan
AMR	Automatic meter reading	Type of water meter that can be read remotely using drive-by technology
BVP	Best Value Plan	A Water Resource Management Plan (WRMP) or regional plan which considers a range of factors (alongside economic cost) with the aim of increasing overall benefit to customers, the environment and society
	Catchment	The area from which rainfall and groundwater would naturally collect and join the flow of a river
	Central Area	Supply area made up of the Sussex North, Sussex Brighton and Sussex Worthing Water Resource Zones
CAP	Customer Advisory Panel	Independent panel to make sure Southern Water delivers its customer priorities and promises
Defra	Department of Environment, Food and Rural Affairs	The government department responsible for setting water policy
DO	Deployable output	The output of a source or bulk supply as per the licence (if applicable); pumping plant and/or well/aquifer properties; raw water mains and/or aqueducts; transfer and/or output main; treatment; water quality
	Drought permit	An authorisation granted by the Environment Agency under drought conditions, which allows for removal and storage of water outside the schedule of existing licences on a temporary basis
	Drought order	Powers granted by the Secretary of State during drought to manage quantities of water removed and released on a temporary basis
DYAA	Dry Year Annual Average	Represents a period of low rainfall and unrestricted demand and is used as the basis of a Water Resource Management Plan
DYCP	Dry Year Critical Period	The period(s) during the year when water resource zone supply and demand balances are at their lowest
DYMDO	Dry Year Minimum Deployable Output	This is the autumn period in a dry year when groundwater levels and river flows are at their lowest and we limit water sources to their minimum deployable outputs
DWI	Drinking Water Inspectorate	The Government's drinking water quality regulator
	Eastern Area	Supply area comprising the Kent Thanet, Kent Medway East, Kent Medway West and Sussex Hastings Water Resource Zones
EA	Environment Agency	The government's environmental regulator
	Environmental destination or Environmental ambition	A strategy developed at a regional level to help enhance the natural environment through water resources activities and sustainable abstraction (water removal)

Glossary continued

Acronym	Term	Definition
ERP	Emerging Regional Plan	The draft least cost regional plan prepared by Water Resources South East (WRSE) under the National Framework, as put into public consultation in January 2022
GW	Groundwater	Water held underground in the soil or in voids in rock
HRA	Habitat Regulations Assessment	Assessment to consider the potential effects of alternative options and strategies on designated European sites
HWTWRP	Hampshire Water Transfer and Water Recycling Project	An SRO with two component parts including a WRP that makes use of the storage in Portsmouth Water's consented Havant Thicket reservoir and a transfer pipeline from the reservoir to Otterbourne WSW, being progressed as a collaboration between SW and PWC
MDO	Minimum deployable output	Deployable output for the period when groundwater levels are at their lowest
Ml/d	Mega litres per day	Millions of litres per day. Unit of measurement for flow in a river or pipeline
	National framework	The Environment Agency's national framework for managing future water need for England by the means of regional planning introduced in March 2020.
NE	Natural England	The government's adviser for the natural environment in England
NEUB	Non-Essential Use (Ban)	A drought order approved by the Secretary of State to restrict specific water uses activities
NYAA	Normal year annual average	This is the demand for water expected under normal conditions
Ofwat	Office of Water Services	The economic regulator of the water sector in England and Wales
	Outage	Temporary loss of deployable output
PCC	Per capita consumption	Amount of water typically used by one person, per day
PDO	Peak deployable output	Deployable output for the period in which there is the highest demand
PWC	Portsmouth Water Company	Provides public water supplies to a domestic population exceeding 698,000, as well as many important industries, large defence establishments and varied commercial businesses through South East Hampshire and West Sussex from the River Meon in the West to the river Arun in the East
Pywr	Python water resource model	A python-based water resources model which is open source, flexible and extendable, and which is faster than many other existing water resource modelling platforms
RAPID	Regulators' Alliance for Progressing Infrastructure Development	The collaborative regulatory group of Ofwat, the Environment Agency and DWI formed to accelerate development of new water infrastructure and design future regulatory frameworks
RBVP	Regional Best Value Plan	The Best Value Plan for the region prepared by WRSE – currently in development with a draft anticipated to be put into consultation in Autumn 2022.
RSA	Restoring sustainable abstraction	Environment Agency programme to identify abstractions that are unsustainable or potentially damaging and to restore sustainable abstraction
	Source	A named input to a water resource zone where water is abstracted from a well, spring or borehole, or from a river or reservoir

Glossary continued

Acronym	Term	Definition
	Section 20 agreement	The agreement signed by Southern Water and the Environment Agency during the Western Inquiry in March 2018 pursuant to Section 20 Water Resources Act 1991
SRO	Strategic Resource Option	Large schemes Intended to provide a resilient future water supply determined as Strategic Resource Options by RAPID and investigated through RAPID's gated process
SEA	Strategic Environmental Assessment	Assessment to identify and assess any significant environmental effects of the WRMP strategies
SES	SES Water	Supplies water to 745,000 people in parts of Surrey, Kent and south London
SEW	South East Water	Supplies water to 2.2 million customers in the south east of England, namely Kent and Sussex
SDB	Supply-demand balance	The difference between total water available for use (as supply) and forecast distribution input (as water demand) at any given point in time over the Water Resource Management Plan's planning period/horizon
	Sustainability reduction	Reductions in deployable output required to meet statutory requirements and/or environmental expectation or to reach any regional environmental destination
SWS	Southern Water Services	Private company supplying around water services to 2.6 million customers and wastewater services to around 4.6 million customers across Kent, Sussex and Hampshire
SWW	South West Water	Water and wastewater service provider for a population of c. 1.7 million in Cornwall, Devon, and parts of Somerset and Dorset
T2ST	Thames to Southern Transfer	An SRO enabling water from the South East Strategic Reservoir (a reservoir SRO) and/or the Severn to Thames Transfer (a transfer SRO) in TWUL's Swindon and Oxfordshire water resource zone to be transferred to SW's Western Area, being progressed as a collaboration between SW and TWUL.
TUB	Temporary Use Ban	Drought restriction imposed by water companies on customers. Restrictions include not using water supply for non-essential activities such as watering a 'garden' using a hosepipe, filling a pool, washing a car, among others
TWUL	Thames Water Utilities Limited	Water and wastewater services provider serving 15 million customers across London and the Thames Valley
WAFU	Water Available for Use	Combined total of deployable output; future changes to deployable output from sustainability changes, climate change; transfers and any future inputs from a third parties; short-term losses of supply and outage; and, operational use or loss of water
	Western Area Inquiry	A public inquiry into proposed changes to Lower Itchen, Test and Candover abstraction licences in Hampshire, held in March 2018.
WFD	Water Framework Directive	EU Environmental Legislation committing all EU member states to achieving good quality and good quantitative status of all water bodies
WINEP	Water Industry National Environment Programme	A list of environment improvement schemes that ensure water companies meet European and national targets related to water
WRMP	Water Resource Management Plan	Statutory plan produced by water companies every five years to plan to meet supplies over 25 to 50-year period

Glossary continued

Acronym	Term	Definition
WRP	Water recycling plant	A plant using advanced treatment techniques to convert treated wastewater into highly purified source water. Special membranes are used to remove salts and a range of other impurities
WRPG	Water Resources Planning Guideline	The Water Resources Planning Guideline prepared by the Environment Agency, Ofwat and Natural Resources Wales.
WRSE	Water Resources South East	Partnership of water companies and regulators in South East England working together to make best use of available water resources
WRZ	Water Resource Zone	The largest possible zone in which all resources, including external transfers, can be shared and hence the zones in which all customers experience the same risk of supply failure from a resource shortfall
WSX	Wessex Water	Water supply and sewerage company serving customers across Bristol, most of Dorset, Somerset and Wiltshire and parts of Gloucestershire and Hampshire
	Western Area	Supply area comprising the Hampshire Andover, Hampshire Kingsclere, Hampshire Winchester, Hampshire Rural, Hampshire Southampton East, Hampshire Southampton West and Isle of Wight Water Resource Zones

Executive summary

This is our draft Water Resource Management Plan 2024 (draft WRMP24). It sets out how we plan to maintain a high quality and reliable supply of water for customers and improve the water environment for future generations.

The way we plan for water resources has undergone significant change since our last WRMP. In 2020 the National Framework was published by the Environment Agency which assessed future water needs across England from 2025 to 2050 and beyond and introduced strategic regional planning.

The National Framework, Water Resource Planning Guideline and other supplemental policies all recognise the need for water resource plans to not only secure supply but to also add wider environmental and societal benefit. They require the development of a Best Value Plan i.e. a plan that considers a range of factors in addition to economic cost such that it not only meets our supply obligations but also delivers greater resilience and additional benefits for our customers, the environment, and to wider society.

This plan has been developed in close collaboration with the Water Resources South East group and follows the publication of its Emerging Regional Plan in January 2022 and the development of a Best Value Plan during summer 2022 which will be published for consultation in autumn 2022. In developing this plan, we have taken account of the feedback from public consultation on the Emerging Regional Plan as well as pre-consultation feedback on how we intend to develop the draft WRMP24.

Overview of our plan

Water is a precious resource and to meet the challenge of securing sustainable, long-term water supplies and to protect the environment, our strategy is built on four pillars that work in tandem to deliver a step change in water resources planning:

- Efficient use of water and minimal wastage across society
- New water sources that provide resilient and sustainable supplies
- A network that can move water around the region
- Catchment and nature-based solutions that improve the environment we rely upon

To achieve these four pillars, we will deliver strong reductions in demand and losses from our supply network (which also reduce pressure on customer bills and carbon footprints). We are developing new sources in line with the National Infrastructure Commission recommendations in ‘Preparing for a Drier Future’, and greater network flexibility which allows better operational resilience to different weather events (e.g. freeze/thaw) or pollution incidents. We are also enhancing our catchment approach to improve the health of the environment in the long term for the benefit of all water users.

Longer term, there could be further opportunities to move water between water companies with a large-scale transfer of up to 120Ml/d from Thames Water supported by the South East Strategic Reservoir in Oxfordshire and new pipelines from Portsmouth Water to transfer from Havant Thicket Reservoir to both north Hampshire and north Sussex. Other improvements are planned to transfer water within Hampshire, Kent and Sussex.

What this means for each area:

Our Western Area strategy

- Reducing consumption by household customers in order to reduce average per capita consumption to less than 100 litres per person per day by 2050
- Leakage reduction: reduce leakage so as to achieve a minimum 50% reduction in leakage by 2050
- Catchment First: implementing a catchment solution to improve environmental resilience
- Hampshire Water Transfer and Water Recycling Project (a Strategic Resource Option)
- Recycling water at Sandown Wastewater Treatment Works (WTW)
- Recycling water at Woolston WTW
- River Test Managed Aquifer Recharge
- Newbury groundwater option
- Romsey groundwater option
- Newchurch groundwater option
- Bulk imports – both continuation of existing imports and new transfers from Portsmouth Water and Thames Water
- Drought Interventions (Temporary Use Bans and Non-Essential Use Bans) and Test Drought Permit/Order.

Our Central Area strategy

- Reducing consumption by household customers in order to reduce average per capita consumption to less than 110 litres per person per day by 2050
- Leakage reduction: reduce leakage so as to achieve a minimum 50% reduction in leakage by 2050
- Recycling at Littlehampton WTW
- Recycling at Horsham WTW
- Desalination on the Sussex Coast
- River Adur Offline Reservoir
- Pulborough Winter Transfer Stage 1 and 2
- Western Rother licence change and water storage
- Bulk transfers – both continuation of existing import and new transfer from Portsmouth Water, SES Water and South East Water
- Drought Interventions (Temporary Use Bans and Non-Essential Use Bans) and Pulborough, North Arundel and East Worthing Drought Permit/Orders.

Our Eastern Area strategy

- Reducing consumption by household customers in order to reduce average per capita consumption to less than 110 litres per person per day by 2050
- Leakage reduction: reduce leakage so as to achieve a minimum 50% reduction in leakage by 2050
- Recycling at Medway WTW
- Recycling at Hastings WTW
- Desalination on the East Thanet Coast
- Desalination on the Thames Estuary
- Desalination on the Isle of Sheppey
- Recommissioning of Gravesend groundwater source
- Reconfiguration of Rye groundwater source
- Raising Bewl Reservoir
- Bulk transfers – both continuation of existing import and new transfer from Affinity Water and South East Water
- Drought Interventions (Temporary Use Bans and Non-Essential Use Bans) and River Medway Scheme and Sandwich Drought Permit/Orders.

Managing uncertainty

Long-term planning requires making decisions for an uncertain future.

To manage uncertainty, we have used an adaptive planning approach. We have looked at multiple supply-demand balance scenarios in view of the uncertainties associated with growth forecasts, the level of reductions required in the water we take from the environment and climate change impacts. This approach has helped us produce a more robust and resilient plan. The options listed above for each of our three areas allow us to maintain supply-demand balance across all future scenarios we have considered in this plan with key decision points in 2030 and 2035.

We also recognise the challenge of delivering ambitious demand reductions and new water resource developments. Reductions in customer demand is not fully within our control as demonstrated by the recent COVID-19 pandemic. Our leakage reduction target is also more ambitious than the level of reduction we have achieved in the past and carries risk. The new water resource schemes we need to build include long-distance transfers, water recycling and desalination plants. These schemes are technically more challenging and require greater investment than conventional river and groundwater abstraction schemes.

We are therefore also developing a contingency plan that will allow us to accelerate and/or pause activities to adjust to and manage these uncertainties. We recognise that many of these solutions may not have been tested at the scale we are proposing, and we will work with customers, suppliers, stakeholders and regulators to improve the maturity and deliverability of these ambitious schemes. This will include consideration of:

- Whether existing options can be brought forward e.g. mains replacement for leakage reduction
- Water resource and demand options not selected in the programme that can be developed as alternatives e.g. a water recycling scheme at a different site
- Operational measures which can be implemented to provide supply-demand benefit e.g. temporary pumps to increase network flexibility at peak demand.

Board assurance statement

The Board has put in place internal and independent technical and legal assurance to support the development of the water resources management plan for October submission.

The Board engaged with, oversaw and scrutinised the development of the WRMP for submission to the Secretary of State on 3 October. It was satisfied that the submission and assurance steps were appropriate.

The Board fully endorses the adoption of WRSE's Best Value Regional Plan as the basis for the WRMP from 2025 onwards. This regional plan is based on sound and robust evidence.

The Board makes the endorsement of our WRMP on the basis that the WRMP is based on sound and robust evidence, and:

- is an adaptive plan suitable for the complex supply challenges faced by Southern Water;
- currently aligns with the gated submissions to RAPID for strategic resource options;
- sets out our new strategy for our Western, Central and Eastern Areas.
- sets out the change in approach to national water resource planning since WRMP19;
- has gone through further regional governance and assurance processes and approval;
- has been developed with clear public participation through consultation.

The Board also endorses the approach taken by way of separation of required planning years 2023–2025 so as to enable the WRMP to be clearly informed by regional planning. The Board is satisfied that the steps taken to assess the continuity of (and revise where appropriate) the current WRMP to support the basis of these planning years were appropriate.

The Board confirms that:

- the WRMP is informed by WRSE's Draft Regional Best Value Plan from 2025 and developed in accordance with the National Framework for Water Resources;
- the adoption of this plan adequately ensures that Southern Water can meet its obligations;
- Southern Water continues to remain committed to WRSE and to the development of a best value regional plan, based on a sound and robust framework
- Southern Water has put in place an enhanced governance process and adequate assurance process which will continue until the final WRMP is published.

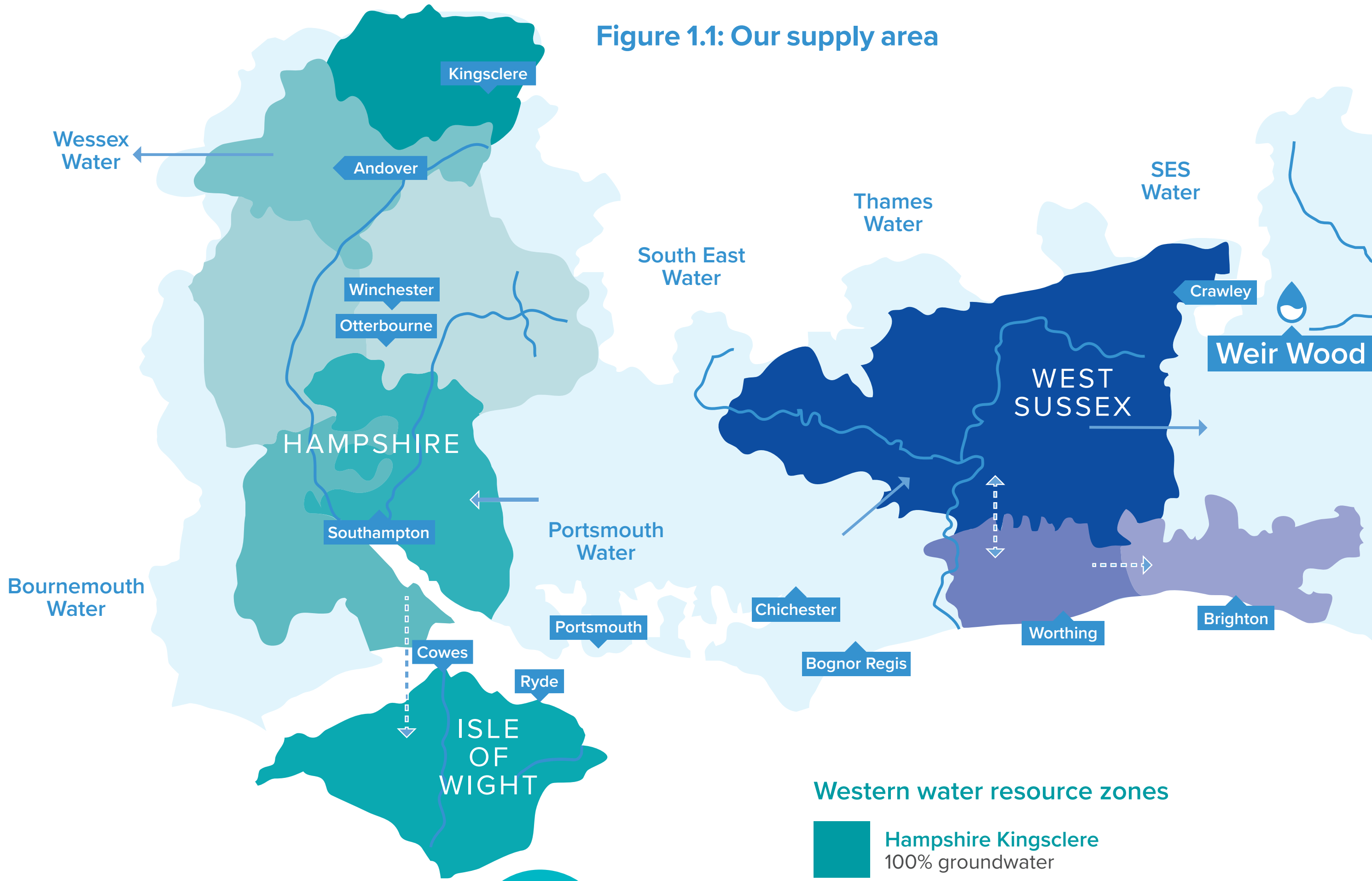
Where your water comes from today

We supply water to parts of Kent, Sussex, Hampshire and the Isle of Wight.

Where the water comes from, how it is supplied and how much is used varies across each county. We divide our supply area into 14 ‘water resource zones’ which are shown on the map.

About 70% of the water we supply comes from groundwater. These water supplies are stored underground in rocks and soils called aquifers and we pump them up to the surface. The rest come from rivers and streams, some of which are supported by chalk-fed groundwater. In some areas, reservoirs store water that is typically pumped from nearby rivers when flows are high. Our natural water resources are split into catchment areas – we take water from eight catchments across the South East.

Figure 1.1: Our supply area



Western water resource zones

- **Hampshire Kingsclere** 100% groundwater
- **Hampshire Andover** 100% groundwater
- **Hampshire Rural** 100% groundwater
- **Hampshire Winchester** 100% groundwater
- **Hampshire Southampton East** 52% river, 48% groundwater
- **Hampshire Southampton West** 100% river
- **Isle of Wight** 47% groundwater, 23% river, 30% transfers

Western Area

Much of the water supplied in the Western Area comes from underground sources. In South Hampshire, the River Test and River Itchen provide the majority of supplies while on the Isle of Wight around a quarter comes from the River Yar.

Water is transferred from South Hampshire to the Isle of Wight to supplement its water supplies. Water can also be transferred from Portsmouth Water’s area to South Hampshire.

89% of homes are metered in Hampshire

95% of homes are metered on the Isle of Wight

Average water use:

Hampshire – 129 litres per person per day

Isle of Wight – 131 litres per person per day

Central Area

Brighton, Worthing and surrounding areas rely predominately on the groundwater sources beneath the South Downs. Sussex North is supplied from a mix of water sources including the River Arun and the Western Rother, Weir Wood reservoir near East Grinstead and a transfer from Portsmouth Water. There are pipelines that allow water to be moved between our Sussex North and Worthing water resource zones in both directions, and from Worthing to Brighton.

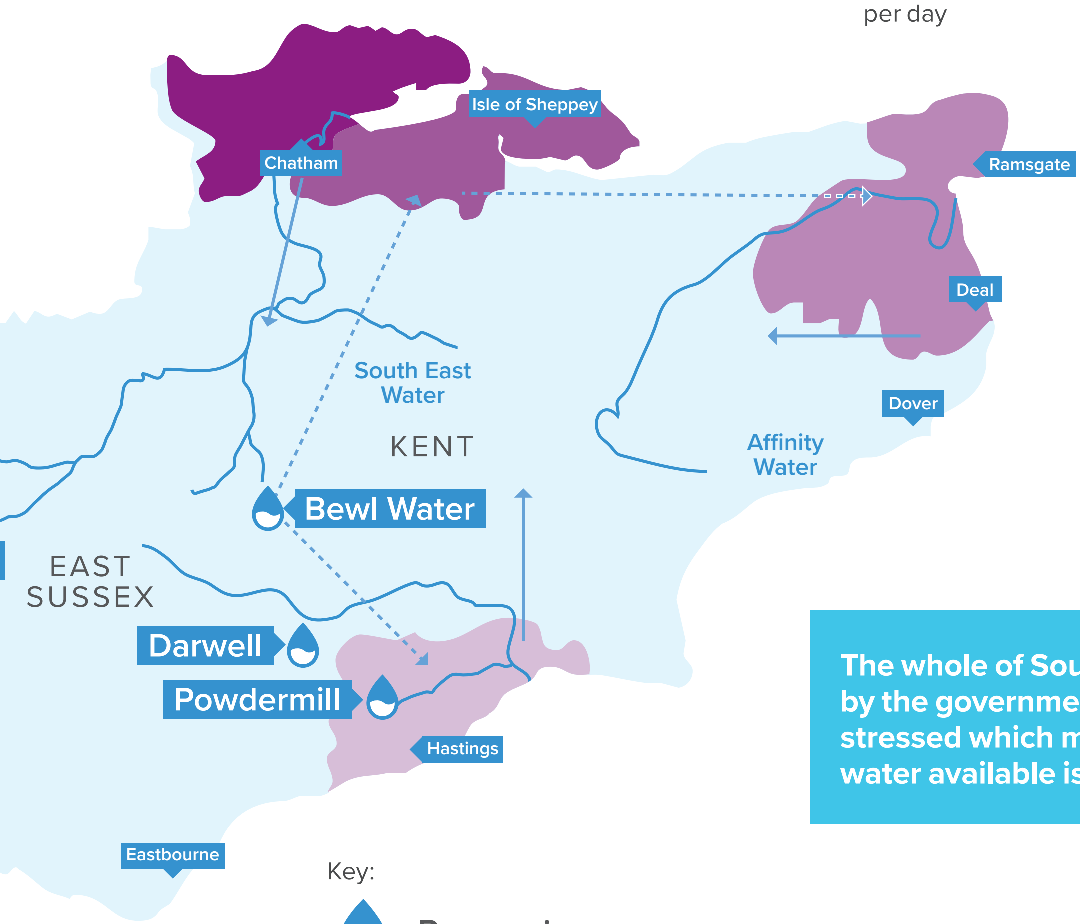
84% of homes are metered

Average water use:

139 litres per person per day

Central water resource zones

- **Sussex North** – 35% groundwater, 51% river, 8% reservoir, 6% transfers
- **Sussex Worthing** – 98% groundwater, 2% transfers
- **Sussex Brighton** – 100% groundwater



Key:

Reservoir

Sharing supplies between water companies

Moving water in our supply zones

The whole of South East England is classed by the government as being seriously water stressed which means that the amount of water available is limited.

Eastern Area

Our Kent supply areas take most of their water from groundwater. The rest comes from the River Medway, some of which is stored in Bewl Water reservoir before it is released back into the River Medway where it is abstracted. Hastings in East Sussex takes most of its water from Darwell reservoir which stores water from the River Rother and Powdermill reservoir which stores water from the River Brede. We can transfer water from Medway to Thanet and from Medway to Hastings.

88% of homes are metered

Average water use:

132 litres per person per day

Eastern water resource zones

- **Kent Medway East** – 100% groundwater
- **Kent Medway West** – 56% river and reservoir, 44% groundwater
- **Kent Thanet** – 79% groundwater, 21% transfers
- **Sussex Hastings** – 5% groundwater, 79% reservoir, 16% transfers

1. Who we are and what we do

1.1 Our services and supply area

Southern Water provides water services to nearly 2.6 million customers and wastewater services to nearly 4.6 million customers across an area of 4,450 square kilometres, extending from Kent, through parts of Sussex, to Hampshire and the Isle of Wight in the west (Figure 1.1). This includes providing wastewater services in areas where water is supplied by other water companies.

Water supplies are largely reliant on groundwater from the widespread chalk aquifer that sits under much of the region. Groundwater makes up around 70% of our total water supply. Groundwater is also important in maintaining flows to the River Test and River Itchen in Hampshire.

River abstractions account for 23% of our water supplies. These include the Eastern Yar and Medina on the Isle of Wight; the Rivers Test and Itchen in Hampshire; the Western Rother and Arun in West Sussex; the River Eastern Rother and River Brede in East Sussex; and the River Teise and River Medway in Kent.

Four surface water impounding reservoirs provide the remaining 7% of our water supplies: Bewl Water, Darwell, Powdermill and Weir Wood. The total storage capacity of these four reservoirs is 42,390 million litres (Ml). South East Water (SEW) is entitled to 25% of the yield from the River Medway Scheme, which incorporates the storage within Bewl Water Reservoir.

In addition to SEW, we share borders with Affinity Water (AFW), Portsmouth Water (PWC), SES Water (SES), South West Water (SWW) Thames Water (TWUL) and Wessex Water (WSX). Water is shared between us and a number of these companies through existing pipelines. We are looking to increase sharing of water with our neighbouring water companies through participation in the Water Resources South East (WRSE) group.

1.2 Water resource zones

Our supply area is divided into 14 water resource zones (WRZs). The WRZs are geographical areas where all customers have the same risk of loss of supply. The 14 WRZs are grouped into three larger, sub-regional supply areas: Western, Central and Eastern (Figure 1.1). This approach helps us to manage demand for water for customers within these WRZs both individually, and at a sub-regional level.

Western Area – parts of Hampshire and the Isle of Wight, including the following WRZs:

1. Hampshire Andover (HAZ)
2. Hampshire Kingsclere (HKZ)
3. Hampshire Winchester (HWZ)
4. Hampshire Rural (HRZ)
5. Hampshire Southampton East (HSE)
6. Hampshire Southampton West (HSW)
7. Isle of Wight (IOW)

Central Area – parts of West and East Sussex, including the following WRZs:

8. Sussex North (SNZ)
9. Sussex Worthing (SWZ)
10. Sussex Brighton (SBZ)

Eastern Area – parts of Kent and East Sussex, including the following WRZs:

11. Kent Medway East (KME)
12. Kent Medway West (KMW)
13. Kent Thanet (KTZ)
14. Sussex Hastings (SHZ)

Supplies in our Western Area predominantly come from groundwater with only the IOW and HSE and HSW getting a significant proportion of their supplies from other sources. The same is true for the Central Area where only SNZ currently gets most of its water from rivers, whereas SWZ and SBZ are almost exclusively reliant on groundwater. The Eastern Area has a greater mix of sources with KME and KTZ predominantly reliant on groundwater, with KMW getting roughly equal proportions from reservoirs and groundwater and SHZ getting most of its supplies from reservoirs.

1.3 Water resource zone integrity

Our WRZs face a range of pressures, some of which are common to all WRZs and some unique to particular areas. This might include vulnerability of existing supplies to climate change or abstraction licence changes in order to provide greater environmental protection. Some areas are also predicted to experience significant growth over the coming decades, increasing the demand for water.

We review these zone boundaries when we develop our Water Resources Management Plan (WRMP) to make sure that they are appropriate.

For our 2019 WRMP (WRMP19) we carried out an integrity assessment and made some changes to our zones to better reflect our understanding of Level of Service risks at that time.

- The former Hampshire South WRZ was split into four – HWZ, HRZ, HSE and HSW – to reflect the risks arising from licence changes to our River Test and River Itchen abstractions.
- The former Kent Medway WRZ was split into KME and KMW.

We have reviewed the integrity assessment for our 2024 WRMP (WRMP24) (Annex 1), with a particular focus on SNZ as Weir Wood reservoir is currently out of service. This resulted in the need for tankering in the Turners Hill area during high demand periods in 2020. In response, we investigated and enhanced availability from our Pulborough WSW source. We also rezoned customers to receive supply from SES. As a result, we can now supply 29.4 million litres per day (Ml/d) against a total potential dry year demand of 28.7Ml/d, meaning we can guarantee customers remain in supply in SNZ while work is being carried out at Weir Wood reservoir. As a result, we have made no changes to the zone boundary.

There have been no further significant changes or emerging supply risks to any of our other WRZs since our WRMP19 assessment.

The change in planning guidance to derive system-response-based metrics of deployable output (DO) (see Section 6.4.1) and planned improvements to our supply network as part of WRMP19, are likely to change our WRZs further in the future, especially in the Western Area. We will undertake a further review to inform our 2029 WRMP (WRMP29).

2. What is a water resource management plan?

2.1 Purpose and basis of our plan

All water companies in England and Wales are required under the Water Industry Act 1991 (as amended) to prepare and maintain a Water Resource Management Plan (WRMP). It is therefore a statutory plan and its purpose is to describe the way in which we aim to achieve a secure supply of wholesome water for our customers.

Unless directed otherwise, we must prepare and consult on a WRMP at least every five years. These plans are reviewed annually to keep them up to date with the latest data and information, policies, and customer and stakeholder views. Generally, they need to cover a minimum of 25 years although companies are encouraged to plan for longer periods, depending on the complexity of challenges faced.

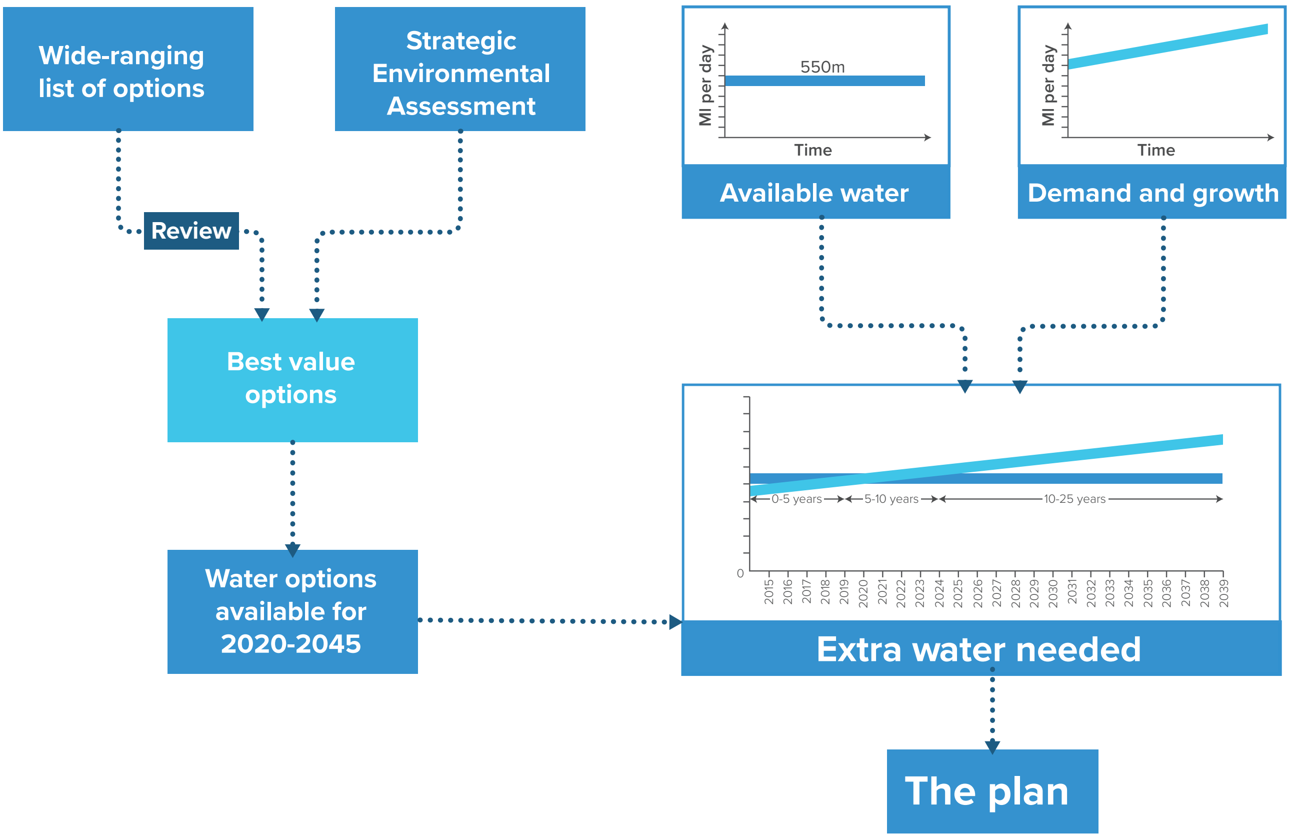
Our WRMP19 looked ahead at the next 50 years (2020–70). For our WRMP24, Defra directed us in April 2022 to plan for a minimum of 27 years, stipulating that our plan should start from 2023.

As a result, the following plan covers the periods 2023–25 and 2025–75, separately, to better demonstrate our alignment to WRSE's regional plan.

In accordance with Section 37B(10) of the Water Industry Act 1991, our plan does not include any information that is considered commercially sensitive, nor does it include any information that is contrary to the interests of national security. We are required to anonymise the names of our existing sources of water for security reasons, but we have tried to use readily understandable names for them so that our proposals can be easily understood.

The primary objective of our WRMP is to ensure that there is always enough water available to meet anticipated demand in our area of supply, regardless of weather conditions. Particular focus has been placed on 'dry' and 'very dry' years, when the average rainfall is much lower than the long-term average. An overview of the WRMP development process is shown in Figure 2.1.

Figure 2.1: Overview of WRMP development process



2.2 Overview of regulatory approach and changes to water resources planning

Water resource planning has undergone significant change since WRMP19. There are a number of key drivers for change, including:

- The National Framework, published in 2020 (Environment Agency, 2020a), which called for a shift to collaborative regional planning in order to meet the future needs of all sectors that depend on a secure supply of water i.e. public water supply, agriculture, power generation, industry and the environment. Five regional groups have been set up for this purpose.
- The introduction of the concept of best value planning (UKWIR, 2020). This requires consideration of a number of factors such as customer preference, resilience and environmental impact, in addition to economic cost. This enables WRMPs to deliver wider societal and environmental benefits along with security of supply.
- Adoption of an adaptive planning approach that considers multiple future supply-demand balance scenarios and develops a set of options to meet demand. These scenarios could include uncertainties associated with future growth, demand for water and climate change impacts.
- The Water Resources Planning Guideline (WRPG) for WRMP24 requires water companies to maintain supplies in a drought, with a return period of 1-in-500-year (1:500 drought), without resorting to the use of drought permits and orders to increase supply. The suggested date for achieving this level of resilience is 2039 but the optimum timing is to be determined through regional groups considering the costs and benefits of alternative approaches (Environment Agency, 2021).

For a number of planning cycles we have been involved in developing regional plans as part of the WRSE group, which consists of AFW, PWC, SES, SEW and TWUL. However, for WRMP24, WRSE has been set up as separate entity with its own core staff. Because of this, it has seen a greater degree of collaboration and consistency of approach across the member water companies in developing the regional plan.

Our WRMP19 was an adaptive, 'best value' plan, however for WRMP24, together with other WRSE companies, we have developed a completely new combined adaptive and best value planning approach.

2.3 Incorporation of government and regulatory policy

2.3.1 Government policy

The Water Resource Management Plan (England) Direction 2022, issued in April 2022, and the accompanying government expectations for water resources planning, set out key expectations, which we have incorporated. Key policy areas we have included are:

- **Planning at regional and company levels** – our plan sets out how we will secure supply-security in the short, medium and long-term. We have developed it in conjunction with WRSE to combine national, regional and company approaches to water resource planning.
- **Nature and the water environment** – Government's 25 Year Environment Plan (HM Government, 2018) promotes a need for a step change in environmental improvements. We have included this through incorporation of environmental destination in our plan (see Section 5.3.8).
- **Climate change** – expectation is that the plan can adapt to, and mitigate, the impacts of climate change in our region. We have assessed a range of climate scenarios (see section 6.3.2) to look at the impacts on supply and demand and incorporated into this plan. It has also been developed to contribute to our Net Zero Plan to 2030.
- **Supply security** – the plan must cover at least 25 years. Our plan covers 52 years to reflect the long-term decisions needed for the region.
- **Delivery of plans** – expectation is that plans must be deliverable. Our plan sets out the actions we propose to take, the uncertainties which currently exist around the solutions we have proposed and a contingency plan for the final programme plan to manage the uncertainty in delivery.

In developing this plan, we have also considered the National Infrastructure Commission recommendations in 'Preparing for a Drier Future' (National Infrastructure Commission, 2018). Accordingly, this plan follows a twin-track approach to significantly reduce demand and to develop new sources.

2.3.2 Regulatory frameworks

We have also considered relevant regulatory frameworks and expectations in building this plan. This includes, but is not limited to:

- **National Framework** – The National Framework (Environment Agency, 2020a) includes an expectation from water companies to Per Capita Consumption (PCC) to 110 litres per person, per day and leakage by 50% by 2050.

  Our plan includes interventions to meet these daily water usage and leakage targets and we have explored the potential go further to reduce water usage to 100 litres per person per day by 2040 in line with our previously stated T100 target (see Section 7.2.1). The National Framework also recommends developing regional plans and more regional transfers. We have worked closely with WRSE to develop a regional plan and have identified potential options for resource sharing. In keeping with the National Framework, and WRPG, we are planning to stop the use of drought permits and orders to increase supply after 2040.

- **Best value planning** – we have used the principles laid out in UKWIR (2020) to develop a Best Value Plan (BVP) (see Section 7.1).
- **Managing uncertainty** – we have used a range of growth, environmental destination and climate change scenarios to develop a range of future supply-demand balance situations, and a plan that can be adapted to mitigate them.
- **Water stress** – our operating region is classified as under severe water stress by the Environment Agency (EA). We already have high levels of meter penetration and are considering other measures to reduce demand.
- **Environmental destination** – the EA and Natural England have set out their expectations on the need to deliver ambitious reductions in abstraction to protect the environment. We have included a range of scenarios in our plan that seek to meet the current and future needs of the environment. We have also included an explanation of the activities needed to deliver them (see Section 5.3.8).

There is also a requirement for WRMP24 and the Business Plan 2024 (BP24) to be aligned. We have built this plan as part of our overall programme for Periodic Review 2024 (PR24).

2.4 Working with the regional group

We are part of WRSE and have worked closely with the other five member water companies in the South East in developing a regional plan aligned with government guidelines and best practice.

All key decisions are taken by the WRSE project management board (PMB), which consists of representatives from each water company as well as the EA. There are a number of sub-groups, consisting of subject matter experts from the member water companies, who have looked into various technical elements of the plan and provided their feedback to ensure consistency across the region.

PMB meetings are held fortnightly to discuss and agree various aspects of the plan. Any decisions taken are then put forward to the Oversight Steering Group (OSG) made up of senior employees from each water company, before final approval is given by the Senior Leadership Team (SLT) which includes the chief executives of the member companies.

We have worked both independently and collaboratively as part of WRSE, contributing to the development of method statements on demand forecasts and approaches such as Best Value planning, as well as decision-making. While independently developing demand and supply forecasts and options appraisals.

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

WRSE consulted on its Emerging Regional Plan (ERP) from January to March 2022 (WRSE, 2022a) and is working to publish its draft Regional Best Value Plan (RBVP) in November 2022. This draft WRMP24 is consistent with the draft RBVP and takes account of the feedback on the ERP.

2.5 Links with other plans

In addition to the WRMP, we are currently in the process of developing three other plans which have close links to our submission.

- **Drought Plan**: It sets out in more detail the operational steps we will take in the event of an impending or actual drought. We submitted our draft Drought Plan 2022 (DP22) in March 2021, consulted on the draft plan in spring 2021 and issued a Statement of Response (SoR) to the representations we received in September 2021. We then published an addendum to our SoR in April 2022. We published an updated addendum to the SoR and submitted our revised draft Drought Plan in September 2022 after taking account of further feedback from the regulators.
- **Business Plan**: We produce a business plan every five years which describes the services we plan to deliver and how much this will cost. We have started work on our Business Plan 2024 (BP24). We would expect investment for the WRMP24 schemes to be delivered between 2025–30 to be allowed for in BP24, with some schemes to be delivered in AMP9 or to further investigate their feasibility.
- **Drainage and Wastewater Management Plan (DWMP)**: Our DWMP was published for consultation in June 2022. We have worked to align both plans through our 'Catchment First' approach to environmental improvement and through selection of water recycling schemes. We have also used consistent methodologies and assumptions where appropriate.

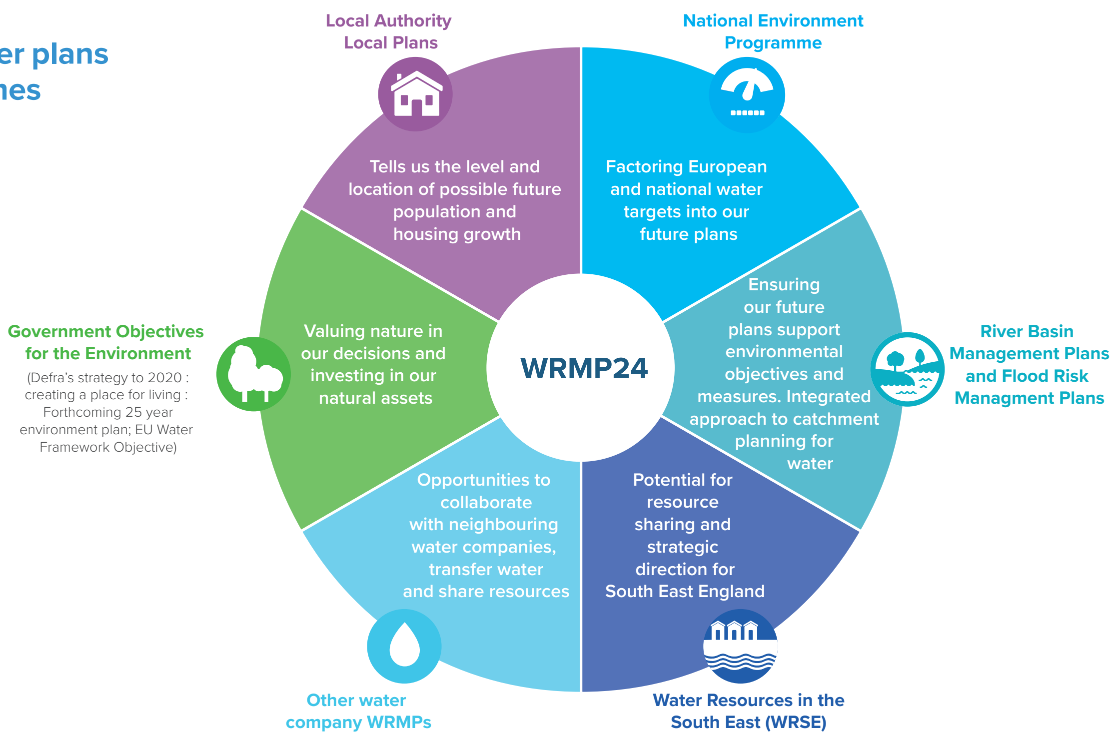
Our plans are prepared in a collaborative manner across the business to ensure synergies, and in close partnership with our regulators, customers and other stakeholders.

In planning for the future, we not only consider our regulatory obligations but also government policies and proposals as well as those made by other bodies that can impact our plans. These provide information about the future levels of growth expected in our region along with areas where economic activity is forecast to increase.

We also take account of the environmental investigations that need to be undertaken under the Water Industry National Environment Programme (WINEP) to inform decisions on our existing and future licences.

Figure 2.2 shows the links between our WRMP and other plans and programmes.

Figure 2.2: Links with other plans and programmes



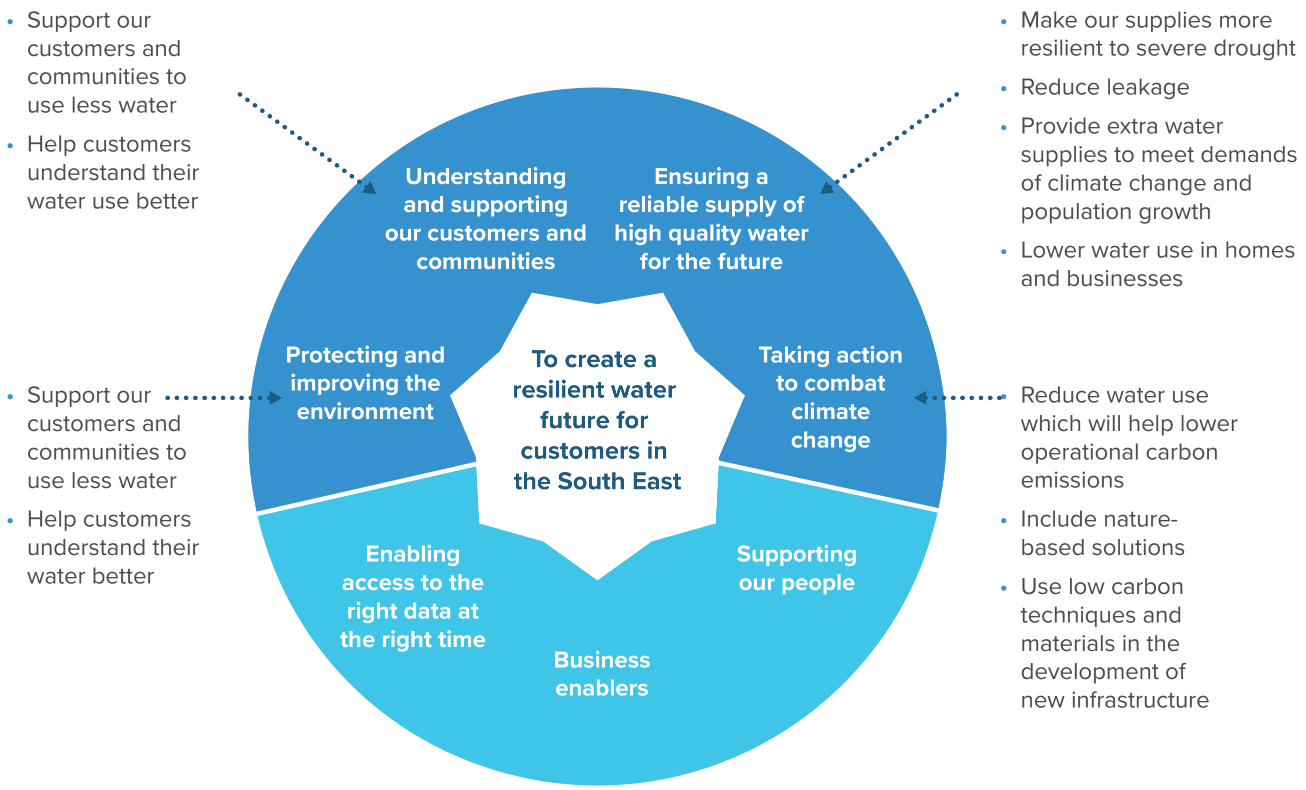
2.6 Our challenges and opportunities

In planning to provide resilient supplies for customers, we face a number of challenges and opportunities. The greatest challenge is the scale and timing of sustainability reductions to our abstraction licences, which have recently been made and are likely to be needed to protect and improve the environment. We need to investigate, design and secure permissions to build a number of large-scale solutions over the next few years, while we keep our plans flexible enough to adapt to the final scale of licence changes needed to meet environmental targets.

Population growth and climate change will add to the pressure on water resources by increasing demand and threatening available supplies. In addition, there is a need to increase our resilience to future drought events to protect customers and the environment.

Figure 2.3 summarises our key challenges and opportunities.

Figure 2.3: Summary of key challenges and opportunities



2.6.1 Challenges

- **The nature of our catchments presents us with a unique set of challenges:** The chalk landscape of the South East contains some of the most precious and valuable water resources in the world. Protecting the water environment is vital for long-term sustainability and biodiversity. A key challenge is doing this while delivering a long-term reliable supply of water to the public and businesses.
- **We are operating in uncharted territory:** We are moving from a historically low-tech industry to highly innovative and technologically advanced water supply systems. We need to find the best new available technology while providing a safe, reliable and sustainable supply of drinking water and keeping bills affordable for our customers.
- **We are facing a multi-dimensional problem:** Water is an increasingly scarce resource due to the impacts of climate change, population growth and environmental needs. We are embracing adaptive planning approaches to ensure we are prepared for a range of different futures.

We are currently working to address the immediate supply-demand challenges under drought conditions in the Western Area, as a result of the licence changes to abstractions related to the River Test and River Itchen. In our Central Area we have taken action to protect designated habitats in the Arun Valley and to ensure we have sustainable abstraction licences and secure supplies for our customers for the long term.

We know that traditional approaches to water resources management are not adequate in the face of future uncertainties. To ensure we have a robust plan, we have worked closely with WRSE and our neighbouring water companies to consider a range of potential futures relating to abstraction licence changes, growth and climate change. By planning to meet several different futures, our plans will be more resilient to change and avoid making unnecessary investment decisions.

2.6.2 Opportunities

Our WRMP24 provides a unique opportunity for us to plan how we will maintain a high-quality drinking water supply for our customers, as well as provide additional environmental and societal benefits through adoption of sustainable and innovative solutions.

The challenges we face and techniques we have adopted afford us several opportunities, including:

- **Leaving the environment in a better state than we found it:** Our plan provides significant environmental benefits and sustainable supplies, in line with the Government's 25-Year Environment Plan's remit.
- **Nature-based solutions**: We have developed ambitious catchment management programmes to deliver a step-change in environmental improvement and supply resilience, as well as bring wider benefits to our biodiversity and carbon sequestration.
- **Delivering what customers value**: Our customers have told us that they want us to protect and improve the environment for current and future generations. This commitment is explicit in our company purpose statement.
- **Adopting smarter solutions**: We are at the forefront of exploring innovative solutions and technologies so we can be better prepared to deliver what is needed in the future. We can also share that knowledge with the rest of the industry.

2.6.3 Role of technology

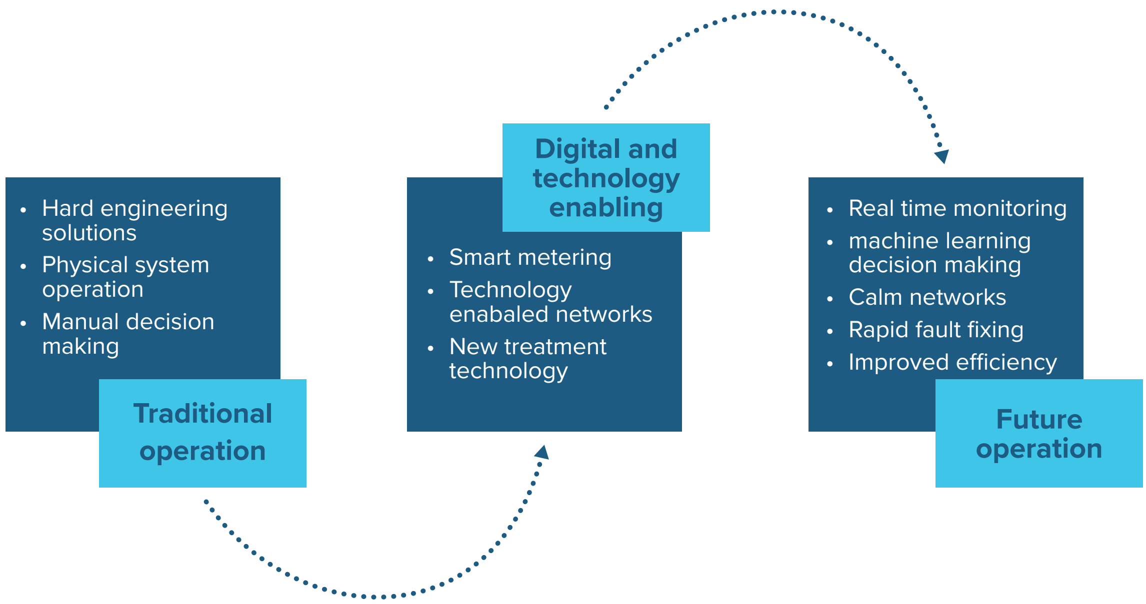
Harnessing technology is key pillar to create a resilient water future, and our WRMP will play its part in delivering our long-term vision.

Our WRMP strategy includes the use of technology from source to tap, making our services smarter, faster, and more resilient. It covers all aspects of water resource management:

- **For the customer** – Smart meters will give customers near real-time usage information, allowing them to reduce consumption and their bills. The real-time demand data will also help us better identify and fix leaks on our network.
- **For networks** – We are introducing smarter management of pressure on the networks, remote sensing to locate leaks and acoustic logging to listen for leaks and pre-empt bursts. This will create a calmer, smarter, network to improve service and reduce leakage. In the future we will need to develop faster, less invasive ways of maintaining our network.
- **For water quality** – Research into areas such as advanced desalination, ceramic membrane treatment and water recycling will help us deliver cheaper and more resilient water treatment in the medium to long term.
- **Harnessing the power of data** – Machine learning techniques and real-time diagnostics will enable us to automatically find leaks, improve water resource optimisation and achieve full system operation. The move to fully smart systems also allows for more intelligent water charging for a changing world.

Taken together the WRMP technology actions in this report are supporting a roadmap moving from a traditional 'physical' system operation to one that is digitally enabled, as shown in Figure 2.4. This focus can be seen in the final strategies in Section 9 and the planned programmes of work.

Figure 2.4: Technology roadmap



2.6.4 Other regulation and policy considerations

Other closely related regulations and policies we have considered include the following:

- **Water transfers (National Framework)** – We have examined options to transfer water within the company and from bulk imports to move water from areas of surplus to deficit.
- **Working across sectors (National Framework)** – We have worked with WRSE on the regional plan to identify potential options for cross-sector working. Our collaborative Catchment First programme is a key long-term feature of our plan and looks to help protect and improve the environment.
- **Drought Plan 2022** (see detail in section 2.5) – Our WRMP is aligned to the process and procedures set out in our latest drought plan, including how, when and where drought permits may be needed.
- **Water Quality and Water safety plans (DWI)** – We have updated our assessments of our system yields to reflect latest reliable yields based on resource and water quality constraints. Our WRMP includes water quality improvements at sites where this is currently restricting water availability.

2.7 Our approach

Our strategy aims to create a resilient supply system in the face of challenges posed by population growth, climate change and the need to protect and improve the environment.

We are already feeling the impacts of climate change with changes in the timing, duration and amount of rainfall having a direct impact on groundwater levels and river flows that we rely on for our supplies.

Abstraction licence changes have already restricted the volume of water we can take from existing sources, reducing the water available in dry and very dry years. We expect further restrictions on our licences going forward, to protect and improve rivers, aquifers, reservoirs and coasts.

As a result, we know we will have less water available in the future as our regional population continues to grow.

The WRMP process allows us to work with our customers and stakeholders to make sure we can provide them secure, safe, affordable and sustainable water supplies into the future, and we know that we must do this to support economic growth. Our WRMP, once finalised will ensure that the infrastructure and services we provide are effective and fit for the future.

Our 2009 WRMP saw us become the first UK water company to implement universal metering for customers. For our 2014 WRMP, we developed stochastic rainfall sequences over a 2000-year period rather than relying on historical climate records to predict the frequency and severity of future drought events. This enabled us to plan for drought events that are not reflected in the historical climate records that only extend back approximately 125 years. For WRMP19, we made use of adaptive planning to prepare for a range of supply-demand ‘futures’. We also extended the planning period from 25 years to 50 years.

For WRMP24, our work with WRSE represents a more holistic approach to water resources planning for the South East looking ahead to 2075.

3. Our progress on WRMP19

In view of the pressures we face, we consider demand management to be of vital importance. In our WRMP19, we planned to reduce average PCC to 100 litres per head (person) per day (l/h/d) by 2040 as part of our Target 100 (T100) initiative. We also committed to reducing leakage by 50% by 2050.

COVID-19 led to an increase in household demand during 2020–21 and 2021–22 as customers worked from home and made changes to their hand washing and personal hygiene routines. Our high meter penetration levels and continued water efficiency activities meant that the increase in demand was among the lowest in the industry (7.4% compared to an industry average of 10.4%). We have nevertheless had to revise our AMP7 forecast and our 2024–25 outturn forecast for individual daily usage, which is now higher than our original target.

Despite the higher starting position for AMP8, we remain committed to achieving T100 and have refocused our efforts on a multi-channel communication campaign with our customers as well as developing the additional service of ‘remote home audits’. During 2021–22 alone we delivered more than 64 million impressions and 1.6 million direct communications in the form of emails and door drops. This resulted in estimated campaign awareness levels in our three supply areas of: Western 56%; Central 39%; Eastern 47%, which we estimate amounts to more than 858,000 customers and around 338,000 households who have taken active steps to reduce consumption as a result. We are also continuing to increase our water efficiency education programme through our ‘City to Sea’ partnership and are working with stakeholders to promote water neutrality in SNZ. We also promote home visits and water saving through our projects with local councils, including Kent County Council and Southampton City Council.

We have maintained our leakage activities in line with our WRMP19 programme. However, increased demand due to COVID-19 led to higher network pressures resulting in higher than forecast leakage at the start of this five-year period. We are increasing the level of field detection resources, in line with our action plan to reduce leakage and aim to achieve our target by 2025. Further details of our progress delivering against our AMP7 demand management targets are provided in the following subsections.

We have launched our Catchment First strategy (summarised in Section 5.3.7 and described in more detail in Annex 9) which puts the environment at the centre of our decision-making and the services we deliver. It represents a shift in focus from relying on traditional engineering solutions, to working collaboratively with partners to create long-term sustainable improvements to the environment. It includes delivery of our water quality and catchment management schemes from WRMP19 and integration with our WINEP and Environmental Ambition to improve catchment resilience. It is embedded in our key strategic plans and delivery mechanisms, such as through WRSE, WRMP and our DWMP. Our evolving Environment Strategy also builds on this by embedding catchment and nature-based solutions across broader business processes.

On the supply-side, we have improved the resilience of our network by increasing connectivity, particularly in the Western Area. Most of the schemes planned for delivery over AMP7 and AMP8 are on track, however, there have been some delays to a small number of schemes. A licence variation scheme in Pulborough, to be delivered by 2021–22, was delayed after Natural England raised concerns about the potential impact of abstraction on downstream ecosystems. The scheme is currently on hold pending the outcome of a sustainable abstraction investigation. Similarly, a licence variation scheme in the Sandwich area in Kent, also due by 2021–22, is now scheduled for delivery by 2023–24.

Of the schemes due to complete in AMP8, a bulk import from South West Water (SWW) into our Western Area has been removed after we were informed that it can no longer guarantee the supply. A desalination option in the Western Area due to be delivered by 2027–28 is being replaced by a water recycling option to be used as part of the Havant Thicket reservoir project, developed in partnership with PWC.

Leakage

We committed to an extra £18m of funding during 2021–22 in order to safeguard meeting the required levels of leakage reduction versus performance. Our leakage activities are in line with our programme. Our reported leakage of 94.9Ml/d in 2021–22 was marginally above the target of 93.9Ml/d. However, during the COVID pandemic we did not feel it would be responsible to increase our leakage activities. Since restrictions were relaxed we have been able to increase our leakage activity once again. Utilising remote and flexible working patterns we were able to maintain a stable work force to detect, promote and repair leaks to target. We promoted and repaired in the region of 23,800 leak repairs in 2021–22 and have deployed approximately 7,000 new acoustic loggers designed to find leaks.

Metering

We commenced a smart meter trial in 2021–22 which is testing the assumption that we can reduce water consumption by 3-5% over a year simply by giving people data on how much they use. Clip-on smart meters have been being installed in homes in Southampton, Andover, Midhurst and Brighton. Consumption data is given to customers so we can test their level of engagement and the outcomes against different behavioural nudges.

Water efficiency

Our ongoing water efficiency initiatives have continued. We completed 8,774 home visits, giving advice to householders living in water-stressed areas on how to use less water during 2021–22. We inspect for leaks and fit water-saving devices and outdoor water butts and tap jackets. The most up-to-date figures are showing an average saving in water use of 27.5 litres per property per day since we began the visits in 2015.

3.1 Western Area

As a result of abstraction licence changes on the rivers Test and Itchen, and the risk that long-term reliance on drought permits and drought orders could pose to their rare and protected habitats and species, we have entered into an operating agreement with the EA (under section 20 of the Water Resources Act 1991) to enable us to continue to meet our water supply duty until we develop alternative water resource solutions. As part of the agreement, we have committed to implementing the long-term scheme for alternative water resources set out in our final WRMP19, as may be revised by future WRMPs.

Our WRMP19 was prepared to meet supplies in a drought with a 1-in-200 year return period (1:200-year drought), which forecast an overall water resource deficit in the Western Area of around 192Ml/d during peak periods up to 2029–30. We planned to meet this deficit through leakage and demand reduction and through the development of several new supply solutions across the Western Area, including a long-term and large-scale water resource solution.

3.1.1 Strategic Resource Options (SROs)

The long-term water resource solution identified in the WRMP19 preferred strategy was a 75Ml/d desalination plant on the West Southampton Coast. As WRMP19 was an adaptive plan, we also said we would progress alternative options in parallel with our preferred option. Our principal alternative to the West Southampton Coast desalination scheme was an indirect water recycling scheme using the lower River Itchen as an environmental buffer.

Following the PR19 Final Determination and the creation of the gated process by Regulators' Alliance for Progression of Infrastructure Development (RAPID), we were required to consider further alternative schemes not included in WRMP19, such as recycling options involving the use of an environmental buffer (new lakes and wetlands to store treated water) near our Otterbourne Water Supply Works (WSW). One option included using the Havant Thicket Reservoir, being developed by PWC, to store highly treated recycled water from a new Water Recycling Plant (WRP) before transferring it to Otterbourne WSW for further treatment via a new direct raw water pipeline.

Our SRO Options Appraisal Process included a review of environmental, planning, social and value-based criteria, legal and policy obligations and strategic objectives. We tested these options (the West Southampton Coast desalination scheme and the alternative schemes, which included additional desalination options) and considered their performance and delivery against one another. We also considered known risks to our supply-demand balance and undertook a Future Needs Assessment. It was determined that a scheme capable of delivering up to 90Ml/d into our Otterbourne WSW, in drought conditions, would be required in our Western Area.

Development of the Western Area SRO up to RAPID Gate 2

In September 2021, we presented an Interim Update to RAPID, this showed that desalination options on the West Southampton Coast ranked the lowest in the SRO Options Appraisal Process, and that the preferred location presented difficulties, with other locations not considered consentable which meant these options were not likely to achieve planning consent. Therefore, we considered it appropriate to no longer progress with the desalination options. Regulators and other statutory bodies were engaged as part of the SRO Options Appraisal Process and both EA and RAPID supported this approach.

In December 2021, at accelerated Gate 2, we presented RAPID with the outputs of our full SRO Options Appraisal Process. The highest-ranking option, and our selected option, was the Hampshire Water Transfer and Water Recycling Project (HWTWRP) (known at the time as Option B.4). It has the following main components:

- Abstraction from Budds Farm Wastewater Treatment Works (WTW);
- Treatment at a new WRP to produce recycled water at (least 15Ml/d);
- Transfer of recycled water from the WRP to Havant Thicket Reservoir (ca. 5km);
- Abstraction (75Ml/d) at Havant Thicket Reservoir and transfer (ca. 40km) to Otterbourne WSW; and
- Treatment at Otterbourne WSW.

In addition to our selected option, we presented RAPID with a Back-Up Option, which was the next highest-ranking option and could be progressed in the event that the selected option was no longer feasible or deliverable.

The Back-Up Option identified was the HWTWRP back-up option (known at the time as Option B.5). This option was a water recycling and transfer via a new Environmental Buffer Lake project and its main component parts are as follows:

- Abstraction from Budds Farm and Peel Common WTW;
- Treatment at a new WRP to produce recycled water (75Ml/d);
- Transfer (ca. 40km) to an Environmental Buffer Lake at Otterbourne WSW; and
- Abstraction from the Environmental Buffer Lake (75Ml/d) and treatment at Otterbourne WSW.

Each of these options was considered able to deliver the 75Ml/d into supply as required in WRMP19. Furthermore, through the SRO Options Appraisal Process and SRO Future Needs Assessment carried out at Gate 2, they were both considered capable of being scaled-up to deliver up to approximately 90Ml/d into Otterbourne WSW in drought conditions, in order to deliver against known risks to supply and to meet future needs. However, key differentiators between the two options were that HWTWRP represented better value for customers than the Back-Up Option and was better able to meet long-term regional supply requirements.

We published our 2021 Annual Review of WRMP19 in December 2021. It confirmed the outcome of our SRO Options Appraisal Process and SRO Future Needs Assessment. As such, our selected option for the Western Area is the HWTWRP, in a form that will transfer approximately 90Ml/d during peak demand conditions, with a WRP of at least 15Ml/d and up to 60Ml/d capacity. This scheme is on an accelerated timeline as part of the RAPID gated process for investigation and development compared to the SROs being promoted by other water companies on the standard timeline.

In April 2022, in line with the consenting strategy for our selected option submitted at Gate 2, we submitted to the Secretary of State a request for a section 35 Direction for the HWTWRP to be brought into the Development Consent Order (DCO) regime. On 31 May 2022 the Secretary of State gave the Direction, meaning that the selected option must now be consented under the DCO process.

The selected option is now being progressed into the consenting and delivery phases and we are currently in the early stages of the pre-application process for our DCO, including consultation and engagement, Environmental Impact Assessment (EIA), preparing our consenting documentation and progressing scheme development.

We have been engaging throughout the development of the HWTWRP with regulators, local stakeholders and customers to understand and incorporate their views. We ran a public consultation on this scheme in Summer 2022 as part of our DCO pre-application process. To find out more visit our website **here**[1].

Western Area SRO, regional plan and draft WRMP24

The ERP published in January 2022 provided an early look at the water resource solutions that could be needed across the whole region, in the event of a 1:500-year drought.

In developing the regional plan, we looked at a range of options including different sized schemes.

In respect of the SRO for the Western Area described above, the scheme was considered as having two separate component parts, a pipeline, that will need to transfer approximately 90Ml/d from Havant Thicket Reservoir (sized to account for future needs and mitigate against known risks), and a WRP into Havant Thicket Reservoir of four different sizes 15Ml/d, 30Ml/d, 45Ml/d and 60Ml/d. All four variations were combined with a conjunctive use benefit of Havant Thicket Reservoir.

Working with WRSE, we used a high-level regional Python Water Resource (Pywr) model to review the current situation and generate a baseline understanding of the water resources need in the South East. This baseline was then used, together with proposed water resource solutions and possible futures, which depend on a range of forecasts including population forecasts, climate change and environmental destination to generate a Regional Best Value Plan (RBVP).

Our draft WRMP24 has selected the HWTWRP from around 2031[2].

In our draft WRMP24, the HWTWRP is selected by reference to its two constituent parts – a WRP into Havant Thicket Reservoir and a pipeline from Havant Thicket Reservoir to Otterbourne WSW (see Section 7.2.3).

Southern Water and PWC have taken the high level regional Pywr model for the Western Area and PWC supply areas to develop a more granular Pywr model, reflecting more detail in the network and known river and ground water constraints. The initial runs through this model will be based on the RBVP modelling data, which is being used to populate the WRMP tables. The runs will look at the asset available, demand, leakage and environmental constrains etc. around years 2030, 2040 and 2050 (the exact year might change depending on key available assets). The aim of these initial runs is to understand how the Havant Thicket Reservoir provides conjunctive benefit with the HWTWRP, at these key time intervals in the network development.

Another SRO option that we are investigating jointly with TWUL is the 'Thames to Southern Transfer' (T2ST), a transfer from TWUL into our Western Area. This strategic pipeline could move up to 120Ml/d and is dependent on TWUL developing new sources of water, options for which are also being investigated through the RAPID gated process. This SRO is not anticipated to deliver water resources into the supply network until around 2040 and it is dependent on other new and not yet consented or delivered sources. This scheme is being selected in addition to HWTWRP.

For more information on the RAPID process visit **www.ofwat.gov.uk/regulated-companies/rapid/**.

[1] https://www.southernwater.co.uk/our-story/water-for-life-hampshire/consultations

[2] It is worth noting that the Back-Up Option, although an option in the regional plan modelling, is not being selected in the RBVP.

3.1.2 Summary of Western Area deliverables

Table 3.1 summarises progress on options selected as part of the WRMP19 in the Western Area, excluding drought options. Key changes to our WRMP19 preferred plan are as follows:

- As a result of the COVID-19 pandemic, we have had to revise our PCC target for AMP7. We expect the PCC at the end of AMP7 to be higher than originally forecast.
- The bulk import from SWW for up to 20Ml/d has been replaced as SWW has informed us that the supply can no longer be guaranteed. This need is now incorporated into the design of the HWTWRP.
- The desalination option on the West Southampton Coast has been replaced by a new SRO as discussed in the preceding section.

Demand management

Challenges presented by COVID-19 and a global semi-conductor shortage have hit the supply-chain that manufactures our water meters. However, using meters we have been able to source, smart meter installation has begun, and for some customers in Andover and Southampton provision of usage data along with advice aims to reduce their consumption by 3-5%. If this benefit materialises, this could be further rolled out within the region.

Further initiatives within T100 include home audits targeted at high usage customers to influence usage behaviour. In addition, incentivising installation of water-efficient shower heads and tap replacement have been designed to reduce the amount of water used in households.

All in all, T100 including meter penetration in the Western Area is progressing, albeit with revised targets driven by COVID-19 related to increased home working.

In terms of leakage, progress has been made to achieving the 15% reduction target by 2025.

Technology improvements such as the use of automated pressure release valves has helped stabilise the network, reducing leakage. The Western Area has fared better than other areas given its extensive chalk base; other areas typically consist of a clay based sub-structure

Resource development and bulk supplies

Additional import from PWC (additional 9Ml/d): Development of this scheme is underway with borehole testing currently being undertaken by PWC to ascertain adequacy of groundwater supply to support the scheme.

Import from SWW (20Ml/d): This scheme is no longer viable as sustainability targets imposed means this resource is no longer available to transfer to Southern Water. The capacity shortfall of this scheme was also included in the sizing of HWTWRP prior to accelerated RAPID Gate 2.

Additional import from PWC linked to Havant Thicket Reservoir (21M/d): We have established an innovative Bulk Supply Agreement with PWC to govern the development and operation of Havant Thicket Reservoir leading to the provision of raw water in-line with our WRMP19. We continue to work closely with PWC to understand risks relating to reservoir delivery remains on-track.

West Southampton Coast desalination (75Ml/d): This scheme has been replaced with HWTWRP as a result of the outcome of the SRO Options Appraisal Process undertaken for RAPID's accelerated Gate 2. The required capacity of the scheme has been amended from that identified in WRMP19, first reduced to remove a planned surplus originally accommodated in the 75Ml/d sizing, and then increased to accommodate for known risks to the additional import from PWC supply (4.5Ml/d of the additional 9Ml/d) and import from SWW (20Ml/d) and future needs for both Southern Water and PWC. Further details on the calculation of the sizing of the SRO are set out in our RAPID accelerated Gate 2 Submission SRO Options Appraisal Process.

Table 3.1: Status of WRMP19 preferred options in the Western Area, excluding drought options

Schemes	WRZ	Delivery year	Progress
Demand management			
Target 100 water efficiency activity	All	From 2020	Progressing but with revised target
Leakage reduction (15% reduction by 2025; 50% by 2050)	All	From 2020	Progressing
Extension of UMP to take household meter penetration from 88% to 92%	All	From 2020	Progressing
Resource development and bulk supplies			
Additional import from PWC (additional 9Ml/d)	HSE	2024–25	Progressing
Import from SWW (20Ml/d)	HSW	2027–28	Abandoned
Additional import from PWC linked to Havant Thicket reservoir (21Ml/d)	HSE	2029–30	Progressing
Southampton coast desalination (modular to 75Ml/d)	HSW	2027–28	Replaced
Sandown WwTW Indirect Potable Reuse (8.1Ml/d)	IOW	2027–28	Progressing
Hampshire grid (reversible link HSE-HWZ)	HWZ & HSE	2027–28	Progressing
Hampshire grid (reversible link HWZ-HAZ)	HAZ & HWZ	2027–28	Progressing
Southampton link main (reversible link HSW-HSE)	HSW & HSE	2027–28	Progressing
Romsey Town and Broadlands valve (HSW-HR reversible)	HRZ & HSW	2024–25	Progressing
Newbury WSW asset enhancement (1.2Ml/d)	HKZ	2027–28	Progressing
WSW near Cowes – reinstate and additional treatment	IOW	2065 1 branch	Not yet progressing
Catchment management			
In-stream river restoration works on the Itchen	HSE & HW	2027–28	Delayed pending outcome of WFD no deterioration investigations
In-stream river restoration works on the Test (upper reaches)	HA & HR	2027–28	Progressing
Pesticide catchment management / treatment – Sandown	IW	2024–25	Progressing
Pesticide catchment management / treatment – Test Surface Water	HSW	2024–25	Progressing
Nitrate catchment management / treatment – Winchester	HWZ	2027–28	Progressing
Nitrate catchment management / treatment – Romsey	HRZ	2022–23	Progressing
Nitrate catchment management / treatment – Twyford	HSE	2021–22	Progressing

As to delivery date, our draft WRMP24 is selecting the HWTWRP from 2031 (i.e. 1 April 2030 to 31 March 2031) (see Section 7.2.3) and we are fully committed to implementing the scheme by then. We are continuing to optimise the schedule in order to achieve delivery as soon as possible. However, a 2030 delivery date has substantial known and unknown risks and is subject to further development, which we are assessing. We are discussing with regulators around what can realistically be achieved for delivery of the scheme and any mitigations which will be required to support this.

Sandown WTW recycling (8.1Ml/d): The development of a WRP transferring to Sandown WTW to deliver 8.05Ml/d benefit on the IOW. The scheme is progressing with a location for the WRP having been identified and a contractor engaged to support development and delivery.

Hampshire grid (reversible link HSE-HWZ) and Hampshire grid (reversible link HWZ-HAZ): These schemes have progressed with system architecture having been developed, supported by hydraulic optioneering modelling to define system requirements. Route corridors have been developed and a contractor engaged to support development and delivery to outline design. Additionally, ecology and environmental activities have commenced. Due to development in the wider grid design and change of the SRO, for HSE-HWZ the design flow has increased from 38Ml/d to 78Ml/d, and for HWZ-HAZ it has been reduced from 25Ml/d to 15Ml/d. HSE-HWZ remains as reversible, whilst HWZ-HAZ is currently not required to be reversible but can be changed to bidirectional flow after the connection of the T2ST. This still provides appropriate drought and operational resilience.

Southampton link main (reversible link HSW-HSE): This scheme is at the same stage as the Hampshire grid schemes described above. The design flow remains at 60Ml/d.

Romsey Town and Broadlands valve (HSW-HRZ reversible): Scheme to transfer water into HSE WRZ is progressing through solution optioneering before moving into construction.

Newbury WSW groundwater asset enhancement: Scheme to enhance resilience of the HKZ WRZ is progressing with solution optioneering complete. The preferred solution will be developed further before moving into construction.

WSW near Cowes - reinstate and additional treatment: This scheme was only selected in one future branch in our WRMP19 and not until 2065. As such, we have not needed to progress its development. Furthermore, the need for the scheme is under review as part of our WRMP24 work.

Catchment management

Our catchment management and nitrate infrastructure plans were established to mitigate against the impact of higher nitrate levels in raw source water from 2027 onwards. We have continued to monitor and forecast source nitrate levels and plan work accordingly. We are planning to deliver our capital works schemes at Twyford and Romsey providing a 19.6Ml/d and 10.8Ml/d benefit respectively by March 2023. Our current forecast of nitrate levels indicates that these schemes will be sufficient to maintain use of sources. We are able to bring further investments into our plans should monitoring indicate that they are required. This includes WRMP19 referenced works at Winchester which would deliver an 18.2Ml/d benefit. We have reforecast the benefit of our ongoing catchment management to a longer term profile, beyond 2027.

Environmental protection measures

While not directly contributing to supply/demand, we proposed to invest in a range of environmental protections. This includes enhancing and maintaining habitats supporting biodiversity. We continue to work with a range of stakeholders and our plans remain on track.

3.2 Central Area

3.2.1 SNZ water neutrality

SNZ WRZ remains an area under stress from growth and the environmental needs of the Arun Valley. Clear and transparent communication with stakeholders is a priority for us. We welcome feedback and engagement in all of our schemes. We have worked closely with our stakeholders this year to ensure we have an integrated plan of measures in place to manage current needs and to develop the future strategy. We have funded a water neutrality post (one full time employee) to coordinate our internal activity and liaise with partners and we have also offered access to our supply chain to provide dedicated project management resource to the local planning authorities.

Our own requirement to mitigate the potential impact of abstraction from the Pulborough groundwater source has seen us successfully reduce abstraction by more than 50% from the source compared to the average abstraction in the first half of 2021–22. We are continuing to use alternative sources of supply and maximise the bulk import from PWC wherever possible. We are currently investigating the opportunity to formalise this operational regime outside of drought conditions (when we are more reliant on groundwater sources) and whether this could be an alternative solution to water neutrality.

Natural England has raised concerns regarding the current Pulborough groundwater abstraction and any increase to serve planned development. It has advised that the abstraction may be having an adverse impact on site integrity of habitats at designations including Amberley Wild Brooks SSSI, Pulborough Brooks SSSI[2] and Arun Valley SPA[3], Arun Valley SAC[4] and Arun Valley Ramsar site.

Investigations and discussions between Southern Water, the EA and Natural England on the long-term sustainability of the Pulborough groundwater abstraction are ongoing. This includes a sustainability investigation to assess a sustainable level of ground and surface water abstractions.

In the meantime, Natural England has advised local planning authorities that development in SNZ must not add to this potential adverse effect. In a position statement, issued in September 2021, it stated that water neutrality is required to allow development to proceed, without increasing abstraction from the Pulborough groundwater source.

Water neutrality can be defined as: ‘For every new development, total water use in the region after the development must be equal to or less than the total water use in the region before the new development.’ Over the past decade, several Water Cycle Studies (WCSs), supporting local plans, have included water neutrality assessments. However, to the best of our knowledge, this is the first case in the UK where a Local Planning Authority (LPA) is required to demonstrate a deliverable plan for achieving water neutrality. This must demonstrate that the local plan will not have an adverse impact on designated sites.

Water neutrality is required as long as there is potential for an adverse effect on the sensitive habitats in the Arun Valley. In practice, this means it is required until an alternative water source to replace groundwater abstraction at Pulborough can be found. In developing WRMP24, we are looking at a potential scenario where Pulborough groundwater source is no longer available, in order to assess alternative options that could be used to maintain the supply-demand balance. It is possible the water neutrality strategy will be required throughout the time frame covered by affected Local Plans, up to 2037.

We are planning to address the supply-demand balance in SNZ as quickly as possible. Our WRMP19 included the Littlehampton water recycling scheme to provide benefit from 2027–28. This could create sufficient supply-demand headroom to stop any reliance on the Pulborough groundwater source. Depending on the outcome of the sustainability investigation, water neutrality could be required until this date.

A water neutrality strategy has been commissioned by the Local Planning Authorities. This has estimated growth in Sussex North up to 2037 to be approximately 22,000 new houses. This is based on development that did not have full planning consent on 14 September 2021 (and is subject to water neutrality).

New water demand during the plan period is estimated to be 5.5Ml/d should these authorities adopt a water efficiency target of 100l/p/d for new build houses in planning policy. This can be significantly reduced if more ambitious targets of 85l/p/d or 62l/p/d were adopted. These ambitious targets could be achieved with a combination of water efficient fittings and/or the requirement for new-build housing to incorporate rainwater harvesting and/or greywater recycling schemes, where possible.

We had already accounted for a significant proportion of growth within our WRMP19, and while these growth forecasts are higher than originally anticipated, a significant proportion of planned growth in SNZ is already offset by our planned interventions.

[2]SSSI = Site of Special Scientific Interest [3] SPA = Special Protection Area [4] SAC = Special Area of Conservation

If a water efficiency target of 100l/h/d for all new-build houses was applied, the water demand to be offset would be 0.4Ml/d. If a more ambitious target of 85l/h/d were adopted, the local plans would be water neutral by the end of the plan period. However, there would be periods where water neutrality would not be achieved, and so further mitigation would still be required. Offsetting demand would include a combination of measures such as Water-Saving Home Visits, leakage reduction measures, smart metering and non-household rainwater harvesting.

3.2.2 Other options in the Central Area

Table 3.2 summarises the progress on options selected as part of the WRMP19 in the Central Area, excluding drought options.

Key changes to our WRMP19 preferred plan are as follows:

- As a result of COVID-19 pandemic, we have had to revise our PCC target for AMP7. We expect the PCC at the end of AMP7 to be higher than originally planned.

Table 3.2: Status of WRMP19 preferred options in the Central Area, excluding drought options

Schemes	WRZ	Delivery year	Progress
Demand management			
Target 100 water efficiency activity	All	From 2020–21	Progressing but with revised target
Leakage reduction (15% reduction by 2025; 50% by 2050)	All	From 2020–21	Progressing
Extension of UMP to take household meter penetration from 88% to 92%	All	From 2020–21	Progressing
Resource development and bulk supplies			
Littlehampton WTW Indirect Potable Water Reuse	SNZ	2027–28	Progressing
Coastal Desalination – Shoreham Harbour	SBZ	2027–28	Progressing
Pulborough groundwater licence variation	SNZ	2021–22	Delayed
Aquifer Storage & Recovery (Sussex Coast – Lower Greensand)	SWZ	2027–28	Abandoned
Transfer to Midhurst WSW & Petersfield borehole rehabilitation	SNZ	2025–26	Progressing
Scheme to bring West Chiltington back into service	SNZ	2024–25	Progressing
Winter transfer Stage 2: New main Shoreham/North Shoreham and Brighton A	SBZ	2027–28	Progressing
Catchment management			
Arun/W Rother – instream catchment management options	SNZ & SWZ	2027–28	Delayed pending outcome of WFD no deterioration investigations
Pesticide catchment management / treatment – River Arun	SNZ	2024–25	Progressing
Pesticide catchment management / treatment – Pulborough Surface	SNZ	2024–25	Progressing
Pesticide catchment management / treatment – Weir Wood Reservoir	SNZ	2024–25	Progressing
Nitrate catchment management / treatment – North Falmer A	SBZ	2026–27	Progressing
Nitrate catchment management / treatment – North Arundel	SWZ	2027–28	Progressing
Nitrate catchment management / treatment – North Falmer B	SBZ	2025–26	Progressing
Nitrate catchment management / treatment – Long Furlong B	SWZ	2022–23	Progressing
Nitrate catchment management / treatment – Brighton A	SBZ	2027–28	Progressing

- Pulborough groundwater licence variation has been delayed pending further investigation as described above.
- The Aquifer Storage and Recovery option in the Sussex Coast Lower Greensand has been abandoned as a suitable site for the option could not be secured.
- The coastal desalination scheme is not deliverable at the proposed Shoreham Harbour location. Alternative locations are being considered alongside upsizing of the Littlehampton WTW Indirect Potable Recycling scheme.

The scheme to install a new main between Shoreham and Brighton is currently being reviewed to determine the impact of water neutrality on available water.

Resource development and bulk supplies

Littlehampton WTW Indirect Potable Water Recycling: Optioneering for this scheme was carried out in July 2022 and site investigations are progressing.

Coastal Desalination – Sussex Coast: The scheme has been renamed Sussex Brighton WRZ drought and resilience scheme as other options for consideration outside of Shoreham are now being considered. The scheme has proved to be undeliverable at the proposed location of Shoreham Harbour. We are actively looking at alternative locations and solutions including upsizing of the Littlehampton WTW Indirect Potable Recycling and relocating the desalination plant to the River Adur. Despite these challenges we are planning to deliver the original required benefit in March 2027.

Pulborough groundwater licence variation: This scheme has been delayed pending the outcome of the WFD No Deterioration investigations.

Aquifer Storage and Recovery in the Sussex Worthing WRZ: This scheme is no longer being delivered.

Transfer to Midhurst WSW and Petersfield borehole rehabilitation: Scheme to investigate the release of additional DO from Petersfield WSW. Optioneering has been scheduled for September 2022.

Scheme to bring West Chiltington back into service: Scheme to release additional deployable output from West Chiltington was selected as a preferred option in July 2020. Environmental surveys are currently being conducted on site as part of the scheme delivery.

Pulborough Winter transfer Stage 2: New main between our Worthing and Brighton Water Resource Zones to facilitate additional transfer of water from Pulborough during the winter to allow resting of groundwater sources near Brighton. We are currently reviewing the potential impact of Water Neutrality on the viability of this scheme, as it utilises water from Pulborough during the winter to allow groundwater sources near Brighton to be rested.

Catchment management

Our catchment management and nitrate infrastructure plans were established to mitigate against the impact of higher nitrate levels in raw source water from 2027 onwards. We have continued to monitor and forecast source nitrate levels and planned work accordingly. Our aim is to prevent the loss of 20 Ml/d of supply by March 2025 at North Falmer A, North Falmer B, Brighton A, North Arundel and Long Furlong B. Current forecast of nitrate levels indicate that these schemes will be sufficient to maintain use of sources. We are able to bring further investments into our plans should continued nitrate monitoring indicate that they are required. We have reforecast the benefit of our ongoing catchment management to a longer terms profile, beyond 2027.

Environmental protection measures

While not directly contributing to supply/demand, we proposed to invest in a range of environmental protections. This includes enhancing and maintaining habitats supporting biodiversity. We continue to work with a range of stakeholders and our plans remain on track.

3.3 Eastern Area

Table 3.3 summarises the progress on options selected as part of the WRMP19 in the Eastern Area, excluding drought options.

Key changes to our WRMP19 preferred plan are as follows:

- As a result of COVID-19 pandemic, we have had to revise our PCC target for AMP7. We expect the PCC at the end of AMP7 to be higher than originally planned.
- The option to use full existing transfer capacity from Faversham4 has been delayed.

Table 3.3: Status of WRMP19 preferred options in the Eastern Area, excluding drought options

Schemes	WRZ	Delivery year	Progress
Demand management			
Target 100 water efficiency activity	All	From 2020–21	Progressing but with revised target
Leakage reduction (15% reduction by 2025; 50% by 2050)	All	From 2020–21	Progressing
Resource development and bulk supplies			
Medway WTW Indirect Potable Water Reuse	KMW	2027–28	Progressing
SEW bulk supply near Canterbury	KTZ	2025–26	Progressing
Utilise full existing transfer capacity (from Faversham4)	KTZ	2027–28	Progressing
West Sandwich and Sandwich WSW licence variation	KTZ	2021–22	Delayed
Catchment management			
Pesticide catchment management / treatment – Darwell Reservoir	SHZ	2024–25	Progressing
Pesticide catchment management / treatment – River Medway Scheme	KMW	2024–25	Progressing
Pesticide catchment management / treatment – Powdermill Reservoir	SHZ	2024–25	Progressing
Nitrate catchment management / treatment – Deal	KTZ	2022–23	Progressing
Nitrate catchment management / treatment – West Sandwich	KTZ	2025–26	Progressing
Nitrate catchment management / treatment – Manston	KTZ	2022–23	Progressing
Nitrate catchment management / treatment – Ramsgate B	KTZ	2022–23	Progressing
Nitrate catchment management / treatment – Birchington	KTZ	2022–23	Progressing
Nitrate catchment management / treatment – North Deal	KTZ	2022–23	Progressing
Nitrate catchment management / treatment – near Canterbury	KTZ	2025–26	Progressing
Nitrate catchment management / treatment – Sandwich	KTZ	2027–28	Progressing

- The West Sandwich and Sandwich WSW licence variation option has been delayed to 2023–24.

Resource development and bulk supplies

Medway WTW Indirect Potable Water Recycling: Optioneering for this scheme occurred in July 2022. A sampling programme has been established to inform the process requirements and sampling is underway. Following analysis of future flow regimes at Medway WTW, we have identified a risk that the full 18 Ml/d may not be available in a 1 in 200 year drought scenario.

SEW bulk supply near Canterbury: We are working with SEW to progress this import.

Utilise full existing transfer capacity (from Faversham4): This involves modifying two separate underground sources to allow more water to transfer to Kent Thanet WRZ. Review of achievable output is currently underway.

West Sandwich and Sandwich WSW licence variation: The scheme was due to be implemented by March 2021, however, this was delayed. A licence change application was submitted in March 2022 and a water feature survey has been completed. Pump testing with environmental monitoring at Woodnesborough and Flemings will be carried out in Autumn 2022 and outputs will be determined in December 2022.

Catchment management

Our catchment management and nitrate infrastructure plans were established to mitigate against the impact of higher nitrate levels in raw source water from 2027 onwards. We have continued to monitor and forecast source nitrate levels and planned work accordingly. We are planning to prevent the loss of 33 Ml/d of supply by March 2025 at Deal, West Sandwich, Ramsgate B, Birchington, North Deal, Near Canterbury and Sandwich. Our current forecast of nitrate levels indicate that these schemes will be sufficient to maintain use of sources. We are able to bring further investments into our plans should continued nitrate monitoring indicate that they are required. We have reforecast the benefit of our ongoing catchment management to a longer terms profile, beyond 2027.

Environmental protection measures

While not directly contributing to supply/demand, we proposed to invest in a range of environmental protections. This includes enhancing and maintaining habitats supporting biodiversity. We continue to work with a range of stakeholders and our plans remain on track.

3.4 Our plan for 2023–25

This draft WRMP24 covers the 2023–25 period from WRMP19, in addition to the 2025–75 period.

The plan to maintain a supply-demand balance for 2023–25 to 2024–25 remains a combined programme of demand reduction and increasing resource availability. Demand reduction targets remain unchanged from Water Resources Management Plan 2019 and consistent with meeting the PR19 targets. There are some changes resource schemes to reflect updated estimates of reliable scheme and system yields as well as changes to water transfers.

Annex 2 provides a Resource Zone level breakdown of the 2023–25 plan and is accompanied by a separate set of tables.

The plan for 2023–2025 uses the demand forecasts in WRMP19. The retention of those forecasts allows consistency of reporting to that plan and line of sight back to the commitments made. The impact of changes in the updated demand forecasts and in turn levels of service is addressed in the plan post 2025. We have adopted this approach as it ensures that the 2023–25 plan remains coherent to the current approved plan but migrates into the post 2025 plan with the activities and targets reflecting the latest demand forecasts.

The approach also recognises that the WRMP19 plan and the targets were developed reflecting regulatory policy at that time. That plan was not developed on a ‘best value’ basis as defined in the current regulatory processes. Retaining alignment to WRMP19 ensures that consistency of decision making mid periodic review cycle.

It is supplemented by an additional annex on Contingency Options. This sets out work we have undertaken to identify and prepare options should the planned activity fail to delivery on time or with a lower yield.

Given the significance of leakage and demand management, these programmes also have a separate annex setting out work already completed and planned.

Our plan for 2025–75

4. Development of draft WRMP24

A schematic overview of the planning process is shown in Figure 4.1, which summarises the key stages in the development. While the primary risk is drought, we also test the plan against other planning scenarios and other weather events.

A key difference between this WRMP and previous plans is that our approach has been fully integrated with development of the WRSE regional plan. This means that, together with other companies in the region, we can identify and deliver schemes that will give regional-scale benefits, for customers, the environment and other sectors that rely heavily on water. Enabling more water transfers between companies to provide better regional resilience has been a key outcome of this process.

As discussed in Section 1.3, this plan is based upon, and is consistent with the regional best value plan which will be published in November 2022.

Figure 4.2 shows a summary of how we expect our plans to align with the wider regional strategy, our neighbouring companies and other strategic plans, such as our business plan (BP24).

Figure 4.1: WRMP development and consultation process

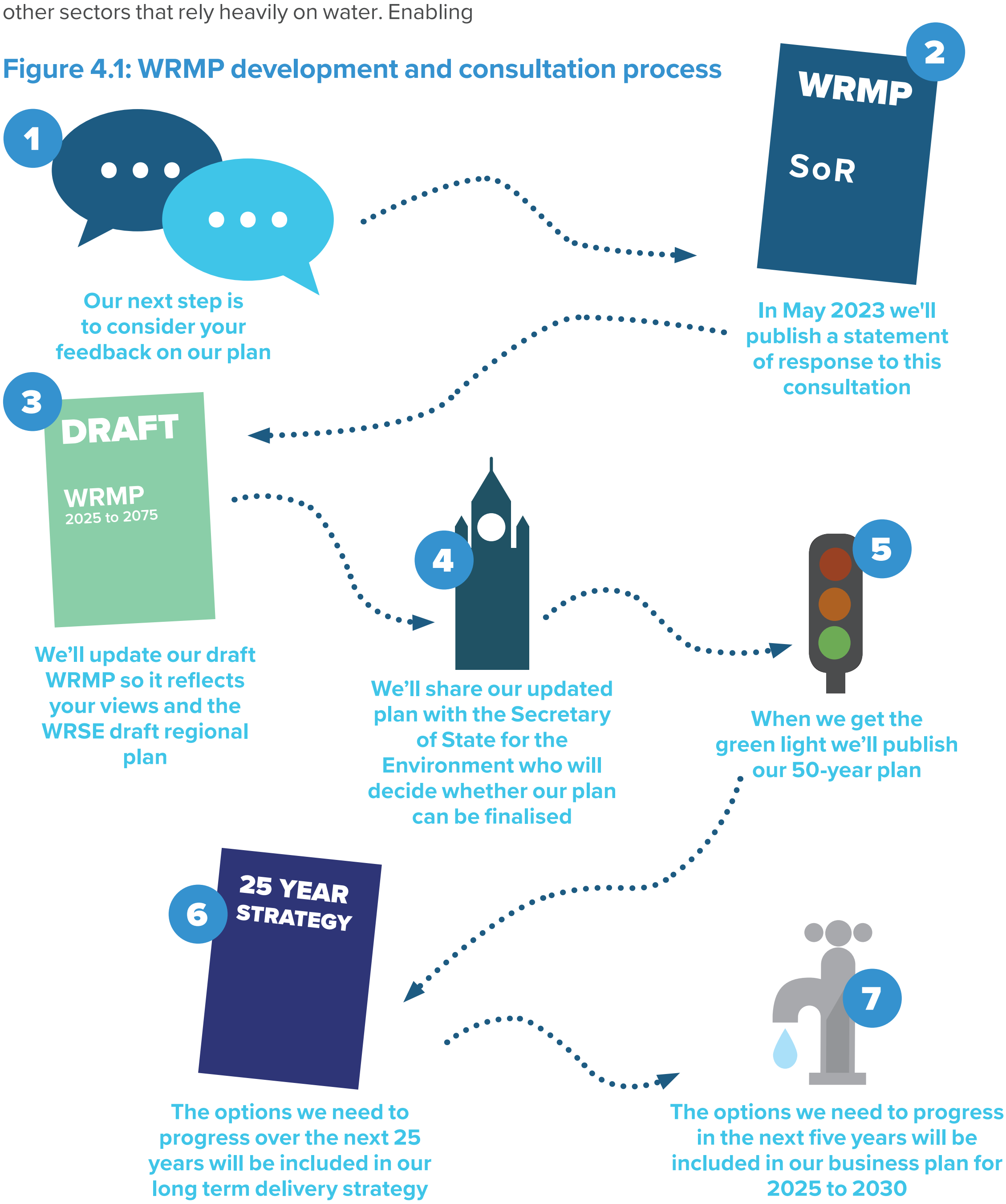
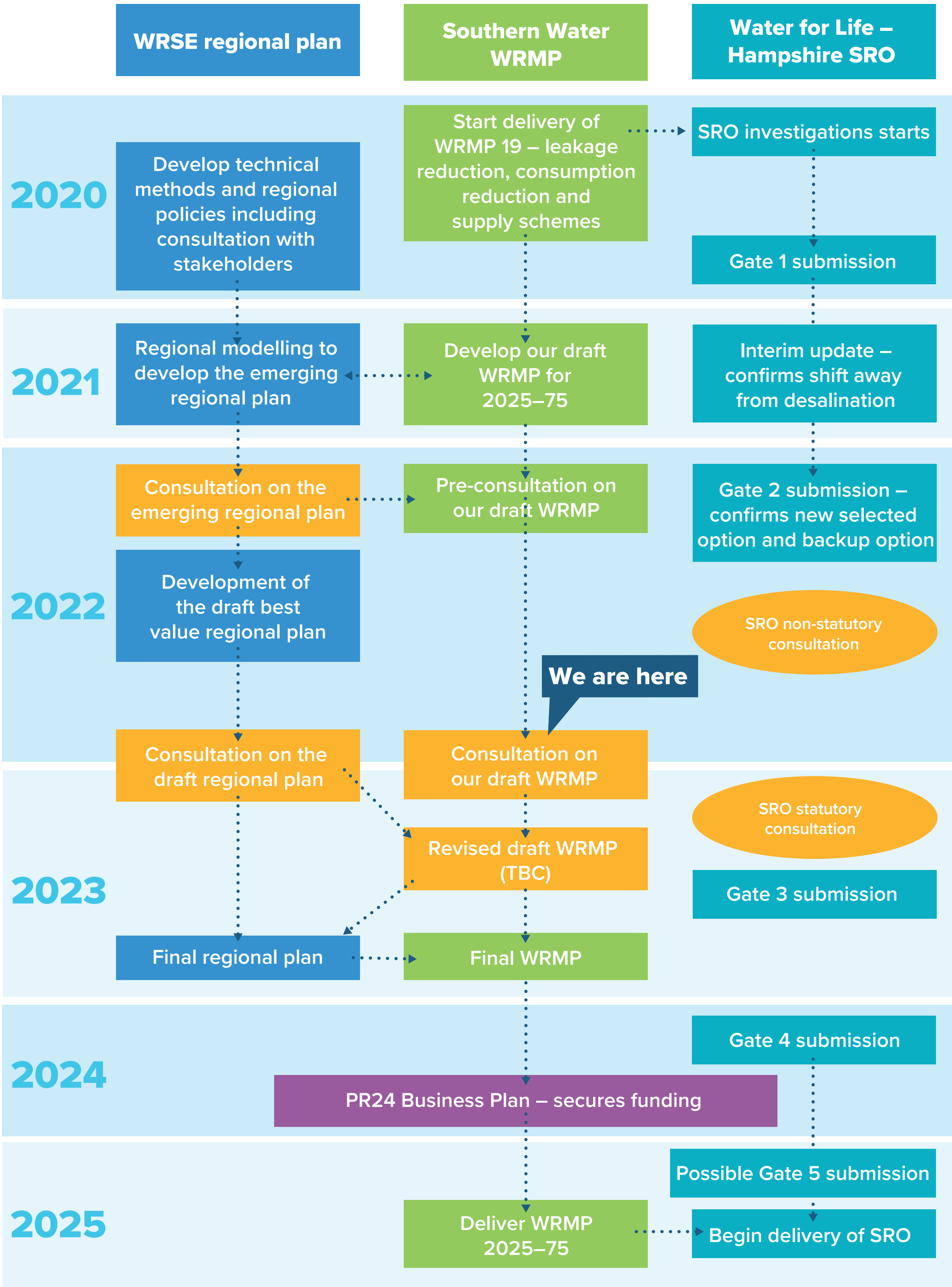


Figure 4.2: Timeline to illustrate how our plan aligns with the wider draft WRMP24 submissions and regional strategy



4.1 Problem characterisation

We have completed a problem characterisation assessment following the UK Water Industry Research (UKWIR) guidance (UKWIR, 2016a and UKWIR, 2016b) for risk-based planning.

This assessment was conducted at a supply area level to reflect the different characteristics and connections of our catchments and water resources. The full results are presented in Annex 3 and a high-level summary is shown in Figure 4.3.

Our strategic needs have become greater, since our 2019 assessment, (i.e. a shift to the right in Figure 4.3) and our complexity factors have become more challenging (a shift down in Figure 4.3). All areas have been categorised with a **Large** Strategic Need, combined with a **High** Complexity Score. The greatest change is in our Eastern Area, which has moved from a Medium to High score for complexity factors.

Figure 4.3: Results from our problem characterisation assessment for draft WRMP24

	Complexity factors score				
Area	**Strategic needs score**	**Supply**	**Demand**	**Investment**	**Overall**
Western	6	7	5	7	19
Central	6	6	5	7	18
Eastern	6	6	5	5	16
Company	4.67	6.33	5	6.33	17.67

		Strategic needs score ("How big is the problem?")			
		0–1	**2–3**	**4–5**	**6**
		(None)	**(Small)**	**(Medium)**	**(Large)**
Complexity factors score ("How difficult is it to solve?")	**Low (<7)**				
	Medium (7–11)				
	High (11+)				**Eastern Area** **Central Area** **Western Area** **Company**

We have moderately significant or very significant concerns over the scale of reductions in supply arising from reductions in abstraction we will need to make to protect the environment, and the potential impacts of climate change on supplies, especially in our WRZs with large reservoir and surface water supplies and the large range of uncertainty in projected demands. Specifically, these relate to metrics S(b), S(c) and D(b) in our problem characterisation.

Under the UKWIR risk based planning guidance (UKWIR, 2016a and UKWIR, 2016b), the problem characterisation assessment should be used to guide selection of appropriate decision making and modelling methods which are proportional to the scale of and complexity of the problem.

We have combined our problem characterisation assessment with those of other WRSE companies (WRSE, 2020a) and many similar trends and drivers have emerged with the south east region overall facing large strategic needs and high complexity.

Given the high complexity and large strategic needs of both the region and Southern Water we considered it appropriate to adopt an extended approach to water resource planning under the UKWIR framework.

Examining the problem characterisation quantitatively, the key complexity factor questions (I(a), I(b), I(d), S(a), S(b), S(c), D(a) and D(b)) that would favour an aggregated approach mostly highlighted very significant concerns in our, and the regional assessment.

4.1.1 An adaptive planning approach

Working with WRSE we believe that adopting an adaptive planning approach offers us greater ability to account for the uncertainty in the selection and scheduling of future water resource options. This will allow our plan to accommodate large step changes in supplies driven by the need to reduce abstraction but also from more gradual changes driven by climate change or population growth.

The investment solutions required to accommodate such large step changes are likely to be highly complex with long lead and development times (e.g. desalination) and have multiple dependencies and interrelationships with other options (e.g. network enhancement, water supply works upgrades etc.). The flexibility offered by an adaptive plan also allows us to move to alternative pathways depending on future outcomes and support earlier adoption of 'no-regret' options that will help to provide better value for money for our customers.

Whilst alternative decision making approaches such as robust decision making offer an optimised and resilient plan against a given metric or set of metrics, they are generally poorer at providing an idea of scheduling and allowing flexibility in the near term in the face of uncertainty. System simulation methods also tend to be better at addressing significant demand side concerns. Whilst we have identified some moderately significant concerns over demand, these tend to be relatively small compared to the supply and investment problems we face as both a company and a region.

4.2 Understanding our drought vulnerability

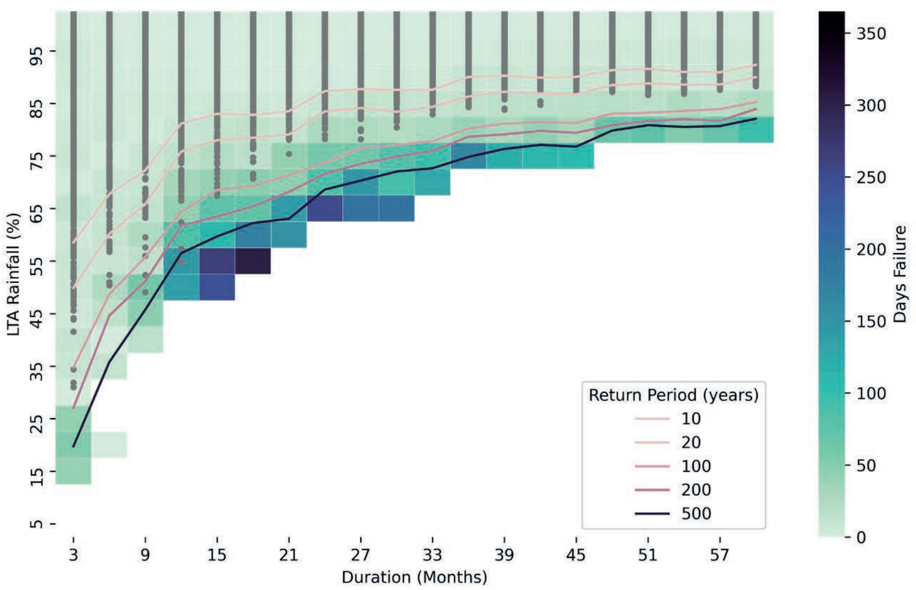
As mentioned in Section 2.2, each of our WRZs will have its own mix of supply sources, and each water source reacts differently to weather conditions, with some being more susceptible to certain planning scenarios or types of drought than others.

To understand the different risks, we have conducted a drought vulnerability assessment following the UKWIR (2017) methodology. The full assessment is presented in Annex 4 and a summary is provided below.

We started by carrying out a high-level screening against set criteria to identify the zones that required detailed assessment. The results show there are five WRZs; four in the Western Area (Hampshire Andover (HAZ), Hampshire Kingsclere (HKZ), Hampshire Winchester (HWZ) and Hampshire Rural (HRZ)) and one in the Eastern Area (Kent Medway East). These were screened out because the deployable output of a source is largely constrained by the assets, infrastructure and licence conditions surrounding it, and does not vary significantly with drought.

For the WRZs identified as 'drought vulnerable' from the high-level screening, we have created 'drought response surfaces', which relate duration and severity of a lack of rainfall to the likelihood of supply failures. An example drought response surface is shown in Figure 4.4 below.

Figure 4.4: Example drought response surface



The zones that predominantly rely on abstraction from rivers (HSE, HSW, SNZ) are the most drought vulnerable. This vulnerability arises from a combination of existing or marginal supply-demand deficits and DO, which is largely made up of river flows above minimum or hands-off flow (HoF) licence conditions.

Our assessment found that Central and Western Areas show very similar critical droughts. This is due to the characteristics of the chalk aquifer, which dominates SBZ and SWZ and provides groundwater support to the rivers Test and Itchen in Hampshire.

Southern Hampshire and the Sussex chalk are most sensitive to 12-to-21-month drought events, ending in October, with the most critical event lasting around 15 months. These represent single dry winter events, but with multiple dry summers and autumns. Dry autumns are particularly critical, with a lack of rain preventing recharge and groundwater recovery after a dry summer. SNZ shows a similar critical drought response, but the supply mix differs, being mostly made up of Lower Greensand groundwater and base flow to the Western Rother.

Our Eastern Area zones tend to be more sensitive to longer droughts than in the Central and Western Areas, as a result of the storage buffering of the large reservoir systems, which provide a degree of resilience to short drought events.

4.3 Our planning scenarios

The primary objective of water resources planning is to ensure that there are always enough supplies available to meet anticipated demands, under various weather conditions, but especially in dry and very dry drought conditions. The balance between supply and demand can fluctuate and it is important that we are able to maintain supplies in an average year and in drought. This means planning for different scenarios to mitigate different challenges.

Our drought vulnerability assessment has highlighted the key supply risks relating to rainfall deficits that accumulate most significantly over winter periods and which then materialise as loss in DO through summer and autumn months primarily between July and October.

To address these risks our plan considers supply and demand under normal-year annual average (NYAA), dry-year annual average (DYAA) and dry-year critical period (DYCP) scenarios, and for different severity drought conditions i.e. 1-in-100 year (1:100), 1-in-200 year (1:200) and 1-in-500 year (1:500).

4.3.1 Minimum Deployable Output scenario

In our previous WRMPs we have also considered a further scenario based on Minimum Deployable Output (MDO). This scenario goes outside the minimum required scenarios, but we considered it to better reflect the risks in some of our river and groundwater dominated WRZs because it reflects the supply position at the time of lowest water resource availability, usually in the early Autumn when groundwater levels and river flows are at their annual minimum. Typically, this applies to our Western and Central Areas where we currently do not have significant storage reservoir resource and so DOs vary seasonally and with drought severity.

For this plan we have not assessed a specific MDO scenario because the system simulation approach we have adopted for our supply forecast to determine our DOs accounts for the seasonal and transient variability in deployable output and WRZ level system response. This includes the transition between normal and dry year average demand and critical period (DYCP) peak demand (corresponding with our DYCP/Peak DO Scenario). Annex 8 provides further details.

4.4 Our target levels of service 2025–75

Our customers expect a certain level of service from us in terms of their risk to supply interruptions and demand restrictions due to drought. This plan needs to make sure that there is enough water available to meet anticipated demand in all WRZs and to ensure we meet the level of service which has been agreed with our customers.

We express our levels of service in terms of the expected frequency of restrictions i.e. temporary use bans (TUBs) and non-essential use bans (NEUBs) that our customers are willing to accept (customer target levels of service) and the frequency of drought permits and orders, allowing modified abstraction regimes at some of our sources (environmental target level of service).

A key principle of our plans is that our water supply system should be 'resilient' to severe drought events. We have assessed our water supply system against a range of drought scenarios, up to and including low probability droughts (1:500 return period with and annual probability of 0.2%). Although such events are unlikely, their economic and social impact would be significant, and there is still around a 10% chance of such an event up to 2075.

We plan for these unlikely droughts, ensuring that there is no risk of our system failing to balance supply and demand in each supply area.

For this plan we are planning to be resilient to droughts of up to 1:500 severity by 2040. The need to increase our resilience to 1:500 by 2040 is a step change from WRMP19 required within planning guidance and will help to ensure secure water supplies for our customers even in extremely rare drought events. As well as improving resilience to drought our plan will provide greater environmental protection and we will not require the use of drought permits and orders to increase abstractions beyond licenced quantities in droughts of up to 1:500 severity (0.2% annual probability) in any zone after 2040. These interventions have not been included as options in our decision making after 2040. However, to achieve these targets we will need to reduce demand and develop new and alternative sustainable sources of water.

Our target levels of service for restrictions on water use, drought permits and drought orders are set out in Table 4.1.

Table 4.1: Target levels of service

	Annual chance	Return period	Chance of at least one occurrence between 2025–75
Customer target levels of service			
Advertising to restrict water use	20%	1:5 years	100%
Temporary Use Ban on different categories of water use	10%	1:10 year[1]	99%
Drought order (Non-Essential Use Ban)	5%	1:20 year[1]	92%
Environmental target levels of service			
Application for drought permits and orders to increase supplies through relaxation of abstraction licence conditions, increase in licensed quantities or other measures[2]	5%	1:20 year[3]	92%

[1] Frequency of first implementation but would be introduced via a phased approach.

[2] The 1:500-year target is achieved by 2040 in line with Water Resource Planning Guidelines. Our target level of service is less than this in some prior to 2040. See emergency drought orders section for more information on how we will reach this target.

[3] For HSE we expect the short-term level of service for these drought permits and orders (up to 2027) could be less than our target.

4.4.1 Customer levels of service for restrictions on demand

Temporary restrictions of customers' water use, such as temporary use bans (TUBs) and Non-Essential Use Bans (NEUBs), balance the need to invest significant amounts in water resources that may increase customers' bills. During our pre-consultation with customers, TUBs and NEUBs were not seen as significant concerns, as they do not occur very often and had limited impact on most customers. Most participants felt that they were not a priority when improving future service levels – although there was also no appetite for an increase in the frequency of restrictions.

To meet customer expectations, we plan to maintain our target level of service for demand restrictions, including TUBs and NEUBs, in keeping with our WRMP19, our Drought Plan 2019 (DP19) and our draft Drought Plan 2022 (DP22). Water savings made as a result of temporary drought measures are in addition to those saved as part of day-to-day water efficiency activity, although they are only used when needed.

Our 'Section 20 agreement' with the EA (Water Industry Act 1991) specifies the phasing of TUBs and NEUBs in affected WRZs in our Western Area (namely HSE and HSW). TUBs are required before implementation of the River Test Drought Permit and partial implementation of NEUBs is required before the River Test or River Itchen Drought Orders are implemented. The expected frequency and probability of these events has been incorporated into our forecast levels of service, based on recent modelling undertaken using WRSE datasets and in support of our DP22.

In our Central Area the level of service for restrictions on water use has been impacted by a need to protect designated conservation sites which are near to one of our key sources (Pulborough). In order to maintain security of supply in the area there is an increased risk of needing to apply for a Pulborough drought order, rather than a drought permit, which will increase the frequency of needing to implement NEUBs.

4.4.2 Environmental level of service for drought permits and drought orders

Our DP22, sets out our proposed levels of service for the use of drought permits and orders. These are intended to temporarily increase supplies by relaxing abstraction licence conditions, increasing licensed quantities or other measures. The triggers we have proposed to implement these permits and orders are set to keep us in line with our target environmental levels of service of use.

We expect to apply for these drought permits and orders no more than once in 20 years on average, equivalent to an annual chance of 5% or a 40% chance in the next 10 years. We have not planned to include drought permits and orders to deliver permanent improvements in resilience due to the sensitive nature of the chalk streams in these areas. Our plan also aligns with the EA's National Framework (Environment Agency 2020a).

However, long-term strategic water resource schemes can take several years to appropriately plan and deliver so orders and permits may still be required to 2040. Keeping some in reserve allows us to further avoid the use of extreme restrictions, such as rota cuts and standpipes, something customers have repeatedly said they would find unacceptable.

In order to provide more protection to the rare chalk river habitats of the River Itchen, our Western Area drought permits and orders will not be used after 2030, except the River Test Drought Permit/Order that can be used up to 2040 in a 1:500 scenario.

4.4.3 Emergency drought orders

Our customers do not like severe drought restrictions (rota cuts or standpipe supply). Restrictions on day-to-day life as a result of COVID-19 changed customers' perceptions about the impacts they consider to be tolerable, particularly in terms of essential services. Among customers there is a good level of support for reducing the risk of severe restrictions from the industry standard of 1:200 severity.

A voting exercise showed that, while some were comfortable with the current level of risk, the majority would prefer to see a further reduction. There were mixed views as to how far the reduction in risk should go beyond 1:200.

In our WRMP19, our target level of service was set to provide resilience against emergency drought orders for events of 0.2% probability (1:500). For more severe events, we would need to use emergency drought orders, including standpipes and rota cuts (Level 4 restrictions), as was last experienced in the 1976 drought. Table 4.2 sets out our current levels of service for emergency drought orders and permits and the glidepath for achieving 1:500 resilience.

4.4.4 Our Level of service statement

To assess our level of service at WRMP19 and WRMP24 we modelled our system against multiple future scenarios. The results show we will only have to apply up to seven or eight TUBs and up to four NEUBs the next 75 years. This is based on current projections and impacts of climate change. After 2028, once our strategic resource options for the Western Area are in place, we would also expect to have to apply for temporary abstractions beyond normal environmental safeguards in around two droughts to 2040.

Table 4.3 shows our current and planned levels of service for customers and the environment.

Table 4.2: Level of service glidepath to 1:500 resilience against use of emergency drought orders without drought permits and orders

Area	Current position	2025–30	2030–40	Beyond 2040
Western Area	0.5% annual chance (1:200 return period) without drought permits and orders 0.2% chance (1:500 return period) with drought permits and orders	Less than 0.5% annual chance (1:200 return period) with drought permits and orders	Less than 0.5% annual chance (1:200 return period) with drought permits and orders	0.2% annual chance (1:500 return period) without drought permits and orders
Central Area		Less than 1% annual chance (1:100 return period) with drought permits and orders	Less than 0.5% annual chance (1:200 return period) with drought permits and orders	
Eastern Area		Less than 0.5% annual chance 1:200 return period with drought permits and orders	Less than 0.5% annual chance 1:200 return period with drought permits and orders	

Table 4.3: Current and planned levels of service for customers and the environment

	Likelihood of use		
Drought actions	**Hampshire and Isle of Wight**	**West Sussex and Brighton & Hove**	**East Sussex and Kent**
Temporary Use Bans	Once in every five years on average until 2030 Once in every 10 years after 2030	Once in every five to 10 years on average until 2027 Once in every 10 years after 2027	Once in every 10 years on average
Drought Order to restrict water use – Non-Essential Use Ban	Once in every 20 years on average	Once in every five to 10 years on average until 2027 Once in every 20 years after 2027	Once in every 20 years on average
Emergency drought measures – standpipes and rota cuts	Less than once in every 200 years until 2040 Once in every 500 years after 2040	Less than once in every 100 years until 2030 Less than once in every 200 years between 2030 and 2040 Once in every 500 years after 2040	Less than once in every 200 years until 2040 Once in every 500 years after 2040
Drought orders and drought permits to increase supplies	Once in every five years until 2030 Once in every 20 years until 2040 After 2040 no use of drought orders or drought permits	Once in every 20 years until 2040 After 2040 no use of drought orders or drought permits	Once in every 20 years until 2040 After 2040 no use of drought orders or drought permits

4.5 Customer and stakeholder engagement

We have been engaging with our regulators, customers and stakeholders as we have developed this WRMP. Through these regular interactions, we have identified their key priorities and sought opinions on our water resources strategy and the range of options we could include in our plan.

4.5.1 Customer engagement

We have engaged with over 3,000 customers and stakeholders to create WRMP24, including households, businesses, stakeholders, future customers and harder to reach audiences, placing particular emphasis on the use of deliberative approaches to ensure we gathered quality insight.

During initial discussions customers are often surprised by the current and future challenge of water scarcity. Water tends to be viewed as an abundant resource with limited experiences of shortages, perceptions that it is 'always raining' and the fact we are an island surrounded by water. Upon further exploration, customers understand the challenges of population growth, climate change and environmental protection and they support the need for action to be taken to ensure a resilient water future for the South East.

Customer preference tends to start with a desire to make best use of what water is available and therefore they want to see demand measures to reduce leakage and improvements to water efficiency. However, they also want to see supply side solutions that help address the root cause of water scarcity for future generations and want the risk of emergency drought restrictions reduced.

Through all our engagement there is a high level of priority placed on environmental protection. Therefore, the focus on reducing abstraction first, as set out in the regional plan, is welcomed, although the consultation showed that customers are looking for more detail from company WRMPs on how this will be achieved. In our plan we have set out our approach to achieving sustainable abstraction through our Environmental Ambition and the measures and assets we will need to get there through our proposed strategies.

They want to see us take a collaborative approach to long-term water resources planning, including a focus on resilience to drought and unexpected events. While they support the sharing of resources, they want more information about local level impacts in order to decide whether specific strategic options are the right choice for them. They also support an adaptive planning approach that looks at the different scenarios and pathways.

Throughout the development of the regional plan, customers have shown support for using water demand levers, but want to see these blended with other solutions to avoid reliance on one at a time. The two measures that received a less positive response were desalination and water transfers. During the evaluation phase of the development of the regional plan, customer support for either of these was reliant on a need to mitigate key concerns around cost and environmental impact.

Overall, there was consensus that an acceptable plan would protect the environment, have a strong focus on education and demand management, increase the level of resilience and continue to drive down the risk of emergency drought measures. It would also need to incentivise companies to minimise waste.

Further details of this customer engagement are set out in Annex 6.

4.5.2 Stakeholder pre-consultation

To create our plan we held detailed pre-consultation discussions with the EA, Natural England, Ofwat and neighbouring water companies. We delivered briefings on the methods and techniques we are using as part of the plan, and received detailed pre-consultation feedback from Ofwat, the EA and PWC.

The EA provided valuable technical comments and inputs, however, also identified some concerns relating to the deliverability and potential impacts of certain options, including desalination and water recycling. The EA also wanted to see more alignment between our WRMP and the Strategic Resource Options being progressed through the RAPID gated process.

Ofwat requested clarity on the WRMP19 supply demand balance position currently being implemented. Particularly, it wanted to see details on the significant resource developments and demand savings planned for, including glidepaths towards achievement and sensitivity testing around delivery and costings.

PWC provided comments on options that were common to or shared between our respective WRMPs, seeking an understanding of why options had been included, including information on the outputs and data underpinning them.

We also received comments on the options, and the assessments of benefits and impacts, particularly from the EA and Natural England.

Our draft WRMP responds to a lot of these comments. We aim to provide a clear explanation of the relationship between options being progressed (through the RAPID gated process). This means explaining where different data sets are being used and why, as different plans and documents are submitted and published. We have also ensured that the draft WRMP clearly explains why options have been included, including any assessments of environmental performance and financial and carbon costings.

We have been involved in discussions with the other regional groups to look at potential water transfers from other parts of the country to the South East through various WRSE consultations. These have looked at technical methods, regional polices and how to measure the additional value the Regional Plan delivers through the development of a best value framework. We have actively supported these activities and contributed to a series of workshops and webinars with stakeholders where we asked for their input on various options.

In the past we held county-specific face-to-face stakeholder workshops (in Kent, Sussex, Hampshire and the Isle of Wight), but this has not been possible due to COVID-19 restrictions. Instead, for WRMP24 we held online workshops, organised and run by WRSE companies, to specifically discuss the Regional Plan proposals, almost as a pre-consultation on the WRMPs.

Four of the five WRSE workshops were relevant to our WRMP:

- 17 January 2022 – Joint webinar with other regions
- 20 January 2022 – Regional overview
- 31 January 2022 – East
- 1 February 2022 – West

All of the slides from the webinars, together with a recording of the presentation and discussion, were published online. WRSE also published a document containing the questions posed during the webinars, with responses included (WRSE, 2022b). Some 590 people joined the five online consultation webinars, with over 170 questions submitted and responded to. An additional interactive online Q&A session was held on 1 March with a further 24 questions submitted and responded to.

We received specific feedback from the EA on the options which were selected in the ERP that has informed the further work we have undertaken around deliverability and contingency planning as set out in section 9.

We also wrote to a wide range of stakeholders in February 2022, with pre-consultation information on our WRMP, setting out the key issues we are facing and the methods and techniques we are using to create our plan. We also asked for their views on any new options for us to consider as part of the WRMP process.

As well as the responses from the EA, Ofwat, Natural England and PWC referred to above, we received responses from Salmon & Trout Conservation UK, Horsham District Council, Mid Sussex District Council, Adur and Worthing Council and individual responses.

During the development of the plan the Drinking Water Inspectorate (DWI) has issued guidance on the ‘Long-Term Planning of Water Supplies’ which they expect water companies to follow when securing new supplies. We are taking account of their guidance in the development and appraisal of new water resources options, such that we are having due regard for drinking water quality and the potential for water quality risks.

In June 2022 we submitted an early draft WRMP submission to Defra as required by the WRMP Direction 2022 and this has enabled us to take on board some early feedback which has influenced the development of this plan. One of the key areas we have improved in this plan in response to that feedback is the inclusion of more detail on both our demand management and supply-side delivery schemes. In addition, in recognition of the comments we have received around delivery risk, we have undertaken a deliverability assessment of our supply-side schemes and included a contingency plan to show how we will mitigate any supply-demand risks associated with the planned timing and benefit of schemes.

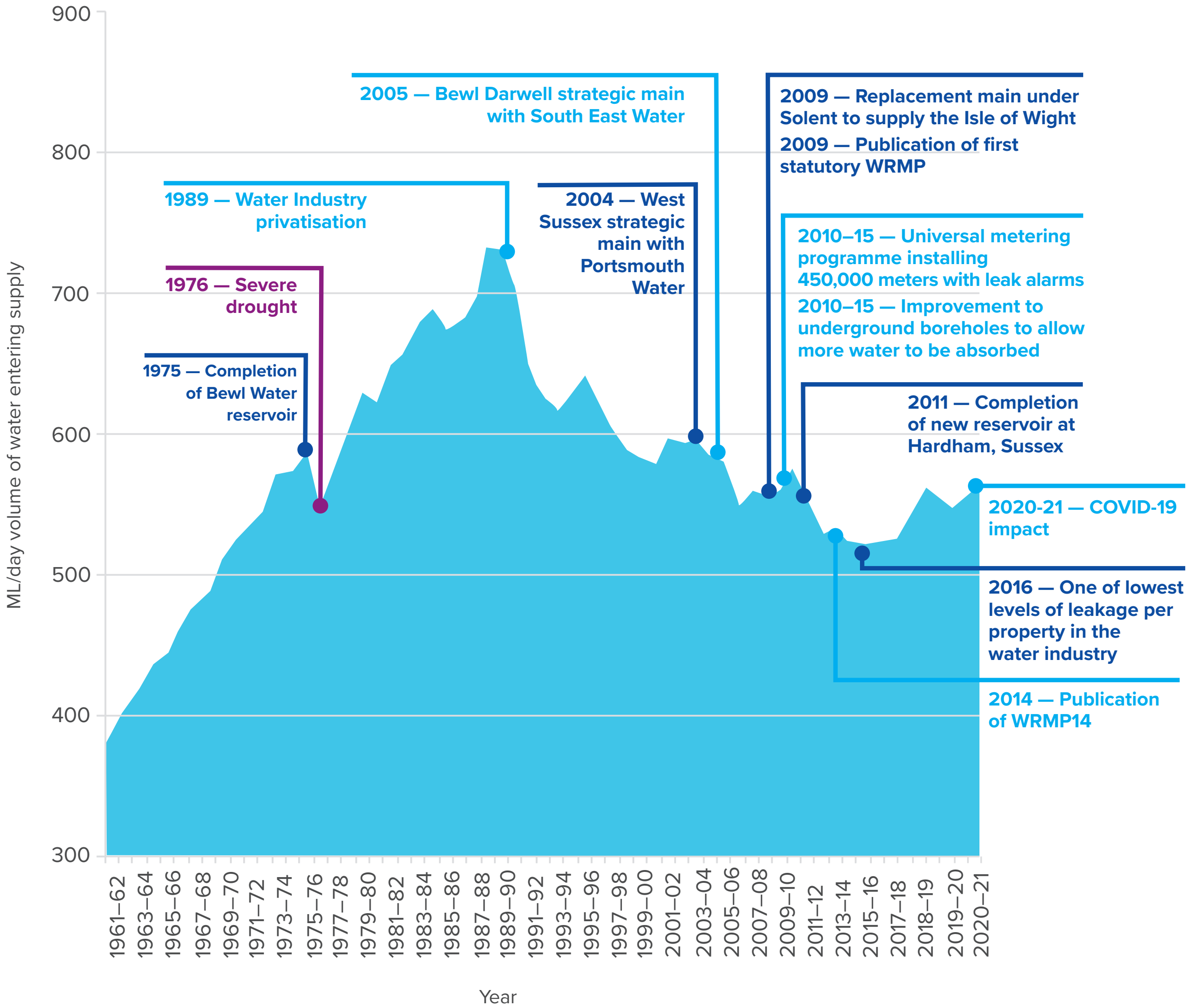
We have set out details of all the pre-consultation feedback received in the development of our draft WRMP24 in Annex 6.

5. Our supply-demand situation 2025–75

5.1 Previous levels of water supply

Before predicting future demand for water, it is important to look at past trends. We would normally expect demand to increase over time, primarily due to population growth. This is certainly what we saw from the early 1960s to privatisation of the water sector in England and Wales in 1989. After that, the amount of water we put into supply, or Distribution Input (DI), has declined over time despite populations increasing (Figure 5.1). This has been achieved through both significant reductions in leakage, as well as more efficient use of water by our customers. Our DI has increased recently as a result of the impacts of COVID-19, but we continue to work with our customers and other stakeholders to promote water efficient behaviours. We must do this to maintain clean, safe and sustainable water supplies for our customers while protecting and improving rivers, reservoirs and coasts for the future.

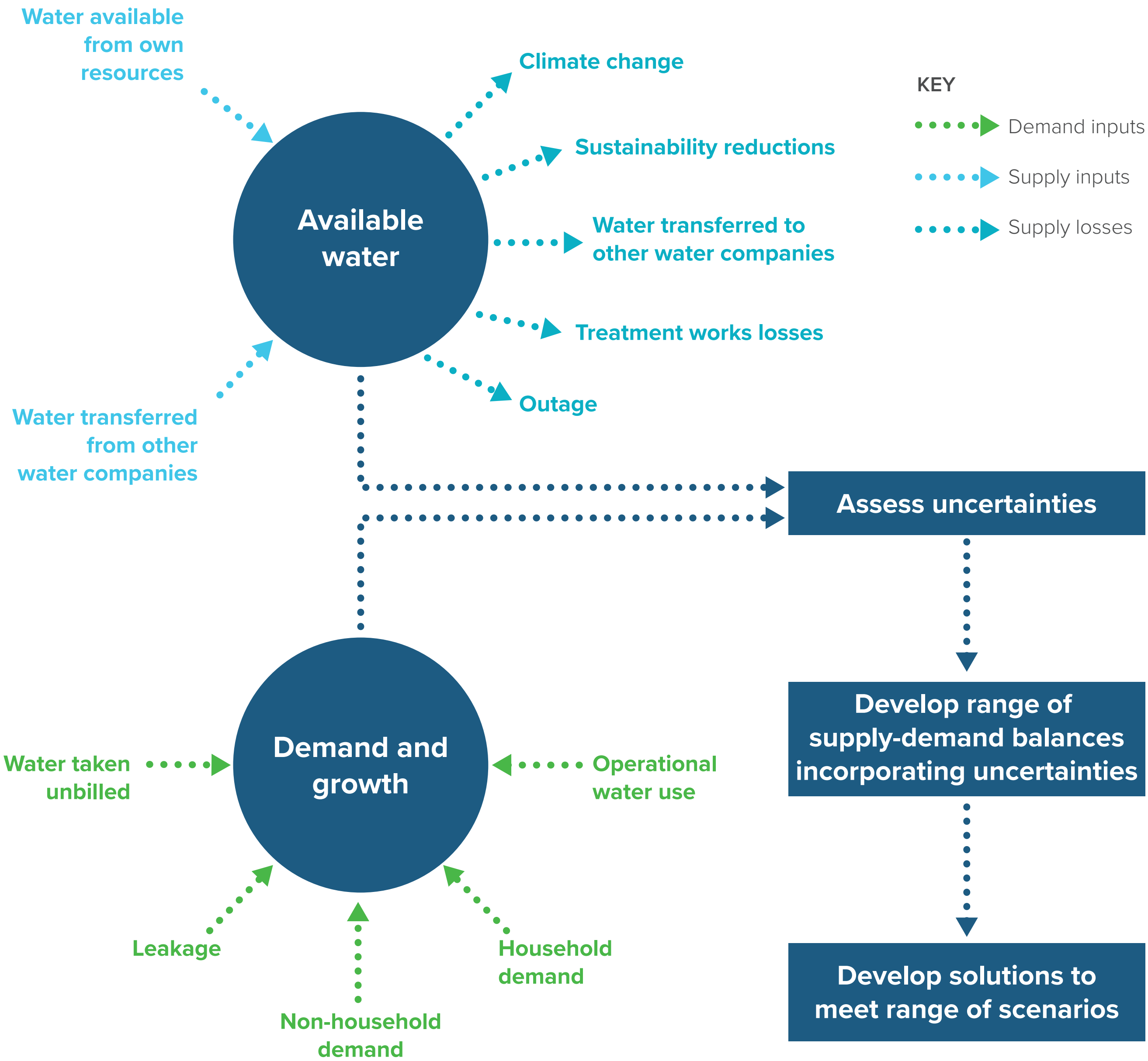
Figure 5.1: Changes in our distribution input over time



To develop a future-proof WRMP, we need to start by understanding how much water will be needed in the future.

We do this by forecasting demand for water under different planning scenarios. We also forecast the supplies that will be available to meet that demand, taking account of associated risks and uncertainties (Figure 5.2). In cases where demand exceeds supply, we have a supply-demand deficit. This will need to be closed by identifying options that can bridge the gap.

Figure 5.2: Key components of supply and demand forecasts



5.2 Our demand forecast to 2075

5.2.1 Population, properties and occupancy

Population growth and changes in household composition are key drivers for demand. We commissioned Edge Analytics together with other WRSE companies to provide growth forecasts for all companies, in line with government guidelines (WRSE, 2020b). Edge Analytics used the latest available local plan data, as well as data from the Office for National Statistics (ONS) and the Greater London Authority (GLA), to produce projections at a WRZ level. Separate forecasts were developed for total population, household population, non-household population, dwellings, dwellings occupancy, population in commercial properties and business counts (Edge Analytics, 2020).

The forecasts were developed for a wide range of scenarios, by using a combination of trend, housing-led and employment-led forecasts, to account for the considerable uncertainty in the projections. A total of 25 scenarios were developed up to 2050, including forecasts for the Oxford-Cambridge (OxCam) area, which overlaps the WRSE supply area and Water Resources East (WRE) companies (see Table 5.1 and Annex 7). Excluding the OxCam area, there are 21 main scenarios up to 2050.

Post 2050, each scenario is further split into three projections; Principal, Low and High (see Table 5.1 and Annex 7). The main difference in the Principal, High and Low projections is the assumed level of net international migration post 2050. There were up to 63 growth projections for each WRZ.

Table 5.1: Growth scenarios included in demand forecast for each water resource zone

Number	Scenario	Notes
1	Housing-Plan-P (bottom-up)	Baseline forecast
2	Maximum growth	Maximum growth projection up to 2100
3	Median growth	Median growth projection up to 2100
4	Minimum growth	Minimum growth projection up to 2100
5	Completions-5Y-P	Proxy for trend-based projections; unless covered by Maximum, Median or Minimum projections
6	Housing-Need-H	To account for growth based on housing needs assessment; unless covered by Maximum, Median or Minimum projections
7	ONS18-P	To comply with Ofwat PR24 guidance. The central forecast by ONS based on 2018 data that is typically towards the lower end of all growth projections

Household demand accounted for nearly 60% of our total distribution input in 2020–21 and nearly 75% of total demand by household and non-household customers. Household demand is primarily influenced by population, with properties playing a secondary role through their influence on household occupancy. We have used the population forecast as the principal for informing our demand forecast.

In keeping with government guidance (WRPG), and based on recommendations from Edge and WRSE, we have used population growth from the housing plan (Principal) scenario (based on local plans) for our baseline growth forecast.

The housing plan forecasts have been developed using two approaches: a ‘top-down’ approach and a ‘bottom-up’ approach. The ‘top-down’ forecasts allocate growth, based on location of existing housing stock, i.e. growth continues in locations where houses have already been built. The ‘bottom-up’ housing-plan forecasts take account of areas or sites where housing is identified for delivery in the future, not just where it currently exists. As proposed by WRSE (2020b), we have adopted ‘bottom-up’ figures for the housing plan values as they represent a more realistic view of the locations of new growth, and allocate growth to WRZs more accurately.

[5] WRSE, 2020, Problem Characterisation, Consultation Version, August 2020

Additional scenarios have been considered to account for uncertainty in the growth forecast. Several scenarios show similar results. As a result, including all 63 projections in the demand forecasts would have increased the complexity of the work, without improving the reliability or accuracy of the demand forecasts.

The WRPG recommends considering housing need assessments in addition to housing plan data. In its PR19 determination, Ofwat used historic trend rather than plan-based growth forecasts recommended in the WRPG for WRMP19. Therefore, the Completions-5Y scenario was used as a proxy for trend-based projection. For the remaining alternative scenarios, we have used the maximum, median, minimum and Office of National Statistics (ONS) 2018 Principal (ONS18-P) growth projections as additional scenarios (Table 5.2). The ONS18 projection was added to comply with Ofwat PR24 guidance (Ofwat, 2022). There will therefore be a minimum of four and a maximum of seven growth scenarios per WRZ.

We had originally used the net growth from 2025 to 2100 to define maximum, median and minimum growth scenarios for household population. It was subsequently decided to limit the plan to 2075. This was done primarily to reduce the amount of time taken by the investment model to run. The comparison of growth rates to 2075 and 2100 is shown in Table 5.2. As can be seen, the same projections represent the maximum, median and minimum growth projection at both 2075 and 2100 for household population and properties.

The picture is different at the WRZ level where median growth at 2075 and 2100 is represented by different growth projections in the majority of cases. However, this does not influence the final water resources strategy as the median growth projection has not been used for developing supply-demand balances considered in this plan (see section 5.4.2).

Table 5.2: Net growth in the selected household population scenarios and the corresponding household properties growth scenarios

Growth scenario	Net growth (2025–75)	Growth projection	Net growth (2025–2100)	Growth projection
Household population				
Baseline	24%	Housing-Plan-P	31%	Housing-Plan-P
Maximum growth	33%	Housing-Need-H	46%	Housing-Need-H
Minimum growth	6%	ONS-18-Low-L	9%	ONS-18-Low-L
Median growth	21%	ONS-16-P	28%	ONS-16-P
Trend based	28%	Completions-5Y-H	39%	Completions-5Y-H
Housing need	33%	Housing-Need-H	46%	Housing-Need-H
ONS18	16%	ONS-18-P	23%	ONS-18-P
Household properties				
Baseline	35%	Housing-Plan-P	47%	Housing-Plan-P
Maximum growth	46%	Housing-Need-H	64%	Housing-Need-H
Minimum growth	16%	ONS-18-Low-L	22%	ONS-18-Low-L
Median growth	32%	ONS-16-P	44%	ONS-16-P
Trend based	38%	Completions-5Y-H	56%	Completions-5Y-H
Housing need	46%	Housing-Need-H	64%	Housing-Need-H
ONS18	27%	ONS-18-P	38%	ONS-18-P

Household population growth figures for Southern Water as a whole, and the corresponding household properties projections, are given in Table 5.2 and plotted in Figure 5.3 and Figure 5.4 respectively. At the company level, Housing-Need-H is the same as the Maximum growth scenario, with 33% growth by 2075 (Table 5.2). However, this may not necessarily be true at the WRZ level (see Annex 7).

Table 5.2 shows the increase in household properties to be higher than the increase in population for the same scenario. This leads to a decrease in overall occupancy over time. Assuming all properties to be occupied, the overall occupancy for the baseline scenario drops from 2.33 in 2025 to 2.14 in 2075.

Figure 5.3: Household population growth scenarios at the company level

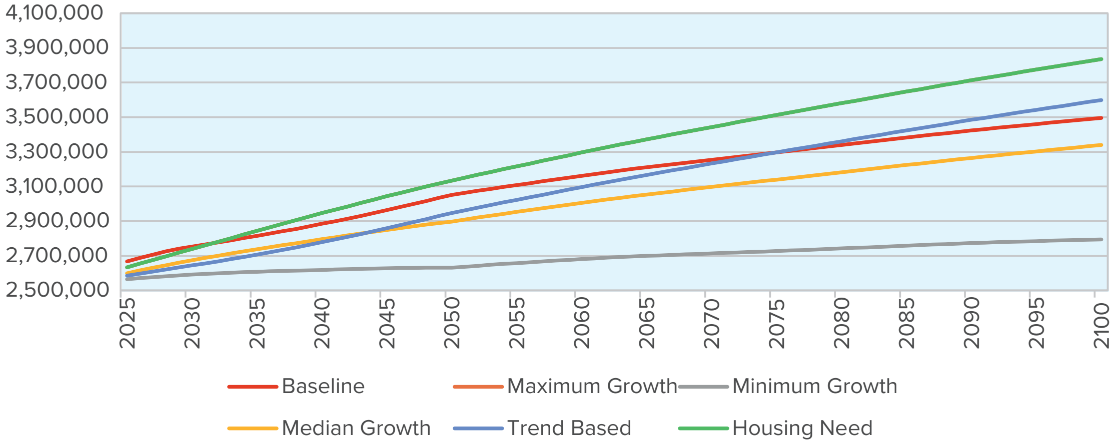
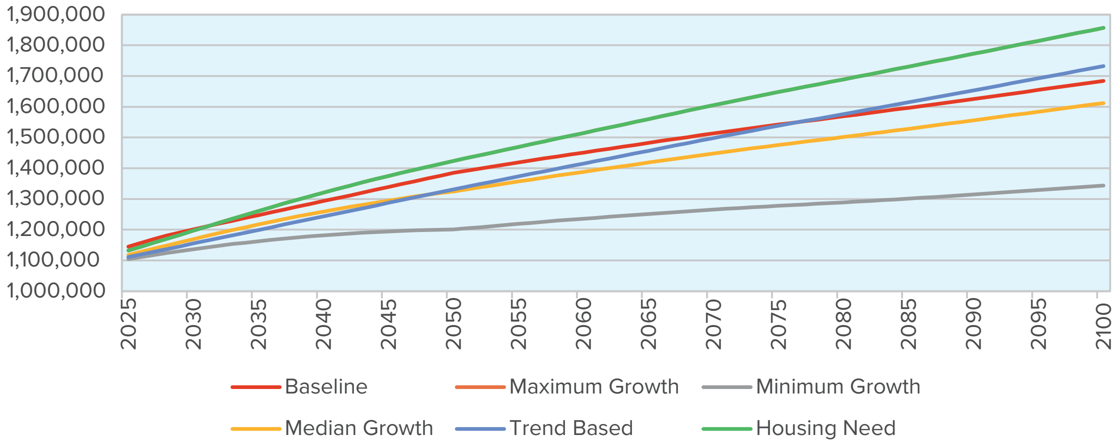


Figure 5.4: Household properties growth scenarios at the company level



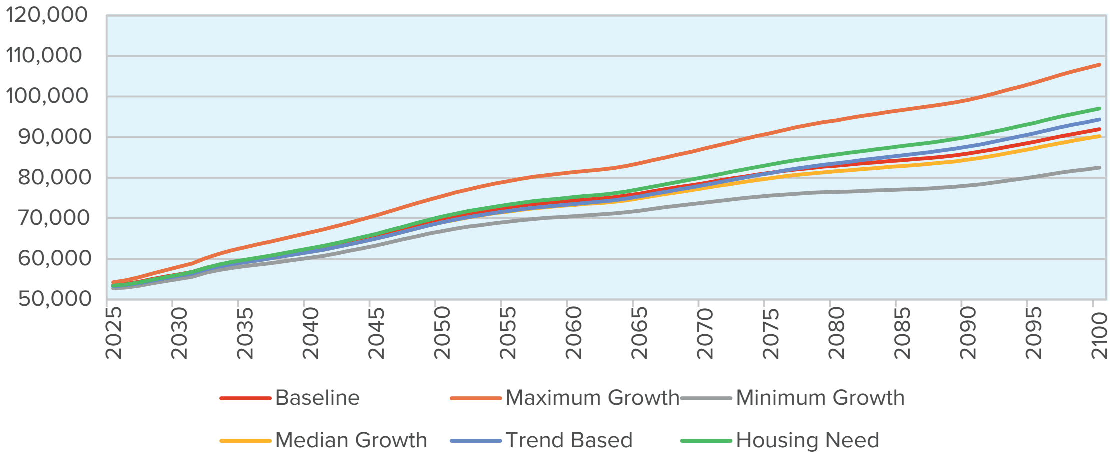
Non-household population growth scenarios at the company levels are shown in Table 5.3 and Figure 5.5. Figures at the WRZ level are included in Annex 7. We have not used the business count figures provided by Edge Analytics, as they were almost twice as high as our reported non-household connections. We have used the non-household population forecast to project non-household connections.

Overall, our growth forecast for WRMP24 is very similar to our WRMP19 forecast. Our principal forecasts for WRMP19 covered the period up to 2044–45. Under the plan-based scenario, total population in 2044–45 was forecast to be 3,044,555. Under the Housing-Plan-P scenario in current forecast, total population in 2044–45 is forecast to be 3,030,448; a reduction by 14,107 or 0.5%.

Table 5.3: Non-household population growth scenarios

Growth scenario	Net growth (2025–75)	Growth projection	Net growth (2025–2100)	Growth projection
Baseline	52%	Housing-Plan-P	72%	Housing-Plan-P
Maximum growth	68%	ONS-14-H	99%	ONS-14-H
Minimum growth	43%	GLA-18-15Y-L	57%	GLA-18-15Y-L
Median growth	49%	Employment-2-H	70%	Completions-5Y-P
Trend based	53%	Completions-5Y-H	77%	Completions-5Y-H
Housing need	56%	Housing-Need-H	82%	Housing-Need-H
ONS18	48%	ONS-18-P	67%	ONS-18-P

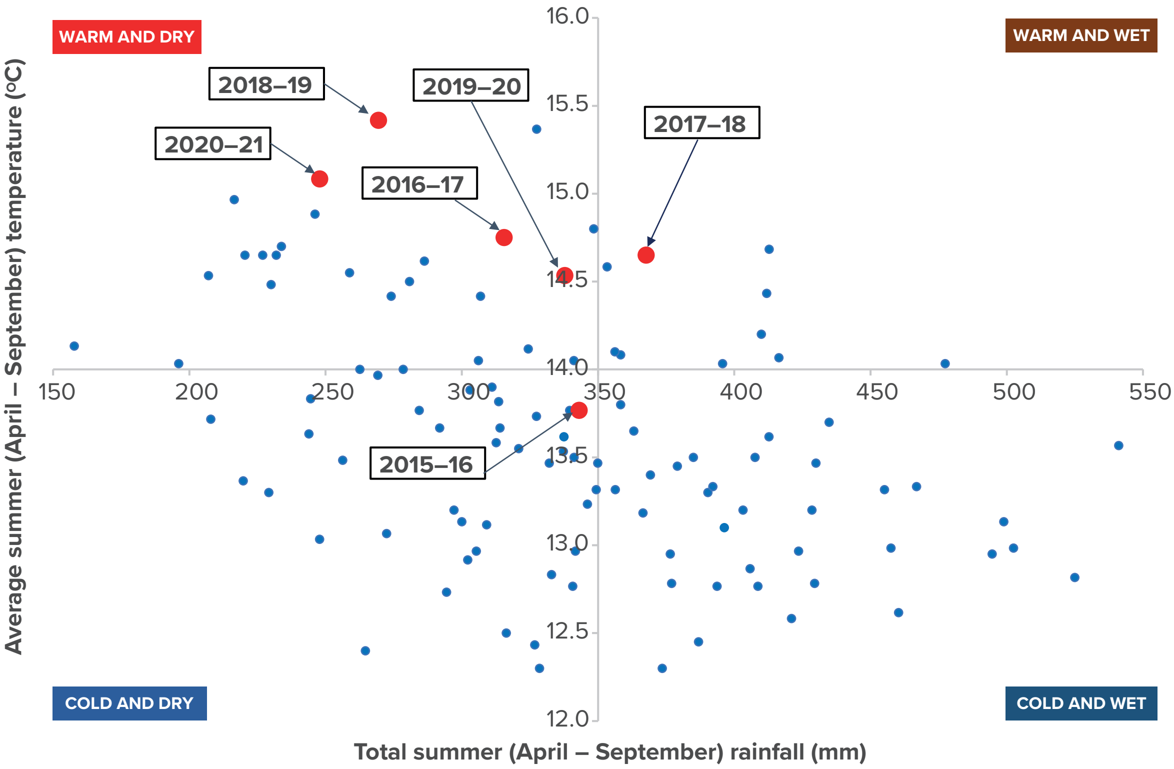
Figure 5.5: Non-household population forecast at the company level



5.2.2 Household demand forecast

Understanding the starting point (or base year) is critical to developing a robust forecast. The base year for our demand forecast is 2019–20. Under normal circumstances, household demand is primarily driven by the summer weather. Figure 5.6 shows the average summer temperature and total rainfall data for southern England, with values since 2015–16, when we completed our Universal Metering Programme (UMP), clearly indicated. The summer of 2019–20 was slightly warmer and drier than the long-term average; however domestic demand, in terms of PCC was slightly lower than in 2015–16, which was much closer to the long-term average summer conditions. We have therefore not rebased our household demand. The only adjustment we have made to our 2019–20 reported figures (shadow leakage methodology version) is to replace the reported leakage figure with the 2019–20 benchmark figure set by Ofwat (99.90Ml/d) for measuring progress against PR19 leakage reduction target. This has been done to make sure that our leakage reduction targets over the short, medium and long-term are consistent between WRMP24 and PR24.

Figure 5.6: Average summer temperature and total summer rainfall since 1910



Demand forecast scenarios

We have developed demand forecasts for the following scenarios.

- Normal Year Annual Average (NYAA) demand
- Dry Year Annual Average (DYAA) demand
- Dry Year Critical Period (DYCP) demand
- Dry Year Minimum Deployable Output (DYMDO) demand
- 1:200-year average 1:200 DYAA
- 1:200-year peak demand 1:200 DYAA
- 1:500-year average 1:500 DYAA
- 1:500-year peak 1:500 DYCP

Uplift factors for NYAA, DYAA and DYCP demand have been derived in the same way as they have been derived for our previous WRMPs, using company data. For 1:200-year and 1:500-year scenarios, we have used the dynamic demand analysis work done by Artesia (Artesia, 2021), which builds on the dynamic demand modelling work by the Water Research Centre (WRC, 2020). Both pieces of work were commissioned by WRSE.

Only the NYAA, DYAA and DYCP demand forecasts have been used in developing future supply-demand balance scenarios.

Table 5.4: Climate change scenario impacts

	No climate change impact scenario	Low climate change impact scenario	High climate change impact scenario
NYAA impact after 28 years	0.00%	0.74%	1.45%
DYAA impact after 28 years	0.00%	0.74%	1.45%
DYCP impact after 28 years	0.00%	2.08%	4.09%
DYMDO impact after 28 years	0.00%	1.43%	2.79%

Methodology

We commissioned Ovarro DA Ltd ('Ovarro') to develop our overall demand forecast (Ovarro, 2021) by:

- developing a micro-component forecast to determine the likely changes in demand due to appliance efficiency and societal trends over time
- derivation of base-year household demand for each planning scenario
- derivation of the impacts of climate change and water efficiency scenarios on household demand
- incorporation of forecasts of other components of demand (non-household demand, leakage and minor components)
- forecasting of distribution input under each of the scenarios being considered.

Data from our metered household customers shows that household customers can be grouped into three main groups, based on property type, as follows:

- Group 1. This group consists of detached houses and has the highest per household consumption (PHC).
- Group 2. This consists of semi-detached and terraced houses with typically lower PHC than detached houses.
- Group 3. This group consists of bungalows and flats and typically has the lowest PHC.

Micro-component modelling was done using these three customer segments and was informed by work done for our WRMP19 as well as the work published by UKWIR (UKWIR, 2012a) and the Energy Saving Trust (EST) (Energy Saving Trust, 2019).

We have incorporated three climate change scenarios based on UKWIR (2013) as follows:

- No climate change impact: No adjustment to consumption due to climate change.
- Low climate change impact: Based on the 50th percentile results in UKWIR (2013).
- High climate change impact: Based on the 90th percentile results in UKWIR (2013).

UKWIR (2013) contains two models that forecast demand over a 28-year period for the different planning scenarios. Using the average of the two models gives the climate change scenario impacts for a 28-year period. DYCP impacts have been used for the 1:200-years and 1:500-years planning scenarios.

In terms of water efficiency, we have considered the following four scenarios under NYAA conditions:

- **Baseline scenario:** Average PCC across our region reduces over AMP7 as per our PR19 target, but there is no further intervention to reduce individual daily usage in accordance with government guidance in WRPG.
- **Low water efficiency scenario:** Average individual daily usage across our region reducing to 110l/h/d by 2040 and to 100l/h/d by 2050, remaining constant thereafter.
- **Medium water efficiency scenario:** Average individual daily usage across our region reducing to 100l/h/d by 2040, remaining constant thereafter.
- **High water efficiency scenario:** Average individual daily usage across our region reducing to 100l/h/d by 2040 and to 85l/h/d by 2050, remaining constant thereafter.

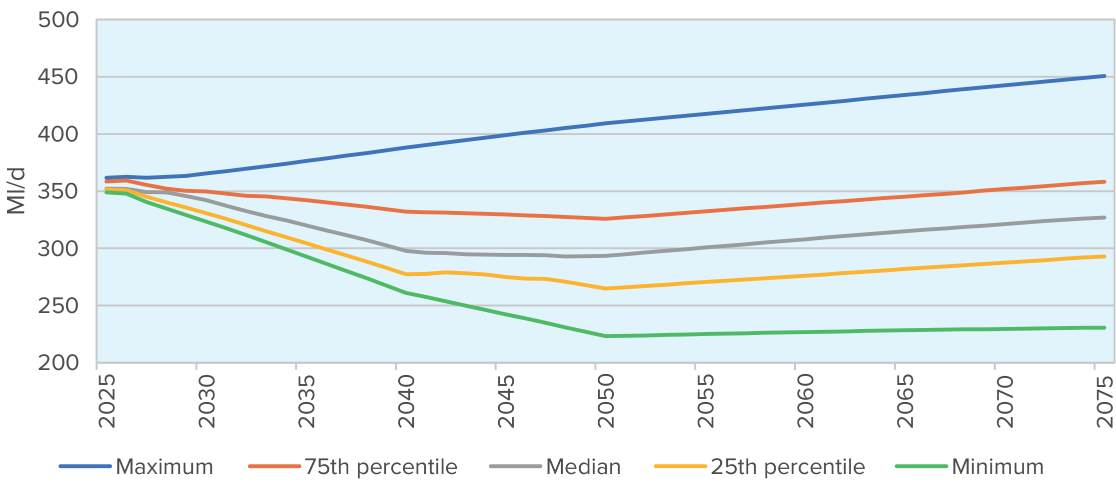
We have incorporated the impact of COVID-19 on household demand. We are still planning to reduce individual daily usage over the remainder of AMP7 but our outturn figure in 2024–25 is expected to be higher (135.63l/h/d) than our original target (122.53l/h/d). This was primarily done to avoid the risk of entering the next five-year delivery period with a more optimistic view of supply-demand balance than is likely to be the case.

Our 2021–22 forecast for individual daily usage has turned out to be lower than our forecast for 2024–25. We have therefore revised our forecast again. The new forecast for 2024–25 is 129.76l/h/d. The latest demand forecast has not been used in our draft WRMP24 as it was too late to incorporate it in the WRSE regional plan, given its potential implications for other member companies. We have run a sensitivity scenario with the latest demand forecast to see its impact on our strategy (see section 7.4.5) and will incorporate the revised forecast in the next iteration of both the regional plan and our WRMP.

The combination of seven growth scenarios, three climate change scenarios and four water efficiency scenarios resulted in 84 household demand forecast scenarios for each planning scenario, in each WRZ. The range of household demand from 2025–75 at the company level, under the NYAA scenario, is shown in Figure 5.7.

Results at the WRZ level for the various planning scenarios are shown in Annex 7.

Figure 5.7: The range of household demand forecasts at the company level for the NYAA scenario



In most scenarios, the total household demand decreases up to 2050 in line with individual daily usage reductions. There is no reduction after 2050, and total household demand starts to increase as a result of an increase in population.

5.2.3. Non-Household demand forecast

WRSE commissioned a review of the non-household demand forecasting methods used by companies in the past. The review concluded that methods used by all companies were appropriate, but recommended using a consistent method going forward (Ovarro, 2020).

WRSE then developed a non-household demand forecast for the entire region (Artesia, 2020a). The results were provided at the company level (Artesia, 2020b). The forecasts were developed separately for metered and unmetered properties at company level, WRZ level and disaggregated by the following five sectors:

- Agriculture and other weather dependent sectors.
- Non-service industries (excluding agriculture and other weather dependent sectors).
- Service industries – population driven.
- Service industries – economy driven.
- Unclassified.

Forecasts were developed using multi-linear regression models, using population forecasts (from Edge Analytics, 2020), gross value-added (GVA) metrics (from Oxford Economics), employment rate (from Oxford Economics) and population density (from ONS) as explanatory factors on data from the Central Market Operating System (CMOS) operated by Market Operator Services Ltd (MOSL). Future demand by other sectors not currently connected to the public water supply (PWS) system has also been estimated.

The forecasts also take account of several other factors that can influence future non-household demand. These include:

- climate change impacts on demand (three scenarios)
- water efficiency impacts on demand (three scenarios)
- Brexit impacts on population, GVA and employment (three scenarios)
- quality of MOSL data (three scenarios)
- COVID-19 impacts on GVA, employment, overall non-household demand and shifting demand between sectors (three scenarios).

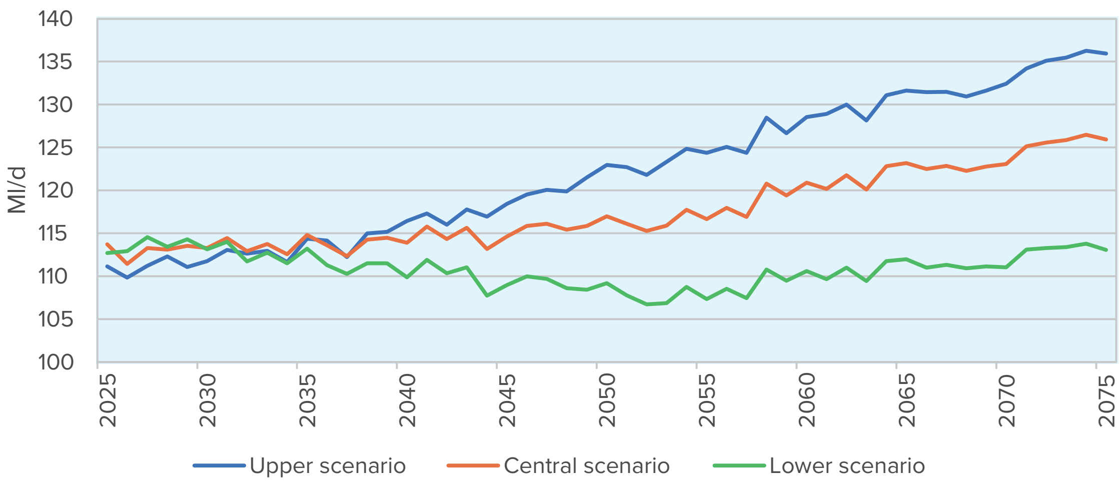
These scenarios, combined with three population growth scenarios, resulted in 729 scenarios per WRZ. These were used to define Upper, Central and Lower forecasts as follows:

- Upper threshold: 90th percentile of all the scenarios each year.
- Central threshold: 50th percentile of all the scenarios each year.
- Lower threshold: 10th percentile of all the scenarios each year.

We have adopted the Central scenario as the baseline scenario for non-household demand forecast.

Total change in non-household demand forecast from 2025–75 for each scenario at the company level is shown in Figure 5.8. Forecasts at the WRZ level are included in Annex 7.

Figure 5.8: Total non-household demand forecast at the company level



5.2.4 Leakage

Managing leakage is an important part of our water resources strategy, both for the environmental benefit and because maintaining a low level defers the need to invest in new resources to meet demand. It also shows our customers that we are doing our bit to be water efficient. We are asking them to help us by reducing their use to 100 litres per person, per day as part of our T100 initiative so we need to demonstrate our own commitment to water efficiency.

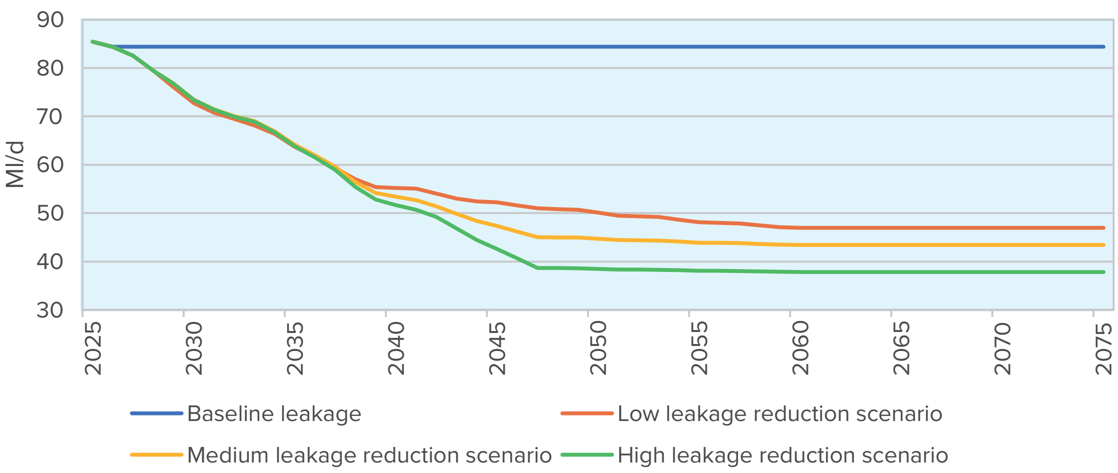
In our WRMP19, we stated that we would achieve a 50% reduction in leakage by 2050, and a 15% reduction by 2025. Beyond this, we have considered the following leakage reduction scenarios:

- **Baseline:** No further reduction from the 2024–25 level in line with government guidelines (WRPG).
- **Low reduction scenario:** Leakage reduces by 50% by 2050 and by 53% by 2059 (compared to 2020); remains constant thereafter
- **Medium reduction scenario:** Leakage reduces by 55% by 2050 and by 57% by 2059 (compared to 2020); remains constant thereafter
- **High reduction scenario:** Leakage reduces by 62% by 2050 (compared to 2020); remains constant thereafter.

In addition to active leakage control and mains replacement programmes, we are using emerging technologies to achieve significant reductions in leakage. The four leakage profiles are shown in Figure 5.9.

We have assumed that the reduction in distribution and supply-pipe losses will proportionately be the same as overall leakage.

Figure 5.9: Total leakage reduction scenarios



5.2.5 Other components of demand

We have not assumed any changes in distribution system operational use and water taken unbilled (legally). Water taken unbilled (illegally) is calculated as for our annual water balance. However, it shows little change over the planning period and remains constant.

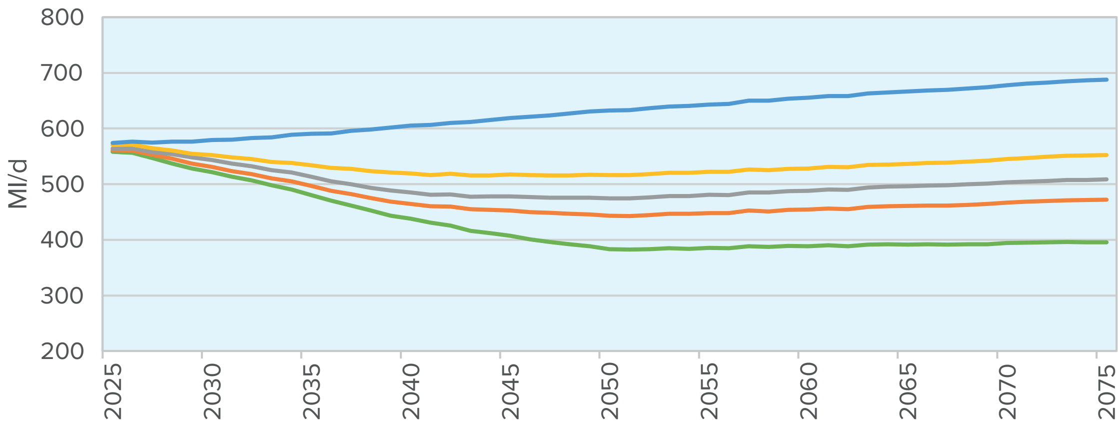
5.2.6 Total demand forecast

The combination of six growth scenarios, four water efficiency scenarios, three climate change impact scenarios (on household demand), three non-household demand scenarios and four leakage scenarios results in 864 scenarios of total demand or distribution input in each WRZ, for each planning scenario. The change in total demand over the planning period ranges from -22% to 33% (Table 5.5). The profiles for the NYAA scenario at the company level are shown in Figure 5.10. Results for other scenarios at the WRZ level are shown in Annex 7.

Table 5.5: Change in total DI at the company level for the NYAA scenario

Scenario	Change from 2025–75 (Ml/d)	Change from 2025–75 (%)
Minimum	-162.06	-29%
25th percentile	-88.91	-16%
Median	-55.41	-10%
75th percentile	-17.90	3%
Maximum	-113.83	20%

Figure 5.10: Total DI forecast at the company level for the NYAA scenario



5.2.7 Metering strategy – baseline

We rolled out our universal metering programme during 2015–20, metering around 88% of our household customers. Our current Target 100 programme is based on introducing a smart metering programme by 2030. This means replacing all our Visual Meter Read (VMR) and Automated Meter Read (AMR) meters with smart meters, delivering 25% of the total saving in household demand needed to achieve Target 100 by 2040.

We have assumed that all new properties will be metered and have also allowed for a small number of optants (around 600 per year) in our growth forecast. This will increase meter penetration over time, although we have capped our meter penetration at 95% in recognition of the fact that there will be a small proportion of properties that we will not be able to meter for a variety of reasons.

We do not currently have ‘selective metering’ or ‘change of occupancy metering’ policies in place but we are keeping these under consideration to meet our penetration target. The breakdown of properties by metering status is included in the Water Resources Planning tables that accompany this plan.

5.3 Our supply forecast to 2075

The supply forecast refers to how we determine the baseline water resources we have available to meet demands in each WRZ for each planning scenario, and for each year throughout the 50-year planning period before the addition of any new schemes. This forecast is composed of several elements:

- Our Baseline Deployable Outputs
- The impacts of climate change on the water available in the environment
- Bulk imports and exports from other water companies or businesses
- Potential reductions in the amount of water we use in order to protect the
- Process losses due to water used during treatment
- A risk-based allowance for outage at our supply works.

This section summarises how we have prepared our supply forecast, further detail is provided in Annex 8.

5.3.1 Deployable output

Deployable output (DO) refers to the amount of water we can take from river, reservoir and groundwater sources after taking account of any constraints on the maximum amount of water than can be taken from a source on a sustainable basis. These constraints vary at each site and can include:

- Source characteristics (e.g. hydrological or hydrogeological yield)
- Physical and infrastructure constraints (e.g. aquifer properties, pump capacity, distribution networks)
- Raw water quality and treatment constraints
- Licence and other regulatory constraints on water abstraction
- Demand constraints and levels of service.

DO normally forms the majority of the water resource available in any WRZ. DO varies seasonally following natural fluctuations of water in the environment. Typically, less water is available during the autumn following the warm summer months in which groundwater recharge is rare. DO also varies year on year depending on the weather and climate. DO is lower in dry or drought years and decreases as the severity of the drought increases. It is often useful to describe DO in terms of the return period of weather conditions such as 1:2 (normal year), 1:10 (dry year), 1:200 (severe drought) etc. These provide an estimate of the average probability of a given drought event and the associated water resource yield we can expect in a drought of that severity.

Average DO (ADO) is used for the volume that can be obtained on average from a source or system during a year whereas Peak DO (PDO) is used for the volume that can be abstracted during the period of peak demand which typically lasts for 2-3 weeks in the summer. ADO and PDO will vary with return period i.e. ADO in a normal year would be different from the ADO in a dry year. Sometimes we also use Minimum DO (MDO) which relates to the volume of water available from a source during the period of minimum resource availability (typically the autumn).

Our estimates of DO have been calculated through the development and application of a number of advanced mathematical models to estimate hydrological yield. We have used stochastically generated, but historically plausible, synthetic time series of weather to consider water resource availability under very severe droughts. We use these climate data with our computer models of our aquifers, rivers, reservoirs and supply networks to determine the DO of each WRZ under different drought conditions. Our baseline DO estimates for each WRZ are described in more detail in Annex 8 and summarised in Table 5.6.

Table 5.6: Summary of baseline DO at the WRZ level.

WRZ	DO by return period (DYAA/MDO) - Ml/d				DO by return period (PDO) - Ml/d			
	1:500-year	1:200-year	1:100 year	1:2 year	1:500-year	1:200-year	1:100 year	1:2year
HKZ	8.75	8.75	8.75	8.75	9.28	9.28	9.28	9.28
HAZ	22.86	22.86	22.86	22.86	24.80	24.80	24.80	24.80
HRZ	10.35	10.35	10.35	10.35	10.35	10.35	10.35	10.35
HWZ	22.52	22.52	22.52	22.52	24.40	24.40	24.40	24.40
HSE	20.49	32.46	45.65	77.97	41.00	58.38	78.36	108.42
HSW	0	0	0	73.54	0	0	11.85	78.8
IOW	23.96	25.89	26.07	26.58	30.54	34.09	34.33	34.65
SNZ	17.6	21.46	54.84	83.94	20.81	57.32	70.6	99.16
SWZ	45.78	46.26	46.69	51.73	54.96	55.52	56.05	62.11
SBZ	77.5	80.05	81.57	86.94	93.82	96.88	98.74	105.33
KMW	72.98	74.16	75.98	77.09	79.70	80.79	82.61	83.32
KME	85.37	86.15	86.71	89.13	97.65	98.62	99.47	103.93
KTZ	44.71	46.50	47.98	51.42	52.86	54.71	55.52	59.68
SHZ	19.75	20.90	21.98	32.84	23.90	27.14	29.15	41.25

5.3.2 Climate change

The Water Resource Planning Guideline (Environment Agency and Natural Resources Wales, 2016) requires that water companies make an assessment of the impact of climate change on water supplies. The impacts of climate change may materialise uncertainly between possible drier futures in which water resources will become scarcer, and wetter futures where increased winter rainfall translates to increased resource availability. Climate change can therefore act in both directions in terms of water resource yield assessments. Our assessment of impacts of climate change must account for this uncertainty.

To assess the uncertain impact of climate change on water supplies we have followed an agreed, consistent approach across all WRSE companies (WRSE, 2021a). This was to ensure that our climate change projections and scenarios were regionally consistent. Accordingly, we have followed a 3-tier climate change assessment approach in the context of current guidance, even for our previously established medium and low vulnerability WRZs using consistent methods, models, and datasets with the other companies in our region.

Our climate change modelling approach is described fully in Annex 8 and is summarised below.

Since the last round of water resource planning a new set of updated climate change projections 'UKCP18' have been derived. The forecasts show that the general trends of climate change are expected to be similar to earlier forecasts. In South East England we can expect hotter, drier summers with more frequent and more intense heatwaves. Winters are expected to become milder and rainfall is expected to increase overall but we'll see more variability in autumn and spring especially in drought years.

To determine the impact of climate change, we calculated change factors for rainfall and potential evapotranspiration were derived from the 28 Global and Regional Circulation Models (GCMs and RCMS) included in the 2018 United Kingdom Climate Projections (UKCP18). We used the spatially coherent projections across the region so that our forecasts of climate change impacts were consistent with other WRSE companies for regional planning (WRSE, 2021a).

Following the initial baseline water resource model assessment and DO assessments, a sub-set of the stochastic climate replicates were selected through agreement with neighbouring companies that were considered to contain a series of representative significant drought events across the WRSE region with probabilities generally between 1% and 0.2%.

Using these potential changes to rainfall and potential evapotranspiration up to the 2060-2079 period, (2070 being the mid-point of the UKCP climate projections) we passed them through our water resource models (i.e. Those that we used to derive our baseline supply forecast to determine the potential changes in our DO). We then used a standard scaling equation (Environment Agency, Ofwat and Natural Resources Wales, 2021) to analyse how DO might change through time (Table 5.7)

Following our updated water resource modelling we have considered the final climate change vulnerability of our WRZs by 2070 (Figure 5.11). The year 2070 represents the mid-point of the UKCP18 regional and global climate projections (which cover the 2060–2079 time slice) that we have used in our water resource modelling and hence no scaling is applied to these forecasts. This review shows that across our supply areas the forecast impacts of climate change fall into three broad categories:

1. Highly vulnerable WRZs where both the 'mid-range' forecast impacts and the uncertainty between 'wetter' and 'drier' future scenarios is large. As previously this generally applies to WRZs with minimum residual flow constraints either imposed already, or forecast, on surface water abstractions. As with specifically HSE, SNZ, KME and SHZ. KME is now considered to be highly vulnerable owing to the range of uncertainty of climate change impacts between 'wet' and 'dry' scenarios. Compared to our WRMP19 assessment because after confirmed 2027 licence changes, there is no DO available under any climate change condition. KTZ has moved to medium vulnerability as the uncertainty has reduced

2. Medium vulnerability WRZs include those WRZs where the most likely mid-range impact is small (<5% of WRZ DO) but where the range of predictions between the 'wet' and 'dry' scenarios suggests substantial uncertainty (up to 15% of WRZ DO). This group includes IOW, SWZ, SBZ and KTZ.

3. Low vulnerability WRZs are those where the impacts of climate change are small and the uncertainty between wet and dry conditions is also low (<5% of total WRZ DO). This group includes HAZ, HKZ, HWZ and HSW. The vulnerability of these WRZs is typically lower as a greater proportion of their sources are license or infrastructure constrained, therefore reducing their overall sensitivity to drought and other effects of climate change.

Table 5.7: Summary of forecast climate change impacts on DO and uncertainty by WRZ for DYAA 1:500 DO

WRZ	2040		2060		2075	
	Median (Ml/d)	Uncertainty (% of baseline)	Median (Ml/d)	Uncertainty (% of baseline)	Median (Ml/d)	Uncertainty (% of baseline)
HAZ	0.00	0%	0.00	0%	0.00	0%
HKZ	0.00	0%	0.00	0%	0.00	0%
HRZ	0.00	0%	0.00	0%	0.00	0%
HSE	0.00	0%	0.00	0%	0.00	0%
HSW	-17.92	-62.5% to 38.6%	-25.08	-87.5% to 54%	-30.46	-106.3% to 65.6%
HWZ	0.00	0%	0.00	0%	0.00	0%
IOW	0.24	-1.3% to 2.3%	0.34	-1.9% to 3.3%	0.41	-2.3% to 4%
KME	-6.30	-14.9% to 3.1%	-8.82	-20.8% to 4.4%	-10.70	-25.3% to 5.3%
KMW	0.33	-14.9% to 1.7%	0.46	-20.8% to 2.3%	0.55	-25.3% to 2.8%
KTZ	0.16	1.9% to 2.8%	0.22	2.7% to 3.9%	0.27	3.3% to 4.7%
SBZ	0.00	-8.7% to 0%	0.00	-12.2% to 0%	0.00	-14.8% to 0%
SHZ	-7.56	-1.3% to 0.3%	-10.59	-1.9% to 0.4%	-12.86	-2.3% to 0.5%
SNZ	1.96	1.9% to 8.5%	2.74	2.7% to 11.9%	3.33	3.3% to 14.4%
SWZ	-1.73	-14.9% to -0.2%	-2.43	-20.8% to -0.3%	-2.95	-25.3% to -0.4%

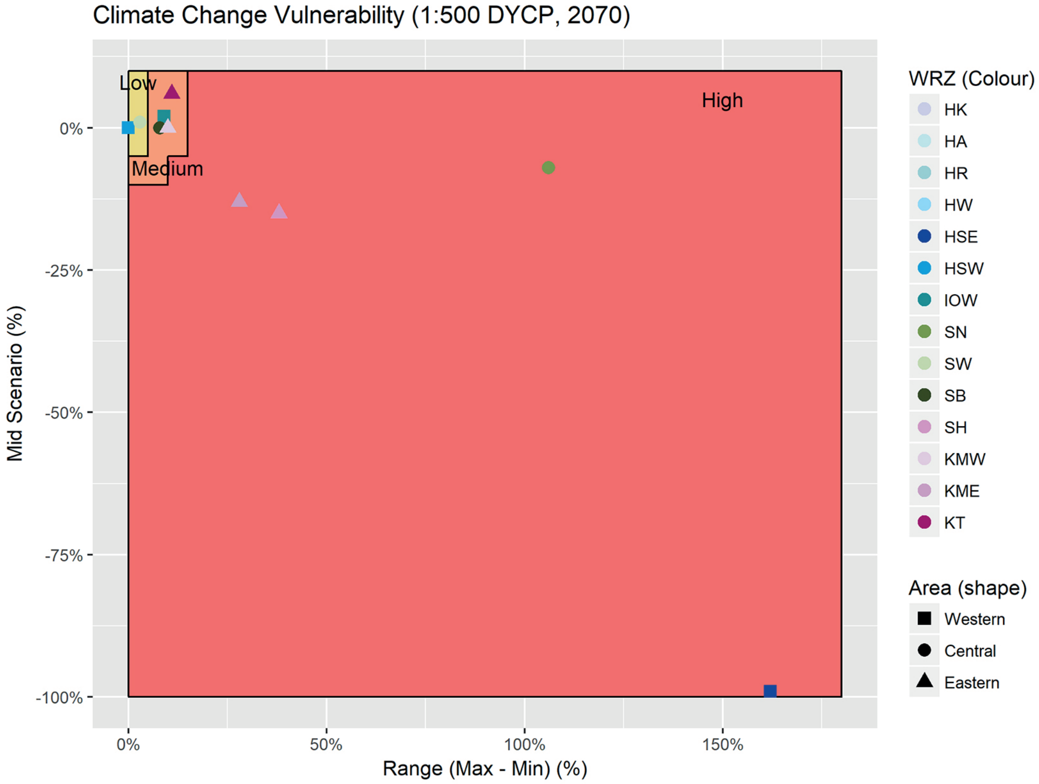
For the majority of the most sensitive WRZs (HSE, SNZ and SHZ), the vulnerability arises due to the dominance of surface water over groundwater, of which the former is less robust in responding to climate change. The final highly vulnerable zone, KME, is dominated by groundwater; however, within our system simulator model, it sees greater conjunctive benefit from Bewl Water due to an internal transfer from KMW and hence has a greater degree of climate change vulnerability as a result of the climate change effects upon the reservoir.

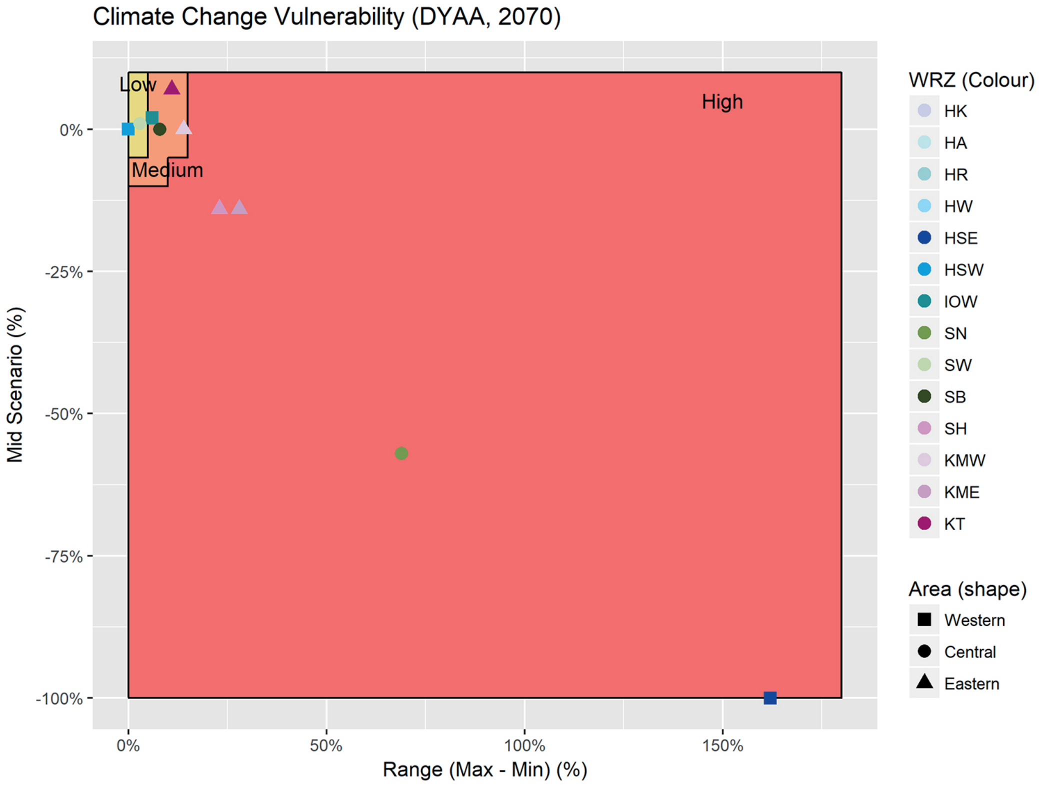
Inclusion of climate change in our decision making

Our assessment has shown that most of our resource zones show relatively minor impacts of climate change and in some cases the forecast wetter winters are expected to lead to small DO benefits, largely as result of increased winter groundwater recharge. However, our more surface water dominated zones are much more vulnerable and there is a high degree of uncertainty in the forecasts as to the magnitude of the impacts.

To address this risk in our adaptive plan decision making, we have considered three of the 28 climate change scenarios, the median impacts and CC06 and CC07 climate change runs which represent the upper and lower quartile estimates of DO impacts at a regional level.

Figure 5.11: Climate change vulnerability assessments for Dry Year Annual Average and Dry Year Critical Period Scenarios





5.3.3 Bulk imports and exports

The bulk imports and exports component reflect transfers of water in and out of a WRZ. This can reflect both within company inter-zonal transfers as well as exports and imports to other neighbouring water companies or other formal transfers.

We have several bulk transfer agreements with our neighbouring water companies (Table 5.8). We also transfer water across our WRZs (Table 5.9). In addition, we also provide non-potable supplies to two large industrial users; one in HSW and the other in SHZ.

For this plan we have assumed that all of our existing transfers will continue, unless there is a specific option to modify any of them. Bulk transfer agreements with our neighbouring water companies are included as options in our options appraisal investment modelling upon the expiry of their current contractual term.

Table 5.8: Existing bulk transfers with neighbouring water companies

Type	Donor WRZ	Recipient WRZ	Potable or raw	Maximum volume (Ml/d)	Contract expiry
Export to AFW (Deal)	KTZ	RZ7	Potable	1.24	
Export to SEW (Belmont)	KME	RZ6	Potable	7.8	
Export to SEW (Bewl)	KMW	RZ7	Potable	12.3	
Export to SEW (Burham)	KMW	RZ7	Raw		
Export to SEW (Darwell)	SHZ	RZ3	Raw	8/17th of the Bewl/ Darwell Yield	
Export to SEW (Matts Hill)	KME	RZ6	Potable	7.5	
Export to SEW (Pitfield)	KMW	RZ6	Potable	0.5	
Export to SEW (Weir Wood)	SNZ	RZ5	Potable	5.4	2031
Export to WSX (Ibthorpe)	HAZ		Potable	0.41	
Import from AFW (Napchester)	RZ7	KTZ	Potable	0.1	
Import from SES (North Sussex)	SES	SNZ	Potable	0.8	2026
Import from PWC (Eastleigh)	PWC	HSE	Potable	15.0	
Import from PWC	PWC	SNZ	Potable	15.0	2026
SEW bulk supply near Canterbury	SEW	KTZ	Potable	2	tbc*

*This transfer is in development for 2025 as part of our preferred WRMP19 delivery

Table 5.9: Existing inter-zonal transfers

Donor WRZ	Recipient WRZ	Link	Potable or Raw	Maximum volume (Ml/d)
HRZ	HSE	Abbotswood	Potable	5.1
HSE	IOW	Cross-Solent main	Potable	20.0
HSE	HWZ	Olivers Battery	Potable	9.6
HSW	HSE	Woodside	Potable	16.8
HSW	HSE	Gover Road	Potable	2.7
HSW	HSE	Rownhams	Potable	5.6
HSW	HRZ	Broadlands	Potable	3.1
SNZ	SWZ	Rock Road	Potable	11.8
SWZ	SNZ	Tenants Hill	Potable	13.1
SWZ	SBZ	V6	Potable	16.8
KME	KTZ	Selling transfer	Potable	12.0
KMW	KME	Nashenden	Potable	37.1

In addition to our existing inter-zonal transfers our supply forecast for Western Area has been developed assuming implementation of the 'Hampshire Grid' transfers which were selected as preferred options in WRMP19. The transfers are planned to improve connectivity between our Hampshire WRZs (HAZ, HRZ, HSE and HSW), these transfers are still in development as part of our Water for Life Hampshire, but their assumed benefits are summarised in Table 5.10.

As discussed in our WRZ integrity assessment these new transfers are expected to improve the connectivity across our Hampshire supply area and reduce drought risks. We will revisit our WRZ arrangement in Hampshire in future plans to reflect the benefits of these transfers.

These transfer options would increase the interconnectivity and move towards a single, larger zone underpinned by a water grid.

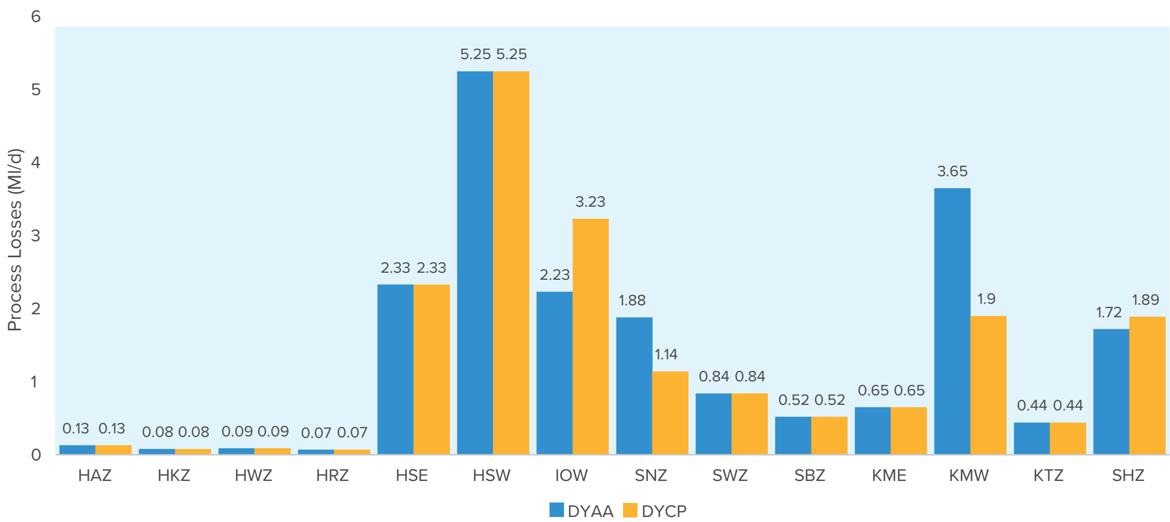
Table 5.10: Hampshire grid transfer options currently being developed

Donor WRZ	Recipient WRZ	Link	Potable or Raw	Maximum volume (Ml/d)
HSE	HWZ	Hampshire grid (reversible link HSE-HW)	Potable	78.0
HWZ	HSE	Hampshire grid (reversible link HSE-HW)	Potable	78.0
HSE	HAZ	Hampshire grid link (HSE-HA)	Potable	15
HSW	HSE	Southampton link main (reversible link HSW-HSE)	Potable	30
HSE	HSW	Southampton link main (reversible link HSW-HSE)	Potable	30
HSW	HRZ	Romsey Town and Broadlands valve (HSW-HR reversible)	Potable	10
HRZ	HSW	Romsey Town and Broadlands valve (HSW-HR reversible)	Potable	10

5.3.4 Process losses

When we treat water, there are some limited process and operational losses. We account for these in our supply forecast. Process losses here refer to the volume of water that is recycled back into the environment between the point of abstraction from the environment and where treated water enters the distribution network due to water treatment processes. Typically, groundwater sources have a simpler treatment process (in some cases only disinfection is required) than surface water sources and so process losses in groundwater dominated WRZs will tend to be smaller. Our analysis of process losses is described in Annex 8 and the estimated volumes of losses are shown in Figure 5.12.

Figure 5.12: Estimated process losses by WRZ



5.3.5 Outage allowance

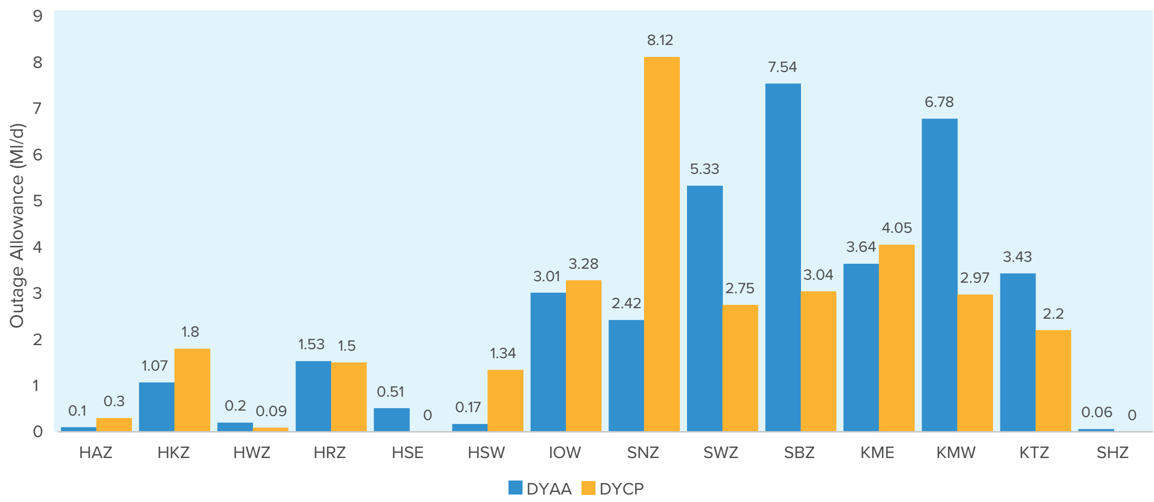
'Outage' refers to the planning allowance we make for the temporary loss of DO from a source. We include a risk-based assessment of outage in our supply forecast to cover against the risk that not all of our supplies might be available at any given time. Outages can be both unplanned or planned. Unplanned outages can occur for a variety of reasons, such as mechanical failures or water quality issues. These can be either full outage, where an entire source is unable to produce water, or partial outage, where a site can produce water but not at the maximum DO. Planned outages occur where we need to take a source out of supply so we can undertake maintenance or improvement works.

To calculate outage we followed a consistent approach with our neighbouring WRSE water companies to calculate our appropriate outage allowance for 2025–26 onwards (WRSE, 2021b). The approach looks at historical outage patterns and uses statistical models to forecast a future risk based outage allowance at the 95th percentile. In effect this means that if our calculated outage allowance was 5Ml/d then 95% of the time we would expect our outage volumes to actually be less than or equal to that total.

Since 2018 our outage levels have been reducing significantly. We are still slightly behind the outage allowance but have plans in place to continue reducing outage in line with our outage recovery plan. Since publishing our WRMP19 we have also been constantly improving our outage data collection. These improvements involve a more accurate capturing of partial outages, more clarity around the reasons for outage and a breakdown of different types of outages between planned, unplanned and asset constrained. This improved data collection is allowing us to pinpoint cost-efficient outage recovery as well as improving our estimation of outage.

Following the agreed regional approach the outage allowance by WRZ for each of the planning scenarios is shown in Figure 5.13. Figure 5.14 shows the historic reported outage up to March 2022, the WRMP19 recovery plan up to March 2025 and then the WRMP24 forecast outage allowance for the DYAA scenario which we have used for this draft plan from April 2025 onwards.

Figure 5.13: Estimated outage allowance for the 2025–75 planning period by WRZ

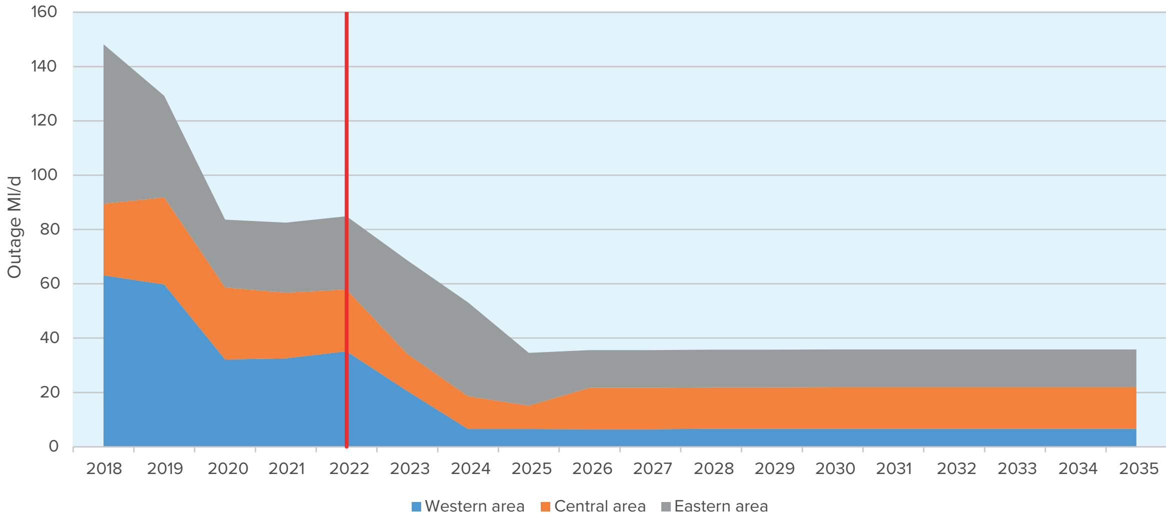


In addition to our existing inter-zonal transfers our supply forecast for Western Area has been developed assuming implementation of the 'Hampshire Grid' transfers which were selected as preferred options in WRMP19. The transfers are planned to improve connectivity between our Hampshire WRZs (HAZ, HRZ, HSE and HSW), these transfers are still in development as part of our Water for Life Hampshire, but their assumed benefits are summarised in Table 5.11.

As discussed in our WRZ integrity assessment these new transfers are expected to improve the connectivity across our Hampshire supply area and reduce drought risks. We will revisit our WRZ arrangement in Hampshire in future plans to reflect the benefits of these transfers.

These transfer options would increase the interconnectivity and move towards a single, larger zone underpinned by a water grid.

Figure 5.14: Historic outturn (to March 2022) and forecast outage allowance figures (from April 2022) for the DYAA planning scenario by supply area



5.3.6 Catchment First

Catchment First is our commitment to put the well-being of the environment at the centre of the decisions we make and the services we deliver. It represents a shift in focus from relying on traditional engineering solutions, to working collaboratively with partners to create long-term sustainable improvements to the environment on which our business and customers depend.

As such, Catchment First is embedded in key strategic plans and delivery mechanisms such as the WRSE regional plan, our WRMP and our DWMP. Our evolving Environment Strategy also builds on this by embedding catchment and nature-based solutions across broader business processes.

New government policies strongly reflect the current climate and biodiversity crises. It is also a rapidly evolving landscape in terms of agricultural subsidies, with the focus moving forwards being on 'public money for public goods'.

We are already well aligned with these shifts, having developed our catchment strategy and delivery approaches to focus on working in partnerships with agricultural groups, agronomists and directly with farmers in order to mitigate key water quality risks whilst focusing on natural capital and catchment resilience. Our mitigation measures have focused on delivering wider benefits such as carbon sequestration, biodiversity and flood resilience, alongside water quality and water resource benefits.

The key principles underpinning our Catchment First programme are also aligned with our WRMP24 aims and include:

- **Improving Environmental Resilience:** A healthy and resilient environment is fundamental to Southern Water's ability to supply customers into the future. This goes beyond mitigation of potential impacts and requires proactively improving the health of the water environment so that it is more resilient to natural pressures (such as climate change, droughts, floods) and to man-made pressures from catchment activities (including abstraction, wastewater discharges, farming etc). Alongside ensuring compliance through engineered solutions, we can work in parallel to improve the natural environment to help ensure supply solutions are sustainable longer term. Examples of this include:
    - Engaging with farmers, and other land users, to reduce catchment sources of nitrate (e.g. nitrate fertilisers or urban uses of fertilisers) and prevent deterioration in the quality of underground sources long term; this would be in parallel to further treatment (or additional blending) to ensure drinking water sources are maintained in the short to medium term.
    - Engaging with farmers to ensure pesticide and herbicide concentrations in the rivers are maintained at a level that does not overwhelm existing treatment processes, thereby improving the catchment and protecting customer sources.
    - Mapping natural capital assets in the catchment and understanding how they could be improved to solve key water quality issues whilst improving and building habitats, thereby enhancing biodiversity, increasing resilience to floods and droughts and providing increased public value. By embedding natural and social capital into optioneering assessments, we are better recognising the ***value*** of a solution, rather than just evaluating the cost of a solution. Such Best Value solutions should then be delivered either instead of engineered solutions, or alongside engineered solutions to achieve compliance in the short to medium term and to provide environmental and asset resilience into the future under a changing climate and regulatory landscape.
- **Reduced embedded carbon and emissions:** delivering our Net Zero Plan, incorporating carbon costs into decisions, delivering offsetting over and above reductions.
- **Outcome Focus:** clear targets for Environmental Improvement and Biodiversity Net Gain (BNG). Clear and consistent monitoring to support evidence of environment outcome delivery and to feed into our wider Natural Capital and Environment Social Governance (ESG) reporting beyond water resource planning and the specific best value approach used in this plan.
- **Transparent evidence base:** developing an integrated monitoring plan for catchments and consistent ways of working.
- **Collaborative Planning and Delivery:** co-identification, co-development, co-funding, and co-delivery of the environmental issues and potential solutions with stakeholders and catchment partners. Working with Non-Governmental Organisations (NGOs) to provide the best outcomes for customers and environment.

Our Catchment First programme reflects the environmental and customer priorities, and closely links to key strategic plans, including both the WRMPs and the DWMPs. Our key strategic Catchment First projects aligned with WRMP to protect water resources include Figure 5.15):

- **Sustainable abstraction and mitigation programme:** understanding the baseline condition of the environment and the potential impacts of our abstractions, and enhancing the waterbodies in which we operate, with a water resources and hydro-ecology focus. Instream Catchment Resilience Schemes (ICRS) are WRMP24 and WINEP schemes, which are multi-AMP with the AMP7 element being monitoring to establish an ecological baseline within a waterbody where we may be having an impact due to our abstractions. The AMP8 element is to implement targeted instream measures to reduce the write-down in abstraction licence quantity in agreement with the EA. This will be developed and integrated alongside our Environmental Destination scenarios (5.3.7).
- **Groundwater nitrate reduction programme:** understanding the risk of nutrient concentrations (specifically nitrate) in groundwater sources and the resulting risk to drinking water compliance and source sustainability in the future. Implementing catchment schemes, working with agriculture and other land users, to ensure the resilience of the sources and assets in six key project areas: Hampshire, Worthing, Brighton, North Kent, Thanet North and Thanet South, collectively covering approximately 42 groundwater sources from AMP8 onwards (Figure 5.15).
- **Surface water catchment resilience programme:** understanding the nature of the river catchments and the risks to raw water quality at key abstractions, working with farmers, agronomists and catchment stakeholders to mitigate upstream water quality pressures whilst providing wider environmental outcomes for example for natural capital, carbon, flooding, soil health and sediment erosion. Key focus areas in AMP7 and into AMP8 are the Western Rother and River Arun catchments in Sussex, the River Beult sub-catchment to the River Medway in Kent, and the Eastern Yar catchment on the IOW (Figure 5.16).

Moving forwards, we continue to build on this approach. Our catchment resilience pilots developed in 2019–20 have enabled us to know how to use natural capital in Best Value decision making, work with farmers to understand how our soil health programme fits with emerging carbon markets, and to identify and integrate other funders, including the supply chain, in blended financing approaches. We will be further expanding the catchment resilience approach into the future; an approach that is not only aligned with our regulatory requirements via the new WINEP, but is also a more progressive approach to engagement and delivery and one which provides multiple benefits for the environment, the local economy and for social capital.

Key to all this is communication and engagement – with the agricultural sector, with catchment and environment groups, and also with our customers. The Catchment First programme provides new avenues to help us achieve compliance, prevent pollution and enhance the environment, alongside improving the confidence of our customers and communities, through additional opportunities for education and participation.

Figure 5.15: Our key Catchment First projects

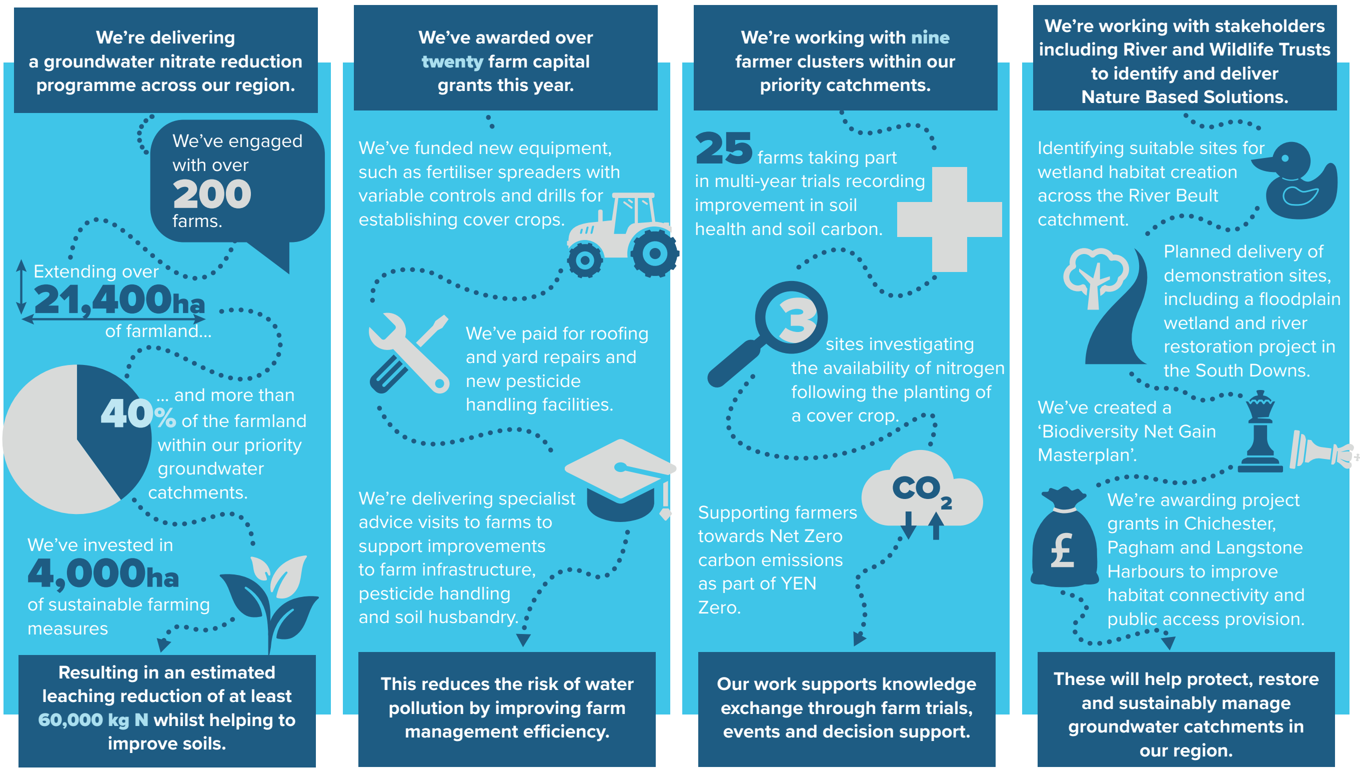
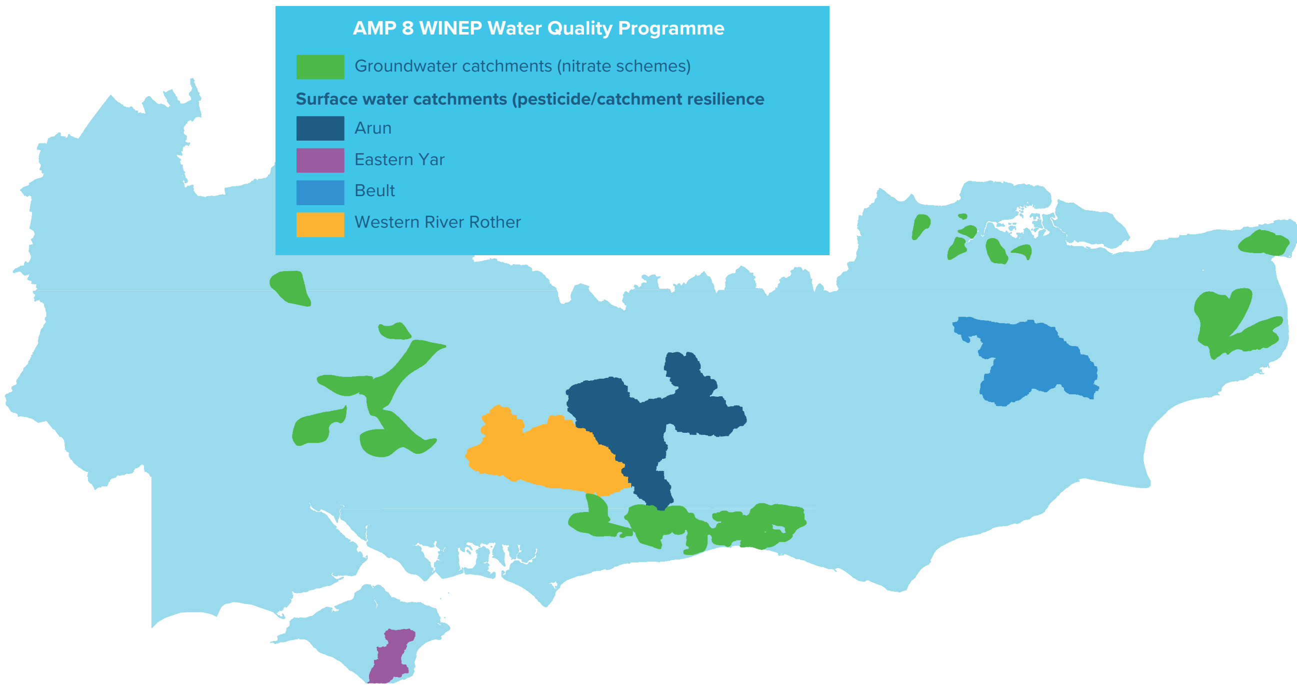


Figure 5.16: Our key catchments which form part of our water quality programmes for surface and groundwater



5.3.7 Our Environmental Ambition for 2050

One of our key aims, aligned with our Catchment First approach is to establish our long-term sustainable licensing of our sources as soon as possible, so that we can progress supply-demand planning and management on a stable and more certain footing. We have developed our Environmental Ambition for 2050 which seeks to achieve this.

The primary route for this will be our series of ongoing WINEP and environmental investigations including detailed monitoring and modelling to provide a robust evidence base to inform the most appropriate set of long-term licence reductions and mitigations that will deliver considerable environmental benefits alongside those delivered through our Catchment First programme (Section 5.3.6, Annex 9). Through this work we expect to reduce the uncertainty associated with the range of possible licence reductions considered under our environmental ambition scenarios. By the time of our next WRMP in 2029 our environmental investigations will enable us to have greater certainty around the long-term strategic solutions that are still required to protect and enhance the environment and to refine our adaptive planning decision points (see Section 5.5).

The full detail of this work is presented in Annex 9 and a summary of the DO reductions under each of the adaptive planning branches is presented in Table 5.11.

Table 5.11 Summary of total DO (1:500) impacts for each Environmental Destination scenario

	1:500 DO reductions by 2050 for each branch (Ml/d)		
WRZ	Low	Medium	High
HAZ*	-12.40	-11.61	-12.52
HKZ	-4.16	-4.63	-4.16
HRZ	-3.45	-3.45	-3.45
HSE*	0.00	0.00	-20.49
HSW*	0.00	0.00	0.00
HWZ*	-6.68	-12.8	-22.71
IOW	-8.06	-11.02	-14.25
SNZ	-6.76	-6.8	-8.23
SBZ	-6.48	-20.99	-39.44
SWZ	-7.86	-17.87	-19.72
KME	-20.27	-48.51	-48.51
KMW	-3.31	-22.42	-22.70
KTZ	-11.94	-29.56	-29.56
SHZ	-1.56	-1.56	-1.56

*Where relevant we have also included reductions to DYCP DO, e.g. under Alternative Scenario or where Common Standards Monitoring Guidance (CSMG) is applied in Enhanced Scenario as we expect that licence reductions would apply year round, including during times of normal operation outside of drought.

In working towards our goal of achieving sustainable abstraction, we have:

- Used the supplementary guidance ‘actions required to prevent deterioration’ to inform our Environmental Ambition scenarios. We have applied an initial review of licence capping based our assessment. Our ongoing work through our extensive 'WINEP No Deterioration investigations' will continue to refine and inform licence changes needed to prevent deterioration. We expect these to begin from 2030.
- We have identified our role associated with the actions identified through the Water Abstraction Plans for achieving sustainable abstraction. We have highlighted our continued regard to the River Basin Management Plans and WFD regulations objectives, the delivery of measures through ongoing investigation, monitoring and delivery of solutions via WINEP.
- We have taken account of government and regulator objectives for the environment and highlighted our work associated with vulnerable chalk streams. Our long-term Environmental Destination scenarios propose significant reductions in our chalk groundwater abstractions to support nature recovery, and meet environmental flow or other agreed WFD targets.
- We will deliver the regulatory actions required to avoid deterioration, and meet targets for Protected Areas through the continuing development of our WINEP and proposed interim mitigation measures before final delivery of water resource schemes.
- Where our investigations show it is needed, we will also support nature recovery through river and habit enhancement alongside any required reductions to our abstractions.
- We have been ambitious - through our ‘alternative’ scenario we are investigating what solutions would be required to allow us to stop all abstraction in our most sensitive catchments including the River Itchen and Lower River Rother and River Arun to remove any potential risk to designated wetlands going beyond the required reductions just to meet flow targets.
- We have brought forward many of our 'WINEP No Deterioration investigations'.
- Through the development of the regional and our own specific Environmental Destination scenarios we are exploring the impact of potential climate change scenarios to 2050 and beyond.
- We have not been constrained by previous decisions, and have revisited past WINEP outcomes previously considered non-cost beneficial to support full flow recovery in all of our Environmental Destination scenarios. This includes catchments such as the River Anton, Lukely Brook and Lewes Winterbourne.
- We have considered the most appropriate timing by reviewing and prioritising the catchments where abstraction reductions are most needed and will have the greatest impact. We have balanced that against our available alternate supply options to ensure supplies remain resilient.

We expect that our ambition will continue to evolve as we shape our final WRMP and take account changes in policy, guidance and the continuing assessment of outcomes from our WINEP investigations.

5.3.8 Water Available For Use

In order to effectively prepare our WRMP we need to forecast what water supplies will be available over the planning period. This is our Water Available for Use (WAFU), which is calculated based on:

- Water available from our resources
- Bulk imports and exports
- Climate change
- Sustainability reductions
- Process losses
- Outage.

The WAFU charts at company level (Figure 5.17) show similar overall trends to those at an area level (Annex 8) through the planning period.

For our baseline DO there are generally reductions through time in all areas as we improve our drought resilience to achieve 1:500-year drought resilience (the fall in baseline DO represents the fact that under a 1:500-year drought less resources are available).

Our baseline imports and exports are relatively stable through time in all areas. Where changes occur, these reflect the nature of our current bulk supply agreements and that some existing and new transfer options are instead included in our investment modelling as options rather than being fixed in the baseline.

We only have one, relatively small (3.02Ml/d) confirmed further licence change which has a DO impact (at Andover in our HAZ WRZ in 2027 – see Annex 9); however for our potential, but presently unconfirmed licence changes which are possible through our Environmental Destination scenarios there are significant reductions forecast through to 2050, especially for Situation 4 (see Section 5.5) which represents the High Environmental Destination scenario. We are undertaking a considerable amount of environmental investigation through to 2027 to help to reduce the uncertainty around the possible magnitude of any licence changes required to achieve our Environmental Ambition.

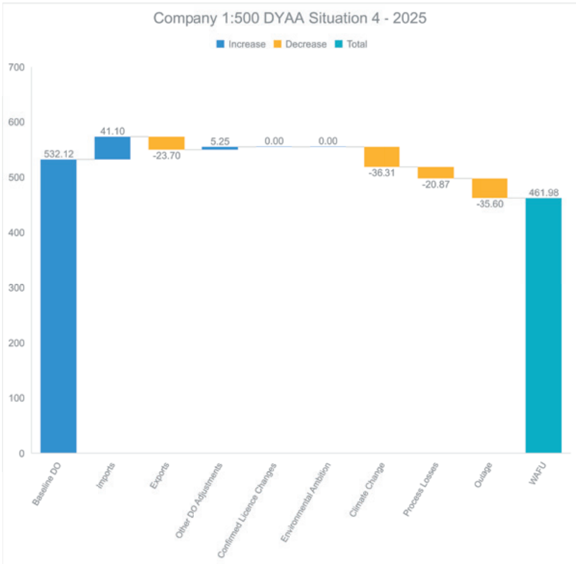
Climate change presents the next largest possible reduction in WAFU, primarily in HSE and SNZ which are also amongst the most environmentally sensitive WRZs and hence the Western and Central Area WAFU declines significantly.

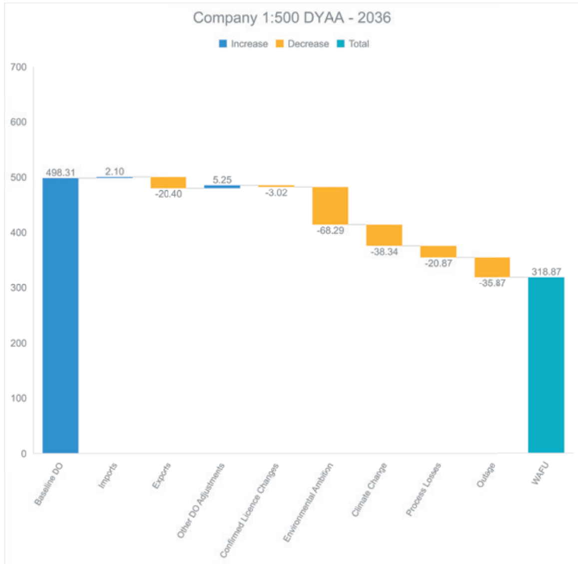
The key supply side uncertainties our adaptive plan is designed to hedge against are the loss of supply due to climate change and the loss of supply due to licence changes we may need to make to protect the environment. Both drivers can potentially lead to large reductions in WAFU depending on which future 'situation' we progress towards. However, while the drivers of each change are to a large degree independent variables i.e. the degree of climate change will not directly influence the degree of environmental protection we must provide (though the two are indirectly related) the way that the adaptive branches are constructed means that we need to be careful to avoid double counting deficits i.e. we cannot lose DO to climate change if that DO has already been lost to Environmental Destination.

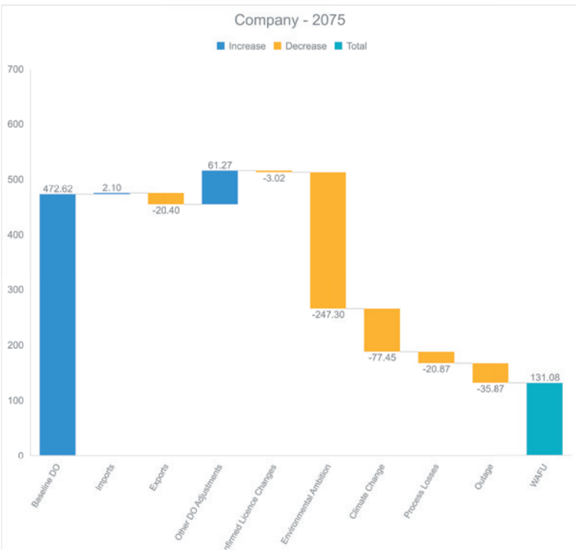
Since both impacts have been calculated independently during our resource modelling we have included DO adjustments which offset under scenarios where both climate change and Environmental Destination act in combination to reduce DO to avoid double counting leading to greater water losses than is available to lose (i.e. leading to negative WAFU). This is most obvious in our HSE and SNZ WRZs, both of which are highly vulnerable to climate change and at risk of needing significant licence reductions to protect the environment.

Although both are expected to occur in some combination it is likely (for the purposes of our Monitoring Plan) that any changes in DO from licence changes are likely to be the primary, and most obvious cause of WAFU loss, and will precede the loses due to climate change.

Figure 5.17: Forecast water available for use – Situation 4 (company level)





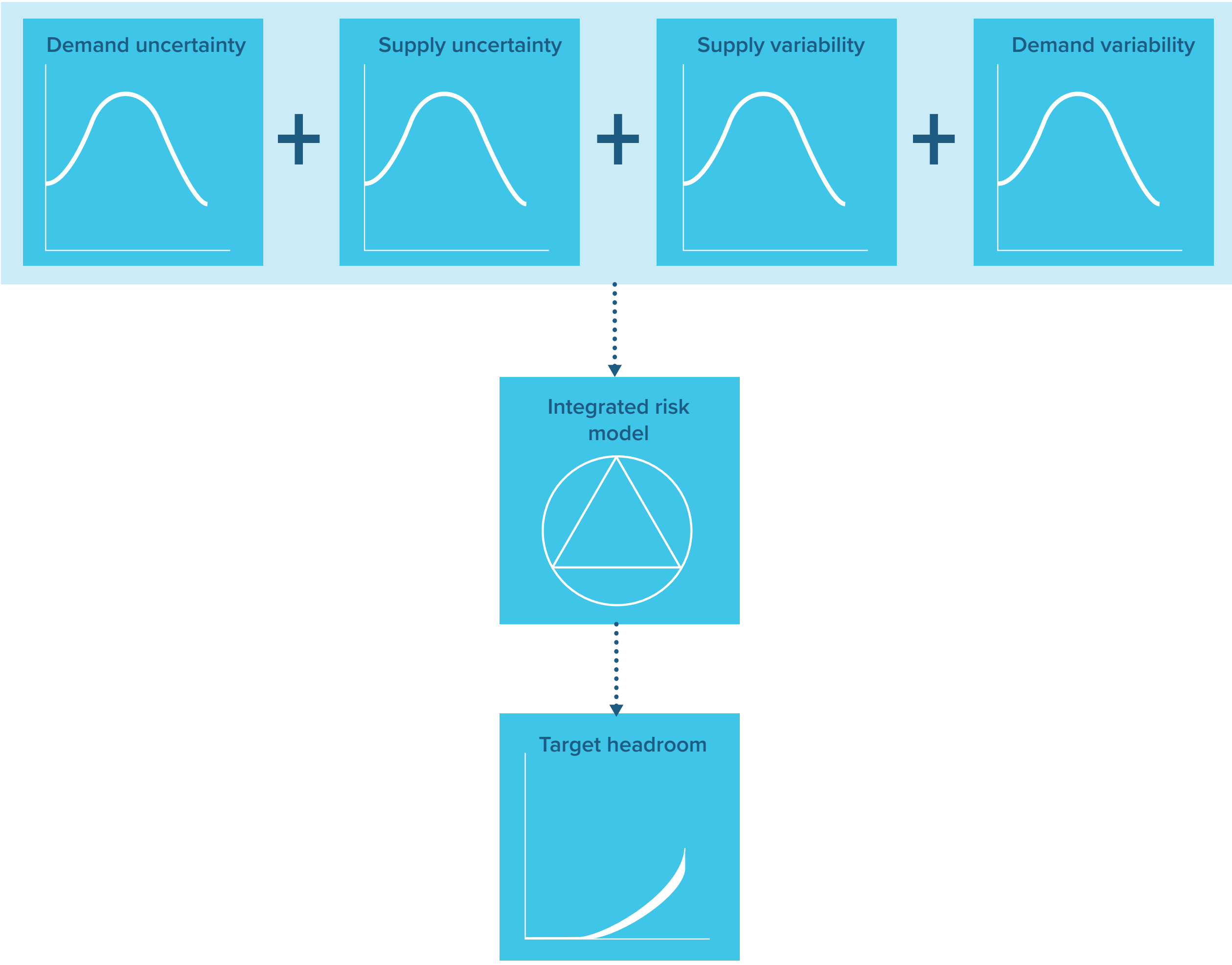


5.4 Accounting for uncertainty (headroom)

There are several uncertainties associated with our supply and demand forecasts. Target headroom is traditionally added as an allowance to the demand forecast to account for these uncertainties. It refers to a planning margin that allows for uncertainty in the supply and demand forecasts, and is defined as the threshold of minimum acceptable headroom (i.e. a surplus of supply over demand) which, if breached, would represent an increased risk to the company that it would not be able to meet its desired Target Levels of Service.

To estimate target headroom in line with UKWIR recommended methodology (UKWIR, 2002), we developed an integrated risk model (IRM) for WRMP14, which was updated for WRMP19 (Figure 5.18). The IRM incorporates all risks and uncertainties in a Monte Carlo model, including uncertainties defined by the UKWIR (2002) headroom methodology. Stochastic rainfall models were used to generate DOs at specified return periods, while demand variability is assessed through examination of dry year factors.

Figure 5.18: Our approach to modelling uncertainty



The IRM contains several key elements:

- Supply and demand probability distributions to reflect natural annual variability
- Supply and demand-side uncertainty components
- Correlations between key components

Using these inputs, the IRM calculates three sets of supply-demand balance profiles at the relevant return period. In our case, these are 1:200 and 1:500-year drought events.

1. A simple additive supply-demand balance without probabilities (i.e. supply minus demand).
2. A probabilistic supply-demand balance that includes both ‘aleatory’ uncertainty in supply and demand (i.e. the natural, quantifiable annual variability in both DO and demand) and ‘epistemic’ uncertainty.
3. A probabilistic supply-demand with no risk or uncertainty (i.e. with ‘aleatory’ variability only and without the inclusion of any of the uncertainty components).

The target headroom allowance is calculated by subtracting supply-demand balance profile (2) from (1). This represents the effect that uncertainty in supply-demand modelling has on the supply-demand balance at the level of risk that defines the Level of Service design event.

Target headroom figures for each WRZ are provided in Annex 10. These are reported as absolute values in the WRP tables. The target headroom generally increases steadily through the planning period, driven by the increasing uncertainty in the demand forecast and the impact of climate change on supply and demand over time.

5.5 Our adaptive planning approach for an uncertain future

5.5.1 What is adaptive planning?

For this plan, as in our WRMP19, we have chosen to follow an adaptive planning approach, working closely with WRSE and neighbouring water companies to further refine the process in order to ensure our strategies address the range of supply and demand uncertainties we face as a company and a region.

Traditionally in water resource planning, future uncertainty has been accounted for by adding a headroom allowance to the demand forecast as described above. However, that approach only provides a single view of future supply-demand balance. Our WRMP19 was one of the first to start using an advanced real options and adaptive planning approach in recognition of the uncertainties associated with future estimates of supply and demand.

An adaptive plan is useful when there are significant future uncertainties as adaptive plans show how a programme of investment would change if and when those uncertainties are resolved. The aim is to develop a plan that can change to ensure that the needs of our customers and the environment are met in a cost effective way but when we do not know for certain how much, or how little water will be required.

The approach concentrates on understanding what needs to be done in the near term, against the context of what might happen in the future – i.e. it aims to identify a 'no regrets' or 'low regrets' solution set to deliver now and then a tailored set of options to meet the, as yet, uncertain long term future needs.

When planning for the future, we want to avoid being locked into developing options that may either not be needed at all or may not be needed as originally envisaged in terms of location, capacity, timing etc. On the other hand, in view of the long lead-in times required for developing some options, we also do not want to be in a position where we are caught unprepared should the supply-demand situation turn out to be more challenging than planned. Adaptive planning allows us to simultaneously consider and plan for multiple future supply-demand balance scenarios enabling the development of a 'no regret' or 'low regret' strategy.

5.5.2 Why adaptive planning?

An adaptive planning approach is promoted by the National Framework (Environment Agency, 2020a), and the WRPG and is consistent with UKWIR guidance (UKWIR, 2016) as an advanced approach suitable for our strategic needs and complexity. Our problem characterisation (Section 4.1) highlighted some significant uncertainties we face around the scale of the supply, demand and investment challenge.

5.5.3 Our Adaptive Plan

Our supply forecast has identified two key drivers of potential reductions in WAFU (see section 5.3.9), these are the loss of water through impacts of climate change, and the loss of available supplies through reductions in our abstractions to protect and enhance the environment. Similarly on the demand side there are large variations between the potential future population growth scenarios. There are thus three main factors to consider:

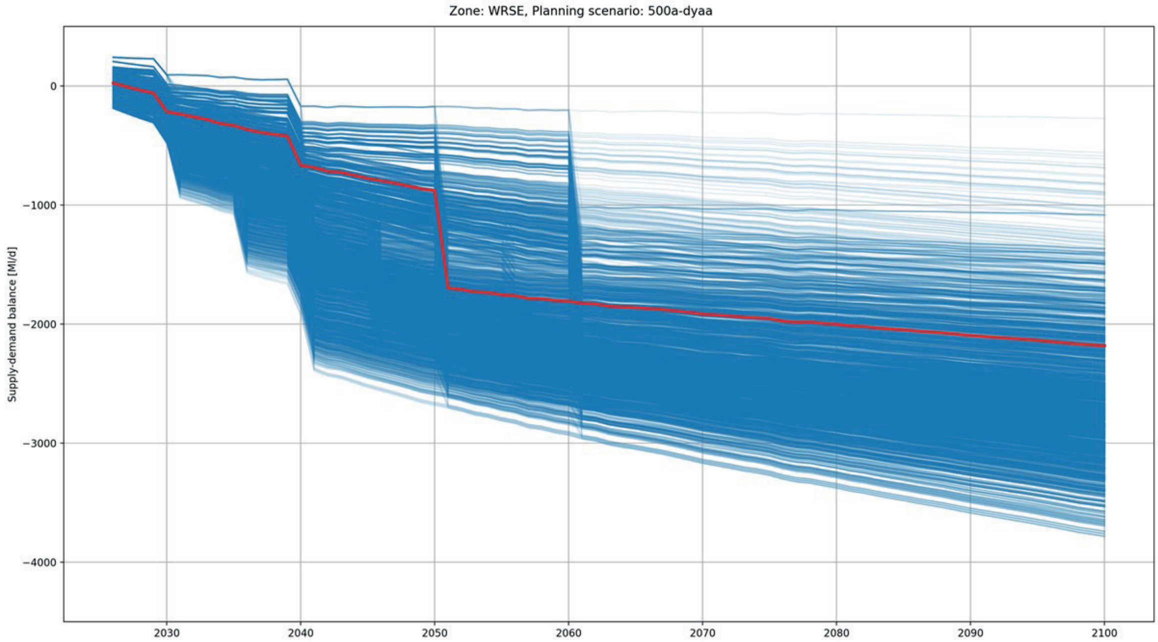
- Growth; which determines the demand that will need to be met in the future.
- Climate change; which impacts the amount of water we can abstract from our current sources.
- Environmental Destination; which determines the reductions that need to be made in abstractions from aquifers and rivers in order to preserve or enhance the environment going forward.

For regional planning and through our supply and demand forecasts we looked at 6 growth scenarios, 28 climate change scenarios and 5 Environmental Destination scenarios. Figure 5.19 shows the full range of uncertainty of the possible supply demand balance challenge at a WRSE regional level through combinations of these three drivers.

In order to come up with a more practical number of future supply-demand situations, we, alongside WRSE decided to limit the number of situations to nine in consultation with the member companies. These were based on the following combinations of growth; climate change and environmental destination scenarios and the aim was to cover the range of supply-demand situations (Figure 5.19) and defined based on the following factors:

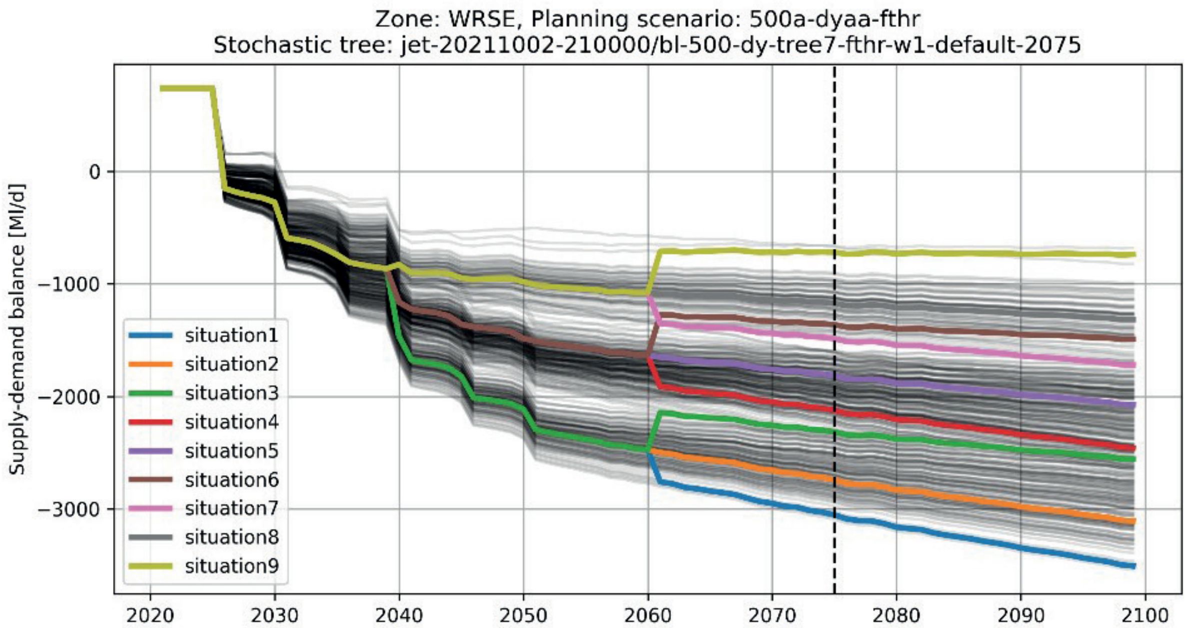
- Growth: Housing plan as defined by the local authorities; Housing plan taking into account the potential growth in the Oxford Cambridge growth corridor; The Office for National Statistics (ONS) 2018 central forecast for the South East region; ONS 2018 low growth forecast for the South East and a Housing max forecast which is defined initially by the housing plan forecasts from the local authorities but is defined in the later years by the housing need number of the local authorities (Section 5.2, Annex 7).
- Environmental destination: We have three scenarios of high, medium, and low based on locally derived (through discussion between ourselves and the Environment Agency) scenarios to reducing abstractions at key sources to leave more water in the environment in the future. We have also included further reductions for licence capping (Section 5.3.8, Annex 9).
- Climate change: We have simulated the impact that climate change could have on future supplies using the UKCP18 datasets. In total we have simulated 28 different climate change futures. From these we have selected three scenarios which represent an average impact, upper impact and lower impact measured at a regional level (Section 5.3.2, Annex 8).
- Supply forecast: This has been derived from simulation models, groundwater models and hydrological models using the spatially coherent stochastic weather sequences for the region (Section 5.3.1, Annex8). For our core plan we have used the supply forecast sequences that move to a 1:500 year drought sequence by 2040. As the choice of timing to move to 1:500 resilience is within company control We have also explored earlier and later dates for achieving the 1:500 drought resilience through sensitivity analysis (see section 7.4) rather than as part of the adaptive plan branches.
- The selection of the growth forecasts attracted several comments from stakeholders in the WRSE regional emerging plan. We have selected these forecasts for the following reasons:
- The selection of the housing plan and the housing plan plus OXCam are the two forecasts explicitly set out in the Water Resource Management Plan guidance. For any WRMP and by implication any regional plan to be compliant it should consider these growth scenarios. The purpose of building a resource plan around this growth rate is simply to ensure that the water resource infrastructure is there to support housing growth.
- The ONS 18 central forecast was selected as it was referred to both in the consultation responses to the emerging plan but also in the Ofwat long term strategy methodology. This forecast is lower than the housing plan forecasts.
- The maximum and minimum growth forecasts both severe as stress tests in the adaptive regional plan to ensure that this wide range of uncertainty is considered when selecting the schemes in the next 5 years. and how we have turned to guidance to define the branches on the situation tree.

Figure 5.19: The range of baseline supply-demand balances for WRSE region under a 1:500 DYAA scenario



We have consequently introduced the latest ONS forecast based on 2018 data (ONS18) in situations towards the lower end of the spectrum in addition to the minimum growth forecast. Similarly, following EA feedback on the ERP, growth projections for the Oxfordshire-Cambridge arc have also been incorporated in the branching. The Oxfordshire-Cambridge growth arc is not directly relevant for Southern Water but projections for the arc can impact demand forecasts for AFW and TWUL which can in turn impact the development and/or utilisation of shared options.

Figure 5.20: An illustration of the root and branch approach adopted for adaptive planning



When determining when to branch our adaptive plan we have two ways of looking at these points:

- Branching once acceptable levels of risk are exceeded (Risk Based Decision Points). We identify our starting strategy, but acknowledge that we need multiple different strategies open to us at the point where uncertainty in the future exceeds the uncertainties we have included for in our current strategy. This works well when drivers, for example population growth and climate change, change gradually with time.
- Branching at a ‘natural break point. In this context this would tend to be at the point when we have a substantially more definitive answer to our key uncertainties than we currently have. At that point it is ’natural’ for us to review/change strategies. This works well when there are sudden step changes, for example due to policy choice and would be more suitable for Environmental Ambition.

When looking at the gradual, risk-based drivers (growth and climate change) we looked at the difference between the upper forecast and the central regional forecasts. This was found to exceed the target headroom allowance just after 2035, which suggests that a branch point should be set at this point. The decision point, for the monitoring plan would therefore be set at 2030, the beginning of AMP period. This would allow a five year review period to be undertaken to determine which growth and climate change scenarios that the plan is tracking against. The break points are then set at 2035.

For the policy choice regarding the Environmental Ambition there are several uncertainties that must be investigated before the final policy positions are known. The time taken to undertake these investigations and conclude their outcomes with the regulators will be key to deciding when a decision on environmental destination impacts can be made. It will not be until the final sign off of our environmental investigations and options appraisals that we can conclude the destination to deliver. We expect that a decision on the Environmental Destination will be made by 2035 once we have concluded our environmental investigations.

This branching (Figure 5.20) was used in the WRSE ERP that was consulted upon in February 2022 (WRSE, 2022a). Following the consultation responses (WRSE, 2022b) and publication of Ofwat’s PR24 methodology (Ofwat, 2021), we have revised the branching as shown in Figure 5.21.

In revising the branching points, we have taken account of:

- The timing of potential divergence of growth and climate change uncertainty.
- The potential earliest date for a decision on environmental destination.
- Ofwat plausible scenarios.
- The need to identify a core pathway as per WRPG.

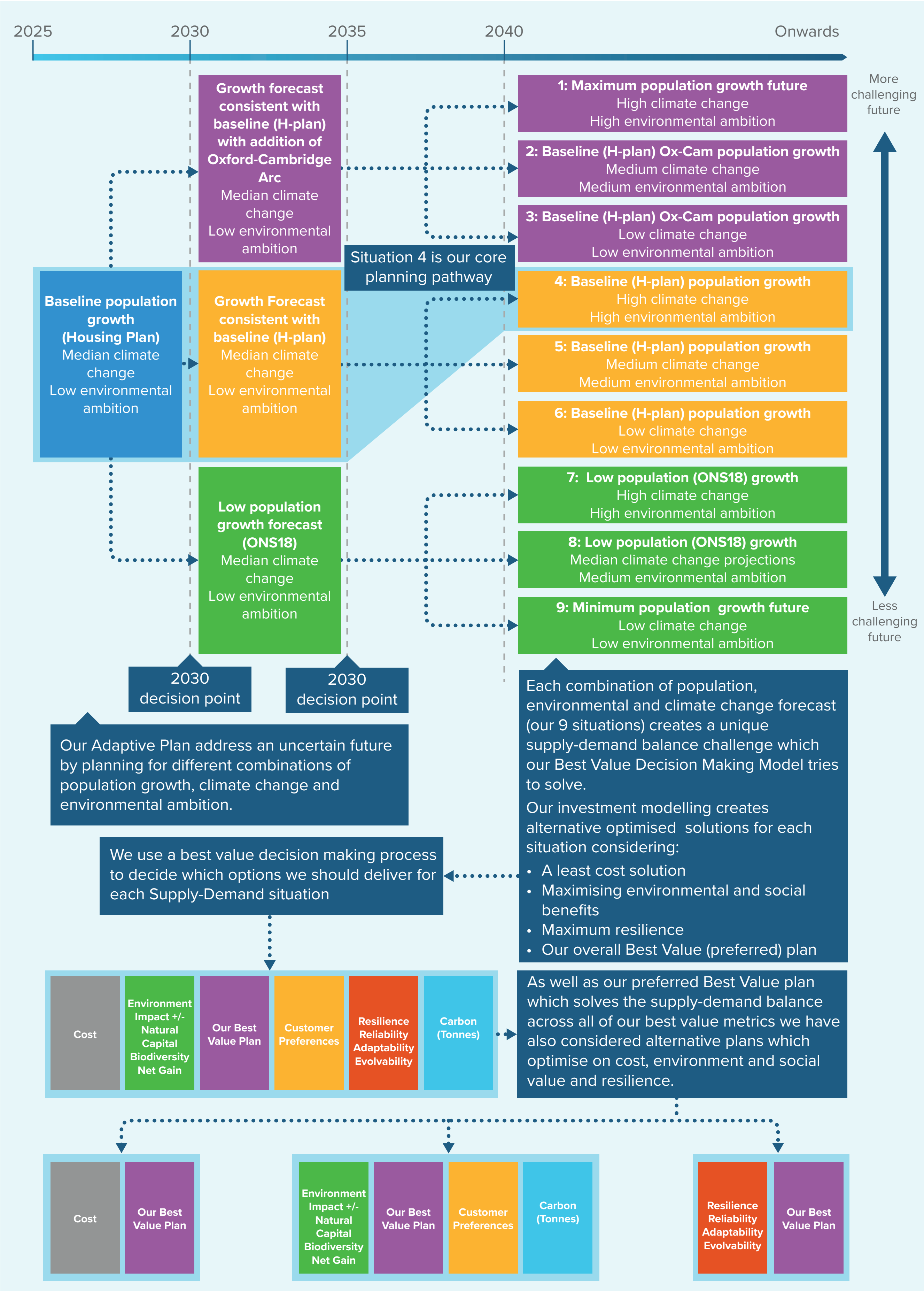
Figure 5.21 summarises our adaptive planning approach for this plan. There are nine different situations which represent different combinations of population growth, climate change and environmental ambition and which are expressed as different magnitudes of supply-demand deficit. The first branch point and decision point in 2030 is based on population growth forecasts, and the decision point in 2035 splits into different situations depending on supply-demand deficits caused by climate change and the level of environmental ambition.

This situation tree is applied to every WRZ against the four different supply-demand scenarios i.e. NYAA, 1:100 year DYAA, 1:500 DYAA and 1:500-year DYCP. Therefore, for every WRZ, we created four sets of situational trees covering nine potential supply demand forecasts.

Whilst the range of uncertainty explored here is driven by uncertainty due to climate change, population growth and environmental destination there are a number of other combinations of discrete forecasts that can also produce similar levels of deficits (e.g. an MDO scenario). Therefore, the solutions being presented in our plan should be considered as not just answering these 9 specific combinations of uncertainty drivers but also a more general point that a given level of supply-demand deficit is best solved using this combination of solutions via our best value decision making.

The distinction between branch points and decision points should be noted. For the purpose of investment modelling, the branches (or situations) are the point where the decision on which future branch to follow needs to be made. To help us decide which branch we will follow after each decision point, and hence which strategy we will need to deliver we have set out an adaptive Monitoring Plan (Section 5.5.4, Annex 11).

Figure 5.21: Summary of our adaptive planning approach



For regulatory purposes we have selected 'Situation 4' as our core 'reported pathway' and this situation is reported in our WRMP tables. We have agreed to use this pathway in discussion with WRSE and through regulatory feedback which included a requirement that our core pathway reflect housing plan growth and BAU+ Environmental destination. This is purely a table reporting convention and our plan remains fully adaptive across the whole range of the future situations.

In the longer term Situation 4 includes our full High Environmental Ambition which goes further than BAU+ and EA Enhanced scenario (Environmental Agency, 2020b) but this does not affect our investment proposals for the next 5 years. Under our adaptive plan all environmental pathways are consistent with the low ambition, including licence capping until 2040.

Ofwat has set out its expectations in relation to long-term management of assets through its 'long-term delivery strategy' (LTDS) guidance (Ofwat, 2021). This requires that long-term plans consider a 'do minimum' scenario, and to demonstrate that, adaptations from that scenario represent best value. This 'do minimum' scenario is covered by Situation 8 because it includes likely statutory minimum environmental destination and ONS18 population growth.

Target headroom and adaptive planning

When considering an adaptive planning approach, it is important to ensure that uncertainties are not double counted. The three sets of branches described above set out the alternative forecasts explicitly. Therefore, the adaptive planning approach takes account of some of the uncertainty arising from a range of forecasts at the branch points.

To avoid double counting risks, any components used to define a branch (growth, climate change impact and Environmental Ambition) have been taken out of the headroom assessment. Therefore, the root branch of the adaptive plan from the beginning of the plan (2025) to the first branch point (2030) has a full target headroom assessment, as explained in Section 5.4.1 above.

At the first branch point, the adaptive plan branches on Environmental Destination and growth forecasts but leaves climate change as a median estimate. Therefore, the target headroom profile from this first branch point drops relevant supply-side and demand-side component. Accordingly, this target headroom profile is referred to as the EDG profile to indicate it has dropped components associated with Environmental Destination (ED) and growth (G).

In the final set of branches, a third target headroom profile is required which accounts for the upper and lower quartile impacts of climate change on the demand and supply forecasts respectively. This target headroom profile is referred to as the EDGC profile to indicate it has dropped components associated with Environmental Destination, growth and climate change (EDGC).

5.5.4 Monitoring our adaptive plan

Our adaptive Monitoring Plan sets out how we will track the different supply and demand variables that could influence which adaptive pathway, or 'situation' we are likely to be following into the future and therefore the particular portfolio of supply and demand options that we will need to deliver to maintain secure water supplies.

Our adaptive plan focuses on the supply-demand uncertainty from three drivers; population growth, the amount of abstraction reduction we will need to deliver to protect and enhance the environment and climate change impacts on our water resources (DO).

Our full adaptive monitoring plan is set out in Annex 11 and is summarised below for each of the three drivers.

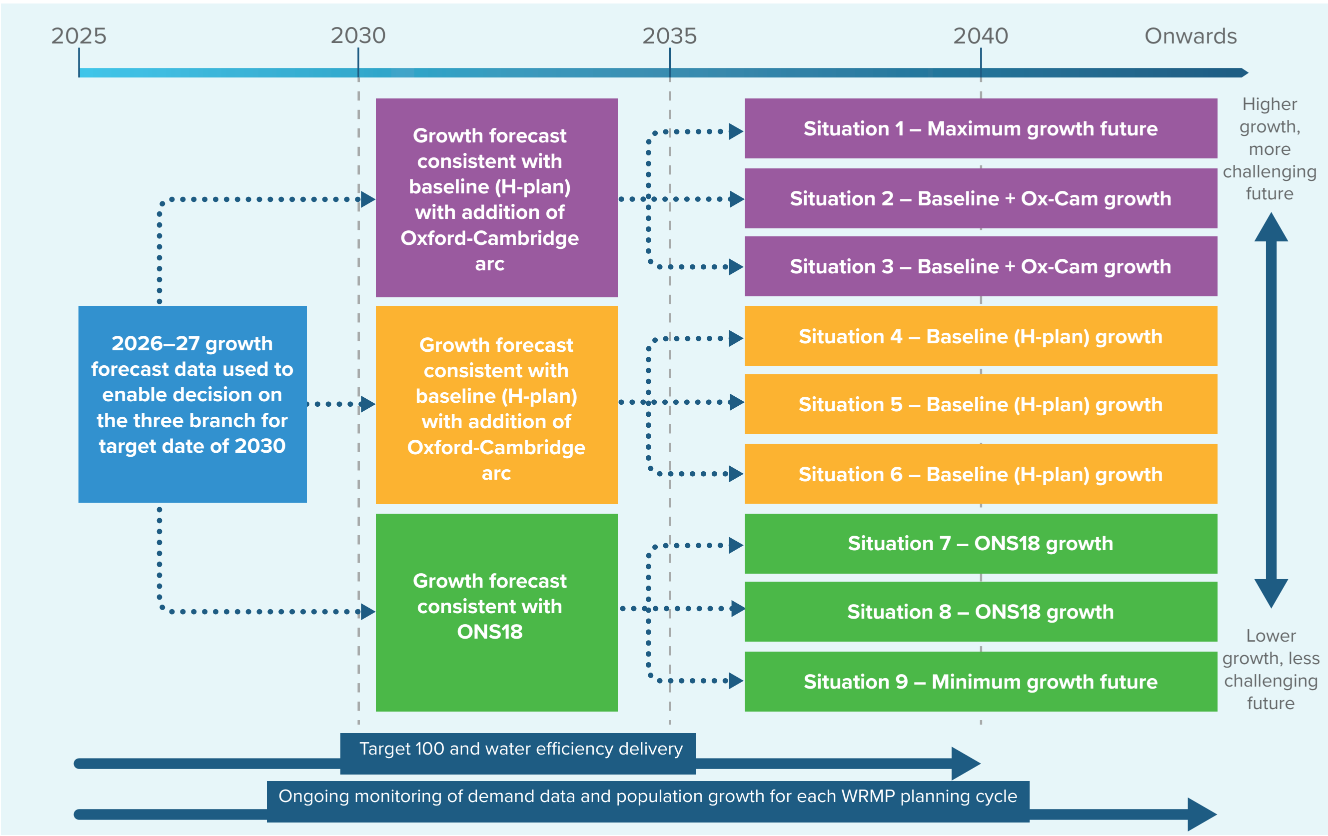
Population growth

Our population growth forecasts are based on population and housing growth forecast from multiple sources, such as Local Plans from local authorities in our supply area and ONS data combined with PCC and per household consumption (PHC) forecasts.

We normally re-assess population growth forecasts for each WRMP cycle. The next update should be undertaken for draft WRMP29 and will be incorporated into our WRMP29 demand forecasts. This update will be used to support and determine the adaptive planning decision point for population growth in 2030. We will use actual data compared to forecast range of uncertainty between different projections.

Figure 5.22 summarises our adaptive monitoring approach and metrics for population growth and the 2030 decision point.

Figure 5.22: Summary of adaptive plan metrics, monitoring and decision points for the population growth uncertainty driver



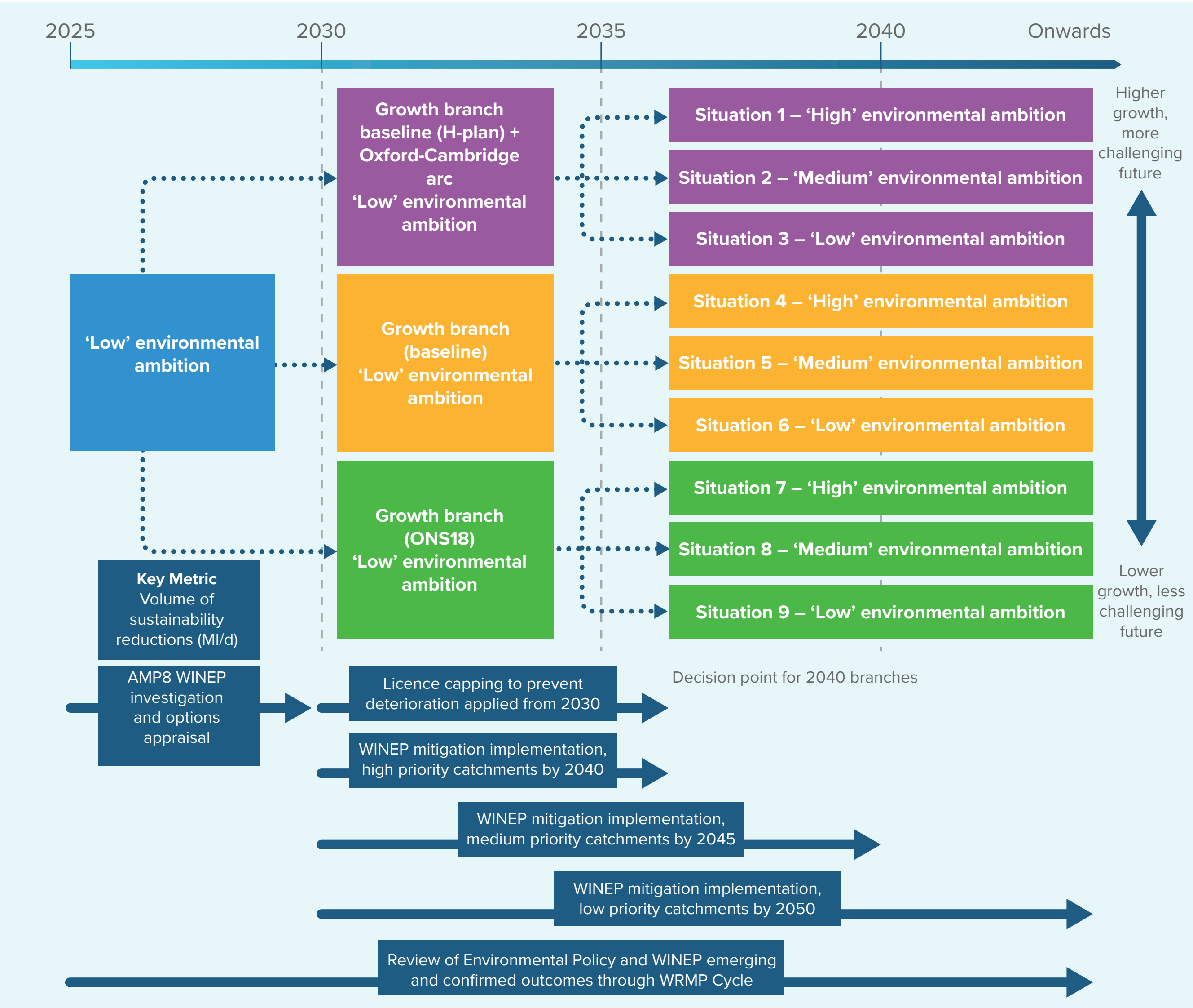
Our Environmental Ambition

Presently there is a lot of uncertainty about both the quantity and location of abstraction licence changes we will need to deliver to protect the environment and therefore the potential impacts on our water supplies.

We are addressing this uncertainty through our wide ranging WINEP over the next five years and by 2027 we expect to have finished investigations into the sustainability of most of our water sources. This will allow us to work with the EA, Natural England and other stakeholders to make robust, evidence-based decisions around the scale of abstraction reductions and other mitigations required to protect and restore the environment and improve its resilience to climate change. The conclusion of our WINEP investigations and options appraisal between 2024 and 2027 will therefore be critical to informing the likely Environmental Destination pathway we are likely to follow.

Our current adaptive plan considers 'high', 'medium' and 'low' volumes of DO losses which reflect the potential range of different combinations of environmental policy and the outcomes of our ongoing WINEP investigations. This allows greater flexibility in our approach because individual licences changes can be considered and tailored at a source or water body level as appropriate but the range of uncertainty

Figure 5.23: Summary of adaptive plan metrics, monitoring and decision points for the Environmental Ambition driver



in terms of supply-demand balance impact in those reductions is still covered within the three scenarios.

The key metric to monitor is therefore the DO impact of sustainability reductions and the timing of those impacts relative to the planned branches (see Section 5.3.8). Because of the timing of our WINEP investigations (Table 5.12, Figure 5.23) we are likely to know in advance of the environmental adaptive plan decision point in 2035 the Environmental Destination scenario we are likely to be following.

Table 5.12: Summary of key Environmental Destination monitoring points.

Review Mechanism	Date of review
Review of Environmental Policy and Water Resource WINEP emerging and confirmed outcomes reported in WRMP annual review	Annually
Conclusion of AMP7 and AMP8 WINEP studies (investigation and options appraisal)	2024–27
Environmental Ambition update and confirmed sustainability reductions for WRMP29	2027–29
Start of mitigations associated with 2027 WINEP investigation and options appraisal	2030 Onwards
Environmental Ambition update and confirmed sustainability reductions for WRMP34	2030 Onwards
Environmental Ambition decision point	2030
Adaptive branching point for Environmental Destination	2035

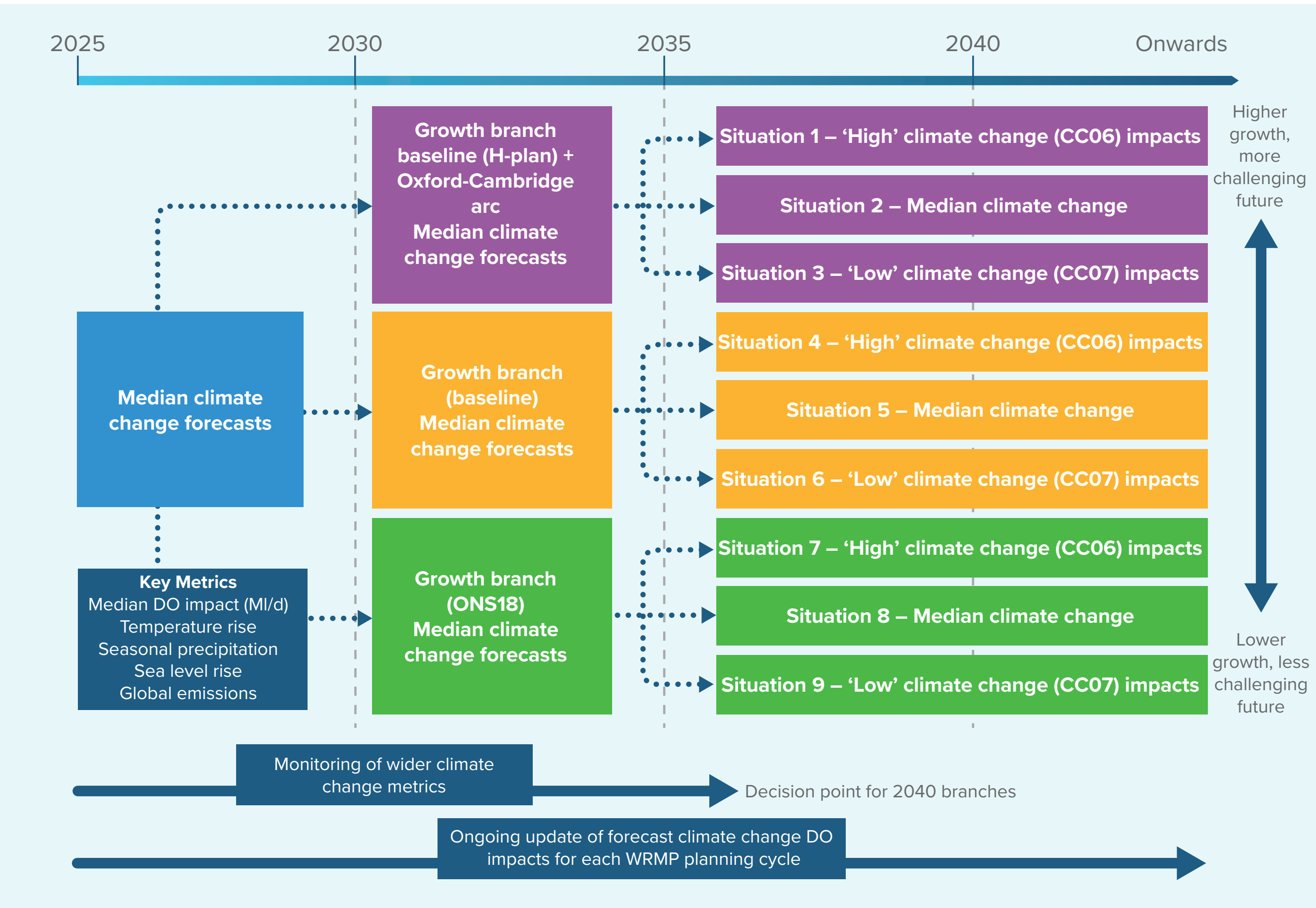
Climate change

Along with the reductions in DO delivered through achieving our Environmental Ambition, we expect that climate change will be the other major supply side driver of reductions in supplies.

Because of the comparatively long timescales over which climate change is expected to operate (compared to the water resource planning cycle) and the natural variability of the climate we will need to look at projections and trends over several planning cycles to characterise its impact and its effects on DO may be less obviously visible than other climatic events such as extreme weather (e.g. heatwaves, droughts, floods). However, we recognise that these events themselves can also be difficult to directly attribute to climate change alone. There also remains a large uncertainty in the trajectory of climate change impacts and given the lead times future trends will be influenced by 'green' policy choices, some of which are yet to be made.

Our adaptive plan branches on the expected supply impacts we might face under median, and regional 'high' and 'low' climate change impacts. We propose to use the median climate change impacts from our water resource modelling as one guide of the likely trajectory of climate change and will compare that to the range of supply forecast impacts.

Figure 5.24: Summary of adaptive plan metrics, monitoring and decision points for the climate change driver



This modelled assessment will also be supported by wider monitoring of the evolution of climate metrics which provide an indication of the severity of climate change we experience:

- Increase in average temperature
- Changes in seasonal rainfall patterns (e.g. drier summers, wetter winters)
- Sea level rise
- Frequency and intensity of extreme weather including heatwaves and floods
- UK climate projections and other synthesis reports, e.g. State of Climate Review and Climate Change Attribution Studies by the UK Met Office. Figure 5.24 summarises our proposed monitoring approach for climate change.

Our combined proposed timeline for adaptive planning decision points

Combining these three programmes into an integrated programme, Table 5.13 summarises the timelines when data from the 3 drivers must be reviewed and when decisions will need to be made on the adaptive pathway.

Using the 5-year cycle of water resource management planning we can ensure progress on the adaptive plan is monitored and updated regularly and this will be undertaken through our Annual Review process.

Using the WRMP cycle will provide the necessary framework for consultation and engagement with stakeholders, regulators, and other water companies and regional groups.

Table 5.13: Summary of integrated adaptive monitoring plan against required decision points for our adaptive plan

Planning cycle	Decision timing	Environment Destination	Growth progress	Climate change impacts
PR19/AMP7		WINEP investigations and options appraisal		Ongoing review of climate variables
PR24/AMP8	2026–27 growth data must be available to enable decision on the 3 branch decision for target 2030	WINEP investigations and options appraisal conclusion 2026–27 WINEP data is available	Water efficiency delivery by 2040	Ongoing review of climate variables
PR29/AMP9 – 2030 target branch for growth		Start of mitigations associated with AMP8 WINEP investigation and options appraisal WINEP and highest priority catchments implementation of solutions / or interim measures	Water efficiency delivery by 2040 Updated growth forecast for WRMP29	Update of resource modelling, impact and vulnerability assessment for WRMP29
PR34/AMP10 – 2035 Target branch for environment ambition and climate change impacts	Review environmental outcomes, and latest climate change projections for WRMP34	WINEP and highest priority catchments implementation of solutions	Water efficiency delivery by 2040 Updated growth forecast for WRMP34	Update of resource modelling, impact and vulnerability assessment for WRMP34 The Western Area WRZ's vulnerability to climate change will partially be determined by environmental ambition outcomes for the rivers Test, Itchen & Rother
PR39/AMP11		Medium priority implementation		Ongoing monitoring and review
PR44/AMP12		Lowest priority implementation		Ongoing monitoring and review
PR49/AMP13 – 2050 target for GES		Good ecological status by 2050		Ongoing monitoring and review
PR54/AMP14				Ongoing monitoring and review
PR59/AMP15				Ongoing monitoring and review
PR64/AMP16				Ongoing monitoring and review
PR69/AMP17				Ongoing monitoring and review

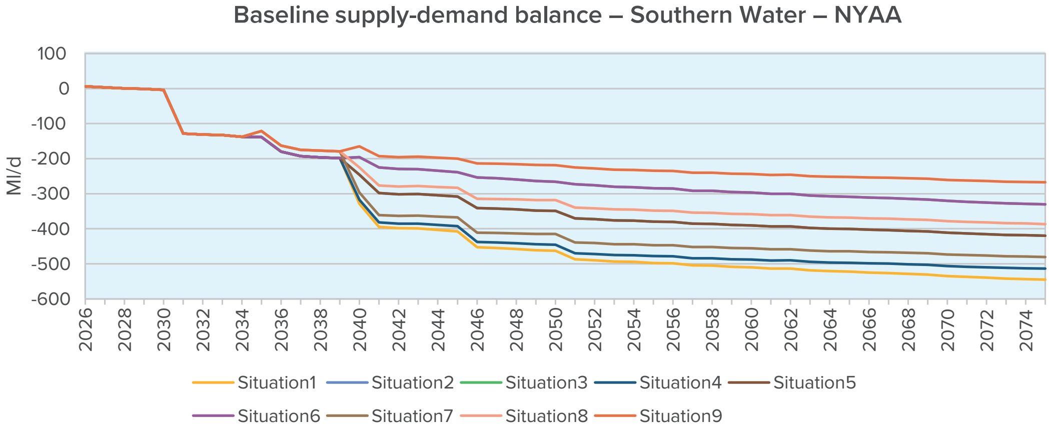
5.5.5 Summary of supply-demand balance situations for our adaptive plan

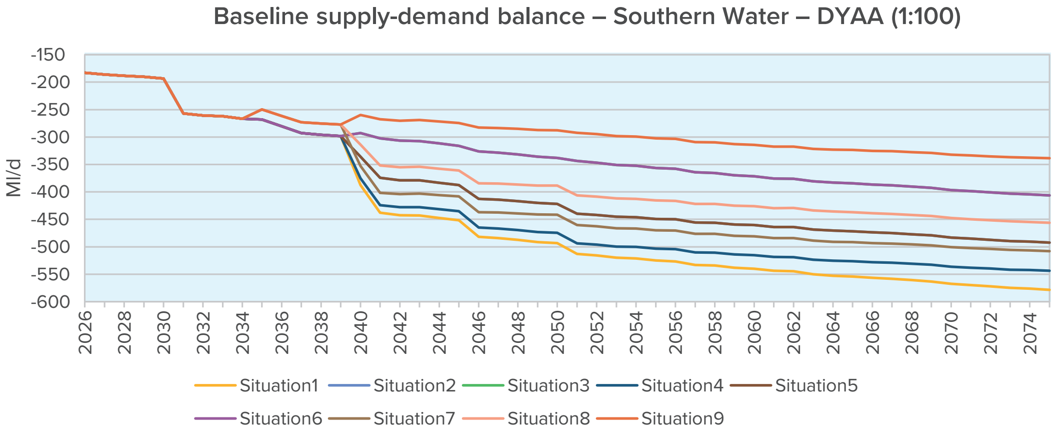
The supply-demand situations at the company level for each of the branches under the four planning scenarios are shown in Table 5.14 and Figure 5.25. The supply-demand balance situations are included in Annex 10.

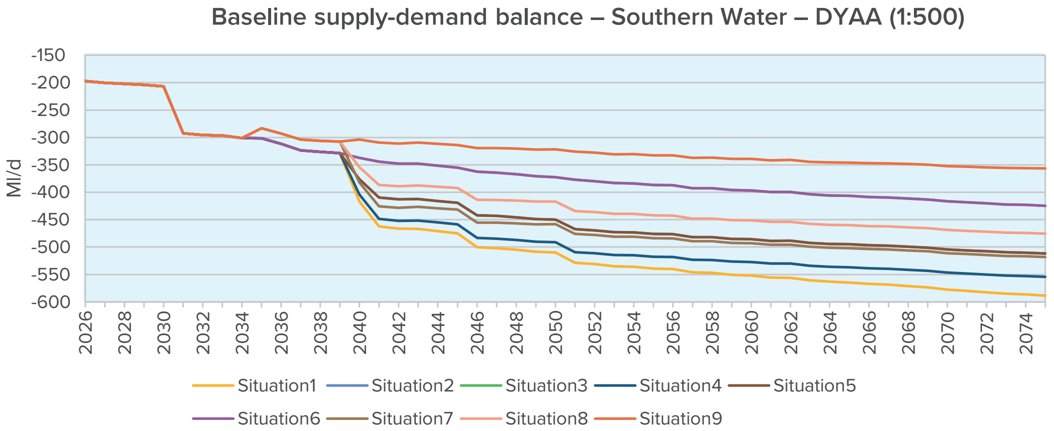
Table 5.14: Supply-demand balance under different situations for each of the planning scenario at the company level

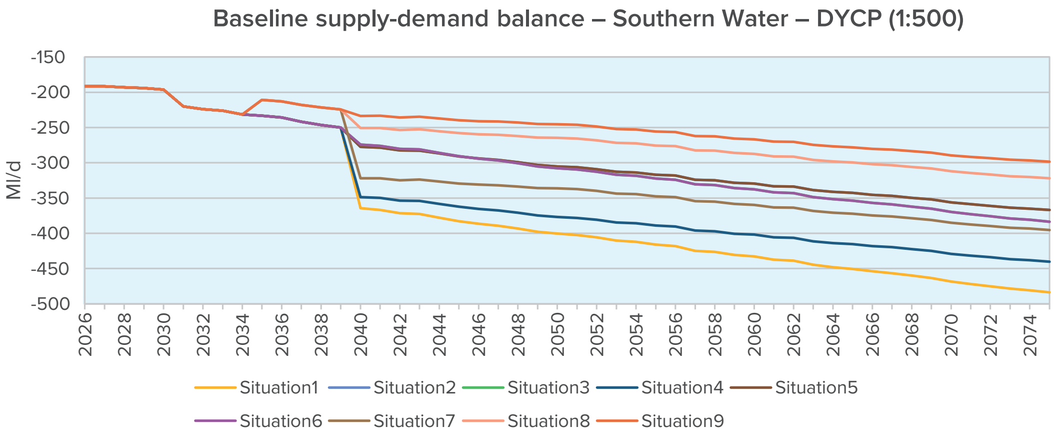
Planning scenario	Supply-demand situation	Supply-demand balance (Ml/d) 2030	Supply-demand balance (Ml/d) 2035	Supply-demand balance (Ml/d) 2050	Supply-demand balance (Ml/d) 2075
NYAA	Situation 1	-3.98	-138.60	-462.30	-545.13
	Situation 2	-3.98	-138.60	-349.12	-419.93
	Situation 3	-3.98	-138.60	-265.60	-330.32
	Situation 4	-3.98	-138.60	-445.38	-513.74
	Situation 5	-3.98	-138.60	-349.12	-419.93
	Situation 6	-3.98	-138.60	-265.60	-330.32
	Situation 7	-3.98	-121.55	-414.56	-480.24
	Situation 8	-3.98	-121.55	-318.30	-386.43
	Situation 9	-3.98	-121.55	-218.49	-267.39
DYAA (1:100)	Situation 1	-193.41	-267.94	-493.35	-578.34
	Situation 2	-193.41	-267.94	-421.76	-492.28
	Situation 3	-193.41	-267.94	-338.29	-406.45
	Situation 4	-193.41	-267.94	-474.62	-543.87
	Situation 5	-193.41	-267.94	-421.76	-492.28
	Situation 6	-193.41	-267.94	-338.29	-406.45
	Situation 7	-193.41	-249.67	-441.55	-507.94
	Situation 8	-193.41	-249.67	-388.69	-456.35
	Situation 9	-193.41	-249.67	-287.57	-338.59
DYAA (1:500)	Situation 1	-206.87	-301.67	-510.01	-588.53
	Situation 2	-206.87	-301.67	-450.05	-511.51
	Situation 3	-206.87	-301.67	-372.44	-424.47
	Situation 4	-206.87	-301.67	-491.28	-554.06
	Situation 5	-206.87	-301.67	-450.05	-511.51
	Situation 6	-206.87	-301.67	-372.44	-424.47
	Situation 7	-206.87	-283.40	-458.21	-518.13
	Situation 8	-206.87	-283.40	-416.98	-475.58
	Situation 9	-206.87	-283.40	-321.72	-356.61
DYCP (1:500)	Situation 1	-196.18	-233.12	-400.40	-483.77
	Situation 2	-196.18	-233.12	-305.29	-367.03
	Situation 3	-196.18	-233.12	-307.72	-383.48
	Situation 4	-196.18	-233.12	-376.99	-440.22
	Situation 5	-196.18	-233.12	-305.29	-367.03
	Situation 6	-196.18	-233.12	-307.72	-383.48
	Situation 7	-196.18	-210.95	-336.38	-395.30
	Situation 8	-196.18	-210.95	-264.68	-322.11
	Situation 9	-196.18	-210.95	-245.29	-298.38

Figure 5.25: Baseline supply-demand balance at the company level









6. Identifying and assessing options to address supply-demand deficit

When supply and demand forecasts show a supply-demand deficit in any area over the planning period, we need to identify options to reduce demand (demand-side options) and/or increase supplies (supply-side options) to be able to meet future demand.

Demand-side options can help to control what might otherwise be unrestricted growth in demand for water. The implementation of demand management measures has been a key component of our water resources planning strategy and will continue to be so in the future.

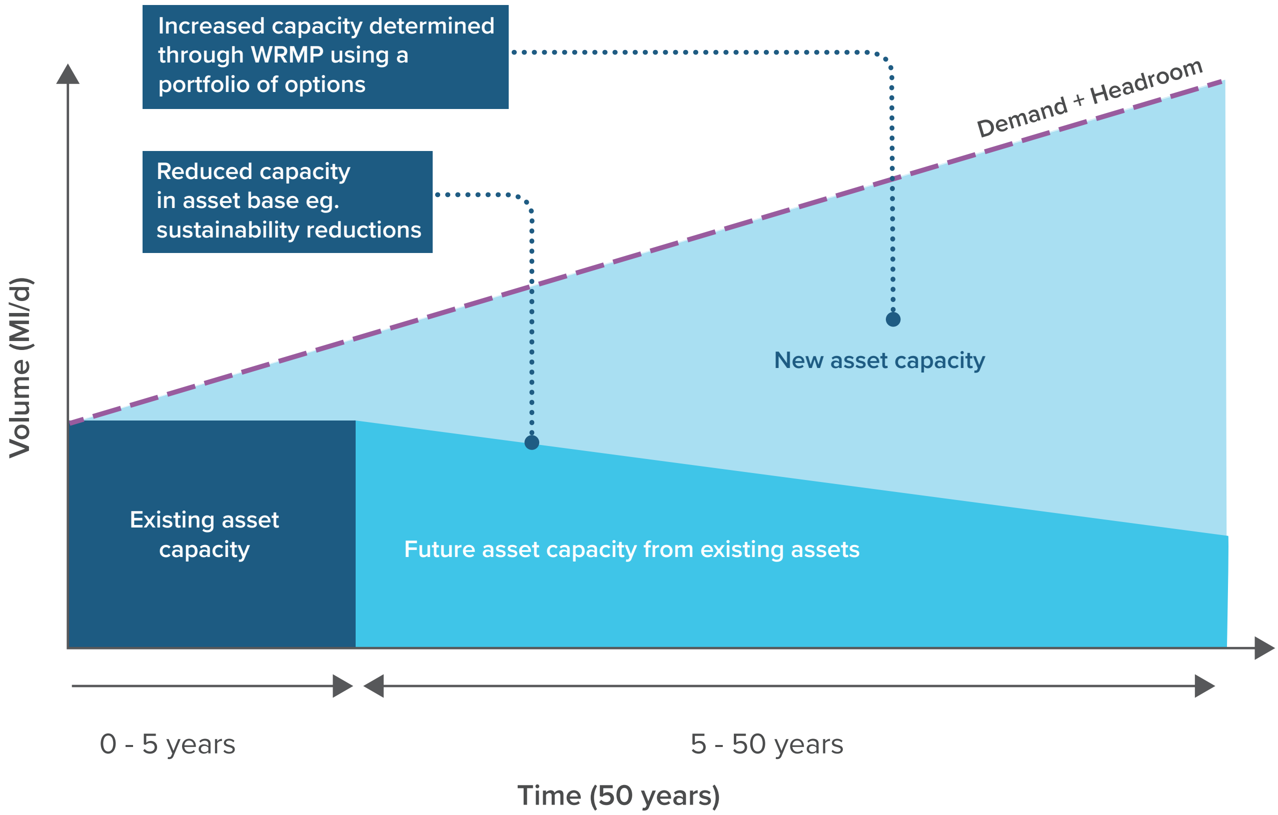
The demand-side reductions are significant to this plan. Reflecting their importance, separate technical annexes are provided for the following areas:

- T100
- Smart metering
- Leakage reduction

These technical annexes should be read in conjunction with this section. The detail has not been included here and an overview is provided.

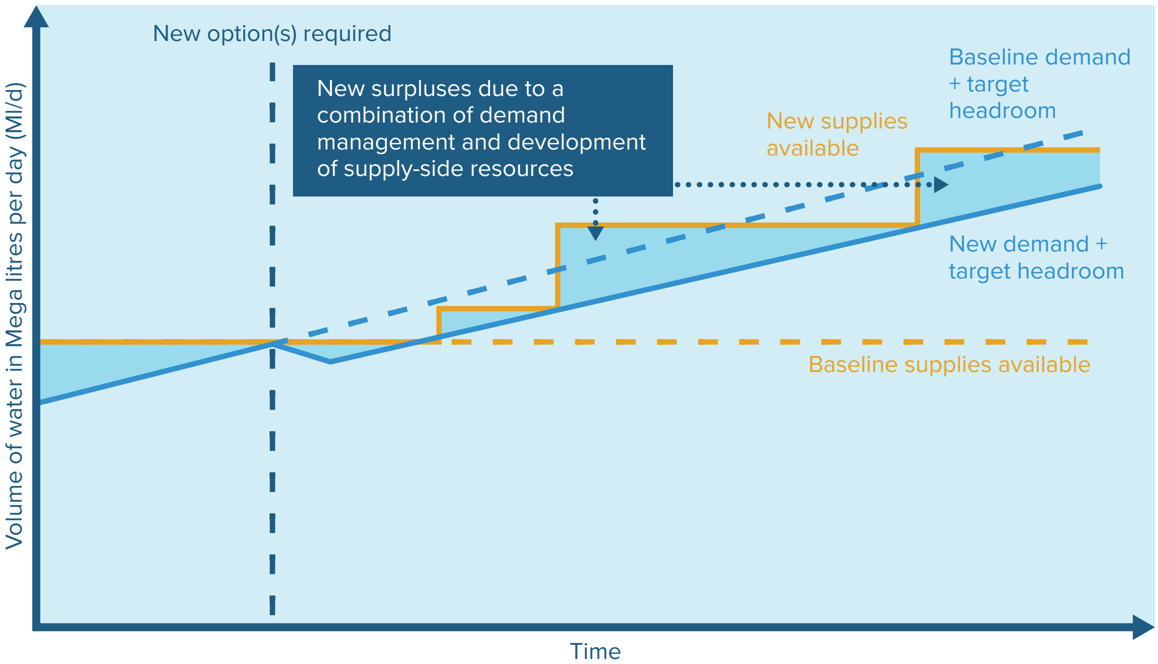
As mentioned earlier in section 5.4.1, an allowance (headroom) has traditionally been added to the demand forecast to account for the uncertainty. Future options must be able to meet demand plus headroom in all scenarios (Figure 6.1).

Figure 6.1: The role of new options in maintaining supply-demand balance



The options appraisal process is a key part of WRMP development. It enables us to identify and assess a wide range of supply-side and demand-side options to increase supplies and reduce demand. The effect of this 'twin-track' approach is illustrated in Figure 6.2.

Figure 6.2: The twin-track approach to meeting supply-demand deficit



Working with WRSE (WRSE, 2021c), we developed a consistent framework for options appraisal. Some of the work was done at the regional level but the assessment of the options was carried out by individual water companies (Figure 6.3).

We followed the same approach adopted in WRMP19, and took account of WRPG (Environment Agency, Ofwat and Natural Resources Wales, 2021) and UKWIR guidance (UKWIR, 2002, UKWIR, 2012b and UKWIR, 2016b).

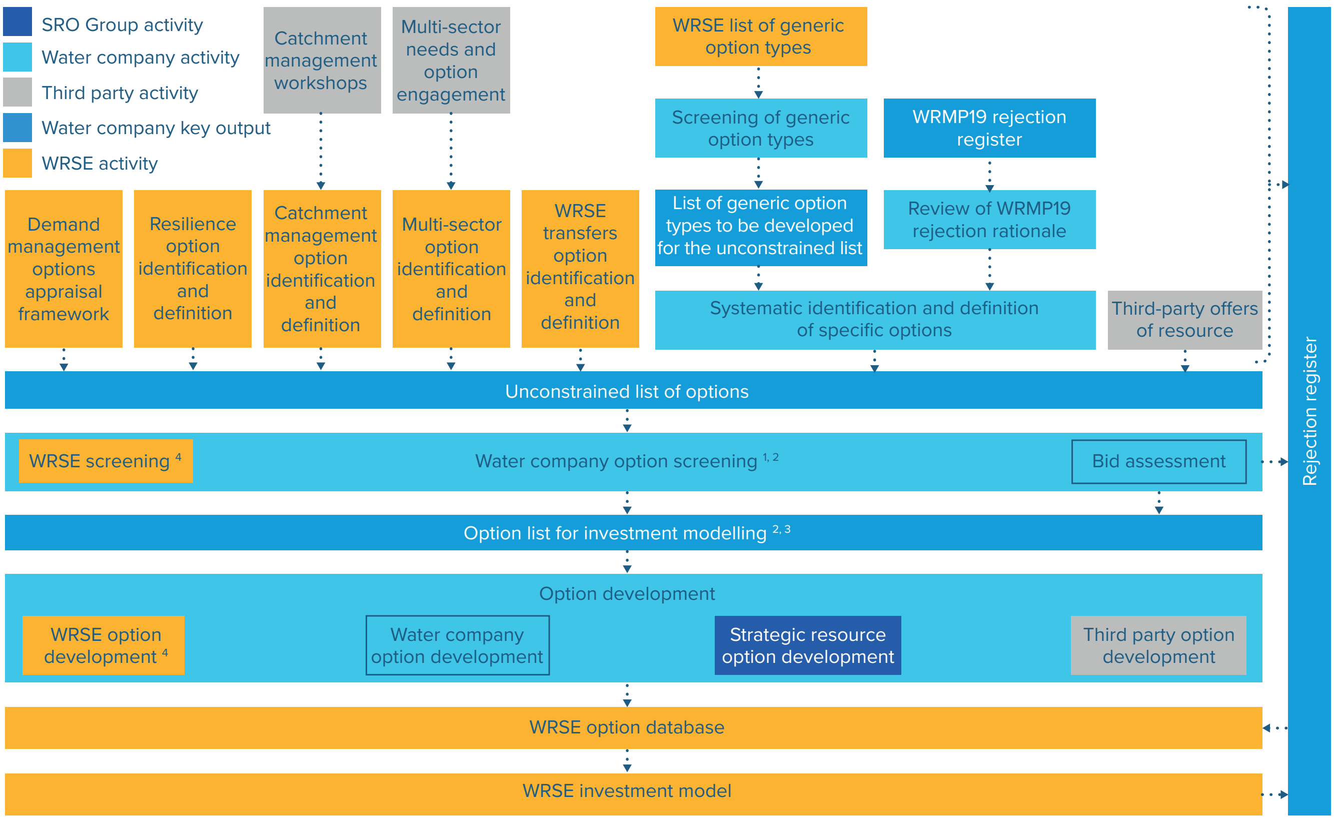
The options appraisal method follows several stages:

1. Prepare supply-demand balance information
2. Develop a list of options that considers government policy and aspirations
3. Undertake problem characterisation and evaluate strategic needs and complexity
4. Decide on a modelling method
5. Identify and define data inputs to model(s)
6. Undertake decision-making (options appraisal) modelling
7. Carry out sensitivity tests
8. Produce a final planning forecast.

Steps 1–3 have primarily been undertaken by member water companies individually. WRSE has progressed steps 4–8 after agreeing on an approach with members and consulting on the overall method with other stakeholders. This has led to an integrated approach across the WRSE region (Figure 6.4).

The aim of the process is to develop an optimal set of options that will maintain supply-demand balance over the planning period, under all planning scenarios. This forms the basis of the WRMP.

Figure 6.3: The options appraisal process developed for the regional plan



Note 1: Screening processes will vary between companies and may include a one or two stage approach, company specific feedback has been provided to improve robustness of option screening.

Note 2: The option list for investment modelling may be the full feasible list of options, or a constrained feasible list, where this has been agreed with stakeholders (including the EA), provided that care is taken when constraining the feasible list to ensure options that could benefit other companies are not rejected at this stage.

Note 3: Demand management options are represented as strategies comprising baskets of consumption and leakage reduction options, combined options combined by Water Companies to achieve different levels of total demand reduction.

Note 4: WRSE option identification, screening and development activities focused upon catchment management, multi-sector and strategic transfer options.

Figure 6.4: Integrated options appraisal approach

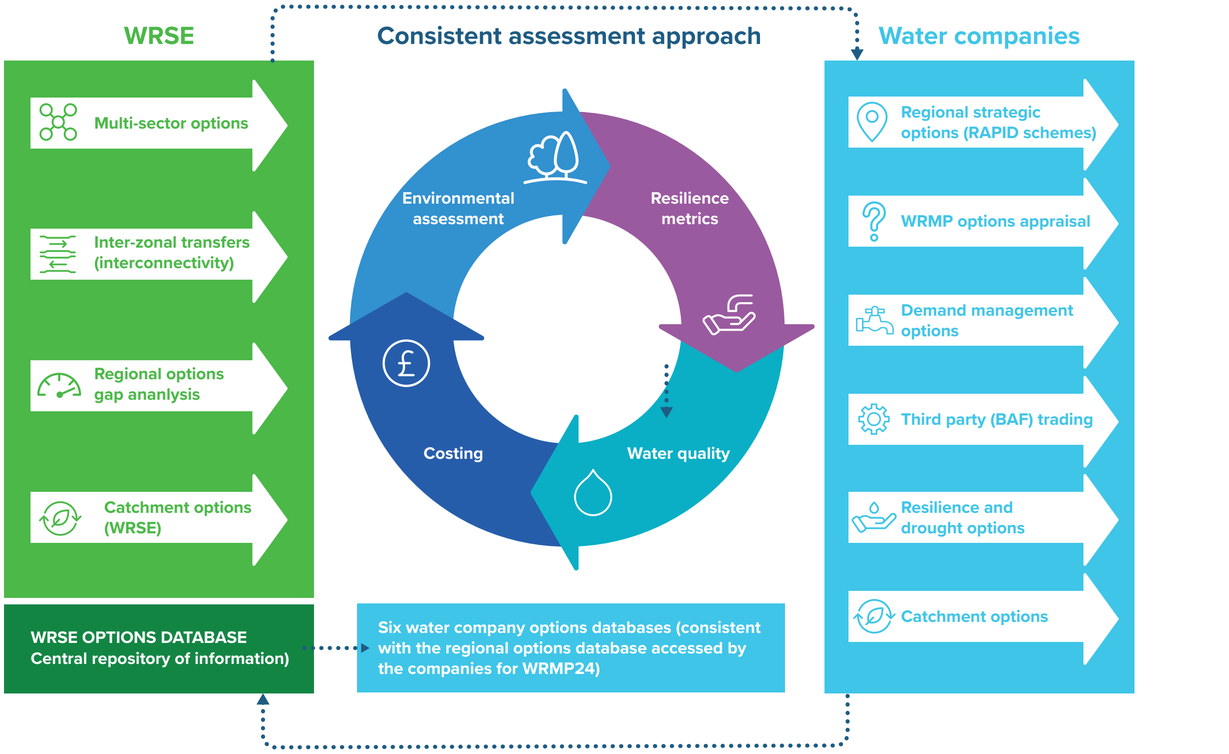
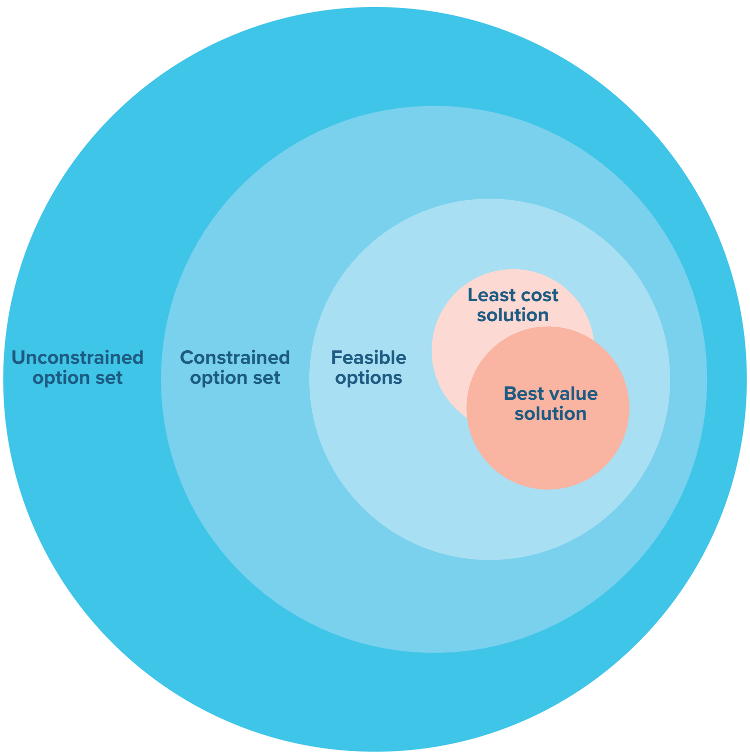


Figure 6.5: Option screening process



The optimisation can be based purely on cost 'least-cost' plan (LCP) or can take account of additional factors such as customer acceptability and resilience to develop a plan that delivers overall best value to the customer 'best value' plan (BVP). Our WRMP24 will be a BVP.

The options appraisal process enables us to screen a wide range of options to develop future strategies. The screening of options is carried out as follows (Figure 6.5).

- Identification of an **unconstrained list** of options.
- Screening and filtering of the list against initial screening criteria to develop a **feasible list**. Options that are impractical or have unacceptable environmental or economic impacts are removed.
- Screening against final screening criteria to arrive at a **constrained list**. Constrained options are taken forward into the decision-making modelling process (see Section 7).
- **Environmental assessment** of the constrained options as part of the Strategic Environmental Assessment (SEA), Habitats Regulations Assessment (HRA) and WFD assessment processes.

6.1 Unconstrained list of options

The unconstrained list of options is a high-level list including generic types, taking account of government policy and aspirations. It includes options and studies from past WRMPs as well as new ones identified through consultation with customers and stakeholders.

In order to invite ideas, we developed a pro-forma to gather information on any potential new options. This invitation was advertised on our company website, employee notice board and on social media. We also invited ideas in stakeholder panels and held employee sessions.

Each unconstrained option was assessed against an initial set of screening criteria to see if it should be taken forward to the feasible list of options. The purpose of this screening process is to remove options that are impractical or have unacceptable environmental or economic impacts.

We assessed the unconstrained list of options against the following criteria:

- **Will the option deliver beneficial environmental outcomes, whether on its own or in combination?** Does it provide additional benefits such as improved water quality, reduced flood risk or improved catchment management, over and above the objective of improving water resources? Can it contribute to environmental sustainability?

- **Would the option provide enhanced resilience through broadening types or locations of water resources available for supply?** This could include links to areas or sources that may respond differently to certain drought conditions or a resource that is not weather dependent (e.g. desalination or water recycling).

- **Can the option be delivered in a phased or modular way?** This increases the flexibility of the option in response to future changes in the forecast supply-demand balance.

- **Is the option likely to be technically feasible?** For example, the location of aquifer storage and recovery (ASR) options would be limited to locations with suitable geology.

- **Does the option help address our water resources planning problem, or could it be used to provide a regional benefit?** Can it provide water or water saving in the WRZ, or can it provide a direct or conjunctive use water resource benefit with a neighbouring water company.

- **Is the option likely to meet both customer and regulator expectations?** If an option is likely to meet public resistance or may contravene environmental and planning restrictions, government policy or impact upon WFD non-deterioration objectives, then it may need to be omitted or given a longer timeline for implementation.

- **What is the indicative cost and capacity of the option and when is it likely to become available?** If an option is disproportionately expensive or its capacity is too small to be suitable/practicable to meet the projected supply-demand deficit or part of it then it may not be considered viable. Similarly, an option is also assessed in terms of the time required to develop and achieve benefit from it. If an option cannot be developed in time, then we would look for alternatives that can.

- **Is the option likely to be particularly risky to implement, or the output highly uncertain?** This considers aspects like land availability, deliverability of the option in terms of achieving the estimated output, the availability and reliability of the required technology and experience within the company in developing and operating similar options. It also looks at confidence in the lead-in time required to develop the option, the likely spend profile and the nature and amount of environmental and engineering work required at each stage from planning to delivery.

This screening criteria allows us to narrow down the unconstrained list to a smaller list of feasible options.

6.2 Feasible list of options

Options that progressed to the feasible list were subject to a further screening process which included consideration of the water resource problem faced in each WRZ, and the flexibility of options for investment modelling. For example:

- Are there sufficient options in each WRZ?
- Is there sufficient connectivity?
- Do the options contain enough granularity (i.e. different sizes of options)?
- Is there a need for modular options?
- Is the granularity of those modular options sufficient?

Southern Water teams worked alongside the WRSE investment modelling team to answer these questions, particularly in terms of any new options developed as part of dWRMP24.

Each option was assessed against the following criteria:

- **Monetised costs and benefits** – economic assessment of each option and engineering judgement.
- **Non-monetised costs and benefits** – environmental and social factors
- The opportunity to employ **mitigation measures** in cases where environmental and/ or social impacts are identified.
- **Dependencies** or **mutual exclusivities** with other options and potentially with third parties, including neighbouring water companies.
- The **adaptability** of the option to future uncertainties, and/or the possibility to be implemented in a phased way. This includes assessing the risk to delivery from an extended programme that may spread over multiple AMP periods, before a scheme is implemented.
- **The reliability and resilience** of the option i.e. its vulnerability to future regulatory changes, climate change and increasingly severe droughts.

6.3 Constrained list of options

Each option was screened against the following criteria:

- **Environmental and social assessment** – SEA and HRA have been produced which summarise the environmental and social costs and benefits and impacts upon European designated sites of each option. The SEA screening criterion illustrates:

  – the risk of adverse effects and, where available, mitigation measures; and

  – the opportunity for beneficial (effects e.g. improved water quality, reduced flood risk, improved catchment management) resulting from the option (Annexes 18-20).
- **Links to other options** – in terms of mutual exclusivities and dependencies.
- **Risks** – including vulnerability of the option to future uncertainty relating to climate change impacts, regulatory changes, sustainability and acceptability of the option, potential planning constraints and risks and changes in customer behaviour (for some demand management options).
- **Phasing** – whether the option can be constructed in a phased or modular way, which would increase its flexibility to future changes in the forecast supply-demand balance.
- **Resilience** – an indication of the confidence that the option will 'deliver' the required supply-demand balance benefit.

The constrained options are subject to more detailed engineering and environmental assessment, to provide consistent and comparable information as an input to the selection of options for the dWRMP24. The options were then classified into option types and sub-types using WRSE classifications (Table 6.1).

A list of constrained options under each option type is included in Annex 12.

Table 6.1: Option types

Option types	Option sub-types
Hard infrastructure	• New resources and storage • Transfers between and within regions • Recycling of water already abstracted
Efficient use and management of water	• Reducing leakage • Reducing household consumption • Embedding water efficient practice across industry
Green infrastructure	• Catchment solutions • Protecting vulnerable environments • Stopping damaging abstractions • Reducing net abstractions from the environment
Response to regional events	• Planning responses to extreme events • Coordinating activities across companies and sectors

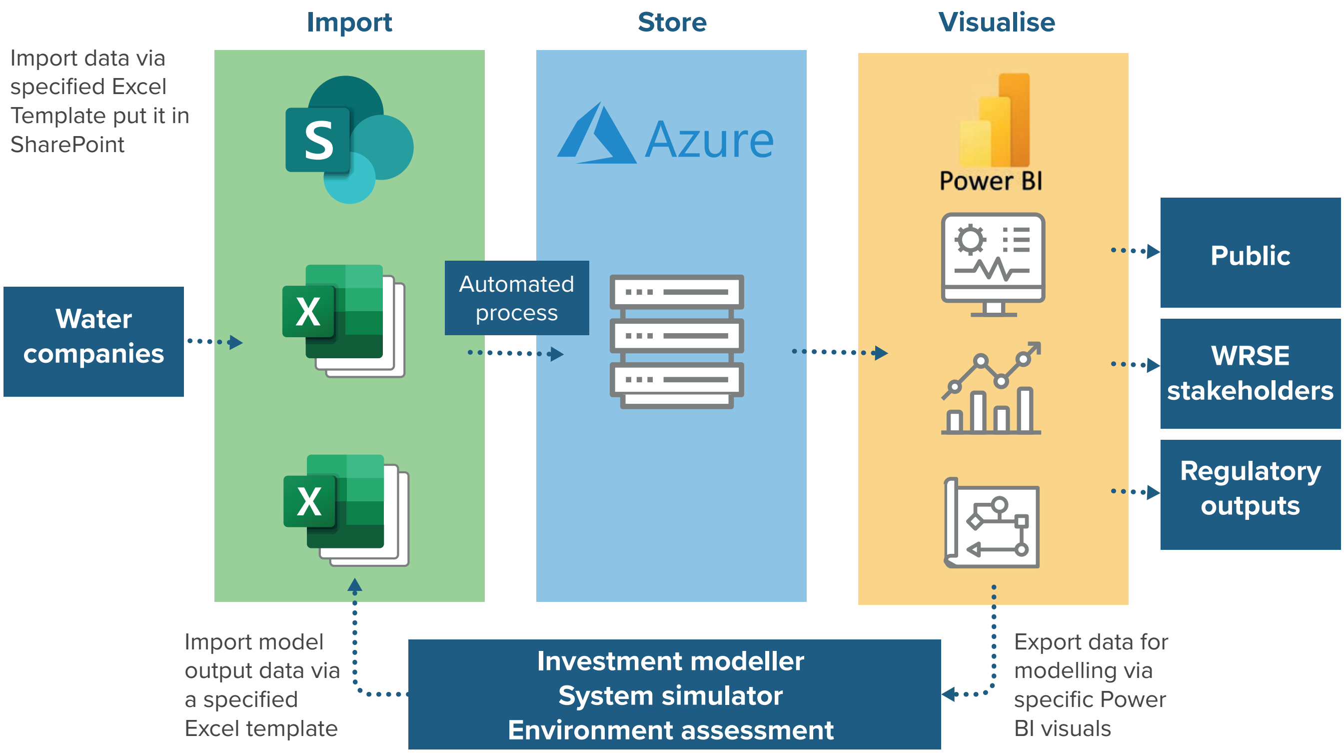
The more detailed assessment of the constrained options undertaken at this stage, includes investigations and assessments to provide:

- engineering description and designs to calculate a cost
- the earliest potential start date, taking account of construction complexity, likely planning constraints and risks, and environmental and other investigations likely to be required to implement the scheme
- likely costs – capital expenditure, operating and financing costs
- carbon emissions – embodied carbon (the lifecycle carbon emissions of materials used in construction) and operational carbon (emitted through operation of the scheme over its lifetime)
- environmental and social considerations – impacts and costs informed by the Strategic Environmental Assessment (SEA), more general environmental assessment, Habitats Regulations Assessment (HRA) and its ability to meet the WFD objectives
- the water savings across a range of potential drought event scenarios.

All of the options on the constrained options list are considered to be viable and potentially deliverable and are, therefore, made available for selection in the investment modelling process. The options selected by the investment model, under various planning scenarios in each WRZ, form the list of 'preferred options' in our WRMP.

The upload of the constrained options list to the WRSE database and its subsequent incorporation in the modelling process is shown in Figure 6.6.

Figure 6.6: Export of options data into WRSE database and its subsequent processing for investment modelling



6.3.1 Designing and costing of constrained options

For technical assessments, which are used to develop an engineering scope for costing, the constrained options and their elements were split into the following groups.

- Pipelines and transfers
- Desalination
- Water recycling
- Reservoirs
- Borehole rehabilitation
- Demand interventions, supply interventions and licence variations
- Asset enhancement.

Capital expenditure (CAPEX) estimates

For Strategic Resource Options (SRO), we adopted the CAPEX and OPEX estimates used in the Gate 1 submission. For all the other non-SRO, we used the CAPEX sheets developed by our internal Cost Intelligence Team (CIT) and followed a similar approach to the SRO in order to maintain consistency. Costing was done using CIT processes and requirements. Our cost curves were used where available. Where our cost curves were not available, water industry costing data held by the Mott MacDonald team was used.

CAPEX estimates generated using the CIT process include our Smart Targets, which consist of an allowance for 'known unknowns' and an allowance for 'unknown unknowns'. We normally use this approach instead of applying optimism bias for individual options.

The WRSE upload required the calculation and application of optimism bias and it was, therefore, in consultation with CIT, considered appropriate to remove the 'unknown unknowns' portion of the Smart Targets from the CAPEX costs, as otherwise there would be double counting.

The upload template further requires the costs to be split into several metrics. In order to achieve this split, each of the CIT cost curves was mapped against the corresponding upload metric.

Operating expenditure (OPEX) estimates

OPEX has been calculated and split into fixed OPEX and variable OPEX to align with regional planning requirements:

- Fixed OPEX is made up of operational maintenance as a percentage of CAPEX and employee costs, whereas variable OPEX is made up of abstraction charges, pumping costs, treatment costs for electricity and consumables and network distribution costs.
- An OPEX calculating tool per option type was developed and used.
- The WRMP19 OPEX costs, where available, have been used as a reference only.
- For the SRO options, the OPEX costs submitted at Gate 1 were used.

OPEX calculations have taken account of:

- Time of operation
- Full-time employee (FTE) costs
- Chemicals
- Operational maintenance
- Electricity
- Employee transport and waste disposal.

Carbon costs

Our approach to calculating carbon costs is set out in Chapter 10: Greenhouse Gas Emissions.


WATER
for LIFE

6.3.2 Third-party options

We, together with other water companies, sought offers from third parties to support our supplies. We received one proposal for sea tankering of water from Norway to London and Kent for use in extreme drought conditions. The offer included an insurance premium to cover costs of up to six months of daily deliveries of up to 60Ml/d. After assessing the option, we do not consider it to be feasible but have uploaded it to the WRSE options database for scenario testing if needed.

6.3.3 Demand-side measures

Accompanying annexes set out further detail on the demand-side measures and how they were assessed for this plan. This includes:

- T100 (Annex 14 and 15) – two supporting documents which set out a) the overall plan for delivering behaviour change to reduce the demand for water b) a technical write up of the options appraisal approach including a risk assessment.
- Smart metering (Annex 16) – a supporting document that sets out the different metering strategies examined and their different costs and benefits.
- Leakage (Annex 17) – a supporting annex that sets out the approach and activity to deliver the planned leakage programme.

These elements of the plan are drawn out to give clarity and transparency on how they have been assessed. This also means they provide more detail on how the national regulatory targets in these areas have been translated into this plan.

6.4 Rejected options

A list of rejected options is included in Annex 12.

6.5 Best value objectives, criteria and metrics

This is a BVP, in line with WRPG requirements, that aims to deliver wider benefits to society and the environment. It takes account of a wide range of factors, alongside economic cost, in identifying the preferred water resource programme. This programme may not be the cheapest, but it will deliver additional value in the areas that matter most to our customers and stakeholders.

Working with WRSE, we have developed a set of Best Value planning objectives to ensure we can meet our statutory and policy requirements (WRSE, 2022c). These are:

- Deliver a secure and wholesome supply of water.
- Deliver environmental and social benefit.
- Increase the resilience of water systems.
- Deliver at a cost that is acceptable to customers.

These objectives are underpinned by a set of supporting environmental and social metrics that can be optimised through investment modelling. These metrics were developed in consultation with stakeholders and in line with the National Framework and WRPG. These are shown in Table 6.2.

Table 6.2: Objectives, criteria and metrics for our Best Value Plan

Best value objective	Criteria	Metric
Deliver a secure and wholesome supply of water to customers and other sectors to 2100	Meet the supply-demand balance	Public water supply – supply-demand balance profile (Ml/d) Provides additional water needed by other sectors (Ml/d)
	Leakage	50% reduction in leakage by each company by 2050 from 2017–18 baseline (%) % leakage reduction above 50%
	Water into supply	Distribution input (DI) per property (litres per day)
	Customer preference	Customer preference for option type (score)
Deliver environmental improvement and social benefit	Strategic Environmental Assessment (SEA)	Programme benefit (score max) Programme disbenefit (score min)
	Natural capital	Enhancement of natural capital value (£m)
	Abstraction reduction	Reduction in the volume of water abstracted at identified sites (Ml/d) and by when (date)
	Biodiversity	Net gain score (%)
	Carbon	Cost of carbon offsetting (£m)
Increase the resilience of the region's water systems	Drought resilience	Achieve 1:500-year drought resilience (date achieved)
	Resilience assessment reliability	Programme reliability score
	Resilience assessment adaptability	Programme adaptability score
	Resilience assessment evolvability	Programme evolvability score
Deliverable at a cost that is acceptable to customer	Programme cost	Net present value (£m) using the social time preference rate (STPR)
	Inter-generational equity	Net present value (£m) using the long-term discount rate (LTDR)

The assigning of metric scores to each option was done in two stages.

Stage 1: Scores for each metric were initially assigned to each option type (e.g. water recycling, desalination). This scoring was done by independent consultants.

Stage 2: The scores were discussed with each water company to check if:

a. the generic scores assigned to the options were appropriate; and

b. the score for individual options needed to be changed to reflect any site-specific factors (e.g. customer preference for an option at a particular site may be higher or lower than overall preference).

The use of these scores in developing the overall BVP is described in Section 7.1.

6.6 Resilience to non-drought events

This WRMP takes a holistic view of resilience, by considering wider non-drought resilience benefits within the optioneering of our BVP. Our final WRMP will be informed by the wider regional plan, and we have aligned our approach, evaluating drought and non-drought resilience benefits with the methodologies employed by WRSE. This is also consistent with the approach we have taken to evaluate non-drought resilience benefits as part of the RAPID gated process for the SROs being proposed in our region.

Resilience benefits are considered in a wider context in our optioneering approach for both supply and demand schemes. We have adopted the following definition of resilience:

'Resilience is about the ability to continue to function effectively in the face of future challenges. The requirements to achieve it change over time, as challenges alter.'

We are aligned with the WRSE resilience framework (WRSE, 2021a), which broadens the scope for scheme planning. This moves us from mitigating only a single 'hazard', for example, shortage of water caused by droughts, to a position where we assess the resilience of non-public water supplies, the environment and our society and economy as a whole. The purpose of the framework is to ensure that plans are resilient to future shocks and stresses, including both the ones that can be forecast and those that cannot. Examples of non-drought resilience shocks include:

Exceptional events such as:

- cascading/long-duration regional power outage events
- long-duration communications loss – cyber-attack/solar flare/space weather/telecoms failure
- supply chain loss – materials shortages e.g. chlorine, fuel, strikes, commodity price change
- human resource loss – epidemic/pandemic, civil unrest, skills crisis, national strike
- rapid behavioural change – e.g. recent COVID-19 conditions causing demand shocks.

Meteorological hazards such as:

- flooding
- extreme weather – excessive cold, ice, snow, or heat
- fire
- terrorism/vandalism
- geotechnical instability.

Water quality events occurring in the catchment beyond those that are adequately covered by outage:

- high colour/turbidity
- metaldehyde affecting multiple sources during runoff events
- algal blooms causing widespread treatment problems.

The resilience framework is based on three key attributes: adaptability, evolvability and reliability. This aligns with the 'resilience in the round' approach recommended by Ofwat (Ofwat, 2017) and the 4Rs recommended by the Cabinet Office (2011) – resistance, reliability, redundancy and response/recovery.

Table 6.3 below shows how these attributes map to the best practice recommended by the Cabinet Office and Ofwat. Table 6.4 shows the sub-metrics defined under the three key metrics of Best Value planning.

Table 6.3: Resilience attributes based on best practice from Ofwat and the Cabinet Office

Attribute and definition	Best practice
Reliability: the ability of the system to continue to provide services in the face of shock events	Contains metrics that cover the 'resistance' and reliability elements of the Cabinet Office '4Rs'. Covers 'traditional' infrastructure hardening type approaches and measures that seek to maintain system integrity during shock events.
Adaptability: The ability of the system to adapt the way it delivers service in the face of shock events, and recover following unexpected system failure	Contains metrics that cover the 'redundancy' and 'response/recovery' elements of the Cabinet Office '4Rs'. Looks to see how investment can enhance system and operational flexibility to help cope with consequences when shock events happen.
Evolvability: The ability of the system to modify or function to cope with long-term trends	Contains metrics that examine the 'deliverability' of investment plans and how flexible those plans are to uncertain futures. Covers the implication of stress caused by longer-term trends and how we should manage them when planning investment.

The framework takes a systems-based approach to resilience, with three primary systems of interest: the public water supply (PWS) system, the water environment (environment) system and the non-public water supply (non-PWS) system (e.g. other sectors that use water from sources such as agriculture and industry).

The framework sets the overall approach to measuring both drought and non-drought resilience. It identifies a series of metrics for each system and a scoring approach for each metric. The scoring is from one to five, which is assigned to each option. This approach was agreed in a series of workshops with WRSE and neighbouring water companies. Further details on the development of the resilience framework can be found in WRSE (2021d).

Our approach to scoring drought and non-drought resilience benefits is consistent with the regional resilience framework (WRSE, 2021d). The majority of the metrics used to score our supply-demand schemes are associated with the PWS system, with some non-PWS and environment system metrics also considered.

Initial scoring of each option was done by independent experts. These scores were then reviewed in a series of workshops to ensure:

a. a consistent approach was followed

b. the wider resilience benefits had been properly considered from an operational perspective

c. trade-offs at a local level.

Table 6.4: Sub-metrics defined under the resilience metric for best value planning

Resilience metric	Sub-metric
Reliability	• Uncertainty of option supply/demand benefit • Risk of service failure due to physical hazards • Availability of additional headroom • Catchment/raw water quality risks (including climate change) • Capacity of catchment services • Risk of service failure to other exceptional events • Soil health
Adaptability	• Operational complexity and flexibility • WRZ connectivity • Customer relations support engagement with demand management
Evolvability	• Scalability and modularity of proposed changes • Intervention lead times • Reliance on external bodies to deliver changes • Collaborative land management

6.6.1 Scheme operational resilience benefits

Since WRMP19 we have developed a deeper understanding of how shocks and stresses might impact on our ability to provide water to customers.

Table 6.5 outlines how WRMP supply and demand schemes will provide additional non-drought, operational resilience within our water supply system. It also highlights how they will enhance our ability to deliver on the 4 ‘R’s of resilience. Typical shocks we have considered include flooding, freeze/thaw events, cyber-attack and water quality events.

Table 6.5: Non-drought resilience benefits delivered by WRMP schemes

Scheme type	Flooding	Freeze/ thaw	Cyber-attack	Water quality	Non-drought resilience benefits delivered
Demand management – smart metering		✓	✓		In case of a freeze/thaw event smart metering solutions will help provide early detection by quickly and accurately identifying supply interruptions or bursts, particularly on customer supply pipes. This will enable our operational teams to **respond** to events quicker and more effectively.
Demand management – leakage detection		✓	✓		In case of a freeze/thaw event, acoustic loggers and pressure loggers throughout our network will help to provide early detection and warning of bursts and supply interruptions. This will enable our operational teams to **respond** to events quicker and more effectively.
Water recycling plants	✓	✓		✓	As well as providing a rainfall-independent source of raw water, water recycling plants offer system **adaptability** in the form of an additional water source for some of our treatment works in specific conditions. For example where existing raw water sources experience quality issues such as algal blooms in surface water or groundwater contamination and therefore cannot be used. Individual raw water sources could be shut down completely for extended periods for critical maintenance activities, potentially offering **redundancy** in the system. The detailed non-drought resilience benefits of each scheme will depend on how the plants are going to be operated under prevailing conditions. These benefits and operating arrangements will be key considerations throughout the scheme-specific design process.
Desalination plants	✓	✓		✓	As well as providing a rainfall-independent source of treated water, desalination plants provide the ability to optimise source blending ratios to achieve water quality requirements and meet customer expectations to provide a **reliable** water supply. Opportunities for operational flexibility and system **redundancy** will be considered throughout the design process including plant utilisation optimisation and consideration of source blending. There may be limited opportunity to blend desalinated water with other sources in the context of Drinking Water Inspectorate regulation 4, which requires that 'drinking water must be wholesome' and the appearance, odour and taste is acceptable to our customers.
Imports and inter-zonal transfers	✓	✓		✓	Optioneering of new inter-company transfers are considered at a regional level. From an operational perspective, wider resilience benefits include the removal of single points of failure for raw water abstraction into some of our water treatment works. This provides additional **reliability**. We have undertaken a detailed resilience assessment of our proposed network interconnectors and transfers within our Water for Life – Hampshire (WfLH) programme.

Table 6.5: Non-drought resilience benefits delivered by WRMP schemes continued

Scheme type	Flooding	Freeze/ thaw	Cyber-attack	Water quality	Non-drought resilience benefits delivered
Storage		✓			Storage options provide enhanced raw water **reliability** and offer redundancy in the system. RAPID is exploring opportunities for the development of multi-sector reservoirs (CEPA and Agilia, 2022) including for public water supply, large users, flood protection, energy sector, irrigation, tourism, navigation and environment. We welcome this initiative as these schemes may offer system-wide resilience benefits across the PWS system, non-PWS system and the environment.
Groundwater abstraction	✓			✓	Draft WRMP24 proposes significant long-term reductions in our chalk groundwater abstractions to support nature **recovery** and meet environmental flow or other agreed WFD targets outlined. We also identify options of expanding capacity at other sites and drilling new boreholes. Saltwater intrusion is a risk for some of our groundwater sources near the coast, particularly in the Central Area. We demonstrate **resistance** to this risk by pumping around the high tides to avoid saltwater ingress at two of our borehole sites. We monitor other sites for conductivity and our planning will **respond** to emerging risks.
Catchment management and nature-based solutions	✓			✓	These schemes are a key pillar of our Catchment First approach and provide significant wider environmental resilience benefits, discussed in Section 5.3.7. Schemes are wide-ranging in scope and provide both DO benefits as well as mitigating the impacts of flooding (**resistance**) and protection and improvement of water quality from runoff. We provided a detailed assessment of wider benefits of groundwater and surface water natural capital solutions as part of our WINEP BVP submission, which have been quantified and monetised. The WINEP submission included land management schemes benefitting groundwater quality and air quality (via reduced emissions from farming activities). Our surface water schemes slow water through the catchment, providing increased **resistance** to flooding as well as enhanced water quality, climate, and biodiversity benefits. By reducing the transmission time of water as it flows through the catchment (**resistance**) this increases operational resilience of our treatment works by reducing nitrates and pesticides in raw water. At certain times of year, these pollutants can overload our plants. This reduces the need for treatment plant outages, improves our ability to plan maintenance activities and extends the life of our assets.

Table 6.5: Non-drought resilience benefits delivered by WRMP schemes continued

Scheme type	Flooding	Freeze/ thaw	Cyber-attack	Water quality	Non-drought resilience benefits delivered
Other resilience considerations	✓			✓	In line with the DWI's updated long-term planning guidelines (Drinking Water Inspectorate, 2022) we proactively plan for the **resistance** to and **recovery** from potential adverse events. We plan to review the validity of previous studies on our critical water treatment works **resistance** to flood events. Past schemes have been in line with historic Security and Emergency Measures Directive requirements. This will need review, as a result of updates to climate change modelling and flood risk due to increasing rainfall intensity. We monitor and model nitrate trends in our raw water. Where trends are on the increase, we model when concentrations are expected to breach our internal trigger levels and the DWI's prescribed concentration or value (PCV). We will **respond** by planning interventions (treatment, blending etc) to mitigate these risks to ensure we are able to continue using the sources in the future. During periods of intense rainfall, we experience increases of nitrate loading at our treatment works. There is a risk that as these rainfall events become more intense that this issue will get worse. We have schemes in the planning process that, although not part of dWRMP24, will be required into AMP8 (2025–30).

6.7 Follow on options development

We recognise the need for continual option development to ensure we have a robust and adaptable plan able to meet the environmental needs of the region and security of supply over the life of the plan.

Whilst this is normal practice in option lifecycle development, to help inform feedback on this plan especially around what is the appropriate balance of risk, in the following table we set out the areas of investigation and technical development work on supply options we will undertake as part of this plan. These will be done prior to their delivery, or decisions on implementation and are as much a part of the overall strategy as the proposed Best Value Plan options themselves. This continuous option development process is analogous to that used through the gated process in the RAPID Strategic Resource Options and allows information on option performance to be regularly reviewed and any issues raised to be examined. This will give more certainty on the removal of short-term drought options and temporary drought permits as it ensures any issues on options are understood and mitigated prior to implementation.

Table 6.6 summarises the key work areas by option type.

Table 6.6: Non-drought resilience benefits delivered by WRMP schemes

Option type	Principal work areas				Description of work planned	Example schemes
	Costing	Operating regime	Water quality	Environment		
Pipelines and transfers		✗		✗	Refinement of pipeline routes and environment impacts	Portsmouth Water bulk transfer Cross solent transfer
Desalination		✗	✗	✗	Further environmental assessments of discharges (hypersaline effluent) and DWI/WQ risk assessments	Isle of Sheppey/ Kent options
Water recycling		✗	✗		Development of blending regimes, drinking water quality risk assessments	Littlehampton recycling Horsham recycling Medway recycling Sandown recycling
Reservoirs		✗	✗	✗	Work to refine operating regimes, water quality and environment impact assessments e.g. change in habitat from reservoir raising	Bewl raising Blackstone reservoir Havant Thicket (inc recycling and DWI/ WQ assessments)
Borehole rehabilitation		✗		✗	Investigation of yield reliability and environmental assessments	ASR/MAR schemes (e.g. Test) Short-term drought schemes
Demand interventions	✗			✗	Updating of the smart metering costs for survey data, natural capital assessments	T100, leakage, smart metering

7. Our draft WRMP24

Reducing the overall demand for water is a strategic element of our plan. This is a continuation of a process started in 2010–15 following the introduction of universal metering of our household customers, which took our domestic meter penetration to c. 88%.

The National Framework (Environment Agency, 2020a) recommends reducing customers' individual daily usage (PCC) to 110l/h/d by 2050. However, we had already set ourselves a more challenging target of reducing average PCC across our area to 100l/h/d as part of our Target 100 (T100) commitment in WRMP19.

Since WRMP19, household demand has increased due to COVID-19 and homeworking. We revised our demand forecast which resulted in the 2024–25 PCC estimate increasing from 122.6l/h/d to 135.6l/h/d (under normal year annual average conditions). This meant that the volume we need to save by 2040 to achieve T100 increased from approximately 60Ml/d to over 89Ml/d i.e. a 48% increase.

To ensure our WRMP24 is robust and has the best value mix of activity needed to meet environmental needs and supply security, the impact of the shift in demand on long term targets was assessed for this Plan. Our analysis has shown that achieving T100 remains possible with the higher level of savings needed but carries significant additional risk.

We received comments during the pre-consultation period about the ambitious nature of our demand management strategy options, particularly from Ofwat. We have also taken on board the Defra Direction that requires assurance on the deliverability of the plan.

Considering these factors and the analysis we have undertaken on delivery risk, the demand forecasts in our Plan are built on achieving a PCC of 109l/p/d. This out-performs the National Framework target and aligns to the overall WRSE regional plan, however from a planning perspective adopts a slightly higher pcc than T100 reflecting the risk and the higher starting demand.

As demand reduction is so critical to meeting the environmental and security of supply needs, we do not believe the T100 vision should be extinguished. To reflect this the optioneering and delivery plan on household demand reduction has retained the long-term ambition of meeting T100. The options are included in the WRMP tables and supporting technical annexes.

This has been done to ensure that at WRMP29 we have information on how reliably the T100 demand profile could be met, allowing decisions on whether to revert to T100 in that plan. The counterfactual of a delivery plan based only on meeting 109l/p/d means there would be insufficient information on whether the ambition can be reliably delivered for future plans.

We have adopted a similar approach on leakage, aligning to the national framework expectation of a 50% leakage reduction by 2050, but with the development of a plan that will allow choices to be made on meeting deeper savings at future WRMPs.

We are keen in the consultation process to seek views on the balance of this approach. In particular if we should plan on meeting T100 alone and the associated delivery risk as we currently understand it, or, as in this Plan, have a demand forecast aligned to the National PCC targets but continue a programme to see if we can confidently achieve the T100 profile allowing the future plans to adjust based on the findings.

To inform responses on this, Annex 14 and 15 set out the components of the activity to reduce demand and the risk analysis. The key components we plan to undertake are summarised below.

Independent of the choice of planning on the National target for PCC or T100, and illustrated in the recent Waterwise Water Efficiency 2022 Strategy, both cases require a significant behavioural change in how customers and society use water.

7.1 Decision-making process

Our adaptive planning approach (described in Section 5.5) sets out the supply-demand challenge across each of the nine adaptive planning situations which reflect the range of uncertainty in future population growth, climate change and the amount of abstraction reduction we will need to achieve to protect and enhance the environment.

Our options appraisal (Section 6) then sets out the potential range of feasible new water resources and water efficiency strategies we could employ to meet those supply-demand deficits into the future and the Best Value Planning metrics we will use to decide between them, in summary, these are:

- Strategic Environmental Assessment Score (+ve or -ve)
- Natural Capital
- Biodiversity Net Gain
- Customer preferences
- Resilience metrics (Adaptability, Evolvability and Reliability)
- Programme cost
- Carbon costs which are included in overall option costs.

This section describes how we have chosen between different options following a Best Value Planning methodology, consistent with the regional planning approach, to derive our preferred plan and some alternative strategies. Whilst our plan needs to be 'cost efficient', our preferred strategy is not necessarily the lowest cost option, but instead considers the trade-offs between cost, and our Best Value objective.

We have used an investment model (IVM) to select a suite of preferred options by mathematically optimising across the different best value metrics. The model was developed at a regional level and we worked with WRSE to ensure that the decision making process reflects the needs of all the member companies.

Each of the potential supply-demand situations is provided to the IVM as a single future pathway to allow it to select the optimal water resource programme. Strategies are derived using the IVM to meet the projected supply-demand deficit in each situation and under each planning scenario (NYAA, DYAA, DYCP etc). The model output is the combination of demand management strategies and new resource development options that provide the required amount of water to meet the deficit.

A key principle of the modelling is to select low regrets investment early in the overall programme, where the IVM indicates it is 'best value' to do so. This then favours inclusion of options which will work well across each of the adaptive pathways.

When making a decision about inclusion of an option the IVM looks to see if it makes economic sense to defer investment until after 2030 and only includes investment in the 2025–30 period if it makes economic sense once all the futures after the 2030 and 2035 branch points are considered.

The IVM was then run multiple times to examine the potential sensitivity of the plan to changes inputs, optimisation criteria and different policy choices, these were:

- Development of a Least Cost (Cost Efficient) Plan (LCP) which optimised only on programme cost but still tracked all Best Value metrics
- Best Value model runs to examine the trade-off between programme cost and Best Value metrics.
- Policy and sensitivity assessments which include different programmes based on policy choice. These included:
  - Sensitivity assessment on the timing of achieving 1:500-year drought resilience
  - Optimising on Environmental and Social Value metrics
  - Optimising on maximising plan Resilience (Adaptability, Evolvability, Reliability)
  - Sensitivity of the plan to changes in the availability, performance or cost of specific options .

  We aim to achieve resilience to 1:500 year drought scenario without use of drought permits and orders by 2040, so strategies that seek to increase supplies through use these options were made unavailable to the IVM after 2040–41.

Each of these strategies are described in the following sections.

7.1.1 Least Cost (Cost Efficient) Plan methodology

To provide an initial baseline to the best value modelling a least cost plan (LCP) was derived using the IVM to meet the projected supply-demand deficit in each supply-demand balance situation, under each planning scenario. For this planning approach the IVM optimised only on lowest economic cost, expressed in terms of Net Present Value (NPV). Although all the Best Value metrics were not optimised on at this stage, the options used to develop the LCP still have scores for these metrics against each situation.

NPV was calculated using three types of discount factors. The default calculation used the Social Time Preference Rate (STPR) based on the HM Treasury 'Green Book' discount rate. Two additional methods were also used. These include the Inter-Generational Equity Rate (IGEQ) and Long-Term Discount Rates (LTDR). Figure 7.1 shows a screenshot of the output from the IVM for the regional LCP. Two estimates are provided for each measure. In cases where the IVM is able to fully resolve the supply-demand deficit, the NPV is reported as 'w/o deficit'. In cases where the IVM cannot fully solve the supply-demand gap, a cost penalty is applied and NPV figure is reported as 'w/deficit'.

Figure 7.1: A screenshot of the NPV figures at the regional level for the 'least-cost' model run

Metrics

Net present value (Cost)

Metric	situation1	situation2	situation3	situation4	situation5	situation6	situation7	situation8	situation9	Units
Cost w/ deficit (STPR)	16,453	12,790	11,655	15,587	12,879	11,604	13,543	11,663	10,749	(£m)
Cost w/o deficit (STPR)	16,453	12,790	11,655	15,587	12,879	11,604	13,543	11,663	10,749	(£m)
Cost w/ deficit (IGEQ)	26,544	19,742	17,666	24,913	19,919	17,578	21,289	17,791	16,103	(£m)
Cost w/o deficit (IGEQ)	26,544	19,742	17,666	24,913	19,919	17,578	21,289	17,791	16,103	(£m)
Cost w/ deficit (LTDR)	18,367	14,126	12,817	17,361	14,231	12,759	15,022	12,844	11,787	(£m)
Cost w/o deficit (LTDR)	18,367	14,126	12,817	17,361	14,231	12,759	15,022	12,844	11,787	(£m)

Cost breakdown (STPR)

Metric	situation1	situation2	situation3	situation4	situation5	situation6	situation7	situation8	situation9	Units
Capex	7,254	4,858	4,167	6,652	4,926	4,115	5,403	4,104	3,559	(£m)
Fixed opex	6,842	6,452	6,348	6,784	6,456	6,347	6,485	6,367	6,293	(£m)
Fixed operational carbon	233	223	219	231	221	220	216	209	205	(£m)
Embedded carbon	635	423	361	602	437	359	451	349	318	(£m)
Variable opex	1,325	764	519	1,183	774	521	896	594	352	(£m)
Variable carbon opex	164	70	40	134	66	41	93	40	20	(£m)

7.1.2. Developing a preferred Best Value Plan

Once a stable least cost baseline programme had been determined a BVP was generated by undertaking further investment modelling runs as follows:

- In the first set of runs, the IVM looked to increase plan performance against individual Best Value metrics through 'Pareto' runs which traded off Best Value Metric Improvement against cost.
- In the second set of runs, the model sought to improve the scores of all Best Value metrics in parallel.

The least-cost plan provided the lower threshold for each of the metrics (Figure 7.2). For the first set of 'Pareto' runs, the IVM looked to increase the score from the least-cost plan to the maximum value in five equal increments or thresholds (Figure 7.3).

Figure 7.2: A screenshot of the Best Value metrics scores for the regional least-cost plan

Environmental

Metric	situation1	situation2	situation3	situation4	situation5	situation6	situation7	situation8	situation9
SEA environmental benefit	84,252.00	78,877.00	77,171.00	83,476.00	77,480.00	77,065.00	80,836.00	76,897.00	76,642.00
SEA environmental disbenefit	122,674.00	90,711.00	82,025.00	112,972.00	88,106.00	80,826.00	103,672.00	81,489.00	72,999.00
Natural capital	10,163,502.36	11,611,978.30	11,979,384.83	10,790,008.09	11,946,114.20	12,223,620.49	11,408,615.74	13,632,458.24	16,165,209.
Bio-diversity net gain	−260,076.00	−190,310.00	−185,348.00	−260,076.00	−223,408.00	−169,801.00	−202,077.00	−159,159.00	−148,418.0

Social

Metric	situation1	situation2	situation3	situation4	situation5	situation6	situation7	situation8	situation9
Customer preference	36,131.00	34,218.00	33,668.00	35,620.00	34,015.00	33,668.00	35,057.00	33,614.00	33,203.00

Reliability

Metric	situation1	situation2	situation3	situation4	situation5	situation6	situation7	situation8	situation9
Reliability	41.36	43.48	46.87	42.28	43.55	46.58	43.47	46.25	53.22
R1: Uncertainty of option supply/demand benefit	12.80	13.22	14.24	13.12	13.35	14.19	13.25	13.82	16.00
R3: Risk of service failure due to other physical hazards	10.83	11.43	12.41	11.05	11.44	12.34	11.40	12.25	14.26
R4: Availability of additional headroom	6.61	7.01	7.19	6.61	6.93	7.12	7.00	7.42	7.92
R5: Catchment/raw water quality risks (incl. climate change)	0.90	0.97	1.04	0.94	0.91	1.03	0.99	1.06	1.26
R6: Capacity of catchment services	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02
R7: Risk of service failure to other exceptional events	10.18	10.83	11.96	10.52	10.89	11.87	10.81	11.67	13.76
R8: Soil health	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Adaptability

Metric	situation1	situation2	situation3	situation4	situation5	situation6	situation7	situation8	situation9
Adaptability	19.76	21.63	24.09	20.60	21.77	23.84	21.59	23.58	27.64
A3: Operational complexity and flexibility	10.15	10.90	12.01	10.48	10.92	11.94	10.84	11.74	13.86
A4: WRZ connectivity	9.58	10.71	12.06	10.08	10.83	11.88	10.73	11.82	13.76
A7: Customer relations support engagement with demand management	0.04	0.02	0.02	0.04	0.02	0.02	0.02	0.02	0.02

Evolvablility

Metric	situation1	situation2	situation3	situation4	situation5	situation6	situation7	situation8	situation9
Evolvability	29.33	29.89	32.41	29.89	30.09	32.25	30.02	32.15	37.40
E1: Scaleability and modularity of proposed changes	12.25	12.84	13.98	12.48	12.93	13.93	12.87	13.91	16.18
E2: Intervention lead times	7.27	6.72	7.11	7.39	6.78	7.07	6.82	7.15	8.27
E3: Reliance on external bodies to deliver changes	9.74	10.29	11.27	9.94	10.33	11.21	10.29	11.05	12.91
E5: Collaborative land management	0.07	0.04	0.04	0.07	0.04	0.04	0.04	0.04	0.04

Figure 7.3: An illustration of the approach taken to improve the score of individual metrics for developing the Best Value Plan

<table>
<tr><th>Threshold 1</th><th>Threshold 2</th><th>Threshold 3</th><th>Threshold 4</th><th>Threshold 5</th></tr>
<tr><td colspan="5">SEA +'ve</td></tr>
<tr><td colspan="5">SEA -'ve</td></tr>
<tr><td colspan="5">Natural Capital</td></tr>
<tr><td colspan="5">Biodiversity Net Gain</td></tr>
<tr><td colspan="5">Customer Preference</td></tr>
<tr><td colspan="5">Reliability</td></tr>
<tr><td colspan="5">Adaptability</td></tr>
<tr><td colspan="5">Evolvability</td></tr>
<tr><td colspan="5">Carbon (tonnes)</td></tr>
</table>

The highest score for each metric was determined by the highest threshold for which the IVM was able to resolve the supply-demand deficit. The concept is illustrated in Figure 7.4, which shows that, for example, it may be possible to increase the scores for some of the metrics to their maximum value but for others, the model may not be able to improve the score beyond the LCP derived value.

Figure 7.4: An illustration of the possible outcomes when attempting to improve scores for individual metrics

	Threshold 1	Threshold 2	Threshold 3	Threshold 4	Threshold 5
SEA +'ve	✓	✓	✓	✓	✓
SEA -'ve	✓	✓	✓	✓	✓
Natural Capital	✓	✓	✓	✓	✓
Biodiversity Net Gain					
Customer Preference	✓	✓	✓	✓	✗
Reliability	✓	✓	✓	✓	✗
Adaptability	✓	✗			
Evolvability	✓	✗			
Carbon (tonnes)					

When we look at the overall performance of a plan, we aggregate the Best Value metric scores that each of the schemes provide.

The scores are then normalised for each of the plans to allow better comparison to be made across the plans. This process takes the raw performance score of a BVP metric and compares it with the raw scores for that metric for each of the nine situations in the adaptive plan. The best performing score would receive the best BVP score of 100% whilst the worse performing score would receive 0%. This process is repeated for all eight BVP metrics and for all nine situations in an adaptive plan.

Programme level scores are generated by averaging across the situations for a particular programme. Therefore, at the end of this process we have one BVP score per programme. This process helps us identify which adaptive plans generally perform well and which do not. However, we do break down the performance of each of the plans to see how well they perform across specific BVP metrics.

When we reach the final stages of reviewing which of the many plans should be the preferred plan for the purpose of consultation, we then use a series of axiom plots which allow us to see how well individual metrics perform across each of the situation in the adaptive plan branches.

It should be noted that unlike costs, the BVP metrics are not discounted and therefore schemes, from a BVP perspective, perform as well now as they will in the future.

We use several plots when we look at the performance of programmes. These are:

- Cost versus BVP score
- Environmental and societal BVP metrics v Resilience metrics
- Carbon v BVP

The purpose of these plots is to demonstrate how the performance of different policies perform against each other.

7.1.3 “What If” sensitivity test scenarios and policy choices

The next step in the process involved running multiple ‘what if’ scenarios to test the sensitivity of the IVM output to key policy decisions, such as the timing of achieving 1:500-year drought resilience, delivery of key options such as the SROs or demand management.

For example, the South East Strategic Reservoir Option (SESRO) can be developed for multiple storage capacities ranging from 75 million cubic meters (Mm3) (SESRO75) to 150Mm3 (SESRO150). The size and availability of SESRO also affects selection and/or timing of other options, such as the Severn to Thames Transfer (STT) and options to supply London including water recycling schemes. As discussed in Section 7.2, we require a bulk import of up to 120Ml/d in some situations via the T2ST SRO. Therefore, the size and availability of SESRO has direct cost and resource implications for us.

In view of the feedback received during public consultation on the ERP, we tested the impact of different sizes of SESRO. This was done by allowing the IVM to select only one size variant of SESRO at a time. In one scenario, SESRO was excluded altogether.

We then compared the outputs of these model runs in terms of:

- Comparison of CAPEX and OPEX (Figure 7.5)
- Comparison of scores based on environmental and resilience metrics (Figure 7.6)
- Comparison of Best Value aggregate score vs customer preference score (Figure 7.7)
- Comparison of Best Value aggregate score vs carbon cost (Figure 7.8)

The results show that the SESRO100 performs better than other size configurations in all comparisons. However, the difference in costs and Best Value metrics between SESRO100 and SESRO150 are modest compared to the additional volume, and therefore greater resilience, offered by SESRO150.

Figure 7.5: Assessment of various configurations of SESRO against CAPEX and OPEX

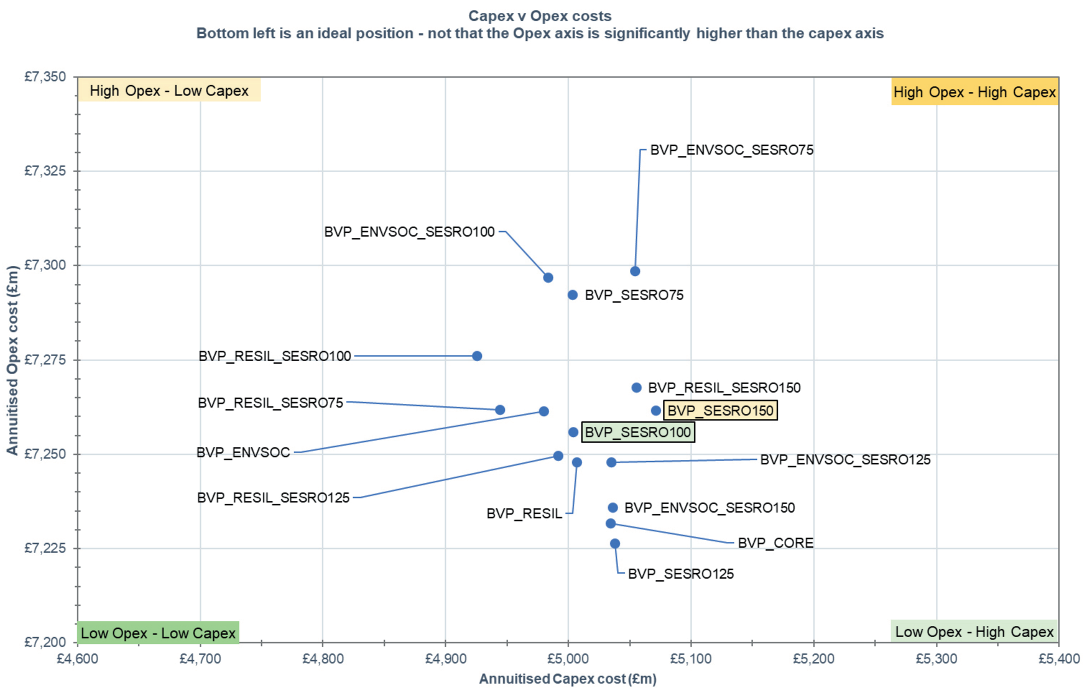


Figure 7.6: Assessment of various configurations of SESRO against resilience and environmental metrics

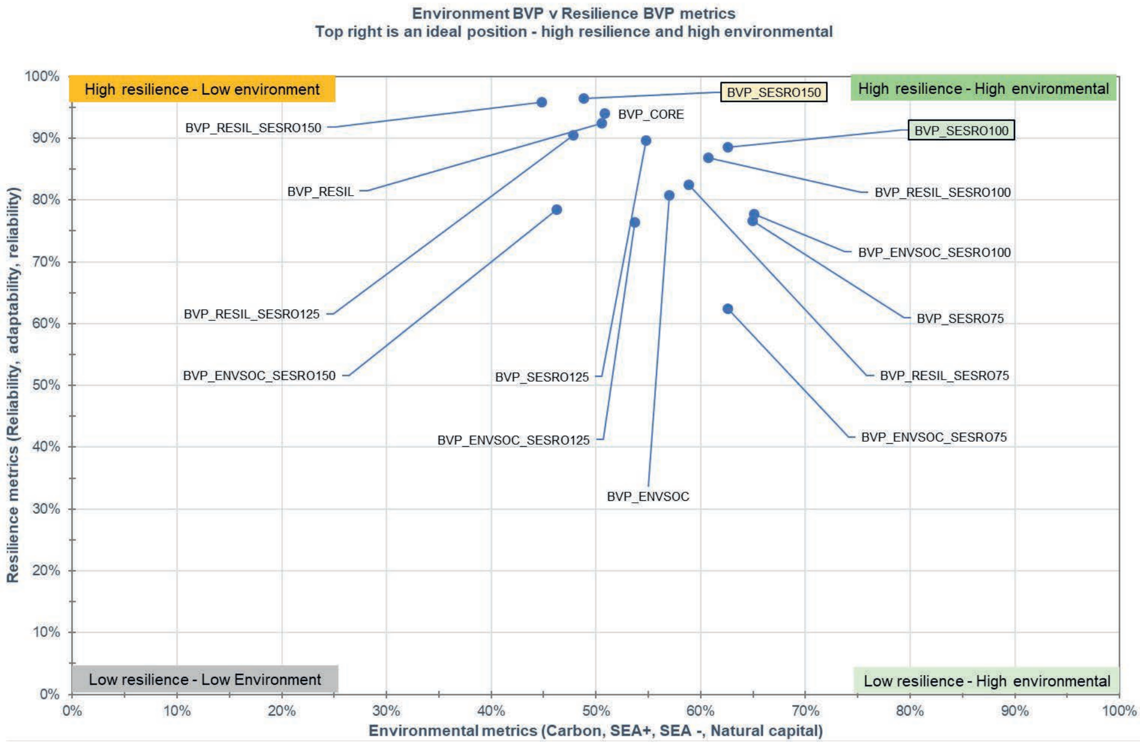


Figure 7.7: Assessment of various configurations of SESRO against Best Value plan and customer preference scores

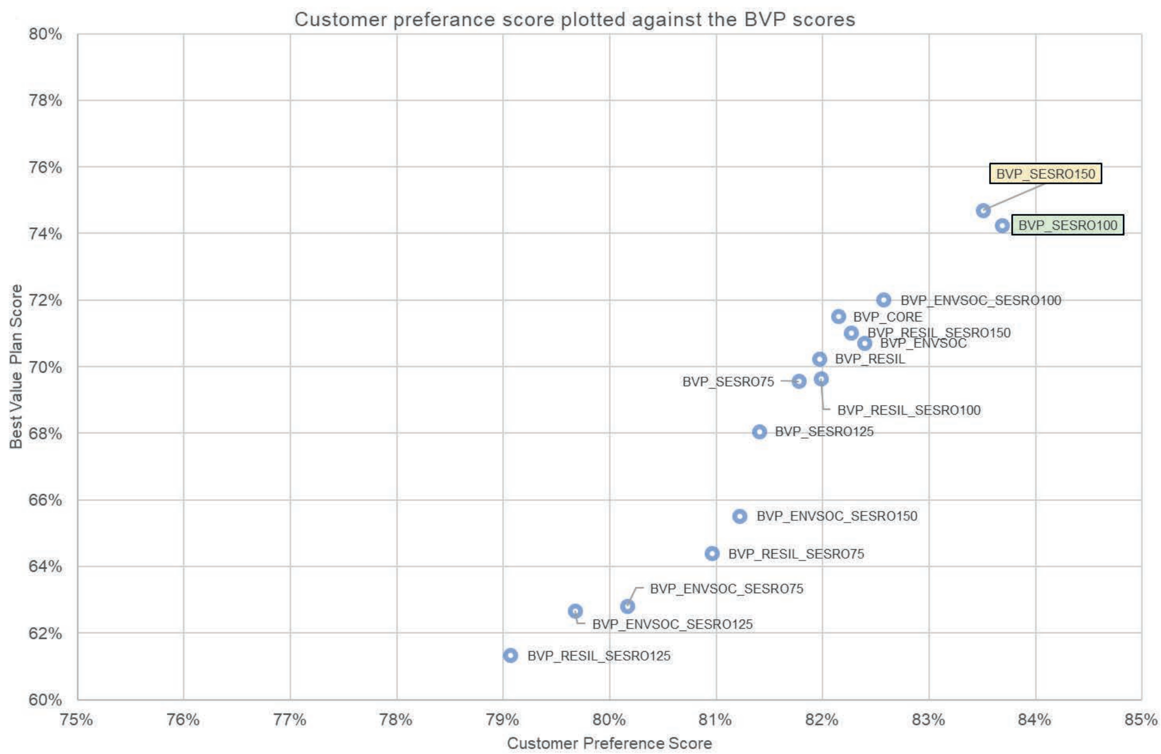
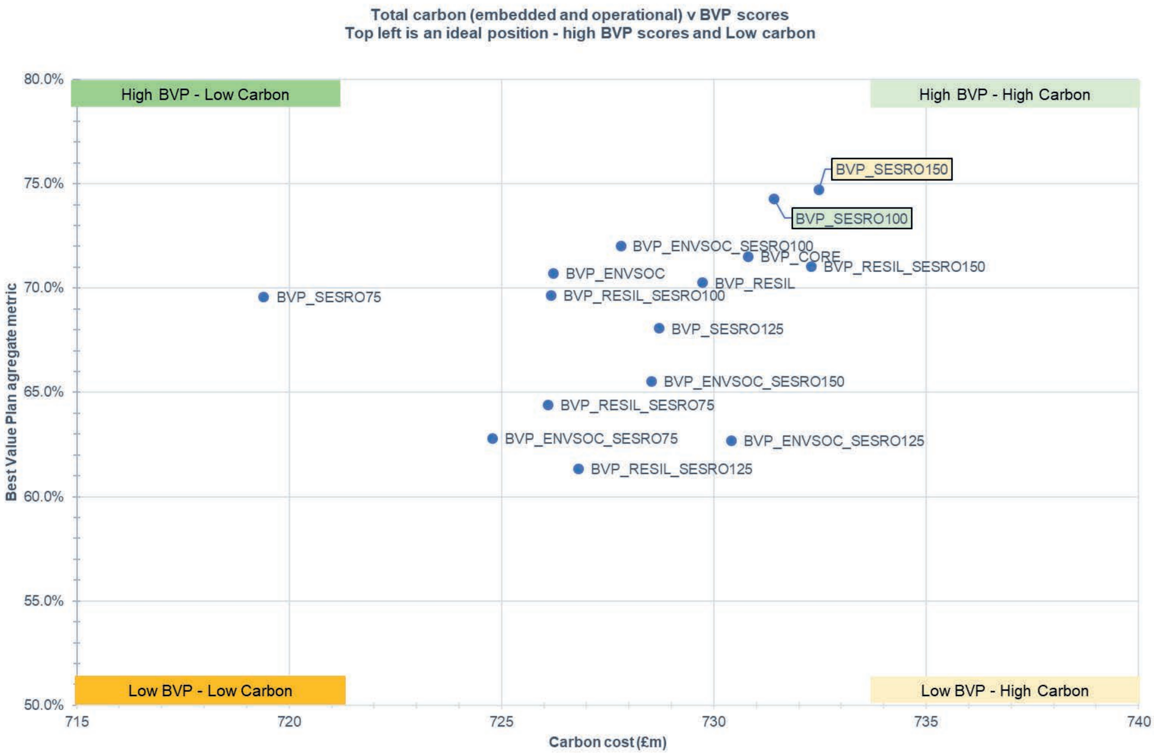


Figure 7.8: Assessment of various configurations of SESRO in terms of aggregate Best Value score and carbon cost



In view of the results and following discussions with TWUL, AFW and WRSE, we have decided to adopt the best value plan run based on SESRO100 as our preferred plan. The preferred set of options in each of our three supply areas are presented in Section 7.2 and changes from the LCP are described in Section 7.3.

7.2 Our Best Value Plan

In keeping with our previous WRMPs and WRPG guidance, our Best Value dWRMP24 uses the twin-track approach of reducing demand while developing new water resources to maintain supply-demand balance.

As described, we have looked at multiple IVM runs and held several sessions with other water companies to arrive at a Regional Best Value plan (RBVP). Our plan is based on this RBVP, but we have carried out further testing for some issues specific to Southern Water. The results are included in Annex 21.

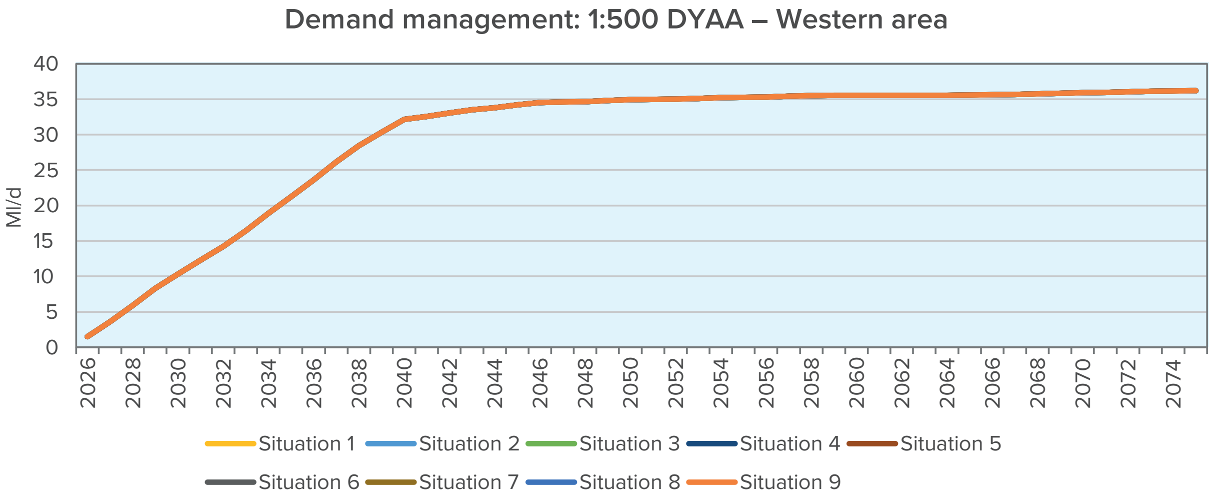
Overall, our preferred plan relies on the following options to maintain supply-demand balance:

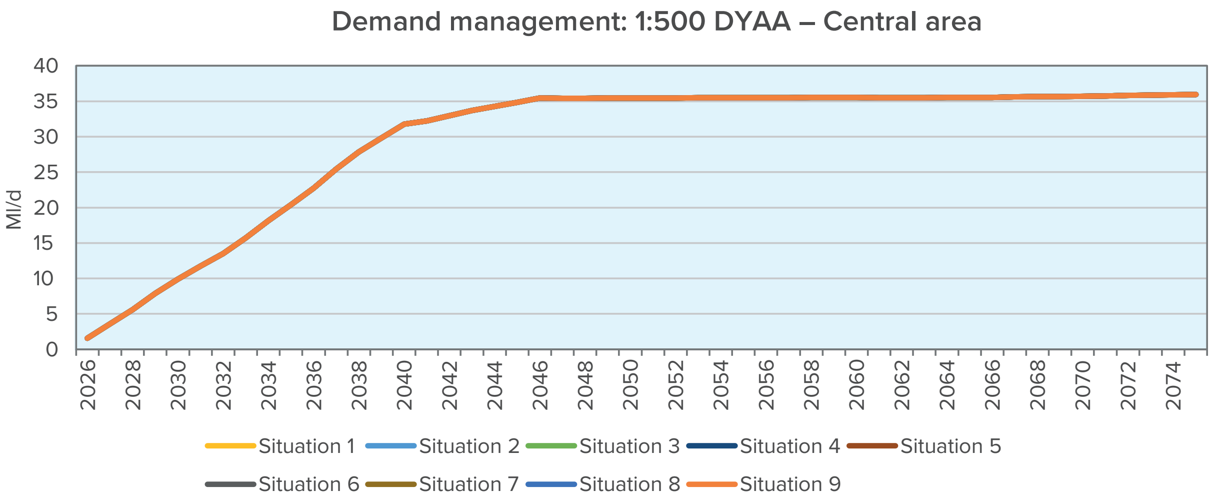
- Demand management
- Bulk imports from neighbouring companies
- Recycling
- Desalination

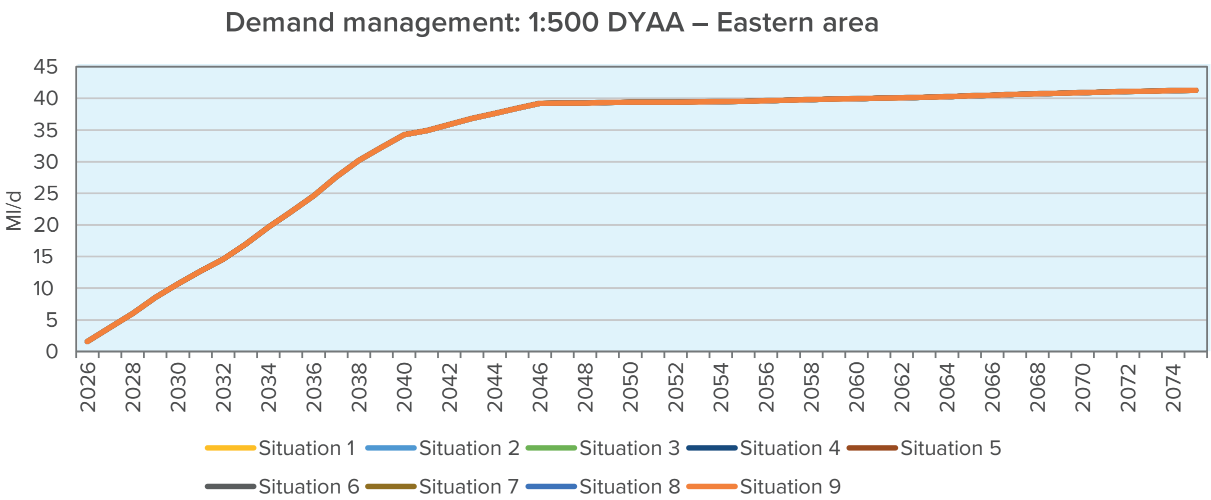
7.2.1 Our demand management strategy

To protect and enhance the natural environment, we have limited options to increase supplies from rivers and groundwater, because we must also reduce the amount of water we take from them. As a result, demand management is a key component of our long-term water resources management strategy. Our leakage and PCC performance has been the among the lowest in the UK water industry. This continues to be the case for this plan. Demand management delivers significant benefits in all our supply areas (Figure 7.9).

Figure 7.9: Savings from demand management in our three supply areas under the 1:100 dry year annual average (DYAA) scenario. The same strategy is selected for all nine situations







Reducing water consumed by our customers

Reducing the overall demand for water is a strategic element of our plan. This is a continuation of a process started in 2010-2015 following the introduction of universal metering of our household customers, which took our domestic meter penetration to c. 88%.

The National Framework (Environment Agency, 2020a) recommends reducing customers' individual daily usage (PCC) to 110l/h/d by 2050. However, we had already set ourselves a more challenging target of reducing average PCC across our area to 100l/h/d as part of our Target 100 (T100) commitment in WRMP19.

Since WRMP19, household demand has increased due to COVID-19 and homeworking. We revised our demand forecast which resulted in the 2024–25 PCC estimate increasing from 122.6l/h/d to 135.6l/h/d (under normal year annual average conditions). This meant that the volume we need to save by 2040 to achieve T100 increased from approximately 60Ml/d to over 89Ml/d i.e. a 48% increase.

To ensure our WRMP24 is robust and has the best value mix of activity needed to meet environmental needs and supply security, the impact of the shift in demand on long term targets was assessed for this Plan. Our analysis has shown that achieving T100 remains possible with the higher level of savings needed but carries significant additional risk.

We received comments during the pre-consultation period about the ambitious nature of our demand management strategy options, particularly from Ofwat. We have also taken on board the Defra Direction that requires assurance on the deliverability of the plan.

Considering these factors and the analysis we have undertaken on delivery risk, the demand forecasts in our Plan are built on achieving a PCC of 109l/p/d. This out-performs the National Framework target and aligns to the overall WRSE regional plan, however from a planning perspective adopts a slightly higher pcc than T100 reflecting the risk and the higher starting demand.

As demand reduction is so critical to meeting the environmental and security of supply needs, we do not believe the T100 vision should be extinguished. To reflect this the optioneering and delivery plan on household demand reduction has retained the long-term ambition of meeting T100. The options are included in the WRMP tables and supporting technical annexes.

This has been done to ensure that at WRMP29 we have information on how reliably the T100 demand profile could be met, allowing decisions on whether to revert to T100 in that plan. The counterfactual of a delivery plan based only on meeting 109l/p/d means there would be insufficient information on whether the ambition can be reliably delivered for future plans.

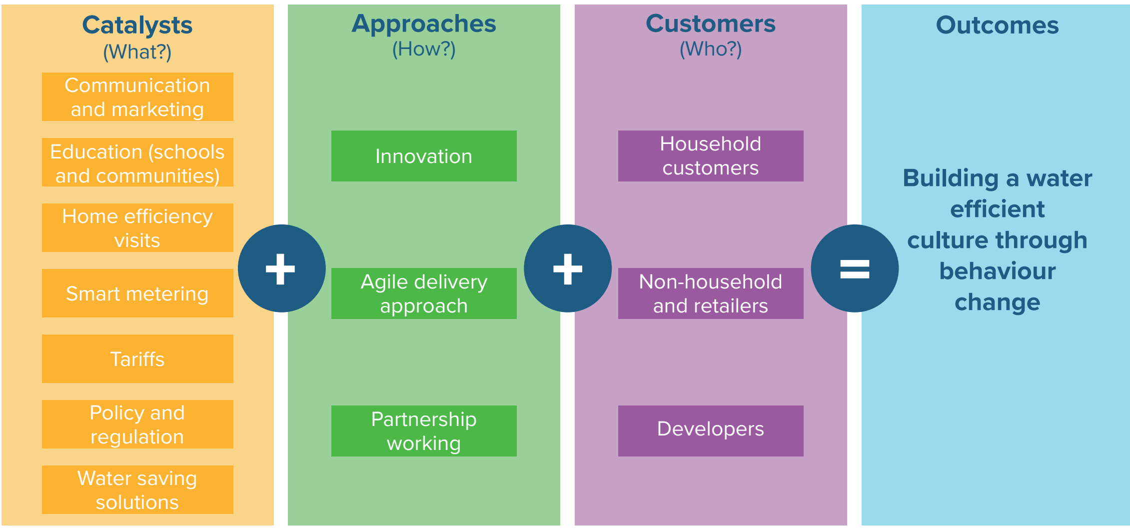
We have adopted a similar approach on leakage, aligning to the national framework expectation of a 50% leakage reduction by 2050, but with the development of a plan that will allow choices to be made on meeting deeper savings at future WRMPs.

We are keen in the consultation process to seek views on the balance of this approach. In particular if we should plan on meeting T100 alone and the associated delivery risk as we currently understand it, or, as in this Plan, have a demand forecast aligned to the National PCC targets but continue a programme to see if we can confidently achieve the T100 profile allowing the future plans to adjust based on the findings.

To inform responses on this, Annex 14 and 15 set out the components of the activity to reduce demand and the risk analysis. The key components we plan to undertake are summarised below.

Independent of the choice of planning on the National target for PCC or T100, and illustrated in the recent Waterwise Water Efficiency 2022 Strategy, both cases require a significant behavioural change in how customers and society use water.

Figure 7.10: A overview of our revised approach to promote water efficiency across all users



The 'catalysts' are planned workstreams that will bring about a change in behaviour and practices among household customers, non-household customers and developers. These are briefly described below.

1 **Communication and marketing:** We will use a sustained and multi-pronged awareness campaign to highlight the financial, social and environmental benefits of using less water. We will use this campaign to:

   a. Build awareness around water scarcity in the South East and the need to use water wisely

   b. Establish a water efficient culture as the norm

   c. Celebrate and encourage behaviour change.

2. **Deploy smart meters:** Smart meters, that can record and transmit consumption data in near real-time, are seen as key enablers for promoting water efficiency, as they facilitate proactive engagement with customers and help identify and fix supply-pipe leaks and plumbing losses earlier than Visual Meter Reads (VMR) and Automated Meter Reads (AMR) meters. We are currently trialling 1,500 smart meters to verify the assumptions around potential savings from installing these meters alone and testing various engagement approaches and behavioural nudges based on near real-time data. We plan to fully replace our current VMRs and AMRs with smart meters by 2030.

3. **Tariffs:** Introducing a different tariff structure, such as rising block tariffs or seasonal tariffs, is considered to have significant water-saving potential. However, there are customer sensitivities around differential tariff structures that need to be addressed before these can be introduced. We will use data from smart meters to trial different tariff structures, and use information from these trials to build awareness and readiness before introducing differential tariffs over time.

4. **Water-saving solutions:** These are the conventional tools, such as water-saving devices or advice, that we have used for a number of years, and continue to use. However, with the help of smart metering data, we plan to use them in a different way going forward, in order to maximise the benefit.

5. **Home audits:** Home audits are an effective way of reducing demand and we have been offering them to customers since we started implementing our Universal Metering Programme (UMP) in 2010. We are on track to carry out 45,000 home audits over AMP7 (2020–25). We plan to carry out 10,000 home audits per year from 2025–26, but with increased effectiveness through use of smart meter data and behavioural science approaches.

6. **Education:** We are commissioning classroom resources from curriculum specialists on water-saving and living efficiently for primary and secondary schools to embed water-efficient behaviour in our future customers – both at home and at work. We are also extending our home audits programme into the education sector as part of our non-household initiatives.
7. **Policy and regulation:** We are working with government policymakers, regulators, other water companies and wider stakeholders across the UK to develop and implement policies that promote water efficiency across all sectors.

We are developing approaches based around innovation, agile delivery and working in partnership to deliver our programme.

We have an in-house **innovation** team (Bluewave) that has commissioned behavioural scientists to carry out ethnographic research on the showering, toilet flushing and garden watering habits to identify what will help and what will hinder our customers from using less water. We plan to use similar behavioural insight to inform our water efficiency initiatives going forward.

We are also adopting an agile delivery approach whereby we will test all initiatives at a smaller scale to establish their efficacy. This will allow us to review and course-correct, if needed, before full roll out.

We intend to **work in partnership** with stakeholders at all levels – community, regional and national – to promote a culture of water efficiency. This includes funding local projects like rainwater-harvesting loos, drought-tolerant gardens, water butts in community allotments, educational displays in schools, to name a few. We will be working with other water companies and stakeholders to push for national policies and legislation aimed at reducing demand for water.

Development of our T100 programme is described in detail in Annex 15.

The supporting annex includes an analysis of the risk and uncertainty in delivering such deep demand reductions. We have used this to inform sensitivity analysis for this plan and to welcome feedback on.

Smart metering

Within the programme for reducing customer water use set out above, a key catalyst is the rollout of full smart metering. The benefits of smart meters are threefold:

- Their presence reduces consumption of water.
- They identify leaks and generate accurate bills for customers.
- It is an efficient solution when looking at whole life costs.

Our plan is to deploy full smart meter (AMI) functionality in AMP8 across household and non-household customers. We chose this option because it delivers the best cost to benefit result and simultaneously gives us the assurance we need that it can successfully deliver T100 and the leakage reduction programme. It also acts as a pathway to keep future options open on areas such as tariffs and gives future flexibility within the programme.

Alternative programmes including replace on fail only policies were assessed in the options. The shorter, faster full rollout of AMI meters in AMP8 was the best performing option from both a financial and non-financial assessment.

Taking all benefits into account including leakage and future tariff enablement, at gross cost the Smart Metering programme has an AIC of c40p/m^3.

Full details of the planned programme are given in Annex 16 and summarised in the following table.

Table 7.1: Summary of costs and benefits of smart metering over the next three AMP periods

Activity	AMP8	AMP9	AMP10
Total AMI Meter installs			
HH	983,970		
Non-HH	45,730	–	–
Costs			
Opex	£5m	£5.4m	£5.4m
Capex	£156.4m	£5m	–
Benefits			
PCC	11Ml/d by 2030	On-going	On-going
Leakage	7-8Ml/d by 2030	On-going	On-going

Leakage reduction

Managing leakage is an important part of our water resources strategy. In developing this plan we have adopted the following strategy:

- **High leakage reduction scenario: Leakage reduced by 62% by 2050** (compared to 2020); remains constant thereafter.

A separate technical annex (Annex 17) provides detail on how we can reduce leakage by up to 62% by 2050 and the alternative options that were assessed. The planned interventions for leakage reduction are summarised below:

- **Traditional find and fix:** The function of this activity is to offset the Natural Rate of Rise (NRR) in leakage. This represents the amount that leakage would increase by over the year if no leakage repairs were undertaken. Our most recent assessment of NRR is that leakage would increase by 120 Ml/d per annum.

- **Enhanced find and fix:** This involves the use of more advanced analytics to assess the level of leakage within a District Metered Area (DMA) and target appropriate interventions. This may involve more time consuming leakage detection survey techniques or improving the data and allowances used to calculate leakage at a DMA level. This type of enhanced activity is able to reduce leakage at a DMA level to less than 10%. However, the challenge becomes maintaining this level across all DMA's.

- **Smart metering:** The roll-out of smart meters is planned for AMP8, replacing the existing AMR and AMR meters. Smart meters provide more frequent information about consumption patterns which in turn allows the leakage calculation to be more accurate and at a more granular level. Leveraging this data will result in an improvement in the way enhanced 'find and fix' activity is targeted enabling more DMAs to be maintained at a lower leakage level. Additionally, smart meters monitor for customer side leaks and generate alarms once a leak is detected. This will enable more customer side leaks to be detected and to reduce the run time of a leak. We estimate this will half the amount of customer side leakage included in our overall reported leakage level.

- **Digital Networks:** Digital networks have the potential to change the way we target and detect leaks. Using near real-time data modelling techniques and incorporating an increased number of network sensors, such as pressure and acoustic loggers, smart meters and water quality sensors, can result in earlier identification of leakage outbreaks and narrow the area of interest significantly with the result that leak detection times are reduced. We estimate that this benefit can be realised with an average of 6 sensors per DMA. The advantage of these digital models is that as well as providing a leakage reduction mechanism they also provide an opportunity for increased efficiency as survey times will be reduced through improved targeting. This is achieved through accurate measurement, preventative maintenance, raised confidence in intervention identification and prioritisation of actions.

- **Advanced Pressure Management:** Our water network is increasingly covered by pressure management and a significant amount of optimisation has been undertaken to minimise pressure variances. However, there is scope to expand this technology and approach to pumping assets. By changing the operating method of a pump to a controlled rather than fixed output pressures can be better managed within the network giving rise to similar benefits to more conventional pressure management techniques. Stabilising network pressures leads to a reduction in network fatigue, extending the life of network assets and reducing the number of burst events. Pressure management can create difficulties with leakage detection techniques that rely on acoustics to locate leaks as pressure management valves can introduce noise into the network masking leak noise. The implementation of digital modelling techniques gives an opportunity to overcome some of these issues.
- **Asset Renewal:** Our latest review indicates that NRR is deteriorating at 2.2 Ml/d per year. Unchecked this would require an additional 11 Ml/d of activity to be included in the plan by 2029–30 to maintain leakage at a constant level. Prevention of network deterioration is achieved by renewing the network as a rate that either maintains or improves network condition.

We have included two asset renewal interventions in our plans:

- Mains renewal: Through asset deterioration modelling we estimate that we need to replace 250km of network a year to offset deterioration in leakage. This is a significant increase in the level included in our PR19 plans but reflects our best and most current view of the state of our network. Our approach will require targeted mains replacement whilst minimising traffic disruption arising from mains replacement activity.

Table 7.2: A summary of the costs and benefits of leakage intervention to reduce leakage by up to 62% by 2050

WRMP24 Leakage Reduction Benefits and Costs	AMP8			AMP9			AMP10		
	Ml/d	£m	£m/Ml/d	Ml/d	£m	£m/Ml/d	Ml/d	£m	£m/Ml/d
Advanced F&F	4.13	6.61	1.60	6.69	10.70	1.60	7.98	12.77	1.60
Comms Pipe Replacement	1.77	13.59	7.68	1.37	13.59	9.93	1.06	13.59	12.83
Advanced Pressure Management	1.80	1.59	0.88	2.40	2.12	0.88	1.80	1.59	0.88
Smart Metering	7.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Digitalisation/Smart Networks	0.84	13.26	15.75	0.84	5.55	6.59	1.84	6.38	3.46
Mains Replacement (Net of NRR)	-2.11	413.75	46.52	-2.11	413.75	46.52	-2.11	413.75	46.52
Total Reduction Requirement	13.95	448.80	16.59	9.19	445.72	20.49	10.58	448.08	19.18

WRMP24 Leakage Reduction Benefits and Costs	AMP11			AMP12		
	Ml/d	£m	£m/Ml/d	Ml/d	£m	£m/Ml/d
Advanced F&F	9.60	15.36	1.60	2.14	3.43	1.60
Comms Pipe Replacement	0.82	13.59	16.58	0.63	13.59	21.43
Advanced Pressure Management	0.00	0.00	0.88	0.00	0.00	0.88
Smart Metering	0.00	0.00	0.00	0.00	0.00	0.00
Digitalisation/Smart Networks	1.69	6.38	3.77	1.56	5.83	3.72
Mains Replacement (Net of NRR)	-2.11	413.75	46.52	-2.11	413.75	46.52
Total Reduction Requirement	10.01	449.08	19.70	2.24	436.59	31.26

(Note: Total mains replacement benefit is 8.89 Ml/d)
(Note: No cost for Smart Metering included. Assumed to be included in Demand programme)

– Communication pipe renewal: The communication pipe is the section of the network that delivers water from a water main to the boundary of a property. Between April 2020 and March 2022 we completed 14,913 communication pipe leak fixes. Of these, over 87% were repairs. The difference between the average repair cost and relay cost is less than the cost of a second repair. We have therefore included an intervention that will result in all communication pipe leak fixes being undertaken as a renewal of the asset. This will result in a sustainable leak reduction through a fix that should have an 80 year plus life.

The interventions outlined above allow us to reduce leakage by up to 62% by 2050 and maintain this level from this point onwards (Table 7.2). We have included a target of 50% leakage reduction by 2050 in this plan in view of the feedback from Ofwat and target proposed in the National Framework. We will decide on a leakage reduction target in view of the feedback from public consultation on this plan and a further review of delivery risks associated with various levels of leakage reduction.

Full details of the leakage programme are set out in the accompanying Annex 17.

7.2.2 New water resource options

While our demand management strategy, and the savings from it, remain consistent through the different supply-demand situations and planning scenarios, the supply-side options vary by situation and planning scenario. Detailed outputs from our BVP are included in Annex 21.

7.2.3 Western Area

2025–35

The key options for the first 10 years of the planning period are:

- Catchment management; from 2027 with a maximum benefit of 8.50Ml/d.
- Demand management; from 2026 up to 24.45Ml/d benefit by 2035 (Figure 7.9).
- Bulk import (HSE): PWC Source to Eastleigh Water Service Reservoir (WSR) (24 Ml/d); from 2026 with a maximum benefit of 24Ml/d.
- Bulk import (HSE): PWC Source to Otterbourne WSW (21Ml/d); from 2030 with a maximum benefit of 21Ml/d.
- Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d); from 2030 with a maximum benefit of 78.17Ml/d.
- Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (HWTWRP) (60Ml/d); from 2031 with a maximum output of 12Ml/d.
- Recycling (IOW) at Sandown WTW (8.1Ml/d); from 2028 with a maximum benefit of up to 8.05Ml/d.
- Groundwater (HKZ): Newbury (1.3Ml/d); from 2028 with a maximum benefit of 1.20Ml/d.
- Groundwater (HRZ): Romsey (4.8Ml/d); from 2032 with a maximum benefit of 4.38Ml/d.
- Groundwater (IOW): Newchurch Lower Greensand (LGS) (1.9Ml/d); from 2035 with a maximum benefit of 1.95Ml/d.

The Havant Thicket Reservoir, recycling water at Sandown WTW and Newbury groundwater options are part of WRMP19 deliverables (see Section 3.1.2).

The bulk import from PWC Source to Eastleigh WSR is utilised to its maximum capacity of 24Ml/d in all situations and planning scenarios except NYAA. During this period, the minimum utilisation of this option across all situations under NYAA conditions is 16.07Ml/d in 2035 (Annex 21).

The greatest utilisation of the bulk import from PWC Source to Otterbourne WSW is under 1:100 DYAA with maximum utilisation in situations from 2031. Its utilisation under the NYAA scenario is limited to 2.10Ml/d in all situations. Under 1:500 DYAA conditions, its utilisation varies from 4.23Ml/d to 18.69Ml/d depending on the year and situations whereas under 1:500 DYCP conditions, the range is from 12.12Ml/d to 21Ml/d (Annex 21).

The utilisation of bulk import from Havant Thicket Reservoir to Otterbourne WSW is 22.50Ml/ in all situations under NYAA, 1:500 DYAA and 1:500 DYCP scenarios. Its utilisation varies from 61.59Ml/d to 78.17Ml/d under the 1:100 DYAA situation. The lower utilisation of this option under the 1:500 DYAA and 1:500 DYCP conditions is because of the availability of Test Drought Permit/Order option under 1:500-year drought conditions. This bulk import relies on the HWTWRP.

The HWTWRP is selected with a 60Ml/d capacity WRP; however, the recharge of Havant Thicket Reservoir by this scheme is limited to 12Ml/d in all situations under all planning scenarios during this period.

The Sandown WTW recycling option is fully utilised in all situations under the 1:100 DYAA scenario. Under the NYAA scenario, its utilisation is constant at 1.61Ml/d in all situations. Its utilisation under the 1:500 DYAA and 1:500 DYCP scenarios varies from 1.61Ml/d to 8.05Ml/d.

The Newbury groundwater option is utilised for 1.20Ml/d in all situations under the NYAA, 1:100 DYAA and 1:500 DYAA planning scenarios. Under the 1:500 DYCP scenario, its utilisation is 1.30Ml/d (Annex 21).

The Romsey groundwater option is only utilised under 1:100 DYAA conditions during this period with utilisation ranging from 4.06Ml/d to 4.38Ml/d (Annex 21).

The Newchurch (LGS) groundwater option is only selected under 1:100 DYAA conditions with a DO of 1.95Ml/d under all situations (Annex 21).

The utilisation of the options during this period is influenced by the availability of supply-side drought permits and orders up to 2041. Most of the supply-side drought options in the Western Area, except the Test Drought Permit/Order under a 1:500 scenario, are not available after 2030. As a result, the utilisation of supply-side options is typically higher under 1:100 DYAA scenario compared to the 1:500 DYAA scenario (Annex 21).

In addition to the network improvements in Table 3.1, upgrade of treatment work capacity at River Test WSW (60Ml/d) and Otterbourne WSW (30Ml/d) will be required in 2031. This applies to all situations under all planning scenarios.

2035–50

Key features of this 15-year period are:

- Continuation of our catchment management activities to maintain the 8.50Ml/d DO benefit.
- Continuation of our demand management activities to further reduce PCC and leakage for a net DO benefit of up to 40.44Ml/d (Figure 7.9).
- Cessation of the use of supply-side drought permits/orders under all planning scenarios from 2041.
- Bulk import (HSE): Thames to Southern Transfer (T2ST) (120Ml/d); from 2040 with a maximum benefit of 102.41Ml/d from 2040 (Figure 7.13).
- Groundwater (HSW): Test Managed Aquifer Recharge (MAR) (5.5Ml/d); from 2041 with a maximum benefit of 5.50Ml/d.
- Groundwater (IOW): Eastern Yar3 (1.5Ml/d); from 2040 with a maximum benefit of 1.50Ml/d.
- Bulk export (HSE): Otterbourne WSW to PWC Source; from 2049 for up to 9.88Ml/d.

The T2ST option is initially utilised under situations 1, 3 and 7 from 2040 and in Situation 5 from 2049 under all planning scenarios (Figure 7.13). Situations 1, 4 and 7 are based on high Environmental Destination scenarios. Situations 1 and 4 also include high climate change impacts. Situation 5 is defined by medium Environmental Destination. Both situations 5 and 7 include median climate change impacts. The utilisation of T2ST is much higher under situations 1, 4 and 7 compared to Situation 5 (Figure 7.13).

The utilisation of T2ST is accompanied by a reduction in bulk imports from PWC (Annex 21).

The bulk import from PWC Source to Eastleigh WSR continues to be used at its maximum capacity up to 2040 under planning scenarios. After 2040 it is only used at 24Ml/d capacity under the 1:500 DYCP scenario in all situations. Under 1:500 DYAA scenario, its utilisation decreases in situations 1, 4 and 7 and reduces to zero in 2049. Under the 1:100 DYAA scenario, it is significantly utilised under all situations up to 2048. From 2049, it is not utilised situations 1 and 4. It continues to be used in all situations under the NYAA scenario; albeit at lower than maximum capacity in situations 1, 4 and 7 (Annex 21).

It is a similar pattern with the bulk import from PWC Source to Otterbourne WSW. The bulk import continues to be utilised at full capacity under the 1:500 DYCP scenario in all situations from 2042. Up to 2041 its utilisation is lower in some years and situations. Under the 1:500 DYAA scenario, its utilisation varies from 4.23Ml/d to 10.79Ml/d across situations. From 2042, it is either fully or significantly utilised in situations 2, 3, 5, 6, 8 and 9 i.e. the situations that do not utilise the T2ST option. The utilisation is low (up to 2.10Ml/d) in situations 1, 4 and 7 after 2042 and completely stops in 2048 in situation 7 and in 2049 from 1 and 4. The utilisation of this option under the 1:100 DYAA scenario is similar to the 1:500 DYAA scenario. The main difference from 1:500 DYAA scenario is that it continues to be used from 2048 in Situation 8 but at much lower capacity. It is used in all situations under the NYAA scenario but with lower utilisations in situations 1, 4, 5 and 7 than other situations (Annex 21).

The utilisation of bulk import from Havant Thicket Reservoir to Otterbourne WSW increases significantly from 2042 across all situations under the 1:500 DYAA and 1:500 DYCP conditions as the supply-side drought options become unavailable. Its utilisation is generally higher under the 1:100 DYAA and 1:500 DYAA scenarios in all situations. Under the NYAA scenario, the maximum utilisation across situations is less than 30Ml/d (Figure 7.11).

The recharge of Havant Thicket Reservoir by recycled water from Budds Farm WTW increases significantly across all situations, except Situation 8, under the 1:500 DYAA scenario to the maximum capacity of the WRP (60Ml/d) in a number of situations. Its utilisation in all situations under the NYAA and 1:500 DYCP scenarios remains at 12Ml/d throughout this period. Its maximum utilisation under the 1:100 DYAA scenario in any situation up to 2050 is 52.56Ml/d (Figure 7.12).

The Sandown WTW recycling option is utilised to its maximum capacity throughout this period in all situations under the 1:100 DYAA scenario and in all situations under 1:500 DYAA conditions from 2042. Its utilisation under the 1:500 DYCP scenario also increases across all situations with some situations utilising the maximum capacity. Under NYAA conditions, the utilisation in Situation 8 remains at 1.61Ml/d during this period but other situations show increased utilisation, with some using this option to its maximum capacity.

There is no change utilisation of the Newbury groundwater option from the preceding period (Annex 21).

The Romsey groundwater option is selected under NYAA conditions from 2037 with utilisation varying from zero to 4.80Ml/d across the situations. It is selected under 1:500 DYAA conditions from 2036 for situations 1-6 in 2036, Situation 8 in 2040, Situation 7 in 2041 and Situation 9 from 2042. It is selected in all situations from 2042 under 1:500 DYCP conditions (Annex 21).

The Newchurch LGS source is selected under NYAA conditions from 2037. It is initially selected in all situations but stops being used in Situation 9 from 2038. Under the 1:500 DYAA conditions, it gets selected in all situations for maximum DO benefit from 2042. It gets selected in situations 1-6 from 2037 but is not used in all years in these situations before 2041. It gets selected in situations 7-8 from 2040. Under the 1:500 DYCP scenario, this option first starts to get used across all situations from 2042 with selection in 2040 in situations 1, 4 and 7. It is used throughout in all situations under the 1:100 DYAA scenario.

Eastern Yar3 groundwater option is only required under the NYAA scenario. It's initially selected in situations 1,2 4,5,7 and 8 from 2040 to 2045 and in situations 3 and 6 from 2046. It is not need in Situation 9. When selected, it is fully utilised to its maximum DO (Annex 21).

The bulk export from Otterbourne WSW to PWC Source is selected in Situation 4 in 2049 only under 1:100 DYAA conditions. Under 1:500 DYAA conditions, it is selected in situations 4 and 7 from 2049 with a maximum export of 12.32Ml/d in Situation 7. It is not selected in any situation under NYAA and 1:500 DYCP scenarios.

Additional transfer capacity between HSE and IOW along the cross-Solent main is selected in 2042 in situations 1, 4 and 7 1 for the 1:500 DYCP scenario. The maximum transfer volume is 2.57Ml/d in Situation 1.

2050–75

The only new option selected during this period is:

- Recycling (HSE): Woolston WTW (7.1Ml/d); from 2059 with a maximum DO benefit of 7.10Ml/d.

This option is only selected in Situation 2 from 2059 under all planning scenarios (Annex 21).

Catchment management and demand management activities continue during period but the main aim to is maintain the level of DO benefit achieved in the first 25 years of the planning period.

The bulk import from PWC Source to Eastleigh WSR is not selected under in situations 1 and 4 from 2054 under NYAA conditions. In addition to situations 1 and 4, this option is not used from 2054 in Situation 7 under the 1:100 DYAA scenario. It is not used in situations 1, 4 and 7 under the 1:500 DYAA scenario but is fully utilised in all situations under the 1:500 DYCP scenario (Annex 21).

Utilisation of the bulk import from PWC Source to Otterbourne WSW is very similar (Annex 1).

The bulk import from Havant Thicket Reservoir to Otterbourne WSW continues to be utilised throughout this period in all situations under all planning scenarios. Its utilisation is less than 33Ml/d across all situations under the NYAA scenario but has much higher utilisation under other planning scenarios (Figure 7.11).

The export of recycled water from HWTWRP to Havant Thicket Reservoir continues in all situations under all planning scenarios. However, the volume is limited to 12Ml/d in all situations under the NYAA and 1:500 DYCP scenarios and in Situation 8 under the 1:100 DYAA and 1:500 DYAA scenarios. Its maximum utilisation is in Situation 1 (1:100 DYAA and 1:500 DYAA scenarios) and situations 2, 4, 5, 7 and 8 (1:500 DYAA scenario) (Figure 7.12).

The T2ST option continues to be utilised in the same situations as the preceding period (Figure 7.13).

Figure 7.11: Utilisation of bulk import from Havant Thicket Reservoir to Otterbourne WSW

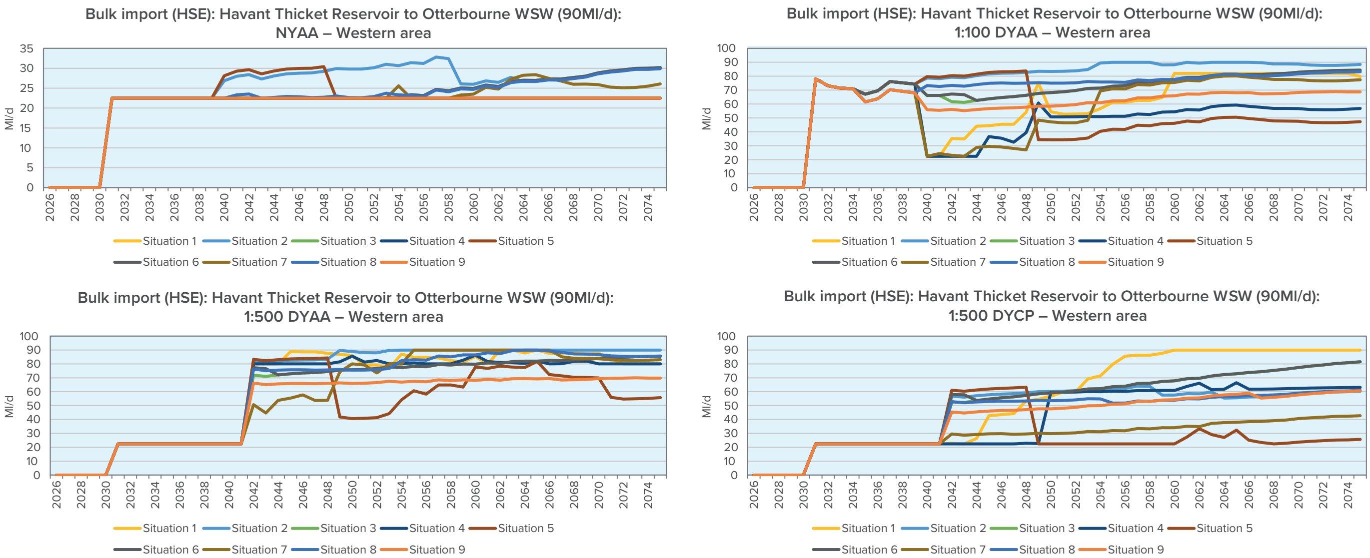
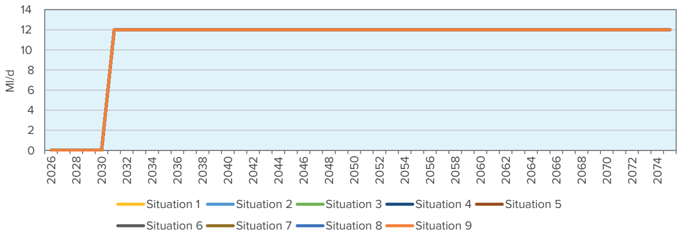
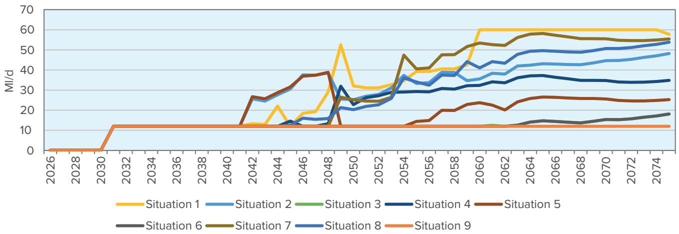


Figure 7.12: Export of recycled water from Hampshire Water Transfer and Water Recycling Project to Havant Thicket Reservoir

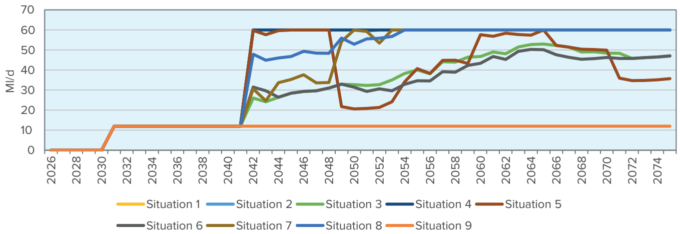
Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (60Ml/d): NYAA – Western area



Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (60Ml/d): 1:100 DYAA – Western area



Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (60Ml/d): 1:500 DYAA – Western area



Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (60Ml/d): 1:500 DYCP – Western area

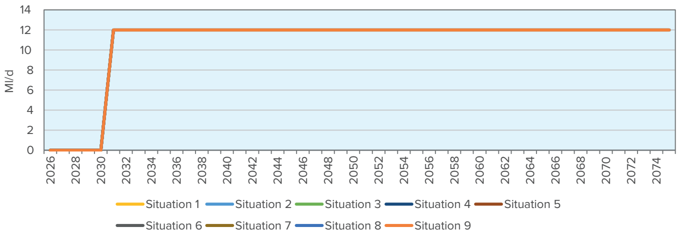
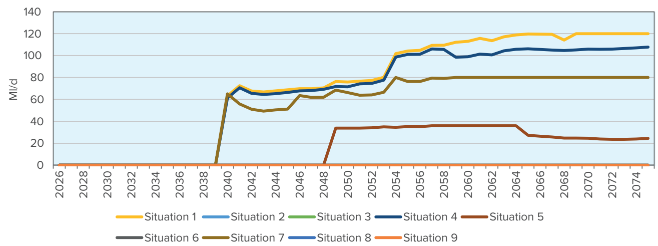
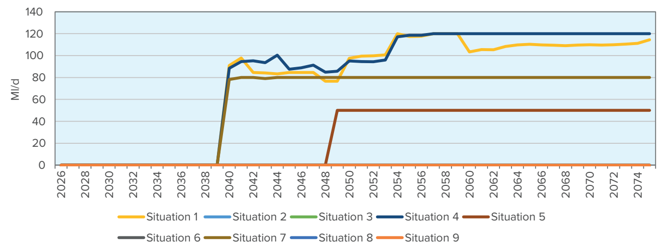


Figure 7.13: Utilisation of Thames to Southern Transfer

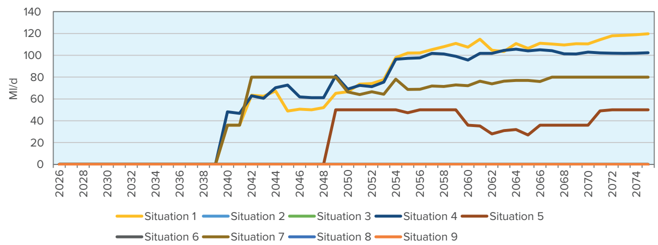
Bulk import (HSW): Thames to Southern Transfer – potable: 1:100 NYAA – Western area



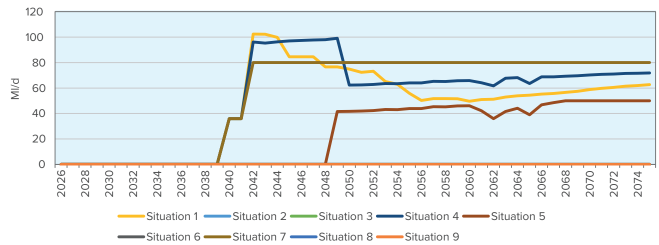
Bulk import (HSW): Thames to Southern Transfer – potable: 1:100 DYAA – Western area



Bulk import (HSW): Thames to Southern Transfer – potable: 1:500 DYAA – Western area



Bulk import (HSW): Thames to Southern Transfer – potable: 1:500 DYCP – Western area



The Sandown WTW recycling option continues to be selected in all situations under all planning scenarios (Annex 21).

There is no change to the selection of groundwater options at Newbury, Romsey, Test MAR or Easter Yar3 during this period. The Newchurch (LGS) groundwater option additionally gets selected in Situation 9 as well under the NYAA scenario from 2052 (Annex 21).

The bulk export from Otterbourne WSW to PWC source starts in situations 1 and 4 in 2054 under NYAA conditions. The maximum volume exported is 13.88Ml/d. Under 1:100 DYAA scenario, this bulk export starts in 2054 in situations 1, 4 and 7 with a maximum of 31.24Ml/d. Under 1:500 DYAA conditions, the export starts in 2054 in Situation 1 in addition to situations 4 and 7. The maximum exported volume under any situation is 37.26Ml/d. This bulk export is not selected under the 1:500 DYCP scenario.

The maximum additional transfer capacity between HSE and the IOW through the cross-Solent main increases to 5.21Ml/d in Situation 1 by the end of the planning period. In situations 4 and 7, the maximum additional volume is 2.55Ml/d and 1.71Ml/d respectively.

7.2.4 Central Area

2025–35

Key developments in the first ten years of the planning period in the Central Area are as follows.

- Demand management to save up to 23.43Ml/d by 2035 (Figure 7.9).
- Desalination (SBZ): Sussex Coast; first selected in 2028 to provide up to 3.54Ml/d.
- Recycling (SNZ): Littlehampton WTW discharge into River Rother (15Ml/d); first selected in 2028 to provide up to 14.96Ml/d.
- Bulk import (SNZ): PWC to Pulborough WSW (15Ml/d); selected from 2026 to provide up to 15Ml/d.
- Bulk import (SNZ): SES to SNZ; first selected in 2031 to provide up to 10Ml/d.
- Bulk import (SNZ): SEW RZ5 to Pulborough WSW; first selected in 2031 to provide up to 10Ml/d.
- Groundwater (SWZ): Pulborough Winter Transfer Stage 1 (2Ml/d); first selected in 2031 to provide up to 2Ml/d.
- Bulk export (SWZ): SEW Weir Wood; reduction in an existing bulk supply to SEW from 2032.

The Sussex Coast desalination and Littlehampton WTW recycling options are part of WRMP19 deliverables and are being utilised in all planning scenarios, under all planning conditions (Figure 7.14 and Figure 7.15 respectively).

The utilisation of the Sussex Coast desalination option is limited to 2Ml/d across all situations in the 1:500 DYCP scenarios. Its utilisation under other planning scenarios is less than 10Ml/d in any situation (Figure 7.14).

The Littlehampton WTW recycling option is utilised from less than 3Ml/d in all situations under all planning scenarios except 1:100 DYAA scenario (Figure 7.15).

The 15Ml/d bulk import from PWC to Pulborough WSW is an existing import that continues to be needed beyond the contractual tenure.

Water from Pulborough Winter Transfer Stage (up to 2Ml/d) is not selected in 1:500 DYCP scenario. It is not selected in situations 7–9 in 2035 under the 1:500 DYAA scenario.

The same is true for the existing Portsmouth Water import to Pulborough Water Supply Works (Annex 21).

The bulk import from SES to Turners Hill is primarily required in 1:100 DYAA and 1:500 DYAA scenarios where it is used to its maximum capacity in all situations. It is only selection in 2031 under the NYAA scenario with 2.47Ml/d volume across all situations. Under the 1:500 DYCP scenario, it is selected in 2031 and 2031 in all situations but with maximum volume limited to 4.92Ml/d (Annex 21).

The bulk import from SEW RZ5 is utilised to its maximum capacity in all situations under the 1:100 DYAA, 1:500 DYAA and 1:500 DYCP scenarios. Its utilisation under NYAA conditions declines from 10Ml/d in 2031 to 5.98Ml/d under situations 1–6 and to 5.94Ml/d under situations 7–9 by 2035.

Figure 7.14: Utilisation of the Sussex Coast desalination option

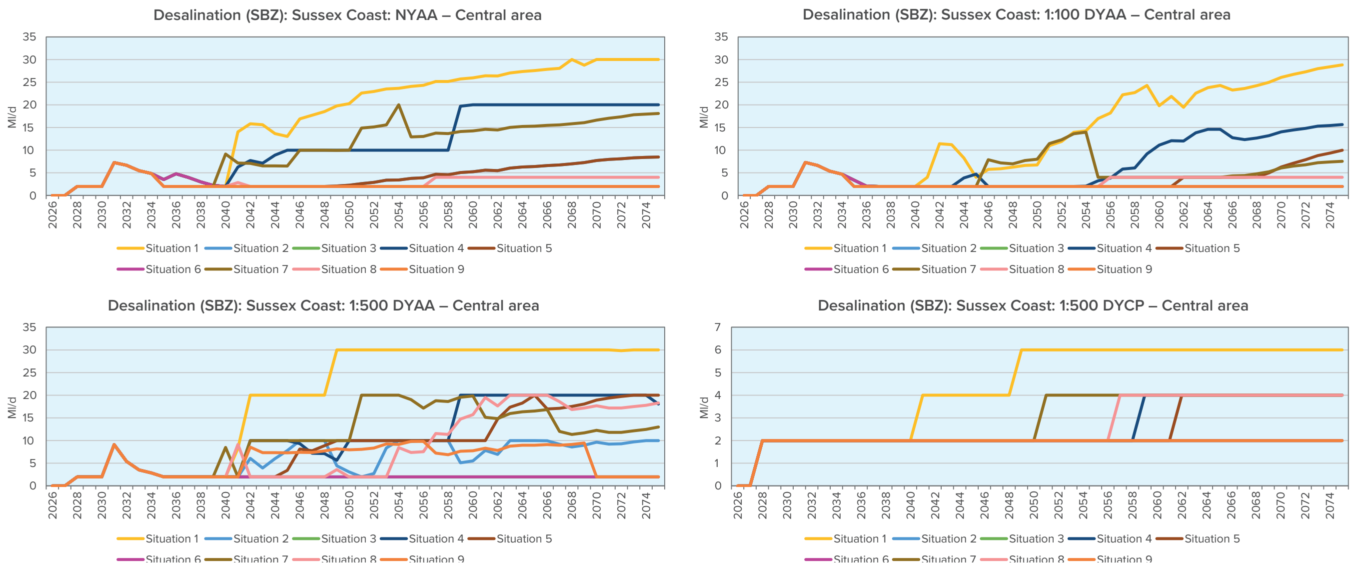
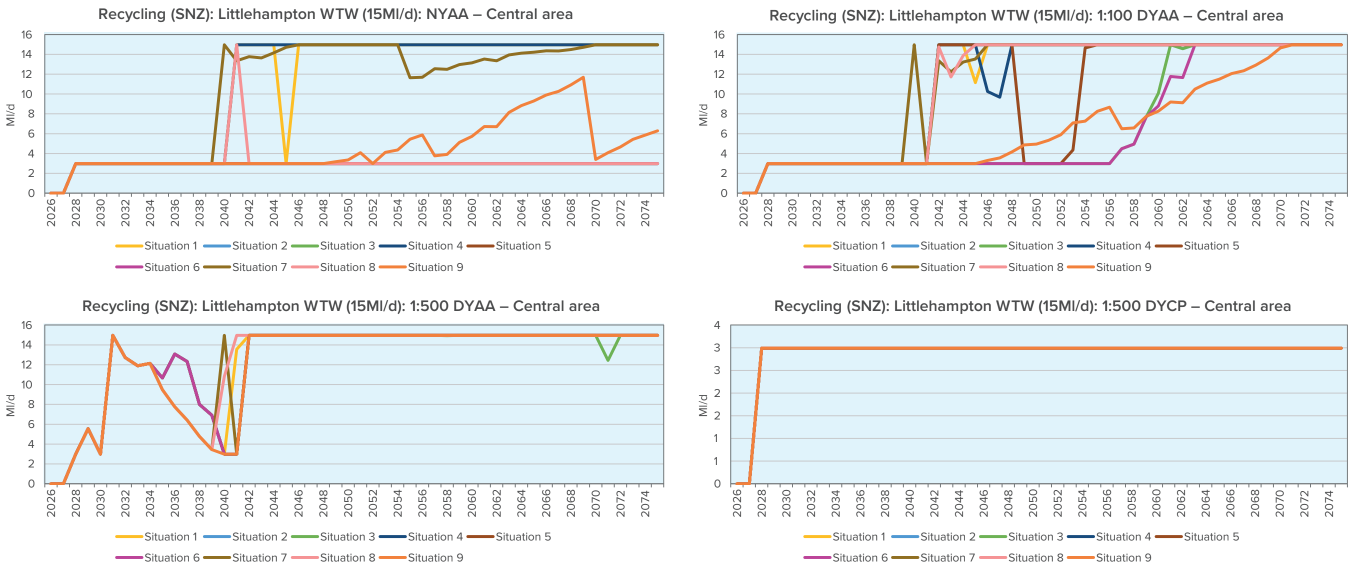


Figure 7.15: Utilisation of the Littlehampton WTW recycling option



The existing export from Weir Wood SEW (up to 5.40Ml/d) reduces to zero in all situations under NYAA and 1:500 DYAA scenarios and situations 7–9 in the 1:100 DYAA and 1:500 DYCP conditions. It reduces to 2.97Ml/d in situations 1–6 under the 1:100 DYAA scenario and to 0.82Ml/d in the 1:500 DYCP scenario (Annex 21).

2035–50

New options selected during this period are:

- Bulk import (SNZ): Havant Thicket Reservoir to Pulborough WSW; first selected in 2040 for up to 50Ml/d (Figure 7.16).
- Storage (SNZ): River Adur Offline Reservoir; first selected in 2045 to provide up to 19.50Ml/d (Figure 7.17).
- Storage (SNZ): Western Rother licence change and farm storage (2Ml/d); first selected in 2040 to provide up to 2Ml/d.
- Groundwater (SNZ): Petworth (4Ml/d); first selected in 2044 to provide up to 4Ml/d.
- The new bulk import from Havant Thicket Reservoir to Pulborough WSW starts in (Figure 7.16):
- 2040 in situations 1, 2, 4 and 5 under the NYAA scenario; in situations 1 and 4 under the 1:100 DYA scenario and situations 1–6 under the 1:500 DYAA scenario.
- 2041 in situations 3, 6 and 7 under the NYAA scenario; in situations 2 and 7 under the 1:100 DYAA scenario and in Situation 7 under the 1:500 DYAA scenario.
- 2042 in Situation 8 under the NYAA, 1:100 DYAA and 1:500 DYAA scenarios and in situations 1–3 and 5–8 under the 1:500 DYCP scenario.
- 2045 in Situation 4 under the 1:500 DYCP scenario.

With the exception of 1:500 DYCP scenario, it continues to be used once selected. Under 1:500 DYCP conditions, it is not used in Situation 1 after 2045 and in situations 4 and 7 after 2046 and after 2048 in Situation 3.

The River Adur Offline Reservoir is selected in Situation 1 from 2045, Situation 4 from 2046 and Situation 2 from 2049. This is true for all planning scenarios (Figure 7.17). It stops being utilised under Situation 4 after 2048 under 1:500 DYCP conditions.

The licence change and farm storage option on the Western Rother is selected in 2040 in situations 1, 4 and 7 and from 2041 in situations 2, 5 and 8. This is the same for NYAA, 1:100 DYAA and 1:500 DYCP conditions. It is not selected under 1:500 DYCP conditions. The maximum DO benefit of 2Ml/d is only needed under NYAA conditions. Under 1:100 DYAA and 1:500 DYAA conditions, the maximum benefit is limited to 0.16Ml/d (Annex 21).

The Petworth groundwater option is selected in 2044 in Situation 1; in 2049 in Situation 4 and in 2046 in Situation 7. This is true for all planning scenarios although under 1:500 DYCP it is only utilised in 2049 in Situation 4 (Annex 21).

Benefit from demand management activities increases to up to 40.54Ml/d by 2050.

The Sussex Coast desalination options is used in all situations under all planning scenarios. However, the utilisation varies significantly between situations and planning scenarios. Its maximum utilisation under the 1:500 DYCP scenario is 6Ml/d and that too in Situation 1 only. In other situations, its maximum utilisation is 2Ml/d. In other planning scenarios, its utilisation varies between 2Ml/d and 30Ml/d depending on the situation (Figure 7.14).

The Littlehampton WTW recycling option continues to be used at maximum capacity under 1:500 DYAA conditions and at less than 3Ml/d under the 1:500 DYCP conditions in all situations. Its utilisation increases in most situations under NYAA and 1:100 DYAA conditions with maximum capacity being used in some situations under these scenarios (Figure 7.15).

The bulk import from PWC to Pulborough WSW in used in all situations at maximum capacity under the 1:500 DYCP conditions. It is also used throughout under the NYAA conditions with some gaps in situations 1 and 7. Under 1:100 DYAA conditions, it is not selected in Situation 1 after 2039; in Situation 4 after 2043 and in Situation 7 after 2041. Under 1:500 DYAA conditions, it is not selected in Situation 1 after 2044, in Situation 2 after 2048 and in Situation 4 after 2045 (Annex 21).

Figure 7.16: Utilisation of the bulk import from Havant Thicket Reservoir to Pulborough WSW

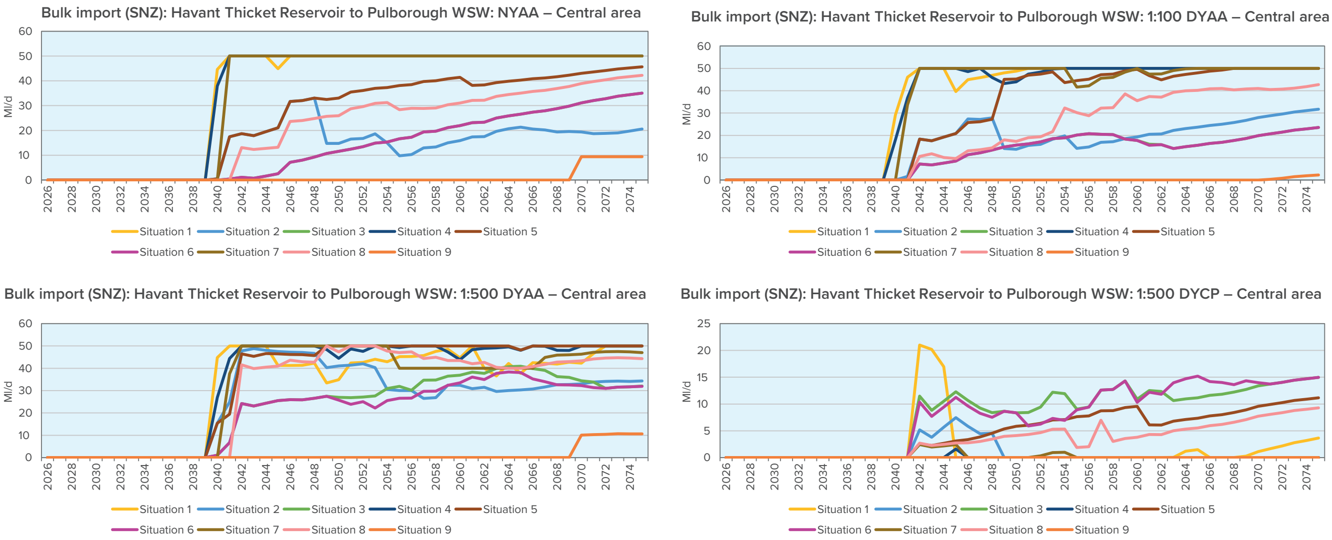
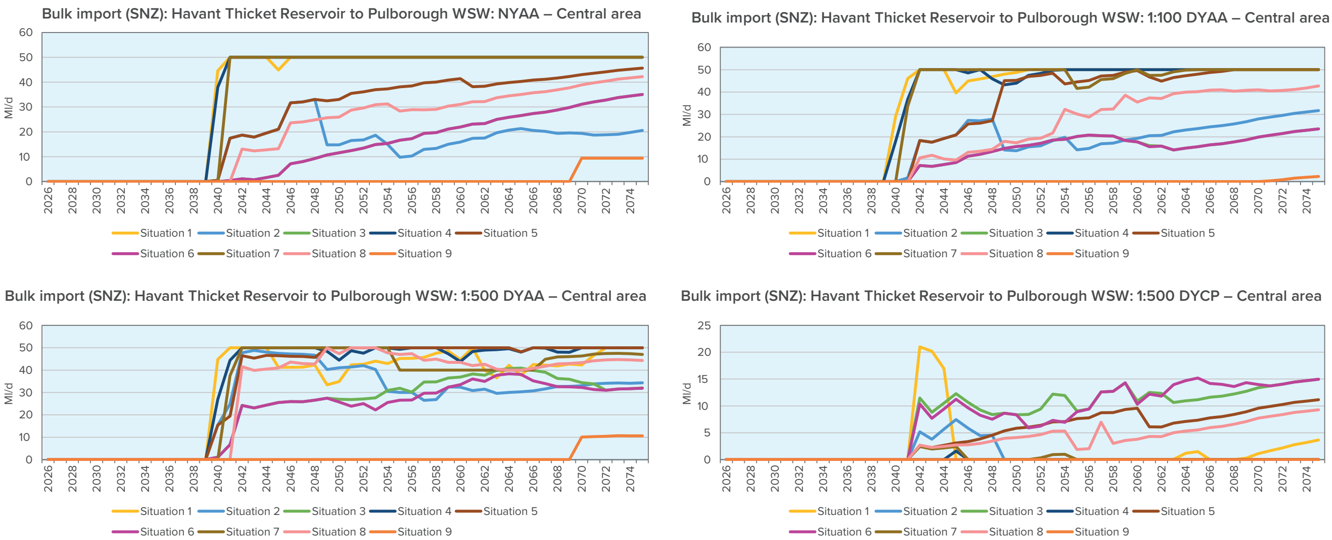


Figure 7.17: Utilisation of the River Adur Offline Reservoir



The bulk import from SES to SNZ starts being utilised again under NYAA conditions from 2036 and under 1:500 DYAA conditions from 2040. It is utilised in all situations under all planning scenarios by 2050 (Annex 21).

The bulk import from SEW RZ5 to Pulborough WSW continues to be utilised in all situations under all planning scenarios (Annex 21).

The bulk export from Weir Wood Reservoir to SEW not used under the NYAA scenario and is only consistently used in situations 4 and 6 from 2041 to 2050 under the 1:500 DYCP scenario. There is no consistent utilisation of this option under the 1:100 DYAA and 1:500 DYAA scenarios (Annex 21).

2050–75

Two new options are selected during this period:

- Recycling (SNZ): Horsham WTW (6.8Ml/d); from 2055 with a maximum DO benefit of 6.80Ml/d.
- Desalination (SNZ): Tidal River Arun; from 2062 for up to 10Ml/d benefit.

The Horsham recycling option is only selected in Situation 2 from 2055 under the NYAA, 1:100 DYAA and 1:500 DYAA scenarios. It is not selected under the 1:500 DYCP scenario (Annex 21).

The desalination option on the River Arun is selected in 2062 in Situation 1 under all planning scenarios with a maximum DO of 10Ml/d under the 1:500 DYAA conditions. Under other planning scenarios, the utilisation of this option is 2Ml/d (Annex 21).

Demand management continues in this period but is mainly aimed at maintaining the PCC and leakage reduction levels achieved up to 2050.

The desalination option on the Sussex Coast continues to be used in a similar pattern as the preceding period with maximum utilisation in any situation under any planning scenario capped at 30Ml/d (Figure 7.14).

The bulk import from PWC to Pulborough WSW is used at maximum capacity in all situations under the 1:500 DYCP conditions. Under NYAA conditions, it is not used in Situation 7 after 2054. Under 1:100 DYAA conditions, it is only consistently used in situations 4 and 6 and in situations 4 and 9 under 1:100 DYAA conditions.

The bulk imports from SES to SNZ and SEW RZ to Pulborough WSW are utilised in a similar pattern to the preceding period with maximum utilisation in most situation under all planning scenarios (Annex 21).

The utilisation of the Petworth groundwater option continues to increase across the planning scenarios and from 2061, it is utilised in all situations except situations 3 and 6 under the NYAA, 1:100 DYAA and 1:500 DYAA conditions and in all situations except 3, 6 and 9 under the 1:500 DYCP conditions (Annex 21).

By 2071, the bulk export from Weir Wood Reservoir to SEW stops being utilised under NYAA, 1:100 DYAA and 1:500 DYCP scenarios and in most situations under the 1:500 DYAA conditions (Annex 21).

7.2.5 Eastern Area

2025–35

The basket of options in the first 10 years of the planning period includes the following:

- Demand management to provide up to 25.29Ml/d by 2035 (Figure 7.9).
- Bulk export (KME) SEW RZ6; up to 7.40Ml/d from 2026.
- Bulk export (KMW): SEW from Darwell Reservoir; 8Ml/d from 2026.
- Bulk import (KTZ): SEW to Near Canterbury; from 2026 for up to 2Ml/d.
- Recycling (KMW): Medway WTW (12.8Ml/d); from 2031 to provide up to 12.80Ml/d (Figure 7.18).
- Recycling (KME): Sittingbourne Industrial Water recycling (7.5Ml/d); to provide up to 5.39Ml/d from 2031 (Figure 7.19).

There are additionally small bulk exports to SEW Pitfield from KMW (0.5Ml/d) and to SEW RZ7 from Deal (0.07Ml/d) as well as a small import from AFW to KTZ (0.1Ml/d). These are included in Annex 21 but not discussed further in this section.

The existing bulk export to SEW RZ6 for up to 7.40Ml/d is deselected under the NYAA scenario after 2030. It is used at maximum capacity under 1:500 DYCP scenario in all situations up to 2034 but is deselected in 2035 for situations 6–9. It is not used consistently in any situation from 2031 to 2031 under 1:100 DYAA and 1:500 DYAA scenarios (Annex 21).

The existing bulk export to Darwell Reservoir is utilised at full capacity in all situations under all planning scenarios (Annex 21).

The bulk import from SEW to Near Canterbury first selected in 2026 but by 2035 it is only used in all situations under the NYAA scenario. It is not used in any situation under 1:500 DYCP scenario after 2031 and is only used in situations 7–9 in 2035 under the 1:100 DYAA and 1:500 DYAA scenarios (Annex 21).

The Medway WTW recycling option is part of the WRMP19 deliverable and is available from 2028. However, it is not selected until 2031. It is used the NYAA scenario (and up to 2034 under 1:500 DYAA scenario. It is only used in 2031 under the 1:100 DYAA scenario and not at all under the 1:500 DYCP scenario (Figure 7.18). This option is fully utilised under the NYAA scenario only.

The Sittingbourne Industrial Water recycling option is utilised in all situations under all planning scenarios but for 1.50Ml/d only (Figure 7.19).

2035–50

A number of new options are selected in the Central Area during this period. These include:

- Desalination (KMW): Thames Estuary; from 2040 for up to 40Ml/d (Figure 7.20).
- Groundwater (KME): Gravesend (2.7Ml/d); from 2040 for up to 2.65Ml/d.
- Groundwater (SHZ): Rye Wells (1.5Ml/d); from 2041 for up to 1.50Ml/d.
- Desalination (KTZ): East Thanet; from 2041 for up to 35.63Ml/d (Figure 7.21).
- Storage (SHZ): Raising Bewl 0.4m; from 2042 for 3Ml/d (Annex 21).
- Recycling (SHZ): Hastings WTW (15 Ml/d); from 2046 to provide up to 15.30Ml/d (Annex 21).
- Recycling (SHZ): Tunbridge Wells WTW (3.6Ml/d); from 2046 for up to 3.60Ml/d.
- Desalination (KME): Isle of Sheppey; from 2049 for 4Ml/d.
- Bulk import (KTZ): SEW Canterbury to Near Canterbury; in 2050 for up to 20Ml/d.

The Thames Estuary desalination option is first selected in 2040 and by 2046 it is utilised in situations 1-8 under all planning scenarios for a maximum output of 40Ml/d. It is not selected in Situation 9 under any planning scenario (Figure 7.20).

The groundwater option at Gravesend is selected in situations 1, 2, 4, 5, 7 and 8 from 2040, in situations 3 and 6 from 2041 and in Situation 9 from 2045. This is true for all planning scenarios except 1:500 DYCP where this option is not selected at all. The maximum DO benefit under NYAA conditions is 1.20Ml/d and 2.65Ml/d under 1:100 DYAA and 1:500 DYCP scenarios (Annex 21).

The Rye Wells groundwater option is selected in situations 1, 2, 4, 5, 7 and 8 from 2041 and in Situation 6 from 2046. This is the case under all planning scenarios except 1:500 DYCP scenario where it is not selected at all. The maximum DO is 1.50Ml/d (Annex 21).

The East Thanet desalination option is selected in situations 1, 2, 4, 5, 7 and 8 under all planning scenarios from 2041. Its maximum utilisation under the 1:500 DYCP scenarios is 8Ml/d but is higher, up to 3.63Ml/d under other scenarios (Figure 7.21).

The option to raise Bewl Water by 0.4m is selected in 2042 in Situation 3 under 1:500 DYAA scenario only for a 3Ml/d benefit.

The Hastings WTW recycling option is selected in 2046 in Situation 4 in all planning scenarios except 1:500 DYCP when it is not selected. It is utilised to its maximum capacity by 2050 under the 1:500 DYAA scenario (Annex 21).

The water recycling option at Tunbridge Wells is selected in Situation 8 only under all planning scenarios for a maximum DO benefit of 3.8Ml/d (Annex 21).

The desalination option on the Isle of Sheppey is selected in Situation 4 in 2049 under all planning scenarios. The maximum utilisation by 2050 is 8.06Ml/d under the 1:500 DYAA scenario (Annex 21).

Figure 7.18: Utilisation of the Medway Wastewater Treatment Works recycling option

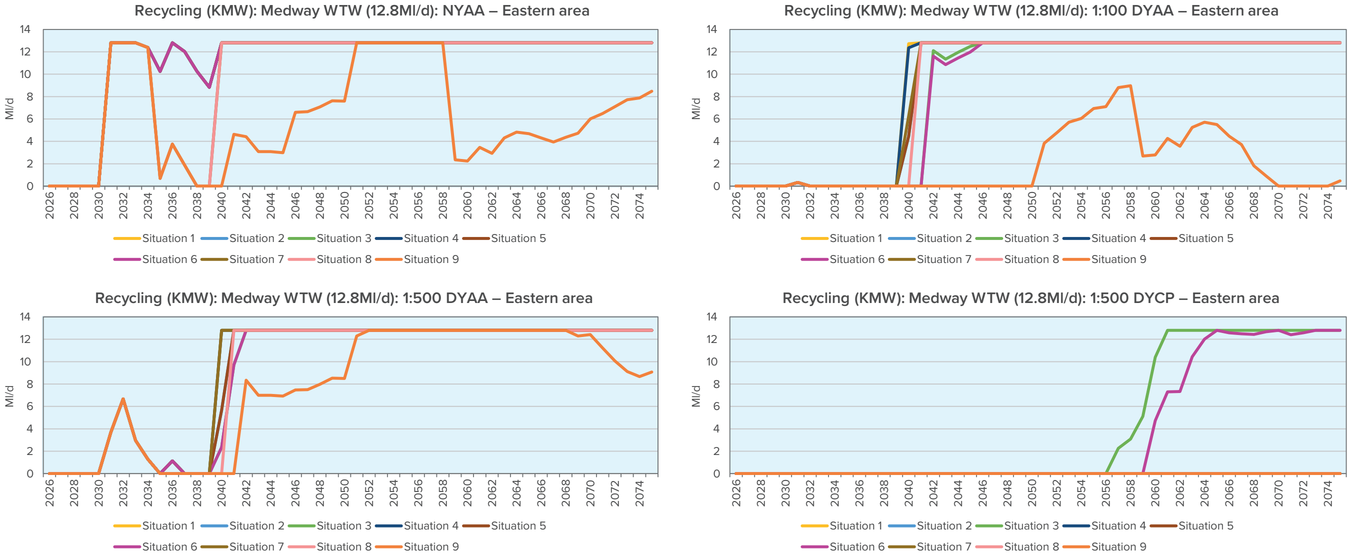


Figure 7.19: Utilisation of the Sittingbourne industrial reuse option

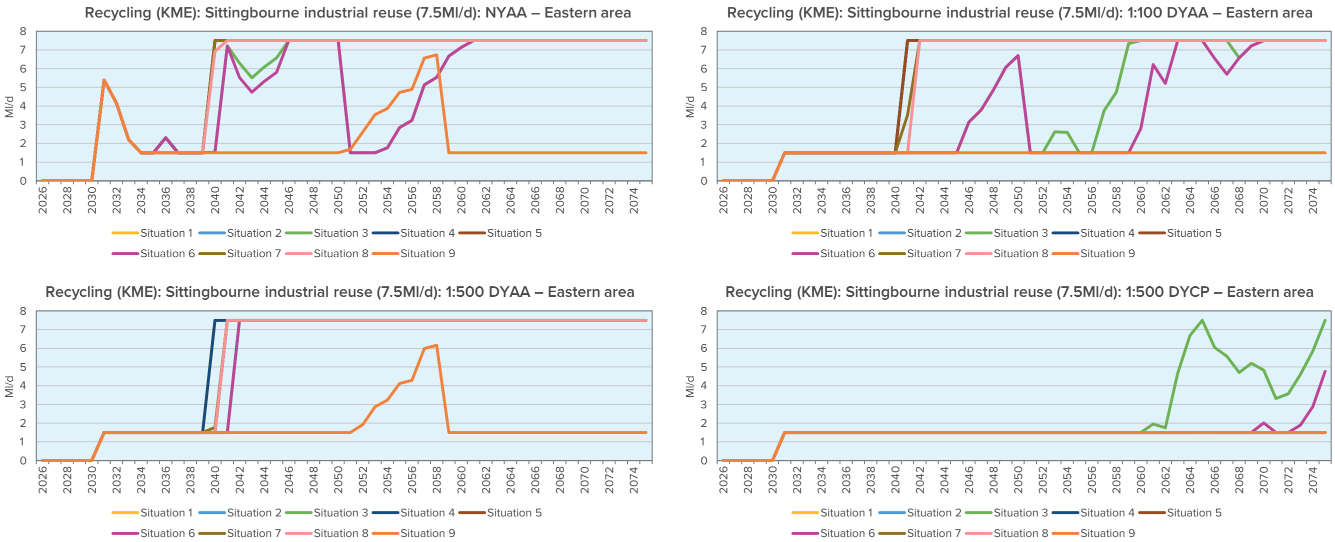


Figure 7.20: Utilisation of the Thames Estuary desalination option

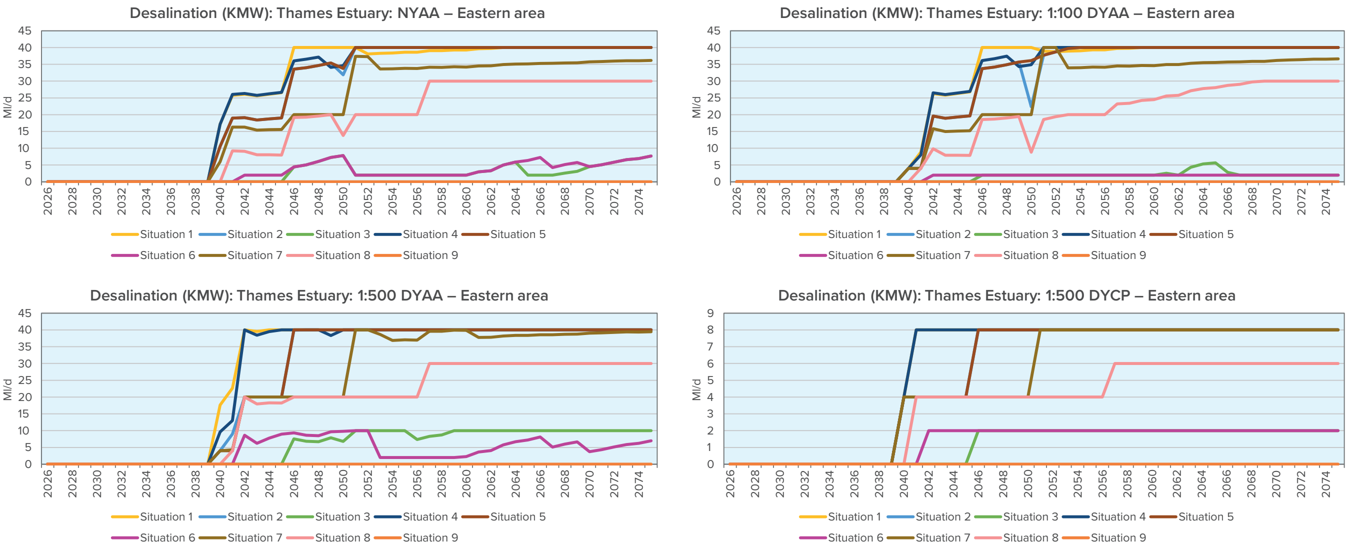
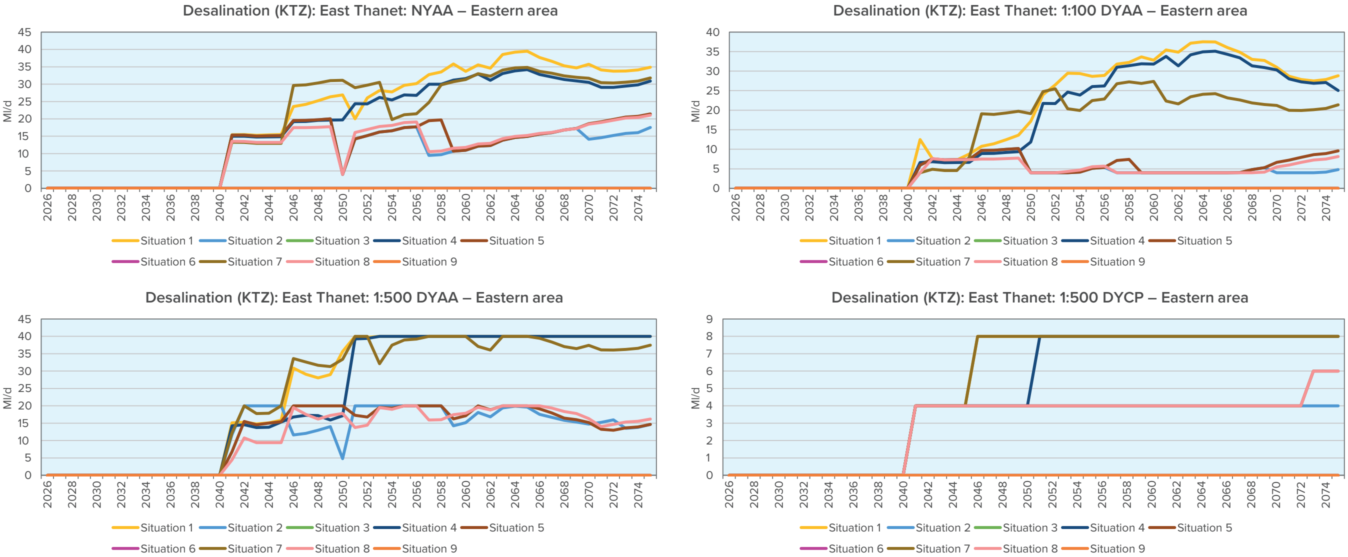


Figure 7.21: Utilisation of the East Thanet desalination option



A new bulk import from SEW Canterbury to Near Canterbury is selected in 2050 in situations 2, 5 and 8 under the NYAA and 1:100 DYAA scenarios for a maximum of 20Ml/d. It is only selected in Situation 2 (9.73Ml/d) under 1:500 DYAA conditions and not selected at all under the 1:500 DYCP scenario.

Benefit from demand management activities increases to up to 44.88Ml/d during period (Figure 7.9).

The bulk export to SEW RZ6 stops altogether from 2046 under the NYAA and 1:100 DYAA scenarios. Under the 1:500 DYCP scenario it is only selected in situations 3 and 6 by 2050. Under the 1:500 DYAA scenario it is consistently used from 2035 to 2050 in Situation 1 only with a break in 2036 (Annex 26).

The bulk export to SEW from Darwell continues at full capacity in all situations under all planning scenarios (Annex 21).

The bulk import from SEW to Near Canterbury continues to be utilised under all situations in NYAA and not at all under 1:500 DYCP conditions. It is not utilised consistently throughout this period under 1:100 DYAA and 1:500 DYCP scenarios although it is utilised in all situations from 2046 to 2050 (Annex 21).

The Medway WTW recycling option is utilised in all situations under NYAA scenario with the exception of situations 6-8 in 2038 and 2039 and in Situation 9 from 2038 to 2040. Under the 1:100 DYAA conditions, it is utilised in situations 1-8 from 2041 and in situations 1-9 under 1:500 DYAA conditions from 2042. It is not utilised under 1:500 DYCP scenario (Figure 7.18).

The Sittingbourne Industrial Water recycling option is utilised to full capacity in most situations under NYAA, 1:100 DYAA and 1:500 DYCP scenarios. It is providing1.50Ml/d in all situations under the 1:500-year DYCP scenario (Figure 7.19).

The raising of Bewl reservoir by 0.4m from 2042 is needed in situation three, only under the 1:500-year DYAA scenario (Annex 21).

2050–75

One new option is selected post 2050; Bulk import (SHZ): SEW RZ8 to Rye; from 2051 for up to 6.81Ml/d (Annex 21).

This option is selected in Situation 7 in 2051 and 2051 under NYAA conditions only. It gets selected again under NYAA conditions from 2065 in Situation 3 and in situations 2 and 4 from 2070. The maximum import from is 6.81Ml/d. Under the 1:100 DYAA scenario, it gets selected in situations 2 and 3 in 2070 and in Situation 6 in 2073. The maximum benefit under 1:100 DYAA scenario is 4.97Ml/d. Under 1:500 DYAA scenario, this option first gets selected in 2067 in Situation 3 and then again from 2072. It gets selected in Situation 4 from 2073 and in Situation 6 from 2070. The maximum benefit under 1:500 DYAA scenario is 4.93Ml/d. This option does not get selected under the 1:500 DYCP scenario (Annex 21).

Demand management continues through this period with the aim of maintaining PCC and leakage to their 2050 positions (Figure 7.9).

There are very few instances of the bulk export to SEW RZ6 being selected post 2050. It is not selected in most situations under all planning scenarios (Annex 21).

The export to SEW from Darwell continues in all situations under all planning scenarios at its maximum capacity (Annex 21).

The Medway WTW recycling option is selected in all situations under NYAA, 1:100 DYAA and 1:500 DYAA planning scenarios from 2051. Under the 1:500 DYCP scenario, it is selected in situation 3 in 2057 and in Situation 6 from 2060 (Figure 7.18).

The Sittingbourne Industrial Water recycling option is utilised as in the preceding period (Figure 7.19).

The utilisation of the Thames Estuary desalination option is similar to the preceding period (Figure 7.20).

The only difference in the utilisation of the Gravesend groundwater option from the 2035–50 period is that it is also utilised in situations 3 and 6 from 2051 under the 1:500 DYCP scenario (Annex 21).

Similarly, the only difference in the case of the Rye Wells groundwater options is that it gets selected in situations 3 and 6 from 2051 and Situation 1 from 2074.

The utilisation of the East Thanet desalination option is similar to the 2035-50 period (Figure 7.21).

The Isle of Sheppey desalination option is additionally selected in Situation 1 from 2051, in Situation 2 from 2057 and in Situation 4 from 2059 under all planning scenarios with a maximum DO benefit of 39.92Ml/d (Annex 21).

There is no change in the utilisation of the option to raise Bewl water by 0.4m (Annex 21).

The bulk import from SEW Canterbury to Near Canterbury gets selected in most situations post 2050 under NYAA, 1:100 DYAA and 1:500 DYAA scenarios. It does not get selected under the 1:500 DYCP scenario (Annex 21).

7.2.6. Summary of the BVP

The key options that we will need to develop as part of our plan are summarised in Table 7.3, and a snapshot of the options selected by 2050 is shown in Figure 7.22.

Table 7.3: Supply-side options selected in supply-demand situations 1–9 (S1–S9) in the BVP in each of the three supply areas

Option	Earliest utilisation	S1	S2	S3	S4	S5	S6	S7	S8	S9
Western Area										
Bulk export (HSE): Bulk export to large industrial user	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk import (HSE): PWC Source to Eastleigh WSR (24Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (HRZ–HSW): Romsey Town and Broadlands – bidirectional	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (HRZ–HSE): Abbotswood –	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Groundwater (HKZ): Newbury (1.3Ml/d)	2028	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recycling (IOW): Sandown WTW (8.1Ml/d)	2028	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (HAZ–HWZ): Hampshire Grid – bidirectional	2028	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (HWZ-HSE): Hampshire Grid – bidirectional	2028	✓	◆	◆	✓	◆	◆	✓	◆	◆
Inter-zonal transfer (HSW-HSE): Southampton Link Main – bidirectional	2028	◆	✓	✓	◆	✓	✓	◆	✓	◆
Bulk import (HSE): PWC Source to Otterbourne WSW (21Ml/d)	2030	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (HSE-HWZ): Olivers Battery	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Treatment capacity upgrade (HSE): Otterbourne WSW (30Ml/d)	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Treatment capacity upgrade (HSW): River Test WSW (60Ml/d)	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk export (HSE): Hampshire Water Transfer and Water Recycling Project to Havant Thicket Reservoir	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d)	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (60Ml/d)	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Groundwater (HRZ): Romsey (4.8Ml/d)	2032	✓	✓	✓	✓	✓	✓	✓	✓	✓
Groundwater (IOW): Newchurch (LGS) (1.9Ml/d)	2035	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk export (Thames to SouthernT2ST): To TWUL KVZ	2040	✗	✗	✗	◆	✗	✗	◆	✗	✗
Groundwater (IOW): Eastern Yar3 (1.5Ml/d)	2040	◆	◆	◆	◆	◆	◆	◆	◆	✗
Bulk import (HSW): Thames to Southern Transfer	2040	✓	✗	✗	✓	✓	✗	✓	✗	✗
Groundwater (HSW): Test MAR (5.5Ml/d)	2041	✓	✓	✓	✓	✓	✓	✓	✓	✗
Inter-zonal transfer (HSW-IOW): Triplicate cross-Solent main	2042	◆	✗	✗	◆	✗	✗	◆	✗	✗
Bulk export (HSE): Otterbourne WSW to PWC Source	2049	◆	✗	✗	◆	✗	✗	◆	✗	✗
Recycling (HSE): Woolston WTW (7.1Ml/d)	2059	✗	✓	✗	✗	✗	✗	✗	✗	✗
Central Area										
Bulk export (SNZ): SEW Weir Wood (5Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk import (SNZ): PWC to Pulborough WSW (15Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (SNZ-SWZ): Rock Road – bidirectional	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (SWZ-SBZ): V6 valve additional capacity – bidirectional	2026	◆	◆	◆	◆	◆	◆	◆	◆	◆
Desalination (SBZ): Sussex Coast	2028	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recycling (SNZ): Littlehampton WTW discharge to River Rother (15Ml/d)	2028	✓	✓	✓	✓	✓	✓	✓	✓	✓
Groundwater (SWZ): Pulborough Winter Transfer Stage 1 (2Ml/d)	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓

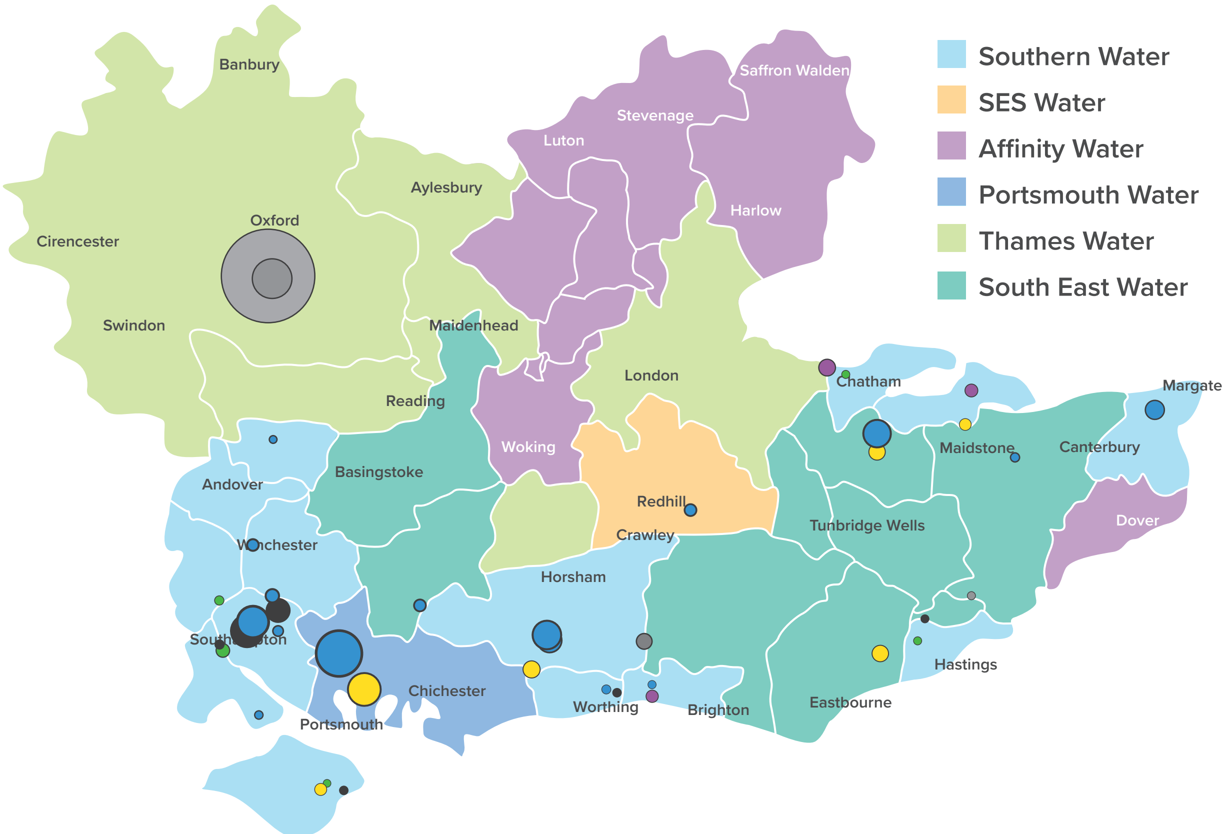
Key: ✓ Selected under all planning scenarios; ◆ Not selected under all planning scenarios; ✗ Not selected under any planning scenarios

Table 7.3: Supply-side options selected in supply-demand situations 1–9 (S1–S9) in the BVP in each of the three supply areas continued

Option	Earliest utilisation	S1	S2	S3	S4	S5	S6	S7	S8	S9
Central Area continued										
Bulk import (SNZ): SES to SNZ	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk import (SNZ): SEW RZ5 to Pulborough WSW	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk export (SNZ): SNZ to SES	2040	◆	✗	✗	✗	✗	✗	✗	✗	✗
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough WSW (50Ml/d)	2040	✓	✓	✓	✓	✓	✓	✓	✓	◆
Inter-zonal transfer (SNZ–SWZ): Pulborough to Worthing	2040	◆	◆	◆	◆	◆	◆	◆	◆	✗
Inter-zonal transfer (SWZ–SBZ): Pulborough Winter Transfer Stage 2 (New main between SWZ and SBZ)	2040	◆	◆	✗	◆	◆	✗	◆	◆	✗
Storage (SNZ): Western Rother licence change and farm storage (2Ml/d)	2040	◆	◆	✗	◆	◆	✗	◆	◆	◆
Inter-zonal transfer (SBZ–SWZ): Brighton to Worthing	2041	✗	✗	✗	◆	✗	✗	✗	✗	◆
Groundwater (SNZ): Petworth (4Ml/d)	2044	✓	✓	✓	✗	✓	✗	✓	✓	✓
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2045	✓	✓	✗	✓	✗	✗	✓	✗	✗
Recycling (SNZ): Horsham WTW (6.8Ml/d)	2055	✗	◆	✗	✗	✗	✗	✗	✗	✗
Desalination (SWZ): Tidal River Arun	2062	◆	✗	✗	✗	✗	✗	✗	✗	✗
Eastern Area										
Bulk export (KME): SEW RZ6 (7.4Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk export (KMW): SEW Darwell (8Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk export (KMW): SEW (1Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk export (KTZ): Deal to SEW RZ7	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk import (KTZ): AFW (0.1Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bulk import (KTZ): SEW to Near Canterbury (2Ml/d)	2026	✓	✓	✓	✓	✓	✓	✓	✓	✓
Inter-zonal transfer (KME–KTZ): KME to KTZ transfer	2028	◆	◆	✓	◆	◆	✓	✓	◆	✓
Recycling (KME): Sittingbourne Industrial Water recycling (7.5Ml/d)	2031	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recycling (KMW): Medway WTW (12.8Ml/d)	2031	◆	◆	✓	◆	◆	✓	◆	◆	◆
Desalination (KMW): Thames Estuary	2040	✓	✓	✓	✓	✓	✓	✓	✓	✗
Bulk export (KTZ): Deal	2040	✓	✗	✗	✓	✗	✗	✓	✗	✗
Groundwater (KME): Gravesend (2.7Ml/d)	2040	✓	◆	✓	◆	◆	✓	◆	◆	◆
Inter-zonal transfer (KME–KTZ): Utilise full transfer capacity KME to KTZ	2040	◆	◆	◆	◆	◆	◆	◆	◆	◆
Desalination (KTZ): East Thanet	2041	✓	✓	✗	✓	✓	✗	✓	✓	✗
Groundwater (SHZ): Rye Wells (1.5Ml/d)	2041	✓	◆	✓	◆	◆	✓	◆	◆	✗
Storage (SHZ): Raising Bewl 0.4m (3Ml/d)	2042	✗	◆	◆	✗	◆	✗	✗	✗	✗
Recycling (SHZ): Hastings WTW (15Ml/d)	2046	◆	✗	✗	◆	✗	✗	◆	✗	✗
Recycling (SHZ): Tunbridge Wells WTW (3.6Ml/d)	2046	✗	✗	✗	◆	✗	◆	✗	◆	✗
Desalination (KME): Isle of Sheppey	2049	✓	✓	✗	✓	✓	✗	✗	✗	✗
Bulk export (KTZ): Near Canterbury to SEW Canterbury	2050	✓	◆	◆	✓	◆	◆	◆	◆	◆
Bulk export (SHZ): Rye to SEW RZ8	2050	◆	✗	◆	◆	✗	✗	◆	✗	✗
Bulk import (KTZ): SEW Canterbury to Near Canterbury	2050	◆	◆	◆	◆	◆	◆	◆	◆	◆
Bulk import (SHZ): SEW RZ8 to Rye	2051	✗	◆	◆	✗	✗	◆	◆	✗	✗

Key: ✓ Selected under all planning scenarios ◆ Not selected under all planning scenarios ✗ Not selected under any planning scenarios

Figure 7.22: A snapshot of the options required by 2050 in situation four under 1:500-year DYAA conditions



7.2.7 Bill impact

We have calculated the bill impact of our preferred plan using Ofwat's regulatory capital value (RCV) methodology[6]. The estimated bill impact is shown in Table 7.4.

This is an indicative bill impact using the price base of 2019–20. The bill impact will be refined as costs and delivery profiles are updated through the WRMP process. The volume of mains renewals in the demand management area of the plan has a significant impact on customer bills.

Table 7.4: Estimated bill impact of our preferred best value plan

		AMP8 Yr1	AMP8 Yr2	AMP8 Yr3	AMP8 Yr4	AMP8 Yr5	AMP8 Total	AMP9 Average	AMP10 Average
WRMP excl Leakage	Totex (£m)	200.27	412.45	335.84	251.00	226.81	1,426.37	96.33	395.71
	Impact (£)	7.99	19.64	50.67	71.15	79.34	228.80	102.62	137.16
Leakage	Totex (£m)	15.73	21.31	18.82	27.48	18.93	102.26	15.84	17.06
	Impact (£)	0.16	1.24	2.52	3.82	5.22	12.96	7.09	9.71
WRMP Total	**Totex (£m)**	**216.00**	**433.76**	**354.65**	**278.48**	**245.73**	**1,528.63**	**112.17**	**412.76**
	Impact (£)	**8.15**	**20.89**	**53.18**	**74.97**	**84.57**	**241.76**	**109.71**	**146.87**

[6] https://www.ofwat.gov.uk/publications/rd-0410-regulatory-capital-values-2010–15

The costs are based on the high-level design costs of the options and are split into three main phases: planning, development and construction and operation. The bill impact takes into account the first year expense is incurred on a scheme even though the scheme may not be operational a few years later. The utilisation of an option is also into account for calculating the cost for operating it. The costs are included in the Water Resources Planning tables accompanying this plan.

7.2.8 Affordability and Intergenerational equity

The area we serve has been officially designated as water-stressed for some time, meaning that water is scarce for all users and for the environment. In this cycle of WRMPs we have also moved from planning to be resilient in a 1-in-200 year drought event to a 1-in-500 year event. We understand and support the need to protect and enhance the environment in our region and in collaboration with WRSE we have explored alternative scenarios for environmental destination, which provide different levels of enhanced environmental protection depending on the scenario being considered.

These conditions inevitably create pressure to use less water from existing sources, leave more water in the environment and invest in alternative sources of supply. More investment would lead to higher bills. It is important that bills remain affordable for all customers, not just vulnerable ones, and that current and future customers pay a fair amount relative to the services they consume and when they consume them.

We have taken and will continue to take every opportunity both to keep overall bills low and to ensure fairness between today's and future customers. Our plans include ambitious targets for leakage and demand reduction. Both can contribute materially to reducing the amount of water to be supplied and hence the need for new investment.

Some new investment is inevitable, and we have been through a careful option identification and selection process to identify investment options that represent best value for money, as well as using adaptive planning.

By carrying out some work well ahead of the need for new investment we can help to manage the risks and costs of future options. For example, early environmental studies and land investigations can de-risk options that may be needed later by identifying and managing issues when there is still time to incorporate the findings into the best value design.

We also have taken appropriate opportunities to investigate alternative delivery models such as Direct Procurement for Customers. In this model we commission alternative owners to build, own and operate assets on our behalf, paying for services received over the life of the contract. This has the effect of spreading the bill impact over a long period of time, avoiding today's customers experiencing a bill increase now to pay for the capital costs whereas the benefits occur in later periods to customers who could have underpaid.

We are using this approach for the largest scheme we need to carry out, involving the water recycling plant as an additional source for the Havant Thicket reservoir. We also expect to use a similar approach for the Thames to Southern Transfer, which may be needed as a long-distance water transfer in future decades. We have already used a similar approach on the construction of the Havant Thicket reservoir itself. Portsmouth Water is developing the reservoir on our behalf, and we are paying over the life of an 80-year contact. This matches the bill impact for our customers more closely with the pattern of benefits received, which will continue throughout the use of a long-lived asset.

In all cases we have looked to identify best value not just least cost options. The best value options take into account the net environmental impacts of an option, in order to choose those that can provide wider benefits to society and the environment, not just water company customers.

7.3 Least-cost vs best value plan comparison

We have developed a 'least-cost' plan (LCP) in line with UKWIR guidance (2002). Detailed outputs from the LCP are given in Appendix 14. A comparison of the LCP with our preferred BVP is shown in Table 7.5. The metrics shown in Table 7.5 are at a regional level. From a Southern Water perspective, there are a few key differences between the two plans but there are no large-scale changes, either in terms of option selection or option utilisation. This could be in part because the investment model does not have sufficient choice in terms of the number of options available and also because some of the best value metrics offset each other.

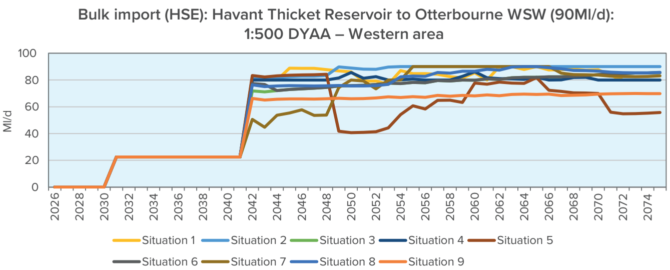
Table 7.5: A comparison of the LCP with our preferred BVP in terms of some key metrics at the regional level

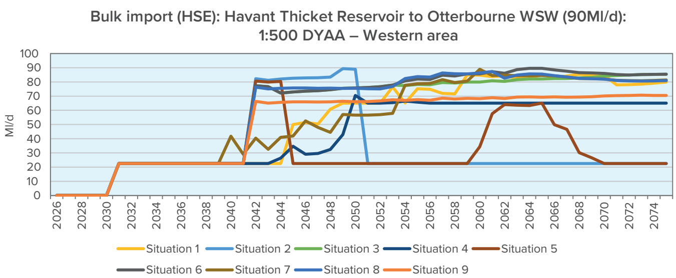
	LCP	BVP
CAPEX (£m)	£4,990	£5,004
OPEX	£7,257	£7,256
Best Value Plan Aggregate Metric	49%	70%
Overall Resilience Score	47%	89%
Overall Environmental and Societal metrics score	42%	63%
Carbon Cost	£730	£731

7.3.1 Western Area

The key change in the Western Area is that the LCP selects a 45Ml/d recycling plant for the HWTWRP instead of the 60Ml/d sized plant required for the best value plan. In both cases, the recycling option is needed by 2031. The volume imported from Havant Thicket reservoir to Otterbourne WSW up to 2040 is similar in both cases, but both the average and maximum volumes need post 2040 are higher in best value plan (Figure 7.23). A bigger recycling plant has been selected from the outset in our best value plan.

Figure 7.23: Comparison of the utilisation of bulk import from Havant Thicket Reservoir to Otterbourne WSW under the 1:500-year DYAA planning scenario in the BVP (below left) and the LCP (below right).





Other changes in the least-cost plan (LCP) include:

- Thames to Southern Transfer is required under one additional situation (situation two) in the LCP by 2051. It is brought forward to 2045, instead of 2049, in situation five and delayed to 2042, instead of 2040, in situation seven.
- The earliest requirement for the Romsey groundwater option under any planning scenario is in 2032, instead of 2036.
- The earliest requirement for the Newchurch (LGS) groundwater source under any planning scenario is in 2032, instead of 2037.
- Woolston Wastewater Treatment Works recycling option is needed in 2062 in situation eight, instead of 2059 in situation two.

These changes are shown in Table 7.6

Table 7.6: Comparison of the BVP with LCP in terms of key supply options in the Western Area (differences highlighted)

Option	First utilised – BVP	First utilised – LCP	Max output – BVP (Ml/d)	Max output – LCP (Ml/d)
Recycling (HSE): Hampshire Water Transfer and Water Recycling Project	2031	2031	60.00	45.00
Bulk import (HSE): PWC Source to Otterbourne WSW (21Ml/d)	2030	2030	21.00	21.00
Bulk import (HSE): PWC Source to Eastleigh WSR (24Ml/d)	2026	2026	24.00	24.00
Bulk import (HSW): Thames to Southern Transfer	2040	2040	120.00	120.00
Groundwater (HKZ): Newbury (1.3Ml/d)	2028	2028	1.30	1.30
Groundwater (HRZ): Romsey (4.8Ml/d)	2032	2032	4.80	4.80
Groundwater (HSW): Test MAR (5.5Ml/d)	2041	2041	5.50	5.50
Groundwater (IOW): Newbury (LGS) (1.9Ml/d)	2035	2031	1.95	1.95
Groundwater (IOW): Eastern Yar3 (1.5Ml/d)	2040	2040	1.50	1.50
Recycling (HSE): Woolston WTW (7.1Ml/d)	2059	2062	7.10	4.77
Recycling (IOW): Sandown WTW (8.1Ml/d)	2028	2028	8.05	8.05

7.3.2 Central Area

In terms of options selection, the LCP differs in two areas:

1. It does not require the option of discharging recycled water from Horsham Wastewater Treatment Works into storage at Pulborough Water Supply Works. This option is only selected in one situation (situation two), in 2055, in the best value plan.
2. It selects a bulk import from South East Water into Rottingdean (SBZ), in 2063, to provide up to 16Ml/d. This option is not selected in the best value plan.

In terms of other changes:

- A bigger River Arun desalination plant (up to 40Ml/d) is needed in 2053. In the best value plan, this option is required in 2062 with a maximum 10Ml/d capacity. In both cases, the option is only selected in situation one.
- The earliest requirement for the Petworth groundwater source is in 2041, instead of 2044 in the best value plan.
- The River Adur offline reservoir is needed in one additional situation (situation eight) and its earliest requirement is in 2040, instead of 2045 in the best value plan.
- The Western Rother licence change and farm storage option is needed in all situations under all planning scenarios except 1:500-year DYCP. In the best value plan it is not selected in situations three and six under any planning scenario.

The key differences between the plans is shown in Table 7.7.

Table 7.7: Comparison of the BVP with LCP in terms of key supply options in the Central Area (differences highlighted)

Option	First utilised – BVP	First utilised – LCP	Max output – BVP (Ml/d)	Max output – LCP (Ml/d)
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough WSW (50ml/d)	2040	2040	50.00	50.00
Bulk import (SNZ): PWC to Pulborough WSW (15Ml/d)	2026	2026	15.00	15.00
Bulk import (SNZ): SES to SNZ	2031	2031	10.00	10.00
Bulk import (SNZ): SEW to Pulborough WSW	2031	2031	10.00	10.00
Bulk import (SBZ): SEW to Rottingdean		2063		16.01
Desalination (SBZ): Sussex Coast	2028	2028	30.00	30.00
Desalination (SWZ): Tidal River Arun	2062	2053	10.00	40.00
Groundwater (SWZ): Pulborough Winter Transfer Stage 1 (2Ml/d)	2031	2031	2.00	2.00
Groundwater (SNZ): Petworth (4Ml/d)	2044	2040	4.00	4.00
Recycling (SNZ): Littlehampton WTW (15Ml/d)	2028	2028	14.96	14.96
Recycling (SNZ): Horsham WTW (6.8Ml/d)	2055	Not selected	6.80	Not selected
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2045	2042	19.50	19.50
Storage (SNZ): Western Rother licence change and farm storage (2Ml/d)	2040	2040	2.00	2.00

7.3.3 Eastern Area

In terms of options selection, the differences between the least-cost and best value plans are as follows:

1. The least-cost plan selects a recycling option in Ashford in 2061 in situation four to provide up to 3.90Ml/d under NYAA, 1:100-year DYAA and 1:500-year DYAA scenarios. This option is not selected in the best value plan.
2. The Tunbridge Wells Wastewater Treatment Works recycling option selected in some situations in the best value plan is not selected in the least-cost plan.

The least-cost plan also does not select the bulk import from South East Water RZ8 to Rye Water Supply Works before 2070. The best value plan selects it as early as 2051 in situation seven.

The key differences between the two plans is shown in Table 7.8.

Table 7.8: Comparison of the best value and least-cost plans in terms of key supply options in the Eastern Area (differences highlighted)

Option	First utilised – BVP	First utilised – LCP	Max output – BVP (Ml/d)	Max output – LCP (Ml/d)
Bulk import (KTZ): SEW Canterbury to Near Canterbury (2Ml/d)	2050	2050	20.00	20.00
Bulk import (KTZ): SEW to Near Canterbury (2Ml/d)	2026	2026	2.00	2.00
Bulk import (SHZ): SEW RZ8 to Rye WSW	2065	2070	6.81	8.53
Desalination (KTZ): East Thanet	2041	2041	40.00	40.00
Desalination (KME): Isle of Sheppey	2049	2051	39.92	40.00
Desalination (KMW): Thames Estuary	2040	2040	40.00	40.00
Groundwater (KME): Gravesend (2.7Ml/d)	2040	2040	2.65	2.65
Groundwater (SHZ): Rye Wells (1.5Ml/d)	2041	2041	1.50	1.50
Recycling (SHZ): Ashford WTW (11.8Ml/d)		2061		7.56
Recycling (SHZ): Hastings WTW (15Ml/d)	2046	2046	15.30	15.30
Recycling (KMW): Medway WTW (12.8Ml/d)	2031	2031	12.80	12.80
Recycling (KME): Sittingbourne Industrial Water recycling (7.5Ml/d)	2031	2031	7.50	7.50
Recycling (SHZ): Tunbridge Wells WTW (3.6Ml/d)	2046	Not selected	3.60	Not selected
Storage (SHZ): Raising Bewl by 0.4m (3Ml/d)	2055	2042	6.80	3.00

7.3.4 Bill impact

There is very little change between the Least Cost Plan and the Best Value Plan, consequently the impact on bills is minimal. A comparison of the best value and least-cost plan bills is shown in Table 7.9.

Table 7.9: Bill impact comparison between the BVP and LCP

		AMP8 Yr1	AMP8 Yr2	AMP8 Yr3	AMP8 Yr4	AMP8 Yr5	AMP8 Total	AMP9 Average	AMP10 Average
WRMP BVP	Totex (£m)	216.00	433.76	354.65	278.48	245.73	1,528.63	112.17	412.76
	Impact (£)	**8.15**	**20.89**	**53.18**	**74.97**	**84.57**	**241.76**	**109.71**	**146.87**
WRMP LCP	Totex (£m)	211.81	419.97	365.55	265.47	232.70	1,495.50	115.23	398.54
	Impact (£)	**8.34**	**20.78**	**52.23**	**74.69**	**83.49**	**239.53**	**107.86**	**144.49**

7.4 Testing the plan – sensitivity analysis

7.4.1. Timing of achieving 1:500-year resilience

Our best value plan aims to achieve resilience to 1:500-year droughts by 2041. We have tested scenarios where this is achieved earlier (in 2037) and later (2052) than planned. These scenarios were tested under the least-cost settings. Key changes from the base least-cost plan are summarised in Table 7.10 and Table 7.11. Detailed investment model outputs are given in Annex 21.

As can be seen below, delaying the termination of supply-side drought options has a profound impact on the least-cost plan in the Western and Central Areas.

Table 7.10: Key changes to the base LCP results when the use of supply-side drought options is terminated after 2036

Supply area	Key changes from the base LCP
Western	• Bulk import from Havant Thicket Reservoir to Otterbourne WSW in 2037 jumps to over 85Ml/d on average across all situations under the 1:500-year DYAA scenario, compared to 22.50Ml/d in the base scenario. • The Sandown Wastewater Treatment Works recycling option has higher utilisation in this scenario in the period 2028–36 (6.77Ml/d across all situations under the 1:500-year DYAA scenario) compared to the base least-cost plan (3.04Ml/d across all situations under the 1:500-year DYAA scenario).
Central	• Bulk import from Havant Thicket Reservoir to Pulborough Water Supply Works is first required in 2037, instead of 2040.
Eastern	• The Gravesend groundwater option is first needed in 2037, instead of 2040. • The Rye groundwater option is first required in 2040, instead of 2041.

Table 7.11: Key changes to the base LCP results when the use of supply-side drought options is extended up to 2052

Supply area	Key changes from the base LCP
Western	• Recharge of Havant Thicket Reservoir from HWTWRP is only needed in situations three and six from 2052. • The first use of bulk import from Havant Thicket to Otterbourne WSW is delayed to 2036 from 2031. • The need for Romsey groundwater option is delayed to 2037 from 2032. • The earliest use of Newchurch (LGS) groundwater sources is delayed to 2040 from 2036.
Central	• The River Arun desalination option is needed in an additional situation (situation four) by 2049. The earliest selection of this option in the base least-cost plan is 2053, in situation one. • The earliest use of Petworth groundwater option is delayed to 2045 from 2052. • The earliest use of River Adur offline reservoir is pushed back to 2046 from 2042. This is option is no longer selected in situation eight but is required in situation five. With the exception of situation seven, this option is not required before 2052.
Eastern	• No significant change.

7.4.2 Optimising on social and environmental value

We also ran a scenario where we wanted to optimise the results on the social and environmental metrics outlined in Table 6.4. The results are not significantly different from the best value plan.

In the Western Area, the selection of the Woolston Wastewater Treatment Works recycling option is delayed to 2067 from 2059 in the main plan.

In the Central Area, the Horsham Wastewater Treatment Works recycling option, selected in situation two in 2055 in the best value plan is no longer selected in this scenario.

There are no material changes in the Eastern Area.

7.4.3 Optimising on resilience

Optimising on resilience metrices (Table 6.4) led to the following changes in the best value plan.

- The 45Ml/d variant of the HWTWRP recycling option is selected instead of the 60Ml/d variant in the Western Area.
- The River Arun desalination option in the Central Area is selected in one additional situation (situation two) and is first utilised in 2050 rather than 2062.
- In the Eastern Area, the Tunbridge Wells Wastewater Treatment Works recycling option is not selected in any situation under any scenario. In the best value plan, it selected in situations four, six and eight, with earliest utilisation in 2046.

7.4.4 Removing recharge to Havant Thicket Reservoir

We have also tested a scenario where there is no recharge of Havant Thicket Reservoir by recycled water from HWTWRP. Detailed outputs from the investment model are presented in Annex 21.

This results in two main changes in the Western Area.

1. The bulk import from Havant Thicket Reservoir to Otterbourne WSW is replaced by direct transfer of recycled water from HWTWRP via an environmental buffer. This option is selected from 2031 to provide up to 75Ml/d.
2. The Woolston Wastewater Treatment Works recycling option is no longer selected in situation eight, as is the case in the base least- cost plan. It is instead selected in situations one, three, five and six from 2042.

There are similarly changes in the Central Area.

1. The bulk import from Havant Thicket Reservoir to Pulborough Water Supply Works is no longer selected in all situations. It is not selected in situations three and eight under any planning scenario.
2. The maximum volume of bulk import from the Havant Thicket Reservoir to Pulborough Water Supply Works is reduced from 50Ml/d to 20Ml/d.
3. The bulk import from South East Water to Rottingdean is selected in additional situations (situations one and two) as is required as early as 2046 instead of 2063.
4. The bulk import of recycled water from Horsham Wastewater Treatment Works to Pulborough Water Supply Works is selected in situations one to six, with an earliest start date of 2048.
5. The River Adur offline reservoir is selected in situations one to eight, with an earliest start date of 2041.

The changes in Eastern Area are as follows:

1. The option to transfer recycled water from Ashford to Bewl is no longer selected. The option to transfer recycled water from Tonbridge to Bewl, with a maximum output of 5.70Ml/d is selected instead from 2057.
2. The Bexhill recycling option is selected in one additional situation (situation five).
3. An option to transfer up to 3.60Ml/d of recycled water from Tonbridge to Bewl is selected in situations three and eight, with an earliest start date of 2041.

7.4.5 Impact of revised demand forecast

For the ERP, we had assumed that we would achieve our AMP7 PCC and leakage targets in line with the WRPG. As with the rest of the UK water companies, we saw a significant increase in household demand post March 2020 during the lockdown imposed by the government to control the spread of COVID-19. We consequently increased the PCC estimate for the end of AMP7 i.e. the starting position for WRMP24, to ca. 135l/h/d in view of our 2020–21 outturn figures and the trend at the start of the 2021–22 reporting period. This was done to avoid starting the WRMP24 planning period with an overly optimistic view of the supply-demand balance.

While our PCC figures continue to be higher than pre COVID-19 levels, the lifting of restrictions in the latter part of 2021 resulted in our 2021–22 out-turn figure being much lower than forecast earlier. We have subsequently revised our 2024–25 PCC forecast to ca. 129l/h/d which is still higher than our 2019–20 PCC figure. It was however too late for it to be incorporated in the regional draft plan and run the full suite of models needed for decision making as described in Section 7.1. We therefore decided to run it as a sensitivity analysis at this stage. We will continue to monitor our PCC trend over the coming months to ensure that we use the most up to date figures for the final WRMP24.

We used the revised draft forecast in the ‘least cost’ setting. The following sections provide a comparison of the results with both the LCP and BVP and the LCP with Revised Demand Forecast (LCP-RDF). The greatest change is in the Eastern Area where the LCP-RDF does not select some of the water recycling options that are selected in either the LCP or the BVP.

Table 7.12: Comparison of the LCP-RDF with both BVP with LCP in terms of first utilisation of key supply options in the Western Area (differences highlighted)

Option	First utilised – BVP	First utilised – LCP	First utilised – LCP-RDF (Ml/d)
Recycling (HSE): Hampshire Water Transfer and Water Recycling Project 45Ml/d)	Not selected	2031	Not selected
Recycling: (HSE): Hampshire Water Transfer and Water Recycling Project (60Ml/d)	2031	Not selected	2031
Bulk import (HSE): PWC to Otterbourne WSW (21Ml/d)	2030	2030	2030
Bulk import (HSE): PWC to Eastleigh WSR (24Ml/d)	2026	2026	2026
Bulk import (HSW): Thames to Southern Transfer	2040	2040	2041
Groundwater (HKZ): Newbury (1.3Ml/d)	2028	2028	2028
Groundwater (HRZ): Romsey (4.8Ml/d)	2032	2032	2032
Groundwater (HSW): Test MAR (5.5Ml/d)	2041	2041	2040
Groundwater (IOW): Newbury (LGS) (1.9Ml/d)	2035	2031	2037
Groundwater (IOW): Eastern Yar3 (1.5Ml/d)	2040	2040	2040
Recycling (HSW): Woolston WTW (7.1Ml/d)	2059	2062	2042
Recycling (IOW): Sandown WTW (8.1Ml/d)	2028	2028	2028

Western Area

The key changes in the Western Area outputs are as follows (Table 7.12):

1. The LCP-RDF differs from the main LCP in that it selects high demand management strategy in all WRZs. It also achieves T100 by 2040.
2. It selects a 60Ml/d WRP for the HWTWRP in line with the BVP although it is selecting a 150Mm^3 capacity SESRO as is the case in LCP.
3. T2ST is selected is first selected in 2041 instead of 2040 as is the case in the LCP and BVP; however, it is only required in three situations (1, 4 and 7) and the 120Ml/d import volume is only required under Situation 1. Maximum import under situations 4 and 7 is limited to 80Ml/d.
4. The Test MAR groundwater option is selected a year earlier in 2040 compared to LCP and BVP.
5. The Newbury groundwater option is selected later (in 2037) compared to both LCP and BVP.
6. The Woolston WTW recycling option is selected earlier (2042) than in LCP and BVP. However, it is selected in Situation 7 whereas in the BVP it is selected in Situation 2 and in Situation 8 in the LCP.

Table 7.13: Comparison of the LCP-RDF with BVP and LCP in terms of key supply options in the Central Area (differences highlighted)

Option	First utilised – BVP	First utilised – LCP	First utilised – LCP RDF
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough WSW (50Ml/d)	2040	2040	2040
Bulk import (SNZ): PWC to Pulborough WSW (15Ml/d)	2026	2026	2026
Bulk import (SNZ): SES to SNZ	2031	2031	2031
Bulk import (SNZ): SEW to Pulborough	2031	2031	2031
Bulk import (SBZ): SEW to Rottingdean	Not selected	2063	2046
Desalination (SBZ): Sussex Coast	2028	2028	2028
Desalination (SNZ): Tidal River Arun	2062	2053	Not selected
Groundwater (SWZ): Pulborough Winter Transfer Stage 1 (2Ml/d)	2031	2031	2040
Groundwater (SNZ): Petworth (4Ml/d)	2044	2040	2040
Recycling: Littlehampton WTW (15Ml/d)	2028	2028	2028
Recycling (SNZ): Horsham WTW (6.8Ml/d)	2055	Not selected	Not selected
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2045	2042	2042
Storage (SNZ): Western Rother licence change and farm storage (2Ml/d)	2040	2040	2040

Central Area

In the Central Area, the LCP-RDF differs from the BVP and LCP in the following aspects (Table 7.13):

1. It selects the bulk import from SEW to Rottingdean in 2046 under Situation 1. This option is selected in the LCP in 2063 for Situation 4 and not at all in the BVP.
2. It does not select the River Arun desalination option.
3. It delays the use of Pulborough groundwater option to 2041. Both the LCP and BVP require this option in 2031.
4. It requires the Petworth groundwater source in 2042 line with the LCP.
5. It does not select the Horsham WTW recycling option that is required in the BVP.
6. It selects the River Adur Offline Reservoir option in 2042 as the case in the LCP. This option is selected in 2045 in the BVP.

Table 7.14: Comparison of the LCP-RDF with BVP and LCP in terms of key supply options in the Eastern Area (differences highlighted)

Option	First utilised – BVP	First utilised – LCP	Max output – BVP (Ml/d)
Bulk import (KTZ): SEW Canterbury to Near Canterbury	2050	2050	2050
Bulk import (KTZ): SEW to Near Canterbury (2Ml/d)	2026	2026	2026
Bulk import (SHZ): SEW RZ8 to Rye WSW	2065	2070	2051
Desalination (KTZ): East Thanet	2041	2041	2041
Desalination (KME): Isle of Sheppey	2049	2051	2051
Desalination (KMW): Thames Estuary	2040	2040	2040
Groundwater (KME): Gravesend (2.7Ml/d)	2040	2040	2040
Groundwater (SHZ): Rye Wells (1.5Ml/d)	2041	2041	2041
Recycling (SHZ): Ashford WTW (11.8Ml/d)	Not selected	2061	Not selected
Recycling (SHZ): Hastings WTW (15Ml/d)	2046	2046	2055
Recycling (KMW): Medway WTW (12.8Ml/d)	2031	2031	2031
Recycling (KME): Sittingbourne Industrial Water recycling (7.5Ml/d)	2031	2031	Not selected
Recycling (SHZ): Tunbridge Wells WTW recycling (3.6Ml/d)	2046	Not selected	Not selected
Storage (SHZ): Raising Bewl by 0.4m (3Ml/d)	2055	2042	2042

Eastern Area

The most significant change in the Eastern Area is that the LCP-RDF does not select the Sittingbourne Industrial Reuse option which is selected in 2031 in both the LCP and BVP. In other changes (Table 7.14):

1. It selects the bulk import from SEW RZ8 into Rye WSW much earlier (2051) than in the BVP (2065) and LCP (2070).
2. It selects the Isle of Sheppey desalination option in 2051 in line with the LCP.
3. It does not select the Ashford WTW recycling option that is selected in the LCP.
4. It selects the Hastings WTW recycling option much later (2055) than the BVP and LCP (2046).
5. It does not select the Tunbridge Wells recycling option that is selected in the BVP.
6. It selects the option of raising Bewl by 0.4m in 2042 like in the LCP but unlike the LCP it does not utilise it under situations 1 and 3. It utilises it in Situation 8 instead.

7.5 Summary of the 'no regrets' plan

Options selected in the best value plan fall into three main categories:

1. Options that are selected in all situations, under all planning scenarios.
2. Options are selected in multiple, but not all, situations and/or planning scenarios. 3. Options selected in a single situation and/or planning scenarios.

In selecting a 'no regrets' plan up to 2040, we have selected all options that fall into category one. From category two, we have selected those options that are required in most situations and planning scenarios. We have not selected any option from category three, as they generally appear very late in the planning period.

As result we have excluded the following options from Table 7.1 the Western Area:

- Eastern Yar3 groundwater option that is selected in 2040 under NYAA conditions only. In some of the situations under the NYAA scenario, the Sandown Wastewater Treatment Works recycling option is not utilised to maximum capacity. In these situations, using Sandown to full capacity can partly or fully cover the deployable output provided by the Eastern Yar3 groundwater option (1.5Ml/d).
- Woolston Wastewater Treatment Works recycling option that is only selected in situation two in 2059.

Table 7.15: Options to be either delivered or investigated over the next 10 years

	Delivery Year
Western Area	
Demand management (PCC and leakage reduction) – plan and deliver	2026
Bulk import (HSE): PWC to Eastleigh WSR (24Ml/d) – deliver	2026
Inter-zonal transfer (HRZ-HSW): Romsey Town and Broadlands – deliver	2026
Inter-zonal transfer (HRZ-HSE): Abbotswood – deliver	2026
Catchment management – deliver	2027
Groundwater (HKZ): Newbury (1.3Ml/d) – deliver	2028
Inter-zonal transfer (HSW-HSE): Southampton Link Main bidirectional – deliver	2028
Inter-zonal transfer (HAZ-HWZ): Hampshire Grid (HAZ-HWZ) bidirectional – deliver	2028
Inter-zonal transfer (HWZ-HSE): Hampshire Grid (HWZ-HSE) bidirectional – deliver	2028
Recycling (IOW): Sandown WTW (8.1Ml/d) – deliver	2028
Bulk import (HSE): PWC to Otterbourne WSW (21Ml/d) – deliver	2030
Inter-zonal transfer (HSE-HWZ): Olivers Battery	
Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (60Ml/d) – deliver	2031
Treatment capacity (HSE): Upgrade Otterbourne WSW (30Ml/d) – deliver	2031
Treatment capacity (HSW): Upgrade River Test WSW (60Ml/d) – deliver	2031
Groundwater (HRZ): Romsey (4.8Ml/d) – investigate	2032
Groundwater (IOW): Newchurch (LGS) (1.9Ml/d) – investigate	2035
Bulk import (HSE): Thames to Southern Transfer (120Ml/d) – plan for delivery	2040

Table 7.15: Options to be either delivered or investigated over the next 10 years continued

	Delivery Year
Central Area	
Demand management (PCC and leakage reduction) – plan and deliver	2026
Inter-zonal transfer (SNZ-SWZ): Rock Road bidirectional transfer – plan and deliver	2026
Inter-zonal transfer (SWZ-SBZ): Trunk main at v6 valve – plan and deliver	2026
Desalination (SBZ): Sussex Coast (modular) – deliver	2028
Recycling (SNZ): Littlehampton WTW (15Ml/d) – deliver	2028
Inter-zonal transfer (SWZ-SBZ): Pulborough Winter Transfer Stage 2 (4Ml/d) – investigate and deliver	2028
Bulk import (SNZ): SES to SNZ (10Ml/d) – investigate and deliver	2031
Bulk import (SNZ): SEW to Pulborough WSW (10Ml/d) – investigate and deliver	2031
Groundwater (SNZ): Pulborough Winter Transfer Stage 1 (2Ml/d) – investigate and deliver	2031
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough WSW (50Ml/d) – investigate and plan	2040
Eastern Area	
Demand management (PCC and leakage reduction) – plan and deliver	2026
Bulk import (KTZ): SEW to Near Canterbury – deliver	2026
Inter-zonal transfer (KME-KTZ): Utilise full existing transfer capacity between KME and KTZ – deliver	2028
Recycling (KMW): Medway WTW (12.8Ml/d) – deliver	2031
Recycling (KME): Sittingbourne Industrial Water recycling (7.5Ml/d) – investigate and deliver	2031
Desalination (KMW): Thames Estuary – investigate and plan	2040
Desalination (KTZ): East Thanet – investigate and plan	2041

Options excluded from the Central Area are as follows:

- Horsham Wastewater Treatment Works recycling option is first selected in 2055 and is only utilised in situation two.
- Western Rother licence change and farm storage option (up to 2Ml/d) that is first selected in 2040. With the exception of NYAA scenario, its utilisation in other planning scenarios is less than 0.2Ml/d.

The following option is excluded from the Eastern Area:

- Tunbridge Wells Wastewater Treatment Works recycling option. This option is in situations four (2046), six (2067) and eight (2062) to provide up to 3.60Ml/d. It is not selected in any situation under the 1:500-year DYCP scenario. The option to raise Bewl by 0.4m provides 3.00Ml/d and is first needed in 2042. It is not selected in situations that the Tunbridge Wells recycling option is needed. Therefore, if Bewl is raised by 0.4m in 2042, it would cover most of the deployable output provided by the Tunbridge Wells option in all situations.

Table 7.15 lists the options that we will be either planning to deliver or investigating for delivery over the next 10 years.

8. Environmental assessments

In developing our draft WRMP24, we have considered environmental constraints with reference to statutory environmental requirements, national legislation and guidance. We have engaged with our environmental regulators (the EA and Natural England) on our environmental and social assessment approach. We have also engaged with them on our findings. Feedback informed our ongoing assessments, requiring us to reject or modify options to consider environmental concerns or opportunities. The statutory processes that we follow are set out in Figure 8.1.

Figure 8.1: Statutory environmental requirements – Habitats Regulations[1] Assessment, Strategic Environmental Assessment[2] and Water Framework Directive[3] Assessment

Strategic Environmental Assessment

Beneficial and adverse effects of each option and strategy are assessed against a broad range of environmental and social topics (e.g. biodiversity, heritage, health).

Habitats Regulations Assessment

Will the option or strategy adversely affect any European designated conservation sites?

Water Framework Directive Assessment

Will the option or strategy lead to adverse effects on the biology and chemistry of water bodies or their physical characteristics?

8.1 Strategic Environmental Assessment (SEA)

The SEA Regulations require an assessment of the likely significant environmental effects of the draft WRMP24. The assessment can help identify ways in which adverse effects can be avoided, minimised or mitigated and how any positive effects can be enhanced.

The purposes of the SEA of the draft WRMP24 are to:

- identify, describe and evaluate the likely significant environmental effects of the constrained and preferred options for water resource management;
- help identify appropriate measures to avoid, reduce or manage adverse effects and to enhance beneficial effects of the draft WRMP24 wherever possible;
- support consultation of the draft WRMP24, and
- inform the selection of measures to be taken forward into the final WRMP24.

Reflecting the integrated approach to the development of the Regional Plan and WRMPs and working with WRSE, a regional wide approach was developed, consulted upon, revised and applied. This has meant we have used a common, compliant and regionally consistent SEA methodology.

The SEA has assessed the effects of each of the 318 constrained water resource options developed to address the forecast deficits across our 14 water resource zones. Each option has been assessed to identify the likely significant environmental effects during both construction/implementation and operation. The options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. As would be expected given the wide range of water resource options considered, a diverse range of effects have been identified. Likely significant effects have been identified for SEA topics including biodiversity, flora and fauna, landscape, population and human health, with effects on designated sites and features a key determinant.

[1] The Conservation of Habitats and Species Regulations 2017
[2] The Environmental Assessment of Plans and Programmes Regulations 2004
[3] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

The findings of the completed individual option SEA were used as part of the more detailed option screening, informing the selection of the preferred options. Following evaluation, we selected 122 preferred supply options as well as demand management and leakage options for inclusion in our best value draft WRMP24.

The SEA has then assessed the environmental effects of the preferred options and preferred programme. This has included consideration of the cumulative, secondary and synergistic effects.

Overall, the draft WRMP24 is assessed as providing a mix of significant positive and negative effects across several of the SEA assessment topics including biodiversity, flora and fauna, water, landscape and population and human health. The preferred programme of options will cumulatively support increased water efficiency, leakage reduction and ensure the sustainable provision of affordable potable water. This would improve resilience and adaptability to the effects of climate change, support population and economic growth, contribute towards delivering reliable and resilient water supplies.

Where negative effects have been identified, generally, these are expected to be either minor or moderate only, although uncertainties remain. The exceptions to this are in respect of biodiversity, climatic factors, landscape and population. The operation of three drought order options (integrated from our revised draft Drought Plan 2022) has been identified as having a likely significant effect on biodiversity. For these options, a programme of mitigation and monitoring has been agreed with the Environment Agency and Natural England. In respect of climatic factors, significant quantities of embodied carbon are associated with the construction materials used for the desalination options. However, whilst such effects are to an extent unavoidable, as they are associated with all large-scale infrastructure proposals, mitigation measures have been identified including the completion of a carbon footprint study that considers the opportunities for use of low and net zero carbon energy materials (linked to our Net Zero Plan). The siting and operation of one option within a National Park has led to the identification of a significant effect in respect of landscape with further mitigation measures to be considered concerning siting, design, materials, landscaping and screening. A potential negative effect is identified against options involving non-essential use bans, as there are potential economic impacts on businesses that benefit directly or indirectly from certain water uses. Detailed mitigation and enhancement measures have been identified to help avoid, minimise, reduce or mitigate effects where identified.

8.2 Habitats Regulation Assessment (HRA)

The Habitat Regulations require the assessment of the potential impacts of plans and programmes on the Natura 2000 network of European protected sites in a process is known as Habitats Regulations Assessment (HRA). The HRA determines whether there will be any ‘likely significant effects’ of a WRMP on any European site as a result of a plan’s implementation (either on its own or ‘in combination’ with other plans or projects) and, if so, whether these effects will result in any adverse effects on the site’s integrity.

For each option (or group of options, as appropriate), the assessment comprises:

- a 'screening’ of European sites within the study area to identify those sites and features where there will self-evidently be ‘no effect’, ‘no likely significant effects’, or positive effects due to the option, and those where significant effects are likely or uncertain; and
- an ‘appropriate assessment’ of any European sites where significant effects cannot be excluded (this may include ‘down-the-line’ deferral of some options in accordance with established HRA practice, where appropriate).

The conservation objectives are taken into account at the screening and appropriate assessment stages as necessary.

The HRA screening is precautionary, and to be compliant with case law, does not take into account the effects of mitigation measures. In consequence, the majority of options needed to be screened for the more detailed appropriate assessment as significant effects were considered either likely or uncertain for a range of European sites. However, once the appropriate assessment was able to take into account the nature of the options and the potential for mitigation through scheme design and delivery, the HRA concluded that the WRMP24 options would not have an adverse effect on the integrity of any European protected site (and Ramsar sites), alone or in combination. However, it is recognised that there are some residual uncertainties associated with some options due to the absence of detailed design and the long planning horizon for delivery. In these instances, this does provide substantial time for any residual uncertainties associated with these options to be resolved and (if necessary) the option set aside and replaced in future WRMP cycles.

The HRA of the draft WRMP24 provides a strategic, plan-level assessment to support the WRMP. It is not an application-specific ("project" level) assessment. A more detailed, project-level HRA (with Stage 2 Appropriate Assessment where required) will be needed to support any actual planning application and environmental permit or consent.

8.3 Water Framework Directive (WFD) Assessment

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 sets a default objective for all rivers, lakes, estuaries, groundwater and coastal water bodies to achieve 'good' status or potential by 2027 at the latest. The current (baseline) status (e.g., 2015 classification), and the measures required to achieve the 2027 status objective, are set out for each water body in the relevant River Basin Management Plans (RBMPs), prepared by the EA and NRW every six years.

We must be able to demonstrate that the WRMP24 will not cause a deterioration in respect of these baseline conditions. Furthermore, for those water bodies that are not currently attaining good status, we must be able to confirm that it would not preclude the delivery of measures to facilitate the improvements needed to attain good status.

In line with WRPG (2022) and UKWIR (2021) guidance, the principal WFD Assessment Objectives that the WRMP (both revised feasible options and preferred option programmes) has been tested against are:

- To prevent deterioration of any WFD element of any water body – in line with Regulation 13(2)a and 13(5)a[4].
- To prevent the introduction of impediments to the attainment of 'Good' WFD status or potential for any water body in line with Regulation 13(2)b and 13(5)c[5].
- To ensure that the planned programme of water body measures in RBMP2 to protect and enhance the status of water bodies are not compromised.

If an option has been assessed to definitively not comply with the WFD Assessment Objectives set out above, then the option has been reported as WFD non-compliant and removed from the WRMP process.

If an option is assessed to potentially not comply with the WFD Assessment Objectives set out above, then the option has been reported as 'potentially WFD non-compliant'. If an option is reported as 'potentially WFD non-compliant' it may remain in the WRMP process as it may be appropriate to consider the option further where it is considered that additional evidence to improve confidence in the assessment and/or enhanced design could mitigate the potentially WFD non-compliant issues.

The WFD assessment has concluded that the majority of the supply options contained in our preferred plan would be compliant with the WFD requirements. The WFD assessment did identify that 19 options were anticipated to be potentially non-compliant (with low confidence) relating to the potential for impacts on water quality and, in some cases flow (where discharge is to a river) or change to the groundwater abstraction regime. These options include some groundwater sources, a reservoir and all of the desalination and effluent re-use schemes.

These conclusions are provisional and reflect relatively precautionary assessments. For all options, further evidence and assessment is required, and is being progressed through the programme of work to reduce delivery risk as well as programmes to support the Hampshire Water Transfer and Water Recycling Project (HWTWRP) SRO. Given the significant lead in time for some options, it is considered to provide an adequate period with which to conclude such investigations.

If after the completion of the further work, a conclusion of potential non-compliance remains, we will then review the potential to use alternative water resource options. In this regard, given that 193 of the original constrained options were assessed as being WFD compliant, we are confident that we have a range of alternative options that are considered to be viable and potentially deliverable if required.

[4] The no deterioration baseline for each water body and element is the status reported in the RBMP. At present this is RBMP 2.

[5] WRPG (2022) states that this a test to identify any options that 'prevent the achievement of the water body status objectives in the river basin management plan'. At present this is RBMP2.

8.4 Next steps

Following consultation, we will review the proposed options and once the final WRMP24 has been published, the selected schemes for water resource management will need to be implemented through specific projects. As part of this process, further study, investigations and assessment will be undertaken to understand and manage the potential environmental and social impacts. These assessments, which may include EIA and project-level HRA, will take account of the issues identified but will also be informed by the greater detail available as the work progresses about option design, siting and pipeline routing, construction methods and scheme operation. All will be supported by active engagement with the relevant regulators.

Further details are provided in the SEA Environmental Report, HRA Report and WFD Technical Note (Annexes 18-20).

9. Delivery risk and contingency

9.1 Scheme delivery assessment

Management of the delivery risks of schemes within our plan is essential if we are to meet our objectives of achieving a supply-demand balance, delivering schemes on time and getting value for money. We identified 19 water supply scheme options to review in terms of their delivery risks and potential mitigations. These options were chosen because of their scale, timing and technical complexity and included desalination plants, water recycling and significant storage and transfer schemes. We have not reviewed simple pipelines or boreholes for delivery risk as they are less complex. The options considered were:

- East Thanet desalination (up to 20Ml/d)
- East Thanet desalination (up to 40Ml/d)
- Thames Estuary desalination (up to 20Ml/d)
- Thames Estuary desalination (up to 40Ml/d)
- Isle of Sheppey desalination (up to 20Ml/d)
- Isle of Sheppey desalination (up to 40Ml/d)
- Ashford recycling to Bewl Water reservoir (12Ml/d)
- Hastings recycled water to Darwell (15Ml/d)
- Sittingbourne Industrial Water recycling (7.5Ml/d)
- Motney Hill recycling (19Ml/d)
- River Adur Offline reservoir
- Sussex Coast desalination (up to 40Ml/d)
- Tidal River Arun desalination (up to 20Ml/d)
- Tidal River Arun desalination (up to 40Ml/d)
- Pipeline from Havant Thicket reservoir to Pulborough WSW (up to 50Ml/d)
- Littlehampton recycling into Church Farm (17Ml/d)
- Horsham recycling into Church Farm (7Ml/d)
- Combined Woolston and Portswood recycling (17Ml/d)
- Woolston WTW recycling (5Ml/d)

We asked ourselves the following questions about each scheme:

- What are the delivery risks associated with the option and what mitigations do we need to develop?
- What is the earliest year that the option can be available? 2030 would mean the option will be available from 2029–30 (from 01/04/2029).
- Are the high-level design and the associated assumptions appropriate?
- Can the capacity of the option be increased? If yes, then:
  - What is the maximum capacity?
  - Can it be increased in a modular fashion?

Ten of these projects have been identified as lower delivery risk in their current form. Five projects were identified as high risk, based on the current information we have available. The assessment has identified what further work is required in order to reduce the delivery risk associated with these projects. The remaining four projects were medium delivery risk. For all projects the review identified the need for a significant amount of early pre-planning work and enabling studies, which we are adding to the programme. Our delivery risk review identified challenges that we will need to address related to:

- **Implementation:** This could include aspects related to costs, time, regulatory and stakeholder obstacles, commercial factors as well as physical constraints. Examples of pre-planning activities we will need to undertake include:
  - Stakeholder engagement and consultations on issues related to land acquisition, raw water abstraction, waste discharge, customer acceptability of recycled water into supply.
  - Assessment of scheme design to align with Net Zero, BNG, ENG and social value goals.
  - Assessment of appropriate technology e.g. membranes to be used at plants.
  - Assessment of conjunctive use benefits (in the case of reservoirs).
- **Engineering and network integration:** Process, MEICA, civil engineering and network connectivity challenges. Examples of pre-planning activities we will need to undertake includes:
  - Water quality sampling of sources and baselining for consideration in design.
  - Intake and outfall screening and pipe configurations.

  - Detailed site locations and assessments.
  - Integration of the strategic network to new schemes.
  - Plant power supply and grid/network capacity.
- **Enabling challenges:** Specific identifiable environmental, planning and estates issues. Examples of pre-planning activities we will need to undertake includes:
  - Project level EIA and Environmental Statements.
  - Project level SEA, HRA, WFD risk assessments.
  - Baseline surveys of the current environmental conditions, possibly over multiple years.
  - Investigations on the impact of any new discharge in conjunction with the Environmental Quality Standards (EQS).
  - Collection of environmental baseline data.
  - Archaeological risk assessments.

Early engagement and consultations with stakeholders will be critical across all schemes to inform our understanding of the project's risks, to make sure everyone is aligned on intended outcomes and benefits, and to ensure projects can be delivered on time.

9.2 Contingency plan

The government's expectations for water resource planning, which accompanied the WRMP Direction 2022, recognise the challenge of WRMP scheme delivery. It states a WRMP **"should include appropriate costed mitigation for delivery risks and adaptive pathways with identified decision-points, should be used to show how risks are managed and sustainable water supplies are secured"**.

Annex 22 sets out our approach to mitigating delivery risk through contingency planning. This approach compliments existing risk management processes for the Drought Plan and Emergency Plan. To accompany this draft WRMP24 submission we have developed a contingency plan for our Central Area and propose to extend this to cover the Eastern and Western Areas in the next iteration of the plan, following feedback on our draft plan.

The key purpose of the contingency plan is to mitigate for any risks around the benefit and timing of delivery of schemes in the short term. Where this could have an impact upon the supply-demand balance, and potentially security of supply, it is important that options can be quickly implemented to ensure a supply-demand deficit situation does not occur. The plan we have included in Annex 22 covers the risk of deficits occurring during the period from 2023–30. This covers the remainder of the current, and the next, five-year scheme delivery period (AMP7 and AMP8).

The contingency plan we have developed for the Central Area includes a summary of the risks to scheme benefit, and delivery year, during the 2023–30 period. We have also captured risks associated with our supply and demand forecasts, as this can be another driver for needing to implement short-term contingency options.

In developing contingency options, we have considered the characteristic of each WRZ, for example network connectivity and types of resources available, as this can influence the adaptability of the WRZ to manage supply-demand risk and the choice of options available.

Options for the contingency plan have been grouped into three types: resource, production and network. A fourth option type, not addressed in the contingency plan, is demand management.

This type of option covers leakage reduction and water efficiency savings under the T100 reductions, metering and intelligent network. We have considered these options types separately because the delivery risks and potential options to accelerate delivery of our water efficiency and leakage programmes. This option type is considered as part of our wider demand management and leakage strategy, discussed further in Annexes 15–17.

All contingency options provided in the plan will require further assessment of their deliverability, benefit, complexity and expense. They will also need to be developed to determine any associated risks and uncertainties.

9.3 Short-Term Drought Schemes

For our plan to be compliant and meet our statutory supply duties it cannot contain any supply-demand deficits in any final planning scenarios, in any WRZ and in any year of the planning period (2023–75).

The initial version of the regional plan based upon our updated supply and demand forecasts, and developed with WRSE, identified deficits in a number of zones SBZ and HSE WRZs that could not be closed during the first few years of the planning period from 2025 to 2029. To address this, we developed and agreed with WRSE to include Short-Term Drought Schemes and to allow the regional plan to select these, where required.

The latest LCP and BVP are selecting the Short-Term Drought Schemes in both HSE (up to 5Ml/d) and SBZ (up to 10Ml/d) in years up to 2028–29 to ensure there are no supply-demand deficits.

We will be revising both the regional plan and our WRMP, with a revised demand forecast based upon updated latest outturn demand data, through the next iteration of the plan. This is expected to reduce the need for the Short-Term Drought Schemes because the demand forecast will be lower than the current forecast which our BVP is based upon.

For this plan we have taken a conservative approach and detailed the activities, costs, and benefits of the Short-Term Drought Schemes needed to ensure a supply-demand balance based on current forecasts.

Table 9.1 sets out the options that have been developed as Short-Term Drought Scheme. The actions identified would meet the current supply-demand need should this conservative scenario materialise.

We intend to further refine the benefit and costs of these Short-Term Drought Schemes to address any deficits which may still exist after we have revised any assumptions, as necessary, for the revised draft regional plan and WRMP. It is our aim to reduce and ideally remove the need for these schemes in the next iteration of the plan.

Table 9.1: Our planned activities which comprise the Short-Term Drought Schemes

Area	WRZ	Maximum Potential Deficit/Need	When	Actions to mitigate		Benefit [Ml/d]	Source
Western	HSE	5.25Ml/d	2028, DYAA	Resources	Implementation of small operational schemes	up to 43	Table 4 + annex 22
				Demand	Overprovision of demand options included in T100 plan in 2028	1.5	See risk provision in Table 5 for T100
					Early delivery of AMP8 products and services programme	1.2	Table 5 (2035 vs 2028 target)
				Leakage	Acceleration of 2030 target to 2027	0.25	See Annex 17
				Total		**>5Ml/d**	
Central	SBZ	10.18 Ml/d	2026, DYAA	Resources	5 operational schemes from existing sources	Up to 10	See Annex 22 on contingency schemes
				Demand	Overprovision of demand options included in T100 plan in 2026	Up to 1.4	See risk provision in Table 5 for T100
				Leakage	–	–	–
				Total		**>10Ml/d**	

10. Greenhouse gas emissions

Greenhouse gas emissions are driving climate change and need to be effectively mitigated. We recognise that the water sector is a significant contributor to the UK's greenhouse gas emissions and that we have an important role to play in supporting the realisation of both sector wide and government net zero targets and commitments.

We have already made sizeable progress in reducing our emissions over the last decade. Our net operational greenhouse gas impact was 91 ktCO_2e in 2020–21, down from 289 ktCO_2e in 2010–11. However, we recognise that we need to sustain and build on this progress to reach net zero carbon.

Greenhouse gas impacts have been central to our decision-making process in WRMP24. Throughout our appraisal of options, we have considered the carbon equivalent impact of a range of different initiatives. We have also looked at how we can reduce both our direct and indirect emissions through the plan. We have taken a whole life approach that considers both the embodied and operational carbon equivalent (CO_2e) impact of each option, prioritising those that can deliver long-term environmental and societal benefits.

10.1 Costing greenhouse gas emissions in WRMP24

Since WRMP19, we have enhanced our approach to modelling, assessing and costing the greenhouse gas impact of the options proposed in our strategy. The SEA specifically considers the emissions impact, which informs the overall appraisal of the feasible options.

10.1.1 Carbon costs

Capital carbon

Capital carbon refers to carbon equivalent emissions associated with the construction of assets, such as buildings and infrastructure. This applies to both new assets and significant upgrades and maintenance of existing assets. Our assessment estimates the carbon equivalent emissions from cradle-to-built-assets and includes equipment manufacture, transport to site and construction emissions. The capital carbon assessment is based on scoping information from our CIT costing sheets.

Analogous to cost models, the carbon models are based on curves created from data points, relating a driver that defines the size of the asset to the carbon emissions.

Where possible, models representing complete assets ('plant group') were used. These include assumptions on all civil, mechanical, and electrical items associated with a process or assets, including ancillaries such as inter-process pipework. These models are based on reference designs for different processes and 'complex' assets which combine multiple equipment items. These provide a representative level of emissions for that type of asset.

The results from this analysis are not intended as a final assessment of the capital carbon emissions associated with each scheme but serve as representative estimates based on standard design practice. As options are developed further, a more detailed appraisal of overall construction emissions will be required. This will be based on bills of quantities for each of the scheme options and preferred material suppliers.

Where a carbon model does not already exist for a particular asset, in some cases we have developed one and included it in the final carbon assessment results. In cases where it has not been possible to develop a bespoke carbon model, or the carbon impact is likely minor, we have allowed for uncertainty regarding unmodelled items and included this within an uplift, based on engineering judgment.

The following approach was used to complete the carbon assessment:

- We mapped each cost model to a Mott MacDonald UK Water carbon model, using the cost model name and scoping comments in the first instance, and reviewed with the costing and scoping teams where unclear.
- Where the sizing driver of the carbon model matched the sizing information provided for the costing, we used these directly in the carbon assessment.
- Where the sizing drivers were not aligned, we made assumptions to either convert the scoping information to a valid input for the carbon model or used alternative site information. In most cases, the carbon models relate to process flow and we derived this sizing information from the process flow diagrams developed for the options.

Where a cost model was not used, we produced a bottom-up carbon assessment using the descriptive information available in the CIT costing. For example, we built up emissions estimates for reservoir schemes using a combination of emissions factors for excavation, stockpiling and filling.

A complete list of assumptions used in the development of the carbon assessments can be found in the 'model mapping' tab in the carbon calculations spreadsheets. Due to differences in assumptions between different option types, carbon calculations are grouped into:

- desalination schemes
- water recycling schemes
- transfers and borehole rehabilitation
- reservoirs
- asset enhancement.

We applied an uplift to the total capital carbon estimates to account for likely additional components that have not been captured in the carbon estimate, that are unknown at this point. These components are likely to be miscellaneous pumping stations, valves, ICA systems and transformers, which will form a relatively small proportion of the total capital carbon estimates.

For pipeline and borehole rehabilitation and asset enhancement schemes, we applied an uplift of 10% to account for unmodelled assets. For the desalination and water recycling options, we applied a larger uplift of 20% to reflect the lower certainty in the modelled scope due to the complexity of these schemes. We also used an uplift of 20% for the reservoir options due to the uncertainty in earthworks emissions factors, which dominate the total emissions profile.

In addition to uncertainty in the modelled scope, there is uncertainty around the assumed emissions factors which represent industry averages and are calculated based on a set of assumptions. Therefore, these factors may not reflect real world scenarios or specific products that are used in each scheme. Mott MacDonald Carbon Portal water models are built using industry standard databases for emissions factors. The primary aim of carbon emissions estimates is to facilitate a comparison between design options, rather than to provide a highly precise estimate of the emissions specific to the final design. Therefore, no additional allowance or confidence range has been applied to account for the emissions factor uncertainty.

Operational carbon

Operational carbon equivalent emissions estimates are based on the operational regime assumed for OPEX calculations. Operational carbon emissions are associated with the variable use of electricity, chemicals and transport fuels. Fixed operational costs associated with staffing and operational maintenance have a negligible carbon impact. Capital replacement is not included in the operational carbon calculations. Our approach to operational carbon calculations is as follows:

- **Electricity:** We calculated carbon emissions associated with electricity use separately based on the kWh values in the WRSE options database to ensure consistency of assumptions across water companies.
- **Chemicals:** we applied emissions factors based on industry standards. We calculated chemical volumes using the OPEX calculations.
- **Transport fuels:** we applied emissions factors based on industry standards.
- **Operational maintenance visits to site:** we assumed 15 miles per journey (round trip) in a class I diesel van (<1.305t).
- **Sludge disposal:** we assumed 50 miles per journey (round trip) in an articulated diesel lorry (33t) that can transport approximately 28m^3 of contents.
- **Screening collection and disposal:** we assumed 50 miles per journey (round trip), transported by skip. We assumed that a standard 18-tonne skip lorry can transport one eight-yard (roughly 6.12m^3) skip of heavy waste.
- **Emissions associated with operational staff and operational maintenance:** we assumed negligible.
- Operational carbon calculations are available in the 'operational carbon' part of the OPEX estimate calculations and we have included scheme specific outputs in the option fact files (Annex 13).

10.2 Calculating the carbon cost for our strategy

The calculation of emissions for the options in the strategy was as follows:

- The WRSE IVM included a list of prioritised options, with the year first selected (the start of construction) in each of nine situations and weighted utilisation of each option profiled by year over the modelled time horizon.
- Embodied carbon is calculated by applying the embodied emissions in the options database from the date the option is selected to start implementation. As assets are renewed over their life, replacement embodied carbon is incurred. This is calculated by proportioning embodied carbon to the CAPEX asset categories that include a repeat period.
- Carbon from fixed electricity is calculated from the date an option is operational by multiplying the kWh/yr of fixed electricity by the emissions factor for the year (tCO_2e/kWh). The calculation for variable electricity is similar except it is also multiplied by the utilisation (in Ml/d) and 365 (the number of days per year). We used emissions factors from the Treasury's Green Book (Department for Business, Energy and Industrial Strategy, 2021a) which account for a progressive fall in the carbon intensity of grid electricity over time as the deployment of sources of renewable electricity generation is scaled up.
- Operating carbon in the options database is applied from the date an option is operational. The calculation for variable operating carbon is similar except it is also multiplied by the utilisation and 365 (the number of days per year).

10.3 Greenhouse gas emissions for our proposed strategy

Following appraisal of all feasible options, we estimated the carbon equivalent impact of our WRMP24 strategy. The total greenhouse gas emissions for the 125 options included in our final plan between 2025 and 2075 is 3,298,472 tCO_2e. Table 10.1 summarises the total carbon equivalent emissions by option type, assuming utilisation of each option at full capacity.

The average annual emissions associated with the plan between 2025–75 (assuming that all options are utilised at full capacity) is 65,969 tCO_2e including electricity carbon and 55,368 tCO_2e excluding electricity carbon.

Based on utilisation in an average year, rather than maximum utilisation, the total operational carbon equivalent impact of the plan between 2025 and 2075 is 1,202,657 tCO_2e. The embodied carbon equivalent emissions remain the same whether the options are utilised at average or maximum capacity.

Table 10.1: Greenhouse gas emissions for our WRMP24 strategy between 2025–75

Option	tCO_2e					
	Embodied carbon	Operational carbon	Electricity carbon (SWS actual)*	Electricity carbon (WRSE model)	Total carbon (SWS actual)*	Total carbon (WRSE model)
Desalination	634,625	561,724	–	447,596	1,196,349	1,643,946
Recycling	450,750	193,659	–	26,340	4,600	670,750
Transfer	165,428	282,680	–	31,944	12,500	480,053
Import	205,562	235,586	–	8,076	441,149	449,225
Groundwater	6,116	6,384	–	7,338	644,410	19,838
Drought option	–	4,600	–	8,794	448,109	13,393
Other	21,268	–	–	–	21,268	21,268
Total	**1,483,750**	**1,284,634**	**–**	**530,089**	**2,768,384**	**3,298,472**

*We moved to a 100% renewable electricity tariff in 2021. Therefore, the electricity carbon impact of the options in our WRMP24 strategy is likely to be negligible. We have provided the electricity carbon using standard industry methodologies based on projected emissions factors in the Treasury's Green Book.

Figure 10.1 highlights that the option type with the largest greenhouse gas impact is desalination schemes, which account for 50% of the emissions in our WRMP24 strategy. This is followed by water recycling plants (20%) and both transfer (14%) and import (14%) schemes, which have a similar greenhouse gas impact in the plan. However, the individual scheme with the largest greenhouse gas impact is the Otterbourne WSW to Andover to Kingsclere water transfer scheme, which is projected to result in 281,320 tCO_2e between 2025 and 2075.

The greenhouse gas impact of the majority of the drought options is negligible.

Embodied carbon equivalent emissions represent 45% of the greenhouse gas impact of the plan, highlighting the need to go further in addressing our Scope 3 emissions through our subcontractor and supply chain activities over the duration of our plan (Figure 10.2).

The greenhouse gas emissions associated with each option included in our WRMP24 strategy are set out at a scheme level in Appendix 1.

Figure 10.1: Greenhouse gas emissions for our WRMP24 strategy between 2025–75 by option type

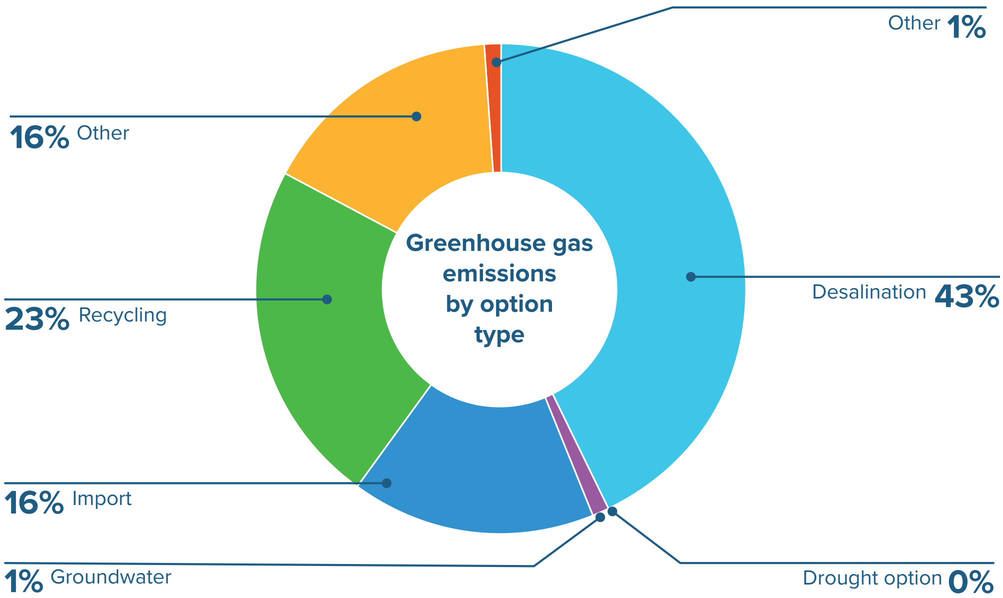
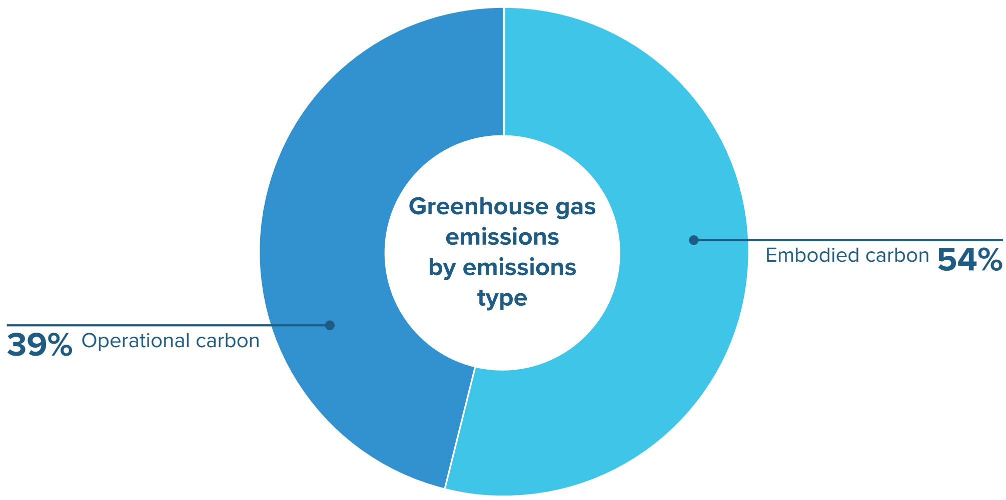


Figure 10.2: Greenhouse gas emissions for our WRMP24 strategy between 2025–75 by emissions type



10.4 Mitigating our greenhouse gas emissions in WRMP24

As one of the largest users of energy in the South East, we recognise that we have an important role to play in contributing to net zero targets.

We are firmly committed to reducing the greenhouse gas emissions released through delivery of our essential water and wastewater services. Our Net Zero Plan outlines the actions we are taking to reduce our carbon footprint, while also supporting the realisation of wider, long-term decarbonisation commitments, including the UK government's legislative target to reach net zero by 2050.

The actions set out in our Net Zero Plan will be key to mitigating the greenhouse gas emissions associated with the options we have proposed in our WRMP24 strategy.

10.4.1 The net zero context

In 2019, the UK government committed to achieving net zero by 2050. This target is underpinned by a series of interim Carbon Budgets (every five years) and a legislative target to reduce UK emissions by 78%, compared with a 1990 baseline by 2035 (Department for Business, Energy and Industrial Strategy, 2021b).

Achieving these targets will require society-wide action to reduce greenhouse gas emissions, at pace and scale. The water sector accounts for nearly 1% of UK greenhouse gas emissions and has an important role to play in tackling these ahead of the UK's 2050 target. In November 2020, Water UK launched a ground-breaking plan for the sector to reach operational net zero by 2030, two decades ahead of the UK target.

In line with Water UK's Net Zero 2030 Routemap, we unveiled our Net Zero Plan, which sets out our pathway towards zero carbon. While we have already made significant progress and reduced our net operational emissions (market based accounting) by 76% from 289 $ktCO_2e$ to 91 $ktCO_2e$ between 2010–11 and 2020–21, we recognise that there is more to be done to accelerate our progress towards net zero through PR24 and beyond.

The Climate Change Committee has called for Ofwat to take a more active role in driving the delivery of net zero in the water sector as a strategic priority (Climate Change Committee, 2022). To that effect, Ofwat published a Net Zero Principles position paper (Ofwat, 2022) in January 2022 which encouraged water companies to:

- Align company targets to national government targets, including interim milestones.
- Focus on both operational and embedded emissions.
- Prioritise greenhouse gas emissions reductions before using offsets.

To support the water sector's decarbonisation ambition, Ofwat also proposed a common operational greenhouse gas emissions performance commitment and is considering the practicality of introducing a common performance commitment for embedded emissions.

We understand the growing policy focus on decarbonisation of the water sector and are fully committed to delivering our Net Zero Plan and implementing a range of actions that support achievement of sector-wide and government emissions targets.

10.4.2 Actions to mitigate greenhouse gas emissions

Our Net Zero Plan outlines a range of actions that we have already taken or plan to implement to reduce our greenhouse gas emissions released through delivery of essential water and wastewater services. In our WRMP24 strategy, we focus on the whole life carbon equivalent impact of our activities and design solutions that will drive down both embodied and operational emissions.

Our approach to achieving operational net zero by 2030 and appraising WRMP24 options follows the carbon reduction hierarchy:

1. Reduce and avoid emissions through efficiency savings.
2. Replace and use alternative solutions that are lower carbon, for example technology change.
3. Remove emissions through sequestration on our estate.
4. Offset any residual emissions, where there is no alternative solution in the short term, through the use of responsible carbon offsetting.

We have also developed a framework of six guiding principles to shape our choice of options and drive progress towards net zero:

- Working together with all stakeholders including government, our regulators, customers, suppliers and employees.
- Using an evidence-led approach which generates and follows data to enable us to model future outcomes as accurately as possible.
- Acting responsibly with transparency and accountability, which includes being honest where uncertainties exist.
- Prioritising the reduction and avoidance of emissions over offsetting following the carbon reduction hierarchy.
- Seeking sustainable, future-proofed and innovative solutions through the use of natural capital decision-making.
- Playing our part in the UK water industry in ambition and action.

We recognise that to manage uncertainty over WRMP24 emissions predictions and to sustain progress towards net zero, we will need to continue to support collaborative research and development with government and industry partners. We will continue to develop and embrace innovative design solutions for driving down and monitoring the whole life emissions impact of our WRMP24 options.

We also understand that as WRMP24 options are constructed, our baseline emissions will evolve. This may increase our total emissions as infrastructure projects with higher carbon costs, such as desalination plants, are introduced. We will need to continuously adapt our solutions to reach and maintain operational net zero, while driving down embodied emissions through our supply chains as much as possible.

Demand management and water efficiency

Our WRMP24 strategy considers a range of options designed to drive down greenhouse gas emissions from operational processes by enhancing the efficiency of our network and reducing total water demand from domestic and business customers. Reducing and avoiding emissions through water efficiency savings is key to our plan, bringing environmental benefits while also ensuring that we have sufficient water resources to meet customer demand in the South East.

To reduce leakage, we installed 7,400 acoustic loggers and completed 20,000 leak repairs during 2020–21. Through our Target 100 programme, we are also raising awareness about water efficiency and scarcity and installing smart meters, in turn helping our customers to reduce their water usage.

Energy

To mitigate the operational greenhouse gas emissions associated with energy usage for the options in our plan, we are embracing the shift to renewable energy and onsite generation. Energy use for water and wastewater pumping and treatment has historically formed one of the largest sources of our operational emissions. We account for both the carbon intensity of grid electricity and distribution losses.

In 2021, we moved to a 100% renewable electricity tariff, which reduced our operational carbon footprint by around half. Without a renewable electricity tariff, the greenhouse gas impact of the electricity use associated with our WRMP24 strategy would equate to 530,089 tCO_2e between 2025 and 2075. We have also pledged to meet 24% of our electricity demand through onsite renewable generation by 2025. In 2020, we generated 74 GWh of energy from biogas combined heat and power plants (CHP) and 3 GWh of electricity from solar photovoltaics across our estate which met around 16% of our energy needs.

Beyond 2030, we are planning to explore opportunities to deploy advanced thermal conversion technology and green fuels including hydrogen and biomethane, which will further increase our onsite low carbon energy generation capacity.

We are also enhancing energy efficiency across our sites to reduce our operational emissions. We are continuing to upgrade systems and controls to reduce our energy usage, while accelerating replacement of inefficient assets before AMP8. Our plan includes an ongoing commitment to asset optimisation and improvement.

Process emissions

We recognise the need to continue to improve our understanding of process emissions and how to mitigate these for the options outlined in our WRMP24. Process emissions from treatment processes and recycling wastewater and biosolids primarily include nitrous oxide and methane, both of which have a significantly higher global warming potential than carbon dioxide. These emissions accounted for 64% of our total operational emissions in 2020–21. We are aiming to reduce our process emissions by 40% by 2030 through consolidation of 16 digestion sites into seven mega-sludge treatment centres with biogas CHPs and advanced digestion technologies. We will continue to collaborate with partners across the sector, including Water UK and UKWIR, to effectively monitor our process emissions, mobilise pilot projects and deploy low carbon solutions where possible including advanced sludge treatment technologies.

Transport

Operational emissions from our vehicle fleet and business travel are embedded in the options included in our plan. In 2020–21, company transport accounted for 4% of our total emissions. To mitigate these emissions, we have committed to transform our company vehicles by electrifying the fleet or introducing alternative low carbon fuels by 2030. We are also engaging with our haulage contractors on the opportunities to transition to low carbon fuels. We are adopting a phased approach that capitalises on developments in low carbon transport and logistics technologies.

Nature-based solutions

Where there is no alternative solution to reduce or remove the emissions associated with the options in our plan, we will implement nature-based solutions such as afforestation and habitat restoration (wetland and peatland) across our estate. We are engaging with Wildlife Trusts across the South East to understand the natural capital value of our estate and identify opportunities to deliver carbon storage and sequestration insets, while also bringing wider environmental benefits.

As part of our offsetting strategy to address any residual emissions, we are working closely with Local Nature Partnerships to develop natural capital solutions, including 'blue carbon' kelp regeneration projects off the Sussex Coast. All offsets will be externally certified to a high sustainability standard. We recognise that nature-based solutions feature strongly in the Green Recovery funding decisions and will play an increasingly important role through PR24 in delivering wider environmental and societal benefits.

Further detail on our approach to reducing our greenhouse gas emissions and reaching our net zero target is available in our Net Zero Plan[7].

[7]https://www.southernwater.co.uk/our-performance/reports/net-zero-plan

10.5 Monitoring and reporting our greenhouse gas emissions

We understand the importance of effectively monitoring our greenhouse gas emissions to ensure that we are able to adapt as predictions of emissions become increasingly accurate. Robust monitoring of emissions will also reduce the level of uncertainty associated with our carbon assessments over time.

For over a decade, we have measured our operational greenhouse gas emissions, and we report these figures annually in line with Greenhouse Gas Protocol accounting and reporting standards. We currently publish our operational Scope 1, 2 and 3 emissions.

Our methodology for reporting operational greenhouse gas emissions follows Defra guidance and is calculated using the water sector's Carbon Accounting Workbook (CAW) developed by UKWIR (UKWIR, 2012c). The workbook is updated by UKWIR annually to reflect the latest UK emissions factors, developments in carbon accounting practices and newly available scientific data. This approach considers all greenhouse gas emissions released as a result of the operational activities of water and wastewater companies, including water treatment and distribution, wastewater collection and treatment, and sludge management. The CAW considers the following emissions:

- **Scope 1 –** direct emissions that are produced from our sites and assets, such as process emissions, our vehicle fleet and fuels used onsite.
- **Scope 2 –** indirect emissions from the generation of electricity provided by energy suppliers.
- **Scope 3 –** other indirect emissions that occur as a consequence of our activities such as the transport and energy emissions from our operational contractors and the emissions associated with the efficiency of electricity transmission and distribution.
- **Outside of scope –** short cycle carbon including biogenic emissions from wood, biogas and biomethane are handled separately and do not appear in any scope totals.

Metrics that we will use annually to monitor our emissions associated with our plan and the deployment of mitigation measures include:

- Reduction of operational and capital carbon equivalent emissions (tCO2e).
- Change in energy use per Ml/day supplied (MWh/Ml/d).
- Proportion of energy generated by renewable, onsite sources (%).
- Proportion of fleet vehicle fleet electrified or converted to alternative low carbon fuels (%).

Since 2019, we have adopted market-based accounting, which reflects the carbon benefit of the renewable electricity that we purchase.

Ofwat recently introduced standardised mandatory annual reporting of greenhouse gas emissions. As we implement our WRMP24 strategy and our Net Zero Plan, we recognise that we will also need to go beyond reporting our operational emissions to fully account for capital greenhouse gas emissions. Carbon decision-making underpinned by robust monitoring will be key to planning our future investments across the network in line with net zero. We will report on the latest available greenhouse gas emissions data in our WRMP annual reporting submissions.

Further detail on our approach to monitoring and measuring our greenhouse gas emissions is available in our Net Zero Plan.

11. Consultation process and next steps

11.1 Our draft WRMP

Our draft WRMP explains how we plan to balance the future supply and demand for water in a sustainable way. It also details how we will protect and enhance the environment and make sure our bills are affordable for all our customers. We are facing significant challenges, but also great opportunities. Our draft WRMP sets out how we will plan for the economic prosperity of our region, deliver significant improvements to our water resources network, improve the quality of the water we provide and the service we give to customers.

This plan represents a step change in our approach at a regional level, aligning our plan with WRSE's Draft Regional Plan We have continued to enhance and refine our planning approach working as part of WRSE to adopt the latest advanced techniques and datasets to better understand the scale of the problem in terms of supply and demand, and future uncertainty.

We have moved towards a new system-based approach to understand the resilience of our supplies during drought, based on the latest modelling techniques. We have also considered the most recent climate change projections.

We have set out our ambitions to provide greater protection to the environment, to mitigate any deterioration from water bodies we already abstract from but also to go further and reduce our abstractions in the long term. This will ensure environmental flow targets are met and we deliver enhancements to delicate and rare ecosystems, particularly chalk streams.

Over the next five years we are carrying out a range of studies across the rivers, streams and aquifers from which we abstract our water. This includes environmental and ecological monitoring alongside state-of-the-art groundwater and hydrological modelling. This will enable us to make informed, evidence-based decisions, alongside stakeholders and regulators, to protect and enhance the environment. These studies will help to reduce the range of uncertainty in our environmental forecasts through the adaptive planning approach. By our next WRMP (WRMP29) we expect that the uncertainty range of reductions will reduce and allow us to refine and better target our environmental ambition to maximise benefits to the environment.

We face particularly large challenges in our Western and Central Areas, due to current and future abstraction licence changes. We are planning to accommodate these changes within our plans, but there are risks associated with this approach. We will face a period when there is a risk that more frequent TUBs and drought permit or order applications will need to be made, until our investment in new resources can be delivered.

Since there are now very limited opportunities to develop new 'conventional' sources of water, such as abstraction from rivers or groundwater, we need to look elsewhere to ensure that we can provide enhanced drought resilience and maintain secure supplies to customers. Our programme of water efficiency, demand management and leakage reduction will help us to achieve our ambition but this cannot replace the lost water, especially with the additional pressures on supplies from climate change and population growth. We will therefore need to source more water from elsewhere.

There are a significant number of new schemes that we are planning to implement over the coming years. We will work in close partnership with our customers, stakeholders and our environmental and financial regulators to plan, investigate, secure approval for, and then build necessary new infrastructure. Alongside this, we will deliver our ambitious plans for improved water efficiency and demand management by delivering, as a minimum, the National Framework demand management targets. There will be significant investment in our existing infrastructure to secure safe and reliable supplies to our customers.

We look forward to receiving the views of our regulators, stakeholders and customers on the proposals in this draft WRMP, and to working closely with them as we further develop our plan over the coming year. The feedback will provide us with invaluable insights from our customers and stakeholders, helping to better inform the next iteration of our plan.

12. References

Artesia, 2020a. Non-Household Demand Forecasts 2020 to 2100. Water Resources South East Regional Report – Final Report. Ref. AR1377.

Artesia, 2020b. Non-Household Demand Forecasts 2020 to 2100. Water Resources South East – Southern Water. Company Report – Final. Ref. AR1395.

Artesia, 2021. Dynamic Demand Analysis, Phase 2. Ref. AR1408.

Cabinet Office, 2011. Keeping the Country Running: Natural Hazards and Infrastructure. A guide to improving the resilience of critical infrastructure and essential services.

Edge Analytics, 2020. Property and Population Forecasts. Methodology and Outcomes. July 2020. **https://www.wrse.org.uk/media/lvmlkv3a/vicus-methodology-final-31-07-2020.pdf**

Energy Saving Trust, 2019. Independent review of the costs and benefits of water labelling options in the UK, Extension Project, Technical Report.

Environment Agency, 2020a. Meeting our future water needs: a national framework for water resources. 16 March 2020, Version 1.

Environment Agency, 2020b. Long-term water resources environmental destination Guidance for regional groups and water companies, Version 1

Environment Agency, Ofwat and Natural Resources Wales, 2021. Water resources planning guideline. Version 10, December 2021.

HM Government, 2018. A Green Future: Our 25 Year Plan to Improve the Environment. **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf**

National Infrastructure Commission, 2018. Preparing for a drier future. England's water infrastructure needs. **https://nic.org.uk/app/uploads/NIC-Preparing-for-a-Drier-Future-26-April-2018.pdf**

Ofwat, 2017. Resilience in the round: Building resilience for the future. ISBN 978-1-911588-11-5.

Ofwat, 2021, PR24 and beyond: Long-term delivery strategies and common reference scenarios.

Ovarro, 2020. Review of Non-Household Demand Forecast Methods. Final Report, Version 1. Water Resources South East. Ref. J2017\GD008\01.

Ovarro, 2021. Household demand forecast 2020. Southern Water Services, Version 2. Ref. J1941\GD013\02.

UKWIR, 2002. The Economics of Balancing Supply and Demand (EBSD). Main report. Ref. 02/WR/27/3

UKWIR, 2012a. Customer Behaviour and Water Use – A Good Practice Manual and Roadmap for Household Consumption Forecasting. Ref. 12/CU/02/11

UKWIR, 2012b. Water Resources Planning Tools – Summary. Ref. 12/WR/27/6

UKWIR, 2013. Impact of Climate Change on Water Demand. Ref. 13/CL/04/12.

UKWIR, 2016a. WRMP 2019 Methods – Risk Based Planning, Ref. 16/WR/02/11.

UKWIR, 2016b. Water Resources Management Plan 2019 Methods – Risk Based Planning. Ref. 16/WR/02/11.

UKWIR, 2016c, WRMP 2019 methods – Decision Making Process: Guidelines. Ref. 16/WR/02/10.

UKWIR, 2017. Drought Vulnerability Framework. Ref. 17/WR/02/12.

UKWIR, 2020, Deriving a Best Value Water Resources Management Plan, 20/WR/02, UK Water Industry Research

WRc, 2020. Dynamic Demand Modelling for WRSE v2.1. Ref. 17265-0.

WRSE, 2020a. Problem Characterisation, Consultation Version. August, 2020.

WRSE 2020. WRSE *Method Statement: Environmental Assessment Consultation* version July 2020.

WRSE, 2021a. Environmental Ambition Sustainability Reductions. Technical Note 100411624-011-SSTNB-01B

WRSE 2021b. *Method Statement: Environmental Assessment Post-consultation version,* November 2021.

WRSE 2022b. *WRSE Regional Plan Habitats Regulations Assessment Stage 1 Screening Report.* Report for WRSE by Mott MacDonald.

WRSE 2021c. Method Statement: Groundwater Framework.

WRSE 2022a. Emerging Regional Plan, Water Resources South East, Annex 1, The Challenge, Consultation Version.

WRSEb 2022b. Emerging Regional Plan Water Resources South East. Consultation responses. May 2022 v.0.5

WRSE, 2020. Population and Property Forecasts, Methodology and Outcomes.

WRSE, 2020a. Method Statement: Investment Programme Development and Assessment, Consultation Version.

WRSE, 2021a. Method Statement: Climate Change – Supply Side Methods Updated version August 2021

WRSE, 2021e. Environmental Ambition Sustainability Reductions, Technical Note 100411624-011-SSTNB-01B

WRSE, 2021e. Method Statement: Climate Change – Supply Side Methods. Updated version.

WRSE, 2021d. Method Statement: Options Appraisal. Updated version, September 2021.

WRSE, 2021. Method Statement: Regional System Simulation Model. Post consultation version.

WRSE, 2021. Method Statement: Resilience Framework, September 2021.

WRSE, 2021. Method Statement: Stochastic Climate Datasets. Updated version.

WRSE, 2022c. Developing Our 'Best Value' multi-sector regional resilience plan our decision making framework.

WRSE, 2022b. Emerging Regional Plan Water Resources South East Annex 3 – Our emerging regional plan (technical details) January 2022 (Consultation version)

WRSE, 2022. Emerging Regional Plan Water Resources South East Annex 1 – The challenge - January 2022 (Consultation version)

WRSE, 2022. Futureproofing our water supplies, a consultation on our emerging regional plan for South East England.

WRMP Annexes

Annex 1	**Water Resource Zone integrity assessment**
Annex 2	**Our 2023–25 plan**
Annex 3	**Problem characterisation**
Annex 4	**Drought vulnerability assessment**
Annex 5	**Summary of pre-consultation feedback**
Annex 6	**Stakeholder and customer engagement**
Annex 7	**Demand forecast**
Annex 8	**Supply forecast**
Annex 9	**Protecting and enhancing the environment**
Annex 10	**Supply-demand balance situations**
Annex 11	**Monitoring our adaptive plan**
Annex 12	**Options appraisal**
Annex 13	**Option fact files**
Annex 14	**T100 Strategy Overview**
Annex 15	**T100 Technical Report**
Annex 16	**Smart metering annex**
Annex 17	**Leakage annex**
Annex 18	**Strategic Environmental Assessment**
Annex 19	**Water Framework Directive**
Annex 20	**Habitat Regulations Assessment**
Annex 21	**Modelling results**
Annex 22	**Contingency Plan**
Annex 23	**Regional Plan methodologies**
Annex 24	**Water Resource Planning tables**

WATER for LIFE®

from
Southern Water®

6177_09.22