Draft Water Resources Management Plan 2024

Technical Report

July 2024

from Southern Water

Contents

Contents continued

Contents continued

Contents continued

Tables

Tables continued

Tables continued

Tables continued

Tables continued

Figures

Figures continued

Figures continued

Figures continued

Glossary

Acronym	Term	Definition
	Abstraction	The removal of water from a source e.g. river
	Aquifer	A body of rock and/or sediment that holds water underground.
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**	The AMP periods are 5-year cycles used by the Water Services Regulation Authority (Ofwat) to set the allowable price increase for consumers. AMP periods are five years in duration and begin on 1 April in years ending in 0 or 5; the current period is AMP7 (2020-2025)
ASR	**Automatic Meter Reading**	Type of water meter that can be read remotely using drive-by technology.
BP24	**Aquifer Storage and Recovery**	The process of injecting surface water into an aquifer for later recovery and use.
BVP	**Business Plan 2024**	Business Plan 2024 - a plan water companies submit to Ofwat every 5 years when requesting funding for the forthcoming AMP.
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	Southern Water's supply area consisting 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.
CAW	**Carbon Accounting Workbook**	A tool developed by UK Water Industry Research for reporting greenhouse gas emissions as a result of the operational activities of water and wastewater companies.
CHP	**Combined Heat and Power Plants**	A CHP plant consists essentially of an electrical generator combined with equipment for recovering and using the heat produced by that generator.
CMOS	**Central Market Operating System**	CMOS is the core information technology system maintained by the Market Operator for Non-Household Water Retail Market in England.

Glossary continued

Acronym	Term	Definition
	Drought Order	Powers granted by the Secretary of State during drought to manage quantities of water removed and released on a temporary basis.
	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.
DCO	**Development Consent Order**	A DCO is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects. This includes energy, transport, water and waste projects.
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.
DPC	**Direct Procurement by Customers**	DPC involves a water or wastewater company competitively tendering for services in relation to the delivery of certain large infrastructure projects, resulting in the selection of a third-party competitively appointed provider.
dRBVP	**Draft Regional Best Value Plan**	Refers to the draft stage of developing a Regional Best Value Plan.
DWI	**Drinking Water Inspectorate**	The government's drinking water quality regulator.
dWRMP	**Draft Water Resource Management Plan**	Refers to the draft stage of developing Water Resource Management Plan.
DYAA	**Dry Year Annual Average**	A period of low rainfall and unrestricted demand.
DYCP	**Dry Year Critical Period**	The period(s) during the year when demand is at its highest and supply is generally its lowest.
DYMDO	**Dry Year Minimum Deployable Output**	This is the DO of a source during autumn period in a dry year when groundwater levels and river flows are at their lowest.
	Eastern area	Southern Water's supply area consisting of Kent Medway East, Kent Medway West, Kent Thanet and Susses Hastings water resource zone.
	Environment Destination	A strategy developed at a regional level to help enhance the natural environment through water resources activities and sustainable abstraction.
EA	**Environment Agency**	The government's environmental regulator.
EIA	**Environmental Impact Assessment**	An EIA is prepared to estimate the environmental effects of a proposed development or construction project.
EQS	**Environmental Quality Standards**	These are the standards that are aimed at protecting and improving the water environment.

Glossary continued

ERP	**Emerging Regional Plan**	The draft Regional Plan prepared by Water Resources South East that went through a public consultation in January 2022.
	Groundwater	Water held underground in the soil or in voids in rock.
GCM	**Global Circulation Model**	Numerical models representing physical processes in the atmosphere, ocean, cryosphere and land surface used for simulating the response of the global climate system to increasing greenhouse gas concentrations.
GLA	**Greater London Authority**	Regional authority, with powers over transport, policing, economic development, and fire and emergency planning in the Greater London area.
GVA	**Gross Value Added**	GVA is a productivity metric that measures the contribution of a corporate subsidiary, company, or municipality to an economy.
HoF	**Hands-off flow**	The flow rate in a river below which abstraction cannot take place.
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**	A supply scheme including a water recycling plant (60Ml/d capacity) a transfer to Havant Thicket Reservoir and a transfer pipeline (90Ml/d capacity) from Havant Thicket Reservoir to Otterbourne Water Supply Works and associated pumping stations and above ground plant.
ICA	**Instrumentation Control and Automation**	A control system using smart devices to communicate data on performance and enable automation of processes.
IGEQ	**Inter-Generational Equity Rate**	This is a rate used in assessing costs over a long period that aims to share the costs between different generations. This is needed because a long-life asset built and paid for by this generation of customers will still be providing benefits to future generations of customers. This technique is included in the HM Treasury Green Book.
l/h/d	**Litres per head per day**	The average amount of water used per person each day.
LCP	**Least Cost Plan**	A Water Resources Management Plan that uses the economic cost for selection of options to maintain supply-demand balance. This plan seeks to meet.
LPA	**Local Planning Authority**	An LPA is the local government body that is empowered by law to exercise urban planning functions for a particular area and also control development.
LTDR	**Long-Term Discount Rates**	This is a rate used when assessing costs over a long period that takes account of the fact that people prefer to have something today rather than at some point in the future. This technique is included in the HM Treasury Green Book.

Glossary continued

Acronym	Term	Definition
MDO	**Minimum Deployable Output**	DO for the period when groundwater levels are at their lowest.
MEICA	**Mechanical, Electrical, Instrumentation, Control and Automation**	Refers to the electrical and mechanical systems put in place to operation a water resources site.
Ml/d	**Mega litres per day**	Millions of litres per day. Unit of measurement for flow in a river or pipeline. 1 Megalitre = 1,000,000 litres.
MOSL	**Market Operation for Non-household Retail Market**	MOSL is the body set up in 2017 for the day-to-day smooth running of the non-household retail market, enabling new companies to enter the market, customers to switch and settlement to take place.
MRF	**Minimum River Flow**	The minimum monthly flow required along a river to meet water quality, fish & wildlife, navigation, recreation, downstream or other requirements.
	National Framework	The Environment Agency's 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 use activities.
NPV	**Net Present Value**	NPV is the value of all future cash flows (positive and negative) over the entire life of an investment discounted to the present.
NYAA	**Normal Year Annual Average**	This is the demand for water expected under normal weather conditions.
	Outage	Temporary loss of DO.
Ofwat	**Water Services Regulation Authority**	The economic regulator of the water sector in England and Wales. Prior to 2006, it was known as the Office for Water Services.
ONS	**Office for National Statistics**	ONS is independent producer of official statistics and the recognised national statistical institute of the UK.
OxCam	**Oxford-Cambridge Arc**	The Oxford-Cambridge Arc is the area between Oxford, Milton Keynes and Cambridge consisting of five counties: Oxfordshire, Bedfordshire, Buckinghamshire, Northamptonshire and Cambridgeshire.
PCC	**Per Capita Consumption**	Amount of water typically used by one person per day.
PDO	**Peak Deployable Output**	DO for the period when demand is at its highest.
PEIR	**Preliminary Environmental Information Report**	The PEIR provides the information required for consultees to understand the likely significant environmental impacts of a project as understood at the time.

Glossary continued

PEIR	**Preliminary Environmental Information Report**	The PEIR provides the information required for consultees to understand the likely significant environmental impacts of a project as understood at the time.
PET	**Potential Evapotranspiration**	PET is the amount of water that would be evaporated and transpired by a specific crop, soil or ecosystem if there was sufficient water available.
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 in parts of South East Hampshire and West Sussex.
PWS	**Public Water Supply**	Provision of water to the public by public utilities, commercial organisations, community partnerships or individuals.
Pywr	**Python Water Resource Model**	A python-based water resources model which is open source, flexible and extendable.
QSRA	**Quantitative Schedule Risk Analysis**	It is a semi-quantitative tool that can be used to understand the time risk in the delivery of a project.
RAPID	**Regulators' Alliance for Progressing Infrastructure Development**	The collaborative regulatory group consisting of Ofwat, Environment Agency and DWI formed to accelerate development of new water infrastructure and design future regulatory frameworks.
RBMP	**River Basin Management Plan**	An RBMP describes the framework used to protect and improve the quality of waters in each river basin district.
RBVP	**Regional Best Value Plan**	The Best Value Plan for the region prepared by Water Resources South East.
RCM	**Regional Climate Model**	Numerical models representing physical processes in the atmosphere, ocean, cryosphere and land surface used for simulating the response of the regional climate system to increasing greenhouse gas concentrations.
rdRBVP	**Revised draft Regional Best Value Plan**	Refers to the revised draft stage of the Regional Best Value Plan.
rdWRMP	**Revised draft Water Resource Management Plan**	Refers to the revised draft stage of the Water Resource Management Plan.
REGO	**Renewable Energy Guarantees of Origin**	The scheme provides transparency to consumers about the proportion of electricity that suppliers source from renewable electricity. This scheme provides certificates called REGOs which demonstrate electricity has been generated from renewable sources.
RLCP	**Regional Least Cost Plan**	LCP developed at the regional level by Water Resources South East.
RSA	**Restoring Sustainable Abstraction**	Environment Agency programme to identify abstractions that are unsustainable or potentially damaging and to restore them to a sustainable level.

Glossary continued

Acronym	Term	Definition
	Section 20 Agreement	The agreement signed by Southern Water and the Environment Agency during the Western area Public Inquiry in March 2018 pursuant to Section 20 of the Water Resources Act 1991.
	Severn Trent Water	A water company providing water to 8 million people across the Midlands, and into north and mid-Wales.
	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.
	Sustainability reduction	Reductions in DO required to meet statutory requirements and/or environmental expectation or to reach any regional Environmental Destination.
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 time period covered by a Water Resource Management Plan.
SEA	**Strategic Environmental Assessment**	Assessment to identify and assess any significant environmental effects of strategies put forward in a Water Resources Management Plan.
SES	**SES Water**	A water company supplying water to 745,000 people in parts of Surrey, Kent and south London.
SESRO	**South East Strategic Reservoir Option**	A project to build a reservoir to serve the South East of England.
SEW	**South East Water**	Private company supplying water to 2.2 million customers in parts of Kent and Sussex.
SLCP	**Southern Water's Least Cost Plan**	LCP developed by Southern Water for its supply area.
SRO	**Strategic Resource Option**	Large schemes intended to provide a resilient future water supply and investigated through RAPID's gated process.
STPR	**Social Time Preference Rate**	A method used to put a present value on costs and benefits that occur at a later date.
STT	**Severn Trent to Thames Transfer**	An SRO to transfer water from Severn Trent Water supply area to Thames Water supply area.
SWS	**Southern Water Services**	Supplier of water services to around 2.6 million customers and wastewater services to around 4.6 million customers across parts of Kent, Sussex and Hampshire.
SWW	**South West Water**	Water and wastewater service provider for a population of around 1.7 million in Cornwall, Devon, and parts of Somerset and Dorset.
T2ST	**Thames to Southern Transfer**	An SRO enabling water transfer from SESRO in Thames Water's supply area to Southern Water's Western area, being progressed jointly by Southern Water and Thames Water.

Glossary continued

TUB	**Temporary Use Ban**	Restrictions imposed by water companies on their customers' water use for non-essential activities such as watering a garden using a hosepipe, filling a pool, washing a car etc.
TWUL	**Thames Water Utilities Limited**	Water and wastewater services provider serving 15 million customers across London and the Thames Valley.
UKCP	**UK Climate Projections**	UKCP is a set of tools and data that shows you how the UK climate may change in the future.
UKWIR	**UK Water Industry Research**	UKWIR is the collaborative research platform for the UK and Ireland water sector.
VMR	**Visual Meter Read**	Meter reads taken manually.
	Water recycling plant	A plant using advanced treatment techniques to convert treated wastewater into highly purified water.
	Western area	Southern Water's 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.
	Western area Inquiry	A public inquiry into proposed changes to Lower Itchen, Test and Candover abstraction licences in Hampshire, held in March 2018.
WAFU	**Water Available for Use**	Combined total of DO, future changes to DO 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.
WFD	**Water Framework Directive**	European Union Environmental Legislation committing all member states to achieve 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.
WRc	**Water Research Centre**	Providers of consultancy, technical services, accreditation schemes, research, innovation and training to customers in the water, waste and environment sectors.
WRE	**Water Resources East**	WRE is the independent, not-for-profit membership organisation pioneering a collaborative, cross-sector approach to water resources and integrated water management planning in Eastern England.
WRMP	**Water Resource Management Plan**	Statutory plan produced by UK water companies every five years to plan to meet supplies over a 25 to 50-year period.
WRPG	**Water Resources Planning Guideline**	The guideline by the Environment Agency, Ofwat and Natural Resources Wales for developing WRMPs.

Glossary continued

Acronym	Term	Definition
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 in which all customers experience the same risk of supply failure from a resource shortfall.
WSW	**Water Supply Works**	This is site at which water is taken from the environment (usually an aquifer, river or reservoir) and treats it so that it is clean and safe to drink. The water from a WSW is then supplied to customers' properties.
WSX	**Wessex Water**	Water supply and sewerage company serving customers across Bristol, most of Dorset, Somerset and Wiltshire and parts of Gloucestershire and Hampshire.
WTW	**Wastewater Treatment Works**	A wastewater treatment works receives all used water and sewage and treats to a sufficiently high standard to safely return it to river or sea.

Executive summary

This is our revised draft Water Resource Management Plan 2024 and includes updates to our interim revised draft Water Resources Management plan 2024 that was submitted to Defra and regulators in August 2023. It sets out our plan to maintain a high-quality, reliable supply of water for our customers and improve the water environment for future generations.

The way we plan for water resources has undergone significant change since our Water Resources Management Plan 2019. 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 advocated collaborative planning at a regional level.

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 the wider society. In fact, leaving more water in the environment is the largest driver of this plan.

In developing this plan, we have taken account of the feedback from public consultation on our draft Water Resources Management Plan 2024 that took place between 14 November 2022 and 20 February 2023 and the draft Regional Plan, as well as additional feedback from the Environment Agency on our Statement of Response to the draft Water Resources Management Plan 2024 consultation and the interim revised draft Water Resources Management Plan 2024.

Following the consultation on our draft Water Resources Management Plan 2024, we revised the delivery dates of two major schemes in the Western area; the Havant Thicket Reservoir was delayed by 2 years to provide benefit from 2031-32 instead of 2029-30 and the Hampshire Water Transfer and Water Recycling Project was delayed by 4 years to provide benefit from 2034-35 instead of 2030-31. This necessitated continued reliance on drought permits and orders in Hampshire during periods of severe droughts up to 2033-34. Our draft Water Resources Management Plan 2024 did not rely on these drought permits and orders beyond 2029-30. These changes represented a material change from the plan that was consulted upon and mean that we have to reconsult on our plan.

We have subsequently revised the delivery dates for the Littlehampton recycling scheme in the Central area and the Sandown recycling scheme on the Isle of Wight in the Western area. Both schemes are now due to provide benefit from 2030-31 instead of 2027-28.

The effect of the revised dates for some schemes means that, in the event of a drought, we have to continue to rely on the use of drought permits and orders in Hampshire (Western area) until these schemes are fully operational. These drought options are the Candover Drought Order and the River Test Drought Permit/Order. They will be needed in the event of a drought until 2033-34. This is the basis of revised draft Water Resources Management Plan 2024 that we are now consulting upon. This reliance is longer than we previously planned for, but we are significantly restricted by a lack of alternative options that can supply the amount of water required in the time available.

The process agreed by the Environment Agency and Southern Water by which we will apply for use of drought permits and orders in Hampshire is set out in the agreement we signed with the Environment Agency under Section 20 of the Water Resources Act 1991. The agreement was signed in 2018 and is due to expire in 2030. We will therefore need to discuss any implications of our extended timelines with regard to the Section 20 Agreement with our regulators.

In addition to the drought permits and orders in Hampshire, the Environment Agency does not support the use of Pulborough surface water drought option in the Central area beyond 2029-30. We were not aware of the Environment Agency's position on the Pulborough drought option when preparing our draft Water Resources Management Plan 2024.

In agreement with the Environment Agency and Natural England, we submitted our interim revised draft Water Resources Management Plan 2024 to Defra on 31 August 2023 but did not publish it. We agreed to publish our revised draft Water Resources Management Plan 2024 at a later date after considering and investigating additional options to see if we could mitigate the impact of delays to schemes in the Western and Central areas. As a result, we have introduced sea tankering from Norway and a groundwater option in Kings Sombourne in the Western area as new options and also brought forward the delivery of groundwater schemes in the Western and Central areas.

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 key objectives 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 objectives, we have set ambitious targets to reduce the water used by our customers and leakage. We are developing new sources across our supply area and improving connectivity both within our supply area and with our neighbouring water companies to be able to move water from areas with surplus water to areas where there is a shortage of water. 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.

We are investing in new technologies and will be developing water recycling across our supply area over the next 10 years.

In the longer term, there will be further opportunities to move water between water companies with a large-scale transfer of up to 120Ml/d capacity from Thames Water (Thames to Southern Transfer). This, in turn, will be supported by the South East Strategic Reservoir in Oxfordshire and new pipelines from Portsmouth Water to transfer water from Havant Thicket Reservoir to both north Hampshire (Western area) and north Sussex (Central area). Other improvements are planned to transfer water within our supply area.

At a company level, we aim to:

- reduce consumption by household customers in order to reduce average Per Capita Consumption to 110 litres per head per day by 2044-45 under dry year conditions. This is 5 years earlier than the 2049-50 target year set by the Government;
- reduce leakage by 53% by 2049-50 compared to 2017-18. The is higher than the 50% reduction required by the Government;
- reduce non-household consumption by 9% compared to 2019-20 by 2037-38;
- promote catchment and nature-based solutions through our Catchment First programme to improve environmental resilience;
- stop the use of all supply-side drought permits and orders by 2040-41 at the latest, unless faced with a drought of more than 1-in-500 year severity.

Our Western area strategy involves:

- continuation of all existing internal transfers as well as external bulk imports and exports;
- implementing water efficiency programmes to reduce household and non-household consumption from 2025-26 to reduce consumption by 39.2Ml/d by 2049-50;
- implementing leakage reduction measures from 2025-26 to reduce leakage by 9.9Ml/d by 2049-50;
- removing constraints at Newbury groundwater source to increase yield (1.2Ml/d) from 2027-28;
- drilling new boreholes at Romsey to provide 4.8Ml/d from 2030-31;
- removing constraints and Kings Sombourne groundwater source to provide additional 2.5Ml/d from 2030-31;
- increasing transfer capacity between Hampshire Rural and Hampshire Southampton West water resource zones through the Romsey Town and Broadlands valve to transfer an additional 5Ml/d from 2030-31;
- delivering Sandown Wastewater Treatment Works recycling scheme to provide up to 8.5Ml/d from 2030-31;
- constructing 'Hampshire grid' to move water more easily in the Hampshire area from 2030-31;
- implementing bulk import of up to 45Ml/d from Norway via sea tankers during severe droughts (1-in-200 year or greater severity) between 2030-31 and 2033-34;
- bulk import (up to 21Ml/d) from Portsmouth Water to Otterbourne Water Supply Works from 2031-32 following the construction of Havant Thicket Reservoir;
- bulk import (up to 90Ml/d) from Havant Thicket Reservoir to Otterbourne Water Supply Works from 2034-35 following the delivery of Hampshire Water Transfer and Water Recycling Project;
- implementing Test Managed Aquifer Recharge scheme to provide up to 5.5Ml/d from 2035-36;
- drilling new boreholes at Newchurch groundwater source to increase yield by 1.9Ml/d from 2036-37;
- drilling new boreholes at Eastern Yar3 groundwater source to increase yield by 1.5Ml/d from 2039-40;
- bulk import (up to 120Ml/d) into Hampshire through Thames to Southern Transfer from 2039-40;
- terminating the use of Lower Itchen Drought Permit/Order after 2029-30 under any drought condition;
- terminating the use of Candover Drought Order by after 2033-34 under any drought condition;
- terminating the use of River Test Drought Permit/ Order after 2033-34 under droughts of up to 1-in-200 year severity;
- terminating the use of all supply-side drought permits/orders after 2040-41 unless faced with a drought of more than 1-in-500 year severity;
- continuing to use Temporary Use Bans and Non-Essential Use Bans to manage demand during droughts.

Our Central area strategy includes:

- continuation of all existing internal transfers as well as external bulk imports and exports;
- implementing water efficiency programme to reduce household and non-household consumption from 2025-26 by 35.8Ml/d by 2049-50;
- implementing leakage reduction measures from 2025-26 to reduce leakage by 7.6Ml/d by 2049-50;
- bulk import from SES Water (up to 4Ml/d) from 2025-26 to 2030-31;
- reinstating West Chiltington groundwater source to provide up to 3.1Ml/d from 2028-29;
- refurbishing Petersfield groundwater source to provide up to 1.6Ml/d from 2028-29;
- terminating the use of Pulborough surface water drought permit/order after 2029-30 under droughts of up to 1-in-200 year drought severity;
- delivering a new treatment works at Weir Wood Reservoir with a 21Ml/d capacity from 2030-31
- drilling new boreholes at Petworth to provide up to 4Ml/d from 2030-31;
- asset enhancement at Lewes Road groundwater source to provide up to 3.5Ml/d from 2030-31;
- recycled water from Littlehampton Wastewater Treatment Works (up to 15Ml/d) from 2030-31;
- bulk import from SES Water of up to 10Ml/d from 2033-34;
- bulk import (up 10Ml/d) from South East Water to Pulborough from 2039-40;
- bulk import (up to 50Ml/d) from Havant Thicket Reservoir to Pulborough from 2039-40;
- building pipeline to transfer up to 35Ml/d between Pulborough and Worthing from 2039-40;
- improving treatment capacity at Pulborough to provide up to 2Ml/d from 2040-41;
- building pipeline to transfer up to 4Ml/d between Worthing and Brighton from 2040-41;
- building a desalination plant close to the River Arun from 2040-41 to deliver up to 40Ml/d by 2049-50;
- construction of River Adur Offline Reservoir to provide up to 19.5Ml/d from 2045-46;
- use of recycled water from Horsham Wastewater Treatment Works with storage at Pulborough to provide up to 11.5Ml/d from 2057-58;
- bulk import (up to 20Ml/d) from South East Water to Brighton from 2065-66;
- terminating the use of all supply-side drought permits/orders after 2040-41 unless faced with a drought of more than 1-in-500 year severity;
- continuing to use Temporary Use Bans and Non-Essential Use Bans to manage demand during droughts.

Our Eastern area strategy involves:

- continuation of all existing internal transfers as well as external bulk imports and exports;
- implementing water efficiency programme to reduce household and non-household consumption from 2025-26 to reduce demand by 37.4Ml/d by 2049-50;
- implementing leakage reduction measures from 2025-26 to reduce leakage by 10.9Ml/d by 2049-50;
- recycling from Medway Wastewater Treatment Works for up to 14Ml/d from 2030-31;
- recycling from an industrial source in Sittingbourne (7.5M/d) from 2030-31;
- recommissioning Gravesend groundwater source (2.7Ml/d) from 2030-31;
- conjunctive use of Bewl Water with recycled water from Tonbridge Wastewater Treatment Works to provide up to 5.7Ml/d from 2035-36;
- reconfiguring Rye Wells to provide up to 1.5Ml/d benefit from 2039-40;
- developing a desalination plant on the Thames Estuary from 2039-40 to provide up to 40Ml/d;
- developing a desalination plant on the Isle of Sheppey to provide up to 20Ml/d from 2040-41, increasing to 30Ml/d by 2062-63;
- developing a desalination plant in East Thanet to provide 20Ml/d from 2040-41, increasing to 40Ml/d by 2049-50;
- bulk import (up to 20Ml/d) from South East Water to near Canterbury from 2049-50;
- bulk import (up to 10Ml/d) from South East Water to Rye from 2049-50;
- conjunctive use of Darwell Reservoir with recycled water from Hastings Wastewater Treatment Works (up to 6.8Ml/d) from 2050-51;
- raising Bewl Water by 0.4m for up to 3Ml/d benefit from 2060-61;
- terminating the use of all supply-side drought permits/orders after 2040-41 unless faced with a drought of more than 1-in-500 year severity;
- continuing to use Temporary Use Bans and Non-Essential Use Bans to manage demand drought droughts.

Managing uncertainty

Long-term planning for water resources requires us to make decisions now 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 supply areas allow us to maintain supply-demand balance across all future scenarios considered in this plan with key decision points in 2030 and 2035.

We 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 Monitoring 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 and;
- operational measures which can be implemented to provide supply-demand benefit e.g. temporary pumps to increase network flexibility at peak demand.

Testing our plan

One of the key changes we have made to our draft Water Resources Management Plan 2024 is a revision in the delivery dates of recycling options in Littlehampton in Sussex (Central area), Budds Farm in Hampshire (Western area) supporting the Hampshire Water Transfer and Water Recycling Project, and Sandown (Isle of Wight, Western area) as well as the Havant Thicket Reservoir. These delays have been caused by a combination of factors which include environmental factors, consenting risks and changes to schemes caused by bulk transfer options no longer being available to us.

Without extending the use of the Candover and River Test drought options up to 2033-34, we are unable to meet supply-demand balance in the Western area during a drought for the period 2030-31 to 2033-34. We have included the option of importing up to 45Ml/d of water from Norway via sea tankers in the event of severe droughts between 2030-31 and 2033-34. This option has significant uncertainties around deliverability and water quality that will need to be resolved by 2029-30. However, even when included, the sea tankering option only serves to reduce to the volume required from the River Test drought option. It does not reduce or eliminate the need for the Candover drought option.

Drought permits and orders have environmental impacts of their own and their use effectively overrides the protections the Environmental Destination is seeking to resolve. We therefore do not consider it appropriate to introduce licence reductions in such situations that would result in more frequent or extended use of drought permits and orders. We have consequently delayed the implementation of uncertain sustainability reductions until alternative supplies are available.

We nevertheless tested our plan by implementing some of the unconfirmed reductions in abstractions from some of our sources in the Central and Western areas earlier than planned. This led to deficits in the supply-demand balance in the Western area but we were able to achieve supply-demand balance in the Central area.

We also tested our plan by changing the assumptions around savings from demand management options, delivery dates and volumes available from certain key schemes, volumes available through bulk imports etc, including in-combination impacts. This has given us a good overview of the schemes that are more critical than others in ensuring that we are able to maintain uninterrupted supplies of high quality water to our customers in droughts of up to 1-in-500 year severity. We are continuing to look for opportunities to close any future supply demand deficits.

Board Assurance Statement

This Board Assurance Statement is in relation to the revised draft Water Resources Management Plan 2024 (rdWRMP24) produced by Southern Water Services Limited (the Company), for the period 2025 to 2050.

The Board has put in place internal and independent technical and legal assurance to support the development of the revised draft Water Resources Management Plan (rdWRMP24) for June submission.

The Board engaged with, oversaw and scrutinised the development of the rdWRMP24 for submission to the Secretary of State on or before 28 June 2024, and is satisfied that it is a best value plan and a plan compliant with the Water Resources Planning Guidelines (WRPG), save for the limited options under continued review. These limited options relate to the updating of environmental assessments on the additional resilience options included in the plan as part of the continuing engagement with the Environment Agency (EA) and Natural England (NE) relating to the mitigation options to avoid drought permitting options. The assessments are expected to be resolved before the publication of the rdWRMP24 in or around September 2024. Board engagement has been sustained with a detailed level of scrutiny, support and challenge on the development of the plan.

The Board makes this assurance statement on the basis that the rdWRMP24 is based on sound and robust evidence and:

- sets out the considerable change in approach to water resource planning nationally since WRMP19;
- has been developed with clear public participation due to a series of consultation exercises that took place in 2022. The Company received 469 written responses and 122 survey responses, which were captured in the Company's Statement of Response. These included pre-consultation with customers, stakeholders including our stakeholder panels and engagement with the Water for Life Hampshire stakeholders; input from Water Resources South East (WRSE's) regional consultation; and targeted engagement with statutory and non-statutory stakeholders including Local Planning Authorities, retailers, NAVs and environmental organisations;
- has been developed in collaboration with WRSE;
- is an adaptive plan suitable for the complex regional supply challenges faced by the Company;
- has been developed with on-going engagement with the EA and NE throughout the development of rdWRMP24, in particular relating to mitigation options to avoid drought permitting options;

The Board is assuring the differences between the draft WRMP24 and the rdWRMP24. In doing so, we confirm that we are satisfied that the Company's rdWRMP24 for the period 2025 to 2050:

- was informed by WRSE Revised Draft Regional Plan (July 2023) as developed in accordance with the National Framework for Water Resources and relevant guidance and policy and now explains the differences in planning approach from WRSE, since publication of that version of the Regional Plan in order to incorporate the additional resilience options included in the plan relating to the mitigation options to avoid drought permitting options;
- the Company has put in place an adequate governance and assurance process for June submission and which will continue until the final WRMP is published;
- the plan is shaped by WRPG and a best value methodology. It is a best value plan and a plan compliant with the WRPG, save for the limited options under continued review, developed with on-going engagement with the EA and NE in particular relating to mitigation options to avoid drought permitting options. Taking this into account the Board, having carefully considered the views of customers, environmental organisations, stakeholders, government and regulators regarding the use of drought options, is satisfied that this variance from WRPG is now necessary in order to include the resilience options;
- the adoption of this plan adequately ensures that Southern Water can meet its supply demand balance based on all currently known criteria;
- the Company has used all best endeavours to develop a plan to address delivery of the long-term scheme for alternative water resources in accordance with the agreement made on the 29th March 2018 under section 20 of the Water Resources Act 1991 between the Company and the EA;
- the Company continues to progress with the development and consenting process for the delivery and utilisation of the long-term scheme in accordance with its projected timeframes. Those timeframes, reflecting on-going engagement with the EA and NE, have been agreed by the Board in the expectation that those development and consenting processes will receive support and approval from relevant regulators in order for them to be achieved.

The Board is committed to working with customers, environmental organisations, stakeholders, government and regulators to develop a plan that satisfies all parties over time.

Supporting Statement

As members of the Board, we have engaged, overseen and scrutinised key stages of development of the plan with different elements being included and discussed at meetings of the Company's Board and Executive Committee and their sub-committees held between August 2023 and May 2024 as follows:

Meeting	Dates
Board	29 November 2023, 1 February 2024, 29 May 2024.
Board Committees	**PR24 Board Meetings:** 17 August 2023, 17 November 2023, 15 December 2023, 1 February 2024, 26 March 2024, 24 April 2024, 28 May 2024. **Audit Committee:** 24 November 2023, 14 March 2024.
Executive Committee	20 November 2023, 13 December 2023, 22 January 2024, 22 May 2024.
PR24 Executive Committee	14 August 2023, 6 December 2023, 15 January 2024, 19 March 2024, 19 April 2024, 20 May 2024.
WRMP Sub-committee	22 April 2024.

Meeting our best value planning obligations when developing the plan

The Company's draft WRMP24 (dWRMP24) was published for consultation on 14 November 2022, with the consultation ending on 20 February 2023. Our Statement of Response to the public consultation to the dWRMP24 was published on 31 August 2023. In the Statement of Response, revised delivery dates for the following large infrastructure schemes were presented as follows:

1. The earliest availability of the Littlehampton water recycling scheme (8.5Ml/d) in our Sussex North Water Resource Zone (SNZ) was revised from 2027-28 to 2030-31.
2. The earliest availability of the 21Ml/d bulk import from Portsmouth Water to Otterbourne Water Supply Works (WSW) in Hampshire Southampton East Water Resource Zone (HSE) was revised from 2029-30 to 2031-32.
3. The earliest availability of the Hampshire Water Transfer and Water Recycling Project (HWTWRP), to provide up to 90Ml/d in HSE, was revised from 2030-31 to 2034-35[1].

The effect of the revised dates means that the Company will have to continue to rely on the use of drought permits and orders in Hampshire (Western area) in the early years of our plan until those schemes are fully operational. Without the use of drought options in the Western area, the Company cannot achieve its projected supply-demand balance and the Board has reached the conclusion that they remain a necessary interim measure until the longer-term infrastructure is developed and operational. The Board fully appreciates that the continued use of drought options (until our longer-term infrastructure is operational) present concern but understands that their inclusion is aligned with WRPG and in terms of the best value planning requirements, represent the best value option overall.

However, through stakeholder and customer engagement, the Company understands that the continued reliance on drought options presents an ongoing concern. The EA requested that we reconsider specific options to mitigate the reliance on drought permits and orders. In developing our plan and in response to regulatory feedback, we undertook a targeted reappraisal of options to identify those which could potentially reduce our dependency on the water sourced from the drought options in the Western and Central areas.

As a result of that process, our plan now includes four options comprising the provision of one new and one accelerated groundwater source and a bulk import via sea tankers in the Western area for utilisation from 2030-31, and the acceleration of a groundwater option in the Central area from 2030-31.

The inclusion of these options does not remove the need to rely on drought options altogether, nor does it alter the frequency of application for drought permits or drought orders in the Western area. The bulk-import via sea tankers, if used in the Western area in parallel with drought options, can however, by providing water from an alternative source, reduce the volume of water needed from the River Test Drought Permit/Order. The Candover Drought Order will still be needed at its full capacity in the event a drought up to 2033-34.

As a result of the measures we have introduced in rdWRMP24, the Pulborough surface water drought option will no longer be needed in the Central area after 2029-30 unless we are faced with a drought of 1-in-500 year severity.

The Board acknowledges that the implementation of bulk import by sea tankers presents a number of deliverability challenges (which had previously resulted in it being rejected) and the Company commits to explore these further throughout AMP8.

Our plan has largely been developed using the investment model we advanced at regional level with WRSE. It optimises the selection of options to meet supply-demand balance using a 'best value' approach as required under WRPG. The investment model selects the use of the continued reliance on drought options because of the high operational costs associated with the bulk import via sea tankers, when compared with the drought options, which the investment model considers as temporary, low-cost solutions with limited or no additional CAPEX. In order to incorporate the utilisation of the bulk import via sea tankers (and the other accelerated options in the Western area) into our plan, we pre-selected this and other resilience options and reduced the volume required from the River Test Drought Permit/Order through an iterative process. This therefore comprises a variance from the way other options are selected by the investment model and which otherwise were materially aligned with the best value requirements in WRPG.

As supported by the investment model, the continued reliance on drought options represents the best value option overall when considered with the addition of the sea tankering option. These new options are however being included in our plan as potential mitigants to the drought options, which are otherwise the preferred basis of our plan, on the assumption that the deliverability challenges can be overcome by their anticipated utilisation dates. In line with the WRPG requirement to achieve a 1-in-500 year drought resilience level, our plan requires no further use of supply-side drought options after 2040-41, in all but the most extreme droughts. Without this manual intervention to the investment model, these resilience options which are being included for the specific beneficial purpose of reducing reliance on drought options, would not be selected as early as 2030-31 in the case of accelerated and new groundwater options and not at all in the case of bulk import via sea tankers.

The Board has considered the implications, potential risks, cost and uncertainty from the bulk import via sea tankers and other resilience options and has balanced this with the wider concern about the continued reliance on drought options in the Western area and the environmental driver to reduce this reliance. The Board had no desire for the plan to include any variance to the best value aspect of WRPG but considers that this is necessary in order to include the resilience options, given stakeholder concern.

[1] Following further review since the publication of the Statement of Response, the estimated delivery date for HWTWRP has now been brought forward by a year to 2033-34 for delivery and 2034-35 for first utilisation.

Assuring the changes between our draft WRMP24 and rdWRMP24

The Board has also reviewed the strategy under our rdWRMP24 and confirms notable amendments since the dWRMP24 including, but not limited, to:

- Updated our growth forecast so that we have a better idea of the population we will need to serve in the future and the properties we will need to connect to our supply system.
- Updated the forecast for how much water we will supply by 2049-50 to meet new environmental targets on reductions in the water we take from rivers and groundwater (to protect and enhance the environment, particularly in droughts).
- Changed the targets for how much water we will save by tackling leaks and promoting savings in homes and businesses. We will reduce the average daily water use to 110 litres per person per day by 2044-45 (5 years ahead of the target date in the National Framework) and achieve a 9% reduction in non-household water use by 2038. We will reduce leakage by 53% by 2049-50.
- Removed desalination on the Sussex coast because there is no suitable location to build a desalination plant. The site we originally identified is no longer available.
- Revised the delivery date for our Sandown recycling scheme on the Isle of Wight in Western area which is now due to provide benefit from 2030-31 instead of 2027-28.
- Revised the delivery date for rebuilding our Weir Wood Water Treatment Works in our Central area providing benefit from 2026 to providing a treatment capacity of 21Ml/d from 2030-31. The treatment capacity will be increased in a modular fashion from 5.4 Ml/d in 2026, to 13Ml/d in 2028 to 21Ml/d in 2030.
- Revised the delivery date for refurbishment of our Petersfield groundwater source from 2025-26 to now provide benefit from 2028-29.
- Revised the delivery date for the reinstatement of our West Chiltington groundwater scheme from 2024-25 to now provide benefit from 2028-29.
- Revised the delivery date of our inter-zonal transfer via our Hampshire Grid scheme from 2027-28 to now provide benefit from 2030-31.

1. Introduction

1.1 Our services and supply area

We provide high-quality drinking water 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 in the east, 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.

Groundwater makes up around 70% of our total water supply; most of our groundwater mainly comes from the chalk aquifer that sits under much of South East England. This groundwater is also important in maintaining flows to the River Test and River Itchen in Hampshire and other smaller chalk streams across Sussex and Kent.

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 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. These are Bewl Water, Darwell, Powdermill and Weir Wood. South East Water is entitled to 25% of the yield from the River Medway Scheme, which incorporates the storage within Bewl Water Reservoir.

In addition to South East Water, we share borders with Affinity Water, Portsmouth Water, SES Water, South West Water, Thames Water and Wessex Water. 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 that comprises Affinity Water, Portsmouth Water, SES Water, South East Water and Thames Water in addition to Southern Water.

1.1.1 Subdivision of our supply area

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

Table 1.1: Our main supply areas and the associated water resource zones

Western area	Central area	Eastern area
1. Hampshire Andover (HAZ)	8. Sussex North (SNZ)	11. Kent Medway East (KME)
2. Hampshire Kingsclere (HKZ)	9. Sussex Worthing (SWZ)	12. Kent Medway West (KMW)
3. Hampshire Winchester (HWZ)	10. Sussex Brighton (SBZ)	13. Kent Thanet (KTZ)
4. Hampshire Rural (HRZ)		14. Sussex Hastings (SHZ)
5. Hampshire Southampton East (HSE)		
6. Hampshire Southampton West (HSW)		
7. Isle of Wight (IOW)		

Supplies in our Western area predominantly come from groundwater with only the IOW, 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 and KMW getting roughly equal proportions from reservoirs and groundwater. SHZ gets most of its supplies from reservoirs.

1.1.2 Water resource zone integrity

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

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

For our WRMP 2019 (WRMP19) we carried out an integrity assessment and made some changes to our WRZs to better reflect our understanding of level of risks to loss of supplies at that time. Consequently, the former Hampshire South WRZ was split into four WRZs (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 similarly split into KME and KMW.

We have reviewed the integrity assessment for this plan - our WRMP 2024 (WRMP24) - and have retained the boundaries from WRMP19. This is discussed in detail in Annex 1.

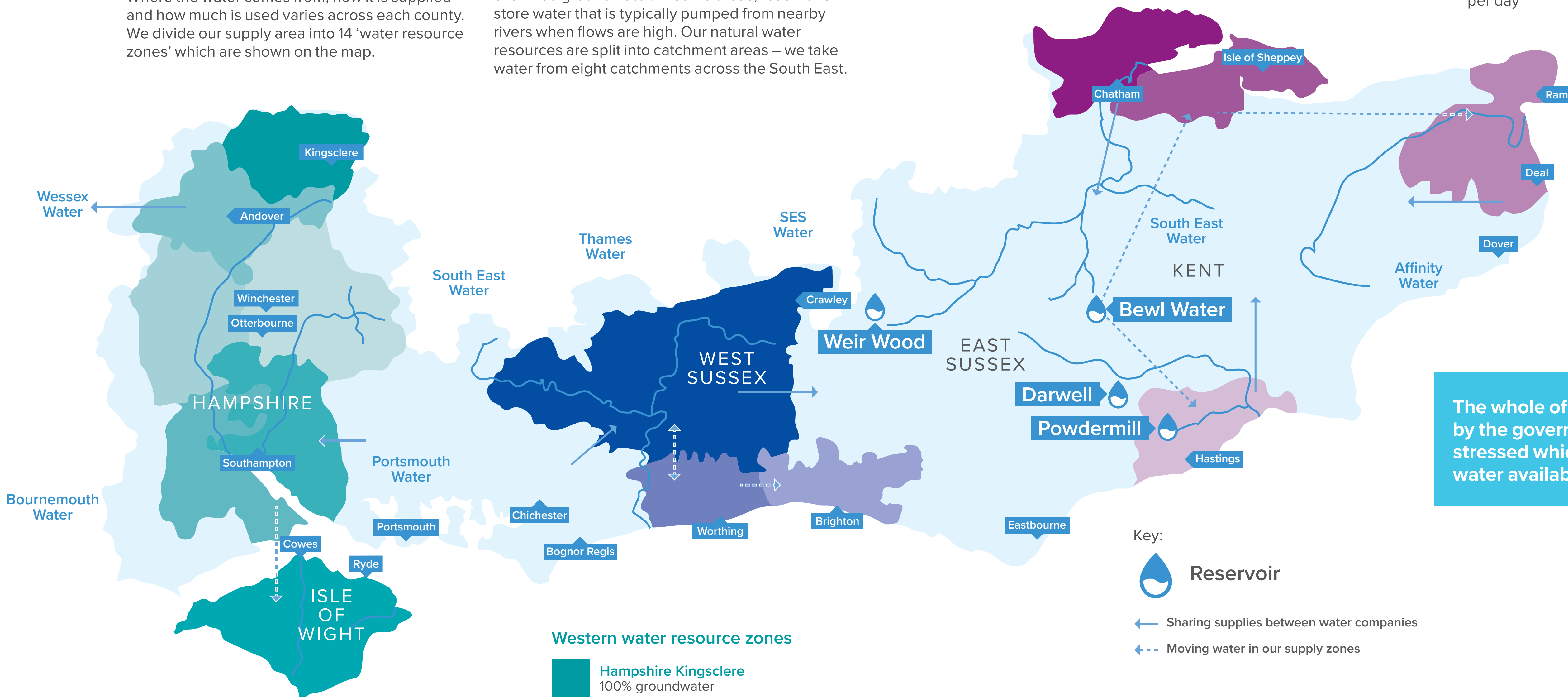
The change in planning guidance requiring estimation of Deployable Output (DO) based on system-response rather than individual sources (see Section 5.3.1) and planned improvements to our supply network as part of WRMP19 delivery, are likely to change our WRZs further in the future, especially in the Western area. We will undertake a further review of WRZ integrity for our WRMP 2029 (WRMP29).

Figure 1.1: Our supply area

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.



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.

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.

91% of homes are metered

Average water use:

125 litres per person per day

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

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.

85% of homes are metered

Average water use:

133 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

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.

87% of homes are metered

Average water use:

128 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

2. What is a Water Resources Management Plan?

2.1 Purpose and basis of our plan

All water companies in England and Wales are required to prepare and maintain a WRMP under the Water Resources Act 1991 (as amended). 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 well into the future.

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, the Department for Environment, Food and Rural Affairs (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, our WRMP24 covers the periods 2023-25 (Section 3.5 and Annex 2) and 2025-75 separately, to better demonstrate our alignment to the WRSE Regional Plan for the entire South East region.

In accordance with Section 37B(10) of the Water Resources 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 name them in a way so that our proposals can be easily understood.

An overview of the WRMP development process is shown in Figure 2.1:

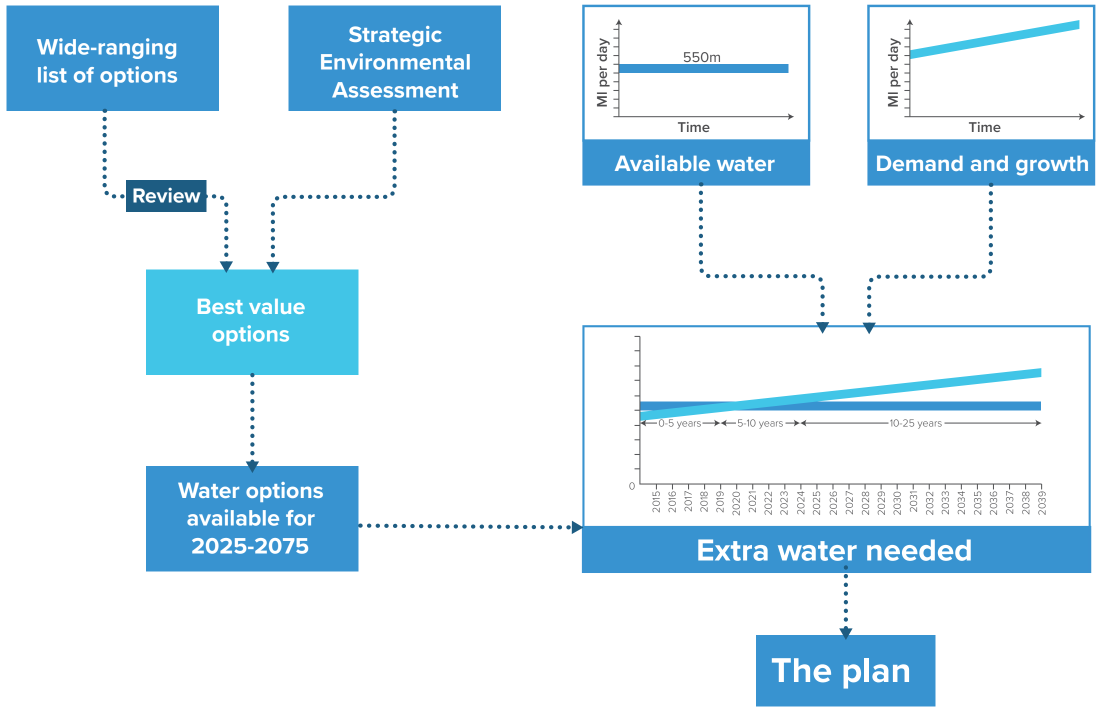


Figure 2.1: Overview of WRMP development process

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.

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. These include the following.

- The National Framework[2], published in 2020, 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.
- Introduction of the concept of 'best value' planning[3]. 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 under all scenarios. These scenarios could include uncertainties associated with future growth, demand for water and climate change impacts.
- The Water Resources Planning Guideline (WRPG)[4] for WRMP24 requires water companies to maintain supplies in a drought, with a return period of 1-in-500 years (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.

We have been involved in developing regional plans as part of the WRSE group for a number of planning cycles. For WRMP24, WRSE was formally set up as separate entity with its own core staff. As a result, there has been a greater degree of collaboration and consistency of approach across the member water companies in developing the Regional Plan as well as individual water company WRMPs.

Our WRMP19 was an adaptive, 'best value' plan. For WRMP24, we have developed a new combined adaptive and 'best value' planning approach in collaboration with WRSE.

2.3 Incorporation of government policy and regulatory frameworks

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 the key planning requirements, which we have incorporated. Key policy areas we have included are:

- **Planning at regional and company levels:** Our plan sets out the way we will maintain supply-demand balance 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.
- **Climate change:** The 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 5.3.2) to look at the impacts on supply and demand and incorporated into this plan. This also contributes to our Net Zero Plan to 2030.
- **Nature and the water environment:** The Government's 25-Year Environment Plan[5] calls for a step change in environmental improvements. We have included this through incorporation of Environmental Destinations in our plan (see Section 5.3.6).
- **Supply security:** The plan must cover at least 25 years. Our plan covers the period up to 2075 to reflect the long-term decisions needed for the region.
- **Delivery of plans:** The plans must be deliverable. Our plan sets out the actions we propose to take and the uncertainties which currently exist around the solutions we have proposed. We have also developed a Monitoring Plan to manage the uncertainty in delivery (Section 9 and Annex 21).

In developing this plan, we have also considered the National Infrastructure Commission recommendations[6]. Accordingly, this plan follows a twin-track approach to significantly reduce demand and to develop new sources.

[2] Environment Agency, 2020. Meeting our future water needs: a national framework for water resources. 16 March 2020, Version 1.
[3] UKWIR, 2020. Deriving a Best Value Water Resources Management Plan. Report WR/02, UK Water Industry Research Limited.
[4] Environment Agency, Ofwat, Natural Resources Wales, 2023. Water resources planning guideline. Version 12, 14 April 2023.

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 includes an expectation from water companies to reduce:
  - Per Capita Consumption (PCC) to 110 litres per head per day (l/h/d) under 'dry year' conditions by 2049-50,
  - non-household consumption by 9% in 2037-38 and by 15% by 2049-50 compared to 2019-20, and
  - leakage by 50% by 2049-50 compared to 2017-18 levels.

In our case, the PCC target of 110l/h/d under 'dry year' conditions roughly equates to 100l/h/d under 'normal year' conditions.

Our plan includes interventions to achieve a PCC of 110l/h/d by 2044-45; 5 years ahead of the target date in the National Framework. We are aiming to reduce non-household consumption by 9% by 2037-38 compared to 2019-20 and leakage by 53% by 2049-50 compared to 2017-18 (see sections 5.2.3 and 5.2.4).

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 drought orders to increase supply, in all but the most extreme droughts, after 2040-41.

- **Environmental Destination:** The Environment Agency 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 5.3.6).
- **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 (see Section 5.5).
- **Best value planning:** We have used the principles laid out by UK Water Industry Research (UKWIR)[2] to develop a Best Value Plan (BVP) (see sections 6.5 and 7).
- **Business planning:** 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 Price Review 2024 (PR24).

2.4 This plan

We published our draft WRMP24 (dWRMP24) for public consultation on 14 November 2022. The consultation closed on 20 February 2023. We published our Statement of Response (SoR) to public consultation on 31 August 2023.

In addition to incorporating feedback from public consultation, we made further changes to the rdWRMP24. These included revised forecasts for the delivery of some of our key schemes. Some of these scheme delays necessitate continued reliance on the use of drought permits and orders in Hampshire, in the event of a drought, until 2033-34 when these schemes are delivered.

The process agreed by the Environment Agency and Southern Water by which the company will apply for drought permits and orders in Hampshire is set out in the agreement we signed with the Environment Agency under Section 20 of the Water Resources Act 1991. The agreement was signed in 2018 and is due to expire in 2030. We will therefore need to discuss any implications of our extended timelines with regard to the agreement with our regulators.

As this represents a material change to the dWRMP24 that was consulted upon, we proposed a further re-consultation on our revised dWRMP24 (rdWRMP24).

[5] 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).
[6] 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).

Following initial discussions with the Environment Agency, we submitted an interim rdWRMP24 to Defra on 31 August 2023. Further discussions have been held with the Environment Agency and Natural England regarding the implications of revised dates for these schemes and identification of any options to mitigate against continued reliance on drought permits and orders in Hampshire up to 2033-34.

This rdWRMP24 has been developed in view of the discussions with the Environment Agency and Natural England and also incorporates feedback from the Environment Agency on our SoR and interim rdWRMP24. It includes further updates to the interim rdWRMP24 as discussed in Section 6.3.4.

2.5 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 Programme Management Board (PMB), which consists of representatives from each water company as well as the Environment Agency. 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 generally held fortnightly, with more frequent meetings when needed, 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 staff 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. We have independently developed our household demand forecast, supply forecast and carried out 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. This has meant that the Regional Plan as well as WRMP24s for WRSE member companies are developed through the same process using a common tool.

2.5.1 Alignment of this plan with the WRSE Regional Plan

WRSE consulted on its Emerging Regional Plan (ERP)[7] from January to March 2022 and its draft Regional Best Value Plan (dRBVP)[8] from November 2022 to February 2023. Our dWRMP24 was consistent with the dRBVP and took account of the feedback on the ERP.

Following revisions to the delivery dates of some of our schemes, i.e. Littlehampton recycling option, Havant Thicket Reservoir and the Hampshire Water Transfer and Water Recycling Project (HWTWRP), WRSE developed a two-step approach for development of revised dRBVP (rdRBVP) in order to limit re-consultation to Southern Water's rdWRMP24 only.

1. The WRSE investment model was initially run using same delivery dates for Southern Water options as in dRBVP and our dWRMP24. This produced a rdRBVP that formed the basis of rdWRMP24 for all WRSE companies, except Southern Water.
2. In the second step, the outcome from the rdRBVP24 for all WRSE companies, except Southern Water and Portsmouth Water, was fixed and the investment model was rerun with the changes made to Southern Water options (see Section 6.3.4). The plan produced in Step 2 was submitted to Defra on 31 August 2023 as our interim rdWRMP24.

This rdWRMP24 is based on the same two-step approach adopted for interim rdWRMP24 to ensure that any differences from the main rdRBVP are confined to Southern Water's supply area.

The rdRBVP will be updated to reflect Southern Water's rdWRMP24 so the two plans are consistent.

[7] WRSE, 2022. Futureproofing our water supplies. A consultation on our Emerging Regional Plan for south east England. January 2022 (https://www.wrse.org.uk/media/vxqjvd1x/wrse-regional-plan-jan-22-consultation-doc-printable.pdf).
[8] WRSE, 2022. Futureproofing our water supplies. A consultation on our draft regional plan for south east England (10306a_wrse-bv-plan-2022final_online.pdf).

2.6 Links with other plans

In addition to this plan, we are developing three other plans which have close links to our WRMP.

- **Drought Plan:** This 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 in March 2021, consulted on it in spring 2021 and issued a Statement of Response to the representations we received in September 2021. We then published an addendum to our Statement of Response in April 2022. We published an updated addendum to the Statement of Response and submitted our revised draft Drought Plan in September 2022 after taking account of further feedback from the regulators. After further discussions with our regulators, we submitted our updated Drought Plan to Defra in February 2024 seeking permission to publish it as the final Drought Plan. Since then, the EA has written to us asking for additional work to be done before it can be finalised.
- **Business Plan:** We produce a business plan every five years which describes the services we plan to deliver and the associated costs. We submitted our BP24 to Ofwat in October 2023. Ofwat will make its final determination on our BP24 in December 2024. We would expect investment for the WRMP24 schemes to be delivered between 2025-30 to be allowed in BP24, with some funding schemes to be delivered post 2030.
- **Drainage and Wastewater Management Plan (DWMP):** Our draft DWMP was published for consultation in June 2022 and the final DWMP is now on our website[9]. We have worked to align both plans through our Long-Term Delivery Strategy (LTDS), including our 'Catchment First' approach to environmental improvement and the selection of water recycling schemes.

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.

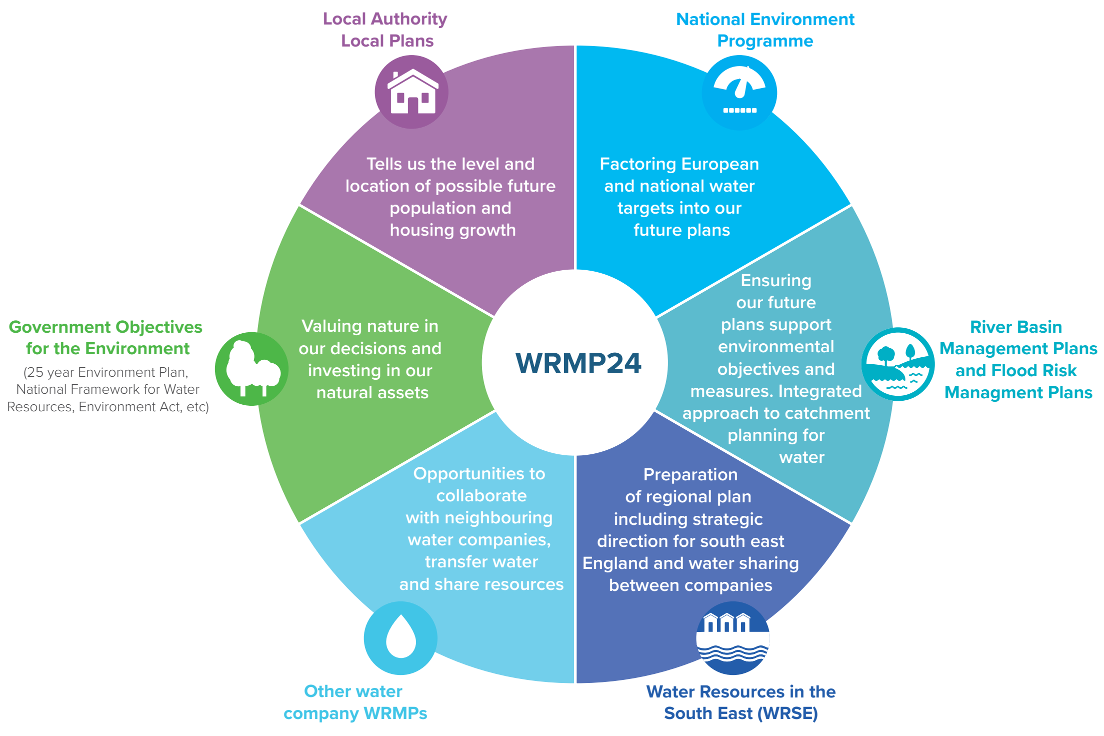


Figure 2.2: Links with other plans and programmes

[9] Drainage and Wastewater Management Plans (DWMPs) (southernwater.co.uk)

2.7 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 5-10 years, while we keep our plans flexible enough to adapt, if needed, once these licence changes are finalised.

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.

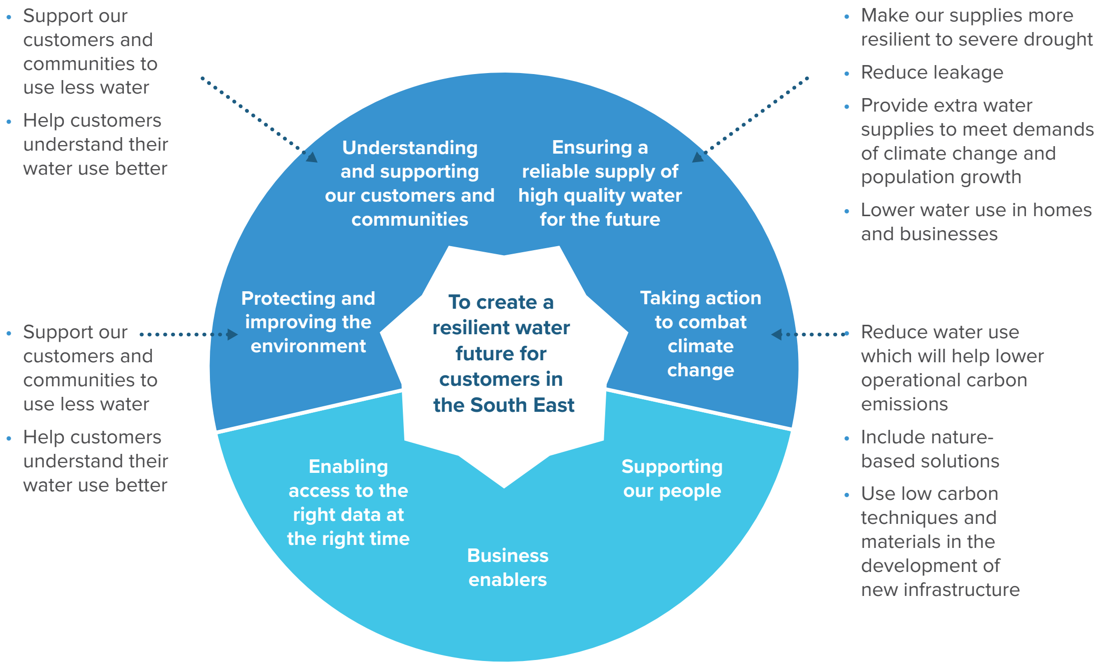


Figure 2.3: Summary of our key challenges and opportunities

2.7.1 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-technology industry to highly innovative and technologically advanced water supply systems. We need to make use of the latest 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:** Our area is officially classed as 'seriously water-stressed' by the government[10]. 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 recognise 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 to consider a range of potential future supply-demand balance scenarios relating to abstraction licence changes, growth and climate change. By planning for multiple supply-demand balance scenarios, we can make our plans more resilient to change and avoid investing in schemes that may not be needed in the long run.

2.7.2 Opportunities

Our WRMP24 aims to 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.
- **Nature-based solutions:** We have developed ambitious catchment management programmes to deliver a step-change in environmental improvement and supply resilience, as well as bringing 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.

[10] Defra and the Environment Agency, 2021. Water-stressed area: 2021 classification. https://www.gov.uk/government/publications/water-stressed-areas-2021-classification

2.7.3 Role of technology

Our WRMP24 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 WRMP24 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.

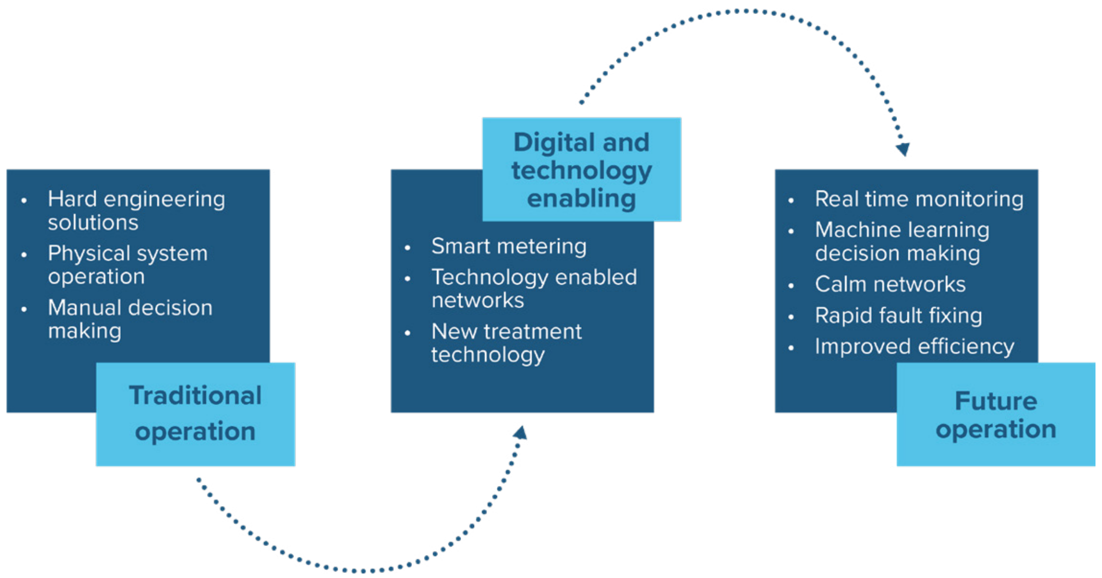


Figure 2.4: Technology roadmap

2.7.4 Other regulation and policy considerations

Other closely related regulations and policies we have considered include:

- **Water transfers (National Framework):** We have examined options to transfer water within the company and from our neighbouring companies to move water from areas of surplus to areas of deficit.
- **Working across sectors (National Framework):** We have worked with WRSE to identify potential options for cross-sector collaboration. 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:** Our WRMP24 is broadly aligned to the process and procedures set out in the Drought Plan that we submitted to Defra in February 2024. We expect to publish our next Drought Plan in 2026 and that plan will be entirely consistent with our WRMP24.
- **Water quality and water safety plans (Drinking Water Inspectorate - DWI):** We have updated assessments of our system yields to reflect latest reliable yields based on resource and water quality constraints. Our WRMP24 includes water quality improvements at sites where this is currently restricting water availability.

2.8 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 during droughts. We expect further restrictions on our abstraction 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 population continues to grow in our supply area.

The WRMP24 process allows us to work with our customers and stakeholders to make sure we can provide them with secure, safe, affordable, and sustainable water supplies into the future, and we know that we must do this to support economic growth. Our WRMP24, once finalised, will ensure that the infrastructure and services we provide are effective and fit for the future.

Our WRMP 2009 (WRMP09) saw us become the first UK water company to implement universal metering for customers. For our WRMP 2014 (WRMP14), 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. We are committed to progressively improving our approach to water resource planning as we look ahead to the development of WRMP29 to ensure we access new technologies and apply innovative ways of working to meet the complex challenges we face.

3. Our progress on WRMP19

3.1 Demand management

3.1.1 Reducing household demand

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 100l/h/d by 2040, under 'normal year' conditions, as part of our 'Target 100' initiative. We also committed to reducing leakage by 50% from 2017-18 levels 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 PCC, which is now higher than our original target.

Despite the higher starting position for AMP8, we remain committed to reducing household demand 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, we delivered more than 64 million impressions and 1.6 million direct communications in the form of emails and door drops. This resulted in a high level of awareness of the need to save water, with an estimated 56% of customers in the Western area, 39% in the Central area, and 47% in the Eastern area being made aware. We estimate this amounts to more than 858,000 customers and around 338,000 households who have taken active steps to reduce consumption as a result. We continued this programme in 2022-23 with over 3 million impressions and 1.4 million direct communications. 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.

Our ongoing water efficiency initiatives have continued. We completed 8,787 home visits in 2021-22 and 8,130 home visits in 2022-23, giving advice to householders living in water-stressed areas on how to use less water. As part of home visits, 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 of 27.5 litres per property per day since we began the visits in 2015. We carried out 13,500 home visits in 2023-24, including an extra 2,000 in Hampshire, and plan to carry out another 5,000 in 2024-25. We have started using behavioural science insights to improve uptake of home visits.

We undertook a smart data enabler trial in 2021-22 to better understand smart meters' impact on water consumption and provide more insights on smart data quality and management. Clip-on AMI smart data enabling devices were installed on external meters in Southampton, Andover, Midhurst and Brighton. The insights from the trial have now been reviewed internally and the lessons learnt have helped support both our smart metering and leakage programmes.

3.1.2 Reducing leakage

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 committed to an extra £18m of funding during 2021-22 in order to meet 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-19 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 workforce to detect, promote and repair leaks to target. We repaired in the region of 23,800 leaks in 2021-22 and have deployed approximately 7,000 new acoustic loggers designed to find leaks.

In 2022-23, leakage levels were above target with an outturn of 108.47Ml/d against a WRMP19 forecast of 91.3Ml/d. Extreme weather patterns including drought conditions over the summer period and two harsh/severe winter weather events in December 2022 and February 2023, have contributed to increased levels of leakage. The demand pattern for household and non-household customers remains more variable than it did pre-COVID19 and therefore the water network is being stressed in areas that were not stressed previously.

To address these challenges, we are increasing the level of field detection resources, in line with our action plan to reduce leakage and aim to achieve our leakage target by 2025. We have used learnings from our AMP7 programme to develop our WRMP24 leakage reduction programme, which is detailed in Annex 14.

3.2 Western area

In order to provide environmental protection for the rivers Test and Itchen, particularly in periods of low flow, the Environment Agency amended four abstraction licences held by Southern Water for public water supply. These licences were the subject of a Public Inquiry in March 2018.

At the Inquiry we entered into an agreement with the Environment Agency under Section 20 of the Water Resources Act 1991 (Section 20 Agreement) which committed us to a sequence of drought measures and set out the process by which we will apply for drought permits and orders for drought supply deficit in Hampshire. This agreement is due to expire on 31 March 2030. As part of the agreement, we agreed to use all best endeavours to implement the long-term scheme for alternative water resources set out in our 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 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 the development of long-term and large-scale solutions across the Western area.

3.2.1 Strategic Resource Options (SROs)

The long-term 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 progressed 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 Price Review 2019 (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 jointly developed by Southern Water and Portsmouth Water, to store highly treated recycled water from a new water recycling plant before transferring it to Otterbourne WSW for further treatment via a new direct raw water pipeline.

Our SRO options appraisal process[11] 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 feasibility against one another. We also considered known risks to our supply-demand balance, including the impacts of not receiving bulk supplies we previously expected to be available, 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.

[11] https://www.southernwater.co.uk/media/pr5hm04q/gate-2-annex-5-options-appraisal-process_redacted.pdf

Development of the Western area SRO up to RAPID Gate 2

In September 2021, we presented an interim update to RAPID[12]. 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. Alternative locations were 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 the Environment Agency 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 had the following main components:

- Abstraction from Budds Farm Wastewater Treatment Works (WTW);
- Treatment at a new water recycling plant to produce recycled water (at least 15Ml/d);
- Transfer of recycled water from the water recycling plant 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 and potable water sent into supply.

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

The Back-Up Option identified was known at the time as Option B.5. This option involves 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 WTWs;
- Treatment at a new water recycling plant 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 and potable water sent into supply.

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, both were considered capable of being scaled-up to deliver up to approximately 90Ml/d into Otterbourne WSW for treatment 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 the HWTWRP represented better value for customers than the Back-Up Option and was better able to meet long-term regional supply requirements.

In December 2021, we published our 2021 Annual Review of WRMP19 confirming 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, that will transfer approximately 90Ml/d during peak demand conditions, with a water recycling plant of at least 20Ml/d and up to 60Ml/d capacity. This scheme is being progressed as part of the RAPID gated process for its continued investigation and development.

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 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. In preparation for our DCO application we ran a public consultation on this scheme in Summer 2022[13] and we are currently developing our Preliminary Environmental Information Report (PEIR) which will be consulted on as part of our Statutory Consultation in Summer 2024.

[12] https://www.southernwater.co.uk/media/5339/wflh_7_gate-2_conceptual-and-detailed-feasibility_desalination-redacted.pdf
[13] https://www.southernwater.co.uk/our-story/water-for-life-hampshire/consultations

Western area SRO, Regional Plan and rdWRMP24

The ERP published in January 2022 provided an early look at the water resource solutions that could be needed across the WRSE region, in the event of a 1-in-500 year drought. In developing the dRBVP and our dWRMP24, we looked at a range of options including different sized schemes.

The SRO for the Western area described above, was considered as having two separate component parts; a pipeline to transfer up to 90Ml/d from Havant Thicket Reservoir to Otterbourne WSW, and a water recycling plant to provide Havant Thicket Reservoir with recycled water. Four capacity variants of the water recycling plant was considered; 15Ml/d, 30Ml/d, 45Ml/d and 60Ml/d. All four variations were combined with a conjunctive use benefit of Havant Thicket Reservoir, which would also contain spring water originating from Bedhampton.

Working with WRSE, we used a high-level regional Python Water Resource Model (Pywr) 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 multiple future supply-demand balance scenarios (see Section 5.5), to generate the dRBVP. Our dWRMP24 selected the HWTWRP from 2030-31.

Subsequently, Southern Water and Portsmouth Water have taken the high level regional Pywr model for the Western area and Portsmouth Water supply area to develop a more granular Pywr model, reflecting the network and known river and groundwater constraints in more detail. The aim of this exercise was to understand how the Havant Thicket Reservoir provides conjunctive-use benefit with the HWTWRP, at key time intervals (2030, 2040 and 2050) in the network development. As a result of this further work since the publication of dWRMP24, the size variants of the water recycling plant options at Budds Farm WTW have been revised to 20Ml/d, 40Ml/d and 60Ml/d, with the initial minimum water recycling plant size being uplifted from 15Ml/d to 20Ml/d. The model enabled us to test whether it would select the larger sized water recycling plant in a phased approach. However, the 60Ml/d capacity plant is selected as soon as it becomes available.

A Quantitative Schedule Risk Analysis (QSRA) was undertaken to test the reliability of the delivery date for the HWTWRP included in our dWRMP24. The analysis has indicated greater confidence in delivering the HWTWRP by March 2034 with benefit from the option first achieved in 2034-35 (i.e. from 01/04/2034). This is now incorporated into rdWRMP24. There are a number of significant factors influencing this assessment, which in combination result in the extension of forecast delivery timescales. These are:

- Water recycling plant sizing requirement; in view of the impact of further supply-demand investment modelling and an updated forecast of future environmental destination needs.
- Development Consent Order (DCO); the potential risks relating to submission, decision, or legal challenge.
- Direct Procurement for Customers (DPC) process; the potential risks to completing an agreement.
- Interface and consenting risks due to combination of the Havant Thicket Reservoir project and the water recycling plant.

Another SRO option that we are investigating and developing jointly with Thames Water is the Thames to Southern Transfer (T2ST), which is a transfer from Thames Water into our Western area. This strategic pipeline can transfer up to 120Ml/d and is dependent on delivery of the South East Strategic Reservoir Option (SESRO), which is also being investigated through the RAPID gated process. T2ST is not anticipated to deliver water resources into the supply network before 2039-40 and it is dependent on other new and not yet consented or delivered sources. This scheme is selected in our rdWRMP24 in 2039-40 in addition to the HWTWRP.

3.2.2 Demand management

As mentioned in Section 3.1.1, we have started smart metering trials in parts of Southampton and Andover. Our home visits programme is progressing as well. Challenges presented by COVID-19 and a global semi-conductor shortage have hit the supply-chain that manufactures our water meters. As a result, we have deferred the increase in household meter penetration from 88% to 92% to AMP8 (2025-30).

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. Clay based soils are more prone to ground movement which can increase the break-out of leaks.

Overall, water efficiency initiatives, with the exception of meter penetration, are progressing, albeit with revised targets driven by COVID-19 related to increased home working.

3.2.3 Resource development and bulk supplies

Additional import from Portsmouth Water (additional 9Ml/d) - This scheme was included in the dWRMP24 but has been removed from our rdWRMP24 as the test boreholes drilled by Portsmouth Water have not been able to provide the required volume of water. This appears as 'Bulk import (HSE): PWC Source A to Otterbourne WSW additional (9Ml/d)' in our rejection register (Annex 12).

Import from South West Water (20Ml/d) - This scheme is no longer viable as sustainability targets imposed on South West Water mean that this resource is no longer available to transfer to Southern Water. The capacity shortfall of this scheme was also included in the sizing of the HWTWRP prior to accelerated RAPID Gate 2. This appears as 'Bulk import (HSW): SWW (20Ml/d)' in our rejection register (Annex 12).

Additional import from Portsmouth Water linked to Havant Thicket Reservoir (21M/d) - This option is referred to as 'Bulk import (HSE): PWC Source A to Otterbourne WSW (21Ml/d)' in this plan. The actual delivery location is Southern Water's network, and not Otterbourne WSW. This option is dependent on the delivery of Havant Thicket Reservoir.

Havant Thicket Reservoir is being delivered through an innovative partnership between Portsmouth Water and Southern Water. The current scheme received planning permission in late 2021. When completed, Portsmouth Water will take water from the reservoir during a drought, allowing it to supply Southern Water with 21Ml/d from its supplies further to the west.

As part of work to plan for the future, Portsmouth Water and Southern Water have been taking further steps to protect and improve our environment by exploring additional ways of supplying the region with new sustainable sources of water. This has involved looking at different options, including adding highly treated recycled water to Havant Thicket Reservoir as part of the HWTWRP to enable it to provide more water both in a normal year and in a drought. Supplementing the reservoir with recycled water will secure up to 90Ml/d extra water.

The two companies have been looking at ways to future proof the already approved Havant Thicket Reservoir scheme by working together to share infrastructure, with an updated planning application for a single pipeline tunnel to the reservoir that can be used by both Portsmouth Water and Southern Water.

A key priority is to minimise disruption to residents and the environment, while efficiently delivering the required infrastructure with value for money for customers. A shared tunnel approach means that, if proposals for water recycling are agreed in the future, residents will not need to experience additional disruption. It will also reduce environmental impact. This future proofing approach could save over £100 million, compared to installing separate new infrastructure at a later stage.

Ofwat has been involved in discussions on this approach, and is supportive of it, recognising that it is in the best interests of Southern Water customers, the environment and society more broadly.

A decision on Portsmouth Water's revised planning application is expected to be in late 2024. Ofwat will then need to approve the revised costs.

As a result, the first year of benefit for Havant Thicket Reservoir has been revised from 2029-30 to 2031-32. The change in delivery date has been incorporated into our rdWRMP24.

While it is prudent for our rdWRMP24 to be based on these revised delivery dates, driven by a number of environmental factors, we will continue to drive for earlier delivery and additional programme mitigations.

West Southampton Coast desalination (75Ml/d) - This scheme has been replaced with the HWTWRP as discussed above (Section 3.2.1). This appears as 'Desalination (HSW): Southampton West - transfer to River Test WSW (75Ml/d)' in our rejection register (Annex 12).

Hampshire Water Transfer and Water Recycling Project (90Ml/d) - As mentioned above, our dWRMP24 selected the HWTWRP from 2030-31. This has now been revised so the option first provides benefit from 2034-35. We are in discussions with regulators around the shift in delivery date and options to mitigate the impacts of this. The three main components of this scheme are:

1. Recycling (HSE): Recharge of Havant Thicket from recycled water from Budds Farm (60Ml/d). This option is also available in 20Ml/d and 40Ml/d capacity variants.
2. Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW pipeline - first section (90Ml/d)
3. Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW pipeline - second section (90Ml/d)

Sandown WTW recycling (8.5Ml/d) - This option is called 'Recycling (IOW): Sandown (8.5Ml/d)' in this plan. The development of a water recycling plant at Sandown WTW to deliver 8.5Ml/d benefit to the IOW drinking water distribution system is progressing, with a location for the water recycling plant now identified and a contractor engaged to support development and delivery. The current forecast date for delivery is March 2030. The main reasons for the revised forecast are:

- Delays and complexities obtaining planning approval for the water recycling plant. A full EIA is now required as the construction will be on a combination of landfill site and a flood plain. Extensive ground investigations are required to inform construction methodology.
- The need to get a River Yar discharge permit for the treated water and modifications required to the existing Sandown WTW permit to account for the water discharged from the water recycling plant. We will need to carry out extensive sampling to support the discharge permit application.
- Complexity associated with partially building on a formal landfill site that requires environmental and ecological investigations. We also need to establish requirements for Biological Net Gain (BNG).

Hampshire grid - Andover Link Main (reversible HSE-HWZ and HWZ-HAZ links) - This scheme has progressed with system architecture having been determined, together with the Southampton Link Main below, 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, the design flow for HSE-HWZ has increased from 38Ml/d to 74Ml/d, and for HWZ-HAZ it has been reduced from 25Ml/d to 15Ml/d. This scheme is referred to as 'Interzonal transfer (HSE-HWZ): Otterbourne WSW to Yew Hill WSW bi-directional (74Ml/d)' in this plan.

Hampshire grid - Southampton Link Main (reversible link HSW- HSE) - This option has been redesigned such that the link is now between HSW and HWZ and connects to the Andover Link Main above. The design flow remains at 60Ml/d. In this document, this scheme is now referred to as 'Interzonal transfer (HSE-HSW): Yew Hill WSW to River Test WSW bi-directional (60Ml/d)'.

Romsey Town and Broadlands valve (HSW-HRZ reversible) - Scheme to transfer water into HSE is progressing through solution optioneering before moving into construction. This scheme is called 'Interzonal transfer (HSW-HRZ): Romsey Town and Broadlands valve bi-directional' in this plan and will be delivered by AMP8.

Newbury WSW groundwater asset enhancement - Scheme to enhance resilience of HKZ is progressing with solution optioneering complete. The preferred solution has been developed and is progressing into construction, with delivery date planned for March 2027. This scheme is now called 'Groundwater (HKZ): Remove constraints at Newbury to increase yield (1.2Ml/d)' in this plan.

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. This scheme was removed as a feasible option following options appraisal for WRMP24.

3.2.4 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 19.6Ml/d and 10.8Ml/d benefit respectively by March 2025. 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.

3.2.5 Environmental protection measures

While not directly contributing to supply-demand balance, 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.

Table 3.1 summarises progress on options selected as part of the WRMP19 in the Western area, excluding drought options.

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

Schemes	WRZ	Delivery year as per WRMP19	Progress
Demand management			
Water efficiency activity	All	From 2020	Progressing but with revised target
Leakage reduction (15% reduction by 2025; 50% by 2050)	All	From 2020	Progressing
Increase in household meter penetration from 88% to 92%	All	From 2020	Delayed until AMP8
Resource development and bulk supplies			
Additional import from Portsmouth Water (additional 9Ml/d)	HSE	2024–25	Abandoned, as Portsmouth Water can no longer provide the supply
Import from South West Water (20Ml/d)	HSW	2027–28	Abandoned, as South West Water can no longer provide the supply
Additional import from Portsmouth Water linked to Havant Thicket reservoir (21Ml/d)	HSE	2029–30	Progressing to revised delivery deadline in line with Havant Thicket Reservoir delivery
Southampton coast desalination (modular to 75Ml/d)	HSW	2027–28	Replaced by Hampshire Water Transfer and Water Recycling Project to provide up to 90Ml/d benefit from 2035-36
Sandown WwTW Indirect Potable Reuse (8.5Ml/d)	IOW	2027–28	Progressing with delivery date revised to 2029-30
Hampshire grid - Andover Link Main (1) (reversible link HSE-HWZ)	HWZ & HSE	2027–28	Progressing with delivery date revised to 2029-30
Hampshire grid - Andover Link Main (2) (reversible link HWZ-HAZ)	HAZ & HWZ	2027–28	Progressing with delivery date revised to 2029-30
Hampshire grid - Southampton link main (reversible link HSW-HSE)	HSW & HSE	2027–28	Progressing with delivery date revised to 2029-30
Romsey Town and Broadlands valve (HSW-HRZ reversible)	HRZ & HSW	2024–25	Progressing with delivery date revised to March 2025
Newbury WSW asset enhancement (1.2Ml/d)	HKZ	2027–28	Progressing with delivery date planned for March 2027
WSW near Cowes – reinstate and additional treatment	IOW	2065 in 1 adaptive planning branch	Not yet progressing

Table 3.1: Status of WRMP19 preferred options in the Western area, excluding drought options.
Continued

Schemes	WRZ	Delivery year as per WRMP19	Progress
Catchment management			
In-stream river restoration works on the Itchen	HSE & HWZ	2029–30	Delayed pending outcome of Water Framework Directive 'No Deterioration' investigations - AMP8 WINEP scheme proposed, completing 2030
In-stream river restoration works on the Test (upper reaches)	HAZ & HRZ	Phase 1 2024-2025 Phase 2 2029-2030	Progressing, will continue into AMP8 completing 2030
Pesticide catchment management / treatment – Sandown	IOW	2024–25	Catchment management progressing - linked to DWI undertaking
Pesticide catchment management / treatment – Test Surface Water	HSW	2024–25	Catchment management progressing - linked to DWI undertaking
Nitrate catchment management / treatment – Winchester	HWZ	2027	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment – Romsey	HRZ	2025	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment – Twyford	HSE	2025	Catchment management progressing, and continuing in AMP8

3.3 Central area

3.3.1 Water neutrality

In September 2021 Natural England issued a Position Statement for planning applications for new development within SNZ, commonly referred to as the Natural England Position Statement or the Water Neutrality Position Statement. This sets out that the existing water abstraction in the SNZ may be contributing to habitat deterioration within internationally protected sites in the Arun Valley.

Until the risk has been eliminated either by demonstrating no impact by further investigations or through development of alternative supplies, the Natural England Position Statement establishes that development proposals within the SNZ that would lead to an increase in water demand must demonstrate that their proposals are water neutral and that the relevant Local Planning Authority (LPA) is the competent authority to carry out this assessment.

These requirements apply to any developments that require planning permission and those developments that take place under permitted development rights.

For those developments that will create demand (regardless of any existing use of the site) for mains water from our Pulborough water supply source, the applicant must submit a Water Neutrality Statement to the relevant LPA setting out the existing and proposed water consumption figures, and a scheme for achieving water neutrality. The LPA will assess the Water Neutrality Statement and impose any relevant planning conditions.

Annex 22 describes our proposed strategy to address water neutrality in SNZ.

3.3.2 Demand management

We have started smart metering trials in parts of Brighton and Midhurst. Our home visits programme is progressing as well. As mentioned above, as a result of COVID-19 and the impact of global semi-conductor shortage on manufacturing of new meters, we have deferred the increase in household meter penetration from 88% to 92% to AMP8 (2025-30).

Overall, water efficiency initiatives, with the exception of meter penetration, are progressing, albeit with revised targets driven by COVID-19 related to increased home working.

3.3.3 Resource development and bulk supplies

Littlehampton WTW Indirect Potable Water Recycling - In response to regulatory feedback to our WRMP19 Annual Review 2022 we submitted a 'delivery roadmap' to regulators in February 2023. The roadmap provided an update on delivery dates and water resource benefits of WRMP19 supply-side schemes, and identified potential risks to the delivery of schemes and the steps we are undertaking to mitigate them. The roadmap highlighted a likely extension to the timing of the Littlehampton WTW Indirect Potable Water Reuse scheme caused by factors beyond our control, due to planning and consenting risks.
The Environment Agency requires longer monitoring to allow discharge consents for this scheme and may not be able to fast track as the scheme, as it was not identified as an SRO at PR19. It is also likely that delays will also be caused by third party approvals covering planning, EIA and the Habitats Regulations Assessment (HRA) for the pipeline route which must cross a National Park. The roadmap included a more mature programme of delivery for the scheme, which accounted for these delivery risks, with a completion date of September 2029. This means that benefit from the scheme will be first available from 01/04/2030 (2030-31). We are engaging with our regulators to understand any further possible mitigations. This scheme is relabelled as 'Recycling (SNZ): Littlehampton with direct river discharge (15Ml/d)' for this plan.

Coastal Desalination - Sussex Coast -
The scheme has proved to be undeliverable at the proposed location of Shoreham Harbour. We have actively looked at alternative locations and solutions including upsizing of the Littlehampton WTW Indirect Potable Recycling and relocating the desalination plant to the River Adur. However, no alternative suitable site has been identified. As a result, the option has been removed from the rdWRMP24. This scheme appears as 'Desalination (SBZ) Sussex Coast (20Ml/d)' in the rejection register (Annex 12).

Pulborough groundwater licence variation -
This scheme has been put on hold pending the outcome of the Water Framework Directive (WFD) 'No Deterioration' investigations due in summer 2025.

Aquifer Storage and Recovery in SWZ -
This scheme is no longer being delivered as access to the site identified for pilot testing could not be secured. It appears as 'Groundwater (SWZ): Sussex Coast LGS ASR (4Ml/d)' in the rejection register (Annex 12).

Transfer to Midhurst WSW and Petersfield borehole rehabilitation - Scheme to investigate the release of additional Deployable Output (DO) from Petersfield WSW. This scheme is now due to be delivered by 2027-28, with benefit from 2028-29. This has been relabelled as 'Groundwater (SNZ): Petersfield refurbishment (1.6Ml/d)' for this plan.

Scheme to bring West Chiltington back into service - Scheme to release additional DO 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. This scheme is now due to be delivered by 2027-28, with benefit from 2028-29. This now labelled as 'Groundwater (SNZ): Reinstate West Chiltington (3.1Ml/d)' in this plan.

Pulborough Winter transfer Stage 2 - New main between SWZ and SBZ to facilitate additional transfer of water from Pulborough WSW 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 WSW during the winter to allow groundwater sources near Brighton to be rested. It is referred to as 'Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d)' in this plan. In the rdWRMP24, this scheme is not needed until 2040-41.

3.3.4 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 20Ml/d of supply at North Falmer A, North Falmer B, Brighton A, North Arundel and Long Furlong B, via catchment management and installation of nitrate treatment where appropriate. We have delivered a nitrate blending solution to protect our Long Furlong B source and will deliver a nitrate treatment plant in AMP8 to ensure the nitrate challenge is mitigated. The first phase of the Brighton A nitrate treatment scheme will be delivered in AMP7, with a second phase delivered during AMP8. A nitrate plant treating flows from North Falmer A and North Falmer B will be delivered by December 2027.

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.

3.3.5 Environmental protection measures

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

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

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

Schemes	WRZ	Delivery year as per WRMP19	Progress
Demand management			
Water efficency 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	Delayed to AMP8
Resource development and bulk supplies			
Littlehampton WTW Indirect Potable Water Reuse	SNZ	2027–28	Delayed to 2029-30
Coastal Desalination - Shoreham Harbour	SBZ	2027–28	Abandoned
Pulborough groundwater licence variation	SNZ	2021–22	Scheme on hold due to sustainability investigations
Aquifer Storage & Recovery (Sussex Coast - Lower Greensand)	SWZ	2027–28	Abandoned
Transfer to Midhurst WSW & Petersfield borehole rehabilitation	SNZ	2025–26	Delayed to 2027-28
Scheme to bring West Chiltington back into service	SNZ	2024–25	Delayed to 2027-28
Winter transfer Stage 2: New main Shoreham/North Shoreham and Brighton A	SBZ	2027–28	Progressing pending completion of feasibility investigations
Catchment management			
Arun/W Rother - instream catchment management options	SNZ & SWZ	2029–2030	Delayed pending outcome of Water Framework Directive 'No Deterioration' investigations - AMP8 WINEP Scheme proposed completing 2030
Pesticide catchment management / treatment - River Arun	SNZ	2024-25	Catchment management progressing - linked to DWI undertaking
Pesticide catchment management / treatment - Pulborough Surface	SNZ	2024–25	Catchment managment progressing - linked to DWI undertaking
Pesticide catchment management / treatment - Weir Wood Reservoir	SNZ	2024–25	Catchment management progressing - linked to DWI undertaking
Nitrate catchment management / treatment - North Falmer A	SBZ	2027-28	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - North Arundel	SWZ	2027-28	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - North Falmer B	SBZ	2027-28	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - Long Furlong B	SWZ	2022-23	Catchment management progressing and continuing in AMP8. Nitrate blending solution delivered.
Nitrate catchment management / treatment - Brighton A	SBZ	2027-28	Catchment management progressing, and continuing in AMP8

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

3.4 Eastern area

3.4.1 Demand management

Water efficiency initiatives in the Eastern area are progressing. As noted above, we expect our PCC at the end of AMP7 to be higher than originally forecast in WRMP19 due to the impact of COVID-19 on working patterns. WRMP19 did not include any increase in household meter penetration in the Eastern area.

3.4.2 Resource development and bulk supplies

Medway WTW Indirect Potable Water Recycling - Optioneering for this scheme took place 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, the DO benefit of this scheme has been revised to 14Ml/d from 18Ml/d. In the rdWRMP24, this scheme is not needed before 2030-31 (see Section 7). The delivery of this scheme as consequently been revised to 2029-30.

South East Water bulk supply near Canterbury - We are working with South East Water 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 KTZ. Review of achievable output is currently underway.

West Sandwich and Sandwich WSW licence variation - The license review has been completed and the benefit from this option has been included in the baseline supply forecast for rdWRMP24.

3.4.3 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 33Ml/d of supply by December 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.

3.4.4 Environmental protection measures

While not directly contributing to supply-demand balance, 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.

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

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

Schemes	WRZ	Delivery year as per WRMP19	Progress
Demand management			
Water efficent 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	To be delivered by 2029-30 - see Section 7
South East Water bulk supply near Canterbury	KTZ	2025–26	To be delivered by 2027-28
Utilise full existing transfer capacity (from Faversham4)	KTZ	2027–28	Progressing
West Sandwich and Sandwich WSW licence variation	KTZ	2021–22	Complete - Benefit included in baseline supply forecast
Catchment management			
Pesticide catchment management / treatment - Darwell Reservoir	SHZ	2024–25	Catchment management progressing - linked to DWI undertaking
Pesticide catchment management / treatment - River Medway Scheme	KMW	2024-25	Catchment management progressing - linked to DWI undertaking
Pesticide catchment management / treatment - Powdermill Reservoir	SHZ	2024–25	Catchment management progressing - linked to DWI undertaking
Nitrate catchment management / treatment - Deal	KTZ	2022–23	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - West Sandwich	KTZ	2025-26	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - Manston	KTZ	2022-23	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - Ramsgate B	KTZ	2022-23	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - Birchington	KTZ	2022-23	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - North Deal	KTZ	2022-23	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - near Canterbury	KTZ	2025-26	Catchment management progressing, and continuing in AMP8
Nitrate catchment management / treatment - Sandwich	KTZ	2027-28	Catchment management progressing, and continuing in AMP8

3.5 Our plan for 2023–25

Our 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 WRMP19 and consistent with meeting the PR19 targets. There are some changes to resource schemes to reflect updated estimates of reliable scheme and system yields as well as changes to water transfers. Annex 2 provides a WRZ level breakdown of the 2023-25 plan and is accompanied by a separate set of tables.

The plan for 2023-25 uses the demand forecasts in WRMP19. The retention of those forecasts allows consistency of reporting to WRMP19 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 and the targets were developed reflecting regulatory policy at that time. WRMP19 was not developed on a 'best value' basis as defined in the current regulatory process. Retaining alignment to WRMP19 ensures consistency of decision-making within the periodic review cycle.

4. Our plan for 2025-75

4.1 Development of WRMP24

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

A key difference between WRMP24 and previous WRMPs 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 provide benefits across the region, 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.

Our WRMP24 is based upon the Regional Best Value Plan (RBVP) which is likely to be published when this WRMP is finalised. 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 BP24.

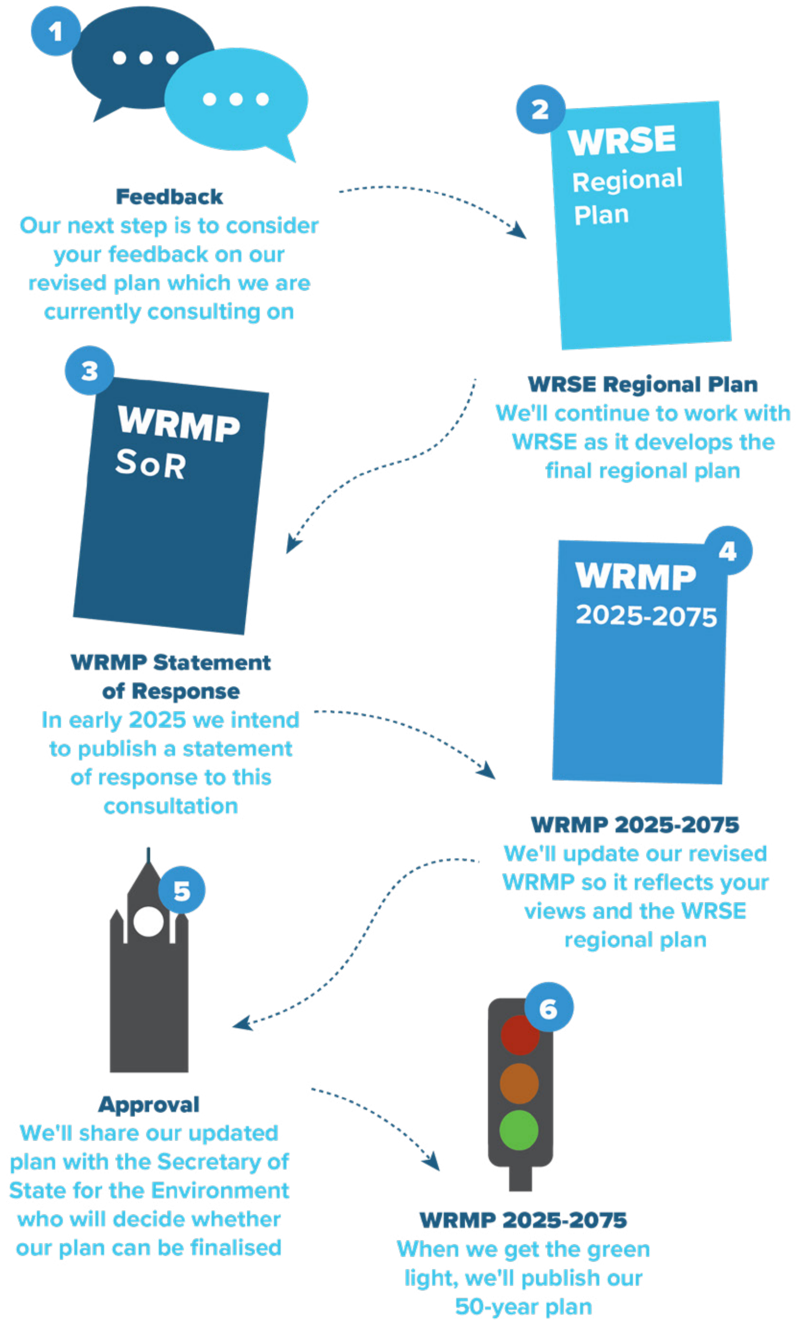


Figure 4.1: WRMP development and consultation process

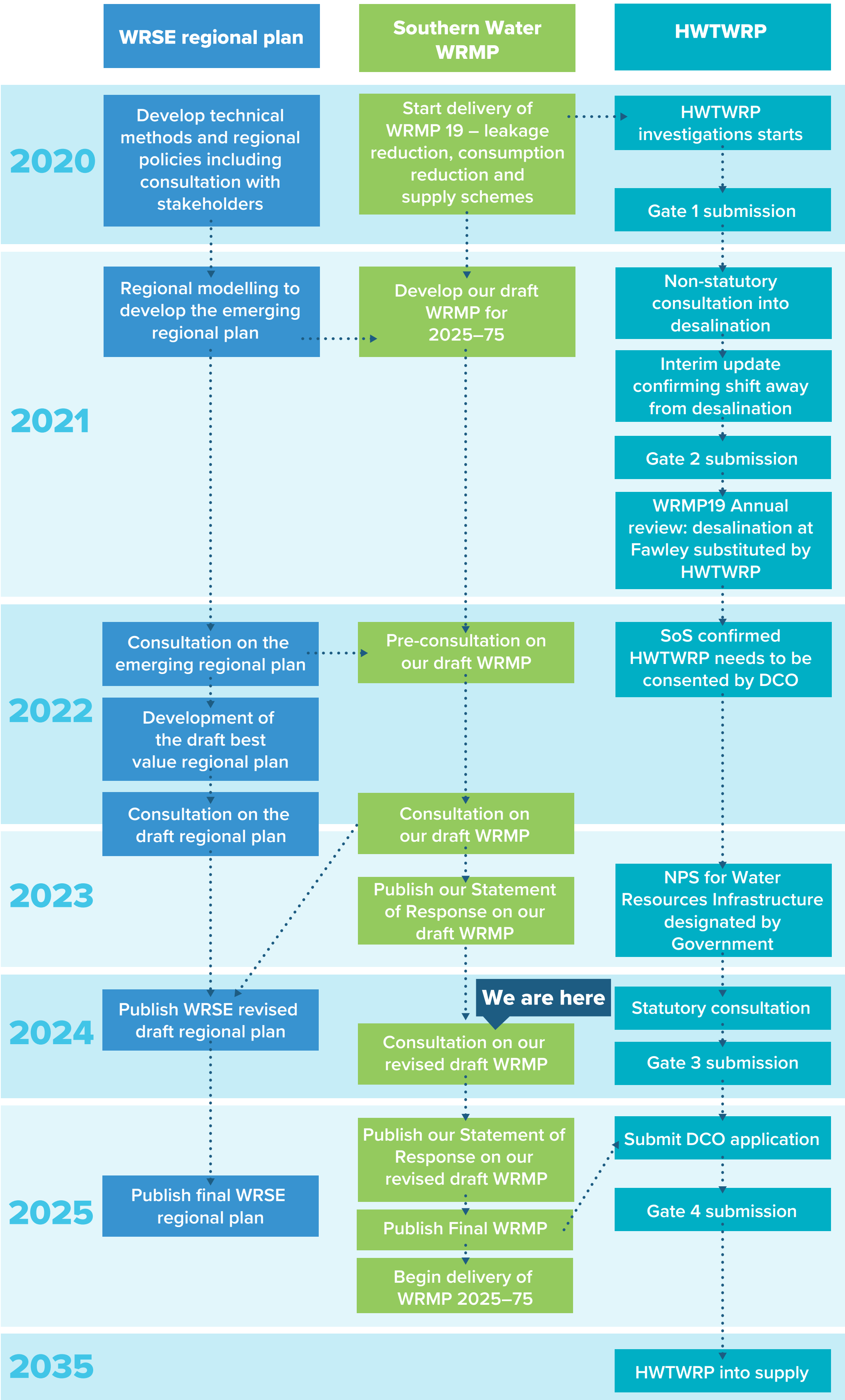


Figure 4.2: Timeline to illustrate how our plan aligns with the wider Regional Plan

4.2 Problem characterisation

We have completed a problem characterisation assessment following the UKWIR guidance for risk-based planning[14,15].

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.

In summary, this process assigns a 'strategic needs' score based on the size of the problem and a 'complexity factors' score based on the level of difficulty in solving the problem. 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. Although the assessment of strategic needs and complexity factors are necessarily subjective, UKWIR guidance for the problem characterisation assessment provides detailed 'scales of significance' to maximise consistency between water companies. These are set out in Annex 3, where we provide more details of all aspects of the problem characterisation process.

		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	6	6	5	6	18

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

Figure 4.3: Results from our problem characterisation assessment for WRMP24

[14] UKWIR, 2016. Water Resources Management Plan 2019 Methods - Decision Making Process: Guidelines. Report 16/WR/02/10, UK Water Industry Research Limited.
[15] UKWIR, 2016a. Water Resources Management Plan 2019 Methods - Risk Based Planning. Report 16/WR/02/11. UK Water Industry Research Limited.

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)[16], S(c) and D(b) in our problem characterisation (Annex 3).

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

We have combined our problem characterisation assessment with those of other WRSE companies[17]. 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 Southern Water and the wider South East region, 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.

Following the assessment, we have adopted an adaptive planning approach for decision-making. This is discussed in Section 5.5.

4.3 Understanding our drought vulnerability

As mentioned in Section 1.1, each of our WRZs has 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 conducted a drought vulnerability assessment following the UKWIR methodology[18]. 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 WRZs that required detailed assessment. As a result, five WRZs; four in the Western area (HAZ, HKZ, HWZ and HRZ) and one in the Eastern area (KME), were screened out because the DO of these WRZs is largely constrained by the assets, infrastructure and licence conditions, and does not vary significantly with drought.

For the WRZs identified as 'drought vulnerable' from the high-level screening, we 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. These drought response surfaces show the potential duration of supply failures for drought events of between 3 and 60 months' duration which end in October (i.e. the rainfall deficits are eliminated in October). October was selected as our drought vulnerability analysis of hydrological data (rainfall and flow) showed that the correlation between drought duration and timing by calendar month was greatest in that month. This is particularly the case for 12-21 months duration events, reflecting the inclusion of one or two dry winters and which present the greatest vulnerability risk.

[16] Annex 3 shows the S questions which relate to supply, the D questions which relate to demand and the I questions that relate to investment.
[17] WRSE, 2020. Problem Characterisation, Consultation Version. August, 2020.
[18] UKWIR, 2017. Drought Vulnerability Framework. Report 17/WR/02/12. UK Water Industry Research Limited.

The WRZs 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.

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 12-21 months duration 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 has a different supply mix; mostly made up of Lower Greensand groundwater and base flow to the Western Rother.

Our Eastern area WRZs 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.

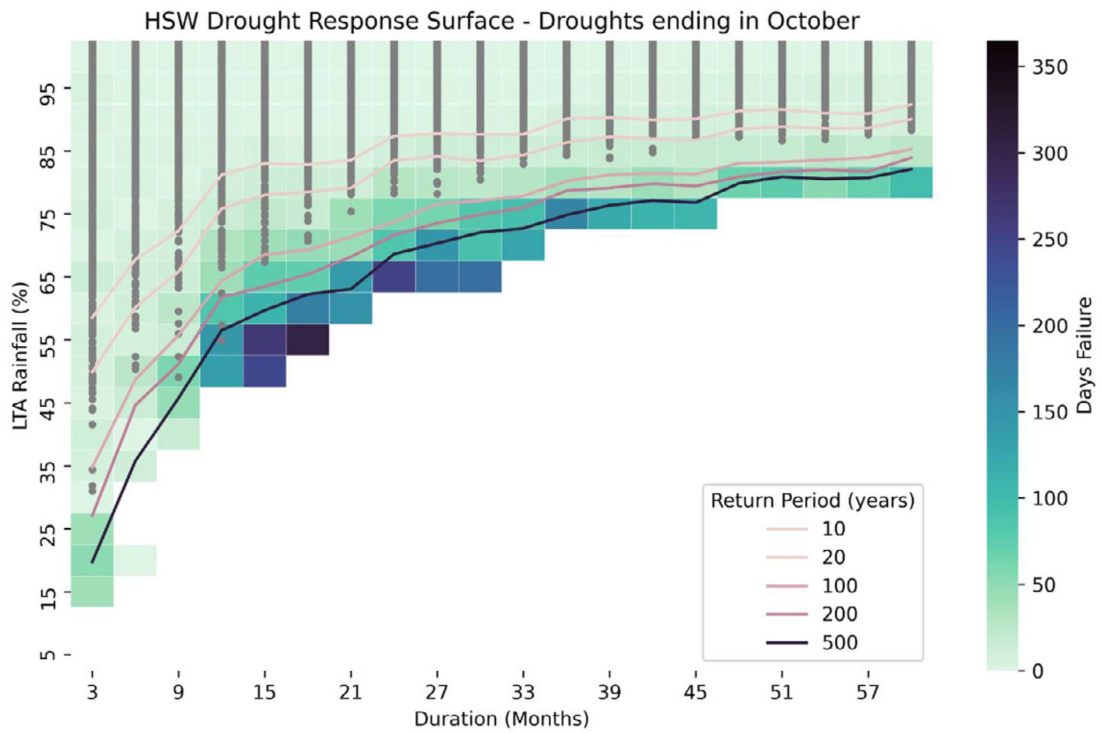


Figure 4.4: Example of drought response curve for droughts of 3 to 57 months' duration which end in October

4.4 Our planning scenarios

The primary objective of water resources planning is to ensure that enough supplies are always 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 as well as in a 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 droughts of different severity i.e. 1-in-100 year (1:100), 1-in-200 year (1:200) and 1-in-500 year (1:500).

4.5 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. Annex 5 provides more detail on customer and stakeholder views about drought restrictions. We need to make sure that there is enough water available to meet anticipated demand in all WRZs, to meet our level of service. We also carried out a review of the lessons learned from the dry conditions in 2022 (see Annex 6).

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 needing to rely on drought permits and orders at some of our sources (environmental target level of service).

A key principle of our plan 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-in-500 year return period with an 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 achieve supply-demand balance in each WRZ.

4.5.1 Defining and testing our levels of service

Our baseline water supply forecast uses a suite of 400 climate sequences (a total of almost 20,000 years of data) of rainfall and potential evapotranspiration (PET) with our water resource models. These represent artificially generated but plausible alternative realisations of the historical climate between 1950 and 1997. We additionally considered the impacts of climate change. Using these large data sets enables us simulate groundwater levels, reservoir storage and river flows and calculate drought return periods and frequencies.

In order to develop our plan, these supply forecasts have been used in combination with different levels of demand to assess supply-demand balances under four different planning scenarios as under (see Section 5.2.2):

- Normal year annual average demand and supply (NYAA)
- Dry Year Annual Average Demand under droughts of 1-in-100 year and 1-in-500 year severity (1:100 DYAA and 1:500 DYAA respectively)
- Dry Year Critical Period (i.e. annual peak) demand against 1-in-500 year drought severity (1:500 DYCP)

Our investment model attempts to resolve these supply-demand balances across all WRZs, under all planning scenarios in each year of the planning period for each adaptive plan pathway to achieve a 'best value' solution. This ensures that the set of options selected by the investment model can meet the anticipated supply-demand deficits across all planning scenarios to provide a more efficient solution for both drought and non-drought years.

In addition to the four different levels of drought severity, we have combined 5 population growth scenarios (see Section 5.2.1), 28 climate change scenarios (see Section 5.3.2) and 4 Environmental Destination scenarios (see Section 5.3.6) together in differing combinations. This results in a total of 580 different future supply-demand balance 'situations', covering the wide range of supply-demand deficits that we must plan for. While these 580 futures are formed from different combinations of the individual growth, climate change and Environmental Destination scenarios, the resulting range of supply-demand balances can be achieved through other combinations. These combinations of discrete forecasts describe the range of overall supply-demand balance situations that we need to account for. While each supply-demand balance is described by a different combination of discrete forecasts, many of the overall impacts are very similar.

While we have not explicitly considered low return period droughts (e.g. 1-in-10 year, 1-in-20 year, 1-in-50 year) in our investment modelling scenarios, they are included in our supply modelling. The resulting uncertainty in the supply-demand balances we have considered across our adaptive plan ensures it should be a robust, resilient strategy and represent a BVP.

4.5.2 Our target levels of service

The WRPG requires water companies to be resilient to droughts of 1-in-500 year severity, i.e. companies should be able to meet demand without having to use drought permits and orders to increase supply in a drought of up to 1-in-500 year severity. For WRMP24, we are planning to achieve this level of resilience by 2040-41. This represents a step change from WRMP19 and will help to ensure uninterrupted 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 by not requiring the use of drought permits and orders to increase abstractions beyond licenced quantities in droughts of up to 1-in-500 year severity (0.2% annual probability) in any WRZ after 2040-41. However, to achieve these targets we will need to reduce demand and develop new and alternative sustainable sources of water (see Section 7). Our target levels of service for demand restrictions and drought permits and orders are set out in Table 4.1.

Table 4.1: Target levels of service

	Annual probability	Return period	Probability of at least 1 occurrence between 2025 and 2075
Customer target levels of service			
Advertising to restrict water use	20%	1-in-5 year	100%
Temporary Use Ban on different categories of water use	10%	1-in-10 year[a]	99%
Drought Order (Non-Essential Use Ban)	5%	1-in-20 year[b]	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[c]	5%	1-in-20 year[c]	92%

[a] Frequency of first implementation but would be introduced in a phased manner.

[b] The 1-in-500-year target is to be achieved by 2040-41. Our target level of service is less than this in some WRZs prior to 2040-41.

[c] For HSE we expect the short-term level of service for these drought permits and orders (up to 2030) could be less than our target.

4.5.3 Customer levels of service for restrictions on demand

When drought risk is identified, we focus demand management activity in the affected area along with the introduction of temporary restrictions of customers' water use, such as TUBs and NEUBs. These interventions delay the need to take other drought actions such as implementation of drought permits and orders and also may partially offset the need to invest significant amounts in new 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 (see Annex 5). 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. We are committed to working with our customers and stakeholders to manage water resources during periods of drought.

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 revised draft Drought Plan 2022 (DP22[19]). 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.

The agreed process in the Section 20 Agreement specifies the phasing of TUBs and NEUBs in affected WRZs in our Western area (HSE and HSW). TUBs are required before implementation of the River Test Drought Permit and implementation of partial NEUBs restrictions is required before the River Test or River Itchen Drought Orders are implemented.

Our assessment of flows during the lead into drought on the River Test has suggested that the trigger at which we would need to apply for a drought permit or order is likely to be reached once every three to five years whilst we develop our long-term water resource options to offset the impact of the 2018 abstraction licence changes. Current Environment Agency guidance on drought permits and orders requires that steps are taken to reduce demand before drought permits are either applied for or implemented. Recent work we have undertaken in this regard suggests that we may need to impose restrictions on water use at a similar frequency to drought permit and order applications, i.e. around once every five years (Table 4.2).

Table 4.2: Forecast reduced level of service in Hampshire

Level of service	Company target level of service	Reduced level of service for Hampshire based on flow modelling for the rivers Test and Itchen	Defining trigger set out in Drought Plan
Advertising to restrict water use	1-in-5 years	1-in-2 years	60 day River Test Drought Permit trigger
Temporary Use Ban on different categories of water use	1-in-10 years	1-in-5 years	35 day River Test Drought Permit trigger
Drought Order (Non-Essential Use Ban)	1-in-20 years	1-in-20 years	Candover Drought Order trigger

We have communicated this risk to our customers in Hampshire consistently throughout our WRMP19 consultation, our current published Drought Plan (DP19), and our consultation in 2021 and in 2022 on our latest Drought Plan. The message is also reported consistently alongside all our engagement on SROs in the Western area and highlighted as one of the drivers for the SROs.

Since 2019, we have made two drought permit applications for the River Test, in 2019 and in 2022. We have also applied TUBs once in this period, in 2022. The actual frequency of restrictions experienced by our customers in Hampshire is therefore broadly in line with the risks we have highlighted. We expect these risks to remain elevated until we have delivered our SROs in Hampshire.

We have therefore kept our stated actual levels of service as being less than target, including the assessment that TUBs and drought permit applications may be required more frequently than our target level of service in our Western area until the SROs are delivered.

It should also be noted that in their representations to our dWRMP24, some environmental stakeholders in Hampshire have suggested that the more frequent use of TUBs in Hampshire should be made permanent. They argue that this would help to reduce reliance on drought permits and orders, and potentially avoid the need for some high-cost and less environmentally friendly resource options.

The supply-demand balance modelling we have undertaken alongside WRSE does not currently allow for optimisation for lower level of service e.g. 1-in-5 year (1:5) or 1-in-10 year (1:10); it only solves for NYAA, 1:100 DYAA, 1:500 DYAA and 1:500 DYCP scenarios. The primary planning focus is on severe droughts. We have assumed that TUBs and NEUBs will be in place under all drought scenarios.

4.5.4 Environmental level of service for drought permits and orders

Our latest Drought Plan 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 drought 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%. 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 National Framework.

However, large-scale schemes such as water recycling, desalination and new reservoirs can take several years to appropriately plan and deliver so drought permits and orders may still be required up to 2040-41. By keeping the reliance on drought permits 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 (see Annex 5). We have sought to find the appropriate balance between developing new schemes that take many years to deliver and relying upon drought permits/orders where required until these schemes become available.

In order to provide more protection to the rare chalk river habitats of the River Itchen, our Western area drought permits and orders are not to be used after 2029-30, except the River Test Drought Permit/Order that could be applied to be used up to 2040-41 in a 1-in-500 year drought scenario. The revisions to the delivery dates for Littlehampton WTW recycling option, Havant Thicket Reservoir and the HWTWRP (see sections 3.2 and 3.3) have necessitated an extension in the potential period over which we may require the use of drought permits and orders. This is further discussed in Section 7.2.

[19] We submitted this revised draft drought plan to Defra in February 2024 but have not yet been given permission to finalise it.

4.5.5 Emergency drought orders

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 4.3 sets out our current levels of service for emergency drought orders and permits and the glidepath for achieving 1-in-500 resilience.

Table 4.3: Level of service glidepath to 1-in-500 year (1:500) resilience against use of emergency drought orders without drought permits and orders

Area	Current Position	2025-2030	2030-2040	Beyond 2040
Western	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		Less than 1% annual chance (1:100 up to 1:170 return period) with drought permits and orders	Less than 0.5% annual chance (1:200 return period) with drought permits and orders	
Eastern		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	

Central area

We are currently forecasting a lower level of service due to the imposition of emergency drought orders (rota cuts and standpipes) in our Central Area, principally SNZ for the period 2025-2030. In our WRMP19, we forecast a 1-in-200 year level of service, equivalent to a 0.5% annual chance or around a 2% chance of occurring between 2025 and 2030.

However, for this plan we are less confident that we can provide 1-in-200 level of service owing to a number of factors:

- Updated supply forecast modelling (see Annex 8) has increased the forecast frequency at which the River Rother Minimum Required Flow (MRF) is reached, this restricts the amount of water we can abstract from our Pulborough WSW during drought and thereby the resilience of our SNZ.
- A long-term water quality problem at Weir Wood Reservoir which has required a full rebuild of the Water Treatment works to return it to operation. We expect this to occur in three stages between 2025 and 2030.
- Delays to delivery of water supply schemes, including the return to service of our West Chiltington and Petersfield groundwater sources to 2028-29 and delay to the delivery of the Littlehampton recycling scheme to 2029-30 to provide benefit from 2030-31.

Table 4.4 summarises the change in DO in SNZ between this WRMP24 and WRMP19, indicating in particular the decline in DO between the two plans at low probability droughts (1-in-200 year or more severe events). The greatest changes are an almost 50% reduction in DO for 1-in-200 drought event under the DYAA/MDO scenario and for a 1-in-500 drought under the DYCP/PDO scenario. The drop in baseline DO effectively represents a direct increase in the supply-demand deficit at the 1-in-200 year level of service compared to our WRMP19 position and in this case arises almost wholly from a change in the baseline supply forecast.

Table 4.4: Comparison of DO in SNZ between WRMP19 and WRMP24

Plan	DO by return period (DYAA/MDO) - Ml/d				DO by return period (DYCP/PDO) - Ml/d			
	1-in-500 year	1-in-200 year	1-in-100 year	1-in-2 year	1-in-500 year	1-in-200 year	1-in-100 year	1-in-2 year
WRMP19	17.50	42.10	46.70	74.10	39.70	69.40	73.70	98.60
WRMP24*	17.60	21.46	54.84	79.00	20.81	57.32	70.60	99.16
Difference	0.10 (1%)	-20.64 (-49%)	8.14 (17%)	4.9 (7%)	-18.89 (-48%)	-12.08 (-17%)	-3.10 (-4%)	0.56 (1%)

*With Weir Wood Reservoir WSW at 21Ml/d

Figure 4.5 illustrates this change. When compared with our WRMP19 assessment, the biggest difference can be seen in the 1-in-150 to greater than 1-in-200 year drought return period. In particular, the system DO assessment for this plan shows a steeper drop off in DO at around the 1-in-180 year return period. Our assessment of river flows in the Western Rother during drought has indicated that both WRMP19 and WRMP24 are generally consistent, therefore this difference appears to be a function of the way DO has been assessed at a system level for this plan.

The forecast drop in level of service to Level 4 restrictions to 1-in-100 between 2025 and 2030 is partially driven by a limitation in the WRSE supply-demand balance modelling approach which only considers 1-in-2, 1-in-100 and 1-in-500 scenarios. As our system modelling has indicated for both WRMP19 and WRMP24, the biggest factor in the decline in DO occurs as the output from Pulborough surface water and groundwater sources reduces as the Western Rother MRF is approached. Our modelling has shown that this also occurs at between a 1-in-170 year to 1-in-200 year return period and so effectively controls the level of service in SNZ. However, at a regional level the supply-demand balance prior to 2029-30 is only assessed at 1-in-100 year level (or more correctly, at 1-in-500 year with a DO adjustment to offset less severe drought).

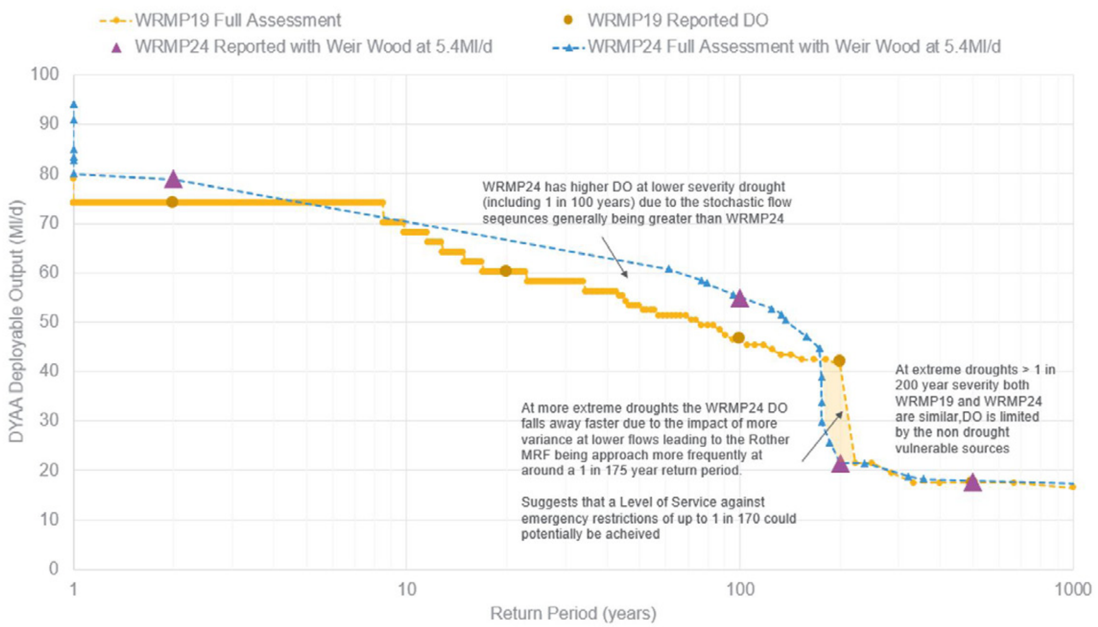


Figure 4.5: Comparison of System DO simulation between WRMP19 and WRMP24

To better understand the true level of service for SNZ, we have considered the total water resource capacity built (for the 1-in-100 year scenario) up to 2029-30 in our preferred plan (see Section 7) and compared that to an adjusted supply forecast in which we have adjusted down the DO to 1-in-150 to 1-in-170 year return period. These scenarios would have an annual risk of Emergency Drought Order restrictions between 0.6% to 0.7% or an overall chance of such restrictions occurring before 2029-30 of around 3% (1% higher than the risk under a 1-in-200 year level of service but 2% less than under a 1-in-100 year level of service).

By adjusting the supply-demand balance in this way (Table 4.5), our preferred plan appears to show resilience up to a 1-in-150 year event between 2025-26 and 2026-27 and up to a 1-in-170 year event from 2027-28 to 2029-30 when 1-in-200 year resilience is achieved. As in other WRZs and compliant with guidance, resilience to 1-in-500 year events is achieved by 2040-41.

Table 4.5: Supply-demand deficit at different levels of service in SNZ during the early part of the plan

Supply-demand balance*	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31
1-in-100 (reported capacity)	8.43	10.96	13.32	18.20	17.93	42.70
1-in-150	0.88	3.41	5.77	10.65	10.38	25.41
1-in-170	-2.75	-0.22	2.14	7.01	6.75	21.78
1-in-200	-21.85	-19.32	-16.96	-12.08	-12.35	2.68

* Note that this reflects all situations in our adaptive plan, (see Section 5.5) as adaptive branching does not occur until later in the planning period.

4.5.6 Our level of service statement

To assess our level of service for WRMP19 and WRMP24, we modelled our system against multiple future scenarios. The results show we may need to apply TUBs up to 3 times before 2035-36 and NEUBs once. After 2034-35, once our strategic resource options for the Western area are in place, we would expect to apply TUBs three to four times further up to 2070 and NEUBs once or twice.

4.6 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. This approach aimed to cover all types of customers including those in vulnerable groups. Annex 5 describes our customer engagement exercise in detail.

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 due to limited experiences of water shortages and commonly held 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 consumption. 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.

There is a high level of priority placed on environmental protection. Therefore, the focus on reducing abstraction first is welcomed, although the consultation showed that customers are looking for more detail from water companies on how this will be achieved. In our plan, we have set out our approach to achieving sustainable abstraction through our Environmental Destination (see Section 5.3.6) and the measures and assets we will need to get there through our proposed strategies.

Our customers 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 future scenarios and pathways.

Throughout the development of the Regional Plan, customers have shown support for demand management, but want to see these combined 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 on customer engagement are provided in Annex 5.

4.6.1 Stakeholder pre-consultation

To create our plan, we held detailed pre-consultation discussions with the Environment Agency, 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 the Environment Agency, Ofwat, Natural England and Portsmouth Water.

The Environment Agency provided valuable technical comments and inputs. It, however, also raised some concerns relating to the deliverability and potential impacts of certain options, including desalination and water recycling. The Environment Agency also wanted to see more alignment between our WRMP24 and the SROs being progressed through the RAPID gated process.

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

Ofwat requested clarity on the WRMP19 supply-demand balance position currently being implemented. In particular, 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.

Portsmouth Water provided comments on options that were common to or shared between our respective WRMP24s, relating to the need for the options and information on the outputs and data underpinning them.

Our dWRMP24 incorporated a number of these comments.

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 ways 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. This was not possible for WRMP24 due to COVID-19 restrictions. Instead, 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 WRMP24:

- 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[20] containing the questions posed during the webinars, with responses included. Around 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 2022 with a further 24 questions submitted and responded to.

We received specific feedback from the Environment Agency 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 WRMP24, 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 WRMP24 process.

As well as the responses from the Environment Agency, Ofwat, Natural England and Portsmouth Water referred to above, we received responses from Salmon & Trout Conservation UK, Horsham District Council, Mid Sussex District Council, Adur and Worthing Council and private individuals.

During the development of WRMP24, the 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.

We submitted an early dWRMP24 to Defra in June 2022, as required by the WRMP Direction 2022 and this enabled us to take on board some early feedback which has influenced the development of this plan. In response to that feedback, we included 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 contingency measures (see Section 9) 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 in Annex 5.

[20] WRSE, 2022. Emerging Regional Plan Water Resources South East' Consultation Response Document. May 2022.

5. Our supply-demand situation 2025-75

5.1 Previous levels of water supply

The main aim of our plan is to ensure that we maintain an uninterrupted supply of wholesome water to our customers while protecting and enhancing the environment in all but the most extreme drought conditions. We would normally expect demand for water to increase over time, primarily due to population growth. This was the case from the early 1960s until the privatisation of the water sector in England and Wales in 1989.

Since privatisation, the amount of water we put into supply, or Distribution Input (DI), has declined over time despite the increase in population (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.

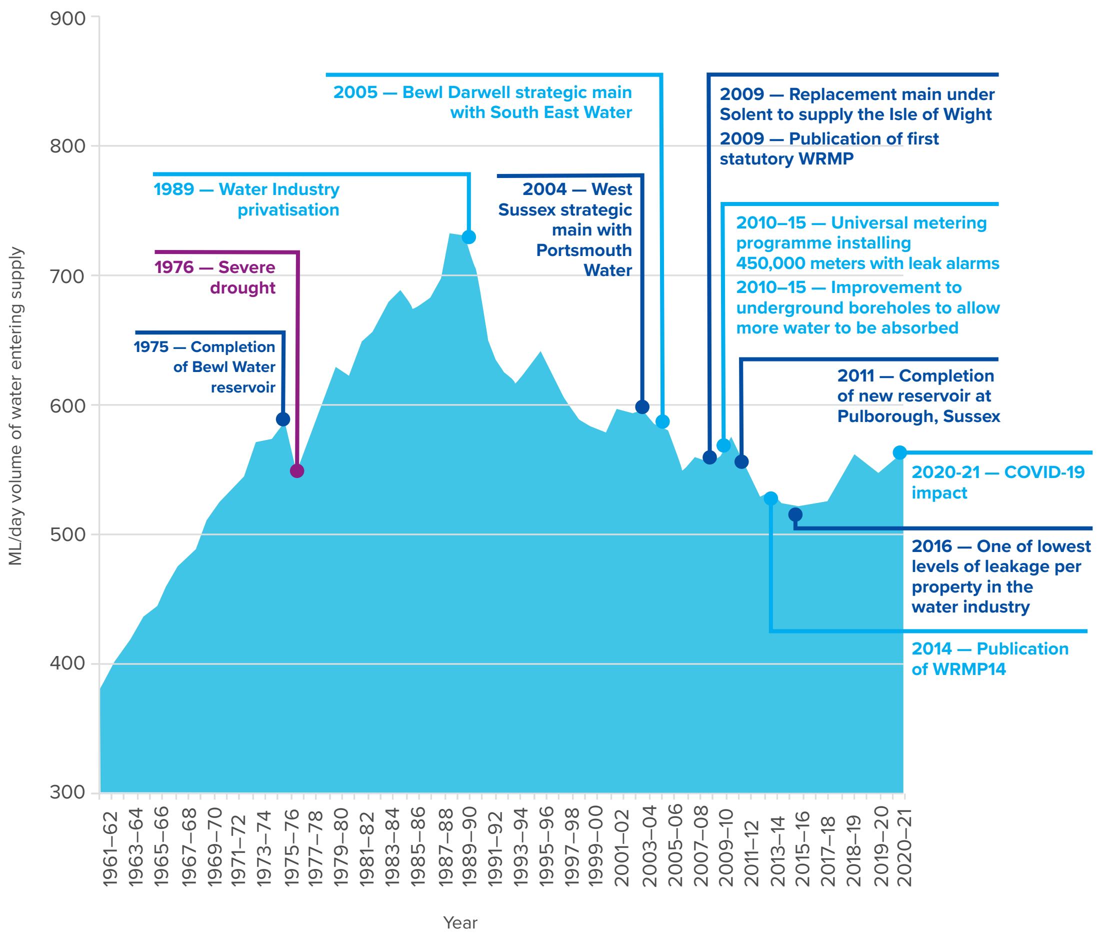


Figure 5.1: Changes in distribution input over time

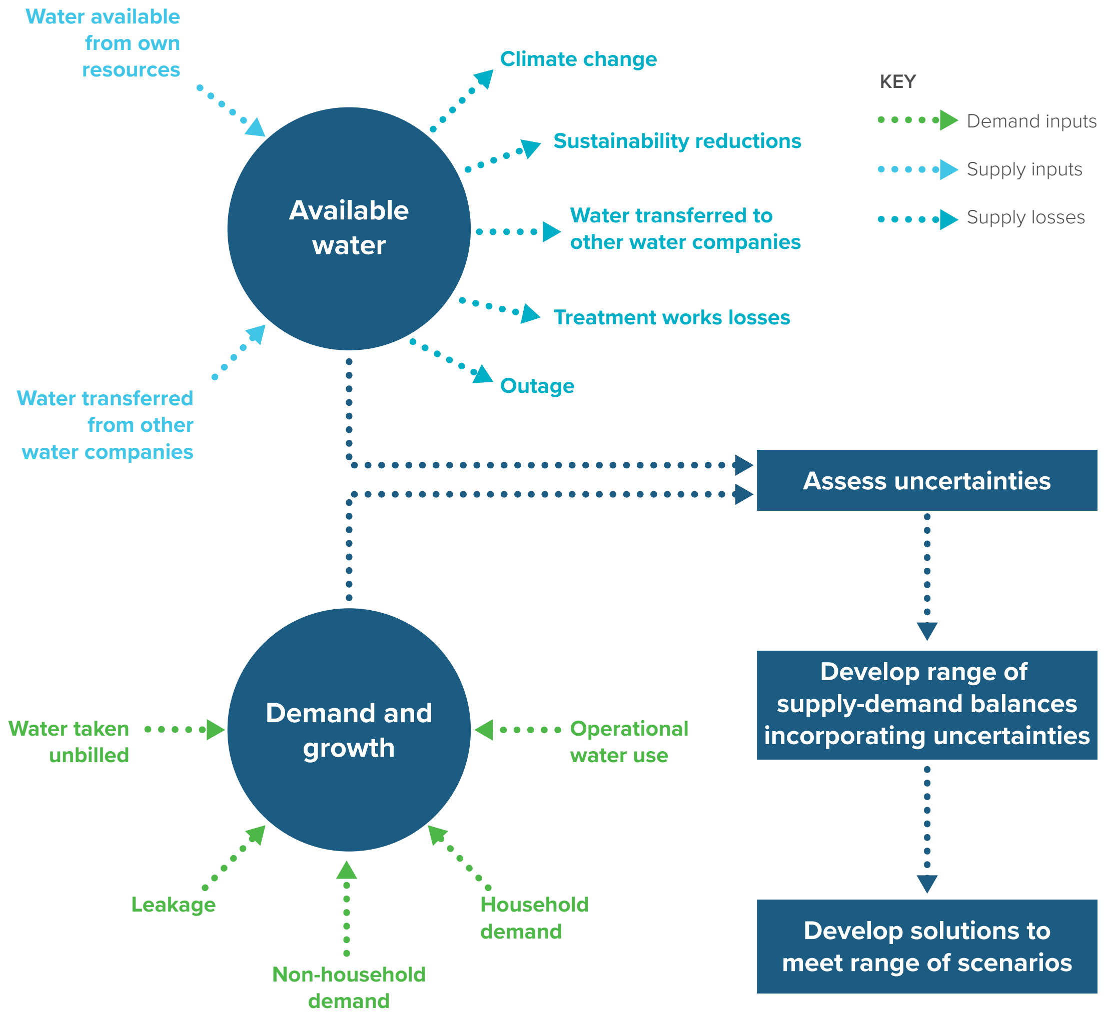


Figure 5.2: Key components of supply and demand forecasts

To ensure that we continue to provide uninterrupted supply in the future, we need to estimate the amount of water that will be needed in the future. As demand can vary between normal and dry years as well as within a year, we forecast demand for water under different planning scenarios.

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

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. For dWRMP24, we commissioned Edge Analytics together with other WRSE companies to provide growth forecasts for all companies, in line with government guidelines. 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.[21]

The forecasts were developed for a wide range of scenarios, by using a combination of trend-based, 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) supply area.

Post 2050, each scenario is further split into three projections; Principal, Low and High. The main difference between these projections is the assumed level of net international migration. There were up to 63 growth projections for each WRZ.

Following the publication of latest WRPG in March 2023, we commissioned an update to our growth forecast jointly with other WRSE companies[22]. For rdWRMP24, we have considered growth under five different projections (Table 5.1) based on data from Local Authorities, ONS and OxCam. These projections cover the range of forecasts used for the rdWRMP24. The revised growth forecast shows that the total population in our supply area in 2075 could range from 2.9 million to 3.6 million (Figure 5.3). This represents 7% (ONS-18 Low projection) to 34% (Housing Need projection) growth in the 2025-75 period (Table 5.2). Growth forecasts at the WRZ level are included in Annex 7.

Table 5.1: Growth scenarios included in the demand forecast for each WRZ

Scenario	Description
Housing Plan Principal[a] (Baseline growth)	A housing-led scenario, with population growth underpinned by each local authority's Local Plan housing growth trajectory. Following the final year of data, projected housing growth in non-London areas returns to the average of ONS-14 and ONS-16 long-term annual growth average by 2050. **This is used as the baseline growth forecast for rdWRMP24.**
Housing Need Principal[a] (Maximum growth)	A housing-led scenario, with population growth underpinned by the trajectory of housing growth associated with each local authority's Local Housing Need or Objectively Assessed Housing Need. Following the final year of data, projected housing growth in non-London areas returns to the ONS-14 long-term annual growth average by 2050.
ONS-18 Principal[a] (ONS-18)	ONS 2018-based Principal sub-national population projection, using a five-year history (2013-2018) to derive local fertility & mortality assumptions, a long-term UK net international migration assumption of +190k and two-year history (2016-2018) of internal migration assumptions. This scenario has been rebased to the 2021 mid-year estimate.
ONS-18 Low[b] (Minimum growth)	Same as above but with a low rate of net migration.
OxCam-1a Principal (Oxcam)	'New Settlement' 23,000 dwellings per annum scenario, with ca.3,800 dwellings per annum above Housing Plan distributed between Cherwell (20%), Aylesbury Vale (20%), Central Bedfordshire (40%), South Cambridgeshire (20%).

[a] The Principal long-term scenario incorporates the mortality and fertility assumptions of the ONS 2018-based national population projection Principal scenario, plus its Principal net international migration assumption of +190,000 per annum for the UK in total.
[b] The Low long-term scenario incorporates the mortality and fertility assumptions of the ONS 2018-based national population projection Principal scenario, plus a Low net international migration assumption of +90,000 per annum for the UK in total.

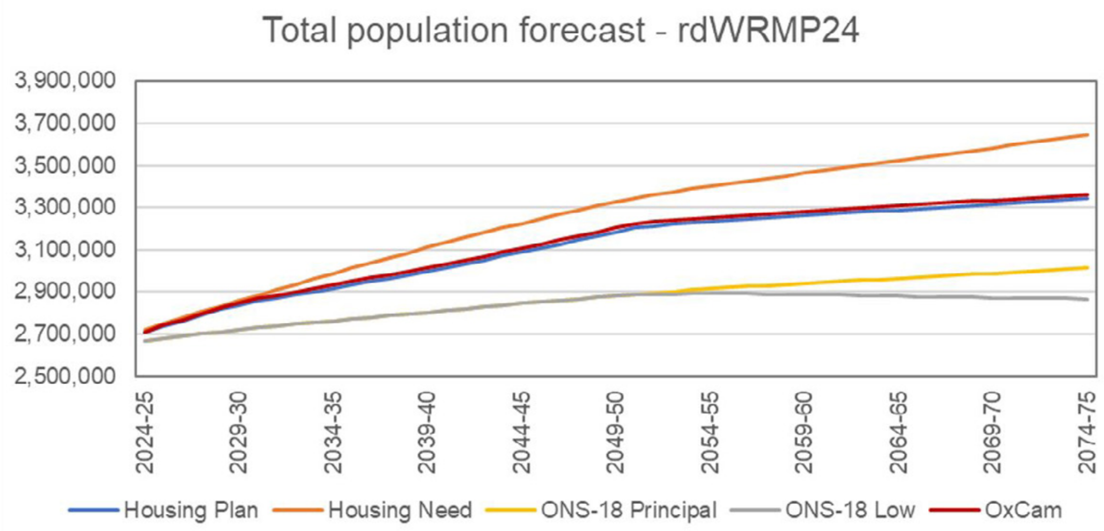


Figure 5.3: Forecasts for total population under different projections

Table 5.2: Net growth in the selected scenarios and comparison with the dWRMP24 forecast

Growth scenario	Net growth (2025–75)	Corresponding growth projection	Net growth (2025–75 in dWRMP24)	Corresponding growth projection in dWRMP24
Household population				
Baseline	23%	Housing Plan Principal	24%	Housing Plan Principal
Maximum growth	34%	Housing Need Principal	33%	Housing Need High
Minimum growth	7%	ONS-18 Low	6%	ONS-18 Low
ONS-18	12%	ONS-18 Principal	16%	ONS-18 Principal
Oxcam	24%	Oxcam-1a Principal		
Household properties				
Baseline	32%	Housing Plan Principal	35%	Housing Plan Principal
Maximum growth	43%	Housing Need Principal	46%	Housing Need High
Minimum growth	15%	ONS-18-Low	16%	ONS-18 Low
ONS-18	21%	ONS-18 Principal	27%	ONS-18 Principal
Oxcam	32%	Oxcam-1a Principal		

[21] Edge Analytics, 2020. Population and Property Forecasts, Methodology and Outcomes.
[22] Edge Analytics, 2023. WRSE forecast comparisons.

Household demand accounted for nearly 60% of our total DI in 2020-21. 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 basis for informing our demand forecast.

In keeping with WRPG, and based on recommendations from Edge Analytics and WRSE, we have used population growth from the Housing Plan Principal scenario as 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. Following WRSE recommendation, 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.

At the company level, the revised growth forecast shows a greater increase in population from 2025 to 2050 compared to the dWRMP24 but overall growth by 2075 is lower than the dWRMP24 (Table 5.2 and Figure 5.4).

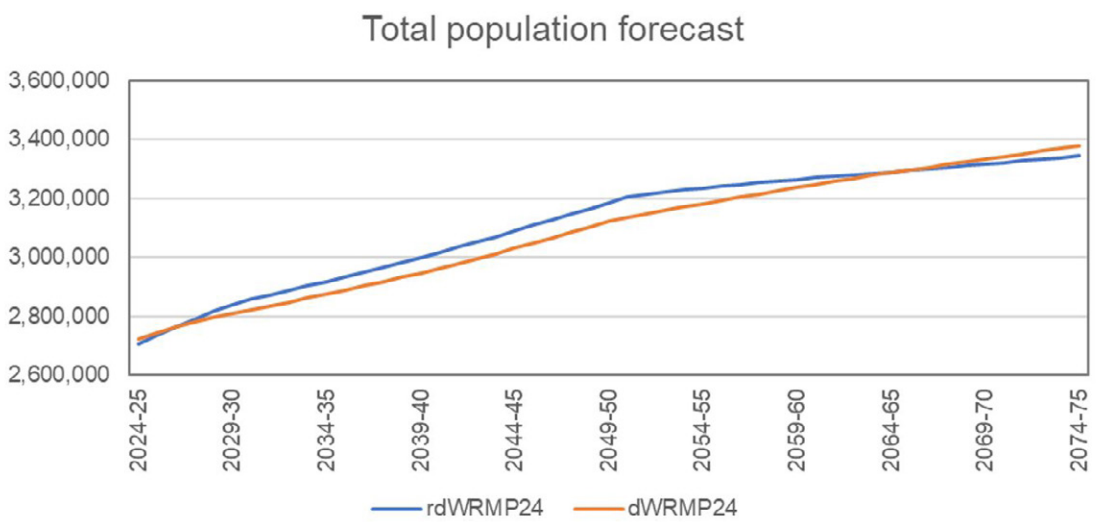


Figure 5.4: Comparison of baseline total population forecast between rdWRMP24 and dWRMP24

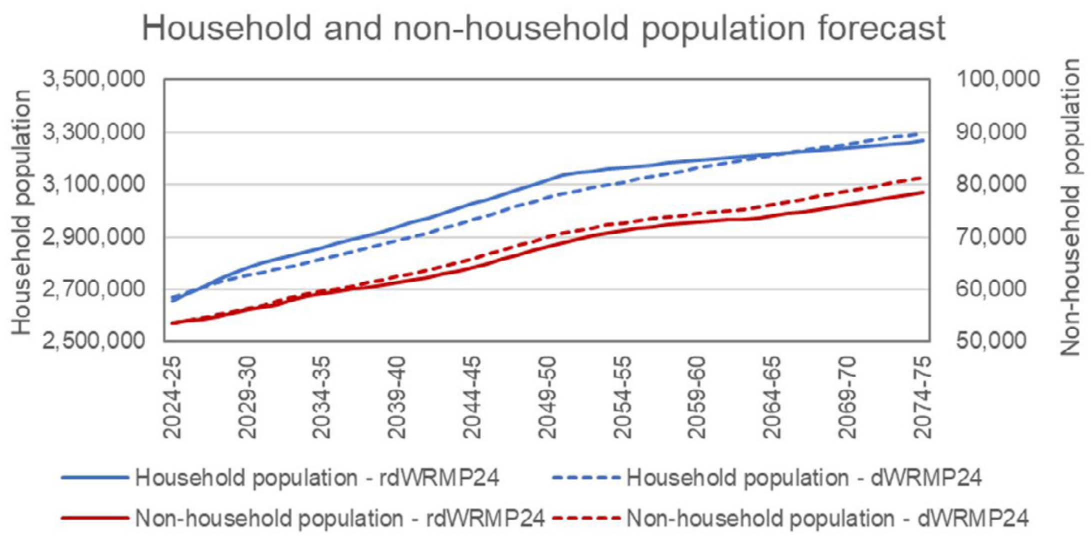


Figure 5.5: Comparison of baseline household and non-household population forecast between rdWRMP24 and dWRMP24

As can be seen from Table 5.2, the revised forecasts under most scenarios are similar to the ones used in the dWRMP24 with the exception of ONS-18-Principal scenario where the revised figures are much lower. The growth up to 2050 is however higher than in the dWRMP24 forecast.

In terms of the split between household and non-household population, the revised forecast shows higher growth in household population and lower growth in non-household population compared to dWRMP24 (Figure 5.5).

Table 5.2 also 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 2.37 in 2025 to 2.22 in 2075.

The revised household properties growth forecast is consistently lower than the dWRMP24 forecast by ca. 1% up to 2055; thereafter the gap starts to increase and is ca. 5% by 2075 (Figure 5.6).

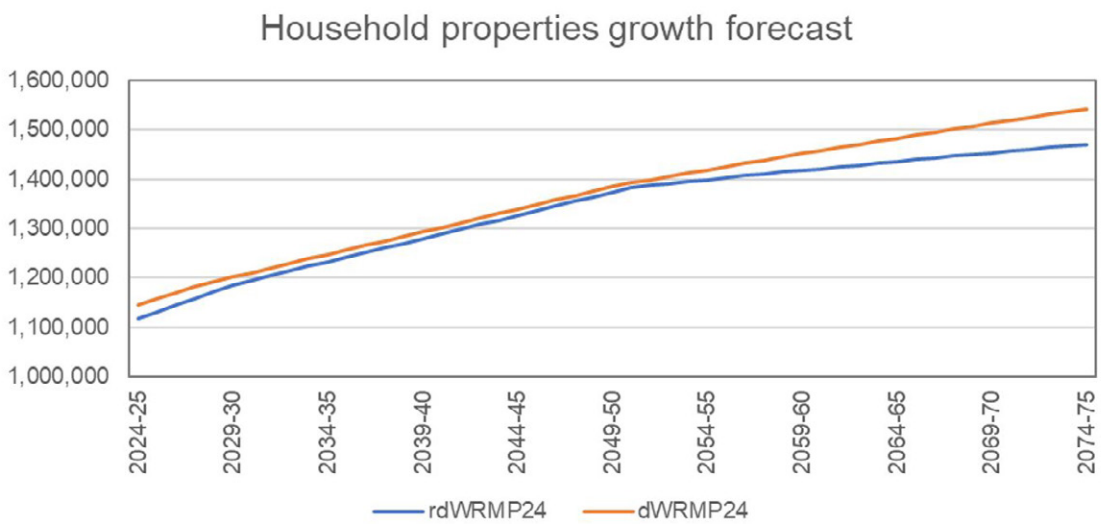


Figure 5.6: Comparison of baseline household properties growth forecast between rdWRMP24 and dWRMP24

Non-household population growth scenarios at the company levels are shown in Table 5.3 and Figure 5.7. 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.

Table 5.3: Non-household population growth scenarios

Growth scenario	Net growth (2025–75)	Growth projection	Net growth (2025–2100)	Growth projection
Household population				
Baseline	46%	Housing-Plan-Principal	52%	Housing-Plan-P
Maximum growth	50%	Housing-Need Principal	56%	ONS-14-H
Minimum growth	40%	ONS-18 Low	43%	GLA-18-15Y-L
ONS-18	42%	ONS-18 Principal	48%	ONS-18 Principal
Oxcam	47%	Oxcam-1a Principal		

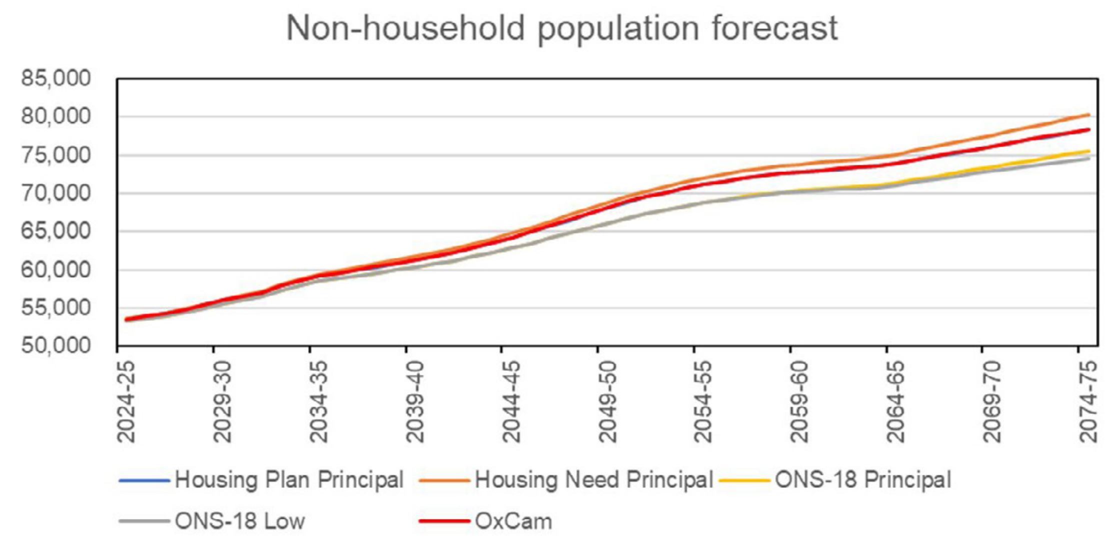


Figure 5.7: Non-household population forecast at the company level

Overall, our growth forecast for WRMP24 is 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 Principal scenario in current forecast, total population in 2044-45 is forecast to be 3,089,264; an increase by 44,709 or 1.5%. Growth forecast figures at the WRZ level are included in Annex 7.

Some respondents to consultation on our dWRMP24 have commented that our growth forecast overestimates growth leading to development of schemes that may ultimately not be needed. The forecasts have been developed independently by a leading expert in the field with experience of developing forecasts for other UK water companies. Annex 7 includes a description of the method used to develop growth forecasts. In using the projections based on housing plan data provided by Local Authorities, we have followed the WRPG that states:

'Your planned property and population forecasts, and resulting supply, must not constrain planned growth. For companies supplying customers in England you should base your forecast population and property figures on local plans published by the local council or unitary authority.'

As part of our adaptive planning approach, we are using multiple growth projections as shown in Table 5.2 and Table 5.3 and can switch to a lower growth forecast in case the baseline growth forecast turns out to be overly optimistic.

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 2020-21. Under normal circumstances, household demand is primarily driven by the summer weather. Figure 5.8 shows the average summer temperature and total rainfall data for southern England, with values since the start of AMP7 clearly indicated.

The summer of 2020-21 was slightly warmer and drier than the long-term average. However, demand in 2020-21 was in large part impacted by restrictions imposed in response to COVID-19 which meant that demand was significantly higher than in the past. We have therefore not rebased our 2020-21 demand but have reprofiled our PCC over the remainder of AMP7 to estimate the demand we are likely to experience in 2024-25 under normal year conditions.

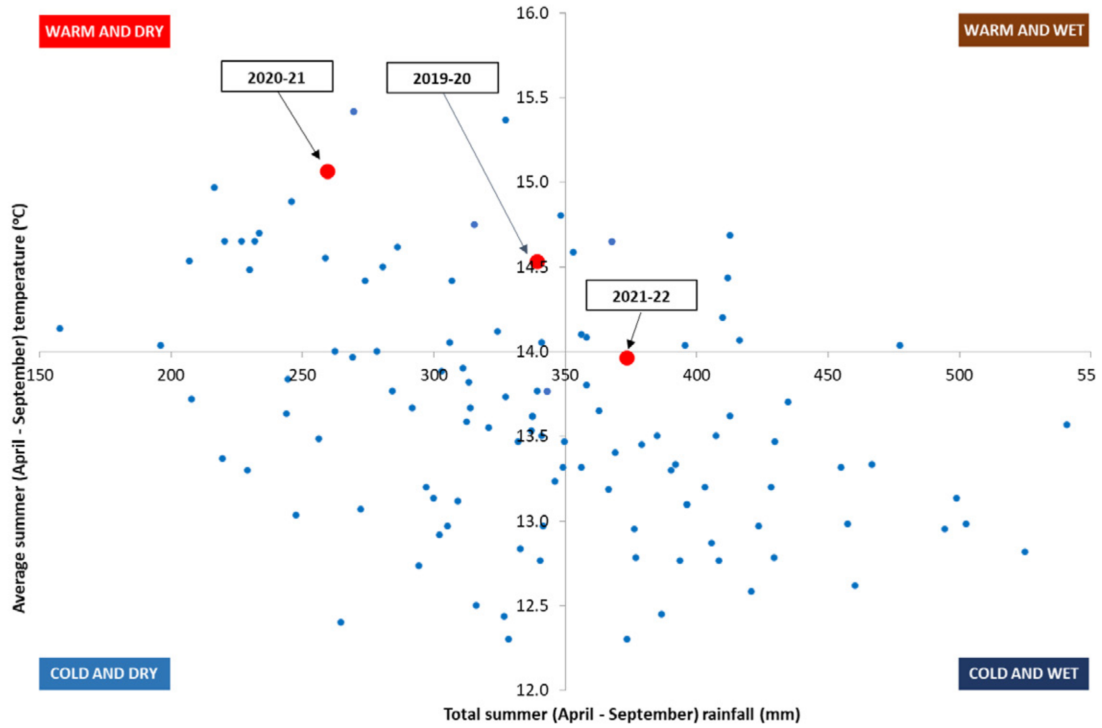


Figure 5.8: Average summer temperature and total summer rainfall since 1910

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-in-200 year Dry Year Annual Average (1:200 DYAA)
- 1-in-200 year Dry Year Critical Period demand (1:200 DYCP)
- 1-in-500 year Dry Year Annual Average (1:500 DYAA)
- 1-in-500 year Dry Year Critical Period demand (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-in-200 year and 1-in-500 year scenarios, we have used the dynamic demand analysis work done by Artesia[23], which builds on the dynamic demand modelling work by the Water Research Centre (WRc)[24]. 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.

Methodology

We commissioned Ovarro DA Ltd ('Ovarro') to develop our overall demand forecast[25] 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[26] and the Energy Saving Trust (EST)[27].

Annex 7 includes the report produced by Ovarro that describes our methodology for developing demand forecast for the dWRMP24.

We have made a number of changes to our demand forecast following the publication of updated WRPG and consultation on our dWRMP24. These include:

- Updating the growth forecast as described above
- Revising our PCC forecast for the end of AMP7 (2024-25)
- Revising our non-household demand forecast
- Revising our leakage forecast.

In terms of AMP7 PCC, we had originally assumed that we would achieve our AMP7 target for PCC reduction. The introduction of restrictions as a result of COVID-19 in early 2020 significantly increased the amount of water used at home. Given the uncertainty around the long-term impacts of COVID-19 on working patterns, we amended our 2024-25 forecast PCC to 135.6l/h/d for dWRMP24. However, by the time our dWRMP24 was finalised, we had already seen a drop in PCC following the relaxation of COVID-19 restrictions. We subsequently tested as scenario with 2024-25 PCC set at 129.8l/h/d. This was part of the sensitivity analysis we did for the dWRMP24. For the rdWRMP24, we have looked at the more recent trends in PCC and have updated our 2024-25 PCC to 127.5l/h/d under NYAA conditions.

For the dWRMP24, we incorporated three climate change scenarios based on UKWIR[28]:

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

The UKWIR report 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. The values were then extrapolated to 2074-75. This gave over 8% increase in DYCP household demand due to climate change by 2075 (Table 5.4). Following WRPG, we have revised our estimates of climate change impact on household demand to a maximum of 3% by 2075 under any planning scenario (Table 5.4).

[23] Artesia, 2021. Dynamic Demand Analysis, Phase 2. Ref. AR1408.
[24] WRc, 2020. Dynamic Demand Modelling for WRSE v2.1. Ref. 17265-0.
[25] Ovarro, 2021. Household demand forecast 2020. Southern Water Services, Version 2. Ref. J1941\GD013\02.
[26] UKWIR, 2012a. Customer Behaviour and Water Use - A Good Practice Manual and Roadmap for Household Consumption Forecasting. Report 12/CU/02/11. UK Water Industry Research Limited.
[27] Energy Saving Trust, 2019. Independent review of the costs and benefits of water labelling options in the UK, Extension Project, Technical Report.
[28] UKWIR, 2013. Impact of Climate Change on Water Demand. Report 13/CL/04/12. UK Water Industry Research Limited.

Table 5.4: Climate change impact on household demand

Planning scenario	Climate change impact on demand by 2075	
	dWRMP24	RdWRMP24
NYAA (low climate change impact)	1.45%	0.75%
NYAA (high climate change impact)	2.85%	1.50%
DYAA (low climate change impact)	1.45%	0.75%
DYAA (high climate change impact)	2.85%	1.50%
DYCP (low climate change impact)	4.09%	1.50%
DYCP (high climate change impact)	8.03%	3.00%

The range of household demand forecasts under DYAA planning scenario resulting from the combination of 5 growth scenarios and 3 climate change scenarios is shown in Figure 5.9.

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

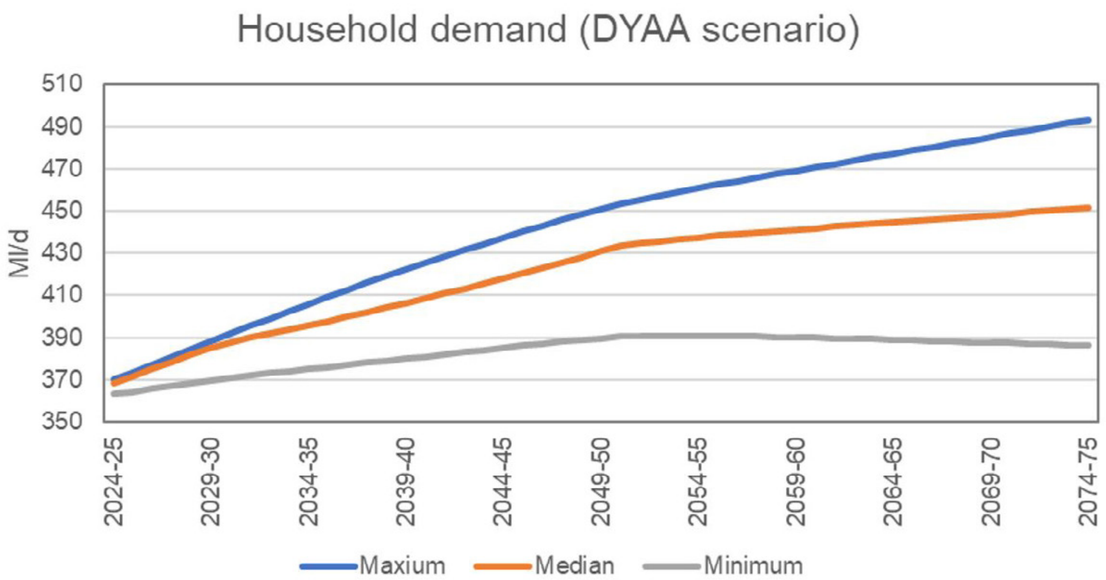


Figure 5.9: The range of household demand forecasts at the company level for the DYAA scenario

The total household demand increases more sharply up to 2050. The increase thereafter is gentler. In the minimum forecast (low growth scenario and no climate change impact), there is a slight decrease in household demand after 2050 (Figure 5.9).

5.2.3 Non-Household demand forecast

WRSE commissioned a review of the non-household demand forecasting methods used by companies for their previous WRMPs. The review concluded that methods used by all companies were appropriate but recommended using a consistent method going forward[29].

WRSE subsequently developed a non-household demand forecast for the entire region. The results were provided at the company level[30].

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, 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 was also 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.

For dWRMP24, we adopted the Central scenario as the baseline scenario for non-household demand forecast.

For the rdWRMP24, WRSE again commissioned Artesia to review and update the non-household demand forecast[31]. In our case, the revised forecast did not reflect the recovery in non-household demand that we had started to see in 2022-23 following the lifting of COVID-19 restrictions and therefore starting point for non-household demand forecast was too low (Figure 5.10). We have therefore not used the latest forecast from Artesia but have instead revised our non-household demand forecast as follows (Figure 5.10):

1. We have used the dWRMP24 non-household demand forecast as the starting position for the rdWRMP24 non-household demand forecast as it better reflected the recovery in non-household demand in 2022-23.
2. Following 2022-23, we have the same overall growth rate (up to 2075) as in the rdWRMP24 growth forecast to develop a smoothened profile.
3. We have removed the 4% reduction in non-household demand by 2050 that was built into the original non-household demand forecast.

A comparison of the non-household demand forecast used in rdWRMP24 with the one used in dWRMP24 is shown in Figure 5.10 below. The figure also shows the revised forecast provided by Artesia that did not accurately capture the recovery in non-household demand between 2021-22 and 2022-23. Non-household demand forecasts at the WRZ level are included in Annex 7.

[29] Ovarro, 2020. Review of Non-Household Demand Forecast Methods. Final Report, Version 1. Water Resources South East. Ref. J2017\GD008\01.

[30] Artesia, 2020. Non-Household Demand Forecasts 2020 to 2100. Water Resources South East - Southern Water. Company Report - Final. Ref. AR1395.

[31] Artesia, 2023. Southern Water Non-Household Forecast. Technical Note. Ref. AR1528.

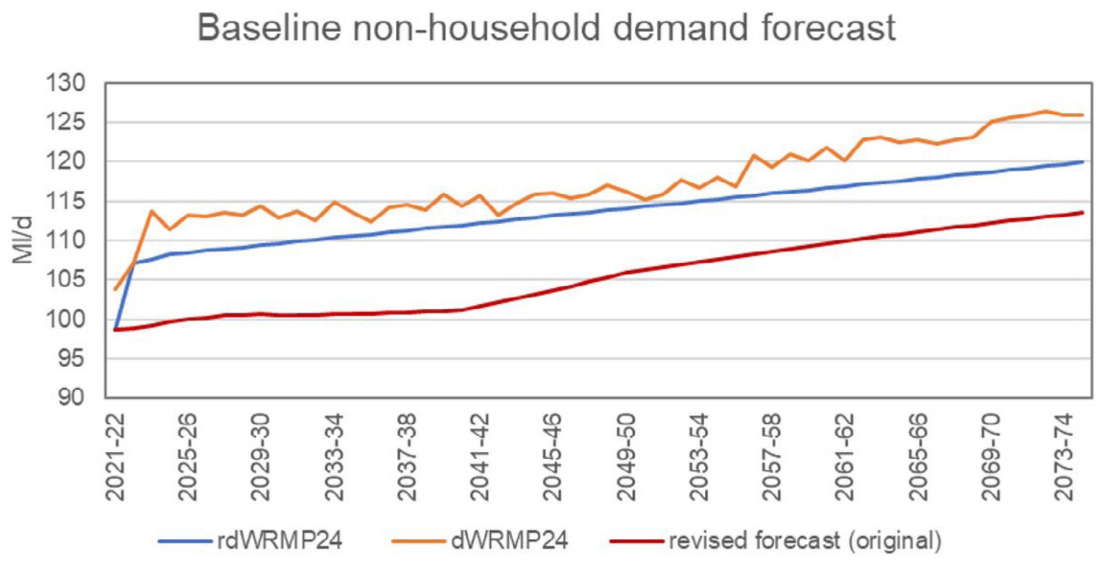


Figure 5.10: Total non-household demand forecast at the company level

5.2.4 Leakage

In developing our leakage forecast we have taken our 2021-22 outturn figure and reprofiled our AMP7 leakage assuming that we will achieve our AMP7 leakage reduction target. In keeping with WRPG, baseline leakage is held constant from 2024-25 with no further reduction.

5.2.5 Other components of demand

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

5.2.6 Total demand forecast

Figure 5.11 shows our revised baseline total DI forecast under the Housing Plan growth scenario as a result of the changes described above and its comparison with our dWRMP24 baseline demand forecast. Figure 5.12 shows the range of total demand forecasts under different growth scenarios.

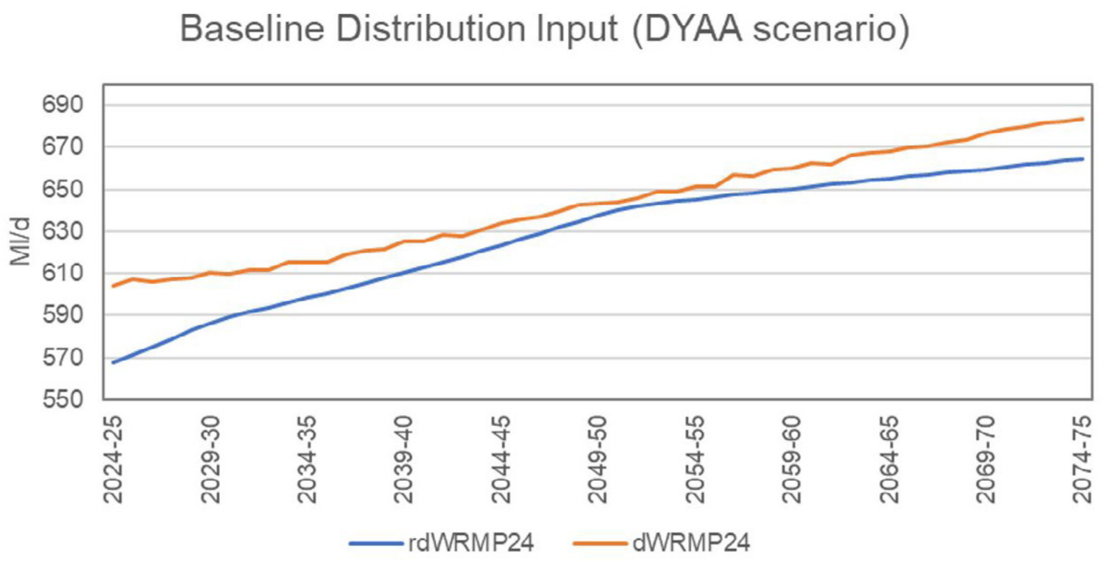


Figure 5.11: Comparison of rdWRMP24 and dWRMP24 baseline Distribution Input forecasts at the company level

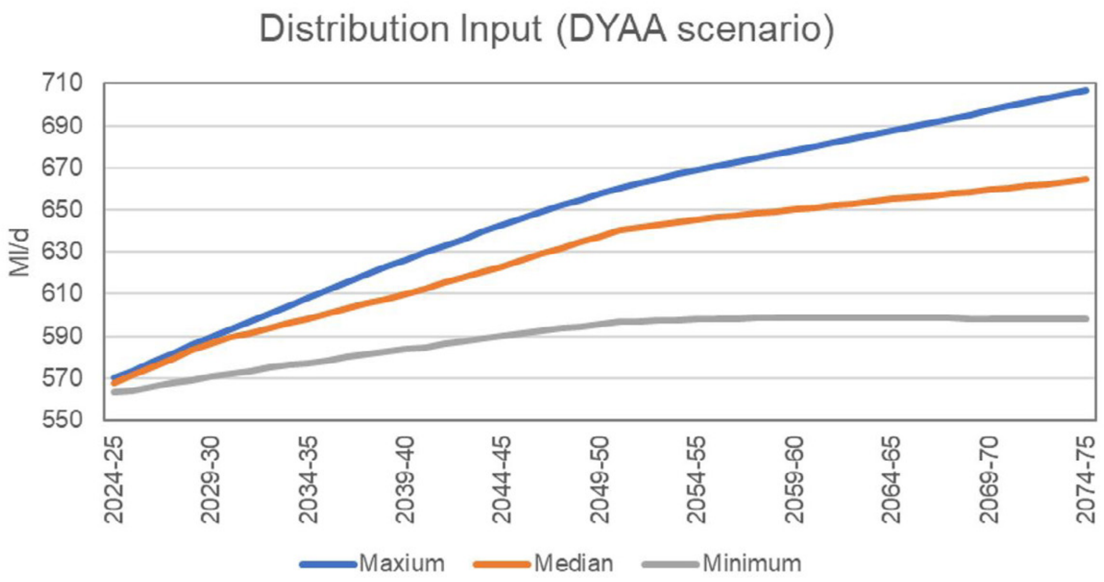


Figure 5.12: The range of rdWRMP24 Distribution Input forecasts under different growth scenarios

5.2.7 Demand management scenarios

Demand management is a key part of strategy to balance supply and demand in the future. This benefits the environment as well as allows us to defer development of supply-side option further into the future. We had considered a number of household consumption and leakage reduction scenarios for dWRMP24. Following the publication of updated WRPG and the Environmental Improvement Plan (EIP)[32], we have revised our demand management scenarios as discussed below.

PCC reduction

We had considered the following three PCC reduction scenarios for our dWRMP24.

- **Low water efficiency scenario:** Average PCC across our region reduces to 110l/h/d by 2039-40 and to 100l/h/d by 2049-50 under NYAA conditions, remaining constant thereafter.
- **Medium water efficiency scenario:** Average PCC across our region reduces to 100l/h/d by 2039-40 under NYAA conditions, remaining constant thereafter. This scenario represented our 'Target 100' ambition that we had outlined in our WRMP19.
- **High water efficiency scenario:** Average PCC across our region reduces to 100l/h/d by 2039-40 and to 85l/h/d by 2049-50, remaining constant thereafter.

The updated WRPG has set an expectation for water companies to achieve a PCC of 110l/h/d under DYAA conditions by 2049-50. We have accordingly revised our PCC reduction scenarios for the rdWRMP24 as follows (Figure 5.13):

- **Target 100 scenario:** Average PCC across our region reduces to 110l/h/d under DYAA scenario by 2044-45, remaining constant thereafter. This equates to a PCC of 100l/h/d under NYAA conditions. This scenario is therefore equivalent to our WRMP19 Target 100 scenario but achieves it in 2044-45. The actual DYAA PCC we achieve by 2044-45 under this scenario is approximately 110l/h/d.
- **Ambitious PCC scenario:** Average PCC across our region reduces to 100l/h/d by 2044-45; remaining constant thereafter. The actual DYAA PCC we achieve under this scenario is 97.7l/h/d.

We also revised our options for achieving the PCC targets and included savings from government intervention in line with Artesia and Eftec (2019)[33] following Environment Agency's feedback on dWRMP24.

Our selected PCC reduction scenario and the associated options are discussed in Section 7.

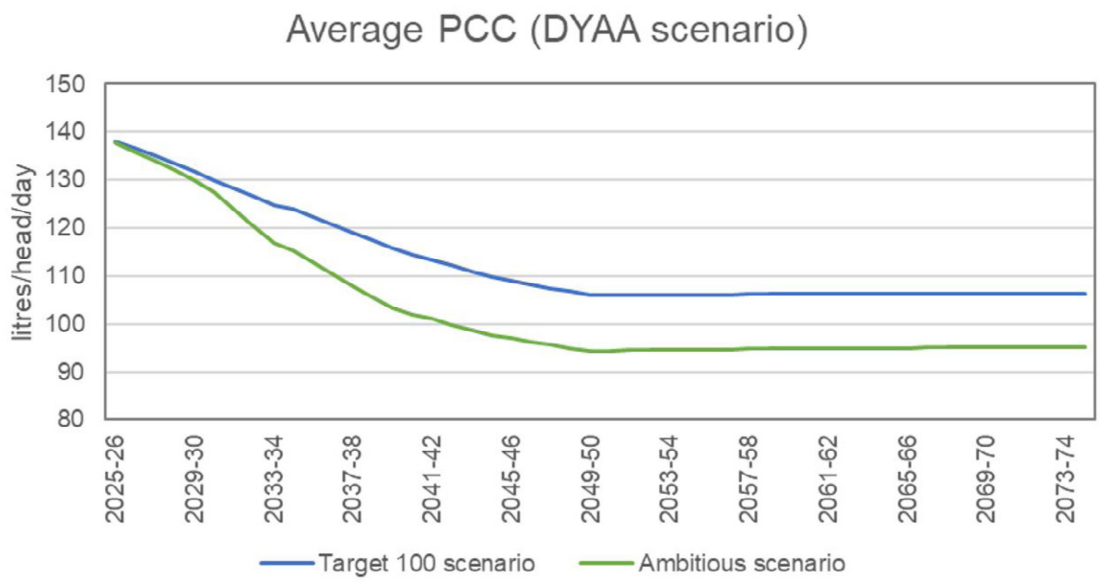


Figure 5.13: The PCC reduction scenarios developed for the rdWRMP24

[32] HM Government, 2023. Environmental Improvement Plan 2023. First revision of the 25 Year Environment Plan. Department for Environment, Food and Rural Affairs.
[33] Artesia and Eftec, 2019. Pathways to long-term PCC reduction. Ref. AR1286.

Non-household demand reduction

Our baseline non-household demand forecast for dWRMP24 included a 4% reduction by 2049-50. Following feedback from the Environment Agency on our dWRMP24, we removed the reduction from our baseline. The updated WRPG and EIP require 9% reduction in non-household demand by 2037-38 compared to 2019-20 reported figures. We reported our 2019-20 figures based on two methods, as required by Ofwat.

1. Method based on our AMP6 leakage calculation methodology. This provided a non-household consumption figure of 112.4Ml/d.

2 Method based on unified leakage estimation methodology[34] to be used from AMP7 onward (shadow reporting). This provided a non-household consumption figure of 110.7Ml/d.

As a result of water efficiency measures, we are planning to put in place for non-household customers, our forecast non-household demand forecast for 2037-38 is 100.5Ml/d. This represents a 10.6% reduction compared to the outturn figure based on Method 1 and 9.3% reduction compared to the outturn figure from Method 2 (Shadow reporting). We have used comparison with shadow reporting figure to report reduction against 2019-20 outturn as this is the method being used to report performance post AMP7.

We have not assumed any further reductions in non-household demand after 2037-38. As a result, non-household demand increases after 2037-38 but the 2074-75 demand is still lower than our 2019-20 reported figures. We have taken this view based on two considerations (Figure 5.14).

1. Once an optimum level of water efficient behaviour is achieved, net demand would be expected to increase as a result of growth. While we do not consider 9% to be optimal level of reduction in non-household demand, it represents the maximum level of savings we expect to achieve with our currently identified options and the associated assumptions.

2. Further reduction of demand beyond 2037-38 would require identification of new options or more ambitious savings associated with the currently identified options. We consider this to considerably increase the deliverability risk and have therefore not chosen to adopt this approach.

We will however review our options for WRMP29 to see if we can further reduce non-household demand beyond 2037-38.

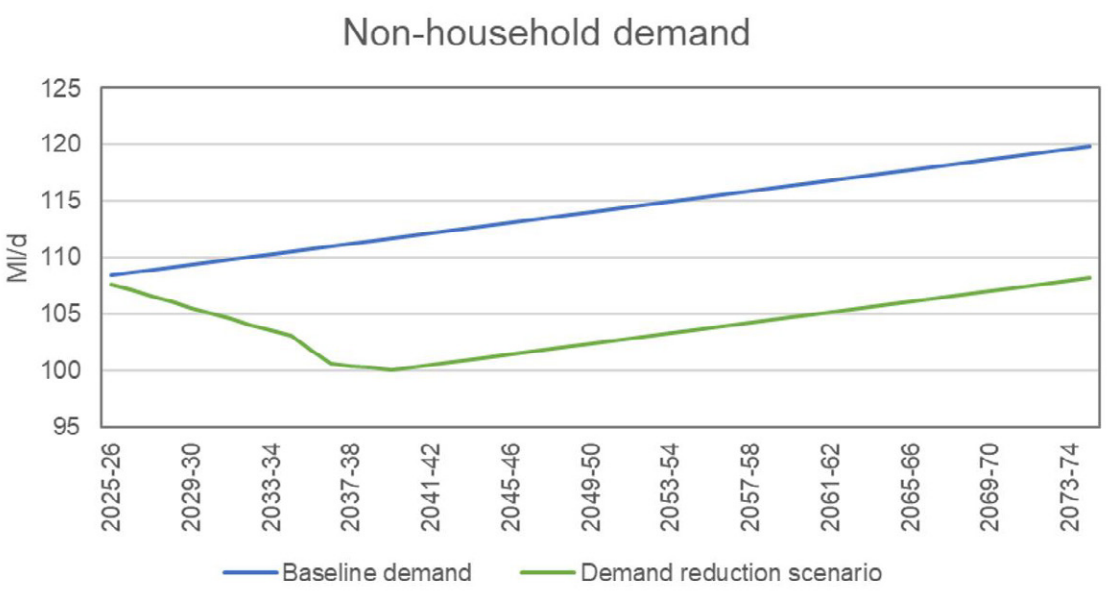


Figure 5.14: The non-household demand reduction profile developed for the rdWRMP24

[34] UKWIR, 2017. Consistency of reporting performance measures. Reporting guidance - leakage. Report 17/RG/04/5. UK Water Industry Research Limited.

Leakage reduction

Managing leakage is an important part of our water resources strategy. In addition to reducing the need to abstract more water from the environment or earlier development of supply-side options, it demonstrates our commitment to be water efficient in our operation as well.

We considered the following leakage reduction scenarios for our rdWRMP24 (Figure 5.15).

- **Low leakage reduction scenario:** Under this scenario, outturn leakage in 2049-50 is forecast to be 48.1Ml/d. This represents a 53.1% reduction in the 102.6Ml/d leakage reported in 2017-18 and 51.8% reduction in the 3-year average leakage figure (99.9Ml/d) from 2017-18 to 2019-20. All figures are based on shadow reporting method mentioned above.
- **Medium leakage reduction scenario:** Under this scenario, the outturn leakage in 2049-50 is forecast to be 41.5Ml/d, representing 59.6% reduction compared to the 2017-18 outturn figure and 58.3% reduction compared to the 3-year average from 2017-18 to 2019-20.
- **High leakage reduction scenario:** Under this scenario, the outturn leakage in 2049-50 is forecast to be 37.3Ml/d, representing 63.6% reduction compared to the 2017-18 outturn figure and 62.7% reduction compared to the 3-year average from 2017-18 to 2019-20.

The leakage reduction profile we have selected in our strategy and the associated options are discussed in Section 7.

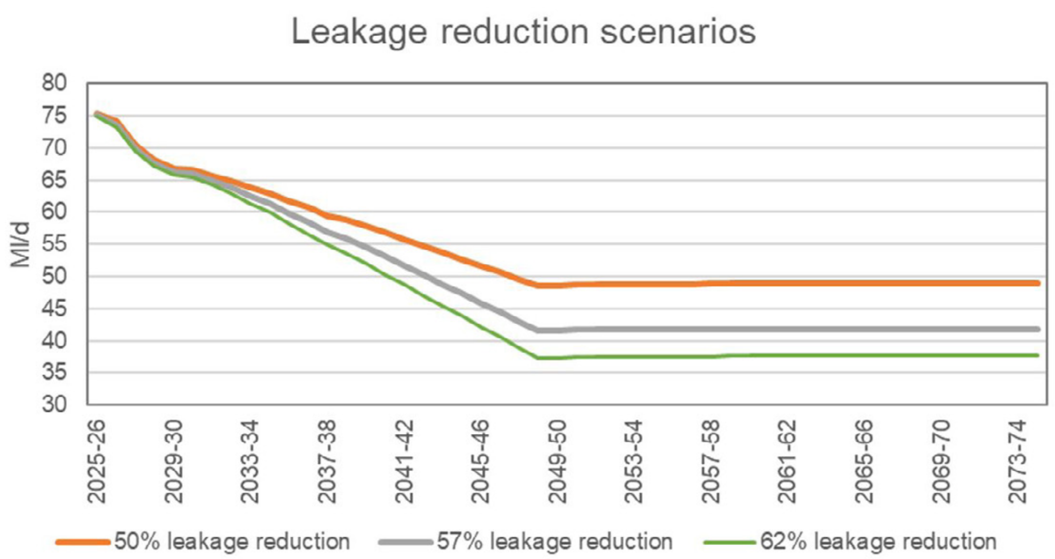


Figure 5.15: Total leakage reduction scenarios considered for the rdWRMP24

Metering strategy - baseline

We rolled out our universal metering programme during 2015-20, taking our proportion of metered household customers to around 88%. 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 2044-45.

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 meter 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 the volume of water 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 DOs
- 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 abstract from rivers and groundwater in order to protect the environment
- Process losses due to water used during treatment
- A risk-based allowance for outage at our supply works.

This section summarises the development of our supply forecast, further detail is provided in Annex 8.

5.3.1 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 that can be taken from a source on a sustainable basis. These constraints vary at each source 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 the volume of water we can take
- 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 when 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-in-2 year (1:2, normal year), 1-in-10 year (1:10, dry year), 1-in-200 year (1:200, severe drought) and up to a 1-in-500 year (1:500, extreme drought). The DO therefore provides an estimate of both the annual average probability of a given drought event and the associated volume of water we can abstract from a resource 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 vary with return period i.e. ADO in a normal year would be different from the ADO in a dry year.

Understanding how our supply system responds to drought

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 have used 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 process for deriving baseline DO estimates for each of our WRZs are described in more detail in Annex 8 and summarised in Table 5.5.

Table 5.5: Summary of baseline DO at the WRZ level

WRZ	DO by return period (DYAA) - Ml/d				DO by return period (DYCP/PDO) - Ml/d			
	1:500	1:200	1:100	1:2	1:500	1:200	1:100	1:2
HKZ	8.75	8.75	8.75	8.75	9.28	9.28	9.28	9.28
HAZ	22.53	22.53	22.53	22.53	24.39	24.39	24.39	24.39
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	0.00	0.00	0.00	73.54	0.00	0.00	11.85	78.80
IOW	23.96	25.89	26.07	26.58	30.54	34.09	34.33	34.65
SNZ*	17.60	21.46	54.84	84.94	20.81	57.32	70.60	99.16
SWZ	45.78	46.26	46.69	51.73	54.96	55.52	56.05	62.11
SBZ	77.50	80.05	81.57	86.94	93.82	96.88	98.74	105.33
KMW	59.25	59.25	59.25	59.25	65.97	65.88	65.881	65.48
KME	85.37	86.15	86.71	89.13	97.65	98.62	99.47	60.75
KTZ	44.71	46.50	47.98	51.42	52.86	54.71	55.52	59.68
SHZ	18.75	19.90	20.98	31.34	22.90	26.14	28.15	39.75

Deployable Output at source level

One of the input components to our system level modelling is to determine the individual yields of each of our sources. We operate a range of surface water, groundwater and reservoir sources across our 14 WRZs. As part of our DO assessment, we undertook a company-wide review to understand the asset and infrastructure constraints of each source and, where relevant, these were used to constrain DO.

We then used our groundwater and surface water models to derive time series of source level groundwater DO, for PDO and Minimum DO (MDO) scenarios, or river flows (for the Western area model). WRZ DO calculations, including assessment of ADO, were carried out within our regional system simulation models. Groundwater model outputs were validated against historical flows and groundwater levels and the corresponding estimates of DO from WRMP19, accepting that some changes will be introduced because of the new climate data for this plan.

Minimum Deployable Output scenario

An MDO scenario considers the water supply available in a drought at the seasonal minimum, i.e. when river flows or groundwater levels are at their lowest. However, there are limitations to using the MDO scenario as it does not fully represent a 'system-based' response.

- It assumes that waters sources experience low yield at the same time, which is not always true.
- It does not consider demand for water and the distribution system

In WRZs with significant seasonal variations in DO, we use a system simulation method to better characterise variations in available water resources during a drought. As input data to the system model, we use time-series modelling of source groundwater DOs on a monthly or daily time step which capture seasonal variations in DO due to groundwater and river flow variations. These variable DOs are then used by the system simulation model to ensure that each source responds coherently to drought conditions and captures local variations in both supply and demand.

Comparison of our DYAA DOs with the equivalent MDOs from our WRMP19 shows that in all cases the DO figures used for WRMP24 are approximately equal to or lower than our equivalent MDO scenario from WRMP19. We therefore do not consider a separate MDO scenario or assessment to be necessary or appropriate for this plan based on the following considerations:

- Our underlying time series calculations of groundwater and surface water DOs include seasonal variations due to variable flows or groundwater levels.
- The DYAA failure condition within our system simulation models implicitly includes MDO driven failures.
- Our DYAA DO estimates are consistent with or lower than our WRMP19 MDO estimates.
- The full range of supply-demand balance uncertainty explored within our adaptive plan is much greater than the potential difference in supply-demand between our DYAA DO scenario and an MDO scenario and therefore we do not expect the overall strategy to differ were an MDO scenario included. However, as described above we feel that there is value in considering the MDO scenario.

Annex 8 provides further details on our assessment.

5.3.2 Climate change

The WRPG requires water companies to assess the impact of climate change on water supplies. The impacts may materialise as uncertainty 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 accounts for this uncertainty. This section summaries our approach to climate change uncertainty. Further detail is provided in Annex 8.

To assess the uncertain impact of climate change on water supplies, we have adopted a 'Tier 3' climate change assessment approach, even for our previously established medium and low vulnerability WRZs. This approach uses consistent methods, models, and datasets with the other companies in our region.

Following the initial baseline water resource model assessment and DO assessments, we selected a sub-set of 400 baseline stochastic climate replicates through agreement with WRSE companies. These rainfall and PET sequences were considered to contain a series of significant representative drought events across the South East region with return probabilities generally between 1% and 0.2% (i.e. equivalent to 1-in-100 year to 1-in-500 year return periods).

Selection of change factors

Our change factors were based on a set of 12 Regional Climate Models (RCMs) and 16 Global Circulation Models (GCMs) from the UKCP data resulting in 28 sets of change factors in total. One of the main drivers for choosing the RCMs and GCMs projections was that the unadjusted outputs were spatially coherent. This was considered critical for regional planning to ensure that climate impacts were consistently modelled across the WRSE region. Annex 8 provides further details on our selection of appropriate climate change forecasts.

The key alternative UKCP18 dataset, for both our own and regional planning, would be to adopt the probabilistic data. This has 3,000 possible outcomes. However, these are impractical to model in totality and a sampling approach at a national and regional level would need to be agreed to derive a practical set of future scenarios for water resource modelling, especially when working with computationally intensive system simulators and groundwater models. The probabilistic data also lack spatial coherence between climate change factors in different regions. Lack of spatial coherence could lead to overestimation of risk and underestimation in yields of regional scheme. Alternatively, the aggregated national change factors for England and Wales would need to be used to ensure spatial coherence in future climate change signals.

The climate change factors were used to perturb the baseline input time series of rainfall and evapotranspiration to our water resource models. The resource models and system simulation models were then re-run with the perturbed inputs following the same sequence as for baseline DO to determine the change in DO for each of the 28 climate replicates. This allowed us to assess the impact of climate change on flows, groundwater levels and DO.

Our approach is broadly equivalent to the 'High Climate Change' PR24 Ofwat reference scenario. Along with other WRSE companies, we have also considered lower emissions scenarios (equivalent to RCP2.6) and associated uncertainty to support Ofwat's low climate change reference scenario for PR24.[35]

Climate change scaling

We adopted a consistent climate change scaling approach across all WRSE companies. We used the 28 RCP8.5 spatially coherent projections for the 2060-80 time slice from the UKCP18 data to derive our climate change perturbations. We chose this period of the UKCP18 forecasts because it is most closely aligned with the end of the rdWRMP24 planning period (2075). We therefore adopted 2070, the central point of the 2060-80 time slice, as the scaling year used in our climate change assessments.

We have applied the standard linear scaling approach to climate change suggested by the WRPG in all our WRZs. Further details are provided in Annex 8.

Accounting for climate change uncertainty

In our dWRMP24, we addressed climate change uncertainty by branching the adaptive pathways or supply-demand balance 'situations' in 2040 between 'high', 'medium' (median), and 'low' climate change scenarios from the regional climate change assessment at the WRSE level. Climate model replicates 6 and 7 are representative of the regional upper ('High') and lower ('Low') quartile impacts on DO respectively from the 28 global and regional spatially coherent climate projections available under the RCP8.5 pathway from the UKCP18 dataset. Replicates 6 and 7 correspond to the HadGEM3-GC3.05-r001i1p01649 and HadGEM3-GC3.05-r001i1p01843 circulation model projections from UKCP18, respectively.

Although these replicates were considered regionally appropriate, when translated down to the WRZ level, the difference in both spatial impacts across the region (for example, Hampshire vs Kent) and the differing hydrological characteristics of different WRZs (e.g. proportion of groundwater vs surface water sources) mean that this assertion does not necessarily apply at a company or WRZ level. For example, in some of our WRZs, the 'low' impact replicate (No. 7) was actually nearly as severe as the 'high' replicate (No. 6) and in some cases both were worse than the median.

[35] Ofwat, 2021. PR24 and beyond: Long-term delivery strategies and common reference scenarios..

For our rdWRMP24, we have re-evaluated the 'High' and 'Low' climate change impact estimates across the full range of 28 climate change scenarios at a WRZ level. This ensures that the selected replicates for the range of uncertainty map more closely to the upper and lower quartiles of the underlying distribution (Figure 5.16). However, this means that the upper and lower ranges selected for each WRZ may be drawn from different UKCP18 replicates. We have also capped the impact at the baseline 1-in-500 year DO to avoid creating negative DO (i.e. climate change impacts being greater than the baseline DO available for reduction). Selection of the median impact is unchanged from the dWRMP24.

The updated range in forecast impacts on climate change on our 1-in-500 year DO are shown for 2070 are shown in Figure 5.16 and Table 5.6 (DYAA) and Table 5.7(DYCP).

Annex 8 provides further details on our assessment of uncertainty within the climate change data including our consideration of the lower emissions scenario (RCP2.6).

Table 5.6: Summary of forecast climate change impacts on DYAA DO and uncertainty by WRZ to 2070 based on UKCP18 spatially coherent projections

WRZ	1-in-500 DYAA DO, 2070 Impact (RCP8.6 2060-2080 Time slice)			
	Median Impact (Ml/d)	Range (Ml/d)	Adaptive Plan 'Low' Scenario (Ml/d)	Adaptive Plan 'High' Scenario (Ml/d)
HAZ	0.00	0.0 to 0.0	0.00	0.00
HKZ	0.00	0.0 to 0.0	0.00	0.00
HWZ	0.00	0.0 to 0.0	0.00	0.00
HRZ	0.00	0.0 to 0.0	0.00	0.00
HSE	-20.49	12.65 to -20.49	-13.44	-20.49
HSW	0.00	0.0 to 0.0	0.00	0.00
IOW	0.51	0.90 to 0.51	0.51	0.12
SNZ	-10.08	0.88 to -11.27	-1.26	-10.63
SWZ	0.52	0.00 to 1.27	0.70	0.43
SBZ	0.25	3.43 to -2.97	1.25	-0.17
KME	-12.10	0.40 to -23.80	-8.80	-20.60
KMW	0.00	0.0 to 0.0	0.00	0.00
KTZ	3.13	0.40 to -23.80	3.64	2.52
SHZ	-2.78	-0.07 to -4.70	1.75	-3.90

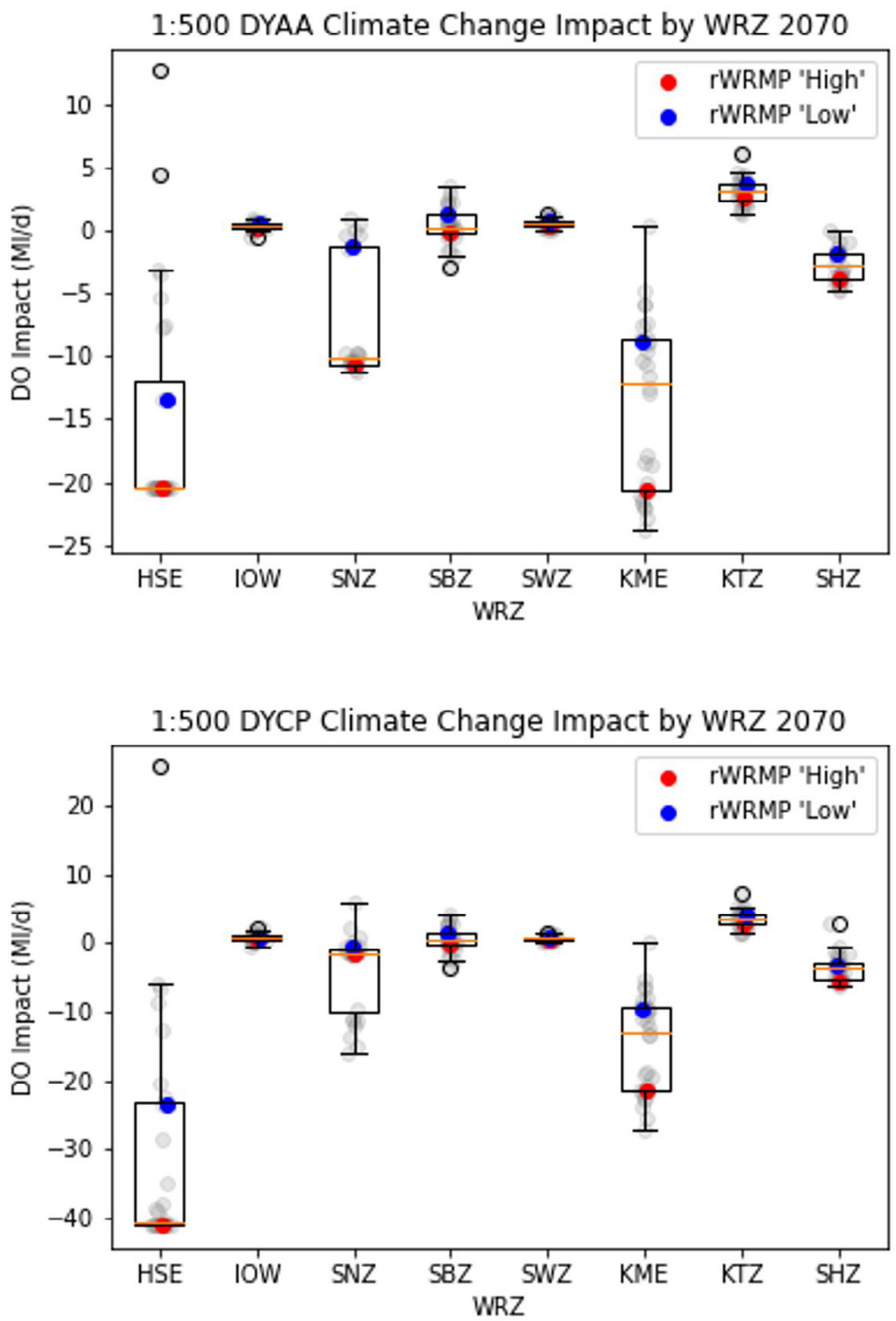


Figure 5.16: Impacts of climate change by 2070 showing the rdWRMP24 'high' and 'low' replicates by WRZ

Table 5.7: Summary of forecast climate change impacts on DYAA DO and uncertainty by WRZ to 2070 based on UKCP18 spatially coherent projections

WRZ	1-in-500 DYAA DO, 2070 Impact (RCP8.6 2060-2080 Time slice)			
	Median Impact (Ml/d)	Range (Ml/d)	Adaptive Plan 'Low' Scenario (Ml/d)	Adaptive Plan 'High' Scenario (Ml/d)
HAZ	0.00	0.0 to 0.0	0.00	0.00
HKZ	0.00	0.0 to 0.0	0.00	0.00
HWZ	0.00	0.0 to 0.0	0.00	0.00
HRZ	0.00	0.0 to 0.0	0.00	0.00
HSE	-40.54	25.53 to -41.0	-23.46	-41.00
HSW	0.00	0.0 to 0.0	0.00	0.00
IOW	0.71	2.10 to -0.62	0.92	0.39
SNZ	-1.45	5.88 to -16.13	-0.63	-1.64
SWZ	0.61	1.45 to 0.00	0.84	0.53
SBZ	0.29	4.17 to -3.61	-0.15	-0.19
KME	-12.90	0.20 to -27.30	-8.80	-21.40
KMW	0.00	0.0 to 0.0	0.00	0.00
KTZ	3.44	7.12 to -1.35	2.73	2.73
SHZ	-3.63	2.68 to -6.35	1.75	-5.47

Climate change vulnerability

Following our water resource modelling, we have considered the climate change vulnerability of our WRZs by 2070 (Figure 5.17). As mentioned above, the year 2070 represents the mid-point of the UKCP18 regional and global climate projections (which cover the 2060-80 time slice) that we have used in our water resource modelling and hence no scaling is applied to these vulnerability forecasts.

This review shows that the forecast impacts of climate change fall into three broad categories across our supply areas:

- Highly vulnerable WRZs where both the 'mid-range' forecast impacts and the uncertainty between 'wet' and 'dry' scenarios is large. This generally applies to WRZs where MRF constraints are either imposed already, or forecast, on surface water abstractions. These include HSE, KME, SNZ 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 primarily on Bewl Reservoir. Compared to our WRMP19 assessment, HSW has moved to low vulnerability, primarily because after confirmed 2027 licence changes, there is no DO available under any climate change scenario. KTZ has moved to low vulnerability as the uncertainty has reduced.
- Medium vulnerability WRZs include those where the most likely mid-range impact is small (<10% of WRZ DO) but where the range of predictions between the 'wet' and 'dry' scenarios suggests greater uncertainty.
- 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 most of our groundwater dominated WRZs. The vulnerability of these WRZs is typically lower as a greater proportion of their sources are constrained by licence or infrastructure, reducing their overall sensitivity to drought and other effects of climate change or for WRZs such as SBZ, SWZ and KTZ due to small positive benefits to groundwater yield.

For the majority of the most sensitive WRZs (HSE, SNZ and SHZ), the vulnerability arises due to the dominance of surface water over groundwater, as surface water is less robust in responding to climate change. The final highly vulnerable WRZ, KME, is dominated by groundwater. However, within the system simulator model, it sees greater conjunctive benefit from Bewl Reservoir due to an internal transfer from KMW and hence has a greater degree of climate change vulnerability as a result. Annex 8 provides further details.

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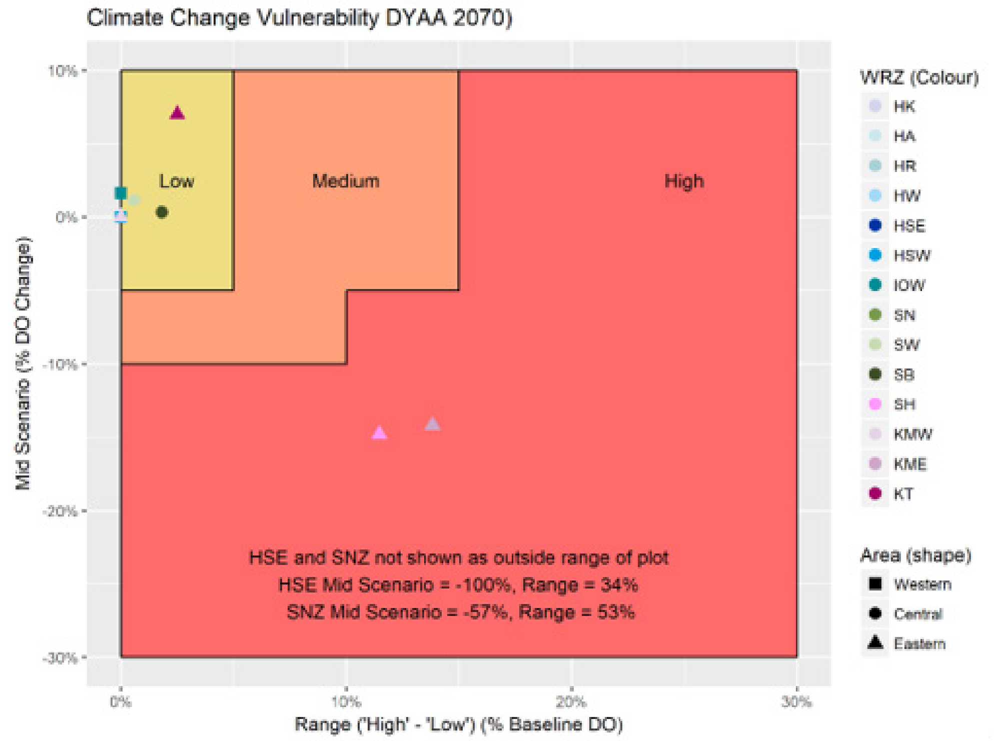


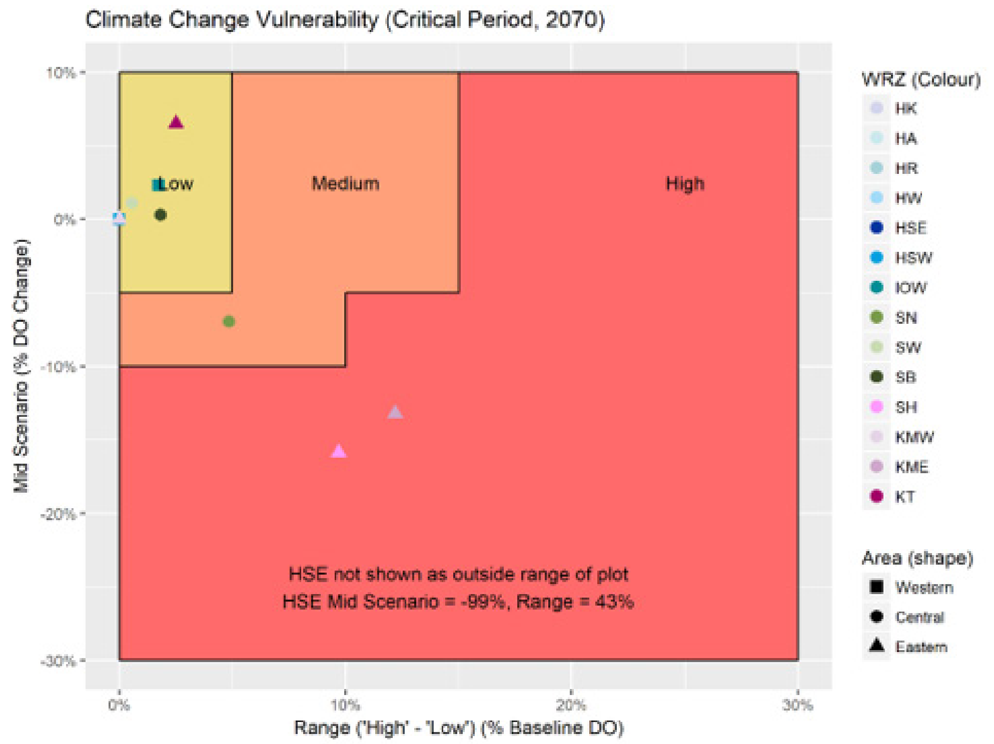


Figure 5.17: Climate change vulnerability assessments for DYAA and DYCP scenarios

5.3.3 Bulk imports and exports

Bulk imports and exports represent transfers of water in and out of a WRZ respectively. This covers transfers between WRZs within the company as well as imports and exports with 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 agreed with our neighbouring water companies that all of our existing transfers will continue to be available at their current volumes. 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. We have carried out some sensitivity analysis to assess the impact if the volumes associated with some of these transfers were reduced. This is further discussed in Section 7.3.

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	AZ7	Potable	1.24	
Export to SEW (Bewl)	KMW	RZ7	Potable	12.3	
Export to SEW (Near Rochester)	KMW	RZ7	Raw	25% of Near Rochester WSW Capacity	
Export to SEW (Darwell)	SHZ	RZ3	Raw	8/17th of the Bewl/ Darwell Yield	
Export to SEW (Hartlip)	KME	RZ6	Potable	7.5	
Export to SEW (To SEW RZ6)	KMW	RZ6	Potable	0.5	
Export to SEW (Weir Wood)	SNZ	RZ5	Potable	5.4	2031
Export to WSX (near Whitchurch)	HAZ	WSX	Potable	0.41	
Export from AFW (Napchester)	R27	KTZ	Potable	0.1	
Import from SES (North Sussex)	SES	SNZ	Potable	1.3	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 interzonal transfers

Donor WRZ	Recipient WRZ	Link	Potable or Raw	Maximum capacity (Ml/d)
HRZ	HSE	Interzonal Transfer (HSE-HRZ) Abbotswood - existing	Potable	5.1
HSW	IOW	Interzonal Transfer (HSW-IOW) Cross-Solent main existing	Potable	20.0
HSE	HWZ	Interzonal Transfer (HWZ-HSE) Existing Transfer	Potable	9.6
HSW	HSE	Interzonal Transfer (HSW-HSE) Existing Transfer	Potable	16.8
HSW	HSE	Interzonal Transfer (HSW-HSE) Existing Transfer	Potable	2.7
HSW	HSE	Interzonal Transfer (HSW-HSE) Existing Transfer	Potable	5.6
HSW	HRZ	Interzonal Transfer (HSW-HSE) Romsey Town and Broadlands Valve	Potable	3.1
SNZ	SWZ	Interzonal Transfer (SWZ-SNZ) Rock Road bi-directional - existing	Potable	11.8
SWZ	SNZ	Interzonal Transfer (SWZ-SBZ) V6 Valve Additional capacity	Potable	13.1
SWZ	SBZ	Interzonal Transfer (SWZ-SBZ) V6 Valve - existing	Potable	16.8
KME	KTZ	Interzonal Transfer (KTZ-KME) Existing Transfer	Potable	12.0
KMW	KME	Interzonal Transfer (KMW-KME) Existing Transfer	Potable	37.1

In addition to our existing interzonal 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, HKZ, HWZ, HRZ, HSE and HSW). These transfers are being developed as part of our Water for Life Hampshire programme.

As discussed in our WRZ integrity assessment (Section 1.1.2), these new transfers are expected to improve the connectivity across our Hampshire supply area and reduce drought risks. We will revisit our WRZ boundaries in Hampshire in future WRMPs to reflect the benefits of these transfers.

5.3.4 Process losses

A small volume of water is lost during the treatment process before it is put into supply. We account for these losses in our supply forecast. Process losses refer to the volume of water that is recycled back into the environment during the water treatment process between the point of abstraction from the environment and where treated water enters the distribution network. 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.

Where individual water supply works process losses are significant, our options appraisal process (Section 6) has considered potential schemes to reduce process losses. Reductions in process losses are included in the groundwater rehabilitation schemes included in our preferred plan.

Further details of our analysis of process losses are provided in Annex 8. The estimated volumes of losses are shown in Figure 5.18 at WRZ and company-wide (SWS) levels.

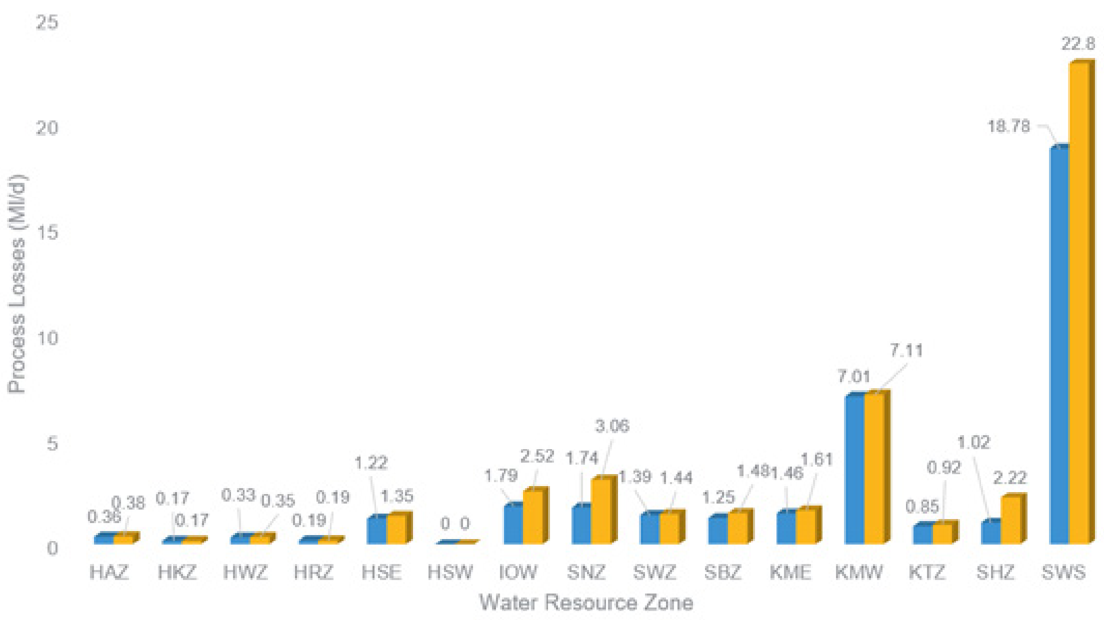


Figure 5.18: Estimated process losses. Blue bars refer to average process losses (Ml/d) and yellow bars to peak losses (Ml/d)

5.3.5 Outage allowance

Outage refers to the temporary unavailability of DO from a source. Outages can be unplanned or planned. Unplanned outages can occur for a variety of reasons, such as asset failures or water quality problems. This 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 undertake maintenance or improvement works. Our supply-demand forecast includes a provision for outage and is summarised here. Full details are provided in Annex 8.

To determine our outage allowance, we have followed a consistent methodology with the other WRSE companies.[36] This ensures we are aligned with the Regional Plan and consistent in our approach.

The calculation method involves collating and checking our historical outage data as a first step. We looked in detail at source performance data from 2015 to 2022 to ensure that outage events were legitimate and whether outage experienced in the recent past is likely to be reflective of potential future levels.

[36] WRSE, 2021. Method Statement: Outage. Version 2.

We applied statistical distributions to the historic data to deduce the probability of these outages occurring again. For example, a normal distribution is applied if the data follows a standard bell curve shape or a fixed distribution if the outage has only occurred once in the past and there is no other information to build on. These distributions are then processed by a Monte Carlo statistical model to produce thousands of simulations of potential outage volumes.

We used this probabilistic assessment of the outage distribution to determine a percentile threshold for the outage allowance that we would expect the outage volume to be less than or equal to for that given percentage of time. The selected percentile was scaled according to number of different sources of water operating in each WRZ.

For example, if a WRZ has 20 sources, we would use a 75th percentile and we would expect outage to be less than the calculated outage allowance volume 75% of the time. If a WRZ has five sources, we would use a 95th percentile outage allowance (Figure 5.19). This scaled approach was used in order to reflect the relative resilience of a WRZ. The more sources a WRZ has, the more resilient it generally is i.e. it is less vulnerable to a single source failing. We can therefore adopt a lower outage allowance figure in these cases.

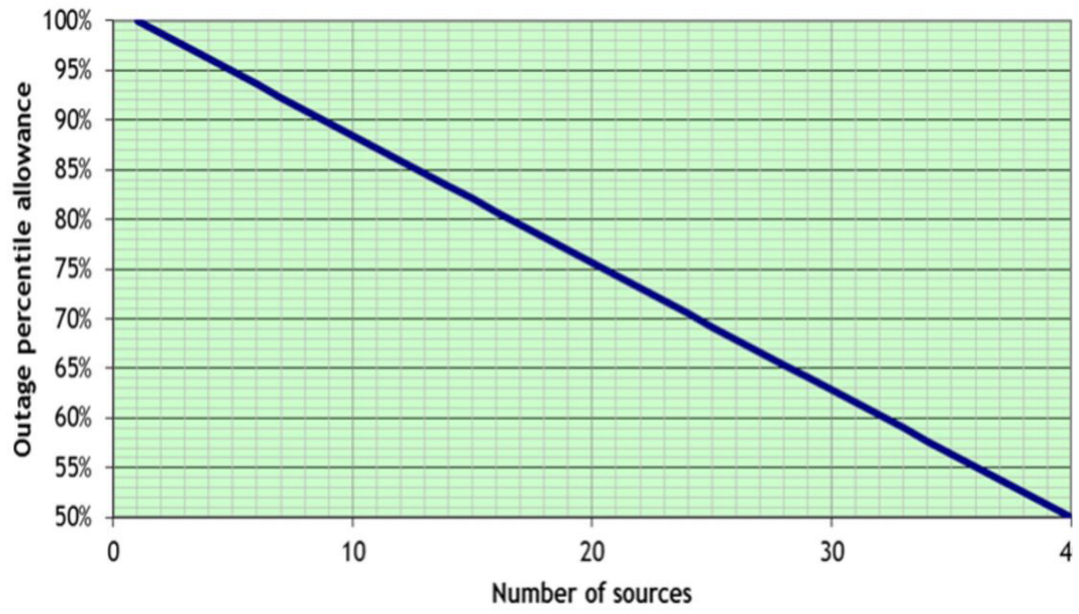


Figure 5.19: Outage percentile allowance dependent on the number of sources in a WRZ

Since 2018, our outage levels have reduced significantly. Our actual outage is still slightly higher than the allowance, but we aim to continue reducing outage in line with our outage recovery plan. Since publishing our WRMP19, we have been constantly improving our outage data collection. These improvements involve 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 5.20. Figure 5.21 shows the historic reported outage up to March 2022, the WRMP19 recovery plan up to March 2025 and the WRMP24 forecast outage allowance for the DYAA scenario from April 2025 onwards.

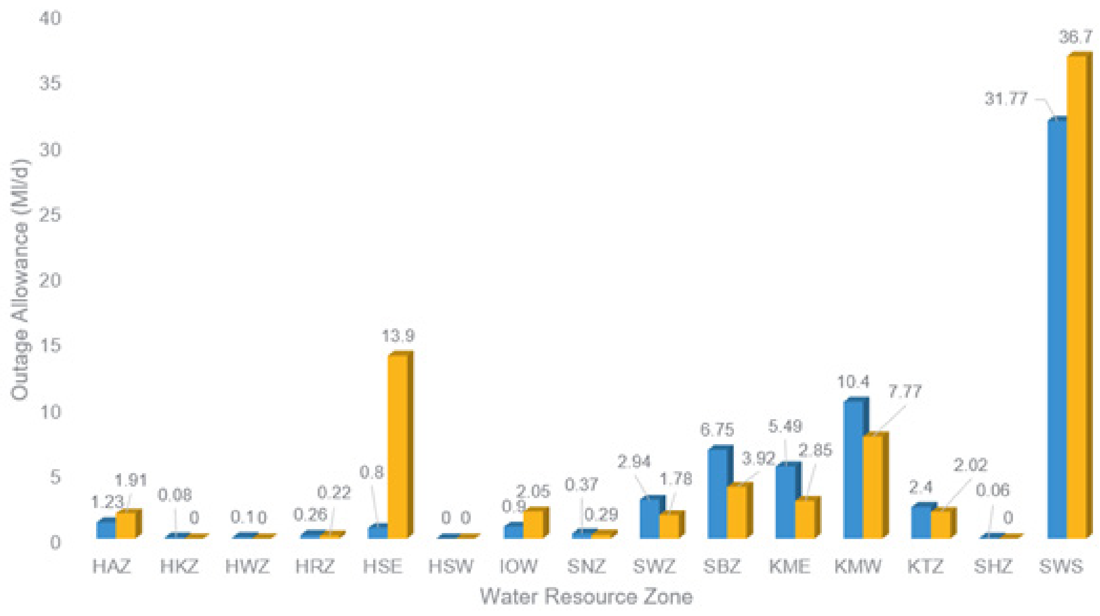


Figure 5.20: Estimated outage allowance for the 2025-75 planning period by WRZ. Blue bars refer to average (Ml/d) and yellow to peak (Ml/d)

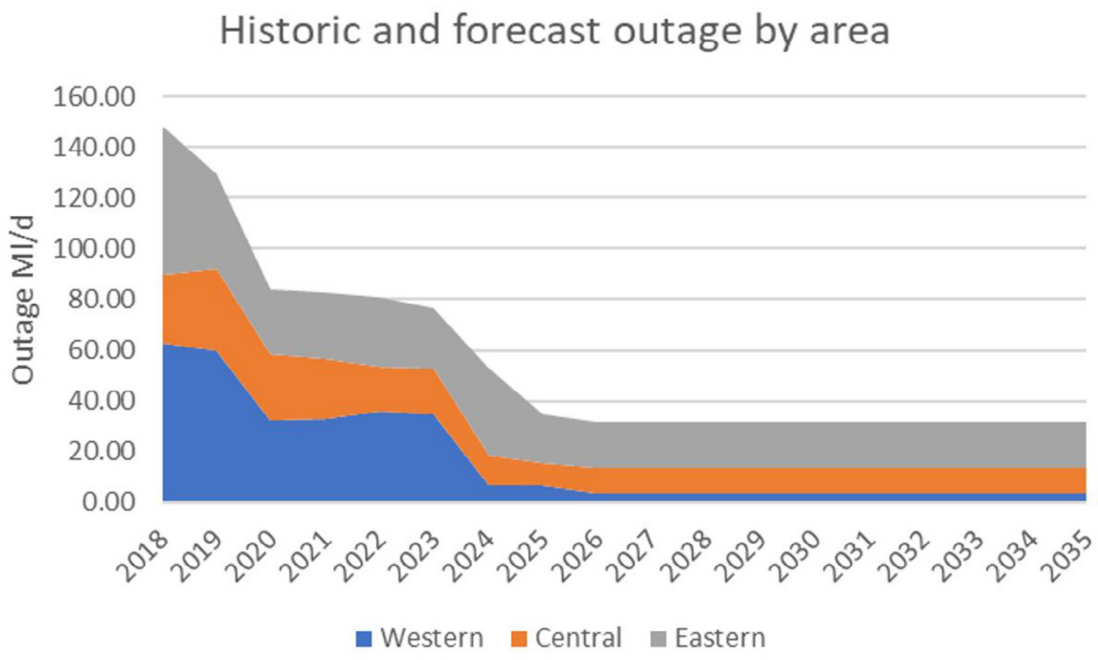


Figure 5.21: Historic outturn (to March 2023) and forecast outage allowance figures (from April 2022) for the DYAA planning scenario by supply area

Some of our WRZs have an outage allowance of zero as a result of this assessment.

- HSW has zero outage for DYAA as during a drought we expect that DO during drought from this WRZ will fall to zero (due to HoF constraints) and hence outage would create negative water available for use.
- For other WRZs with zero outage allowance (HKZ, HWZ, HSE and SHZ at DYCP and SHZ at DYAA) there were no outage events within the data period used for assessment (2015-22) and so consequently the Monte Carlo assessment resulted in an allowance of zero under all percentiles.

5.3.6 Our Environmental Destination for 2050

One of our key aims is to establish 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 Destination, also referred to as Environmental Ambition, for 2050 with the aim to achieve this (see Annex 9).

This is aligned with our Catchment First approach. 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 WRMP24 and our DWMP. Our evolving environment strategy also builds on this by embedding catchment and nature-based solutions across broader business processes.

The primary route for our Environmental Destination is our 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 (Annex 9). Through this work, we expect to reduce the uncertainty associated with the range of possible licence reductions considered under our Environmental Destination scenarios. By the time for WRMP29, our environmental investigations will have enabled 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.

The full detail of this work is presented in Annex 9. A summary of the DO reductions under each of the adaptive planning branches is presented in Table 5.10.

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

- Used the supplementary guidance 'actions required to prevent deterioration'[37] to inform our Environmental Destination 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 licence caps to begin to apply 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 (RBMPs) 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 habitat enhancement alongside any required reductions to our abstractions.
- We have been ambitious through our 'alternative' scenario and are investigating the solutions that 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.

[37] Environment Agency, 2022. Water resources planning guideline supplementary guidance - actions required to prevent deterioration v2.0. Published 4 April 2022

- We have brought forward many of our WINEP 'No Deterioration' investigations. Our ongoing WINEP 'No Deterioration' investigations, for example in the SWZ, consider the environmental impacts of our current abstraction regime and internal transfers, specifically in relation to compliance with the WFD.
- 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 to be not 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.

Our ambition will continue to evolve as we shape our final WRMP24 and take account of changes in policy, guidance and the continuing assessment of outcomes from our WINEP investigations.

Table 5.10: Summary of total DO impacts under 1:500 DYAA conditions for each Environmental Destination scenario

WRZ	1:500 DO reductions by 2050 for each branch (Ml/d)		
	Low	Medium	High
HAZ*	-11.61	-12.40	-15.54
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*	-9.41	-12.80	-22.71
IOW	-8.06	-11.02	-14.25
SNZ	-6.76	-6.80	-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
Western area total	**-36.69**	**-44.30**	**-80.60**
Central area total	**-21.10**	**-45.66**	**-67.39**
Eastern area total	**-37.08**	**-102.05**	**-102.33**
Total	-94.87	-192.01	-250.32

* Where relevant, we have also included reductions to DYCP DO, e.g. under Alternative Scenario or where 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.

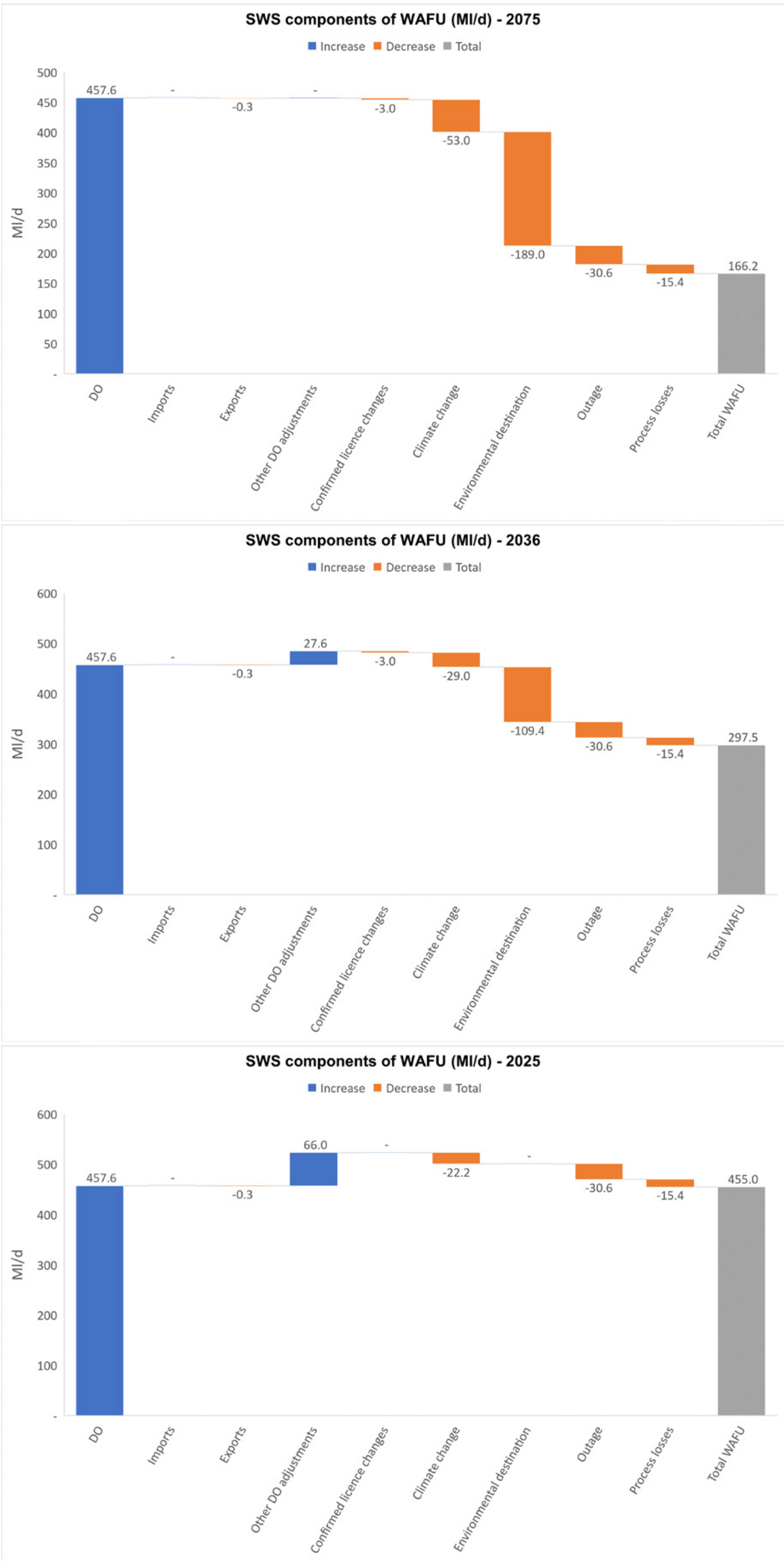


Figure 5.22: Forecast WAFU at the company level for supply-demand balance Situation 4

5.3.7 Water Available For Use

In order to effectively prepare our WRMP, we need to forecast the water supplies that 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 5.22) for supply-demand balance situation 4 (see Section 5.5) show similar overall trends to those at an area level through the planning period (see Annex 8).

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

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 (3Ml/d) confirmed further licence change at Andover in HAZ which has a DO impact (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 (see Table 5.10). 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 Destination.

Climate change presents the next largest possible reduction in WAFU, primarily in HSE and SNZ which are also amongst the most environmentally sensitive WRZs. Consequently, WAFU in Western and Central areas 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 to protect the environment. Both drivers can potentially lead to large reductions in WAFU depending on which future supply-demand balance '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 though the two are indirectly related, the way 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 where both climate change and Environmental Destination act in combination to reduce DO. This is to avoid double counting losses leading to greater water losses than available water (i.e. leading to negative WAFU). This is most obvious in HSE and SNZ, both of which are highly vulnerable to climate change and are at risk of needing significant licence reductions to protect the environment.

Although both are expected to occur in some combination, any changes in DO from licence changes are likely to be the primary, and most obvious cause of WAFU loss, and will precede the losses due to climate change.

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, we developed the individual components using the methodology we followed for WRMP19 (Figure 5.23).

For regional consistency we supplied our headroom components to WRSE. WRSE carried out the uncertainty modelling we are using for this rdWRMP24. WRSE approach to headroom is described in Annex 10.

Target headroom figures are reported as absolute values in the water resources planning tables that accompany WRMP24 submission. 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.

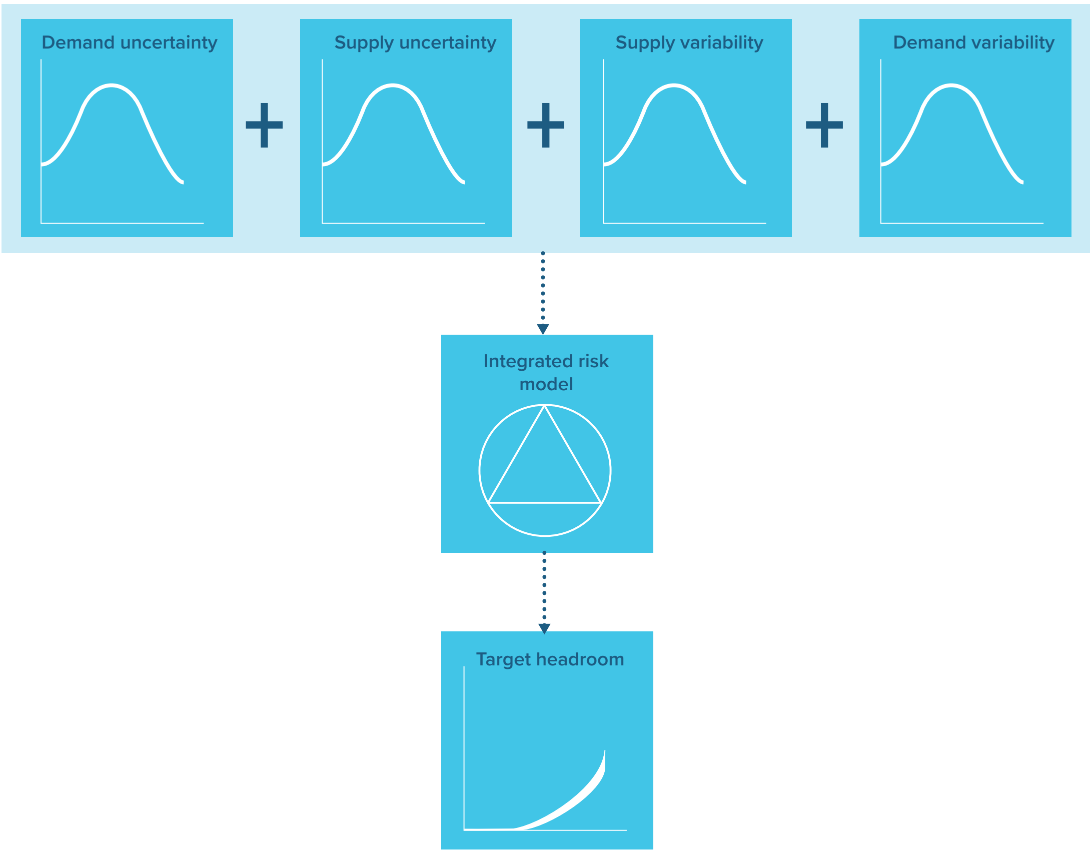


Figure 5.23: Our WRMP19 approach to modelling uncertainty

5.5 Our adaptive planning approach for an uncertain future

5.5.1 What is adaptive planning?

As was the case for WRMP19, we have chosen to follow an adaptive planning approach for WRMP24, working closely with WRSE 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 as 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 plans 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 it shows 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. It aims to identify a 'no regrets' or 'low regrets' solution set to meet current needs and 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 balance situation turn out to be more challenging than planned. Adaptive planning allows us to simultaneously consider and plan for multiple future supply-demand balance situations 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 and the WRPG and is consistent with UKWIR guidance[38] as an advanced approach suitable for our strategic needs and complexity. Our problem characterisation (see 4.2) highlighted some significant uncertainties around the scale of the supply, demand and investment challenge.

Working with WRSE, we have adopted an adaptive planning approach as it 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 both large step changes in supplies driven by the need to reduce abstraction as well as more gradual changes driven by climate change and population growth.

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

Whilst alternative decision-making approaches offer an optimised and resilient plan against a given metric or set of metrics, they are generally less flexible in offering alternative pathways 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 problems we face as both a company and a region.

5.5.3 Our adaptive planning approach

Our supply forecast has identified two key drivers of potential reductions in WAFU (see Section 5.3.7). These are the loss of water through impacts of climate change, and the loss of available supplies through Environmental Destination. 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.

We initially looked at 5 growth scenarios, 28 climate change scenarios and 5 Environmental Destination scenarios to develop a range of future supply-demand balance situations. Figure 5.24 shows the full range of uncertainty of the possible supply-demand balance challenge at regional level through combinations of these three drivers.

[38] UKWIR, 2016. WRMP 2019 methods - Decision Making Process: Guidelines. Report 16/WR/02/10. UK Water Industry Research Limited

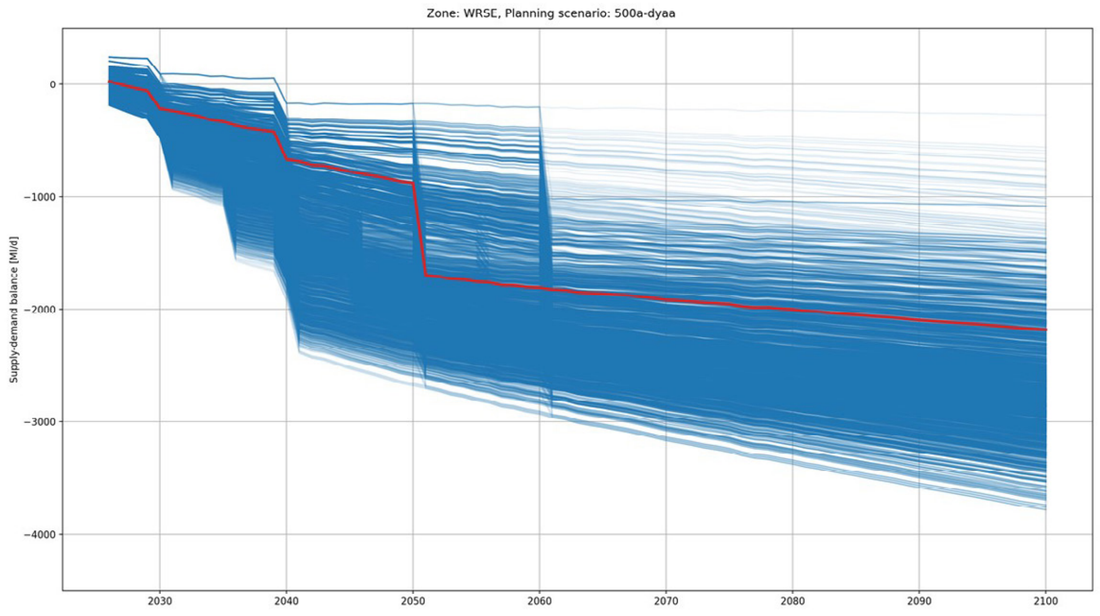


Figure 5.24: The range of baseline supply-demand balances for WRSE region under a 1:500 DYAA scenario

In order to come up with a more practical number of future supply-demand balance situations, we decided to limit the number of supply-demand balance situations to 9 in consultation with other WRSE member companies (Figure 5.25).

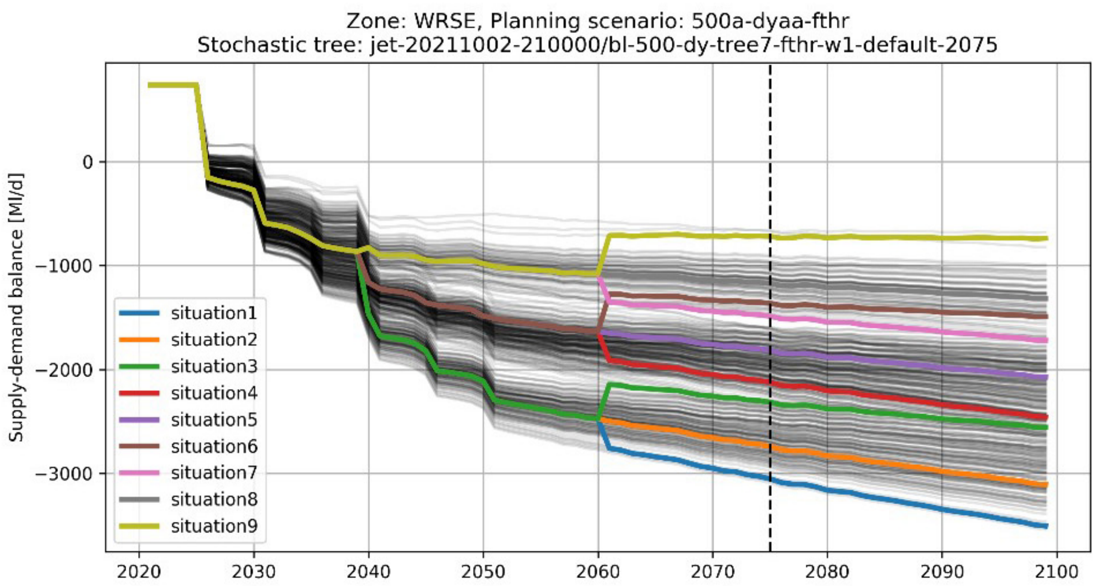


Figure 5.25: An illustration of the root and branch approach adopted for adaptive planning

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 balance situations defined based on the following factors:

Growth forecast: We have considered the following population growth forecasts (see Section 5.2.1):

1. Baseline growth forecast based on Housing Plan Principal forecast from Local Plans.
2. Maximum growth forecast based on Housing Need Principal projections.
3. ONS-18 central forecast based on ONS-18 Principal forecast.
4. Minimum growth forecast based on ONS-18 Low scenario.
5. OxCam growth forecast based on OxCam-1a Principal forecast.

Supply forecast: This has been derived from simulation models, groundwater models and hydrological models using the spatially coherent stochastic weather sequences for the region (Annex 8). We have used the supply forecast sequences that move to a 1-in-500 year drought resilience sequence by 2040-41. As the choice of timing to move to 1:500 resilience is within company control, we have also explored alternative dates for achieving the 1:500 drought resilience through sensitivity analysis (see Section 7.3) rather than as part of the adaptive plan branches.

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 (see Annex 8).

Environmental Destination: Following discussions between WRSE and the Environment Agency, we have developed three scenarios (high, medium, and low) to reduce abstractions at key sources to protect and enhance the environment. We have also included further reductions for licence capping (see Annex 9).

The selection of the growth forecasts attracted several comments from stakeholders on the ERP[39] that was consulted upon in February 2022.We have selected these forecasts for the following reasons:

- The Housing Plan and the Housing Plan plus OxCam are the two growth forecasts explicitly mentioned in the WRPG. 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 these growth projections is 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 ERP 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 serve as stress tests to ensure that the wide range of uncertainty is considered in scheme selection.

We have introduced the latest ONS-18 forecast for supply-demand balance situations towards the lower end of the spectrum in addition to the minimum growth forecast. Similarly, following Environment Agency feedback on the ERP, growth projections for OxCam have also been incorporated in the branching.

When determining the branching points on our adaptive plan we have considered two factors:

- **Branching once acceptable levels of risk are exceeded (Risk-Based Decision Points).**
  We have identified our preferred strategy at the start of the planning period but 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.**
  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 Destination.

[39] WRSE, 2022. Futureproofing our water supplies, a consultation on our emerging regional plan for South East England.

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 determine the 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 Destination, 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 5.25) was used in the ERP. Following the consultation responses and publication of Ofwat's PR24 methodology[40], we revised the branching to take 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 5.26 summarises our adaptive planning approach for this plan.

[40] Ofwat, 2021. PR24 and beyond: Long-term delivery strategies and common reference scenarios.

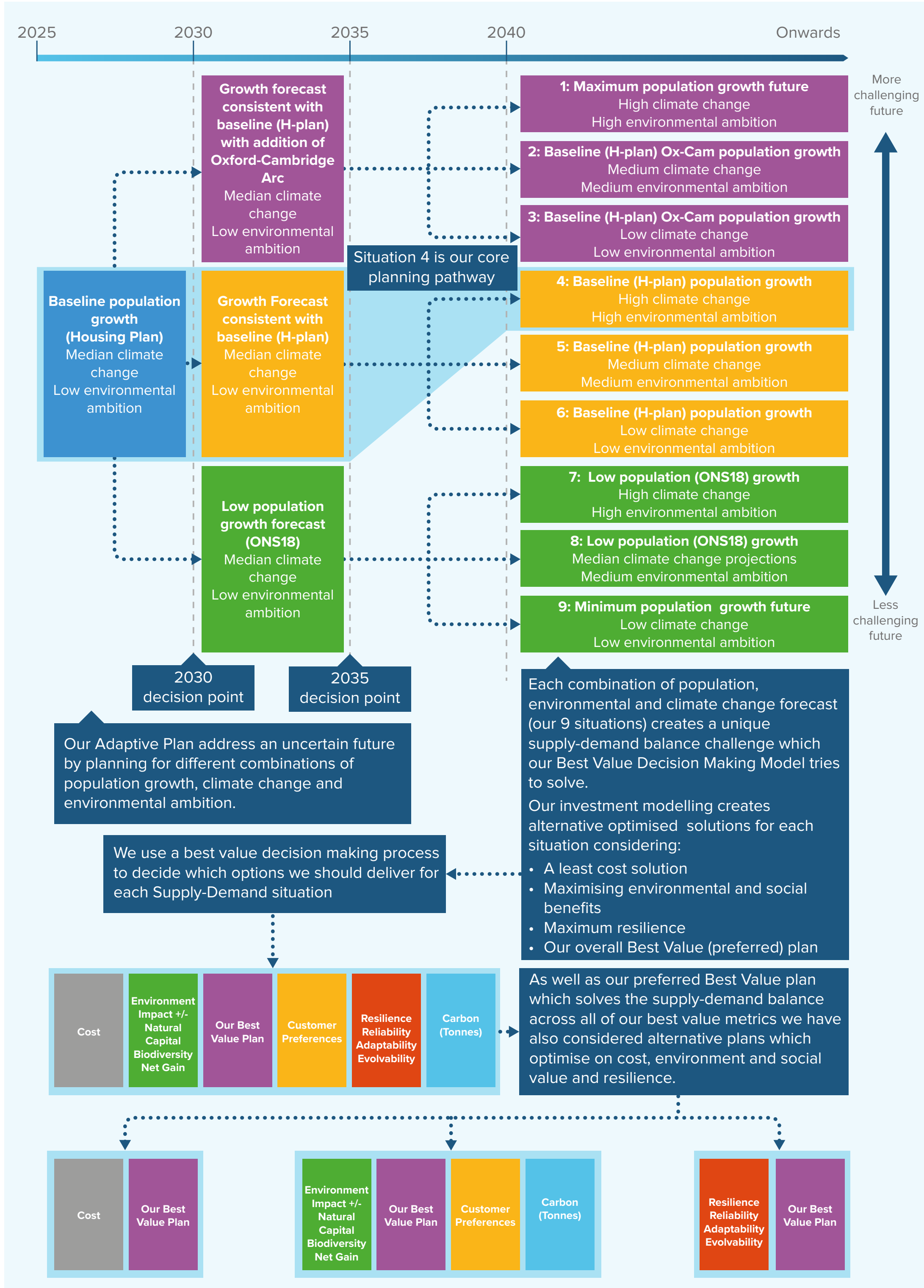


Figure 5.26: Summary of our adaptive planning approach

There are nine different supply-demand balance 'situations' which represent different combinations of population growth, climate change and Environmental Destination. These are expressed as different magnitudes of supply-demand balance 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 Destination.

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 DYCP. Therefore, for every WRZ, we have four sets of situational trees covering nine potential supply-demand forecasts.

Whilst the range of uncertainty explored here is driven by different combinations of the individual growth, climate change and Environmental Destination scenarios, the resulting range of supply-demand balances can be achieved through other combinations. For example, a future with high population growth and low climate change impact could have a similar supply-demand balance to a future with low population growth and greater climate change impact. The overall impacts of these two futures would be similar, even though the individual forecasts are different.

These combinations of discrete forecasts describe the range of overall supply-demand balance situations that we need to account for. Therefore, the solutions being presented in our plan should not be considered as solving these 9 specific combinations of uncertainty drivers but as solutions to a wide range of supply-demand balance situations that would result from a different combination of drivers.

The distinction between branch points and decision points should be noted. For the purpose of investment modelling, the branches (or supply-demand balance 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 is set out in our Monitoring Plan (see Annex 21).

For regulatory purposes, we have selected 'Situation 4' as our core 'reported pathway' and this situation is reported in the water resources planning tables that accompany this plan. 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 one purely for the purpose of population water resources planning tables. Our plan remains fully adaptive across the whole range of the future situations.

In the longer term, Situation 4 includes our full 'high' Environmental Destination which goes further than BAU+ and Environment Agency Enhanced scenarios[41] but this does not affect our investment proposals for the next 5 years. All adaptive pathways in our plan are based on low environmental ambition, including licence capping, until 2040 (Figure 5.26).

Ofwat has set out its expectations in relation to long-term management of assets through its LTDS guidance as part of its PR24 methodology[42]. This requires that long-term plans consider a 'do minimum' scenario, and to demonstrate that, adaptations from that scenario represent best value. For our LTDS, the 'do minimum' scenario is covered by Situation 6 based on the likely statutory minimum Environmental Destination and ONS-18 population growth, which most closely aligns with the core strategy in the Ofwat guidance. The LTDS also considers two other situations, Situation 4 and Situation 5, which collectively provide a reasonable range of pathways to represent our WRMP24 within our LTDS[43].

[41] Environment Agency, 2020. Long-term water resources Environmental Destination Guidance for regional groups and water companies, Version 1.
[42] Ofwat, 2022. PR24 and beyond: Final guidance on long-term delivery strategies. April 2022.
[43] Southern Water, 2024. Long Term Delivery Strategy - Technical Annex. srn12-long-term-delivery-strategy-technical.pdf (southernwater.co.uk)

5.5.4 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 Destination) 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 described in Section 5.4 above.

At the first branch point, the adaptive plan branches on growth forecasts but leaves climate change as a median estimate and Environmental Destination as low. 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. This adaptive planning headroom approach is illustrated in Figure 5.27. Target headroom figures included in the water resources planning tables are based on this approach.

5.5.5 Monitoring our adaptive plan

Our Monitoring Plan sets out the way we will track the different supply and demand variables that could influence the adaptive pathway (supply-demand balance situation) we are likely to be following into the future and therefore the portfolio of supply and demand options that we will need to deliver to maintain supply-demand balance. Our monitoring approach is summarised in Chapter 9 and described in Annex 21.

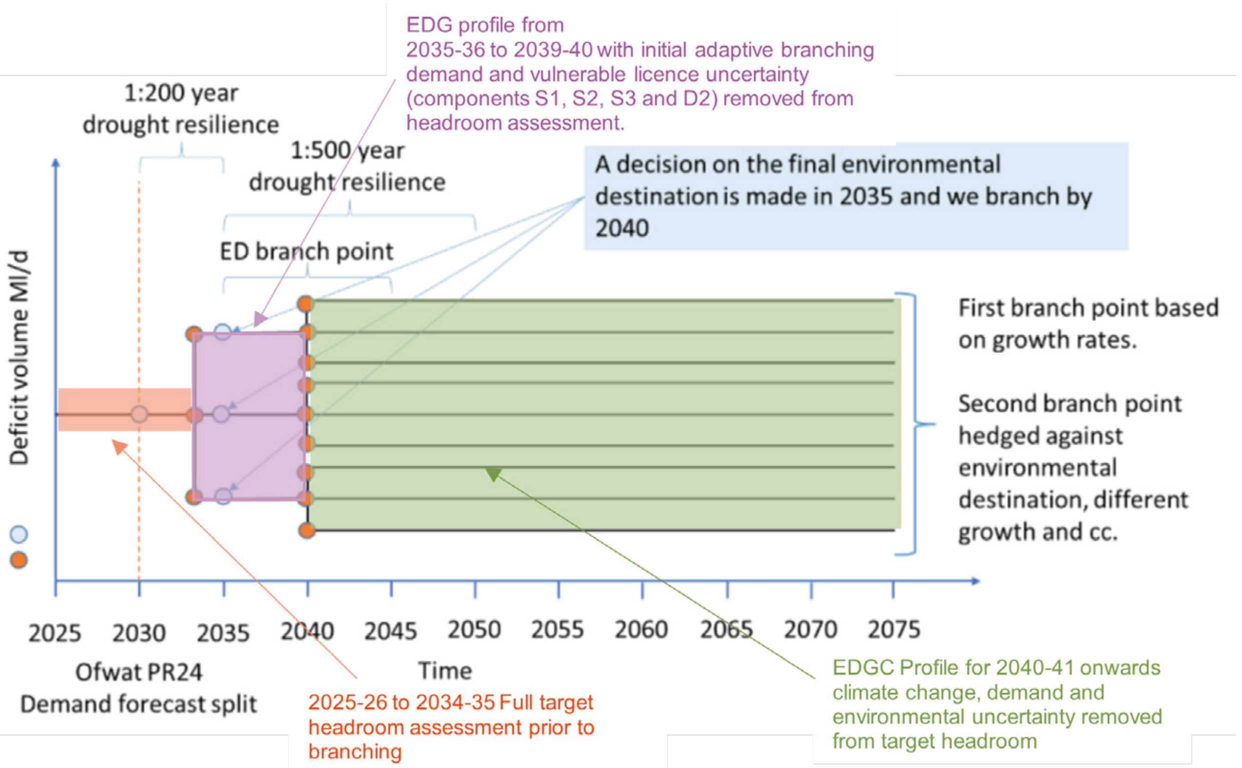


Figure 5.27: Illustration of how headroom has been incorporated into our adaptive planning approach by removing components associated with adaptive branching uncertainty

Component	Description	Full target headroom 2025-2034	Environmental Destination and growth (EDG) target headroom profile 2025-2039	Environmental Destination, growth (EDGC) and climate change target headroom profile 2040 onwards
S1	Vulnerable Surface Water Licences	×	×	×
S2	Vulnerable Ground Water Licences	×	×	×
S3	Time Limited Licences	×	×	×
S4	Bulk Imports	✓	✓	✓
S5	Gradual Pollution of Sources causing a reduction in abstraction	✓	✓	✓
S6	Accuracy of supply-side data/overall source yield	✓	✓	✓
S7	Not used	×	×	×
S8	Uncertainty of impact of climate change on source yields	✓	✓	×
S9	Uncertain output from new resource developments	✓	✓	✓
D1	Accuracy of sub-component data	✓	✓	✓
D2	Demand forecast variation	✓	×	×
D3	Uncertainty of climate change on demand	✓	✓	✓
D4	Uncertain outcome from demand management measures	✓	✓	✓

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 (see Section 5.2.1). These in turn inform our demand forecasts.

We normally re-assess population growth forecasts for each WRMP cycle. The next update should be undertaken for WRMP29 and will be incorporated into our WRMP29 demand forecasts. This update will be used to support and determine the decision point for population growth in 2030. We will use actual data compared to forecast range of uncertainty between different projections. Figure 5.28 summarises our adaptive monitoring approach and metrics for population growth and the 2030 decision point

Environmental Destination

There is currently 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. By 2027, we expect to conclude investigations into the sustainability of most of our water sources, with a small number of investigations to be completed by 2030. This will allow us to work with the Environment Agency, 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 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 as individual licences changes can be considered and tailored at a source or water body level as appropriate, but the range of uncertainty 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. In view of the timing of our WINEP investigations (Table 5.11, Figure 5.29), we should be able to know the Environmental Destination scenario we are likely to follow in advance of the environmental decision point in 2035.

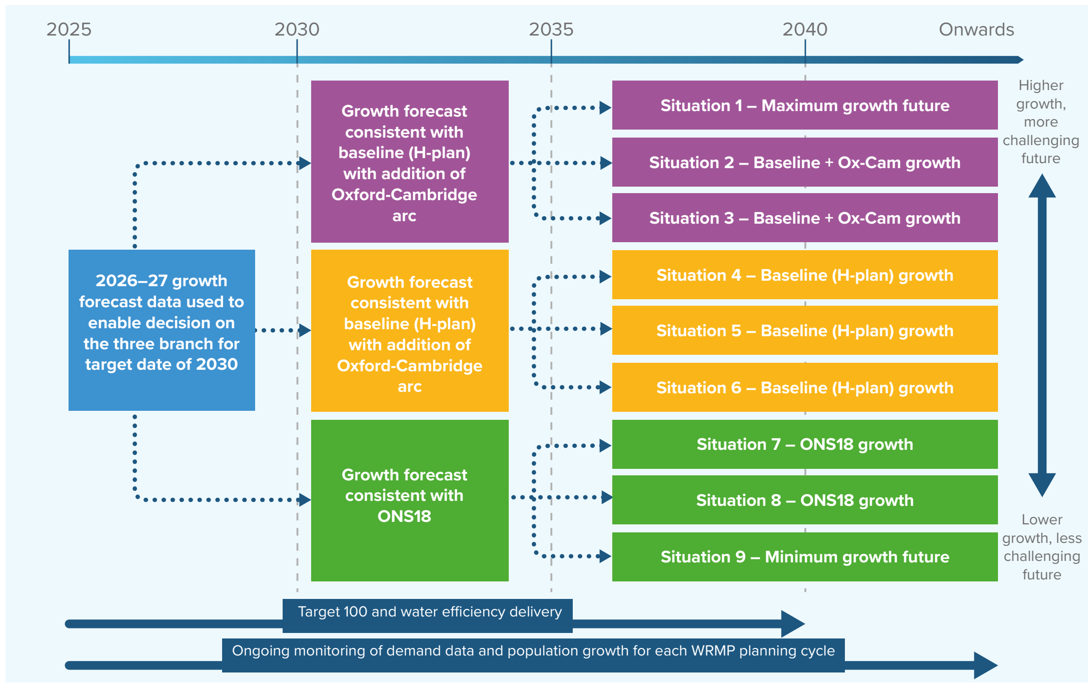


Figure 5.28: Summary of adaptive plan metrics, monitoring and decision points for the population growth uncertainty driver

Table 5.11: 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)	2024-30
Environmental Destination update and confirmed sustainability reductions for WRMP29	2027-29
Start of mitigations associated with 2027 WINEP investigation and options appraisal	2030 Onwards
Environmental Destination update and confirmed sustainability reductions for WRMP34	2030 Onwards
Environmental Destination decision point	2030
Adaptive branching point for Environmental Destination	2035

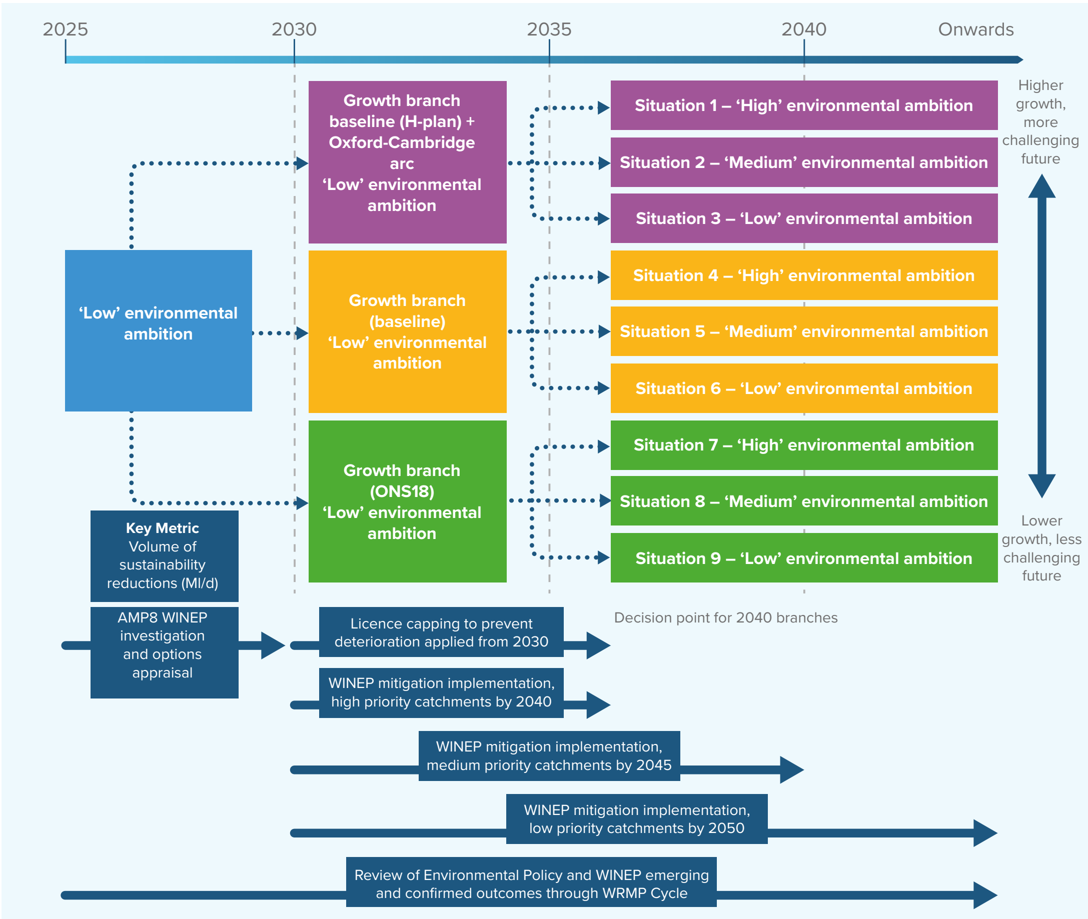


Figure 5.29: Summary of adaptive plan metrics, monitoring and decision points for the Environmental Destination driver

Climate change

Given 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. Its effects on DO may be less obvious than other climate events such as extreme weather (e.g. heatwaves, droughts, floods). However, 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 of 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', '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 5.30).

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

Our combined proposed timeline for adaptive planning decision points

Table 5.12 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. The use of WRMP cycle will also provide the necessary framework for consultation and engagement with stakeholders, regulators, and other water companies and regional groups.

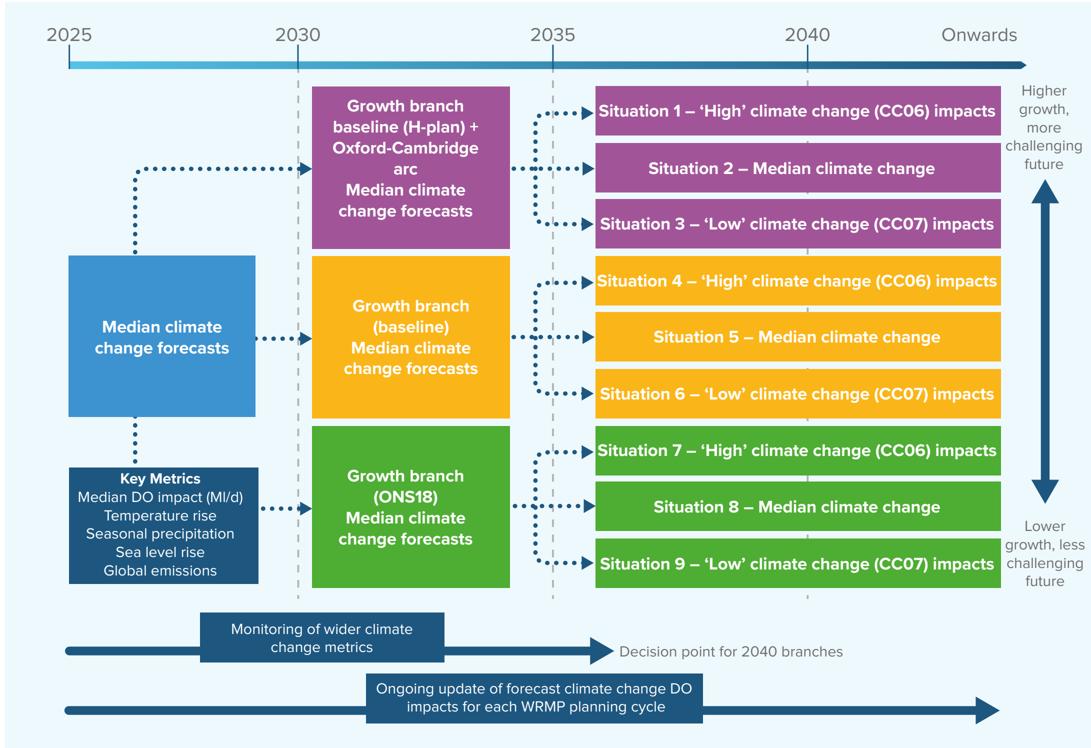


Figure 5.30: Summary of adaptive plan metrics, monitoring and decision points for the climate change driver

Scheme level monitoring

Annex 21 sets out specific scheme-level decision points based on lead times for planning, construction and development. It also includes an associated suite of trigger thresholds that reflect the key adaptive drivers, i.e. demand including population growth, Environmental Destination scenarios and climate change impacts. These triggers also reflect the net impact of these factors in combination through our area-level supply-demand balances. The full set of decision points and triggers is set out in Annex 21.

Table 5.12: Summary of Monitoring Plan against required decision points for our adaptive plan

Planning cycle	Environmental Destination	Demand progress, incl. growth	Climate change impacts
PR19/AMP7	WINEP investigations and options appraisal	Water efficiency programme delivery	Ongoing review of climate variables
PR24/AMP8 - 2026-27 growth data **must** be available to enable decision on the 3 branch decision for target	WINEP investigations and options appraisal completed. Conclusion 2026-27 WINEP data is available, remaining WINEP data 2029-30	Water efficiency programme delivery	Ongoing review of climate variables
PR29/AMP9 - **2030 target branch for growth**	**Environmental Destination decision point** Start of mitigations associated with AMP8 WINEP and implementation of solutions or interim measures in the highest priority catchments	Water efficiency programme delivery 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**	**Adaptive branching point for Environmental Destination** WINEP & highest priority catchments implementation of solutions	Water efficiency programme delivery Updated growth forecast for WRMP34 **Target:** Reduce non-household demand by 9% by 2037-38 compared to 2019-20	Update of resource modelling, impact and vulnerability assessment for WRMP34 The Western area WRZ's highly vulnerability to climate change will partially be determined by Environmental Destination outcomes for the rivers Test, Itchen & Rother
PR39/AMP11	Implementation of solutions in medium priority catchments	Water efficiency programme delivery	Ongoing monitoring and review
PR44/AMP12	Implementation of solutions in low priority catchments	Water efficiency programme delivery **Target:** reduce average Per Capita Consumption (PCC) to 110l/h/d under dry year (DYAA) conditions by 2045	Ongoing monitoring and review
PR49/AMP13	**Target: Good ecological status by 2050**	Water efficiency programme delivery **Target:** Reduce leakage by 53% by 2050 (target: 48.1 Ml/d) by 2050	Ongoing monitoring and review

5.6 Summary of supply-demand balance situations

The supply-demand balance situations at the company level for each of the branches under the four planning scenarios are shown in Table 5.13 and Figure 5.31. The supply-demand balance situations at the WRZ level are included in Annex 11.

Table 5.13: Supply-demand balance under different situations for each of the planning scenario at the company level.

Planning scenario	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	9.97	-94.58	-474.53	-550.82
	Situation 2	9.97	-94.58	-356.15	-414.65
	Situation 3	9.97	-94.58	-272.68	-326.22
	Situation 4	9.97	-92.59	-455.88	-511.78
	Situation 5	9.97	-92.59	-353.67	-412.02
	Situation 6	9.97	-92.59	-270.20	-323.59
	Situation 7	9.97	-73.18	-417.29	-469.88
	Situation 8	9.97	-73.18	-315.08	-370.12
	Situation 9	9.97	-73.18	-231.61	-262.75
1:100 DYAA	Situation 1	-182.25	-250.12	-508.94	-587.77
	Situation 2	-182.25	-250.12	-433.08	-490.71
	Situation 3	-182.25	-250.12	-349.64	-406.03
	Situation 4	-182.25	-247.91	-488.70	-545.36
	Situation 5	-182.25	-247.91	-430.32	-487.79
	Situation 6	-182.25	-247.91	-346.89	-403.10
	Situation 7	-182.25	-227.02	-447.09	-500.19
	Situation 8	-182.25	-227.02	-388.71	-442.61
	Situation 9	-182.25	-227.02	-305.28	-337.33
1:500 DYAA	Situation 1	-230.20	-319.40	-560.74	-635.12
	Situation 2	-193.87	-282.38	-458.39	-507.44
	Situation 3	-193.87	-282.38	-380.84	-421.57
	Situation 4	-193.87	-280.17	-502.85	-552.58
	Situation 5	-193.87	-280.17	-455.63	-504.52
	Situation 6	-193.87	-280.17	-378.08	-418.65
	Situation 7	-193.87	-259.28	-461.25	-507.40
	Situation 8	-193.87	-259.28	-414.02	-459.34
	Situation 9	-193.87	-259.28	-336.48	-352.87
1:500 DYCP	Situation 1	-171.05	-211.16	-391.54	-459.53
	Situation 2	-171.05	-211.16	-303.77	-343.22
	Situation 3	-171.05	-211.16	-300.66	-354.14
	Situation 4	-171.05	-208.43	-367.26	-407.97
	Situation 5	-171.05	-208.43	-300.38	-339.61
	Situation 6	-171.05	-208.43	-297.27	-350.53
	Situation 7	-171.05	-183.16	-316.64	-352.72
	Situation 8	-171.05	-183.16	-249.76	-284.36
	Situation 9	-171.05	-183.16	-246.65	-270.01

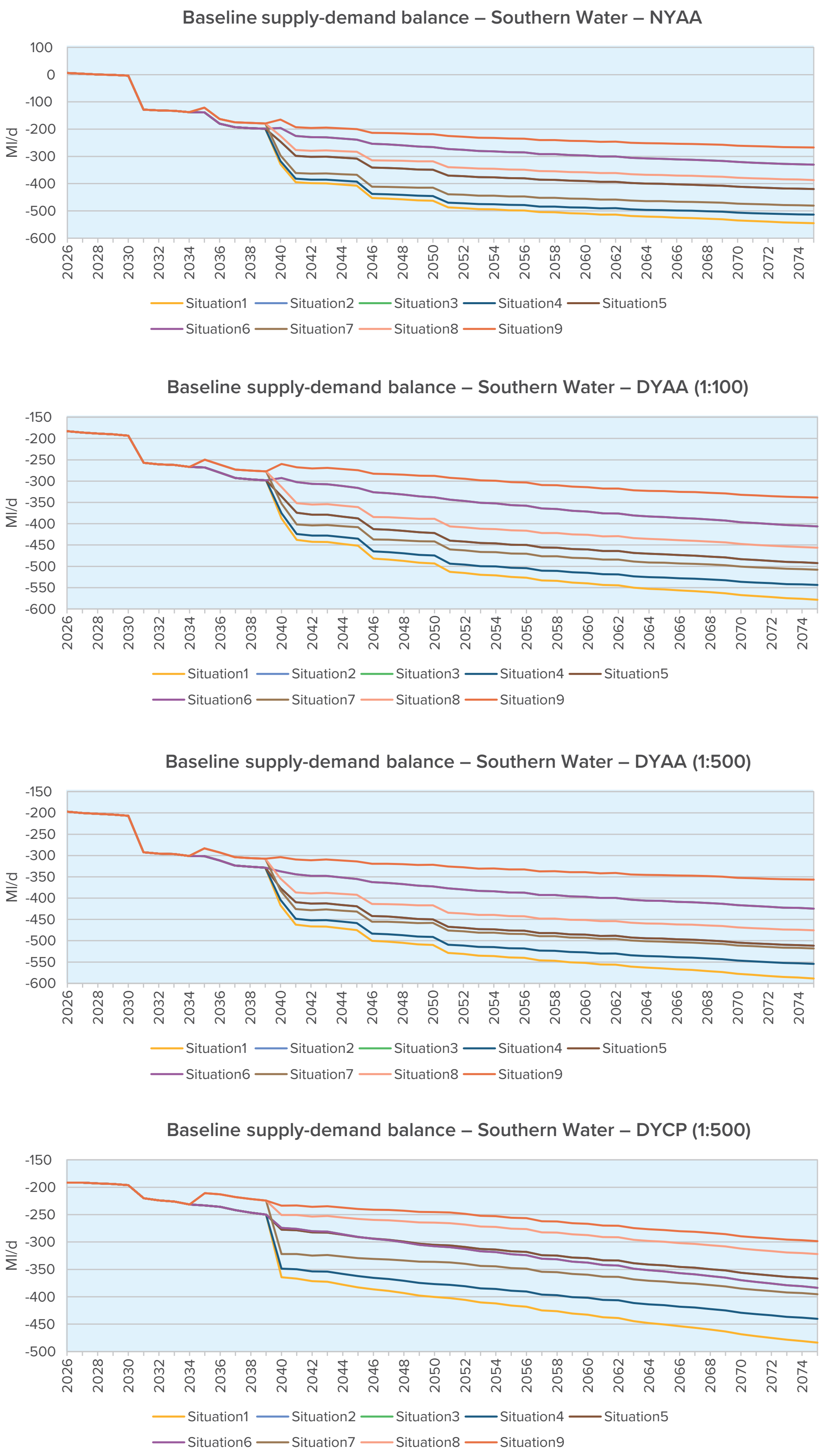


Figure 5.31: Baseline supply-demand balance at the company level

6. Options appraisal

When supply and demand forecasts show a supply-demand balance 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 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.

As mentioned in Section 5.4, 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).

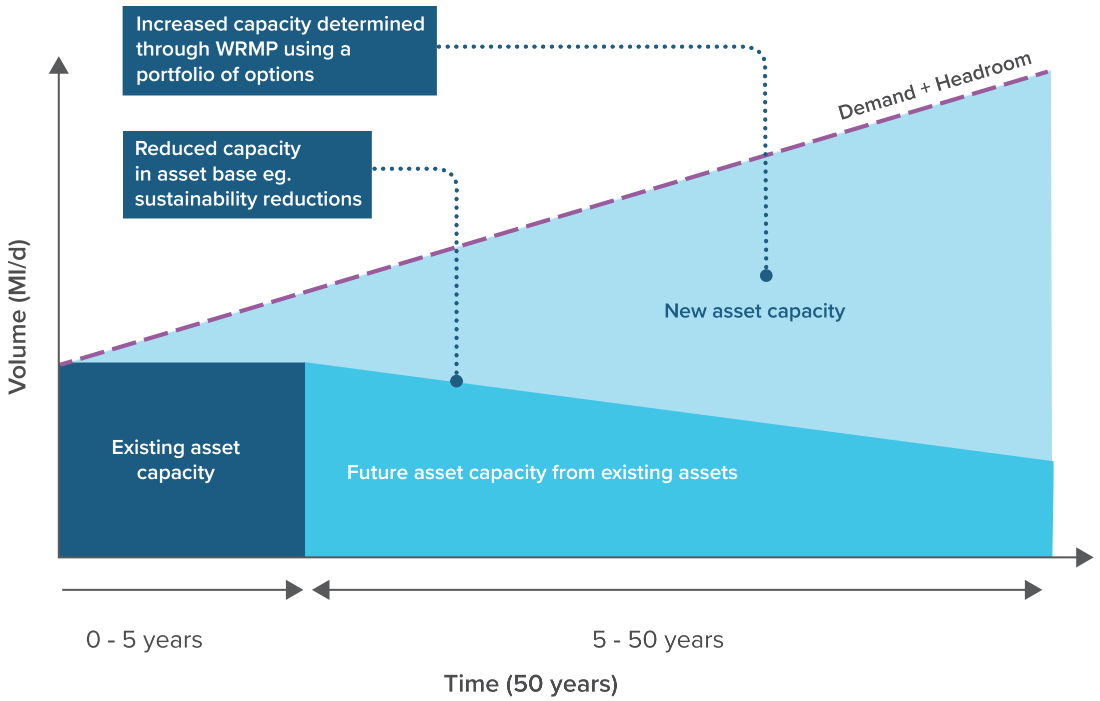


Figure 6.1: The role of new options in maintaining supply-demand balance

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.

Working with WRSE, we developed a consistent framework for options appraisal[44]. 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).

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

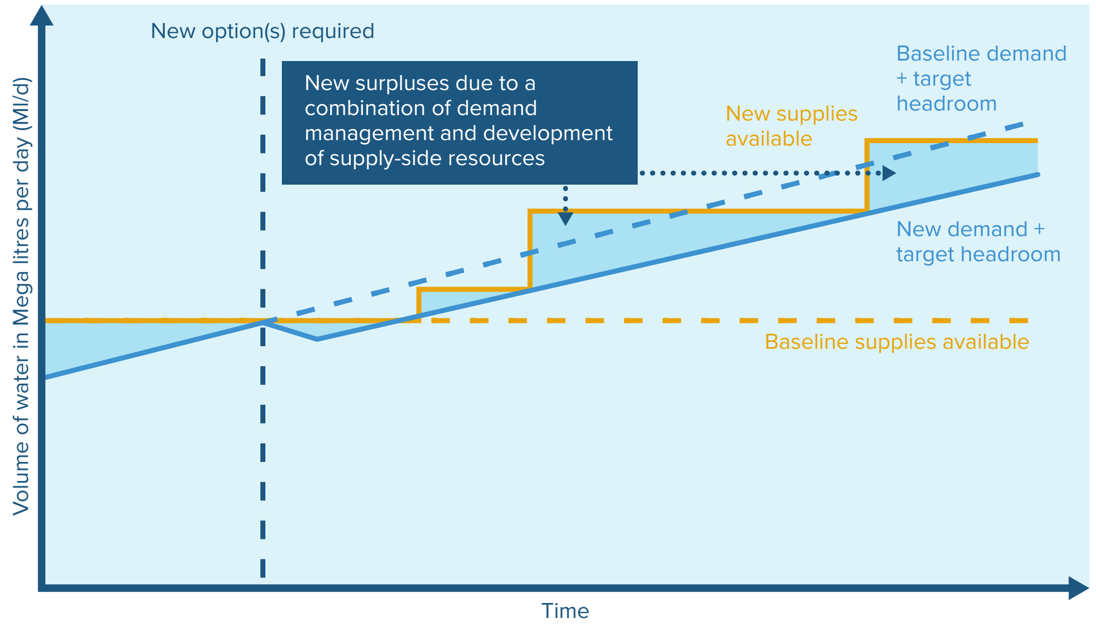


Figure 6.2: The twin-track approach to meeting supply-demand deficit

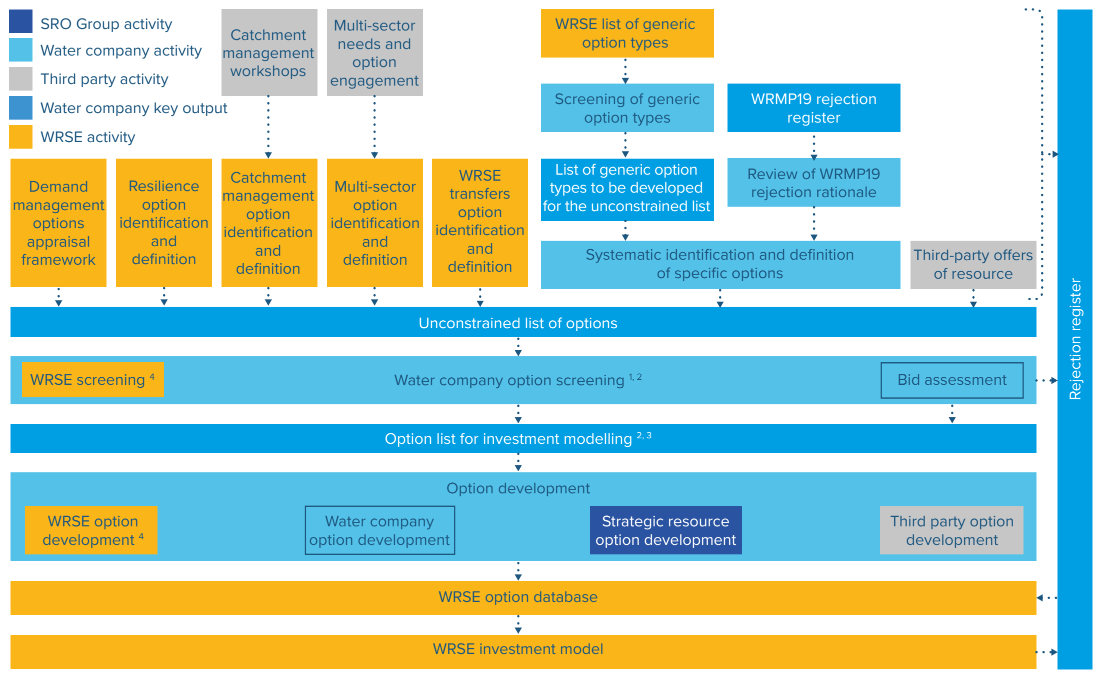


Figure 6.3: The options appraisal process developed for the Regional Plan

[44] WRSE, 2021. Method Statement: Options Appraisal. Updated version, September 2021.

For our options appraisal, we followed the same approach, adopted in WRMP19, and took account of WRPG and UKWIR guidance[45,46,47]. 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.

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.

- Identification of an unconstrained list of options.
- Screening and filtering of the unconstrained 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 feasible list.
- Constrained feasible options are taken forward into the decision-making modelling process (see 7.1).
- Environmental assessment of the constrained feasible options as part of the Strategic Environmental Assessment (SEA), HRA and WFD assessment processes.

The options that were considered for WRMP24 are described in Annex 12.

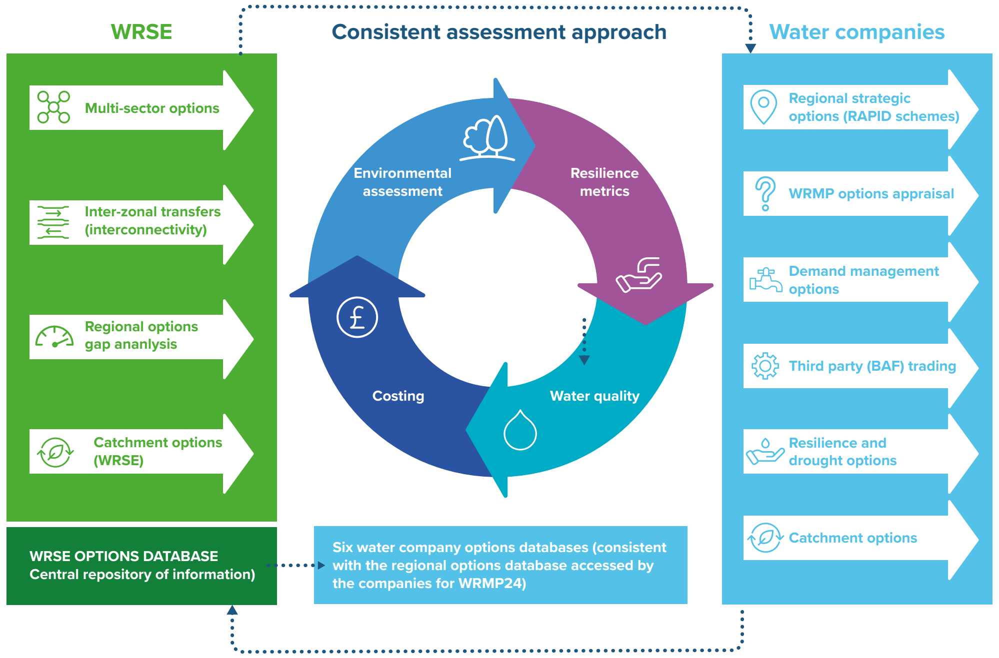


Figure 6.4: Integrated options appraisal approach

[45] UKWIR, 2002. The Economics of Balancing Supply and Demand (EBSD). Main report. Report 02/WR/27/3. UK Water Industry Research Limited.
[46] UKWIR, 2012b. Water Resources Planning Tools - Summary Report. Report 12/WR/27/6. UK Water Industry Research Limited.
[47] UKWIR, 2016, WRMP 2019 methods - Decision Making Process: Guidelines. Report 16/WR/02/10. UK Water Industry Research Limited.
srn12-long-term-delivery-strategy-technical.pdf (southernwater.co.uk)

6.1 Unconstrained list of options

We considered more than one thousand options during our options appraisal for this plan. 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 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 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 'No 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?

We worked alongside WRSE 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 feasible list of options

In the final stage, each feasible 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.
- **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 feasible options were subjected to more detailed engineering and environmental assessment, to provide consistent and comparable information as an input to the selection of options for WRMP24. The options were then classified into option types and sub-types using WRSE classifications (Table 6.1).

WRMP24. The options were then classified into option types and sub-types using WRSE classifications (Table 6.1).

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

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

The more detailed assessment of the constrained feasible 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 SEA, more general environmental 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 feasible 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 6.5. Fact files for preferred supply-side options are included in Annex 13.

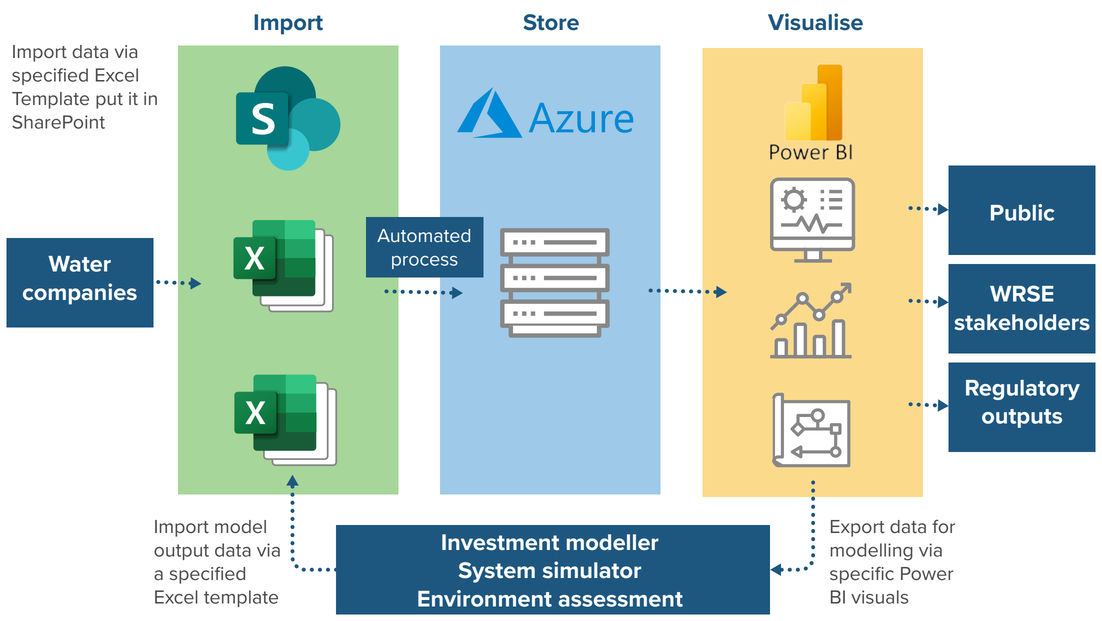


Figure 6.5: Export of options data into WRSE database and its subsequent processing for investment modelling

6.3.1 Designing and costing of constrained feasible options

For technical assessments, which are used to develop an engineering scope for costing, the constrained feasible 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 SROs, we adopted the CAPEX estimates used in submissions through the RAPID gated process. For other options, 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. Internal cost curves were used where available. Where internal cost curves were not available, water industry costing data held by the Mott MacDonald team was used. For the rdWRMP24, we have updated the costs of SROs to our latest estimates.

CAPEX estimates generated for dWRMP24 using the CIT process included 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.

For the rdWRMP24, we have replaced Smart Targets with charge multipliers to account for risk and uncertainty and have also ensured that all cost estimates are based on the 2020-21 cost base.

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

For SROs, we adopted the OPEX estimates used in submissions through the RAPID gated process. For other options, 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 including 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 Section 10.

6.3.2 Demand-side measures

Appraisal of demand-side options followed a similar general process. The list has been revised for rdWRMP24 in view of the targets set out in the National Framework and consultation feedback on our dWRMP24. Annex 14 describes the demand-side measures in detail.

6.3.3 Third-party options

We, together with other WRSE 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. This option was not carried forward for the dWRMP. For the rdWRMP24, we have explored this option further and included it as a constrained feasible option. The assessment is discussed in detail in Annex 20.

6.3.4 Changes to constrained feasible options from dWRMP24

Addition of new options

Our interim rdWRMP24 contained the following two options that were not in the dWRMP24 that was consulted upon:

- **Asset enhancement (SBZ): Lewes Road (3.5Ml/d)** - This option has been included from 2030-31 as an alternative to partially offset the loss of supply from the Sussex Coast desalination option.
- **Bulk import (SNZ): SES rezoning (4Ml/d)** - We currently have 1.3Ml/d supply from SES Water to our customers in SNZ. Following agreement with SES Water, we have increased the volume to 4Ml/d from 2025-26 to 2030-31.

Following the submission of our interim rdWRMP24 in August 2023, the Environment Agency asked us to consider additional options, drawing our attention to three potential options in particular:

1. Temporary desalination on the Southampton Coast and/or the IOW
2. Changing our supply to a large industrial user in HSW (up to 10Ml/d)
3. Bulk import of water from Norway via sea tankers

All of these options had previously been looked at as either part of our Water for Life Hampshire programme or the WRSE Regional Plan. We have nevertheless reappraised these options, among others, to see if they could be delivered to mitigate the impacts of delays to Havant Thicket Reservoir and HWTWRP by reducing the level of reliance on the drought options in Hampshire and SNZ.

The work we undertook in this regard is detailed in Annex 20. We have been in discussions with and held workshops (in November 2023 and March 2024) with the Environment Agency and Natural England regarding these options.

In summary, we do not consider temporary desalination on the IOW or in HSE/HSW to be feasible due to the potential environmental impacts and ability to deliver such a scheme by 2029-30.

The option to change our bulk supply to a large industrial user in HSW was considered previously and was ruled out for the purposes of WRMP24 (see Annex 20 for details). In summary, the agreement expires in late 2026 with an obligation to negotiate a renewal but the options under consideration for the renewal are not determined and therefore do not provide sufficient certainty for the purposes of inclusion in WRMP24.

We have explored the option of importing up to 45Ml/d from Norway via sea tankers at considerable length. This includes discussing costs and logistics with a potential supplier, identifying suitable berthing location for sea tankers (Southampton port) and transfer of water to temporary storage (a lake at River Test WSW in HSW) for further treatment (at River Test WSW) before putting into our supply. However, considerable risks and uncertainties remain, especially around water quality and our ability to mitigate the identified environmental impacts linked to both tankering and transferring water from the port to Test WSW site via temporary pipeline. We have also held preliminary discussions with the DWI. DWI has reinforced some of the concerns we had identified around water quality and has suggested that it might be worth carrying out a pilot study before full-scale deployment. However, given that sea tankering from Norway is the only option that can potentially provide a significant volume of water to reduce the volume of water needed from a River Test Drought Permit/Order, we have included it in as a constrained feasible option.

We will continue to explore both the sea tankering option as well as the possibility of changing our supply to the large industrial user into AMP8. These will also be included in our options appraisal process for WRMP29.

In addition to sea tankering, we have also identified two groundwater options in Hampshire that could be delivered. The three additions to the constrained feasible options list for rdWRMP24 are listed below.

- **Drought option - supply side (HSW): Sea tankering from Norway (45M/d)** - We have included this option to provide up to 45Ml/d in the event of a 1-in-200 year, or more severe, drought in the period from 2030-31 to 2033-34.
- **Groundwater (HAZ): Recommission Chilbolton (0.5Ml/d)** - This option has been introduced to provide benefit from 2030-31 in order to reduce reliance on drought permits and orders in the Western area post 2030. See Annex 20 for further details.
- **Groundwater (HRZ): New borehole at Kings Sombourne (2.5Ml/d)** - This option has been introduced to provide benefit from 2030-31 in order to reduce reliance on drought permits and orders in the Western area post 2030. See Annex 20 for further details.

The following groundwater options were initially included in our baseline supply forecast for dWRMP24 and interim rdWRMP24 as they were due to be delivered in AMP7. Their delivery has however been delayed and they have therefore been included as constrained feasible options in our rdWRMP24.

- **Groundwater (SNZ): Petersfield refurbishment (1.6Ml/d)** - This option has been introduced from 2028-29. However no costs have been assigned to it as it was an AMP7 deliverable.
- **Groundwater (SNZ): Reinstate West Chiltington (3.1Ml/d)** - This option has been introduced from 2028-29. However no costs have been assigned to it as it was an AMP7 deliverable.

Removal of options

We have removed the following options from consideration in our rdWRMP24:

- **Bulk import (HSE): PWC source A to Otterbourne WSW - additional volume (9Ml/d)** - The option has been removed as Portsmouth Water is no longer able to provide this additional volume.
- **Catchment management (HSE): Test and Itchen catchment options** - This has been removed as the benefit is now built into the Environmental Destination profile.
- **Desalination (SBZ): Sussex Coast (up to 40Ml/d):** This option has been removed as a suitable alternative site could not be identified when the site originally identified for this option became unavailable.
- **Recycling (HSE): Woolston WTW (4.8Ml/d and 7.1Ml/d)** - These options have been removed as they involve discharges to the River Itchen which are not supported by RAPID.
- **Storage (SNZ): Western Rother licence and storage programme (2Ml/d)** - This option has been removed as there is high uncertainty around its deliverability and DO benefit.

Changes to Deployable Output benefits

The changes to DO benefits are as follows:

- **Recycling (IOW): Sandown WTW (8.5Ml/d)** - The DO benefit for this option has been revised to 8.5Ml/d from 8.1Ml/d following a design update. The name of the option has been changed to reflect this change.
- **Recycling (KMW): Medway WTW (14Ml/d)** - The DO benefit of this option has been increased to 14Ml/d from 12.8Ml/d following an internal review. The name of the option has been changed to reflect this change.

Changes to delivery dates

We have revised the delivery timelines for a number of schemes in dWRMP24. These are as follows:

- **Hampshire Water Transfer and Water Recycling Project (90Ml/d)** - This SRO consists of two components;
  - Recycling (HSE): Recharge of Havant Thicket from recycled water from Budds Farm (60Ml/d). Two other capacity variants of the recycling plant (20Ml/d and 40Ml/d) are also considered.
  - Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d). The pipeline consists of two sections; a first section from Havant Thicket Reservoir to a mid-point for a potential offtake for Portsmouth Water and a second section from the mid-point to Otterbourne WSW.

As discussed in Section 3.2.1, the date for this option has been revised to provided benefit from 2034-35 instead of 2030-31.

- **Bulk import (HSE): PWC Source A to Otterbourne WSW (21Ml/d)** - This scheme is dependent on the development of Havant Thicket Reservoir. The delivery date of the reservoir has been revised from 2028-29 to 2030-31. This scheme will therefore be first available from 2031-32 instead of 2029-30. See Section 3.2.3 for details.
- **Recycling (IOW): Sandown (8.5Ml/d)** - We have revised the delivery date of Sandown recycling option from 2026-27 to 2029-30. This scheme will therefore first provide benefit from 2030-31 instead of 2027-28. This is due a number of additional activities that we now have to undertake and the associated risks. See Section 3.2.3 for details.
- **Recycling (SNZ): Littlehampton with direct river discharge (15Ml/d)** - The first year of benefit for this option has been revised from 2027-28 to 2030-31. See Section 3.3.3 for details.
- **Bulk import (SNZ): SES to SNZ (10Ml/d)** - Following discussions with SES Water, the earliest availability of this bulk import has been moved from 2030-31 to 2033-34 to allow sufficient time for infrastructure development.
- **Bulk import (SNZ): SEW RZ5 to Pulborough WSW (10Ml/d)** - Earliest delivery delayed from 2030-31 to 2035-36 to allow South East Water sufficient time to develop the resource required to support the supply.
- **Desalination (KME): Isle of Sheppey (up to 40Ml/d)** - Earliest delivery delayed from 2034-35 to 2037-38 to allow sufficient time for investigation and mitigation options.
- **Desalination (KTZ): East Thanet (up to 40Ml/d)** - Earliest delivery delayed from 2034-35 to 2037-38 to allow sufficient time for investigation and mitigation options.
- **Desalination (SWZ): Tidal River Arun (up to 40Ml/d)** - Earliest delivery delayed from 2033-34 to 2037-38 to allow additional time for investigation and mitigation options.
- **Recycling (HSE): Budds Farm and Peel Common WTWs to Otterbourne WSW via environmental buffer (75Ml/d)** - Earliest delivery delayed from 2030-31 to 2037-38 to allow additional time in case the preferred option cannot be progressed.
- **Recycling (HSE): Budds Farm WTW to Otterbourne WSW via environmental buffer (61Ml/d)** - Earliest delivery delayed from 2030-31 to 2037-38 in case the preferred option cannot be progressed.
- **Recycling (KMW): Tunbridge Wells WTW (3.6Ml/d)** - Earliest delivery delayed to 2032-33 from 2031-32 to allow sufficient time for investigation and mitigation options.
- **Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)** - Earliest delivery delayed from 2036-37 to 2039-40 to allow sufficient time for further investigations.

Changes to scheme costs

In addition to adjusting the cost base of all supply-side options, we have revised the costs for a number of our schemes. These are listed below.

- **Bulk import (HSE): PWC source A to Otterbourne WSW (21Ml/d)** - We have revised the cost downward following a review of line items included in the original cost estimate.
- **Bulk import (SNZ): Havant Thicket Reservoir to Pulborough WSW (capacities ranging from 20 to 100Ml/d)** - We have revised these costs downwards following further work on pipeline route and engineering scope.
- **Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d)** - We have revised the cost upwards following further work on pipeline route and engineering scope.
- **Desalination (KTZ): East Thanet (20Ml/d)** - We have revised the cost downwards following a review of engineering scope.
- **Desalination (SWZ): Tidal River Arun (20Ml/d)** - We have revised the cost upwards following a review of engineering scope.
- **Recycling (HSE): Budds Farm and Peel Common WTWs to Otterbourne WSW via environmental buffer (75Ml/d)** - We have revised the cost upwards following review of engineering scope.
- **Recycling (HSE): Budds Farm WTW to Otterbourne WSW via environmental buffer (61Ml/d)** - We have revised this cost upwards following review of engineering scope.
- **Recycling (HSE): Hampshire Water Transfer and Water Recycling Project (up to 60Ml/d)** - We have revised the cost upwards following updated design and engineering scope, including the pipeline route from Havant Thicket Reservoir to Otterbourne WSW.

As part of this exercise, we have included £96.8m[48] as AMP8 (2025-30) CAPEX for installation of a ceramics membrane filtration system at our Otterbourne WSW to enable treatment of water from the HWTWRP. This represents 50% of the total cost of the filtration system. We have a DWI commitment to provide the upgraded treatment system for the part of the WSW that currently treats surface water from the River Itchen by 2030. This accounts for half (45.5Ml/d) of the planned 91Ml/d treatment capacity at Otterbourne WSW. Groundwater treatment, which accounts for other half of the treatment capacity at the site, currently does not need this upgrade but it will be needed to treat water from the HWTWRP. Delivering the full 91Ml/d treatment upgrade in a single phase has significantly lower cost than delivering it in two phases. The funding request has therefore been split equally between our BP24 and WRMP24. As well as cost savings, delivering the upgrade in a single phase also lowers the risk of outages and possible disruption to customers and to our network of undertaking the works over a second phase.

- This CAPEX appears in water resources planning tables '5a Cost Profiles' and '5b. Cost profile' under option ID 'SWS_HSE_HI-ROC_WT1_ALL_cpy_ott_exis' and contributes to AMP8 CAPEX in table '8. Business Plan Links' against line B1 (Supply-side improvements).
- For the purpose of investment modelling the DO benefit of this option is set as zero to avoid double counting the DO benefit of HWTWRP. Consequently, it does not explicitly contribute to the supply-demand balance in HSE and is therefore not separately listed from HWTWRP in our preferred plan.

Changes to scheme phasing

The phasing of the water recycling plant associated with the HWTWRP has been changed to 20Ml/d, 40Ml/d and 60Ml/d from 15Ml/d, 30Ml/d, 45Ml/d and 60Ml/d as a result of the minimum flow requirements of 'Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d)' pipeline increasing to 20Ml/d.

Extension in the use of drought permits and orders in the Western area

The revised delivery dates for Havant Thicket Reservoir and the HWTWRP necessitate continued reliance on drought permits and orders in the Western area until the schemes are operational in 2034-35. The position in dWRMP24 was as follows:

- The Candover drought option was available up to 2028-29 under a 1-in-500 year drought scenario. For less severe droughts (1-in-100 year and 1-in-200 year severity), it was available up to 2026-27 under a 1-in-200 year drought.
- The Lower Itchen drought option was available up to 2026-27 under all drought conditions.
- The River Test drought option (which for supply-demand balance modelling purposes includes the River Test Drought Permit and River Test Drought Order) was available up to 2029-30 under 1-in-100 year and 1-in-200 year drought conditions. It had no time limit under the 1-in-500 year drought scenario but was not utilised after 2040-41 in line with our strategy to achieve 1-in-500 year drought resilience by 2041.

We retained these assumptions following the change in the delivery date for the HWTWRP. However, the modelling results showed that we cannot maintain supply-demand balance in the Western area in the event of a drought before 2034-35. This is in part due to the loss of 9Ml/d supply from Portsmouth Water that was available in dWRMP24.

The effect of the revised dates means that we will have to continue to rely on the use of Candover Drought Order and the River Test Drought Permit/Order in the event of a drought until 2033-34. This is the main element of our rdWRMP24 that we are now consulting upon. This reliance is longer than we previously planned for but we are significantly restricted by a lack of alternative options that can supply the amount of water required in the time available.

Without the continued use of drought options, we cannot achieve supply-demand balance in the Western area in drought scenarios. In every scenario and every adaptive pathway considered in the development of our plan, drought options are selected as the best value options overall. The changes in the use of drought permits and orders from the dWRMP24 are as follows:

- The Candover Drought Order is available up to 2033-34 under 1-in-100 year, 1-in-200 year and a 1-in-500 year drought scenario.
- The Lower Itchen Drought Order is available up to 2029-30 under 1-in-100 year, 1-in-200 year and a 1-in-500 year drought scenario.
- The River Test drought option is available up to 2033-34 under 1-in-100 year and 1-in-200 year drought conditions and up to 2040-41 under the 1-in-500 year drought scenario.

The continued reliance on these drought permits and orders is not ideal and presents an ongoing concern for our customers and stakeholders. The inclusion of drought options is however still aligned with current WRPG and continues to be a necessary interim measure while our longer-term infrastructure becomes operational. We have nevertheless been looking to minimise the level of reliance on these drought permits and orders in that interim period until HWTWRP is available. We have been in discussions with and undertaken workshops with the Environment Agency and Natural England to identify potential options that may reduce the level of reliance on drought options, even though the drought options are a core basis of our plan as they present better value overall. Section 8 and Annex 20 describe the further work we have undertaken in this regard since the publication of SoR to look for ways to reduce the potential frequency and duration of supply side drought permits and drought orders. They set out our intention to continue to explore alternatives to drought permits and drought orders throughout the next AMP.

The revision in the delivery dates of Havant Thicket Reservoir, the HWTWRP and Sandown recycling option also means that we have to delay the introduction of some of the abstraction reductions to meet our Environmental Destinations in some of the WRZs in our Western area.

The offsetting of any supply-demand deficits introduced by future, but as yet uncertain, licence changes through increased utilisation of drought permits and orders, particularly in sensitive catchments does not necessarily achieve environmental improvement or meet environmental targets. Drought permits and orders have environmental impacts of their own and their use effectively overrides the protections the Environmental Destination is seeking to resolve. We therefore do not consider it appropriate to introduce licence reductions in such situations that would result in more frequent or extended use of some drought permits and orders and therefore have delayed the implementation of uncertain sustainability reductions until alternative supplies are available. Regardless of whether we use these sources under abstraction licences or drought orders/permits, we have to rely on the sources until replacement sources are in place.

6.4 Rejected options

A full list of rejected options excluded from our plan is included in Annex 12.

[48] 2020-21 price base.

6.5 Best value objectives, criteria and metrics

The WRPG requires WRP24 to be a BVP i.e. a plan that aims to deliver wider benefits to society and the environment, by taking 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 inform our plan. 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.

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)

[49] WRSE, 2022. Developing our 'Best Value' multi-sector regional resilience plan. Our decision making framework.

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. 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:

- the generic scores assigned to the options were appropriate; and
- 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 our decision making to develop the overall BVP is described in Section 7.1.

6.5.1 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 plan.

We have aligned our WRMP24 with the regional planning approach, evaluating drought and non-drought resilience benefits with the methodologies employed by WRSE. This is also consistent with our approach to evaluating non-drought resilience benefits as part of the RAPID gated process for the SROs 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[50], 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
- terrorism/vandalism
- geotechnical instability

Meteorological hazards such as:

- flooding
- extreme weather - excessive cold, ice, snow, or heat
- fire resulting from excessive hot and dry weather

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[51] and the 4Rs recommended by the Cabinet Office[52] - resistance, reliability, redundancy and response/recovery.

Table 6.3 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.

[50] WRSE, 2021. Method Statement: Resilience Framework, September 2021.
[51] Ofwat, 2017. Resilience in the round: Building resilience for the future. ISBN 978-1-911588-11-5.
[52] Cabinet Office, 2011. Keeping the Country Running: Natural Hazards and Infrastructure. A guide to improving the resilience of critical infrastructure and essential services.

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 1 to 5, which is assigned to each option. This approach was agreed in a series of workshops with WRSE and neighbouring water companies.

Our approach to scoring drought and non-drought resilience benefits is consistent with the regional resilience framework. 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. 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

6.5.2 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 '4R'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 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 as an alternative or augmentation of the source water. 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 must be acceptable to our customers.
Imports and interzonal 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

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 (inc energy sector), 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	✓			✓	dWRMP24 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, which we discussed in Section 5.3.6. 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

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).

7. Our revised draft WRMP24

7.1 Decision-making process

Our adaptive planning approach (described in Section 5.5) sets out the supply-demand challenge across each of the 9 adaptive planning situations which reflect the range of uncertainty in future population growth, climate change and the amount of abstraction reduction required to protect and enhance the environment.

Our options appraisal (Section 6) sets out the potential range of feasible new water resources and water efficiency strategies we could employ to meet the projected future supply-demand deficits and the 'best value' planning metrics we will use to select our preferred strategy. 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 our selection of options to maintain supply-demand balance in the future, consistent with the regional planning approach, to derive our preferred plan. 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, our best value objective and our aim to minimise the level of reliance on drought permits and orders in the Western and Central areas.

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 balance 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, 1:100 DYAA, 1:500 DYAA and 1:500 DYCP). 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 projected supply-demand 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 9 adaptive pathways.

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

The IVM was 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 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-in-500 year (1:500) 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.

Sections 7.1.1 and 7.1.2 describe the process that has been followed for the development of the RBVP. The development of Southern Water's BVP (SBVP) is described in Section 7.1.3

7.1.1 Regional Least Cost (Cost Efficient) Plan methodology

To provide an initial baseline to the RBVP, a Regional Least-Cost Plan (RLCP) was developed 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 the best value metrics were not optimised on at this stage, the options used to develop the LCP still had 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). 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'.

7.1.2 Developing a preferred Regional Best Value Plan

The development of the RBVP involved the following steps.

1. **Develop RLCP:** IVM was used to develop the RLCP, optimising on cost only. No restrictions or constraints were imposed in order to develop a least-cost regional solution.
2. **Test sensitivity of the RLCP:** Additional IVM runs were carried out to see the changes in RLCP with various restrictions and constraints applied. This included testing sizes and timings of schemes, excluding some schemes, and testing the robustness of the demand management strategies and government interventions.
3. **Determine thresholds for the best value metrics:** Using the RLCP as the starting position, IVM was run to incrementally improve the best value metrics, to identify the threshold at which it was not possible to increase the best value metrics any further. This step resulted in a candidate RBVP.
4. **Testing the candidate RBVP:** The candidate RBVP was tested to see the changes in response to various restrictions and constraints applied. This included developing a Best Value Resilience Plan (BVRP) and the Best Value Environmental and Social Plan (BESP), based on the BVP threshold identified in the previous set of runs.
5. **Finalising RBVP:** Selection of the RBVP was based on the outcome of the BVP threshold runs and BVP sensitivity runs. Final RBVP was selected using the IVM runs as decision-support tool in overall programme appraisal. Programme appraisal was based on evidence from IVM runs.
6. **Deriving company BVP:** Once the RBVP is finalised, company specific BVP is a subset of the RBVP.

The process for establishing the maximum thresholds for best value metrics is shown in Figure 7.1. Once a stable RLCP had been determined, it provided the lower thresholds for each of the best value metrics. The best value metrics considered for this purpose are shown in Figure 7.2

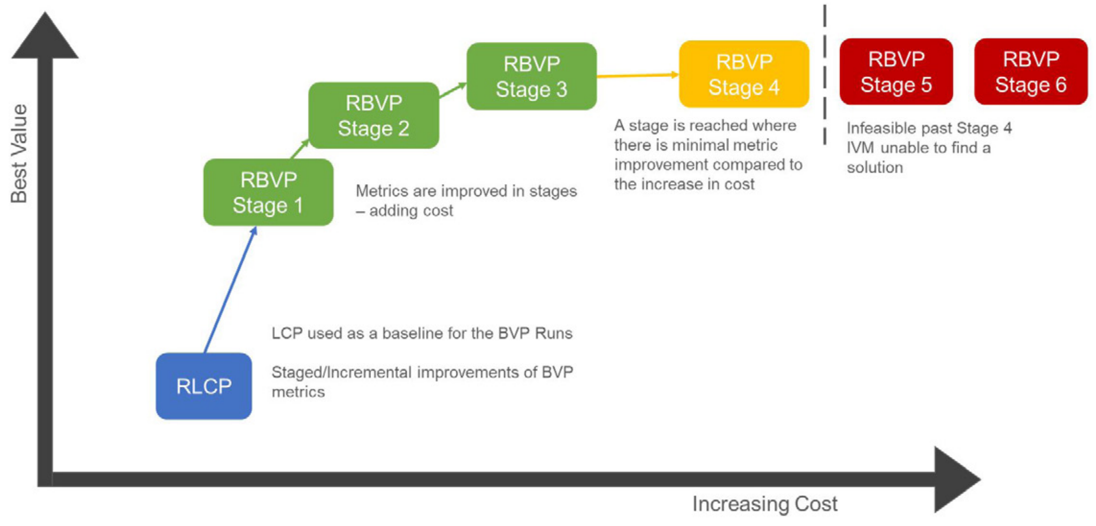


Figure 7.1: The process followed to develop RBVP for the WRSE region

In the example shown above, RBVP Stage 4 has a slightly higher average RBVP score compared to RBVP Stage 3, but also has a much higher cost. This is due to the IVM developing schemes for their best value metrics but not necessarily utilising the schemes as part of the volumetric solution to the plan. A programme appraisal was carried out at this stage to determine if the additional improvement in best value metrics is justified by the extra cost.

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)				

Figure 7.2: The best value metrics used to develop the RBVP and the approach taken to improve the score for each

The highest score for each best value 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 7.3 which shows that, for example, it may be possible to increase the scores for some of the best value metrics to their maximum value but for others, the model may not be able to improve the score beyond the RLCP derived value.

	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)					

Figure 7.3: An illustration of the possible outcomes when attempting to improve scores for individual metrics.

The IVM provides best value metrics score for each supply-demand balance situation under each planning scenario. When looking at the overall performance of a plan, the best value metric scores that each of the schemes provided were aggregated. The scores were 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 best value metric and compares it with the raw scores for that metric for each of the 9 situations in the adaptive plan. The best performing score receives the highest best value score of 100% whilst the worse performing score would receive 0%. This process is repeated for all 8 best value metrics and for all 9 supply-demand balance situations in an adaptive plan.

Programme level scores were generated by averaging across the situations for a particular programme. Therefore, at the end of this process there is one best value score per programme. This process helps identify the adaptive plans that generally perform better than others.

However, the performance of each of the plans is broken down against specific best value metrics for a detailed analysis as shown below.

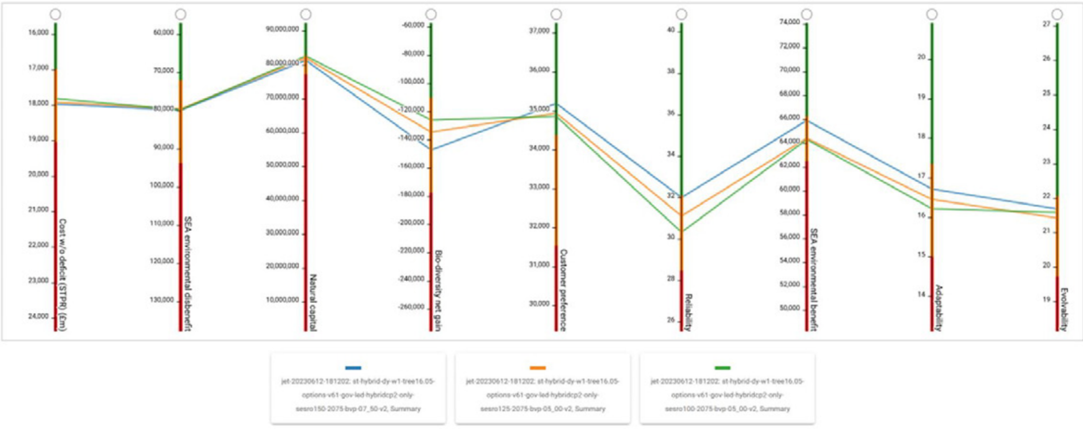


Figure 7.4: An illustration of the direct comparison between individual plans against each of the best value metrics

Once a RLCP had been finalised, WRSE tested its performance against as number of constraints through a series of 'what if' analyses. These include, but are not limited to:

- **Demand management**
  - The impact of companies achieving low demand reduction
  - The impact of only implementing government-led water efficiency scenario H (water labelling only)
  - The impact of government-led scenario H and no West Berkshire Groundwater Management Scheme (WBGWMS)
  - The impact of government-led scenario H along with Grand Union Canal SRO limited to 100Ml/d capacity (GUC100) and SESRO limited to 100Mm³ capacity (SESRO100)
  - As above but with WBGWMS excluded from 2060
- **Demand management and SESRO**
  - The impact of government-led scenario H and no SESRO
  - The impact of government-led scenario H and SESRO delayed by 5 years
  - The impact of government-led scenario H and SESRO available in 75Mm³ capacity only (SESRO75)
  - The impact of government-led scenario H and SESRO available in 100Mm³ capacity only (SESRO100)
  - The impact of government-led scenario H and SESRO available in 125Mm³ capacity only (SESRO125)
  - The impact of government-led scenario H and SESRO available in 150Mm³ capacity only (SESRO150)
- **Timing of Southern Water scheme delivery (Littlehampton and Budds Farm recycling options and Havant Thicket Reservoir)**
  - The impact of no changes to delivery dates from dWRMP24
  - The impact of revision to delivery dates for Littlehampton recycling option and the HWTWRP revised but no extension in use of drought permits and orders in Hampshire beyond 2029-30
  - The impact of revision to delivery dates for Littlehampton recycling option and the HWTWRP revised with extended use in the use of drought permits and orders in Hampshire beyond 2029-30
- **Bulk transfers to Affinity Water**
  - The impact of Thames to Affinity Transfer (T2AT) being limited to 50Ml/d only
  - The impact of 50Ml/d transfer to Affinity Water through the Grand Union Canal (GUC50)
  - The impact of 100Ml/d transfer to Affinity Water through the Grand Union Canal (GUC100)
- **Impact of SESRO variations**
  - No SESRO
  - SESRO delayed by 5 years
  - SESRO75 only
  - SESRO100 only
  - SESRO125 only
  - SESRO150 only
- **Impact of Severn Trent to Thames transfer (STT)**
  - No SESRO and no STT supported by transfer of recycled water from Minworth WTW
  - STT forced in through a pipeline at 300Ml/d from 2050
  - STT forced in through a pipeline at 400Ml/d from 2050
  - STT forced in through a pipeline at 500Ml/d from 2050
- **Impact of Teddington Direct River Abstraction (DRA) scheme**
  - No Teddington DRA
  - No Teddington DRA and low demand reduction in Thames Water supply area
  - No Teddington DRA and delay in the development of groundwater options in the Thames Water area
- **Impact of West Berkshire Groundwater Management Scheme (WBGWMS)**
  - No WBGWMS from 2060
  - No WBGWMS from 2050
- **Impact of Beckton desalination and water recycling options**
  - No Beckton desalination option
  - 50Ml/d Beckton recycling option forced in from 2033
  - 100Ml/d Beckton recycling option forced in from 2033

The work identified SESRO as one of the key components of the Regional Plan. It is possible to achieve supply-demand balance without SESRO but the inclusion of SESRO increases resilience and provides better overall value compared to the model runs without SESRO.

There are trade-offs between different capacity variants of SESRO. The larger SESRO150 performs better than the lower capacity variants in SEA benefit metric, whereas the smaller SESRO75 performs against BNG and natural capital metrics compared to the larger capacity variants. However, the differences are still small (Table 7.1).

Table 7.1: Values of environmental metrics for the Regional Best Value plan based on different capacities of SESRO

Best Value Metric	SESRO75	SESRO100	SESRO125	SESRO150
SEA benefit score)	46	46	46	50
SEA disbenefit scoring	-52	-52	-52	-52
BNG units	2,282	2,052	1,785	1,603
Natural capital (£/year)	1,662,030	1,629,920	1,576,010	1,533,830

WRSE initially developed three candidate RBVPs with SESRO100, SESRO125 and SESRO150 combined with GUC100. The three plans were further tested against known risks:

- Government-led water efficiency scenarios do not deliver the savings as assumed
- Companies' demand management activities result in lower than expected savings
- Loss of WBGWMS (60Ml/d) by 2060
- Loss of Lower Thames flood alleviation schemes; potential loss of 150Ml/d immediately and a further 89Ml/d post 2030
- Teddington DRA, STT supported by Minworth WTW, HWTWRP, STT and Beckton desalination cannot be delivered

The analysis did not provide a clear choice between the three candidate RBVPs. After further discussion between WRSE companies and looking at the pros and cons of each candidate RBVP, the agreed RBVP includes SESRO150 and GUC100. This is based on the following:

- While the differences in best value metrics may be small, the RBVP with SESRO150 provides better average best value metrics scores.
- RBVP with SESRO150 is more resilient to known potential risks outlined above.
- SESRO150 is better able to support earlier implementation of reductions in abstraction to protect and improve the environment than the smaller capacity variants.
- SESRO150 provides greater operational flexibility in cases of both planned and unplanned outage events.
- SESRO150 is better able to cope with the scenario whereby government-led interventions and/or water company initiatives do not provide the expected savings.
- If the identified risks do not materialise, SESRO150 may reduce the need for demand-side drought interventions (i.e. TUBs and NEUBs) and may facilitate earlier implementation of Environmental Destination in some catchments.

7.1.3 Development of Southern Water's Best Value Plan

Following the agreement with the WRSE, Southern Water's LCP (SLCP) was developed by fixing the solution from other water company areas so as to not alter other companies' plans that had been consulted upon and required no material changes. Re-optimisation of option selection was only done in the areas that were impacted by changes to Southern Water's options i.e. Southern Water's Western and Central areas and Portsmouth Water's supply area.

The procedure outlined in Section 7.1.2 produced a rdRBVP with 7.5% improvement on the worst performing best value metrics in the RLCP. Taking SLCP as the starting point, the IVM failed to produce a SBVP that matched the RBVP best value metrics scores. This was primarily because the delay in delivery of Havant Thicket Reservoir created a gap in BNG score that could not be matched by other schemes. In order to develop a SBVP that was aligned to the RBVP, a hybrid approach was thus adopted whereby a least-cost solution in the Central, Western and Portsmouth Water supply areas was allowed while fixing the best value solution from the RBVP in other areas.

As mentioned in Section 6.3.4 and described in Annex 20, we undertook a targeted reappraisal of options in order to identify options that could be developed by 2030-31 to reduce reliance on drought permits and orders in the Western and Central areas. This was in response to the feedback from the Environment Agency on our dWRMP24 and subsequent discussions with both the Environment Agency and Natural England. This reappraisal resulted in two groundwater options in Hampshire (groundwater sources at Kings Sombourne (HRZ) and Chilbolton (HAZ)) and bulk import of water from Norway via sea tankers included as constrained feasible options. We also decided to bring forward groundwater options in Romsey (HRZ), Petworth (SNZ), Eastern Yar3 (IOW) and Newchurch (IOW). All of these options were pre-selected to deliver benefit from 2030-31 i.e. the IVM was not given free choice to select them if and when needed.

The pre-selection of these options from 2030-31 was necessary as the IVM would otherwise not select these options as long as Candover and River Test drought options are available in Hampshire. This is because drought options are considered as temporary, low cost solutions with limited or no additional CAPEX compared to developing new schemes. Even when options such as water recycling are available, the IVM prioritises the utilisation of drought permits and orders over such types of options due to their high operational costs. We are working with WRSE to improve the IVM so that it would maximise the utilisation of non-drought options, regardless of the costs, before selecting drought options. We hope to have this in place for WRMP29.

After reviewing the results, we decided to remove groundwater options at Chilbolton (HAZ), Eastern Yar3 (IOW) and Newchurch (IOW) as accelerated options. This was done as:

- The groundwater option at Chilbolton (HAZ) only provides a small benefit (0.5Ml/d) but even this benefit is confined to HAZ. In the absence of an option to transfer water from HAZ to HSW or HSE, pre-selecting this option only creates additional surplus in HAZ without reducing the volume required from either the Candover Drought Order or the River Test Drought Permit/Order.
- The groundwater option at Eastern Yar3 has zero DO under drought conditions. Accelerated delivery of this option therefore provides no additional benefit under drought conditions.
- Pre-selection of the Newchurch groundwater option (IOW) simply reduces the utilisation of Sandown recycling option. As water cannot currently be moved from the IOW to the mainland, maximising the utilisation of both the Newchurch groundwater option and the Sandown recycling option creates additional headroom on the IOW but does not reduce reliance on the Hampshire drought options.

Consequently, only the groundwater options in Romsey and Kings Sombourne are pre-selected as the surplus water provided by these options can be transferred to HSW by increasing the capacity of the existing Romsey Town and Broadlands valve by an additional 5Ml/d, thereby reducing the volume required for the River Test Drought Permit/Order in the event of a drought. Increasing the capacity of Romsey Town and Broadlands valve was already included as a constrained feasible option through our original options appraisal process. Groundwater options at Chilbolton, Eastern Yar3 and Newchurch are retained as constrained feasible options for the IVM to select as and when needed.

In order to maximise the utilisation of sea tankering and other accelerated options in Hampshire, we reduced the volume available from the River Test drought option from 80Ml/d to 14Ml/d during droughts of up to 1-in-200 year severity. This was done through an iterative process whereby the DO available from the River Test drought option in a 1-in-200 year drought was progressively reduced. 14Ml/d is the minimum DO needed from the River Test drought option to meet supply-demand balance in the event of a 1-in-200 year drought between 2030-31 and 2033-34. The Lower Itchen drought option was made unavailable to the IVM after 2029-30. Candover drought option is made unavailable under any drought conditions post 2033-34 and the River Test drought option is only available in droughts more severe than 1-in-200 year severity post 2033-34.

In the Central area, we initially ran the IVM by retaining the bulk import from SES Water at its current 1.3Ml/d volume and excluding the Petersfield and West Chiltington groundwater options. The IVM was able to achieve supply-demand balance under these conditions. However, testing the plan by reducing DO benefit from the Littlehampton recycling option to 12.5Ml/d from 15Ml/d and/or delays or non-delivery of other groundwater options in the Central area, such as Lewes Road and Petworth, led to unresolved supply-demand balance deficits. Increasing the bulk import from SES Water to 4Ml/d via rezoning and delivery of Petersfield and West Chiltington groundwater options makes our plan for the Central area more resilient. These options were therefore pre-selected with the expansion in rezoning from SES Water from 2025-26 (consistent with SES Water's WRMP24) and Petersfield and West Chiltington groundwater options available from 2028-29.

In order to maximise the utilisation of existing sources as well as new options developed in the Central area in the 2025-30 period, the Pulborough surface water drought option in SNZ was made unavailable to the IVM from 2030-31 in droughts of up to 1-in-200 year severity.

Following the policy adopted by WRSE, no supply-side drought option is available post 2040-41 for droughts up to 1-in-500 year severity.

Our best value plan (i.e. SBVP) is therefore based on analysing initial outputs from the IVM and subsequent manual intervention in some case in order to produce a plan that minimises our reliance on supply-side drought permits and options in Western and Central areas post 2029-30 in droughts of up to 1-in-200 year droughts. The rdBVP has been updated to fully incorporate Southern Water's rdWRMP24.

Complete results for SLCP and SBVP are included in Annex 15. Table 7.2 shows a comparison of key metrics between the SLCP and SBVP. These numbers are specific to Southern Water's plan. Table 7.3 provides a comparison of best value metrics between the two plans. In this case, however, the values are calculated at a regional level. The water resources planning tables accompanying this plan have been populated using the outputs for supply-demand balance Situation 4.

Table 7.2: A comparison of cost and carbon emissions between the SLCP and SBVP. Figures are provided as average across all 9 supply-demand balance situations as well as separately for Situation 4

Metric	Average across all supply-demand balance situations	Supply-demand balance Situation 4		
	SLCP	SBVP	SLCP	SBVP
Capex (£m)	2,224	2,229	2,726	2,726
Fixed Opex (£m)	2,879	2,880	2,950	2,947
Variable Opex (£m)	396	395	617	615
Capital emissions (tonnes)	913,065	915,500	1,129,629	915,500
Operational emissions (tonnes)	2,854,355	2,853,583	2,958,019	2,853,583

Table 7.3: A comparison of best value metrics between the SLCP and SBVP. Figures are provided as average across all 9 supply-demand balance situations as well as separately for Situation 4

Metric	Average across all supply-demand balance situations		Supply-demand balance Situation 4	
	SLCP	SBVP	SLCP	SBVP
SEA environmental benefit	64,030	65,552	67,320	67,726
SEA environmental disbenefit	83,202	80,752	101,155	98,089
Natural capital	79,162,557	80,844,026	74,638,485	80,433,763
Bio-diversity net gain	-135,334	-140,600	-199,940	-195,817
Customer preference	31,926	34,182	33237	35,560
Reliability	31.44	32.86	28.92	29.74
Adaptability	16.79	17.12	14.54	14.72
Evolvability	21.69	22.17	19.07	19.86

In terms of scheme selection, the key differences between the SLCP and SBVP are (see Annex 15 for details):

- **Bulk export (HWZ): Winchester to Kennet Valley** is first selected in 2041-42 in SLCP. In SBVP is it not selected until 2049-50.
- **Groundwater (HAZ): Recommission Chilbolton (0.5Ml/d)** is first selected in 2067-68 in SLCP compared to 2072-73 in SBVP.
- **Recycling (SHZ): Tunbridge Wells with Bewl (3.6Ml/d)** is only selected in SLCP from 2035-36.
- **Recycling (SNZ): Horsham with storage at Pulborough (11.5Ml/d)** is first selected in SLCP in 2049-50. In SBVP, it is first selected in 2057-58.
- **Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d)** is first selected in SLCP in 2054-55. In SBVP, it is not selected until 2060-61.
- **Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)** is first selected in SLCP in 2041-42 compared to 2045-46 in SBVP.
- **Interzonal transfer (HAZ-HKZ): Andover to Kingsclere bi-directional (10Ml/d)** is selected in SBVP from 2049-50. This option is no selected in SLCP.
- **Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d)** is selected in SBVP from 2035-36. It is not selected in SLCP.

7.2 Our preferred Best Value Plan

In developing SBVP, we have used the twin-track approach of reducing demand while developing new water resources to maintain supply-demand balance.

7.2.1 Our demand management strategy

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 case for this plan. Demand management delivers significant benefits in all our supply areas. Overall, we plan to save around 141 M/d from demand management by 2050 under DYAA conditions (Figure 7.5).

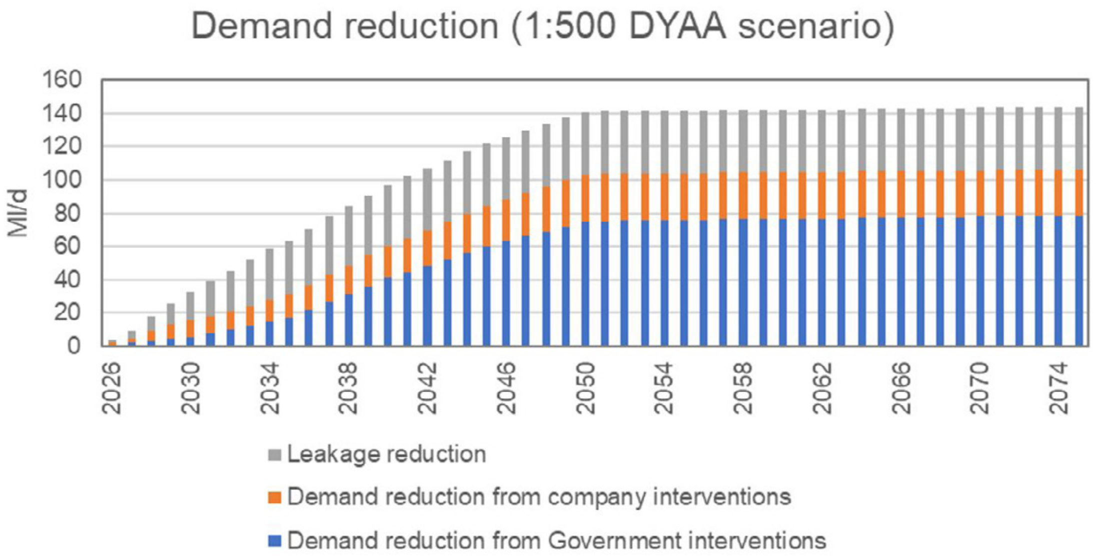


Figure 7.5: Savings from demand management under the 1:500 DYAA scenario

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 2010-15 following the introduction of universal metering for our household customers. This took our domestic meter penetration to ca. 88%.

The EIP sets a PCC target of 110l/h/d, which WRPG further clarifies as a target under DYAA conditions. The EIP also requires 9% reduction in non-household consumption by 2038 and 50% reduction in leakage by 2050. We are aiming to achieve all these targets.

We are targeting a DYAA PCC of 110l/h/d by 2045, 5 years ahead of the EIP target. In our case, a DYAA PCC of 110l//h under DYAA conditions equates to a NYAA PCC of 100l/h/d. Our Target 100 initiative sought to achieve NYAA PCC of 100l/h/d by 2039-40. Our new PCC target is consistent with our Target 100 ambition but achieves it 5 years later. This is largely due to significant increase in PCC during the COVID-19 lockdown. The PCC has come down since the lifting of COVID-19 restrictions but remains higher than pre COVID-19 levels. We are forecasting the 2024-25 PCC to be slightly higher than it was in 2019-20. This has resulted in a shifting of our PCC reduction profile.

We are aiming for 9% reduction in non-household consumption by 2038. We have allowed non-household demand to increase thereafter in response to growth. In the case of household demand, we would initially expect it to decrease as we reduce PCC. However, once the target PCC has been achieved, and held constant, total household demand would increase as a result of growth. We are still forecasting our non-household consumption in 2074-75 to lower than our reported 2019-20 figure.

We will be implementing a number of initiatives to promote water efficiency. These include installing smart meters, introducing innovative tariffs, practical water efficiency advice during home visits, raising water efficiency awareness etc. The planned reductions in household and non-household consumption and leakage associated with different initiatives are shown in Figure 7.6, Figure 7.7 and Figure 7.8 respectively. Annex 14 describes the initiatives we plan to implement in order to reduce demand.

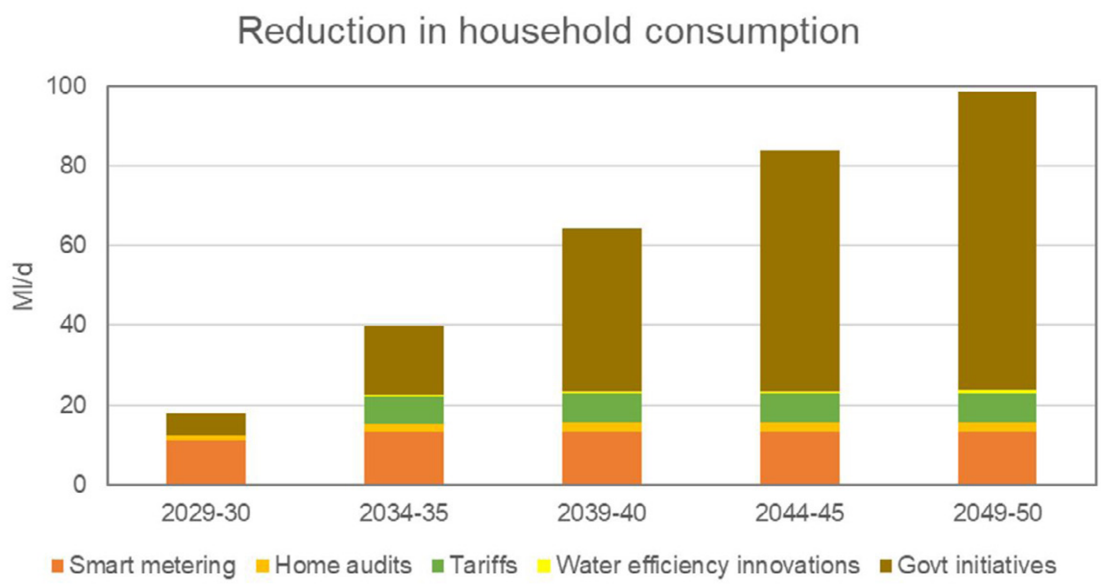


Figure 7.6: Reduction in household consumption linked to different water efficiency initiatives (DYAA scenario)

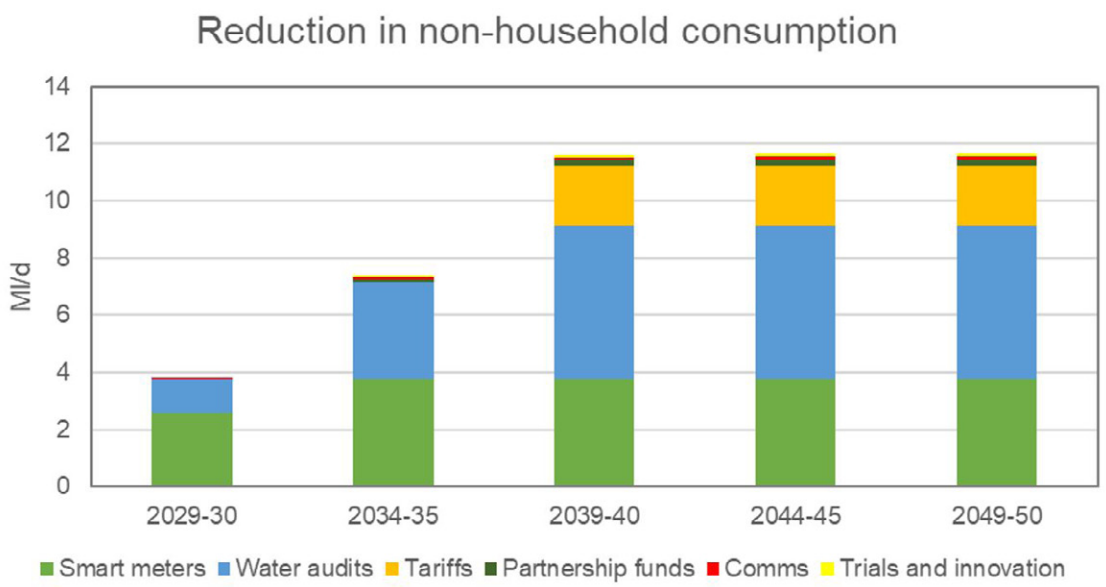


Figure 7.7: Reduction in non-household consumption linked to different water efficiency initiatives

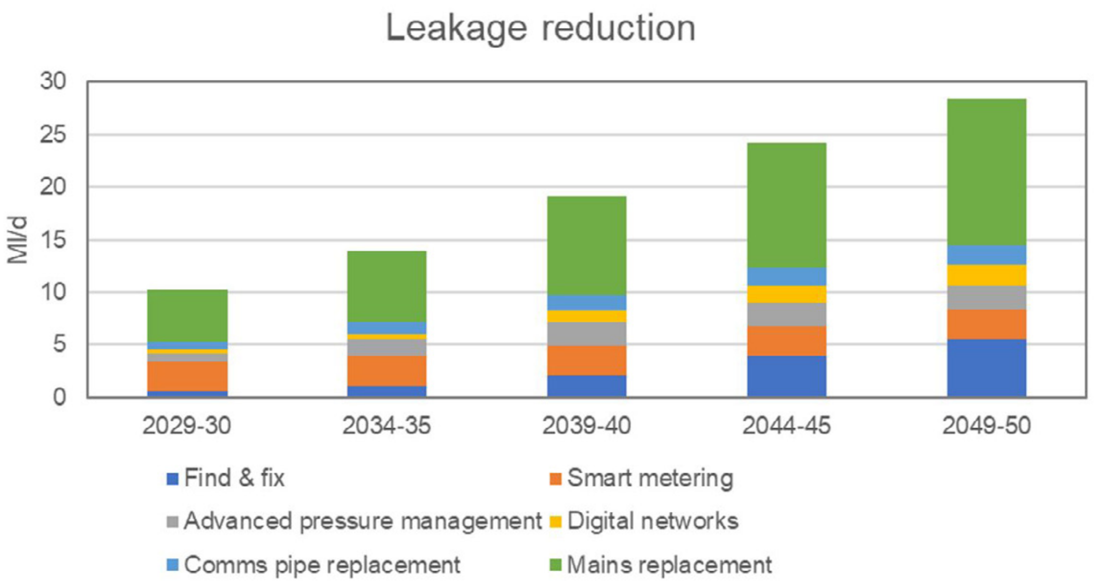


Figure 7.8: Reduction in leakage linked to different measures

7.2.2 Our proposed strategy in the Western area

The key driver for our strategy in the Western area is the need to eliminate reliance on the drought options in Hampshire. This remains unchanged from WRMP19. The drought options are as follows:

- Drought option - supply side (HSE): Lower Itchen groundwater and surface water (61.5Ml/d) (the 'Lower Itchen Drought Order')
- Drought option - supply side (HSE): Candover (22Ml/d) (Candover Drought Order' hereafter)
- Drought option - supply side (HSW): River Test (80Ml/d) (the 'River Test Drought Permit/Order')

As mentioned above, the effect of the revised dates means that we will have to continue to rely on the use of drought permits and orders in Hampshire in the early years of our plan until these schemes are fully operational. This is the basis of rdWRMP24 that we are now consulting upon. This reliance is longer than we previously expected but we are significantly restricted by a lack of alternative options that can provide the required volume in the time available i.e. from 2030-31.

The process agreed by the Environment Agency and Southern Water by which the company will apply for the use of these drought options for drought supply deficit in Hampshire is set out in the agreement we signed with the Environment Agency under Section 20 of the Water Resources Act 1991. The agreement was signed in 2018 and is due to expire in 2030. We will therefore need to discuss any implications of our extended timelines with regard to the Section 20 Agreement with our regulators.

Without the continued use of drought options, we cannot achieve our projected supply-demand balance in the Western area in drought scenarios. The changes in the use of drought permits and orders from the dWRMP24 are as follows:

- In dWRMP24, the Lower Itchen Drought Order was available up to 2026-27 under all drought conditions. This was in-line with our initial aim of reducing reliance on this option, ideally by 2026-27, as we were preparing our WRMP19. However, this was always dependent on a longer-term solution being in place. For rdWRMP24, its use needs to be extended to 2029-30 under all drought conditions. After 2029-30 i.e. by the time of expiry of our current Section 20 Agreement in March 2030, the use of the Lower Itchen Drought Order will cease. It should be noted that although our Western area resilience relied on this option in WRMP19, we have to date not needed to apply for a Lower Itchen Drought Order.
- In dWRMP24, the Candover Drought Order was available up to 2026-27 under 1-in-200 year drought conditions and up to 2028-29 under 1-in-500 year drought conditions. For rdWRMP24, this option needs to be available until 2033-34. As is the case with the Lower Itchen Drought Order, we have not needed to apply for the Candover Drought Order.
- In dWRMP24, the Test Drought Permit/Order was available up to 2029-30 under 1-in-200 year drought conditions and up to 2040-41 under 1-in-500 drought conditions. We aim to achieve resilience to droughts of up to 1-in-500 year severity by 2040-41. For our rdWRMP24, this option needs to be available until 2033-34 under 1-in-200 year drought conditions. It is also used under 1-in-500 drought conditions until 2040-41 after which our plan requires no further use of supply-side drought permits and orders.

In summary, due to the announced delays to the delivery of Havant Thicket Reservoir to 2030-31 and HWTWRP to 2033-34, we will have to continue to rely on the use of the Lower Itchen drought option until 2029-30 and on the Candover and the River Test drought options until 2033-34 during severe droughts. Our current estimate is that we will need to apply for Candover and River Test drought options once in the period 2030-31 to 2033-34.

As discussed in Annex 20, we have explored a number of resilience options to mitigate the impact of delays to Havant Thicket Reservoir and HWTWRP in order to offset some of the volume required from these drought permits/orders. This has included accelerated delivery of a groundwater scheme selected in dWRMP24 (Groundwater (HRZ): Romsey (4.8Ml/d)) and introduction of another groundwater scheme (Groundwater (HRZ): Remove constraints at Kings Sombourne (2.5Ml/d)) in HRZ. These two schemes will provide 7.3Ml/d from 2030-31. However, this is small compared to the volume (over 100Ml/d) that would be available from the Candover Drought Order and the River Test Drought Permit/Order.

It should be noted though that accelerated delivery of groundwater schemes and bulk import from Norway via sea tankers does not remove the need for the Candover and River Test drought options. They reduce the volume required from the River Test Drought Permit/Order to 14Ml/d from the maximum 80Ml/d. The Candover Drought Order will be needed at its full volume, with or without these options, under severe drought conditions.

Table 7.4 shows supply-side schemes that have been selected to meet supply-demand balance in the Western area under 1:500 DYAA conditions. Demand management initiatives and drought options are not included. Supply-side options that are not selected under 1:500 DYAA conditions are also not included. The full set of options selected under all planning scenarios in included in Annex 15.

Table 7.4: Supply-side schemes needed in the Western area and their earliest selection year in all supply-demand balance situations under 1:500 DYAA planning scenario

Option	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
Bulk export (HSE): Otterbourne WSW to PWC Source A (45Ml/d)	2040	2040		2040	2040		2042	2063	
Bulk export (HSW): Existing supply to large industrial user (10Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk export (HWZ): Winchester to Kennet Valley	2050			2050			2050		
Bulk import (HAZ): T2ST to Andover (20Ml/d)	2048			2065					
Bulk import (HKZ): T2ST to HKZ (5Ml/d)				2049					
Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d)	2035	2035	2035	2035	2035	2035	2035	2035	2035
Bulk import (HSE): PWC Source A to Eastleigh WSR (30Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk import (HSE): PWC Source A to Otterbourne WSW (21Ml/d)	2032	2032	2032	2032	2032	2032	2032	2032	2032
Bulk import (HWZ): T2ST to Yew Hill (95Ml/d)	2040	2040	2040	2040	2040	2040	2040	2040	2040
Groundwater (HAZ): Recommission Chilbolton (0.5Ml/d)							2073		
Groundwater (HKZ): Remove constraints at Newbury to increase yield (1.2Ml/d)	2028	2028	2028	2028	2028	2028	2028	2028	2028
Groundwater (HRZ): New boreholes at Romsey (4.8Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Groundwater (HRZ): Remove constraints at Kings Sombourne (2.5Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Groundwater (HSW): Test MAR (5.5Ml/d)	2042	2042	2042	2042	2042	2042	2048		
Groundwater (IOW): New boreholes at Newchurch (LGS) (1.9Ml/d)	2037	2037	2037	2037	2037	2037	2037	2037	2037
Interzonal transfer (HAZ-HKZ): Andover to Kingsclere bi-directional (10Ml/d)				2050			2074		

Table 7.4: Supply-side schemes needed in the Western area and their earliest selection year in all supply-demand balance situations under 1:500 DYAA planning scenario

Option	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
Interzonal transfer (HSE-HRZ): Abbotswood - existing (1.1Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (HSE-HWZ): Otterbourne WSW to Yew Hill WSW bi-directional (74Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Interzonal transfer (HSW-HRZ): Romsey Town and Broadlands valve (3.1Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (HSW-HRZ): Romsey Town and Broadlands valve expansion (5Ml/d)	2042	2042	2042	2042	2042	2042	2042	2042	2042
Interzonal transfer (HSW-HSE): Existing transfer (24Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (HSW-IOW): Cross-Solent main existing (18Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (HWZ-HAZ): Winchester to Andover bi-directional (15Ml/d)	2040	2040	2040	2040	2040	2040	2040	2040	2040
Interzonal transfer (HWZ-HSE): Existing transfer (7.5Ml/d)	2035	2035	2035	2036	2036	2036	2036	2036	2036
Interzonal transfer (HSE-HSW): Yew Hill WSW to River Test WSW bi-directional (60Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Recycling (HSE): Recharge of Havant Thicket from recycled water from Budds Farm (60Ml/d)	2035	2035	2035	2035	2035	2035	2035	2035	2035
Recycling (IOW): Sandown (8.5Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031

Demand management

As part of our demand management activities, we are looking to save ca. 49.0Ml/d in the Western area by 2050. Of this, ca. 39.2Ml/d will come from reduction in consumption by households and non-households and ca. 9.9Ml/d will come from reduction in leakage (Figure 7.9). WRSE has not considered separate demand profiles under the 1:100 DYAA and 1:500 DYAA scenarios, therefore there is a single profile of demand savings under both 1:100 DYAA and 1:500 DYAA scenarios.

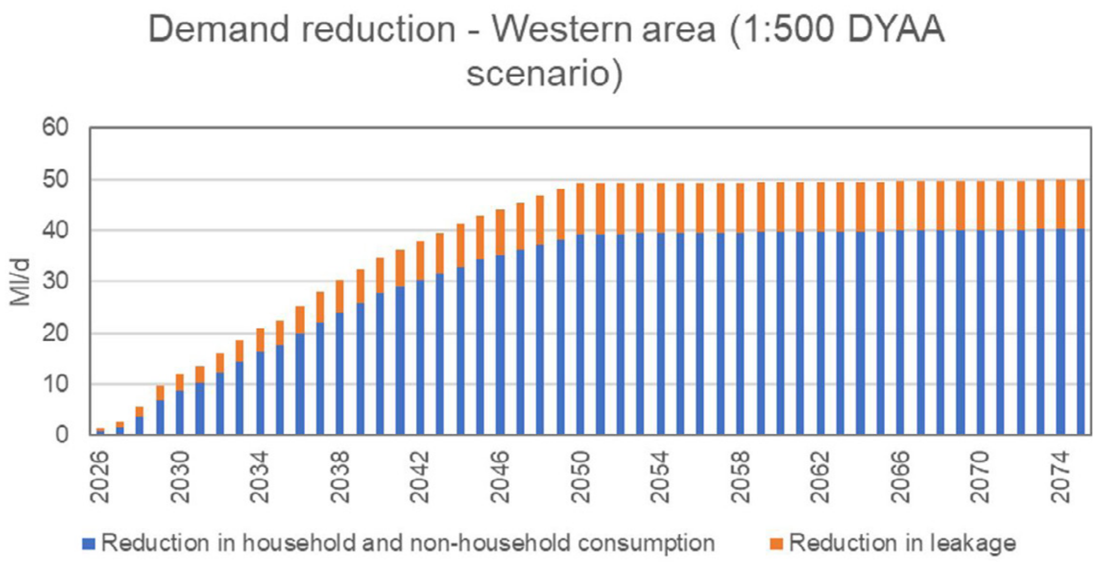


Figure 7.9: Reduction in total demand in the Western area

New supply options in the Western area up to 2050

In addition to demand management, our proposed solution for the Western area consists of a number of options to increase supply. Annex 15 provides their earliest selection in each supply-demand balance situation under each planning scenario and their utilisation under each of these over the planning period.

Drought option - supply side (HSW): Sea tankering from Norway (45Ml/d) - This option involves transfer of glacial meltwater used for hydro-electric generation in Norway via sea tankers to Southampton port. It will then be transferred to a storage lake near Test WSW via temporary pipeline. The water will be treated at River Test WSW before being put into supply. This option has been developed for rdWRMP24 (see Annex 20) and pre-selected in rdWRMP24 to provide benefit in case of severe droughts between 2030-31 and 2033-34. Details including complete utilisation profiles are given in Annex 15. This option will not be needed once HWTWRP is delivered.

Groundwater (HKZ): Remove constraints at Newbury to increase yield (1.2Ml/d) - This is part of WRMP19 deliverables. It involves increasing the yield from the existing Newbury source, within the existing licence, by removing the constraint imposed by the size of the mains leaving the site along with the associated infrastructure enhancements. It is selected to provide benefit from 2027-28 in all supply-demand balance situations under all planning scenarios. Details including complete utilisation profiles are given in Annex 15.

Groundwater (HRZ): New boreholes at Romsey (4.8Ml/d) - The existing boreholes at Romsey WSW are either out of service or operating below their full capacity due to water quality issues. This option proposes three new boreholes to increase DO from the site. Replacement boreholes are to be drilled distant from the existing boreholes and will require new pipeline to connect to the WSW. In dWRMP24, this option was first selected in 2035-36.

For rdWRMP24, it has been pre-selected to provide benefit from 2030-31 in order to reduce the volume required from the River Test Drought Permit/Order in the event of a 1-in-200 year drought. Details including complete utilisation profiles are given in Annex 15.

Groundwater (HRZ): Remove constraints at Kings Sombourne (2.5Ml/d) - This option involves recovering DO through the development of a new borehole and pump capacity to increase the yield from the current 1.5Ml/d to the licenced capacity of 4Ml/d providing a net benefit of 2.5Ml/d. This is a new option introduced for rdWRMP24 (see Annex 20) and is pre-selected to provide benefit from 2030-31. Details including complete utilisation profiles are given in Annex 15.

Recycling (IOW): Sandown WTW (8.5Ml/d): This is a WRMP19 deliverable that is due to provide benefit from 2030-31. It involves the treatment of effluent from Sandown WTW, which currently discharges to the sea. The effluent will be further treated and transferred to the Eastern Yar upstream of the Sandown WSW abstraction. Sandown WSW will use the treated water for the local demand and any excess will be transferred to a WSR near Newport to support the north side of the IOW. The dWRMP24 had its maximum capacity at 8.1Ml/d. This has now been revised to 8.5Ml/d. It is selected in all situations under all planning scenarios from 2030-31. It is fully utilised under all planning scenarios in situations 1, 4 and 7 from 2041-42. This coincides with cessation of all supply-side drought permits and orders by 2040-41. In other situations, its utilisation varies with the planning scenario from a minimum of 1.6Ml/d to a maximum of 8.5Ml/d (see Table 7.5 and Table 7.6). Complete utilisation profiles from Annex 15 are reproduced in Figure 7.10.

Table 7.5: Earliest selection of Recycling (IOW): Sandown WTW (8.5Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:100 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYCP	2031	2031	2031	2031	2031	2031	2031	2031	2031

Table 7.6: Maximum utilisation (in Ml/d) of Recycling (IOW): Sandown WTW (8.5Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	8.5	6.8	1.6	8.5	6.3	1.6	8.5	1.6	1.6
1:100 DYAA	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.4
1:500 DYAA	8.5	8.5	1.6	8.5	8.5	1.6	8.5	8.5	1.6
1:500 DYCP	8.5	1.6	1.6	8.5	1.6	1.6	8.5	1.6	1.6

Bulk import (HSE): PWC Source A to Otterbourne WSW (21Ml/d) - This bulk import, through a new pipeline, becomes available to Southern Water once Havant Thicket Reservoir is built. It is consistently selected across situations from 2031-32 under all planning scenarios, and with the exception of NYAA scenario, used at its maximum 21Ml/d capacity throughout (Table 7.5 and Table 7.8). Detailed utilisation profiles from Annex 15 are reproduced in Figure 7.11.

Table 7.7: Earliest selection of Bulk import (HSE): PWC Source A to Otterbourne WSW (21Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2032	2032	2032	2032	2032	2032	2032	2032	2032
1:100 DYAA	2032	2032	2032	2032	2032	2032	2032	2032	2032
1:500 DYAA	2032	2032	2032	2032	2032	2032	2032	2032	2032
1:500 DYCP	2032	2032	2032	2032	2032	2032	2032	2032	2032

Table 7.8: Maximum utilisation (in Ml/d) of Bulk import (HSE): PWC Source A to Otterbourne WSW (21Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	1.0	1.4	11.5	1.0	1.0	10.9	1.0	9.1	5.5
1:100 DYAA	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
1:500 DYAA	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
1:500 DYCP	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0

Recycling (HSE): Recharge of Havant Thicket Reservoir from Budds Farm WTW (60Ml/d) - This option is part of HWTWRP and involves treating wastewater from Budds Farm WTW to a very high standard and using this recycled water to recharge Havant Thicket Reservoir. This will allow up to 90Ml/d to be transferred from Havant Thicket Reservoir to Otterbourne WSW. Three capacity variants of the water recycling plant were considered which could be built in a modular fashion. The lowest capacity was 20Ml/d which could be increased to either 40Ml/d or 60Ml/d. The IVM has selected the 60Ml/d capacity variant from the date it is first available (2034-35) under all planning scenarios. Its maximum utilisation is 20Ml/d under 1:500 DYCP scenario in all supply-demand balance situations. Under other planning scenarios, its utilisation varies from 20Ml/d to 60Ml/d depending on the supply-demand balance situation (Table 7.9 and Table 7.10). Detailed utilisation profiles from Annex 15 are reproduced in Figure 7.11.

Table 7.9: Earliest selection of Recycling (HSE): Recharge of Havant Thicket Reservoir from Budds Farm WTW (60Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2035	2035	2035	2035	2035	2035	2035	2035	2035
1:100 DYAA	2035	2035	2035	2035	2035	2035	2035	2035	2035
1:500 DYAA	2035	2035	2035	2035	2035	2035	2035	2035	2035
1:500 DYCP	2035	2035	2035	2035	2035	2035	2035	2035	2035

Table 7.10: Maximum utilisation (in Ml/d) of Recharge of Recycling (HSE): Recharge of Havant Thicket Reservoir from Budds Farm WTW (60Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	60.0	60.0	28.1	60.0	60.0	27.7	60.0	38.5	27.8
1:100 DYAA	60.0	52.3	23.9	60.0	51.3	20.0	53.9	40.0	20.0
1:500 DYAA	60.0	60.0	32.6	60.0	60.0	21.5	60.0	49.5	20.0
1:500 DYCP	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0

Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d) - This option is also part of HWTWRP and is designed to transfer up to 90Ml/d from Havant Thicket Reservoir to Otterbourne WSW. It is selected in all situations as soon as it becomes available in 2034-35 under all planning scenarios, except NYAA conditions when it is utilised a year later. Its utilisation is typically higher under the 1:500 DYAA planning scenario (Table 7.11 and Table 7.12). Detailed utilisation profiles from Annex 15 are reproduced in Figure 7.13.

Table 7.11: Earliest selection of Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2036	2036	2036	2036	2036	2036	2036	2036	2036
1:100 DYAA	2035	2035	2035	2035	2035	2035	2035	2035	2035
1:500 DYAA	2035	2035	2035	2035	2035	2035	2035	2035	2035
1:500 DYCP	2035	2035	2035	2035	2035	2035	2035	2035	2035

Table 7.12: Maximum utilisation (in Ml/d) of Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	54.3	46.8	28.1	60.0	47.3	27.8	60.0	32.5	27.8
1:100 DYAA	63.0	63.0	63.0	63.0	63.0	63.0	63.0	63.0	63.0
1:500 DYAA	90.0	90.0	74.5	90.0	90.0	74.8	90.0	90.0	57.3
1:500 DYCP	69.0	61.1	58.6	69.0	61.9	59.4	69.0	52.5	46.0

Groundwater (HSW): Test MAR (5.5Ml/d) - This is a Managed Aquifer Recharge (MAR) scheme that involves recharge of the confined chalk aquifer during the winter months with abstraction during summer/autumn months. The scheme will need an extended trial period and this is reflected in the lead time for this option. This option is selected from 2035-36 under NYAA and 1:100 DYAA conditions and from 2041-42 under 1:500 DYAA and 1:500 DYCP conditions in situations 1-6. In Situation 7, it is first selected from 2047-48 under all planning scenarios. It is not selected in situations 8 and 9. Details including complete utilisation profiles are given in Annex 15.

Table 7.13: Earliest selection of Groundwater (HSW): Test MAR (5.5Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2036	2036	2036	2036	2036	2036	2048		
1:100 DYAA	2036	2036	2036	2036	2036	2036	2048		
1:500 DYAA	2042	2042	2042	2042	2042	2042	2048		
1:500 DYCP	2042	2042	2042	2042	2042	2042	2048		

Table 7.14: Maximum utilisation (in Ml/d) of Groundwater (HSW): Test MAR (5.5Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	5.5	5.5	5.5	5.5	5.5	5.5	5.5	0.0	0.0
1:100 DYAA	5.5	5.5	5.5	5.5	5.5	5.5	5.5	0.0	0.0
1:500 DYAA	5.5	5.5	5.5	5.5	5.5	5.5	5.5	0.0	0.0
1:500 DYCP	5.5	5.5	5.5	5.5	5.5	5.5	5.5	0.0	0.0

Groundwater (IOW): New boreholes at Newchurch (LGS) (1.9Ml/d) - This option proposes replacing all existing boreholes in Lower Greensand (LGS) aquifer so that the site can operate at its full licenced capacity. It is first selected in 2036-37 under all planning scenarios and in all situations. Details including complete utilisation profiles are given in Annex 15.

Groundwater (IOW): New boreholes at Eastern Yar3 (1.5Ml/d) - The existing Eastern Yar augmentation borehole has over 90% loss in performance and previous rehabilitation work has not led to any noticeable improvement. This option proposes drilling a new 100m deep replacement borehole for the Eastern Yar augmentation well. It is selected under NYAA conditions only in situations 1, 4 and 7 from 2039-40. Details including complete utilisation profiles are given in Annex 15.

Bulk import (HWZ): T2ST to Yew Hill (95Ml/d) - This option is selected from 2039-40 under all situations and planning scenarios. Maximum use varies depending on situation and planning scenario from 14.3Ml/d to 95Ml/d, with higher utilisation in situations 1, 4, and 7 (see Table 7.15 and Table 7.16). Detailed utilisation profiles from Annex 15 are reproduced in Figure 7.14.

Table 7.15: Earliest selection of bulk import from T2ST to Yew Hill under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2040	2040	2040	2040	2040	2040	2040	2040	2040
1:100 DYAA	2040	2040	2040	2040	2040	2040	2040	2040	2040
1:500 DYAA	2040	2040	2040	2040	2040	2040	2040	2040	2040
1:500 DYCP	2040	2040	2040	2040	2040	2040	2040	2040	2040

Table 7.16: Maximum utilisation (in Ml/d) of T2ST to Yew Hill (95Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	95.0	18.0	18.0	94.8	18.0	18.0	94.9	18.0	14.3
1:100 DYAA	95.0	49.5	18.0	89.7	49.8	18.0	83.2	32.8	18.0
1:500 DYAA	74.1	27.7	18.0	64.1	30.3	18.0	57.5	19.5	18.0
1:500 DYCP	56.8	16.6	18.0	47.5	15.7	18.0	43.8	18.0	18.0

Bulk import (HAZ): T2ST to Andover (20Ml/d) - This option involves using T2ST to supply HAZ with up to 20Ml/d. It is only selected in situations 1 and 4 in 2047-48 and 2064-65 with utilisation varying from 4.5Ml/d to 14.3Ml/d (Table 7.16 and Table 7.17). Details including complete utilisation profiles are given in Annex 15.

Table 7.17: Earliest selection of bulk import from to HAZ via T2ST under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2048	0	0	2065	0	0	0	0	0
1:100 DYAA	2048	0	0	2065	0	0	0	0	0
1:500 DYAA	2048	0	0	2065	0	0	0	0	0
1:500 DYCP	2048	0	0	2065	0	0	0	0	0

Table 7.18: Maximum utilisation (in Ml/d) of bulk import to HAZ via T2ST (20Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	14.3	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0
1:100 DYAA	13.7	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0
1:500 DYAA	8.2	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0
1:500 DYCP	11.5	0.0	0.0	8.5	0.0	0.0	0.0	0.0	0.0

Bulk import (HKZ): T2ST to HKZ (5Ml/d) - This option to supply HKZ via T2ST is only selected in Situation 4 to provide up to 5Ml/d from 2048-49 under all planning scenarios. Details including complete utilisation profiles are given in Annex 15.

New bulk exports and interzonal transfers

Bulk export (HSE): Otterbourne WSW to PWC Source A (45Ml/d) - This bulk export becomes viable once Southern Water starts to get water via T2ST from 2039-40. It is not selected in situations 3, 6 and 9 under any planning scenario (Table 7.19). It is also not selected under 1:500 DYCP conditions in any supply-demand balance situation. When selected, its utilisation varies between 2.3Ml/d and 45Ml/d (Table 7.20).

Interzonal transfer (HSE-HSW): Yew Hill WSW to River Test WSW bi-directional (60Ml/d) - This transfer is part of the Hampshire grid and is planned for delivery in 2029-30 with first use from 2030-31 (see Annex 15 for details including utilisation profiles).

Interzonal transfer (HSE-HWZ): Otterbourne WSW to Yew Hill WSW bi-directional (74Ml/d) - This transfer is part of the Hampshire grid and is planned for delivery in 2029-30 with first use from 2030-31 (see Annex 15 for details including utilisation profiles).

Table 7.19: Earliest selection of Bulk export (HSE): Otterbourne WSW to PWC Source A (45Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2041	2069		2041	2064		2042		
1:100 DYAA	2040	2044		2040	2043		2042	2069	
1:500 DYAA	2040	2040		2040	2040		2042	2063	
1:500 DYCP									

Table 7.20: Maximum utilisation (in Ml/d) of Bulk export (HSE): Otterbourne WSW to PWC Source A (45Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	45.0	1.6		45.0	2.3		45.0		
1:100 DYAA	45.0	14.2		45.0	14.9		45.0	4.2	
1:500 DYAA	45.0	18.9		45.0	21.9		45.0	17.4	
1:500 DYCP									

Interzonal transfer (HWZ-HAZ): Winchester to Andover bi-directional (15Ml/d) - This transfer is part of the Hampshire grid and is planned for delivery in 2029-30 with first use from 2030-31 (see Annex 15 for details including utilisation profiles).

Interzonal transfer (HSW-HRZ): Romsey Town and Broadlands valve expansion (5Ml/d) - This is an expansion to the existing infrastructure to transfer up to 5Ml/d additional volume. This option is required from 2030-31 to be able to move water from Romsey and Kings Sombourne groundwater options in HRZ to HSW to reduce the volume needed from the River Test Drought Permit/Order in the event of a severe drought (see Annex 15 for details including utilisation profiles).

Existing bulk exports and transfers

Bulk export (HSW): Existing supply to industrial user (10Ml/d) - This is an existing bulk supply that is utilised at maximum capacity throughout the planning period under all planning scenarios and supply-demand balance situations (see Annex 15 for details).

Bulk import (HSE): PWC Source A to Eastleigh WSR (30Ml/d) - This is an existing bulk import. The pipeline can transfer up to 30Ml/d but the current bulk supply agreement is limited to a maximum of 15Ml/d. The dWRMP24 included a proposal to increase this transfer to 24Ml/d. However, we have been informed by Portsmouth Water that they can no longer provide the additional 9Ml/d (see Section 3.2.3). The maximum volume available through this transfer therefore remains at 15Ml/d (see Annex 15 for details).

Interzonal transfer (HSW-HRZ): Romsey Town and Broadlands valve (3.1Ml/d) - This is an existing transfer between HSW and HRZ. See Annex 15 for details.

Existing drought options

Drought option - supply side (HSE): Candover (22Ml/d) - This option is needed in 1-in-200 year and 1-in-500 year droughts up to 2033-34 in all supply-demand balance situations. It is excluded from selection post 2033-34 under any drought situation. See Annex 15 for details.

Drought option - supply side (HSE): Lower Itchen - This option is needed in 1-in-200 year and 1-in-500 year droughts up to 2029-30 in all supply-demand balance situations. This option is excluded from selection post 2029-30 under any drought situation. See Annex 15 for details.

Drought option - supply side (HSW): River Test (80Ml/d) - This option is needed in 1-in-200 year droughts up to 2030-34 in all supply-demand balance situations. With the inclusion of sea tankering from Norway, the maximum volume required from this option is reduced to 14Ml/d. Under 1-in-500 year droughts, this option is available up to 2040-41. See Annex 15 for details.

Options selected post 2050

Groundwater (HAZ): Recommission Chilbolton (0.5Ml/d) - This option is only selected in Situation 7 under all planning scenarios from 2072-73. See Annex 15 for details.

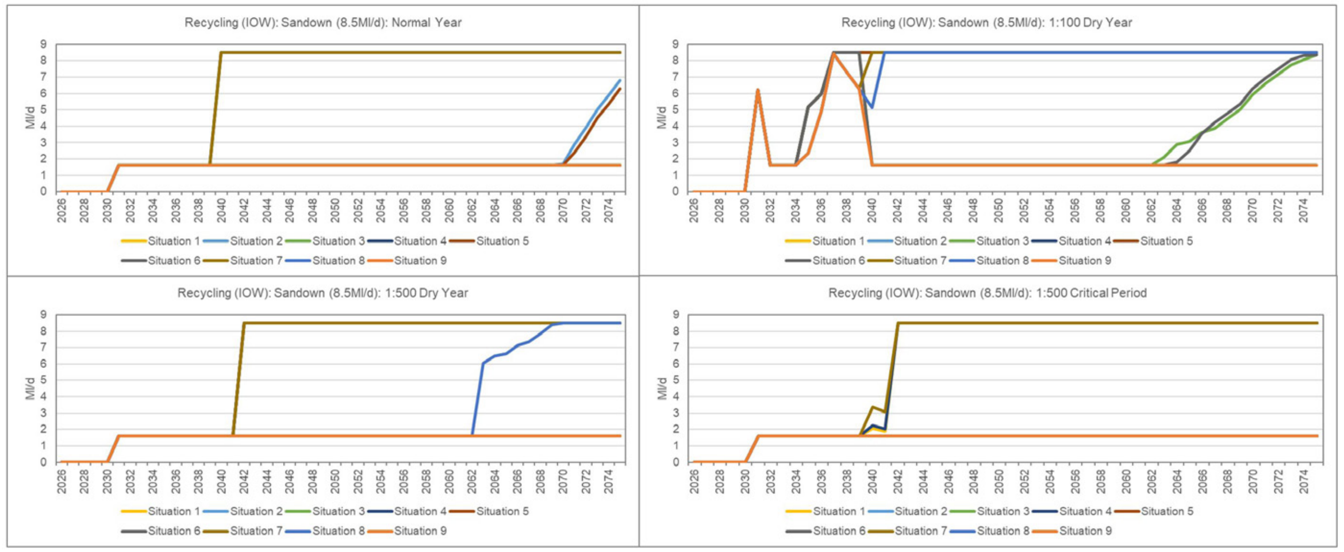


Figure 7.10: Utilisation of Sandown recycling option on the IOW in each supply-demand balance situation under each planning scenario

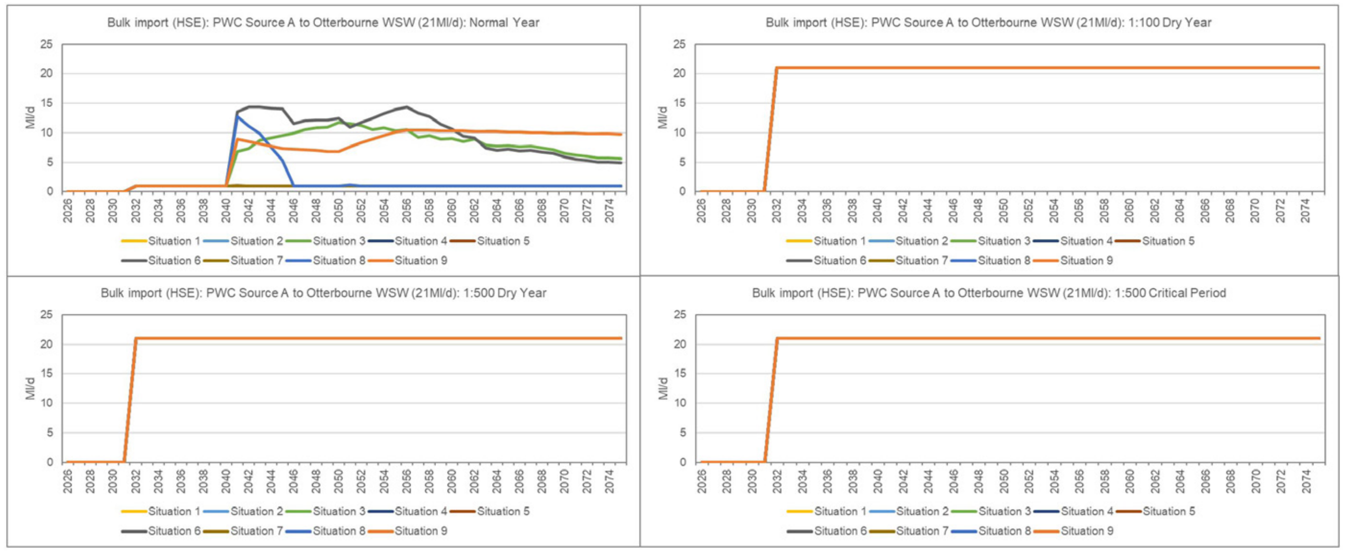


Figure 7.11: Utilisation of bulk import to Otterbourne WSW in HSE from Portsmouth Water Source A in each supply-demand balance situation under each planning scenario

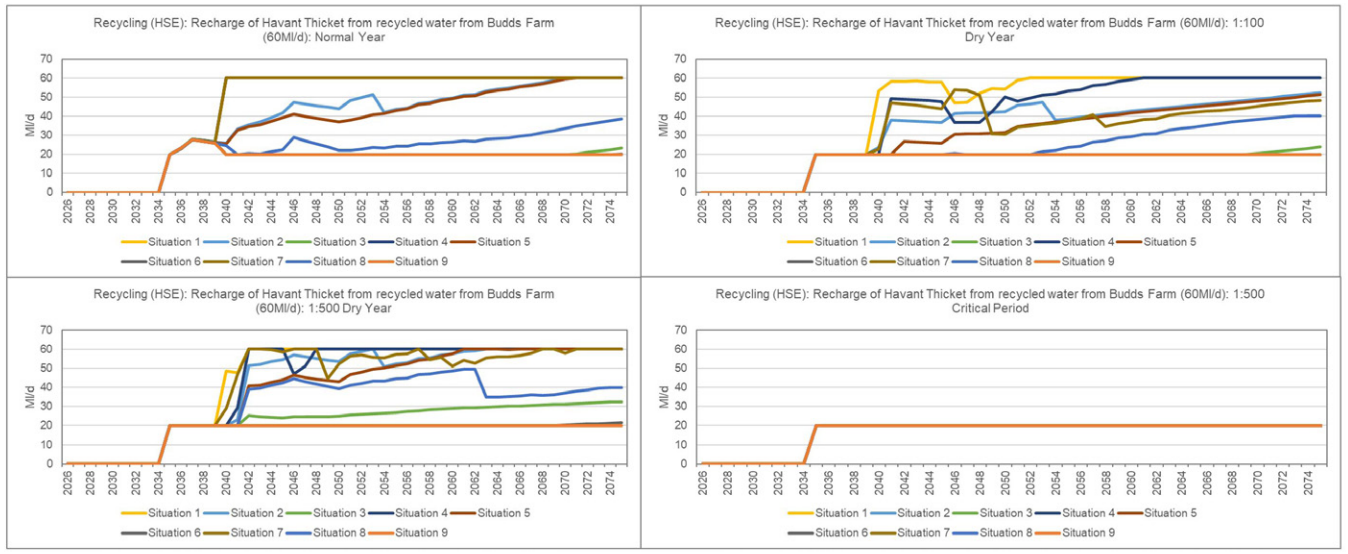


Figure 7.12: Utilisation of the option to augment storage in Havant Thicket Reservoir with recycled water from Budd Farm WTW in each supply-demand balance situation under each planning scenario

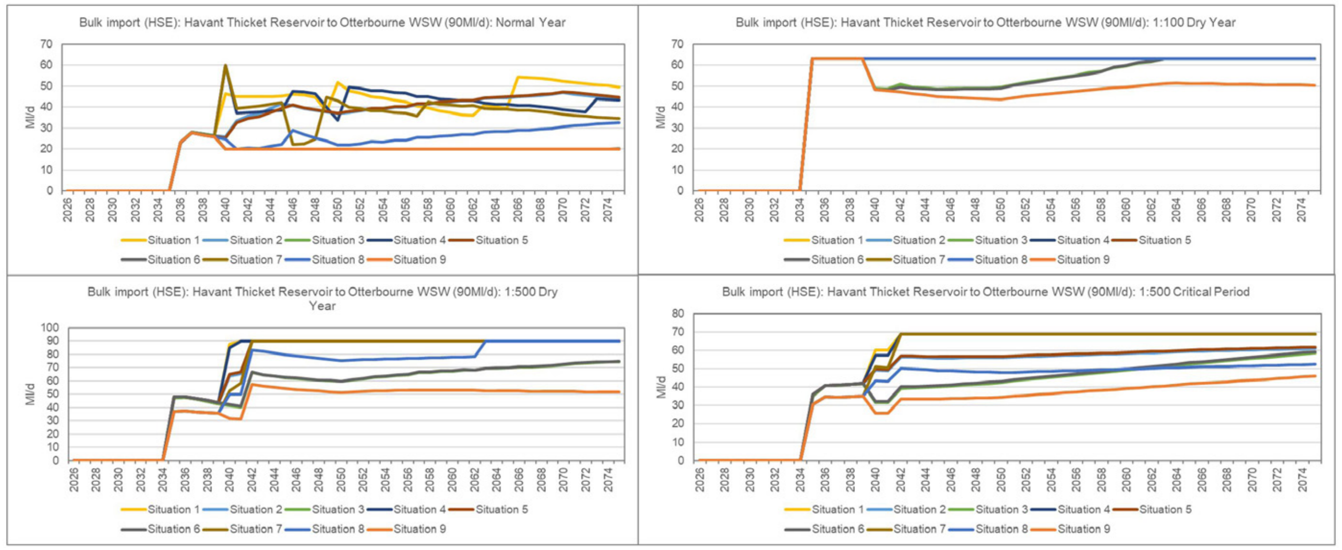


Figure 7.13: Utilisation of bulk import to HSE from Havant Thicket Reservoir in each supply-demand balance situation under each planning scenario

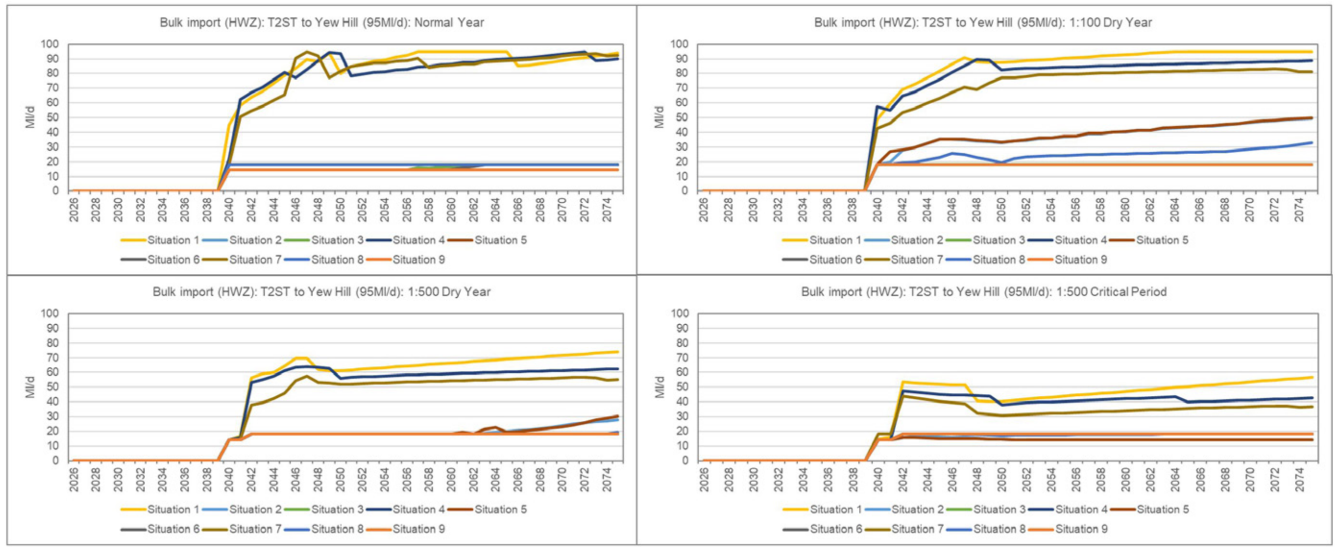


Figure 7.14: Utilisation of bulk import to HWZ via T2ST in each supply-demand balance situation under each planning scenario

7.2.3 Our proposed strategy in the Central area

Like the Western area, our strategy in the Central area is a continuation of our WRMP19 strategy and is being driven by the need to reduce the amount of water we take from the environment. This has been further exacerbated by the Water Neutrality Position Statement issued by Natural England (see Section 3.3.1).

Our dWRMP24 relied on using the Pulborough surface water drought option in case of severe (1-in-200 year or greater severity) droughts. We have however been informed by the Environment Agency that it does not support use of the Pulborough surface water drought option post 2029-30 in droughts of up to 1-in-200 year severity. We were unaware of this requirement at the time of developing our dWRMP24.

In order to meet this requirement, we will be implementing a 4Ml/d bulk import from SES Water through rezoning part of our supply area in SNZ to SES Water network up to 2030-31, followed by a bulk import of up to 10Ml/d from SES Water from 2033-34. We are also bringing forward the Petworth groundwater option selected in our dWRMP24 to 2030-31.

Table 7.21 shows supply-side schemes that have been selected to meet supply-demand balance in the Central area under 1:500 DYAA conditions. Demand management initiatives and drought options are not included. Supply-side options that are not selected under 1:500 DYAA conditions are also not included. The full set of options selected under all planning scenarios in included in Annex 15.

Table 7.21: Supply-side schemes needed in the Central area and their earliest selection year in all supply-demand balance situations under 1:500 DYAA planning scenario

Option	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
Bulk export (SNZ): SNZ to SES (10Ml/d)	2040								
Bulk export (SNZ): Weir Wood Reservoir to SEW RZ2 (5.4Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk import (SBZ): SEW to Rottingdean (20Ml/d)	2066								
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d)	2040	2041	2042	2041	2042	2069	2041	2042	
Bulk import (SNZ): PWC to Pulborough (15Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk import (SNZ): SES to SNZ (10Ml/d)	2034	2034	2034	2034	2034	2034	2034	2034	2034
Bulk import (SNZ): SES re-zoning (4Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d)	2041	2054		2040	2040	2040	2040	2040	2040
Desalination (SWZ): Tidal River Arun (10Ml/d)				2046					
Desalination (SWZ): Tidal River Arun (20Ml/d)	2041								
Desalination (SWZ): Tidal River Arun (20Ml/d) Phase 2	2050			2051					
Groundwater (SBZ): Lewes Road (3.5Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Groundwater (SNZ): New borehole at Petworth (4Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Groundwater (SNZ): Reinstate West Chiltington (3.1Ml/d)	2029	2029	2029	2029	2029	2029	2029	2029	2029
Groundwater (SNZ): Petersfield refurbishment (1.6Ml/d)	2029	2029	2029	2029	2029	2029	2029	2029	2029
Interzonal transfer (SBZ-SWZ): Brighton to Worthing	2041			2074					

Table 7.21: Supply-side schemes needed in the Central area and their earliest selection year in all supply-demand balance situations under 1:500 DYAA planning scenario

Option	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
Interzonal transfer (SNZ-SWZ): Pulborough to Worthing	2040	2040		2040	2040		2040	2041	
Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d)	2041			2051					
Interzonal transfer (SWZ-SBZ): V6 valve additional capacity (13Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (SWZ-SBZ): V6 valve - existing (17Ml/d)	2027	2027	2027	2027	2027	2027	2027	2027	2027
Interzonal transfer (SWZ-SNZ): Rock Road bi-directional - existing (15Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Recycling (SNZ): Littlehampton with direct river discharge (15Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Recycling (SNZ): Horsham with storage at Pulborough (11.5Ml/d)	2063			2073			2058		
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2046			2046			2049		
Treatment capacity (SWZ): Pulborough winter transfer stage 1 (2Ml/d)	2046			2041			2048		

Demand management

We are looking to save 35.8Ml/d by 2050 through reduction in household and non-household consumption. Reduction in leakage will provide an additional 7.6 Ml/d (Figure 7.15). WRSE has not considered separate demand profiles under the 1:100 DYAA and 1:500 DYAA scenarios, therefore there is a single profile of demand savings under both 1:100 DYAA and 1:500 DYAA scenarios.

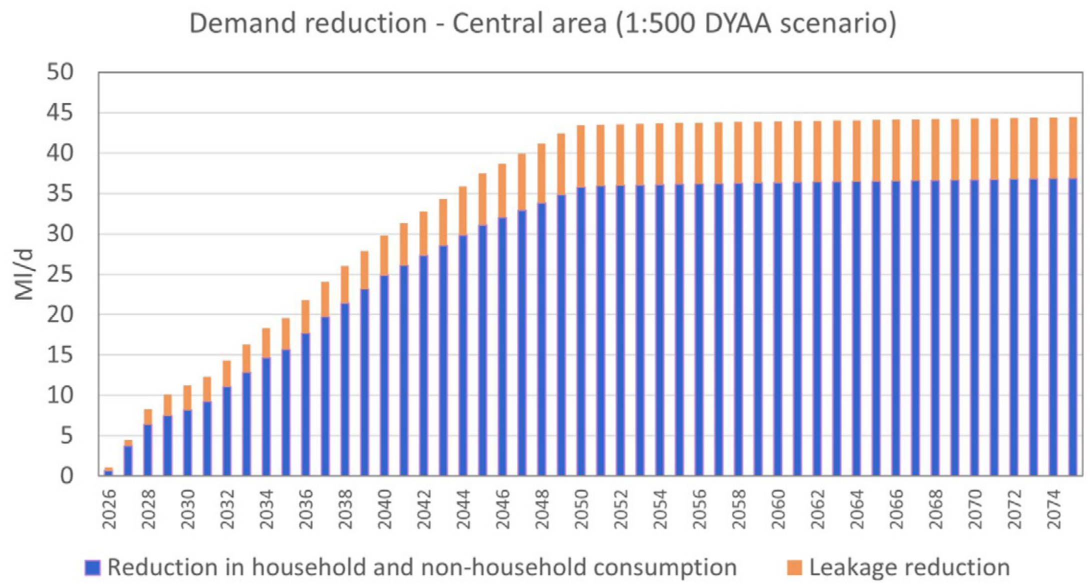


Figure 7.15: Reduction in total demand in the Central area

New supply options in the Central area up to 2050

Bulk import (SNZ): SES re-zoning (4Ml/d) - We currently have an arrangement with SES Water whereby we have rezoned some of our customers in SNZ to receive their water directly from SES Water. SES Water is providing up to 1.3Ml/d under this arrangement. This option is the extension of the current arrangement to 2030-31 and for up to 4Ml/d. Under NYAA conditions, this option is not utilised until 2027-28 and its maximum utilisation in all supply-demand balance situations is 1.3Ml/d. Under all other planning scenarios, it is selected from 2025-26 and the maximum utilisation is up to 4Ml/d. See Annex 15 for details.

Groundwater (SNZ): Reinstate West Chiltington (3.1Ml/d) - This option was originally in the baseline WAFU for SNZ but has now been introduced an option from 2028-29. It is fully utilised in all supply-demand balance situations under all planning scenarios. See Annex 15 for details.

Groundwater (SNZ): Petersfield refurbishment (1.6Ml/d) - This option was originally in the baseline WAFU for SNZ but has now been introduced an option from 2028-29. It is fully utilised in all supply-demand balance situations under all planning scenarios with a DO of 2.0Ml/d under 1:500 DYCP conditions. See Annex 15 for details.

Groundwater (SBZ): Lewes Road (3.5Ml/d) - This option involves increasing pump capacity the Lewes Road groundwater source to achieve licenced DO. It has been included to partially offset the loss of supplies as a result of the exclusion of Sussex Coast desalination option that was selected in dWRMP24. It is selected in all situations under NYAA, 1:100 DYAA and 1:500 DYAA scenarios from 2030-31 and under 1:500 DYCP scenario from 2035-36. It is consistently utilised at its maximum capacity in all supply-demand balance situations except under 1:500 DYAA scenario where its utilisation varies with the supply-demand balance situation. See Annex 15 for details.

Groundwater (SNZ): New borehole at Petworth (4Ml/d) - This option involves returning Petworth WSW to service with a new borehole of up to 80m depth ca. 700m south of main WSW. The earliest delivery of this option has been brought forward to 2029-30 to provide benefit from 2030-31. It is needed from 2030-31 under 1:100 DYAA and 1:500

DYAA conditions. Its selection and utilisation under NYAA and 1:500 DYCP conditions varies with the supply-demand balance situation. Its maximum utilisation in most cases is up to its maximum capacity (Table 7.23 and Table 7.24). Complete utilisation profile is given in Annex 15.

Table 7.22: Earliest selection Groundwater (SNZ): New borehole at Petworth (4Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2040	2041	2051	2040	2041	2064	2040	2041	
1:100 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYCP	2051	2042	2042	2074	2042	2070			

Table 7.23: Maximum utilisation of Groundwater (SNZ): New borehole at Petworth (4Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
1:100 DYAA	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
1:500 DYAA	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
1:500 DYCP	4.0	4.0	4.0	0.2	4.0	2.4			

Recycling (SNZ): Littlehampton with direct river discharge (15Ml/d) - This option is part of WRMP19 deliverables and is planned to deliver benefit from 2030-31. It is utilised in all supply-demand balance situations under planning scenarios (Table 7.24).

Its maximum utilisation is typically 15Ml/d except under 1:500 DYCP where maximum utilisation varies between 3.0Ml/d and 7.5Ml/d (Table 7.25). It utilisation profile from Annex 15 is reproduced as Figure 7.16.

Table 7.24: Earliest selection of Recycling (SNZ): Littlehampton with direct river discharge (15Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:100 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYCP	2031	2031	2031	2031	2031	2031	2031	2031	2031

Table 7.25: Maximum utilisation (in Ml/d) of Recycling (SNZ): Littlehampton with direct river discharge (15Ml/d) option under each planning scenario.

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	15.0	15.0	15.0	15.0	15.0	7.2	15.0	15.0	3.0
1:100 DYAA	15.0	15.0	15.0	15.0	15.0	13.7	15.0	15.0	10.7
1:500 DYAA	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	12.3
1:500 DYCP	3.0	7.5	7.3	3.0	6.4	3.0	3.0	3.0	3.0

Bulk import (SNZ): SES to SNZ (10Ml/d) - This bulk import from SES Water to SNZ is first available from 2033-34 and is selected as soon as it is available under 1:100 DYAA and 1:500 DYAA scenarios. Under NYAA and 1:500 DYCP planning scenarios, it is first selected in 2039-40 or later (Table 7.26). It is utilised to its maximum capacity at some point in most supply-demand balance situations (Table 7.27). Its utilisation profile is shown in Figure 7.17.

Table 7.26: Earliest selection of Bulk import (SNZ): SES to SNZ (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2040	2040	2041	2040	2041	2051	2040	2041	2070
1:100 DYAA	2034	2034	2034	2034	2034	2034	2034	2034	2034
1:500 DYAA	2034	2034	2034	2034	2034	2034	2034	2034	2034
1:500 DYCP	2040	2040	2040	2040	2040	2040	2040	2040	2040

Table 7.27: Maximum utilisation (in Ml/d) of Bulk import (SNZ): SES to SNZ (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	2.2
1:100 DYAA	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
1:500 DYAA	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
1:500 DYCP	10.0	10.0	10.0	10.0	10.0	10.0	2.6	3.1	0.7

Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d) - This option involves the transfer of up to 50Ml/d from Havant Thicket Reservoir to Pulborough WSW. This option is first selected in 2039-40 when the bulk import from T2ST in the Western area creates spare capacity in HSE. It is not selected under 1:500 DYCP scenario and is not needed in supply-demand balance Situation 9 under any planning scenario. Its selection in Situation 6 is limited to 1:500 DYAA planning scenario (Table 7.28). Its maximum utilisation varies with the supply-demand balance situation and is capped at 40Ml/d (Table 7.29). Its utilisation profile is shown in Figure 7.18.

Table 7.28: Earliest selection of Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2040	2046	2071	2041	2052		2041	2065	
1:100 DYAA	2040	2040	2069	2041	2042		2041	2046	
1:500 DYAA	2040	2041	2042	2041	2042	2069	2041	2042	
1:500 DYCP									

Table 7.29: Maximum utilisation (in Ml/d) of Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	22.0	16.3	3.2	26.3	15.4		37.9	6.0	
1:100 DYAA	38.4	32.3	3.9	29.2	31.3		33.9	20.0	
1:500 DYAA	40.0	40.0	12.6	40.0	40.0	1.5	40.0	20.0	
1:500 DYCP									

Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d) - This bulk import from South East Water to Pulborough is first selected in 2039-40 the majority of cases. It is not selected in Situation 3 under any planning scenario (Table 7.30). Its maximum utilisation reaches the maximum capacity in all cases except in Situation 1 under 1:500 DYCP scenario (Table 7.31). Its utilisation profile is shown in Figure 7.19

Table 7.30: Earliest selection of Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2041	2054		2040	2040	2041	2040	2040	2040
1:100 DYAA	2041	2054		2040	2040	2040	2040	2040	2040
1:500 DYAA	2041	2054		2040	2040	2040	2040	2040	2040
1:500 DYCP	2043					2040	2040	2040	2040

Table 7.31: Maximum utilisation (in Ml/d) of Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
1:100 DYAA	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
1:500 DYAA	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
1:500 DYCP	7.7					10.0	10.0	10.0	10.0

Treatment capacity (SWZ): Pulborough Winter Transfer Stage 1 (2Ml/d) - This option provides additional benefit through improvement of treatment process at Pulborough WSW. This option is first selected in 2040-41 in Situation 4, in 2045-46 in Situation 1 and in 2047-48 in Situation 7 with a maximum utilisation of 2Ml/d (Table 7.32 and Table 7.33). Full details are included in Annex 15.

Table 7.32: Earliest selection of Treatment capacity (SWZ): Pulborough Winter Transfer Stage 1 (2Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2046			2041			2048		
1:100 DYAA	2046			2041			2048		
1:500 DYAA	2046			2041			2048		
1:500 DYCP									

Table 7.33: Maximum utilisation (in Ml/d) of Treatment capacity (SWZ): Pulborough Winter Transfer Stage 1 (2Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2.0			2.0			2.0		
1:100 DYAA	2.0			2.0			2.0		
1:500 DYAA	2.0			2.0			2.0		
1:500 DYCP									

Desalination (SWZ): Tidal River Arun (up to 40Ml/d)

This option proposes a desalination plant to treat estuarine water from the tidal River Arun to supply treated water to SWZ and potentially SNZ. This option can be built in a modular fashion to provide 10, 20, 30 and 40M/d. Each capacity variant is introduced as a separate option so that the IVM can select the most appropriate capacity variant in view of the supply-demand balance deficit it is trying to solve.

A 20Ml/d capacity desalination plant is selected in 2040-41 under Situation 1 only (Table 7.34 and Table 7.35). A smaller 10Ml/d plant is needed in 2045-46 in Situation 4 only (Table 7.36 and Table 7.37). The capacity in Situation 1 is then doubled to 40Ml/d by another 20Ml/d in 2049-50. In Situation 4, it is increased to 30Ml/d by adding another 20Ml/d in 2050-51 (Table 7.38 and Table 7.39). Complete utilisation profiles for each capacity variant of this option are included in Annex 15.

Table 7.34: Earliest selection of Desalination (SWZ): Tidal River Arun (20Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2041								
1:100 DYAA	2041								
1:500 DYAA	2041								
1:500 DYCP	2041								

Table 7.35: Maximum utilisation (in Ml/d) of Desalination (SWZ): Tidal River Arun (20Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	20.0								
1:100 DYAA	19.4								
1:500 DYAA	20.0								
1:500 DYCP	4.0								

Table 7.36: Earliest selection of Desalination (SWZ): Tidal River Arun (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA				2046					
1:100 DYAA				2046					
1:500 DYAA				2046					
1:500 DYCP				2046					

Table 7.37: Maximum utilisation (in Ml/d) of Desalination (SWZ): Tidal River Arun (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA				10.0					
1:100 DYAA				2.0					
1:500 DYAA				8.3					
1:500 DYCP				2.0					

Table 7.38: Earliest selection of Desalination (SWZ): Tidal River Arun (20Ml/d) Phase 2 option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2050			2051					
1:100 DYAA	2050			2051					
1:500 DYAA	2050			2051					
1:500 DYCP	2050			2051					

Table 7.39: Maximum utilisation (in Ml/d) of Desalination (SWZ): Tidal River Arun (20Ml/d) Phase 2 option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	20.0			20.0					
1:100 DYAA	20.0			13.3					
1:500 DYAA	20.0			20.0					
1:500 DYCP	4.0			4.0					

Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d) - The option involves the construction of an earth embankment reservoir in Sussex with a proposed storage capacity of up to 4,600Ml. The option will allow treated water to enter the distribution network to supply the Central area. The reservoir will be filled with water pumped from the eastern branch of the River Adur.

This option is selected from 2045-46 in situations 1 and 4 and form 2048-49 in Situation 7 (Table 7.40). Under 1:500 DYCP conditions, it is only need in Situation 1 from 2065-66 for a small volume (Table 7.41). The full utilisation profile is shown in Annex 15.

Table 7.40: Earliest selection of Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2046			2046			2049		
1:100 DYAA	2046			2046			2049		
1:500 DYAA	2046			2046			2049		
1:500 DYCP	2066								

Table 7.41: Maximum utilisation (in Ml/d) of River Adur Offline Reservoir option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	19.5			19.5			19.5		
1:100 DYAA	19.5			19.5			19.5		
1:500 DYAA	19.5			19.5			19.5		
1:500 DYCP	1.2								

New bulk exports and interzonal transfers

Bulk export (SNZ): SNZ to SES (10Ml/d) - This option is selected in 2039-40 only under 1:500 DYAA scenario and in Situation 1 only. See Annex 15 for details.

Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d) - This option is first selected in 2040-41 in situations 1, 4 and 7 with a maximum utilisation of 3Ml/d. In Situation 7, it is needed under NYAA conditions only. It is not utilised at all under 1:500 DYCP conditions (Table 7.42 and Table 7.43). See Annex 15 for complete details.

Table 7.42: Earliest selection of Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2041			2041			2041		
1:100 DYAA	2041			2062					
1:500 DYAA	2041			2051					
1:500 DYCP									

Table 7.43: Maximum utilisation (in Ml/d) of Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	3.0			3.0			3.0		
1:100 DYAA	3.0			1.3					
1:500 DYAA	3.0			3.0					
1:500 DYCP									

Interzonal transfer (SNZ-SWZ): Pulborough to Worthing - This option is first selected in 2039-40. It is not selected in situations 3, 6 and 9 and is not selected under 1:500 DYCP scenario in any situation. The maximum utilisation is 29.2Ml/d (Table 7.44 and Table 7.45).

Table 7.44: Earliest selection of Interzonal transfer (SNZ-SWZ): Pulborough to Worthing option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2040	2040		2040	2040		2040	2040	
1:100 DYAA	2040	2041		2040	2041		2040	2041	
1:500 DYAA	2040	2040		2040	2040		2040	2041	
1:500 DYCP									

Table 7.45: Maximum utilisation (in Ml/d) of Interzonal transfer (SNZ-SWZ): Pulborough to Worthing option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	23.7	26.7		29.7	25.9		34.9	18.3	
1:100 DYAA	28.6	16.2		21.8	15.2		22.2	7.5	
1:500 DYAA	29.2	18.5		24.0	17.5		24.6	9.7	
1:500 DYCP									

Interzonal transfer (SBZ-SWZ): Brighton to Worthing - This option is first selected in 2040-41 in situations 1,4 and 7. In Situation 7, it is selected under NYAA conditions only. Its maximum utilisation is 16.7Ml/d (Table 7.46 and Table 7.47).

Table 7.46: Earliest selection of Interzonal transfer (SBZ-SWZ): Brighton to Worthing option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2041			2041			2041		
1:100 DYAA	2051								
1:500 DYAA	2041			2074					
1:500 DYCP	2042			2042					

Table 7.47: Maximum utilisation (in Ml/d) of Interzonal transfer (SBZ-SWZ): Brighton to Worthing option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	16.7			10.9			4.6		
1:100 DYAA	4.4								
1:500 DYAA	6.3			0.1					
1:500 DYCP	6.5			0.7					

Existing bulk exports and interzonal transfers

Bulk export (SNZ): Weir Wood to SEW (5.4Ml/d) - This is an existing bulk export to South East Water and is fully utilised in all situations and all planning scenarios up to 2030-31. It is only sporadically used thereafter. See Annex 15 for details.

Bulk import (SNZ): PWC to Pulborough (15Ml/d) - This is an existing bulk import that continues to be selected in most situations under all planning scenarios throughout the planning period. See Annex 15 for details.

Interzonal transfer (SWZ-SBZ): Trunk main at v6 valve (17Ml/d) and Interzonal transfer (SWZ-SBZ): Trunk main at v6 valve additional capacity (13Ml/d) - The IVM intermittently uses both these options as it assumes that both are available from 2025-26. In reality, transfers exceeding 17Ml/d are not needed until 2040-41. That is when the 13Ml/d additional capacity will be first needed. This transfer is not needed under 1:500 DYCP scenario. See Annex 15 for details.

Interzonal transfer (SNZ-SWZ): Rock Road bi-directional (15Ml/d) - This is an existing transfer that continues to be used in all planning scenarios and in all situations. See Annex 15 for details.

Existing drought options

Drought option - supply side (SNZ): Pulborough surface water phases 1-3 (23Ml/d) - This option is used for all droughts up to 2029-30. Post 2030, it is only used in extreme droughts (1-in-500 year or greater severity).

Demand-side drought options (e.g. TUBs and NEUBs) are used throughout the planning period.

Options selected post 2050

Recycling (SNZ): Horsham with storage at Pulborough (11.5Ml/d) - This option involves the transfer of recycled water from Horsham WTW to a storage site near Pulborough. This option is not selected under 1:500 DYCP scenario. Under other scenarios, it is selected in Situation 7 in 2057-58, Situation 1 in 2062-63 and Situation 4 in 2072-73. See Annex 15 for details.

Bulk import (SBZ): SEW to Rottingdean (20Ml/d) - This bulk import from South East Water is selected in Situation 1 only from 2066. It is not selected at all under 1:500 DYCP scenario. See Annex 15 for details.

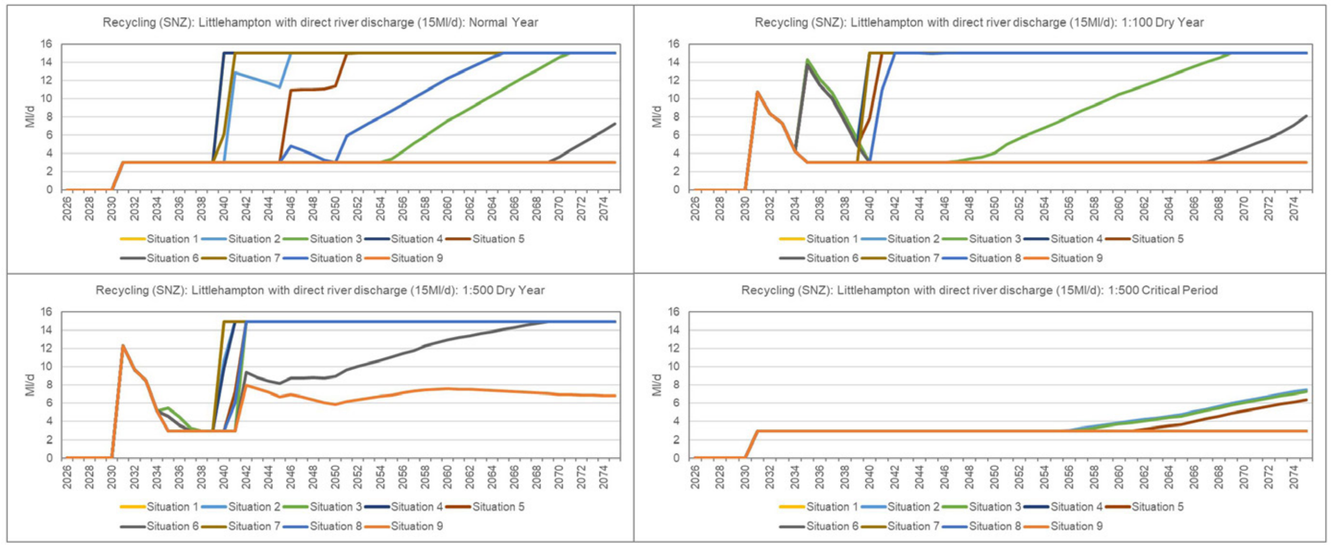


Figure 7.16: Utilisation of Littlehampton recycling option in SNZ in each supply-demand balance situation under each planning scenario

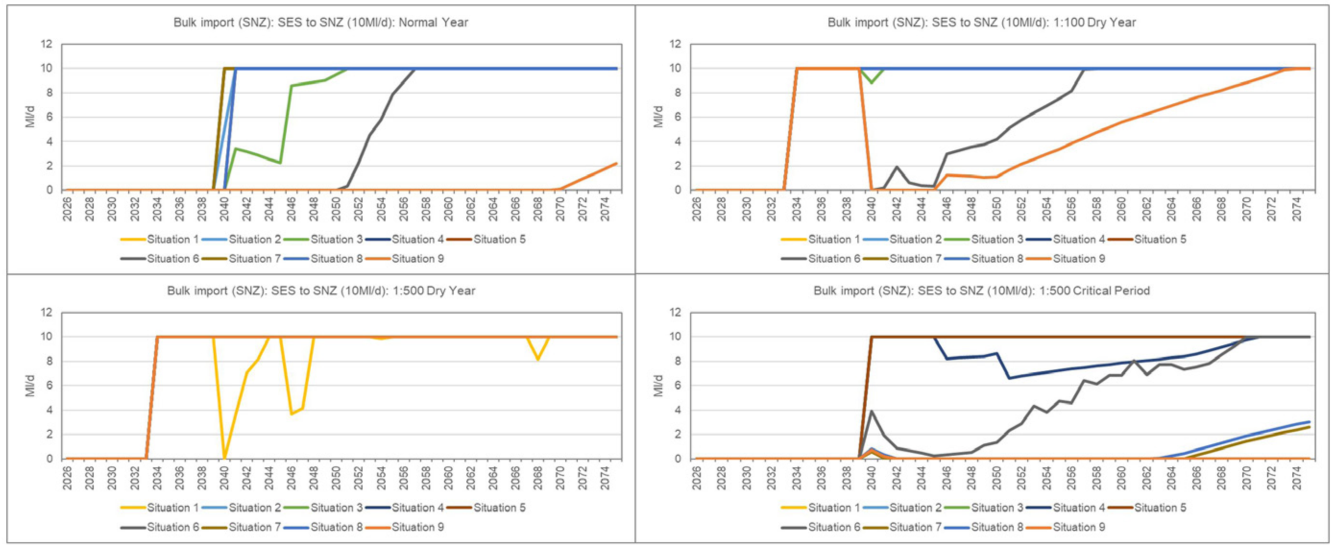


Figure 7.17: Utilisation of bulk import from SES Water to SNZ in each supply-demand balance situation under each planning scenario

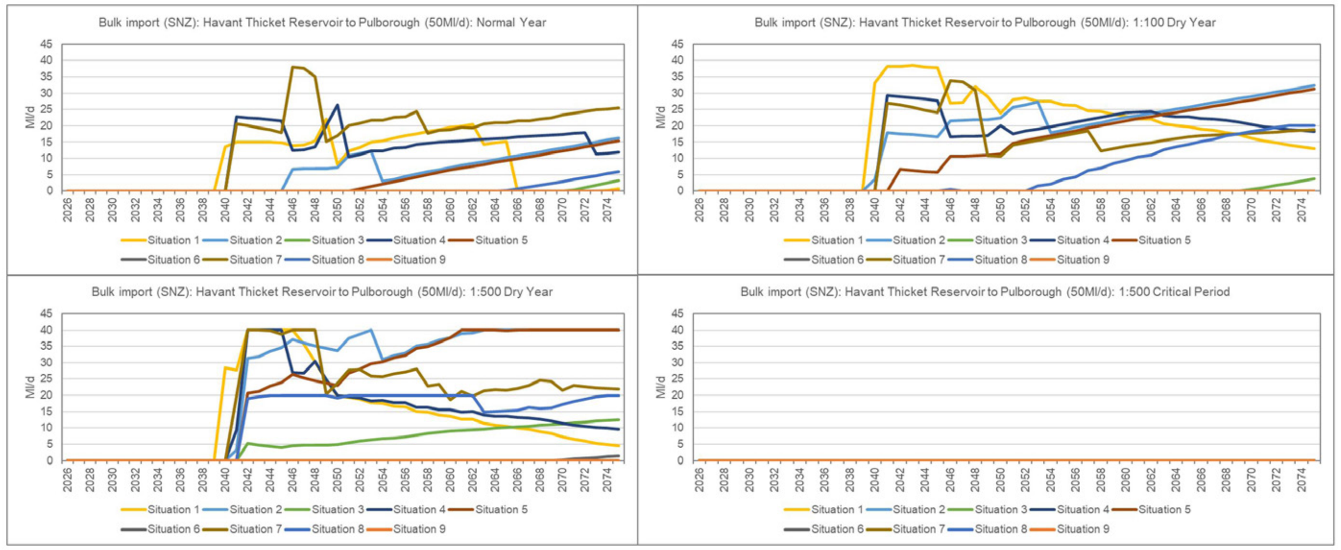


Figure 7.18: Utilisation of bulk import from Havant Thicket Reservoir to Pulborough in SNZ in each supply-demand balance situation under each planning scenario

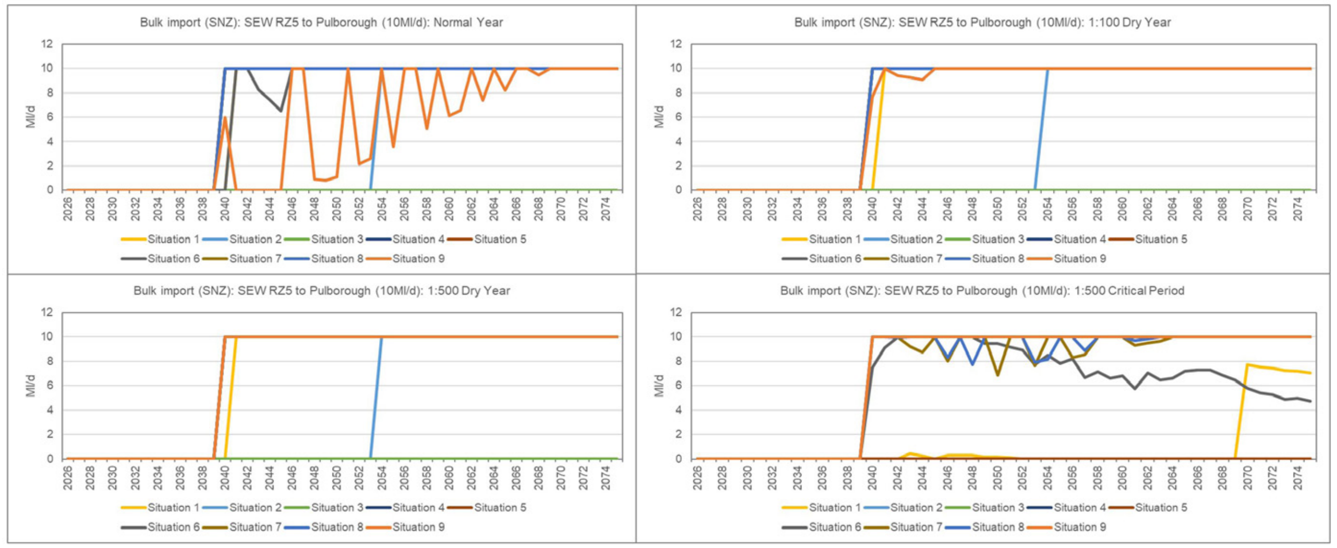


Figure 7.19: Utilisation of bulk import from South East Water to Pulborough WSW in SNZ in each supply-demand balance situation under each planning scenario

7.2.4 Our proposed strategy in the Eastern area

Table 7.48 shows supply-side schemes that have been selected to meet supply-demand balance in the Eastern area under 1:500 DYAA conditions. Demand management initiatives and drought options are not included. Supply-side options that are not selected under 1:500 DYAA conditions are also not included. The full set of options selected under all planning scenarios in included in Annex 15.

Table 7.48: Supply-side schemes needed in the Eastern area and their earliest selection year in all supply-demand balance situations under 1:500 DYAA planning scenario

Option	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
Asset enhancement (KMW): Remove network constraint at Longfield (13Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk export (KME): To SEW RZ6 from Hartlip (7.4Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk export (KMW): Near Rochester to SEW RZ6							2075		
Bulk export (KMW): To SEW RZ3 via Bewl Reservoir (8Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk export (KMW): To SEW RZ6 (.5Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk export (KTZ): SWS Deal to AFW AZ7	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk export (KTZ): SWS Deal to AFW AZ7 (4Ml/d)	2045			2045			2050		
Bulk export (KTZ): Near Canterbury to SEW Canterbury (20Ml/d)	2050			2051			2052		
Bulk export (SHZ): Rye to SEW RZ8	2058			2050			2060		
Bulk import (KTZ): AFW - existing (.1Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk import (KTZ): SEW Canterbury to Near Canterbury (20Ml/d)		2050	2051		2050	2051	2066	2050	2065
Bulk import (KTZ): SEW Kingston to Near Canterbury (2Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Bulk import (SHZ): SEW RZ8 to Rye						2075			
Demand adjustment (KTZ): Headroom adjustment for Regional Plan integrity	2058	2058	2058	2058	2058	2058	2058	2058	2058
Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2	2070	2063		2065	2065				
Desalination (KME): Isle of Sheppey (20Ml/d)	2046	2041		2046	2041		2046	2046	

Table 7.48: Supply-side schemes needed in the Eastern area and their earliest selection year in all supply-demand balance situations under 1:500 DYAA planning scenario

Option	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
Desalination (KMW): Thames Estuary (10Ml/d)			2041			2041			
Desalination (KMW): Thames Estuary (10Ml/d) Phase 2								2041	
Desalination (KMW): Thames Estuary (20Ml/d)	2040	2040		2040	2040		2040	2040	
Desalination (KMW): Thames Estuary (20Ml/d) Phase 2	2041	2046		2040	2041		2041		
Desalination (KTZ): East Thanet (20Ml/d)	2041		2070	2041					
Desalination (KTZ): East Thanet (20Ml/d) Phase 2	2051								
Groundwater (KME): Recommission Gravesend (2.7Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d)	2040	2040	2040	2036	2036	2036	2041	2041	2064
Interzonal transfer (KME-KTZ): KME-KTZ bi-directional (15.8Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (KMW-KME): Existing transfer (44.7Ml/d)	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (KMW-SHZ): Bewl Reservoir (35Ml/d) - existing	2026	2026	2026	2026	2026	2026	2026	2026	2026
Interzonal transfer (KTZ-KME): Existing transfer (14Ml/d)	2027	2027	2027	2027	2027	2027	2027	2027	2027
Interzonal transfer (KTZ-KME): Utilise full existing transfer capacity (9Ml/d)	2050	2040		2040	2040				
Recycling (KME): Sittingbourne industrial water reuse (7.5Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Recycling (KMW): Medway to lake (14Ml/d)	2031	2031	2031	2031	2031	2031	2031	2031	2031
Recycling (SHZ): Hastings to Darwell (15.3Ml/d)	2057			2051			2059		
Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d)	2040	2040	2042						
Storage (SHZ): Raising Bewl Reservoir .4m (3Ml/d)	2068			2061					

Demand management

We are looking to save 37.4Ml/d by 2050 through reduction in household and non-household consumption and 10.9Ml/d reduction in leakage by 2050 (Figure 7.20). WRSE has not considered separate demand profiles under the 1:100 DYAA and 1:500 DYAA scenarios, therefore there is a single profile of demand savings under both 1:100 DYAA and 1:500 DYAA scenarios.

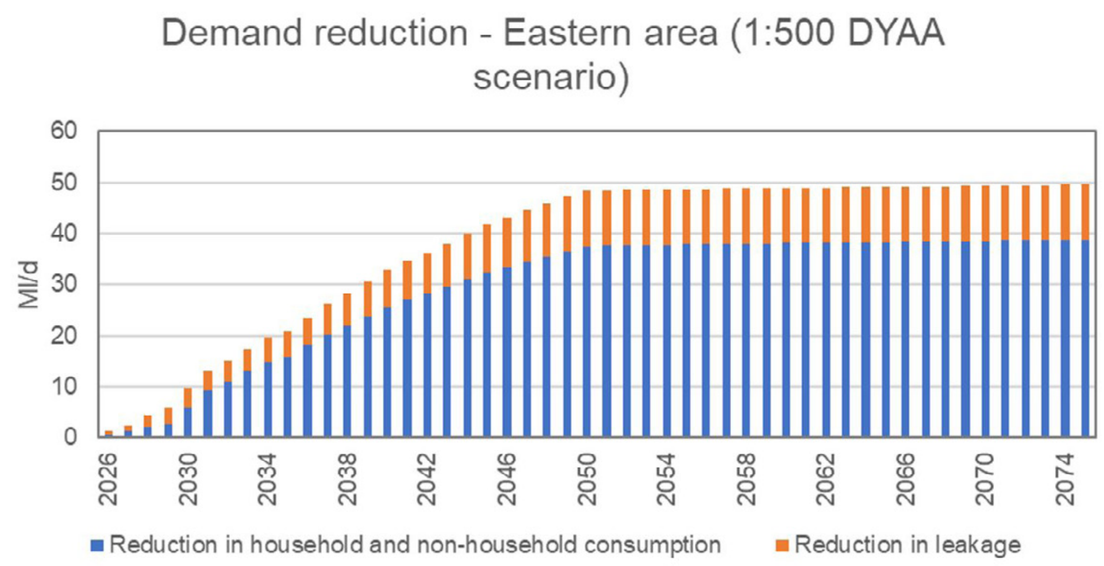


Figure 7.20: Reduction in total demand in the Eastern area

New supply options in the Eastern area up to 2050

In addition to demand management, our proposed solution for the Eastern area consists of a number of options to increase supply. Annex 15 provides their earliest selection in each supply-demand balance situation under each planning scenario and their utilisation under each of these over the planning period.

Asset enhancement (KMW): Remove network constraint at Longfield (13Ml/d) - A possible constraint in the supply network was identified when assessing the DO of KMW under the methodology adopted by WRSE. This will be further investigated to see if it is an actual constraint or a constraint in the model used to calculate DO. If the constraint is found to be real, it will be removed for the start of the planning period. Removal of this constraint provides a DO benefit of 13.3Ml/d in all situations under all planning scenarios. See Annex 15 for details.

Groundwater (KME): Recommission Gravesend (2.7Ml/d) - Gravesend source is a well-and-adit system that was decommissioned in 2007 due to high nitrate levels. A study in 2008 suggested that the nitrate problem was likely caused a faulty nitrate monitor and recommended a number of steps to return the source to service. This option is first selected in 2030-31 and is consistently used in all situations under NYAA, 1:100 DYAA and 1:500 DYAA conditions. Under 1:500 DYCP conditions, it is utilised in Situation 3 from 2050-51 and in Situation 6 from 2052-53. See Annex 15 for details.

Recycling (KMW): Medway to lake (14Ml/d) - This option is part of WRMP19 deliverables. It involves the transfer of treated effluent from Medway WTW to a nearby lake to serve as raw water storage reservoir. It was available to the IVM from 2027-28 but is first selected in 2030-31 under NYAA and 1:500 DYAA scenarios and in 2035-36 under the 1:100 DYAA scenario. It is not selected under the 1:500 DYCP scenario. Under 1:100 DYAA and 1:500 DYAA scenarios, it is continuously used in all situations from 2041-42 once supply-side drought permits and orders are no longer available (Table 7.49 and Table 7.50). The utilisation profile of this option in shown in Figure 7.21.

Table 7.49: Earliest selection of Recycling (KMW): Medway to lake (14Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:100 DYAA	2036	2036	2036	2040	2040	2041	2040	2041	2042
1:500 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYCP									

Table 7.50: Maximum utilisation (in Ml/d) of Recycling (KMW): Medway to lake (14Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
1:100 DYAA	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	12.9
1:500 DYAA	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
1:500 DYCP									

Recycling (KME): Sittingbourne industrial water reuse (7.5Ml/d) - This option is a reuse scheme to free up additional volume in a borehole licenced to an industrial user to allow for the licence to be traded with Southern Water. Groundwater is currently used in the industrial process which could be replaced by treated wastewater from Sittingbourne WTW. This option is first selected under all scenarios and in all situations from 2031. Its utilisation is limited to 1.5Ml/d under the 1:500 DYCP scenario (Table 7.51 and Table 7.52). The utilisation of this option is shown in Figure 7.22.

Table 7.51: Earliest selection of Recycling (KME): Sittingbourne industrial water reuse (7.5Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:100 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYAA	2031	2031	2031	2031	2031	2031	2031	2031	2031
1:500 DYCP	2031	2031	2031	2031	2031	2031	2031	2031	2031

Table 7.52: Maximum utilisation (in Ml/d) of Recycling (KME): Sittingbourne industrial water reuse (7.5Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
1:100 DYAA	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	1.5
1:500 DYAA	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	3.8
1:500 DYCP	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d) - This groundwater source is a well-and-adit system that is over 100 years old and has reached the end of its asset life. It abstracts from the Ashdown Beds. The option involves replacing some of the wells with boreholes. It is first selected in 2035-36 in situations 4-6 and later in other situations. It is only utilised under 1:500 DYCP scenario in situations 3 (from 2053-54) and 6 (from 2055-56). but is consistently used in situations 1-8 under NYAA, 1:100 DYAA and 1:500 DYAA conditions from 2040-41. Under these scenarios, it is used in Situation 9 from 2063-64. Under 1:500 DYCP scenario, it is only used in situations 3 (from 2053-54) and 6 (from 2055-56) (Table 7.53 and Table 7.54). Full utilisation of this option is given in Annex 15.

Table 7.53: Earliest selection of Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
DYCP	2040	2040	2040	2036	2036	2036	2041	2041	2064
1:100 DYAA	2040	2040	2040	2036	2036	2036	2041	2041	2064
1:500 DYAA	2040	2040	2040	2036	2036	2036	2041	2041	2064
1:500 DYCP			2054			2056			

Table 7.54: Maximum utilisation (in Ml/d) of Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
1:100 DYAA	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
1:500 DYAA	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
1:500 DYCP			1.5			1.5			

Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d) - This option proposes a new 8Ml/d water recycling plant producing a DO of 5.7Ml/d near Tonbridge WTW and a transfer of the treated water to Bewl Reservoir, which feeds into Darwell Reservoir. This option is only needed in situations 1-3 with earliest utilisation in 2035-36. It is not needed under 1:500 DYCP scenario. See Annex 15 for details.

Desalination (KMW): Thames Estuary (up to 40Ml/d) - This option proposes the development of a desalination plant at an identified site on the Swanscombe Peninsula. This option can be built in a modular fashion to provide up to 40Ml/d.

The earliest selected variant of this option is the 20Ml/d capacity plant which is selected from 2039-40 in all situations except situations 3 and 6. The maximum utilisation of this option under 1:500 DYCP scenario is 4.0Ml/d (Table 7.53 and Table 7.56). In the case of Situation 4, the additional 20Ml/d phase is also built in 2039-40, effectively building a 40Ml/d capacity plant from 2039-40. In situations 1, 5 and 7, the additional 20Ml/d capacity is built a year later in 2040-41 and in Situation 2, the doubling of capacity to 40Ml/d takes place in 2045-46 (Table 7.57). Utilisation remains low under 1:500 DYCP scenario (Table 7.58).

The 10Ml/d capacity variant is needed in situations 3 and 6 from 2040-41 (Table 7.59). The utilisation in these situations is lower under the 1:500 DYCP scenario as well (Table 7.60). This option is not needed in Situation 9 under any planning scenario. The combined utilisation profile of this option is shown in Figure 7.23.

Table 7.55: Earliest selection of Desalination (KMW): Thames Estuary (20Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2040	2040		2040	2040		2040	2040	
1:100 DYAA	2040	2040		2040	2040		2040	2040	
1:500 DYAA	2040	2040		2040	2040		2040	2040	
1:500 DYCP	2040	2040		2040	2040		2040	2040	

Table 7.56: Maximum utilisation (in Ml/d) of Desalination (KMW): Thames Estuary (20Ml/d) under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	20.0	20.0		20.0	20.0		20.0	20.0	
1:100 DYAA	20.0	20.0		20.0	20.0		20.0	20.0	
1:500 DYAA	20.0	20.0		20.0	20.0		20.0	20.0	
1:500 DYCP	4.0	4.0		4.0	4.0		4.0	4.0	

Table 7.57 Earliest selection of Desalination (KMW): Thames Estuary (20Ml/d) Phase 2 option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2041	2046		2040	2041		2041		
1:100 DYAA	2041	2046		2040	2041		2041		
1:500 DYAA	2041	2046		2040	2041		2041		
1:500 DYCP	2041	2046		2040	2041		2041		

Table 7.58: Maximum utilisation (in Ml/d) of Desalination (KMW): Thames Estuary (20Ml/d) Phase 2 option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	20.0	20.0		20.0	20.0		20.0		
1:100 DYAA	20.0	20.0		20.0	20.0		19.5		
1:500 DYAA	20.0	20.0		20.0	20.0		20.0		
1:500 DYCP	4.0	4.0		4.0	4.0		4.0		

Table 7.59: Earliest selection of Desalination (KMW): Thames Estuary (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA			2041			2041			
1:100 DYAA			2041			2041			
1:500 DYAA			2041			2041			
1:500 DYCP			2041			2041			

Table 7.60: Maximum utilisation (in Ml/d) of Desalination (KMW): Thames Estuary (10Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA			6.0			9.5			
1:100 DYAA			2.2			2.3			
1:500 DYAA			10.0			9.4			
1:500 DYCP			2.0			2.0			

Desalination (KME): Isle of Sheppey (up to 40Ml/d) - This option proposes a desalination plant at a site on the Isle of Sheppey. This option can be built in a modular fashion to provide up to 40Ml/d.

A 20Ml/d capacity variant is selected in 2040-41 in situations 2 and 5 and in 2045-46 in situations 1, 4, 7 and 8. It is not selected in situations 3, 6 and 9 (Table 7.61). Maximum utilisation of this selection, where selected, is lower under the 1:500 DYCP scenario (Table 7.62).

In situations 1, 2, 4 and 5, the capacity is increased to 30Ml/d by adding another 10Ml/d later. The additional capacity is added in 2062-63 in Situation 2, in 2064-65 in situations 4 and 5 and in 2069-70 in Situation 1 (Table 7.63). The additional capacity is not fully utilised in all cases (Table 7.64). The combined utilisation profile of this option is shown in Figure 7.24.

Table 7.61: Earliest selection of Desalination (KME): Isle of Sheppey (20Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2046	2041		2046	2041		2046	2046	
1:100 DYAA	2046	2041		2046	2041		2046	2046	
1:500 DYAA	2046	2041		2046	2041		2046	2046	
1:500 DYCP	2046	2041		2046	2041		2046	2046	

Table 7.62: Maximum utilisation (in Ml/d) of Desalination (KME): Isle of Sheppey (20Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	20.0	20.0		20.0	20.0		18.0	16.0	
1:100 DYAA	20.0	12.0		20.0	14.7		14.4	11.6	
1:500 DYAA	20.0	16.1		20.0	20.0		20.0	20.0	
1:500 DYCP	4.0	4.0		4.0	4.0		4.0	4.0	

Table 7.63. Earliest selection of Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2 option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2070	2063		2065	2065				
1:100 DYAA	2070	2063		2065	2065				
1:500 DYAA	2070	2063		2065	2065				
1:500 DYCP	2070	2063		2065	2065				

Table 7.64: Maximum utilisation (in Ml/d) of Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2 option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	10.0	5.1		8.2	4.8				
1:100 DYAA	10.0	2.0		8.3	2.0				
1:500 DYAA	10.0	2.0		10.0	10.0				
1:500 DYCP	2.0	2.0		2.0	2.0				

Desalination (KTZ): East Thanet (up to 40Ml/d) - This option would see a desalination plant constructed near the North Thanet Coast and would supply potable desalinated water to KTZ. This option can be built in a modular fashion to provide up to 40Ml/d. A 20Ml/d capacity plant is selected in 2040-41 in situations 1 and 4 and in 2069-70 in Situation 3 under all planning scenarios but with lower utilisation under 1:500 DYCP scenario (Table 7.65 and Table 7.66). A further 20Ml/d is needed from 2050-51 under all planning scenarios in Situation 1 only but with a maximum utilisation of 4Ml/d under 1:500 DYCP scenario. The combined utilisation profile of this option is shown in Figure 7.25.

Table 7.65: Earliest selection of Desalination (KTZ): East Thanet (20Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	2041		2070	2041					
1:100 DYAA	2041		2070	2041					
1:500 DYAA	2041		2070	2041					
1:500 DYCP	2041		2070	2041					

Table 7.66: Maximum utilisation (in Ml/d) of Desalination (KTZ): East Thanet (20Ml/d) option under each planning scenario

Planning scenario	Supply-demand balance situation								
	1	2	3	4	5	6	7	8	9
NYAA	20.0		4.0	18.2					
1:100 DYAA	20.0		4.0	15.2					
1:500 DYAA	20.0		12.1	20.0					
1:500 DYCP	4.0		4.0	4.0					

New bulk exports and interzonal transfers

Bulk export (KTZ): Southern to AZ7 (Deal) (4Ml/d) - This new bulk export is utilised from 2044-45 under 1:100 DYAA and 1:500 DYAA scenarios, from 2056-57 under NYAA conditions, and from 2066-67 under 1:500 DYCP conditions. See Annex 15 for details.

Bulk export (KTZ): Near Canterbury to Broad Oak (20Ml/d) - This bulk export to South East Water is first selected in 2049-50 in all scenarios except NYAA. It is utilised in most, but not all, situations under the 1:500 DYCP scenario. See Annex 15 for details.

Bulk export (KTZ): Near Canterbury to SEW Canterbury (20Ml/d) - This bulk export to South East Water is first selected in 2049-50 in all scenarios except DYCP. It is utilised in most, but not all, situations under the 1:500 DYCP scenario. See Annex 15 for details.

Bulk import (KTZ): SEW Canterbury to Near Canterbury (20Ml/d) - This option is first selected in 2049-50 under 1:100 DYAA, 1:500 DYAA and 1:500 DYCP scenarios. It is used in more situations under 1:500 DYAA and 1:500 DYCP conditions. It is not used under NYAA conditions. See Annex 15 for details.

Bulk import (SHZ): SEW RZ8 to Rye (10Ml/d) - This option is first selected in 2049-50 in Situation 4 under the NYAA scenario; it is also selected in Situation 5 in 2059-60 and Situation 6 in 2075. Under 1:100 DYAA and 1:500 DYAA scenarios it is selected in Situation 6 in 2074-75. See Annex 15 for details.

Bulk export (SHZ): Rye to SEW RZ8 (10Ml/d) - This bulk export is first selected in 2050-51. Under NYAA, 1:100 DYAA and 1:500 DYAA conditions, it is only utilised in situations 1, 4 and 7. Under 1:500 DYCP conditions, it is only selected in Situation 5. See Annex 15 for details.

Bulk import (KTZ): SEW Kingston to Near Canterbury (2Ml/d) - This bulk import from South East Water is utilised in all situations under all planning scenarios throughout the planning period, with lower utilisation under the 1:500 DYCP scenario. See Annex 15.

Existing bulk exports and transfers

Bulk export (KME): To SEW RZ6 from Hartlip (7.4Ml/d) - This existing bulk supply to South East Water is used until 2030, then not used until 2041. Thereafter it is only sporadically used under 1:100 DYCP, 1:500 DYCP and 1:500 DYCP scenarios. See Annex 15 for details.

Bulk export (KMW): To SEW RZ6 (0.5Ml/d) - This existing bulk export to South East Water is used until 2030, then not used until 2040-41. Thereafter it is only used sporadically under 1:100 DYAA, 1:500 DYAA and 1:500 DYCP scenarios. See Annex 15 for details.

Bulk export (KMW): To SEW RZ3 via Bewl Reservoir (8Ml/d) - This is an existing bulk export to South East Water and it utilised at maximum capacity in all situations under all planning scenarios throughout the planning period. See Annex 15 for details.

Bulk export (KTZ): SWS Deal to AFW AZ7 - This existing bulk export to South East Water is utilised in all situations under all planning scenarios throughout the planning period. See Annex 15 for details.

Bulk import (KTZ): AFW - existing (0.1Ml/d) - This existing bulk import from Affinity Water is utilised in all situations under all planning scenarios throughout the planning period. See Annex 15 for details.

Interzonal transfer (KTZ-KME): KME-KTZ bi-directional (15.8Ml/d) - This existing transfer is not used under 1:500 DYCP scenario until 2047-48. It is not used under any planning scenarios from 2030-31 to 2039-40. Post 2039-40, it is used more consistently in some situations than others. See Annex 15 for details.

Interzonal transfer (KMW-KME): Existing transfer (44.7Ml/d) - This existing transfer between KMW and KME is selected in all situations and planning scenarios and is utilised throughout the planning period but with much lower utilisation under the 1:500 DYCP conditions. See Annex 15 for details.

Interzonal transfer (KTZ-KME): Existing transfer (14Ml/d) - This transfer is used under 1:500 DYAA and 1:500 DYCP scenarios up to 2029-30 but is used more consistently under other scenarios thereafter. See Annex 15 for details.

Interzonal transfer (KTZ-KME): Utilise full existing capacity - This option is only used in a few years between 2039-40 and 2049-50 in some situations for a maximum benefit of 3.3Ml/d. It is not needed under 1:100 DYAA and the 1:500 DYCP scenario. See Annex 15 for details.

Existing drought options

Drought option - supply side (KMW): River Medway Scheme 1-4 (17Ml/d) - This option is used under 1:100 DYAA and 1:500 DYAA planning scenarios until 2040-41. See Annex 15 for details.

Options selected post 2050

Recycling (SHZ): Hastings WTW to Darwell Reservoir (15.3Ml/d) - This option proposes the transfer of treated effluent from Hastings WTW, currently being discharged to sea, to augment storage in Darwell Reservoir. This option includes tertiary treatment of wastewater from Hastings WTW. Additional treatment may be required at Rye WSW. This option is first selected in 2050-51. It is utilised in Situation 1 (from 2056-57), Situation 4 (from 2050-51) and Situation 7 (2058-59) under NYAA, 1:100 DYAA and 1:500 DYAA scenarios. It is not utilised under 1:500 DYCP scenario. See Annex 15 for details.

Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d) - The scheme involves the raising of Bewl Water by 0.4m to increase storage and yield. The required works include raising the dam crest and building new wave wall, raising overflow and valve chamber shafts and ancillary works around the perimeter of the reservoir. This option is only selected under 1:500 DYAA scenario in Situation 4 (from 2060-61) and in Situation 1 (from 2067-68). It is not otherwise selected. See Annex 15 for details.

Bulk export (KMW): Near Rochester to RZ6 - This bulk export to South East Water is selected in 2074-75 under NYAA and 1:500 DYAA conditions in Situation 7 only. See Annex 15 for details.

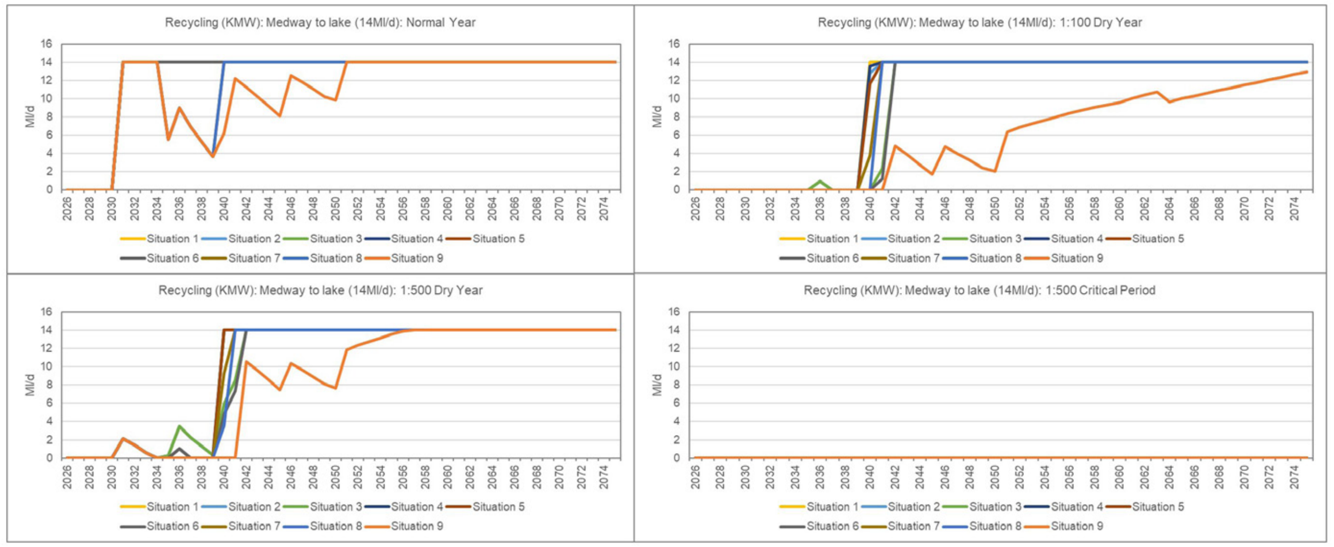


Figure 7.21: Utilisation of Medway recycling option in KMW in each supply-demand balance situation under each planning scenario

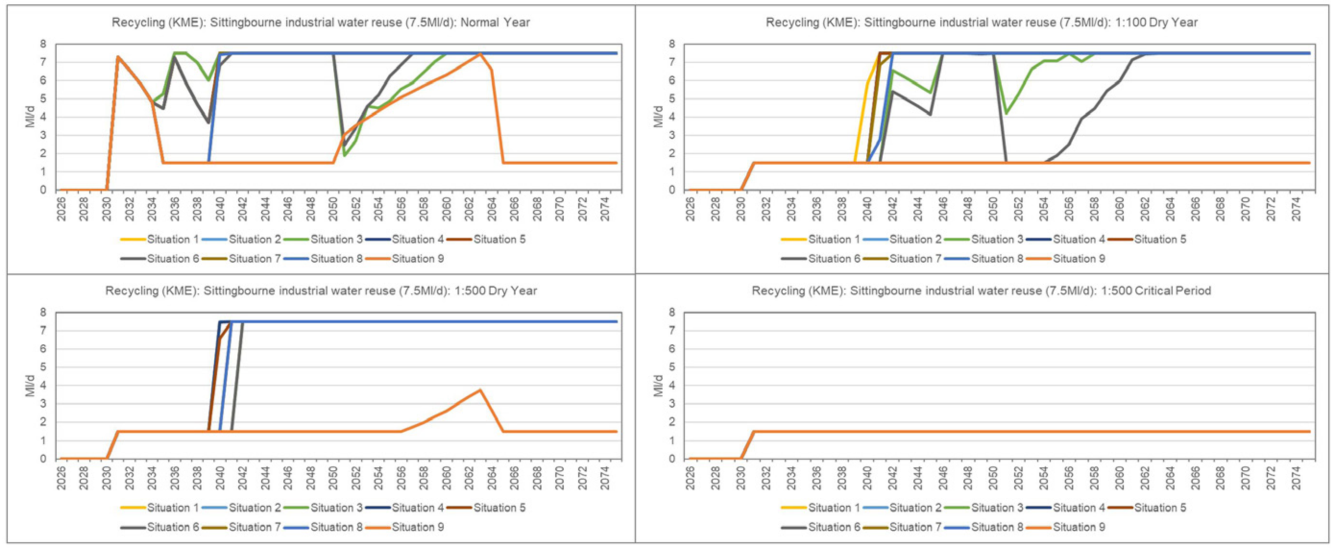


Figure 7.22: Utilisation of Sittingbourne industrial water reuse option in KME in each supply-demand balance situation under each planning scenario

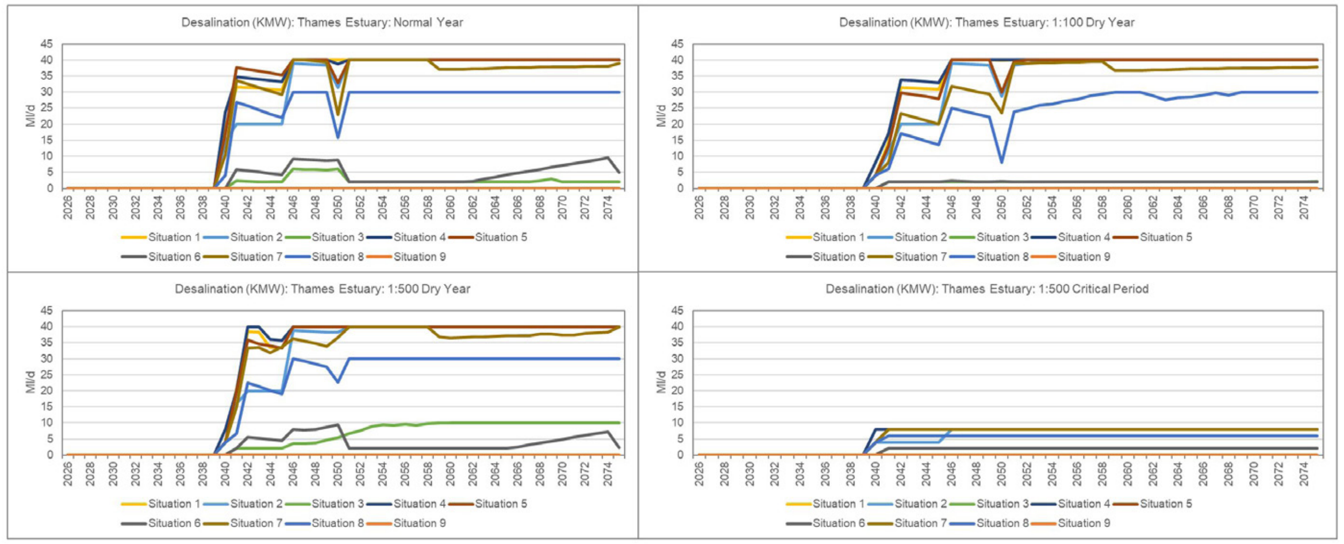


Figure 7.23: Utilisation profile of the Thames Estuary desalination option in each supply-demand balance situation under each planning scenario

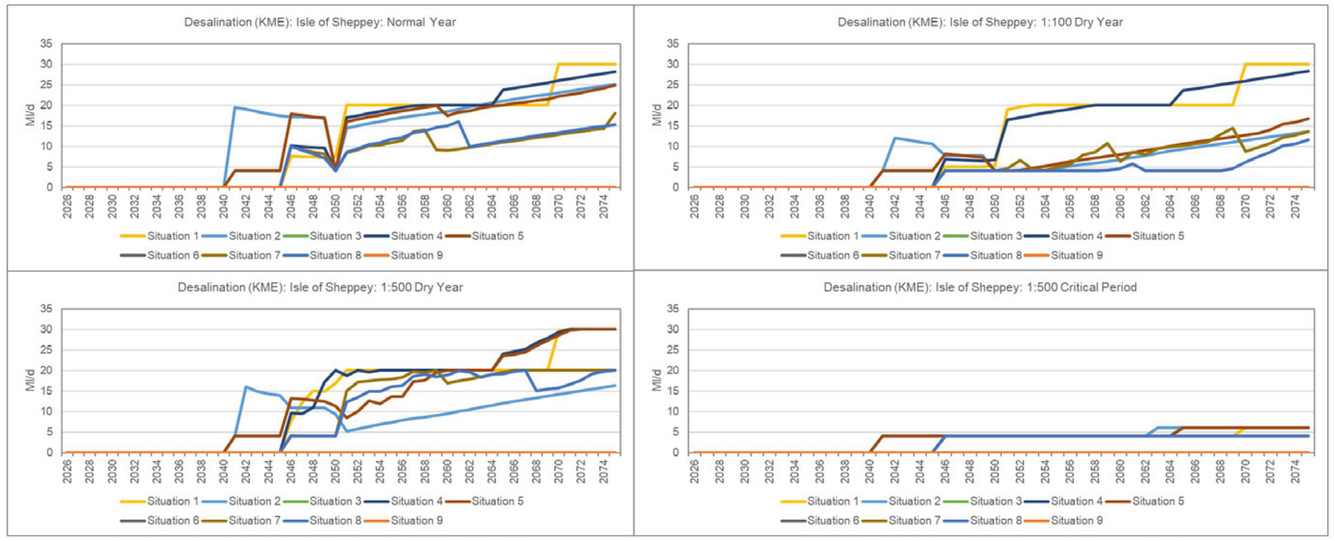


Figure 7.24: Utilisation profile of the Isle of Sheppey desalination option in each supply-demand balance situation under each planning scenario

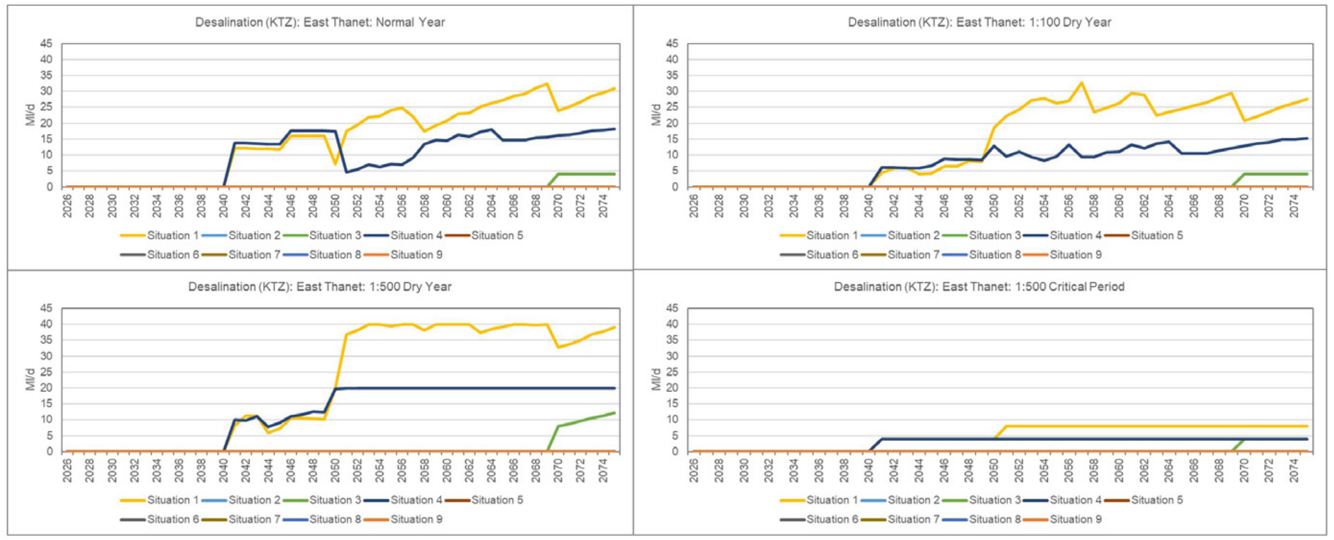


Figure 7.25: Utilisation profile of the East Thanet desalination option in each supply-demand balance situation under each planning scenario

7.3 'What If' sensitivity test scenarios and policy choices

We tested our plan against a number of scenarios. Some of the testing was done at the regional level while we conducted some tests specifically on our plan. The sensitivity testing at the regional level was mainly carried out under least-cost setting in order to remove the constraints on the IVM in selecting alternatives.

7.3.1 Sensitivity testing at the regional scale

In addition to the testing that was carried out to develop the regional BVP, WRSE carried out some additional IVM runs to test alternative dates for achieving 1:500 drought resilience and alternative savings profiles from government-led initiatives. The Regional Plan is in the process of being updated and these sensitivity runs will be repeated once the that has been done. Results below are taken from the rdRBVP that was published in August 2023. The results from the updated Regional Plan will be included in our final WRMP24.

Timing for achieving 1:500 drought resilience

We looked at the impact of delaying the achievement of 1:500 drought resilience to 2045 (scenario D1), 2050 (scenario D2) and 2075 (scenario D3). A comparison of the results, in terms of earliest scheme selection (excluding drought options) up to 2049-50 is shown in Table 7.67.

Table 7.67: Differences in the earliest scheme selection between the Regional Least Cost Plan (RLCP) and the scenarios delaying the achievement of 1:500 drought resilience to 2045 (D1), 2050 (D2) and 2075 (D3). Only schemes selected up to 2050 are considered

Option	Earliest selection year			
	RCLP	D1	D2	D3
Bulk import (HAZ): T2ST to Andover (20Ml/d)	2048	2049	2044	2044
Bulk import (SHZ): SEW RZ8 to Rye (10Ml/d)	2050	2060	2052	2070
Desalination (KTZ): East Thanet (up to 40Ml/d)	2041	2041	2046	2046
Interzonal transfer (KTZ-KME): Utilise full existing transfer capacity (9Ml/d)	2039	2040	2040	2040
Interzonal transfer (SBZ-SWZ): Brighton to Worthing	2042	2047	2052	Not selected
Interzonal transfer (SWZ-SBZ): V6 valve additional capacity (13Ml/d)	2026	2026	2027	2026
Recycling (SHZ): Tunbridge Wells with Bewl Reservoir (3.6Ml/d)	2036	2036	2036	2072
Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)	2057	2044	2057	2051
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2042	2046	2046	2046

The key impacts of delaying the attainment of 1:500 drought resilience are:

- Bulk import from South East Water to Rye is delayed by 2 to 10 years.
- East Thanet desalination option is delayed by 5 years.
- Interzonal transfer between Brighton and Worthing is either delayed by 5 to 10 years or not needed at all.
- Horsham WTW recycling option is brought forward by 6 to 13 years.
- Rive Adur Offline Reservoir is delayed by 4 years.

Savings in household consumption associated with government-led interventions

Following consultation feedback from the Environment Agency on our dWRMP24, we have included government-led household demand reductions in our demand management strategy, and they deliver the bulk of savings in household demand by 2049-50 (see Figure 7.6).

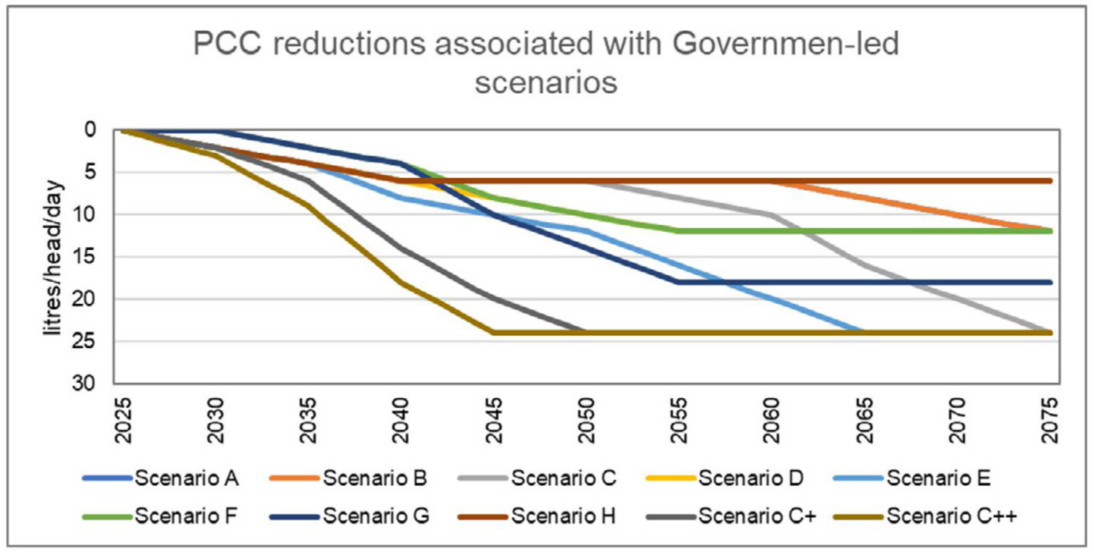
WRSE has developed a number of PCC reduction profiles based on the work commissioned by Water UK[53] as shown in Table 7.68 and Figure 7.26.

Table 7.68: PCC reductions associated with government-led demand reduction profiles developed by WRSE

Scenario	Reduction in PCC (l/h/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
A	2	4	6	6	6	6	6	8	10	12
B	2	4	6	6	6	6	6	8	10	12
C	2	4	6	6	6	8	10	16	20	24
D	2	4	6	8	10	12	12	12	12	12
E	2	4	8	10	12	16	20	24	24	24
F	0	2	4	8	10	12	12	12	12	12
G	0	2	4	10	14	18	18	18	18	18
H	2	4	6	6	6	6	6	6	6	6
C+	2	6	14	20	24	24	24	24	24	24
C++	3	9	18	24	24	24	24	24	24	24

[53] Artesia, 2019. Pathways to long-term PCC reduction. Ref. AR1286

Figure 7.26: Profiles of PCC reduction associated with government-led scenarios



WRSE has adopted C+ scenario (24l/h/d reduction in PCC by 2049-50) as the default PCC reduction profile for government-led interventions.

In order to test the uncertainty associated with delivery of government-led scenario C+, we have tested different profiles of government-led savings.

- **Scenario B**
  - Slight deficit in the Western area in 2036-37 (3.2Ml/d), 2062-63 (0.5Ml/d) and 2063-64 (1.5Ml/d) in Situation 1 under 1:100 DYAA scenario only.
  - Deficits in bulk supply to a large industrial user in Hampshire in 2036-37 (up to 3.3Ml/d) in multiple situations and from 2064-65 to 2067-68 in Situation 1 under 1:100 DYAA conditions.
- **Scenario D**
  - Deficits in the Western area in 2036-37 (up to 3.3Ml/d) in situations 1 and 3 and in 2070-71 in Situation 1 (1.5Ml/d) under 1:100 DYAA scenario.
  - Deficits in the bulk supply to an industrial user in Hampshire in situations 1, 2 and 4 in 2036-37 (up to 3.3Ml/d) and in Situation 1 in 2071-72 under 1:100 DYAA scenario.
- **Scenario E**
  - Deficits in bulk supply to a large industrial user in Hampshire in 2036-37 (up to 2.5Ml/d) in situations 1-6 under the 1:100 DYAA scenario.
- **Scenario F**
  - Small deficits in the Eastern area in 2030-31 (0.8Ml/d) in all situations and in 2035-36 and 2036-37 (up to 0.5Ml/d) in situations 1-3 under NYAA scenario.
  - 4.7Ml/d deficit in the Western area in 2030-31 in Situation 5 under 1:100 DYAA scenario and in 2070-71 (1.5Ml/d) in Situation 1.
  - Deficits in bulk supply to a large industrial user in Hampshire in 2036-37 (up to 5.3Ml/d) in situations 1, 2, 3, 4 and 6 and in Situation 1 in 2071-72 (3.3Ml/d) under 1:100 DYAA scenario.
- **Scenario G**
  - Similar to Scenario F.
- **Scenario H**
  - Deficits in the Western area in 2059-60 (1.8Ml/d) in Situation 1 and in 2073-74 and 2074-75 (up to 1Ml/d) under 1:100 DYAA scenario.
  - Deficits in bulk supply to a large industrial user in Hampshire in 2036-37 (up to 3.3Ml/d) in situations 1-6 and in 2060-61 to 2062-63 (up to 8.8Ml/d) under 1:100 DYAA scenario.

The above only apply to Southern Water supply area. There are additional deficits in other companies' supply areas.

IVM runs with deficits are not fully optimal but based on the results above, shifting from C+ scenario to any of the other government-led savings profile does not lead to continuous unresolved deficits in Southern Water supply area before 2049-50. The majority of the deficits occur in isolated years and in specific situations. With the exception of scenarios F and G, the deficits in other scenarios occur under 1:100 DYAA conditions.

7.3.2 Sensitivity tests specific to Southern Water

As part of the design of our plan, we undertook stress testing and sensitivity analysis to help us to identify and understand the assumptions and factors that have the greatest influence on our plan.

As part of our sensitivity analysis, we examined uncertainties around delivery of supply options, volumes associated with bulk supplies, timing of introducing sustainability reductions and reductions associated with company led demand management initiatives. We also considered specific scenarios which were requested by the Environment Agency in their representation to our interim rdWRMP24. The sensitivity runs are summarised in Table 7.69. The results fall into three main categories.

1. **Changes that resolve supply-demand balance through an alternative solution.** These include:

- Delaying first year of benefit from Sandown recycling option to 2034-35 from 2030-31 (see S3 in Table 7.69)
- Delaying first year of benefit from the 21Ml/d bulk import from Portsmouth Water (linked to development of Havant Thicket Reservoir) to Otterbourne WSW to 2034-35 from 2030-31 (see S4 in Table 7.69)
- Delaying first year of benefit from Sandown recycling option and the 21Ml/d bulk import from Portsmouth Water (linked to development of Havant Thicket Reservoir) to Otterbourne WSW to 2034-35 from 2030-31 (see S5 in Table 7.69)
- Reducing bulk import from Portsmouth Water to Pulborough WSW from 15Ml/d to 10Ml/d in SNZ under all planning scenarios (see S6 in Table 7.69)
- Reducing bulk import from Portsmouth Water to Pulborough WSW from 15Ml/d to 5Ml/d in SNZ under all planning scenarios (see S7 in Table 7.69)
- Reducing bulk import from Portsmouth Water to Pulborough WSW from 15Ml/d to 2.5Ml/d in SNZ under NYAA scenario (see S8 in Table 7.69)
- Bringing forward implementation of Environmental Destination in SWZ to 2030-31 (see S9 in Table 7.69)
- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d (see S10 in Table 7.69)
- Reducing Pulborough groundwater DO in SNZ from 13Ml/d to 5.55Ml/d from 2025 followed by full revocation from 2030-31 (see S11 and S23 in Table 7.69)

2. **Changes that result in supply-demand balance deficits that are either too small and/or appear post 2050 allowing sufficient time to be resolved.** These are:

- Reducing benefit from Littlehampton recycling option to 12.5Ml/d from 15Ml/d and excluding Lewes Road groundwater option in SNZ (see S12 in Table 7.69)
- Reducing benefit from Littlehampton recycling option to 12.5Ml/d from 15Ml/d and excluding Lewes Road, Petworth, Petersfield and West Chiltington groundwater options (see S13 in Table 7.69)
- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d; not delivering Petersfield and West Chiltington groundwater options in SNZ and removing River Adur Offline Reservoir in SNZ (see S14 in Table 7.69)
- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d while excluding Petersfield and West Chiltington groundwater options in SNZ and removing Isle of Sheppey desalination option in KME (see S15 in Table 7.69)
- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d while excluding Petersfield and West Chiltington groundwater options in SNZ and removing Thames Estuary desalination option in KMW (see S16 in Table 7.69)
- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d while excluding Petersfield and West Chiltington groundwater options in SNZ and removing East Thanet desalination option in KTZ (see S17 in Table 7.69)

3. **Changes that result in supply-demand balance deficits that are either too big to be resolved with existing options and/or appear early in the planning period allowing insufficient time for alternatives to be developed.** These are:

- Reducing bulk import of water from Portsmouth Water to Otterbourne WSW to 2.5Ml/d from 21Ml/d under NYAA conditions (see S18 in Table 7.69)
- Delaying first year of benefit from HWTWRP to 2039-40 from 2034-35 without extending drought options in the Hampshire area (see S19 in Table 7.69)
- Delaying first year of benefit from HWTWRP to 2039-40 from 2034-35 and extending drought options in the Hampshire area (see S20 in Table 7.69)
- Reducing Pulborough groundwater DO in SNZ from 13Ml/d to 5.55Ml/d from 2025 followed by full revocation from 2030-31 and early implementation of CSMG guidelines on the River Itchen licence (see S21 in Table 7.69)
- Early implementation of CSMG guidelines on the River Itchen (see S22 in Table 7.69)
- Early implementation of stricter HoF conditions on the River Itchen (see S23 in Table 7.69)
- Reducing DO benefit from River Medway recycling option to 10Ml/d from 14Ml/d (see S24 in Table 7.69)
- Delaying first year of benefit from the Sittingbourne recycling option to 2034-35 from 2030-31 (see S25 in Table 7.69)
- Delaying first year of benefit from all recycling options to 2034-35 (see S26 in Table 7.69)
- Excluding all groundwater options except Newbury (HKZ), Test MAR (HSE), Petersfield (SNZ) and West Chiltington (SNZ) (see S27 in Table 7.69)
- 75% savings from company demand-management initiatives i.e. 25% lower, compared to original assumption (see S28 in Table 7.69)

Some key settings were also changed for various IVM runs. There are also included in Table 7.69 to facilitate a clearer comparison with the preferred plan.

In summary, a key factor in our proposed Western area strategy is the status of Candover and River Test drought options post 2030-31. If these drought options continue to be available until 2033-34, delays to the delivery of Havant Thicket Reservoir and/or Sandown recycling option until 2033-34 can be accommodated. On the other hand, delays to HWTWRP beyond 2033-34 lead to unresolved deficits, even when drought options are extended. This is because there is a major reduction in WAFU in from 2035-36 due to Environmental Destination, which leads to deficits under NYAA conditions.

In the Central area, supply-demand balance can be achieved by maintaining bulk import from SES Water into SNZ at its current volume of 1.3Ml/d and without delivering Petersfield and West Chiltington groundwater options in SNZ. However, increasing the bulk import from SES Water to 4Ml/d and delivering Petersfield and West Chiltington adds resilience to system and provides a cushion against reduced DO from the Littlehampton recycling option and non-delivery of Petworth and Lewes Road groundwater options.

The River Medway and Sittingbourne recycling options are needed to maintain supply-demand balance in the Eastern area. Our preferred strategy for the Eastern are includes three desalination options. There is however time available to develop alternative solutions, such as building a much larger desalination plant jointly with Affinity Water and/or South East Water as a regional solution, instead of multiple smaller desalination plants built separately by the three companies. We have started discussions with Affinity Water, South East Water to explore these options for WRMP29.

Delivering our demand management programme is of key importance. We have no control over the delivery of government-led initiatives and their associated benefits. Savings from company-led initiatives are largely based on data from the wider industry and represent our best estimates. These may be refined as we progress the delivery of our demand management initiatives. Achieving demand reduction targets set by the government is one of the key risks in our plan.

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S1	Preferred plan	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		
S2	Least cost plan	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• Bulk export from HWZ to Kennet Valley takes place in 2041-42 instead of 2049-50 • East Thanet 20Ml/d Phase 2 desalination option (KTZ) is first required in 2056-57 instead of 2049-50 • River Arun 20Ml/d desalination option is first needed from 2045-46 instead of 2040-41 • Chilbolton groundwater option (HAZ) is first needed from 2067-68 instead of 2072-73 • Tunbridge Wells recycling option (SHZ) is selected from 2035-36 instead of Tonbridge recycling option (SHZ) • Horsham recycling option (SNZ) is first needed from 2049-50 instead of 2057-58 • Raising Bewl Reservoir is needed from 2054-55 instead of 2060-61 • River Adur Offline Reservoir is needed from 2041-42 instead of 2045-46
S3	Delay the first year of benefit from Sandown recycling option to 2034-35	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order not available after 2033-34 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios • Western Rother licence change and farm storage option (SNZ) available	Yes		• Weir Wood Reservoir (SWZ), North Arundel (SWZ) and East Worthing (SWZ) drought options selected from 2030-31; these options are not selected in the preferred plan • Eastern Yar drought option (IOW) first selected from 2036-37; it's not selected in the preferred plan • Interzonal transfer between Andover and Kingsclere (10Ml/d) is needed from 2036-37 instead of 2049-50 • The need for interzonal transfer between Andover and Winchester (15Ml/d) is pushed back to 2034-35 instead of 2030-31 • Horsham recycling option (SNZ) is first needed in 2059-60 instead of 2057-58 • River Adur Offline Reservoir (SWZ) is needed from 2041-42 instead of 2045-46 • Western Rother licence change and farm storage option (SNZ) is needed from 2039-40
S4	Delay the first year of benefit from Havant Thicket Reservoir to 2034-35	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• River Arun desalination (SWZ) 10Ml/d variant selected in 2044-45 instead of 2045-46 • River Arun desalination (SWZ) 10Ml/d Phase 2 variant selected in 2060-61; this is not selected in the preferred plan • Interzonal transfer between Andover and Kingsclere (10Ml/d) selected from 2031-32 instead of 2049-50 • Horsham recycling option (SWZ) selected from 2041-42 instead of 2057-58

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

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Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S5	Delay the first year of benefit from Havant Thicket Reservoir and Sandown recycling option to 2034-35	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order not available after 2033-34 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios • Western Rother licence change and farm storage option (SNZ) available	Yes		• Weir Wood Reservoir (SWZ), North Arundel (SWZ) and East Worthing (SWZ) drought options selected from 2030-31; these options are not selected in the preferred plan • Eastern Yar drought option (IOW) first selected from 2036-37; it's not selected in the preferred plan • Interzonal transfer between Andover and Kingsclere (10Ml/d) is needed from 2036-37 instead of 2049-50 • The need for interzonal transfer between Andover and Winchester (15Ml/d) is pushed back to 2034-35 instead of 2030-31 • Horsham recycling option (SNZ) is first needed in 2059-60 instead of 2057-58 • River Adur Offline Reservoir (SWZ) is needed from 2041-42 instead of 2045-46 • Western Rother licence change and farm storage option (SNZ) is needed from 2039-40
S6	Reduce bulk import from Portsmouth Water to Pulborough to 10Ml/d under all planning scenarios	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• East Worthing (SWZ) drought option selected in 2031; this option is not selected in the preferred plan

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S7	Reduce bulk import from Portsmouth Water to Pulborough to 5Ml/d under all planning scenarios	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• Weir Wood Reservoir (SWZ), North Arundel (SWZ) and East Worthing (SWZ) drought options selected from 2030-31; these options are not selected in the preferred plan. • Eastern Yar drought scheme (IOW) selected from 2036-37
S8	Reduce bulk import from Portsmouth Water to Pulborough to 2.5Ml/d under NYAA scenario	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• River Arun desalination (SWZ) 20Ml/d is needed from 2045-46 instead of 2040-41 • Chilbolton groundwater option is needed from 2054-55 instead of 2072-73 • Interzonal transfer between Andover and Kingsclere (10Ml/d) is needed from 2036-37 instead of 2049-50 • Horsham recycling option (SNZ) is first needed from 2039-40 instead of 2057-58 • River Adur Offline Reservoir (SWZ) is needed from 2040-41 instead of 2045-46

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S9	Implementation of Environmental Destination in SWZ by 2030-31	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• 10Ml/d variant of River Arun desalination option (SWZ) delayed to 2069-70 from 2045-46 • 20Ml/d variant of River Arun desalination option (SWZ) delayed to 2045-46 from 2040-41 • North Arundel (SWZ) and East Worthing (SWZ) drought options selected from 2030-31 • River Adur Offline Reservoir brought to provide benefit from 2041-42 instead of 2045-46
S10	Reduce bulk import from SES Water through rezoning to 1.3Ml/d	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• Eastern Yar3 (IOW) groundwater option is first needed in 2035-36 instead of 2039-40 • The Andover to Kingsclere bi-directional transfer in the Western area is needed from 2046-47 instead of 2049-50 • The Winchester to Andover bi-directional transfer in the Western area is needed from 2034-35 instead of 2030-31 • East Worthing (SWZ), North Arundel (SWZ) and Weir Wood (SWZ) drought options selected from 2030-31; these are not needed in the preferred plan • Petworth groundwater option (SNZ) is first needed from 2039-40 instead of 2030-31 • Horsham recycling option (SNZ) is first needed from 2051-52 instead of 2057-58 • Pulborough winter transfer stage 1 (SNZ) is need from 2030-31 instead of 2040-41
S11	Reduction in Pulborough groundwater DO from 13Ml/d to 5.55Ml/d from 2025 followed by full revocation from 2030-31	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	Yes		• Bidirectional interzonal transfer between HAZ and HWZ first needed in 2034-35 instead of 2030-31 • Bidirectional interzonal transfer between HAZ and HKZ first needed in 2036-37 instead of 2049-50 • Eastern Yar (IOW) and East Worthing (SWZ) drought options selected in 2030-31; not selected in the preferred plan • Petworth groundwater option (SNZ) selected in 2039-40 • Expansion in Romsey Town and Broadlands valve (HRZ) first needed in 2034-35 instead of 2030-31 • Horsham recycling option (SNZ) first needed in 2039-40 instead of 2057-58 • River Adur Offline Reservoir first needed in 2041-42 instead of 2045-46
S12	Reduce benefit from Littlehampton recycling option to 12.5Ml/d and exclude Lewes Road groundwater option	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	Yes	• No deficits in Southern Water supply area. Minor deficits in Portsmouth Water supply area post 2061-62 to 2062-63 in Situation 1 under 1:500 DYAA conditions

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S13	Reduce benefit from Littlehampton recycling option to 12.5Ml/d and exclude Lewes Road and Petworth groundwater options	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • Petersfield (SNZ) and West Chiltington (SNZ) groundwater options excluded • SES bulk import through rezoning available at 1.3Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	Yes	• Deficits in SBZ in 2030-31 and 2031-32 under 1:500 DYAA conditions in all situations
S14	River Adur Offline Reservoir excluded	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	Yes	• No deficit in Southern Water supply area except a minor (0.2Ml/d) deficit in HAZ in 2069 in Situation 1 under NYAA conditions • Significant deficits in Portsmouth Water supply area post 2050

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S15	Isle of Sheppey desalination option (KME) excluded	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Petersfield (SNZ) and West Chiltington (SNZ) groundwater options excluded • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	Yes	• Significant deficits in KME Situation 1 only post 2049-40 under NYAA 1:100 DYAA and 1:500 DYAA conditions • Minor deficit (0.1Ml/d) in KTZ in 2062-63 in Situation 1 under NYAA conditions
S16	Thames Estuary desalination option (KMW) excluded	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Petersfield (SNZ) and West Chiltington (SNZ) groundwater options excluded • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	Yes	• Deficits in KMW post 2049-50 in situations 1, 2, 4 and 5 under NYAA and 1:100 DYAA conditions

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S17	East Thanet desalination option (KTZ) excluded	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Petersfield (SNZ) and West Chiltington (SNZ) groundwater options excluded • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	Yes	• Deficits in KME post 2051-52 in Situation 1 under 1:100 DYAA scenario and in situations 1 and 4 under 1:500 DYAA scenario • Deficits in KTZ post 2055-56 in Situation 1 under NYAA conditions; isolated deficits in Situation 1 in 2056-57 (1:500 DYAA scenario) and 2074-75 (1:100 DYAA scenario)
S18	Reduce bulk import of water from Portsmouth Water to HSE to 2.5Ml/d under NYAA conditions	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Deficits in HSE from 2025-26 to 2027-28 in all situations under NYAA conditions

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S19	Delay HWTWRP (HSE) to 2039-40 without further extending Hampshire drought options	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order not available after 2033-34 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios • Western Rother licence change and farm storage option (SNZ) available	No	No	• Deficits in HSE under NYAA conditions from 2035-36 to 2036-37 (all situations), 2037-38 (situations 16) and 2038-39 (situations 1-3, 9) • Deficits in HSW under 1:100 DYAA conditions from 2034-35 to 2036-37 (all situations), 2037-38 to 2038-39 (situations 1-3, 6-9) • Deficits in HWZ under NYAA conditions in 2037-38 (situations 6-9) and 2038-39 (situations 4-8)
S20	Delaying HWTWRP (HSE) to 2039-40 and extending the Candover and River Test drought options to 2039-40	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500	No	No	• Deficits in HSE from 2035-36 to 2038-39 in all situations under NYAA scenario

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S21	Reduction in Pulborough groundwater DO from 13Ml/d to 5.55Ml/d from 2025 followed by full revocation from 2030-31 and CSMG flow standards for the Lower Itchen license	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• No deficits in the Central area • Deficits in HSE 2025-26 to 2027-28 in all situations under 1:100 DYAA and 1:500 DYAA conditions in situations 1-9 followed but further deficits in 2030-31 under 1:100 DYAA conditions in 2030-31 • A few isolated years of unresolved deficits in HSW post 2033-35 under 1:100 DYAA conditions; no deficits post 2039-40
S22	Implementation of CSMG flow standards on the Lower Itchen licence	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Deficits in HSE from 2025-26 to 2027-28 under 1:100 DYAA conditions in all situations • Bulk export to large industrial user not met from 2034-35 to 2038-39 under 1:100 conditions in all situations • Deficit in HSW in 2036-37 under 1:100 DYAA conditions • Deficits in HSE from 2025-26 to 2027-28 under 1:500 DYCP conditions in all situations

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S23	Implementation of stricter HoF conditions on the River Itchen from 2025-26 under high Environmental Destination scenario	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Deficits in HSE from 2025-26 to 2027-28 under 1:100 DYAA conditions in all situations • Bulk export to large industrial user not met from 2034-35 to 2038-39 under 1:100 conditions in all situations • Deficit in HSW in 2036-37 under 1:100 DYAA conditions • Deficits in HSE from 2025-26 to 2027-28 under 1:500 DYCP conditions in all situations
S24	Benefit from Medway recycling option reduced from 14Ml/d to 10Ml/d	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Minor deficits (0.2Ml/d) in KMW under NYAA conditions in situations 1-3 in 2035-36 only • Deficits (2.6Ml/d) in KTZ under NYAA conditions in 2030-31 in all situations; no further deficits

Table 7.69: The IVM runs used for developing and testing our rdWRMP24

Scenario number	Scenario name	Key settings	Deficit free?	Potential to resolve?	Comparison with the preferred plan (where deficit free)
S25	Delaying first year of benefit from Sittingbourne recycling option to 2034-35 from 2030-31	• Chilbolton (HAZ), Romsey (HRZ), Kings Sombourne (HRZ), Easter Yar3 (IOW) and Newchurch (IOW) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 1.3Ml/d • Candover Drought Order not available after 2030-31 • River Test Drought Permit/Order available up to 2033-34 at 80Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order available under all drought conditions up to 2040-41 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Deficits in KME in 2036-37 under NYAA conditions in situations 5 and 6 • Deficits in KME in 2030-31 and 2031-32 in all situations under NYAA conditions • Deficits in KTZ in 2035-36 in situations 1-6 and in 2036-37 in situations 1-4 under NYAA conditions
S26	First year of benefit for all water recycling options delayed to 2034-35	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Deficits in SNZ in 2030-31 under 1:100 DYAA conditions (1.6Ml/d) in situations 1-3 and situations 6-9 and under 1:500 DYAA conditions (3.1Ml/d) in all situations. • Deficits (1.6Ml/d) in SBZ in 2030-31 in situations 4-6 under 1:100 DYAA conditions and in 2031-32 (0.5Ml/d) in all situations under 1:500 DYAA conditions • Small deficits (0.2Ml/d) in KME in 2031-32 under NYAA conditions • Significant deficits (20.1Ml/d) in KMW in 2031-32 under NYAA conditions
S27	Exclude all groundwater options except Newbury (HKZ),Test MAR (HSE), Petersfield (SNZ) and West Chiltington (SNZ)	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Unresolved deficits in HSW under 1:100 DYAA conditions in situations 3-5 in 2038-39 • Unresolved deficits in KMW in isolated years post 2051-52 in Situation 9 (NYAA) and situations 3, 5 and 6 under 1:500 DYAA conditions • Unresolved deficits in KMW under NYAA conditions (2029-30 to 2031-32) in all situations becoming less frequent in subsequent years • Isolated years with deficits under NYAA and 1:500 DYAA conditions post 2038-39 in KTZ • Few isolated years of unresolved deficits post 2047-48 under 1:500 DYAA conditions in SHZ
S28	Demand savings from company initiatives are 75% of the original estimate	• Petersfield (SNZ) and West Chiltington (SNZ) groundwater options preselected from 2028-29 • Romsey (HRZ), Kings Sombourne (HRZ) and Petworth (SNZ) groundwater options pre-selected from 2030-31 • SES bulk import through rezoning available at 4Ml/d • Candover Drought Order available up to 2033-34 in all drought scenarios • River Test Drought Permit/Order available up to 2033-34 at 14Ml/d in droughts less severe than 1:500 • Pulborough surface water Drought Permit/Order unavailable after 2029-30 in droughts less severe than 1:500 • Sea tankering from Norway pre-selected from 2030-31 to 2033-34 in all drought scenarios	No	No	• Minor deficit (0.2Ml/d) on the IOW in 2037 in Situation 4 under 1:100 DYAA conditions • Small (less than 0.4Ml/d) deficits in KME under 1:500 DYAA in Situation 6 in 2041-42 to 2043-44; further deficits post 2050 mainly in Situation 9 under NYAA and 1:500 DYAA conditions • Deficits in all situations under NYAA conditions in KMW from 2030-31 to 2033-34 which remain in some situations up to 2041-42; mainly isolated deficits thereafter • Deficits in some situations post 2038-39 under NYAA and 1:500 DYAA conditions in KTZ

7.3.3 Least cost plan

As mentioned in Section 7.1.3, we have developed a least-cost plan (SLCP). Table 7.2 and Table 7.3 provide a comparison of SLCP with SBVP. The complete list of options selected in the SLCP along with their earliest selection years and utilisation is given in Annex 15.

7.3.4 Alternative plan including optimised social and environmental metrics

As part of the Regional Plan development, we also developed two alternative plans by:

- optimising on resilience metrics (RESIL), and
- optimising on social and environmental metrics (ENVSOC).

The alternative plans do not have the revised dates for Littlehampton and Sandown recycling options, HWTWRP and Havant Thicket Reservoir. The results are therefore directly comparable with the RBVP only. The Regional Plan is being updated with the revised dates for Southern Water schemes. We hope to rerun these optimisations once the Regional Plan has been updated and include the results in our final WRMP24. This section will be updated accordingly for our final WRMP24.

The main changes from the RBVP are shown below and in Table 7.70:

- The plan optimised on resilience delays the bulk export to SES Water to 2070-71. In the RBVP this bulk export is only selected in Situation 1 in 2039-40, 2040-41, 2045-46 and 2046-47 under the 1:500 DYAA scenario.
- The East Thanet desalination option is delayed by 5 years in the plan optimised on resilience to 2045-46.
- The option to recycle water from Hastings WTW to augment Darwell Reservoir is selected in 2066-67 in the plan optimised on environmental and social metrics. This option is not selected in the RBVP.
- The option to recycle water from Tonbridge to Bewl Reservoir is not selected in either of the alternative plans. It is selected 2035-36 in the RBVP.
- The option to use recycled water from Tunbridge Wells to use with Bewl Reservoir is selected in the alternative plans from 2035-36. It is not selected in the RBVP.
- The Horsham recycling option is brought forward by 10 years in the plan optimised on environmental and social metrics.
- The option to raise Bewl Reservoir by 0.4m is brought forward by 6 years to 2054-55 in the alternative plans.

Table 7.70: A comparison of the RBVP with the plans optimised on resilience metrics (RESIL) and environmental and social metrics (ENVSOC)

Option	RBVP	RESIL	ENVSOC
Bulk export (SNZ): SNZ to SES (10Ml/d)	2040	2071	2040
Desalination (KTZ): East Thanet	2041	2046	2041
Drought option - demand side (HAZ): Reduce transfer to other commercial customers	2031	2027	2031
Drought option - demand side (HWZ): Reduce transfer to other commercial customers	2031	2027	2031
Drought option - supply side (SWZ): North Arundel (1.2Ml/d)	2031	Not selected	2031
Interzonal transfer (HSE-HSW): Woodside bi-directional (10Ml/d)	2065	2042	2065
Interzonal transfer (KTZ-KME): Utilise full existing capacity	2040	2039	2036
Interzonal transfer (SWZ-SBZ): Trunk main at v6 valve additional capacity	2027	2030	2026
Recycling (SHZ): Hastings to Darwell Reservoir (9.5Ml/d)	Not selected	Not selected	2067
Recycling (SHZ): Tonbridge to Bewl Reservoir (5.7Ml/d)	2036	Not selected	Not selected
Recycling (SHZ): Tunbridge Wells with Bewl Reservoir (3.6Ml/d)	Not selected	2036	2036
Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)	2057	2057	2047
Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d)	2061	2055	2055

A comparison of the costs and other best values metrics is given in Table 7.71.

Table 7.71: Costs and best value metrics comparison between the RBVP and the alternative plans

Plan	Capex (£m)	Opex (£m)	RESIL (%)	ENVSOC (%)	Customer preference (%)
RBVP	4663.33	11837.47	88.33	73.64	91.27
RESIL	4579.02	11729.91	87.32	65.88	89.94
ENVSOC	4624.22	11825.54	84.44	71.36	90.21

7.4 Summary of the 'no regrets' plan

Options selected in SBVP 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 2039-40, 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, but they will be reassessed for WMRM 2029 (WRMP29). The activity we plan to carry out against selected new options in the Western, Central and Eastern areas is show in Table 7.72, Table 7.73 and Table 7.74 respectively. The tables exclude demand management activities, which will start from 2025-26 in all cases. The also exclude existing transfers and drought options.

Table 7.72: Activities to be carried out against preferred plan options in the Western area over AMP8 (2025-30)

SEMD Name	Selection in supply-demand balance situations (out of a total of 9)				Earliest selection	Activity over AMP8
	NYAA	1:100 DYAA	1:500 DYAA	1:500 DYCP		
Groundwater (HKZ): Remove constraints at Newbury to increase yield (1.2Ml/d)	9	9	9	9	2028	Deliver
Groundwater (SNZ): Petersfield refurbishment (1.6Ml/d)	9	9	9	9	2029	Deliver
Groundwater (HRZ): New boreholes at Romsey (4.8Ml/d)	9	9	9	9	2031	Deliver
Groundwater (HRZ): Remove constraints at Kings Sombourne (2.5Ml/d)	9	9	9	9	2031	Deliver
Interzonal transfer (HSE-HWZ): Otterbourne WSW to Yew Hill WSW bi-directional (74Ml/d)	8	9	9	9	2031	Deliver
Interzonal transfer (HSW-HRZ): Romsey Town and Broadlands valve expansion (5Ml/d)	9	9	9	9	2031	Deliver
Interzonal transfer (HWZ-HAZ): Winchester to Andover bi-directional (15Ml/d)	9	9	9	9	2031	Deliver
Interzonal transfer (HSE-HSW): Yew Hill WSW to River Test WSW bi-directional (60Ml/d)	9	9	9	9	2031	Deliver
Recycling (IOW): Sandown (8.5Ml/d)	9	9	9	9	2031	Deliver
Bulk import (HSE): PWC Source A to Otterbourne WSW (21Ml/d)	9	9	9	9	2032	Deliver
Bulk import (HSE): Havant Thicket Reservoir to Otterbourne WSW (90Ml/d)	9	9	9	9	2035	Plan to deliver
Recycling (HSE): Recharge of Havant Thicket from recycled water from Budds Farm (60Ml/d)	9	9	9	9	2035	Plan to deliver
Groundwater (HSW): Test MAR (5.5Ml/d)	7	7	7	7	2036	Investigate and plan to deliver
Groundwater (IOW): New boreholes at Newchurch (LGS) (1.9Ml/d)	9	9	9	9	2037	Investigate and plan to deliver
Bulk export (HSE): Otterbourne WSW to PWC Source A (45Ml/d)	5	6	6	0	2040	Investigate and plan to deliver

Table 7.72: Activities to be carried out against preferred plan options in the Western area over AMP8 (2025-30)

SEMD Name	Selection in supply-demand balance situations (out of a total of 9)				Earliest selection	Activity over AMP8
	NYAA	1:100 DYAA	1:500 DYAA	1:500 DYCP		
Bulk import (HWZ): T2ST to Yew Hill (95Ml/d)	9	9	9	9	2040	Plan to deliver
Groundwater (IOW): New borehole at Eastern Yar3 (1.5Ml/d)	3	0	0	0	2040	Reassess for WRMP29
Bulk import (HAZ): T2ST to Andover (20Ml/d)	2	2	2	2	2048	Reassess for WRMP29
Bulk import (HKZ): T2ST to HKZ (5Ml/d)	1	1	1	1	2049	Reassess for WRMP29
Bulk export (HWZ): Winchester to Kennet Valley	3	3	3	3	2050	Reassess for WRMP29
Interzonal transfer (HAZ-HKZ): Andover to Kingsclere bi-directional (10Ml/d)	2	2	2	2	2050	Reassess for WRMP29
Groundwater (HAZ): Recommission Chilbolton (0.5Ml/d)	1	1	1	1	2073	Reassess for WRMP29

Table 7.73: Activities to be carried out against preferred plan options in the Western area over AMP8 (2025-30)

SEMD Name	Selection in supply-demand balance situations (out of a total of 9)				Earliest selection	Activity over AMP8
	NYAA	1:100 DYAA	1:500 DYAA	1:500 DYCP		
Bulk import (SNZ): SES re-zoning (4Ml/d)	9	9	9	9	2026	Deliver
Groundwater (SNZ): Reinstate West Chiltington (3.1Ml/d)	9	9	9	9	2029	Deliver
Groundwater (SNZ): Petersfield refurbishment (1.6Ml/d)	9	9	9	9	2029	Deliver
Groundwater (SBZ): Lewes Road (3.5Ml/d)	9	9	9	9	2031	Deliver
Groundwater (SNZ): New borehole at Petworth (4Ml/d)	8	9	9	6	2031	Deliver
Recycling (SNZ): Littlehampton with direct river discharge (15Ml/d)	9	9	9	9	2031	Deliver
Bulk import (SNZ): SES to SNZ (10Ml/d)	9	9	9	9	2034	Plan to deliver
Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d)	9	9	9	2	2036	Plan to deliver
Interzonal transfer (SNZ-SWZ): Pulborough to Worthing	6	6	6	0	2040	Investigate
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d)	7	7	8	0	2040	Plan to deliver
Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d)	8	8	8	5	2040	Plan to deliver
Bulk export (SNZ): SNZ to SES (10Ml/d)	0	0	1	0	2040	Reassess for WRMP29
Desalination (SWZ): Tidal River Arun (20Ml/d)	1	1	1	1	2041	Reassess for WRMP29
Interzonal transfer (SBZ-SWZ): Brighton to Worthing	3	1	2	2	2041	Reassess for WRMP29
Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d)	3	2	2	0	2041	Reassess for WRMP29
Treatment capacity (SWZ): Pulborough winter transfer stage 1 (2Ml/d)	3	3	3	0	2041	Reassess for WRMP29
Desalination (SWZ): Tidal River Arun (10Ml/d)	1	1	1	1	2046	Reassess for WRMP29

Table 7.73: Activities to be carried out against preferred plan options in the Western area over AMP8 (2025-30)

SEMD Name	Selection in supply-demand balance situations (out of a total of 9)				Earliest selection	Activity over AMP8
	NYAA	1:100 DYAA	1:500 DYAA	1:500 DYCP		
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	3	3	3	1	2046	Reassess for WRMP29
Desalination (SWZ): Tidal River Arun (20Ml/d) Phase 2	2	2	2	2	2050	Reassess for WRMP29
Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)	3	3	3	0	2058	Reassess for WRMP29
Bulk import (SBZ): SEW to Rottingdean (20Ml/d)	1	1	1	0	2066	Reassess for WRMP29

Table 7.74: Activities to be carried out against preferred plan options in the Eastern area over AMP8 (2025-30)

SEMD Name	Selection in supply-demand balance situations (out of a total of 9)				Earliest selection	Activity over AMP8
	NYAA	1:100 DYAA	1:500 DYAA	1:500 DYCP		
Asset enhancement (KMW): Remove network constraint at Longfield (13Ml/d)	9	9	9	9	2026	Deliver
Groundwater (KME): Recommission Gravesend (2.7Ml/d)	9	9	9	2	2031	Deliver
Recycling (KME): Sittingbourne industrial water reuse (7.5Ml/d)	9	9	9	9	2031	Deliver
Recycling (KMW): Medway to lake (14Ml/d)	9	9	9	0	2031	Deliver
Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d)	3	3	3	0	2036	Investigate
Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d)	9	9	9	2	2036	Investigate and Plan to deliver
Desalination (KMW): Thames Estuary (20Ml/d)	6	6	6	6	2040	Investigate and Plan to deliver
Desalination (KMW): Thames Estuary (20Ml/d) Phase 2	5	5	5	5	2040	Investigate and Plan to deliver
Interzonal transfer (KTZ-KME): Utilise full existing transfer capacity (9Ml/d)	4	0	4	0	2040	Reassess for WRMP29

Table 7.74: Activities to be carried out against preferred plan options in the Eastern area over AMP8 (2025-30)

SEMD Name	Selection in supply-demand balance situations (out of a total of 9)				Earliest selection	Activity over AMP8
	NYAA	1:100 DYAA	1:500 DYAA	1:500 DYCP		
Desalination (KME): Isle of Sheppey (20Ml/d)	6	6	6	6	2041	Investigate and Plan to deliver
Desalination (KMW): Thames Estuary (10Ml/d)	2	2	2	2	2041	Reassess for WRMP29
Desalination (KMW): Thames Estuary (10Ml/d) Phase 2	1	1	1	1	2041	Reassess for WRMP29
Desalination (KTZ): East Thanet (20Ml/d)	3	3	3	3	2041	Reassess for WRMP29
Bulk export (KTZ): SWS Deal to AFW AZ7 (4Ml/d)	3	3	3	2	2045	Reassess for WRMP29
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	3	3	3	1	2046	Reassess for WRMP29
Bulk export (KTZ): Near Canterbury to SEW Canterbury (20Ml/d)	0	1	3	7	2050	Reassess for WRMP29
Bulk import (KTZ): SEW Canterbury to Near Canterbury (20Ml/d)	9	7	7	0	2050	Reassess for WRMP29
Bulk import (SHZ): SEW RZ8 to Rye	3	1	1	0	2050	Reassess for WRMP29
Desalination (KTZ): East Thanet (20Ml/d) Phase 2	1	1	1	1	2051	Reassess for WRMP29
Recycling (SHZ): Hastings to Darwell (15.3Ml/d)	3	3	3	0	2051	Reassess for WRMP29
Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)	3	3	3	0	2058	Reassess for WRMP29
Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d)	0	0	2	0	2061	Reassess for WRMP29
Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2	4	4	4	4	2063	Reassess for WRMP29
Bulk export (KMW): Near Rochester to SEW RZ6	1	0	1	0	2075	Reassess for WRMP29

[54] https://www.ofwat.gov.uk/publications/rd-0410-regulatory-capital-values-2010-15

7.4.1 Bill impact

We have calculated the bill impact of our preferred plan using Ofwat's regulatory capital value[54] (RCV) and building blocks methodology. The estimated bill impact is shown in Table 7.75. This is an indicative bill impact. The bill impact will be refined as costs and delivery profiles are updated through the WRMP process.

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 that 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 considered for calculating the cost for operating it. The costs are included in the water resources planning tables accompanying this plan.

Table 7.75: Estimated bill impact of our plan

Best value plan	AMP8 year 1	AMP8 year 2	AMP8 year 3	AMP8 year 4	AMP8 year 5	AMP8 average	AMP9 average year	AMP10 average year
Annual bill impact (£)	21	38	51	71	84	53	136	181
Annual totex (£m)	212	280	299	384	386	312	290	430
Annual bill increase (£)		16	13	20	13		82	128

7.4.2 Affordability and Intergenerational equity

The area we serve has been officially designated as water-stressed, meaning that water is scarce for all users and for the environment. In this WRMP cycle, 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. 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 receive and when they receive them.

We have taken and will continue to take every opportunity to both keep overall bills low and to ensure fairness between current and future customers. As discussed in Section 4.6, we have carried out extensive customer research and stakeholder engagement. 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 DPC. 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 bill increases for current customers to pay for the capital costs that would benefit future customers.

We plan to use the alternative delivery approach for some of largest schemes such as the HWTWRP and T2ST. We are already using a similar approach for the Havant Thicket Reservoir. Portsmouth Water is developing the reservoir on our behalf, and we are paying over the life of an 80-year contract. 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-life asset.

As part of WRMP24, we have looked to identify options that provide overall best value to our customers. 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.

8. Environmental assessments

In developing our draft WRMP24, we have referred to statutory environmental requirements, national legislation and guidance, to inform our approach to producing a plan that seeks to provide a reliable and sustainable supply of water to our customers whilst protecting and, where possible, enhancing the environment. We have engaged with our environmental regulators (the EA and Natural England) on our environmental and social assessment approach and on our findings. Feedback informed our ongoing assessments, requiring us to reject or modify options to better address environmental concerns or opportunities. The statutory processes that we follow are set out in Figure 8.1

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?

Figure 8.1: Statutory environmental requirements - Habitats Regulations Assessment[55], Strategic Environmental Assessment[56] and Water Framework Directive Assessment[57].

8.1 Strategic Environmental Assessment (SEA)

The SEA regulations[58] require an assessment of the likely significant environmental effects of the rdWRMP24. 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 rdWRMP24 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 rdWRMP24 wherever possible;
- support consultation of the rdWRMP24 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 region-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 constrained water resource options developed to address the forecast deficits across our 14 WRZs. 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.

[55] The Conservation of Habitats and Species Regulations 2017
[56] The Environmental Assessment of Plans and Programmes Regulations 2004
[57] The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
[58] The Environmental Assessment of Plans and Programmes Regulations 2004

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 85 preferred supply options as well as 10 generic drought options and 16 demand management and leakage options for inclusion in our revised best value draft WRMP24 (rdWRMP24).

The SEA process has then assessed the environmental effects of the preferred options and preferred programme. This included consideration of the cumulative, secondary and synergistic[59] effects.

Overall, the rdWRMP24 is considered to have significant positive operational effects against SEA objectives to: deliver reliable and resilient water supplies; and maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing. The additional design capacity for potable water that Southern Water would provide would help to ensure a continual supply of clean drinking water, supporting economic/population growth, generating a positive effect on human health and increasing adaptability to the effects of climate change.

The rdWRMP24 (post mitigation) is also considered to have a range of likely significant negative effects on the following SEA objectives:

- Protect and enhance biodiversity, priority species, vulnerable habitats and habitat connectivity (no loss and improve connectivity where possible);
- Protect and enhance the quality of the water environment and water resources;
- Reduce embodied and operational carbon emissions;
- Conserve, protect and enhance landscape, townscape and seascape character and visual amenity;
- Minimise resource use and waste production.

These effects reflect the number, scale, proposed location and findings of the HRA and WFD assessments, including a precautionary view on the treatment of uncertainty. Many of the options have been revised from the draft WRMP24, with delivery delayed in the rdWRMP24 to allow sufficient time for investigation and consideration of additional mitigation options.

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, water quality and flood risk. The operation of three drought order options (integrated from our revised draft Drought Plan 2022) have been identified as having a likely significant effect on biodiversity. For these options, a programme of mitigation and monitoring has been discussed 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). 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 Regulations Assessment (HRA)

The Habitat Regulations[60] require the assessment of the potential impacts of plans and programmes on the Natura 2000 network of European protected sites (European sites). The HRA determines whether there will be any 'likely significant effects' from a WRMP on any European site as a result of implementing the plan (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).

[59] Synergistic effects are ones that act together
[60] The Conservation of Habitats and Species Regulations 2017

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 September 2023 HRA (Annex 18), plus the July 2024 HRA Addendum (Annex 18A[61]), concluded that for virtually all of the rdWRMP24 options, there will be no adverse effects on any European protected sites (and Ramsar sites) that cannot be reliably avoided through scheme design or mitigated with measures that are known to be available, achievable and likely to be effective at the project-level. 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 rdWRMP24 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 Environment Agency and Natural Resources Wales every six years.

We must be able to demonstrate that the rdWRMP24 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 and UKWIR guidance[62], the principal WFD Assessment Objectives that the WRMP (both revised feasible options and preferred option programmes) have 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[63].
- 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[64].
- 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.

[61] Annex 18A assessed new and changed options since the 2023 HRA. Annex 18 and Annex 18A should be read in conjunction with each other.
[62] UKWIR, 2021. Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans. Report 21//WR/02/15.
[63] The no deterioration baseline for each water body and element is the status reported in the RBMP. At present this is RBMP2.
[64] 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.

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 September 2023 WFD assessment (Annex 19) plus the July 2024 WFD addendum, which assessed new and changed options since the 2023 report (Annex 19A), should be read in conjunction with each other. These assessments have concluded that the majority of the supply options contained in our preferred plan would be compliant with the WFD requirements. The WFD assessments did identify that 19 options were anticipated to be potentially non-compliant (with either low or medium 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. Some potential cumulative effects between options, as well as potential in-combination effects with other water companies, could also occur. 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 HWTWRP SRO. Given the significant lead in time for some options, it is considered sufficient 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 288 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.

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 July 2024 updated SEA Environmental Report, September 2023 HRA Report plus July 2024 HRA Addendum and September 2023 WFD Technical Note plus July 2024 WFD Addendum (Annexes 17-19).

9. Managing and monitoring risk through our adaptive plan

We have adopted an adaptive planning approach in view of our complex needs and large future uncertainties which we need to plan for (see Section 5.5). To track our progress and to monitor the key uncertainties that will affect future supplies and demand for water we have developed a detailed Monitoring Plan (Annex 21). This plan will help us to identify the potential adaptive pathways or supply-demand balance situations we may end up following in the future and the associated schemes that will need to be delivered. Annex 21 also considers risks associated with scheme delivery and identifies where there may be opportunity to swap to alternative options or bring forward schemes as a contingency.

9.1 Monitoring our WRMP24

The three principal uncertainties on our future balance of supply and demand which our adaptive plan seeks to address are:

- Population growth
- Climate change
- Reductions in abstraction to provide greater environmental protection through our Environmental Destination.

In Annex 21 we have identified a number of sub-components for each of these key drivers that will be monitored as part of the annual review of our WRMP and/or as part of the WRMP planning cycle and will feed into the WRSE monitoring at the regional level on an annual basis. Table 9.1 provides an overview of the components we will be monitoring to manage risks and uncertainties. The associated thresholds and triggers are outlined in Annex 21.

Table 9.1: Overview of Southern Water rdWRMP24 monitoring plan

Category	Component	Indicator(s)	Frequency of monitoring
Overall	Supply-demand balance and target headroom (at WRZ level and overall)	1. deficit or surplus 2. change from core plan forecast	As part of WRMP annual review and WRMP planning cycles
Supply-side components	Climate change	Review of climate variables (see Annex 21 for details)	As part of WRMP planning cycles
	Environmental Destination (including licence capping and WINEP investigation)	Volume of abstraction reduction	When outcomes from WINEP are available
	Bulk transfer imports from neighbouring companies	DO change from core plan (from reduction or non-renewal)	As part of WRMP annual review and WRMP planning cycles
	Delay or constraints to delivery of key supply options	DO change from core plan (from delay or constraints)	Ongoing review of schemes delivery timeline and update of water resource modelling if changes occur

Table 9.1: Overview of Southern Water rdWRMP24 monitoring plan

Category	Component	Indicator(s)	Frequency of monitoring
Demand-side components	Population growth	Population and housing growth and change from core plan forecast	As part of WRMP planning cycles
	Leakage reduction	1. Annual average leakage rates 2. Reduction of 3- year average leakage rates from the 2019-20 baseline 3. Change from core plan forecast at WRZ and company level	As part of WRMP annual review and WRMP planning cycles
	Company-led consumption reduction	1. Smart meter deployment 2. PCC (annual average and % reduction of 3-year average PCC in from the 2019-20 baseline) 3. Reduction in non-household (business) water consumption (annual average and % reduction of 3-year average demand from the 2019-20 baseline)	As part of WRMP annual review and WRMP planning cycles
	Government-led commitments to improve water efficiency	Government policy	On an ad hoc basis
Environmental components	SEA monitoring indicators not covered by SWS reporting criteria	WRMP scheme monitoring of SEA indicators through Environmental Management Plan	These do not have a direct supply-demand balance impact but learnings and environmental monitoring will be reviewed to inform next WRMP cycle

Whilst the WRSE Regional Plan, and our WRMP, set out 9 different supply-demand balance situations, one reported pathway is used to describe the investment plan. This is Situation 4 (see Section 5.5). The investment plans derived from this pathway feature in our BP24 and our LTDS[65].

Given the range of different supply-demand situations, it is important to track annual progression of the schemes and key output data to see if we are still following the forecasts describing Situation 4 and, if not, then the alternative pathway that needs to be followed.

Monitoring will be done and reported through the WRMP annual review process, and this will feed both into the monitoring at the regional level as well as the 5-year WRMP cycle. WRSE will prepare and publish an Annual Monitoring Report, building upon the content of the company WRMP annual reviews. The key purpose of the WRSE Monitoring Plan is to track key indicators, set out the measure that will be used to trigger corrective actions, where necessary, and the timing of these corrective measures.

9.2 Delivery risk and contingency

Our plan involves the largest, most ambitious and complex programme of new water sources, treatment works and transfers, on a scale never previously undertaken in our region. Delivering this alongside an enormous investment in our wastewater services will be challenging, however, we are already engaging our new supply chain and alternative delivery markets to provide the required skills and capacity to succeed.

Having these new supplies available when needed will require the support of our regulators and other stakeholders to ensure they gain the many approvals, permits and consents when needed. Timely permitting and consenting of our proposals is essential to enable us to engage with alternative delivery markets, commence construction activities and operate the new supplies when required.

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 21 sets out our approach to mitigating delivery risk through monitoring and contingency planning. This approach complements our existing risk management processes for drought and emergency planning.

The key purpose of our contingency options is to mitigate 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 does not occur. Annex 21 further outlines our approach to risk management.

In developing contingency options, we have considered the characteristics of each WRZ e.g. 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.

Contingency options have been grouped into three types: resource, production and network. Demand management is discussed separately in Annex 14.

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.

[65] Southern Water, 2023. Long Term Delivery Strategy, Technical Annex southernwater.co.uk/media/flobeaeu/srn12-long-term-delivery-strategy-technical-v2.pdf.

9.2.1 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. For dWRMP24, we identified 21 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 as follows:

Desalination schemes

- Desalination (KTZ): East Thanet (up to 40Ml/d)
- Desalination (KMW): Thames Estuary (up to 40Ml/d)
- Desalination (KME): Isle of Sheppey (up to 40Ml/d)
- Desalination (SWZ): Tidal River Arun (up to 40Ml/d)

Recycling schemes

- Recycling (HSE): Recharge of Havant Thicket from recycled water from Budds Farm (up to 60Ml/d)
- Recycling (SHZ): Hastings to Darwell (15.3Ml/d)
- Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d)
- Recycling (SHZ): Tunbridge Wells with Bewl (3.6Ml/d)
- Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)
- Recycling (KME): Sittingbourne industrial water reuse (7.5Ml/d)
- Recycling (KMW): Medway to lake (14Ml/d)

Storage schemes

- Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d)
- Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)
- Storage (SNZ): Western Rother licence and storage programme (2Ml/d)

Other large storage and transfer schemes

- T2ST and associated schemes
- Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d)
- Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d)
- Interzonal transfer (HSW-HSE): Woodside bi-directional (10Ml/d)
- Interzonal transfer (HSW-IOW): Triplicate cross-Solent main bi-directional (8Ml/d)
- Interzonal transfer (KME-KTZ): KME-KTZ bi-directional (15.8Ml/d)
- Interzonal transfer (SNZ-SWZ): Pulborough to Worthing (up to 60Ml/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?
- 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?

For the rdWRMP24, we again reassessed a number of options. The resulting changes from the dWRMP24 are described in Section 6.3.4. The following options are no longer part included in our preferred rdWRMP24, although they have been selected in some of the sensitivity runs.

- Recycling (SHZ): Tunbridge Wells with Bewl (3.6Ml/d)
- Interzonal transfer (HSW-HSE): Woodside bi-directional (10Ml/d)
- Interzonal transfer (HSW-IOW): Triplicate cross-Solent main bi-directional (8Ml/d)

As mentioned in Section 6.3.4, the following option was removed as a constrained feasible option for rdWRMP24

- Storage (SNZ): Western Rother licence and storage programme (2Ml/d)

For all projects, there is a 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 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[66], civil engineering and network connectivity challenges. Examples of pre-planning activities we will need to undertake include:
  - 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 include:
  - Project level EIA and environmental statements.
  - Project level SEA, HRA, WFD risk assessments.
  - Baseline surveys of 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 risks, to ensure alignment on intended outcomes and benefits and to ensure timely delivery.

[66] MEICA = Mechanical, Electrical, Instrumentation, Control and Automation

10. Greenhouse gas emissions

Greenhouse gas emissions are driving climate change and need to be effectively mitigated. The water sector is a significant contributor to the UK's greenhouse gas emissions and we have an important role to play in supporting the realisation of both sector wide and government Net Zero targets and commitments. This section outlines how our WRMP24 contributes to achieving Net Zero targets in line with the government commitment. Annex 15 includes tables that show the estimated emissions associated with our LCP and BVP.

We have already made sizeable progress in reducing our emissions over the last decade. Our net operational greenhouse gas emissions have reduced due to our progress in implementing measures to further the transition. These include the increase in on-site generation of renewable energy, both solar energy and biogas, and the implementation of energy efficient solutions like smart meters and leakage detection technologies. We have also been trialling process emission monitors across some of our water and wastewater treatment sites to measure and monitor hard to abate emissions more accurately. 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

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. We engaged Mott MacDonald to estimate carbon costs.

10.1.1 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.

Like cost models, carbon models are based on curves created from data points, relating a driver that defines the size of the asset to 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 asset, 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, 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.

Due to differences in assumptions between different option types, carbon calculations are grouped into the following categories:

- 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[67] 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.

10.1.2 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 9 supply-demand balance 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.

[67] ICA = Industrial Control and Automation

- 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 (tCO2e/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 HM Treasury's Green Book[68] 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 from our proposed strategy

Following appraisal of all feasible options, we estimated the carbon equivalent impact of our WRMP24 strategy. For the options included in our plan between 2025 and 2075, we found that 61 of the schemes included in the plan have an emission impact across asset management periods. Of which, 14 account for 80% of the total emissions, highlighting the benefit of focusing decarbonisation efforts on these major schemes. The individual scheme with the largest greenhouse gas impact is the bulk import from Havant Thicket Reservoir to Otterbourne. The estimated emissions from the five most carbon intensive schemes are illustrated below (Figure 10.1).

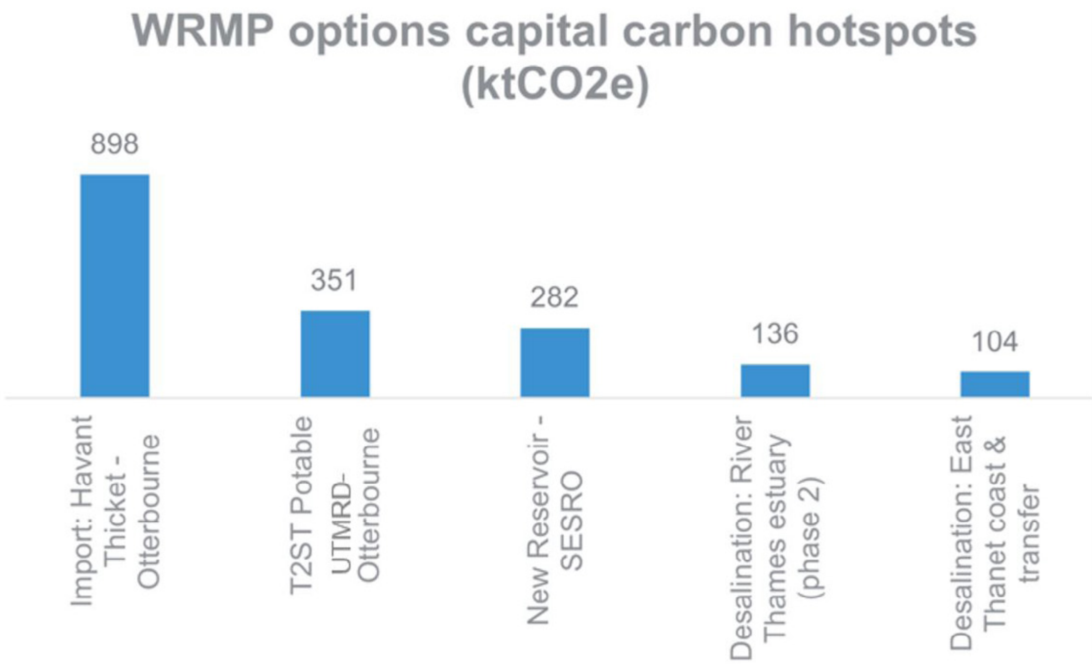

Figure 10.1: WRMP options capital carbon hotspots (ktCO2e)

While the greenhouse gas impact of the majority of the drought options is negligible, a new option, bulk import from Norway via sea tankers has now been considered. This option aims to improve resilience until the Havant Thicket Reservoir and HWTWRP become available. The carbon impact of sea tankering is expected to be significant. A carbon assessment has been undertaken using a carbon accounting tool. This includes a 'bottom-up' assessment of the carbon efficiency of this option. However, a reconciliation of this assessment with a 'top-down' assessment is expected to be completed at a later stage. As such it has not been included in the estimates provided in Figure 10.1.

[68] The Green Book (2022) - GOV.UK (www.gov.uk)

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.

10.5 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[69].

Achieving these targets will require action across the society 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. While we have already made significant progress and reduced our net operational emissions, we recognise that there is more to be done to accelerate our progress towards Net Zero through PR24 and beyond.

Ofwat published a Net Zero Principles position paper[70] 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 ambition. As such, we have revised our Net Zero Plan and are implementing a range of actions that support achievement of sector-wide and government emissions targets.

10.6 Wider actions to mitigate greenhouse gas emissions

Our revised 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 Net Zero by 2050 and appraising WRMP24 options follows the carbon reduction hierarchy:

- Reduce and avoid emissions through efficiency savings.
- Replace and use alternative solutions that are lower carbon, for example technology change.
- Remove emissions through sequestration on our estate.

We have also developed a framework of four guiding principles to shape our choice of options and drive progress towards Net Zero:

- Ensuring carbon is a key focus by instilling carbon conscious decision-making and processes into the Southern Water culture.
- Collaborating with adjacent sectors in the industry to identify alternate options for tackling emissions, such as habitat restoration and new markets for sequestration.
- Participating in trials, research and innovation with the wider sector will allow us to assess hard to abate emissions such as process emissions and implement suitable solutions in successive AMPs.
- Implementing an adaptive approach to planning to better manage the impact of external factors such as climate change, technological development, and consumer demand on our strategies in the future.

[69] HM Government, 2021. Net Zero Strategy: Build Back Greener. ISBN 978-1-5286-2938-6 (net-zero-strategy-beis.pdf (publishing.service.gov.uk).
[70] Ofwat, 2022. Ofwat's regulatory framework and net zero. August, 2022. BEIS-commission-Net-Zero-response-August-2022.pdf (ofwat.gov.uk).

We will need to continue to support collaborative research and development with government and industry partners to manage uncertainty over WRMP24 emissions predictions and to sustain progress towards Net Zero. 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 water recycling 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.

10.6.1 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.

10.6.2 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. In 2022-23, we generated 51GWh of energy from biogas combined heat and power plants (CHP) and 3GWh of electricity from solar photovoltaics across our estate which met around 11% of our energy needs.

In the medium to long term, we are planning to explore low carbon alternative solutions, 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.

10.6.3 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 account for almost two thirds of our total operational emissions. We are aiming to reduce our process emissions 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.

10.6.4 Transport

Operational emissions from our vehicle fleet and business travel are embedded in the options included in our plan. To mitigate these emissions, we have committed to transform our company vehicles by electrifying the fleet or introducing alternative low carbon fuels. 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.

10.6.5 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.

10.7 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 already 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[71]. 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 (tCO_2e).
- Change in energy use per Ml/d supplied (MWh/Ml/d).

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 details on our approach to monitoring and measuring our greenhouse gas emissions is available in our Net Zero Plan.

[71] UKWIR, 2012. A framework for accounting for embodied carbon in water industry assets. Report 12/CL/01/15. UK Water Industry Research Limited.

11. Further consultation and next steps

We face significant water resources planning challenges across South East England in ensuring that we can meet the future demand for water while protecting and enhancing the environment and keeping bills affordable for all customers. However, this also presents opportunities for us to think and plan differently. Our rdWRMP24 describes the measures we plan to take to secure supplies for the future, deliver significant improvements to our water resources network and improve the quality of the service we give to customers.

We published our dWRMP24 on 14 November 2022 for a 14-week consultation during which we organised a number of webinars and meetings to explain our plans to a range of stakeholders including our regulators. We also widely publicised the consultation through the media to encourage our customers to share their views and we held a number of customer focus groups to gain their insight. By the end of the consultation in February 2023, we had received almost 600 responses from members of the public and organisations. We carefully considered all the feedback we received and prepared and published a SoR in August 2023.

In parallel with our dWRMP24 consultation we also supported the WRSE consultation on the dRBVP. As a member of WRSE, we continue to work with the other water companies in the South East to ensure that we have a plan for the region which meets the challenges we face and provides the greatest benefit for all water users.

Our rdWRMP24 reflects the challenges and solutions presented in the Regional Plan but is specific to our supply area and takes on board the feedback we have received from the public, stakeholders and regulators and the changes we proposed to make to our plan that we set out in our SoR.

We have also revised our demand and supply forecasts and the delivery dates of some schemes will mean that we will need to continue to rely on drought orders and permits in Hampshire for a longer period than set out in our dWRMP24. In our view, the nature and scale of changes to the dWRMP24 mean that we should further consult on these new aspects of the plan.

As we set out in our SoR, we sought permission from the Secretary of State to undertake a further consultation on our rdWRMP24. We will launch the consultation in the week commencing 9th of September 2024. We look forward to receiving the views of our regulators, stakeholders and customers on the proposals in our rdWRMP24, and to working closely with them as we finalise our plan over the coming year.

Through our consultation we would like to invite feedback on some key areas of our plan. We have set out a series of questions below that we would like feedback on. This will help us shape our final WRMP24:

1. Our plan includes options to reduce demand (e.g. reducing leaks and encouraging customers to use less water) and increase supply (e.g. building new reservoirs). **Do you agree we have struck the right balance between supply and demand measures?**
2. Our plan includes development of new storage options, such as the River Adur Offline Reservoir. **Do you support more storage options to provide resilience to droughts?**
3. To help protect the environment, our plan sets out how we intend to progressively reduce the volumes of water we take from the environment. **Do you agree with our plans to reduce the amount of water we take from the environment by 2050?**
4. Developing new, more sustainable and resilient sources of supply has a financial cost. **Do you think we have struck the right balance between cost, resilience and protecting the environment in our plan?**
5. Droughts and water scarcity are forecast to become more frequent and severe. **Would you support more frequent restrictions, such as temporary use bans and non-essential use bans, on customers' use to improve resilience and reduce the amount of water we take from the environment during droughts?**
6. By 2050, the Government requires water companies to reduce the amount of water each person uses daily. Currently, each person uses an average of 128 litres per day. **Do you support our target of an average of 110 litres per person per day in a dry year, by 2045, five years earlier than the Government requirement?**
7. In order to meet demand for water in the Hampshire area, we may sometimes have to apply for drought permits/orders to abstract from the River Test during droughts. **In order to protect the River Test do you support temporarily importing water from Norway via sea tankers first over the use and reliance on drought orders and permits, which may still be needed?**
8. Our plan includes desalination. **Do you support the use of desalination for public supply to improve resilience to droughts and reduce the amount of water we take from the environment?**
9. Our plan includes schemes involving recycling of water. **Do you support the use of recycled water for public supply to improve resilience to droughts and reduce the amount of water we take from the environment?**
10. Do you have any other comments on our plan?

Feedback

Feedback on our plan can be provided in a number of ways.

1. Our online survey to answer the above questions at https://waterresources.southernwater.co.uk/have-your-say
2. Emailing Defra at water.resources@defra.gov.uk, putting Southern Water draft water resources management plan in the subject line, and copying in wrmp@southernwater.co.uk.
3. Printing out our survey or writing a response and sending it to Defra at: Water Resources Management Plan Consultation
   Defra
   Water Resources
   Seacole, 2 Marsham Street
   London SW1P 4DF

In case of any issues accessing our plans or any questions relating to our consultation, we can be contacted at wrmp@southernwater.co.uk. All the technical documents for this plan can be accessed at https://waterresources.southernwater.co.uk/find-out-more/

Please respond to this consultation by Wednesday 4 December 2024.

WATER for LIFE®

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