WRMP24 Supply-Demand Balance, Decision-Making and Uncertainty

Wessex Water

December 2024

Document revisions

Major version number	Details	Lead contact	Date
1	Development version	Chris Hutton	06/07/2021
2	Review & changes made	Paul Saynor	30/09/2022
3	Final version issued for dWRMP24	Chris Hutton	03/10/2022
4	Revised draft for regulatory submission	Chris Hutton	16/08/2023
5	Revised draft updates – Defra letter on SoR	Chris Hutton	14/03/2024
6	Final published version	Chris Hutton	02/12/2024

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1. Introduction

This report outlines the technical development and methods for the decision-making and uncertainty analysis required for our Water Resources Management Plan (WRMP).

After developing our supply and demand forecasts and evaluating options to enhance supply and reduce demand, we then apply a decision-making method to a number of future scenarios to ultimately define what our plan to balance supply and demand looks like. Our decision-making approach involves using pre-defined objectives and best value metrics to develop a least cost plan (as well as other scenarios), which is essentially a programme of solutions (options) to meet our planning problem (i.e. a supply deficit). We have then undertaken an assessment of other uncertainties in key plan parameters (including those covered in headroom) and considered decision points for adaptive pathways to address these uncertainties.

Our overall approach to decision making is outlined as follows:

1. Identify Future Scenarios	• Exogeneous factors (e.g. climate change and population growth) • Endogenous factors (e.g. environmental destination and leakage policy)
2. Calculate Supply-Demand Balance	• **System simulation model** to develop deployable Output and calculate supply-demand balance under each future scenario
3. Find least-cost and alternative solutions under central scenario	• **Aggregated decision-making** with Modelling to Generate Alternatives (MGA) to identify least cost, and alternative solutions under the central scenario, as determined by plan constraints
4. Find solutions to alternative future scenarios	• Identify solutions that are selected across low, central and high future scenarios
5. Build Adaptive Plan	• Identify timing of divergence in selected options between programmes, and decision-points • Identify earlier actions, monitoring points and metrics to inform decision-points in the future, considering regional drivers
6. Test Plan	• Test the plan against alternative scenarios

2. Decision-Making Methodology

When developing a WRMP, if we identify a deficit in supplies compared to demand, we are required to develop a **preferred programme** of options to either increase supply or reduce demand so that we achieve an environmentally sustainable, secure supply of water. Building on the problem characterisation assessment, which assesses the scale and complexity of the planning problem we need to solve (see Problem Characterisation Technical Appendix), this section describes the decision-making method developed and applied as part of WRMP24.

2.1 Decision-making guidance requirements overview

For this round of Water Resources Planning, the joint regulatory guidance[1] requires us to develop a best-value plan, which is one that considers other factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and overall society.

In developing the best-value plan, and choosing our **preferred programme** of investment, the guidance requires us to consider a range of **factors** that we should account for, which helps to frame the planning problem. These include factors like government policy and regulatory expectations, customer preferences, environmental improvements, cost, and bill impact. These factors, and how we incorporate these factors into the plan, typically as **constraints** on the preferred investment programme or **metrics** like cost that we seek to optimise (e.g. minimise), are summarised later in this section.

2.1.1 Deriving a best-value, adaptive plan

To develop a best value plan, the planning guidance sets of a set of steps to develop the best-value plan:

1. Set clear objectives for the plan
2. Identify and consider best-value metrics
3. Identify your least-cost plan to provide a benchmark for your other programmes
4. Develop a decision-making approach
5. Appraise and compare different programmes
6. Undertake effective engagement
7. Consider whether an adaptive plan is appropriate
8. Test your plan
9. Present and justify your preferred plan clearly.

The following sections detail this for the plan.

[1] Environment Agency, Ofwat (2021) Water Resources Planning Guideline. Version 9: For publishing. Here-in referred to as the **regulatory planning guidance**.

2.2 Step 1: Objectives for the plan

The first stages in the process of developing a best-value plan are to set out clear objectives for the plan and identify and consider best-value metrics. Current approaches to decision-making and investment tend to focus on and incentivise inputs (e.g. leakage repairs) and outputs (e.g. leakage) rather than the outcomes that matter (e.g. sustainable water abstraction from the environment). By definition this will not necessarily deliver on the true best-value outcomes that may be achieved.

In line with Wessex Water's Strategic Direction Statement[2], we are taking an **outcomes-led approach** to deliver long term ambition in alignment with long term statutory and regulatory ambition. This means rather than focussing on delivering specific targets on system outputs, the plan focusses on delivering against the outcomes and associated metrics that matter.

In a generic sense, the decision-making problem has a core set of components:

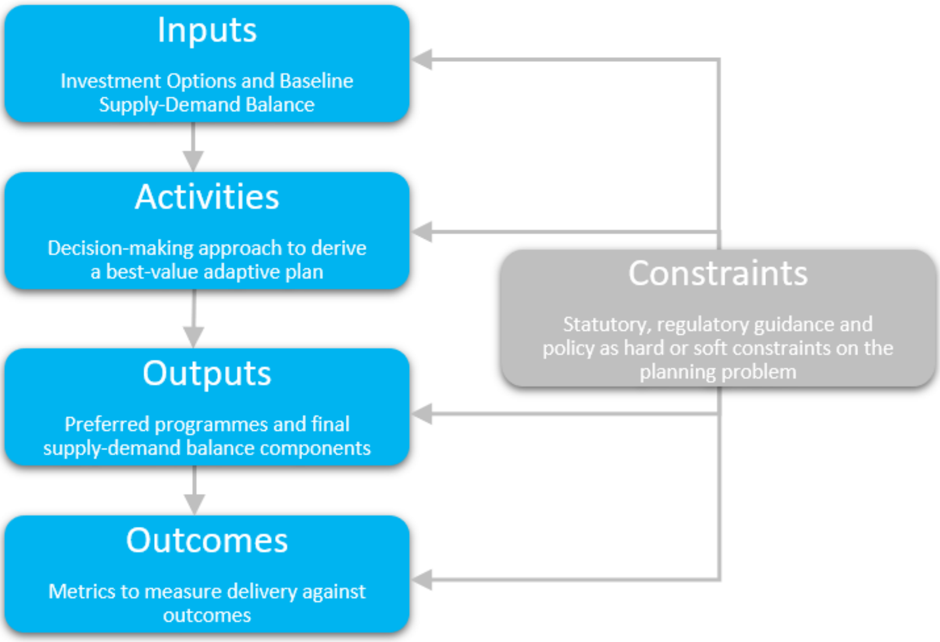
- **Inputs –** the potential investment options to solve the problem.
- **Activity** – the methods used to solve the decision-making problem.
- **Outputs** – factors that contribute to achieving the outcomes – investments and components of the supply-demand balance.
- **Outcomes –** identify what we are trying to achieve, as represented by metrics that are included in best-value decision-making.

To frame the decision-making problem, and appropriately incorporate statutory, non-statutory and government policy requirements and guidance into the decision-making[3], these factors will be included as either **soft or hard constraints** on the different components of the decision-making process (Figure 2-1).

[2] Our strategic direction | Wessex Water

[3] As recommended in the first stage of the UKWIR (2020) Deriving a Best Value Water Resources Management Plan (report ref: 20/WR/02/14).

Figure 2-1 Framing of the decision-making problem, and incorporation of constraints



2.2.1 Planning constraints

A range of factors need to be considered and taken into account when compiling the best-value plan, as set out in government and regulator policy, and summarised in Section 9 of the regulatory planning guidelines. The way in which these different factors are to be incorporated into the plan, as either hard or soft constraints on the definition of the planning problem, depends on the language used in the planning guidelines:

- **Must** refers to actions that are related to a statutory requirement
- **Should** refers to actions that are believed to be needed to produce an adequate plan

Table 2-1 Summarises the constraints on the planning problem, the component of the plan the constraint affects, the area of the plan the constraint applies to (see Figure 2-1) and how the constraint will be incorporated into the plan. The table has been derived from the regulatory planning guidance, Defra direction letter, and pre-consultation liaison with Ofwat and the Environment Agency.

Table 2-1 Key (regulatory) constraints on the WRMP decision-making problem and incorporation into the plan.

Plan Component	Factor	Constraint Area	Plan Incorporation
Supply-Demand Balance	System **should** be resilient to a 0.2% annual chance of failure caused by drought. **Should** aim to achieve this by 2039, but there is flexibility where costs are high locally in comparison to benefits. Where more flexibility is considered appropriate you **should** present a meeting 1 in 500 by 2050 at the latest	Outcome	Future Scenarios
Leakage (Demand)	**Should** plan as a minimum to meet Water UK's commitment to reduce leakage by 50% by 2050	Output	Future Scenarios

Plan Component	Factor	Constraint Area	Plan Incorporation
	(from 2017 levels).		
Metering (Demand)	**Should** evaluate charging by volume on universal metering for water stressed areas, or if compulsory metering would be one of your preferred options. Should also consider smart metering; metering on change of occupier; metering street-by-street; selective metering if there is high discretionary use. Should consider different scenarios, including roll-out as fast as possible.	Inputs: Options	Option development
Water Efficiency (Demand)	As a minimum **should** consider visits to vulnerable customers, the biggest water users, and where the biggest financial savings can be made. You **should** consider the use of different tariffs and incentives and consider as part of options appraisal.	Inputs: Options	Option development
Per Capita Consumption (Demand)	**Should** account for any future demand reduction assumptions set out in the National Framework, Regional Plans and targets set out by government and regulators. National Framework – regional groups should contribute to a national ambition on average PCC of 110 l/p/d by 2050.[4]	Output	Future Scenarios
Distribution Input	We **should** plan as a minimum to meet Defra's water demand target set under the Environment Act 2021 to reduce the use of public water supply in England per head of population by 20% from the 2019-20 baseline by 31 March 2038.	Inputs: Options and Outputs	Option Development and Future Scenarios
Drought permits and orders	**Should** plan to use drought permits and orders less frequently in the future, particularly in sensitive areas. **Should** only consider supply drought measures as options where they have no significant environmental impacts associated with them	Inputs: Options	Option development
Environment	**Should** plan to deliver overall positive environmental benefit	Outcome	Outcome and programme constraint
Environment	**Should** use the Strategic Environmental Assessment, Biodiversity Net Gain and Natural Capital to inform your decision-making	Outcome	Outcome metric constraint
Environment	**Should** deliver environmental and biodiversity net gain and natural capital benefits	Outcome	Outcome metric constraint
Environment	**Should** consider the following five services as a minimum in the Natural Capital assessment: biodiversity and habitat; climate regulation; natural hazard regulation; water purification; water	Outcome	Outcome metric constraint

[4] The EA National Framework states that 110 PCC is an annual average per capita consumption expected in a dry year – e.g. under the DYAA scenario

Plan Component	Factor	Constraint Area	Plan Incorporation
	regulation		
Environment	**Must** assess whether your plan is subject to an SEA	Outcome	Outcome and programme constraint
Environment	**Must** undertake a Habitats Regulations Assessment (HRA)	Outcome	Outcome and programme constraint
Environment	**Should** set objectives to further biodiversity and these should influence your decision-making, including consideration of obligations in the future Environment Bill	Outcome	Outcome and Programme constraint
Environment	**Should** incorporate biodiversity gain into the design of your supply and transfer options where reasonable; schemes that require planning permission are likely to legally provide biodiversity net gain.	Inputs: Options	Option development
Environment	**Must** consider the WFD requirements including legally binding objectives in the RBMPs.	Outcome	Outcome and Programme constraint
Environment	**Should** seek to ensure any development delivers wider environmental gains relevant to the local area such as reduced flood risk, improvements to air or water quality, or increased greenspace	Outcome	Outcome and Programme constraint
Resilience	**Should** improve the resilience of supplies, and ensure that the options selected are resilient to other hazards such as weather extremes	Inputs: Options	Outcome and Programme constraint
Resilience	**Should** not include any 1 in 500 planning deficits. Any deficits in the initial part of the planning period while best-value solutions are implemented should be met with drought measures, or a reduced level of service in the interim period	Inputs: Options	Options development; Outcome and Programme constraint
Decision-making	**Should** consider a range of programmes and undertake sensitivity/scenario testing of your programmes, including a “least-cost” programme and a “best environment and society” programme as a minimum.	Activities: Decision-Making	Decision-making methodology
Decision-making	**Should** demonstrate effective engagement with regulators, stakeholders, and customers at key stages throughout development of the plan.	Activities: Decision-Making	Decision-making methodology

2.2.2 Baseline planning assumptions and decisions

Based on the planning guidelines and our planning problem (Problem Characterisation), Table 2-2 lists the baseline assumptions to be made for our plan.

Based on the Water Resource Zone Integrity Assessment, and recent investments in the new water supply grid[5], we plan on the basis of a single water resource zone. As per the planning supplementary guidance[6], perfect integration is not possible and there will always be limitations to a supply network.

Our plan will cover a 60-year horizon from 2019/20, the base year, to 2079-80. The base year has been selected to provide a baseline for forecasts of household and non-household consumption independently of the impact of covid-19. The extended horizon to 2070-80 is consistent with the West Country Water Resources Group (WCWRG) regional plan, which was chosen to help be consistent with other regions' planning horizons to facilitate inter-regional transfer planning.

As per the problem characterisation assessment, and consistent with previous plans, Wessex Water's supply system is a mix of both groundwater sources (70-80% drought distribution input) and surface water sources. We are therefore planning on the basis of a Dry Year Annual Average Scenario (DYAA), to account for annual average drought issues on reservoir storage an annual licence management, and a Dry Year Critical Period (DYCP) scenario to account for when peak summer demands coincide with low groundwater levels.

All other issues listed in Table 2-2 will be incorporated into the baseline planning scenarios.

Table 2-2 Baseline planning assumptions for WRMP24

Area	Assumption/Decision
Water Resource Zones	Supply Area
Base-year	2019-20
Planning horizon	2019-20 to 2079-80
Planning Scenarios	Dry Year Annual Average (DYAA) and Dry Year Critical Period (DYCP)
Supply Forecast	Estimated supplies availably in a drought with likelihood of 1 in 500 years, or 0.2% in any one year by 2039, and in 1 in 200 drought for alternative level of service prior to 2039.
Demand Forecast	DYAA and DYCP demand when demand is high before temporary use bans imposed.
Leakage	Leakage should remain static from the first year of the plan (2025-26) throughout the planning period
Customer Demand	Forecast without any further water company intervention; all AMP7 water efficiency and metering programmes should end.
Transfers	Existing transfers to the extent of bulk supply agreements
Sustainability Reductions	Impact of any confirmed or likely sustainability changes as identified for implementation in AMP8.

[5] Water supply grid (wessexwater.co.uk)

[6] EA (March 2021) Water resources planning guideline supplementary guidance – Water resource zone integrity.

Non-SDB benefit	The benefit of non-supply-demand balance solutions such as capital maintenance
Water quality	Declining water quality risks to groundwater and surface water sources.
Scheme benefit	Benefits of schemes that have permissions to go ahead or funding such as abstraction licences.
Drought options	No demand side (e.g. temporary use bans or non-essential use bans) or supply side options (e.g. drought permit options) included in the plan.[7]

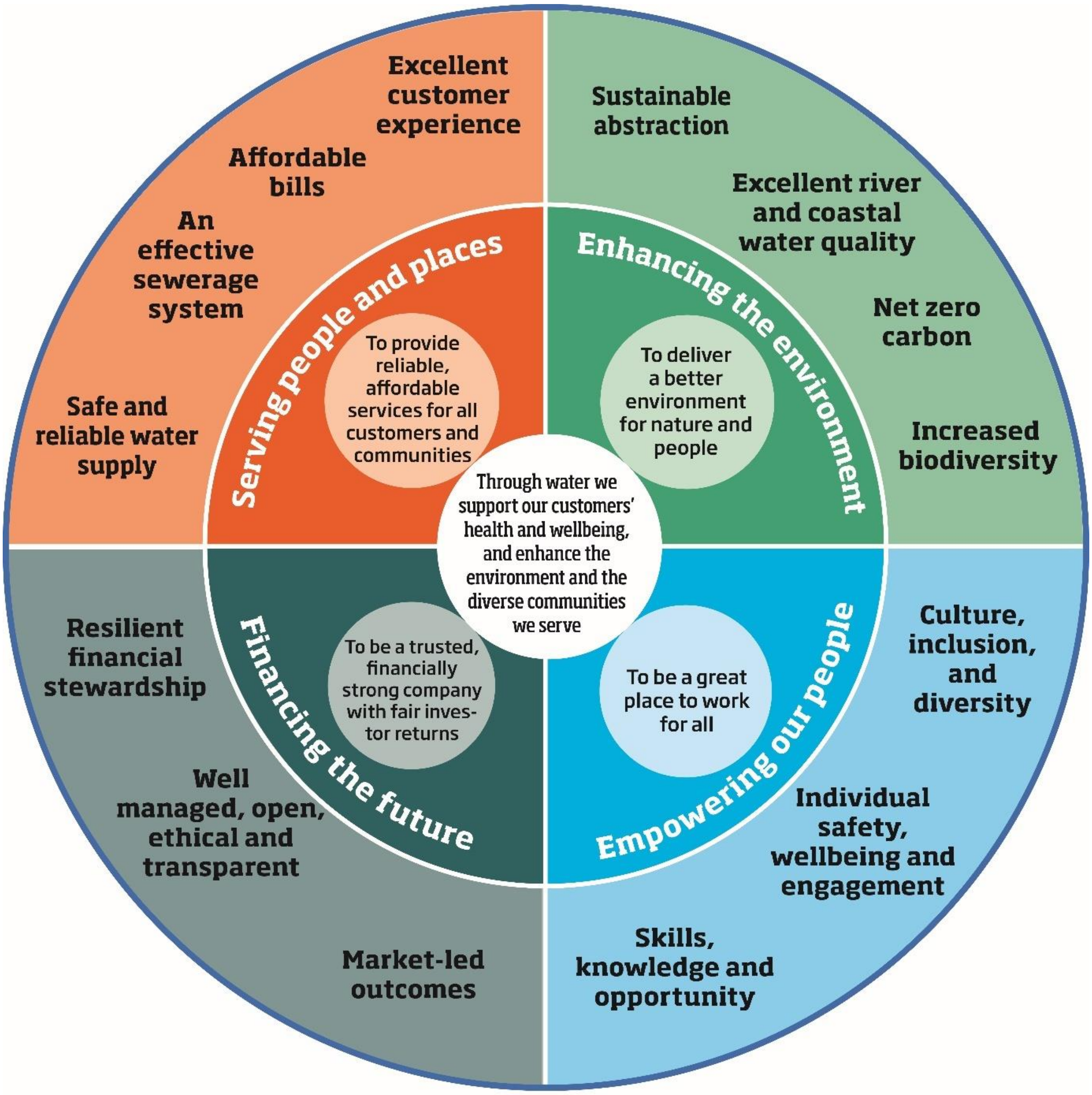
2.3 Step 2: Identify and consider best-value metrics

The challenges facing society today are extreme. There is a compelling need to plan for the long term, to mitigate and adapt to a changing climate, and to reverse the degradation of the natural world. This is to protect the planet itself, and all the people and life it sustains. Our purpose is to support our customers' health and wellbeing and enhance the environment and the diverse communities we serve.

Our overall purpose is to improve public health, enhance the environment, and create value for the people we service. Wessex Water's Strategic Direction Statement[8] is our long-term plan, that sets out our vision through to 2050. At its heart are eight outcomes that our customers and stakeholders have told us are their priorities.
Figure 2-2 summarises our 25-year plan; in the top half are the eight outcomes which we have identified with stakeholders and which comprise the heart of our Strategic Direction.

[7] These will be included as appropriate within the options list for the Plan.
[8] Our strategic direction | Wessex Water

Figure 2-2 Wessex Water's Outcomes-led approach, with 8 outcomes to serve people and places and enhance the environment (top half outer circle)



Based on the outcomes-led approach, and combining with the key regulatory planning constraints shown in Table 2-1, Table 2-3 summarises our key plan criteria, and the associated metrics that will be used to derive the best-value plan, and how these relate to the outcomes and the policy requirements. These metrics capture the key trade-offs we need to consider in developing the WRMP between delivering drought resilience, the carbon and financial cost of achieving this, and the environmental benefit of doing so. These metrics align with the core regulatory planning guidance expectations.

Table 2-3 Summary of Plan criteria, associated metrics, PR24 outcomes and policy requirements

Criteria	Metric	PR24 Outcome	Policy Requirements
Programme Cost	Net Present Value (NPV)	Affordable Bills	Should consider a range of programmes including "least-cost", and consider how application of policy expectations affects costs
Drought Resilience	Timing of achieving 1 in 500; Frequency of Hosepipe Bans	Safe, Reliable Water Supply; Great Customer Experience	Should achieve 1 in 500 no later than 2039, but explore sensitivity to this, no later than 2050
Carbon	Carbon Dioxide Equivalent Emissions	Net-Zero Carbon	Minimise carbon to contribute to Net-Zero by 2050
Biodiversity Net Gain	Biodiversity Score (Defra biodiversity metric)	Increased Biodiversity	Plan should provide net-gain at scheme and plan level
Natural Capital	Natural Capital Metric	"Enhancing the Environment"	Plan should deliver natural capital benefits
Abstraction reduction - Environmental Destination	Achieve Required Environmental Destination Licence Reductions	Sustainable Abstraction	Plan should explore an enhanced environmental scenario beyond the BAU and a "best environment" plan

In addition to the specific metrics considered above, the decision-making approach also incorporated WFD, SEA, INNS and HRA assessments as constraints to feasible options used in the decision-making tool.

2.4 Step 3: Identify a least cost plan

Traditionally, water resources planning has been developed on the basis of least cost planning – that is, the investment plan that satisfies the planning constraints (e.g. zero supply-demand balance deficit over the planning period) at lowest cost. A least cost plan has been developed for this plan and was assessed and compared to other plans. For this plan we have developed a true least cost plan, independent of policy constraints, and least costs plans given policy expectations (soft constraints) on metering and leakage options.

2.5 Step 4: Develop a decision-making approach

The decision-making approach must clearly and transparently set out how the best value metrics have been considered and applied in the selection of the preferred programme to deliver the set objectives. The planning guidance specifies that to determine the decision-making approach we adopt for the plan, we should use the problem characterisation step of UKWIR's Decision-Making Process Guidance[9]. The decision-making process guidance sets out a framework for developing a Water Resources Management Plan, as follows:

[9] UKWIR (2016) WRMP 2019 Methods - Decision-Making Process: Guidance (Report Ref: 16/WR/02/10)

1. Collate and review planning information & supply-demand balances
2. Review list of unconstrained options
3. Problem characterisation – evaluate strategic needs and complexity
4. Select appropriate modelling method
5. Identify and define data inputs to the model(s)
6. Undertake decision-making modelling
7. Stress testing and sensitivity analysis
8. Reporting to summarise and input to the WRMP

Stage 4 of the UKWIR Decision-making guidance sets out a three-step process to identify the appropriate modelling method for the decision-making problem.

1. Use the problem characterisation assessment to determine the level of "modelling complexity to adopt" (Summarising Stage 1 and 3 of the overall framework)
2. Identify if an extended or complex level of modelling is preferred and decide on the appropriate modelling method
3. Select the preferred decision-making tool.

2.5.1 Problem characterisation

The problem characterisation assessment identifies the scale and complexity of the planning problem, and the vulnerability to various strategic issues, risks, and uncertainties, as follows:

- **Strategic Needs ("How big is the problem?")** – a high-level assessment of the scale of need for new water resources and/or demand management strategies; and
- **Complexity factors ("How difficult is it to solve?")** – an assessment of the complexity issues that affect investment in a particular water resource zone or area.

The overall assessment for Wessex Water's supply area led to a Strategic Needs score of 4, and a Complexity Factors score of 8[10]. These scores principally reflect:

- Potentially significant supply/demand imbalances requiring supply side investments, driven by:
  - Change to 1 in 500 level of service for level 4 restrictions by 2039
  - Environmental Destination licence losses by 2050 in the Wessex Water supply area
  - Climate change impact
- Spatial and temporal variation of deficits resulting from above drivers, and uncertainty in how these might operate to meet annual average and critical period demand, which increases the complexity of the problem.

Table 2-4 Problem characterisation model complexity matrix

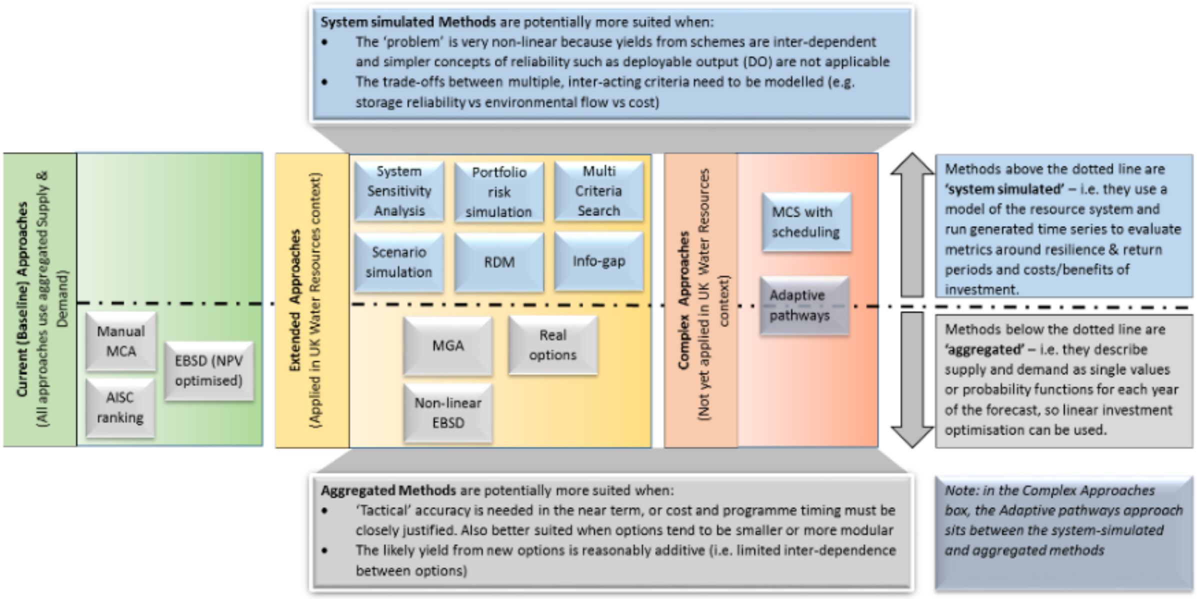
		Strategic Needs Score ("How big is the problem")			
		0 (none)	**2 (small)**	**4 (medium)**	**6 (large)**
Complexity Factors Score ("how difficult is the problem")	**Low (<7)**	X			
	Medium (7-11)			X	
	High (11+)				

2.5.2 Identify level of modelling complexity and a preferred method

The UKWIR guidance states that the evaluation of strategic needs and complexity issues that affect investment need to be used to determine the appropriate modelling tool. A general categorisation of methods that could be applied is shown in Table 2-3, showing there are two main factors to consider:

- **Degree of modelling complexity**: the level of complexity is divided into current, extended, and complex approaches; the choice depends on whether a low, moderate, or high level of concern has been identified in the problem characterisation assessment.
- **Choice of modelling method:** whether an aggregated or system simulated approach should be taken, each with their pros and cons.

Figure 2-3 Mapping of Decision-Making Method and Tools[11]



The purpose of the problem characterisation matrix is to identify whether additional decision-making modelling is required above and beyond current ESBD approaches. As Wessex Water has identified a **moderate level of planning concern** an **extended approach** has been chosen for the modelling complexity. In addition to the issues identified in the problem characterisation, WRMP24 guidance also requires us to move beyond least-cost approaches

[11] UKWIR (2016) WRMP 2019 Methods - Decision-Making Process: Guidance (Report Ref: 16/WR/02/10)

to multi-objective approaches in order to develop a best-value plan, and also to consider developing an adaptive plan – e.g. an adaptive pathways approach as identified in Figure 2-3 as a complex method.

2.5.3 Choice of modelling method

Aggregated or System Simulated methods can be adopted for the choice of modelling method. Each approach has its strengths and limitations:

- **Aggregated approaches** describe the supply-demand balance as single values for each year of the forecast and can use linear investment optimisation approaches to identify and schedule system investments. Under aggregated approaches, "tactical" extended tactical methods can be applied including **modelling to generate alternatives** and **real options analysis**. Aggregated methods can more easily handle exploration of scheduling issues, but the simplified representation of the supply system in an aggregated supply-demand balance – in both space and time – may not capture all issues relating to new investment options and how they interact conjunctively in the supply system.
- **System simulated approaches** are more appropriate when needing to consider other metrics of drought resilience when a Deployable Output metric is not a good metric for system resilience. They are particularly useful for understanding scheme interactions on overall system performance. This is particularly the case where the benefit of new storage options needs to be considered, to understand conjunctive use with existing and new sources – e.g. in how control rules operate. The downside of system simulated approaches is that they do not handle scheduling as well as aggregated approaches, which can become particularly complex.

Based on Wessex Water's problem characterisation, **A hybrid approach** has been initially chosen to develop WRMP24, for the following reasons:

- New planning requirements mean there are a number of tactical decisions that need to be made in WRMP24 relating to the timing (and trade-off) of when specific outputs and outcomes may be achievable, including achieving 1 in 500 drought resilience, timing, and magnitude of delivery of Environmental Destination licence reductions, and of potential delivery of Per Capita Consumption and 50% leakage targets as well the overarching Defra DI target by 2037-38. An 'extended' aggregated approach is therefore required to efficiently explore the choices and implications of different scenarios of SDB change, and programmes on the overall decision-making problem.
- The combined impact of climate change, environmental destination, and the move to 1 in 500 drought resilience, means there is a spatial focus of likely resultant deficits in the groundwater dominated parts of our supply area. A form of distributed modelling is therefore required to understand better the spatial dimensions of the planning problem and ensure that the selected schemes under an aggregated approach are appropriate to meet demand as a result of spatially localised licence losses.

2.5.4 Select the preferred decision-making tool

In selecting the decision-making tool, the UKWIR guidance considers four components of decision-making tool that need to be considered:

1. **Objectives –** whether multiple criteria need to be considered as part of the decision-making tool itself
2. **Approach –** whether aggregated or system simulated approach is to be applied
3. **Selection –** how the solution is selected: human decision-making and expert judgement or some form of ranking or optimisation to identify "optimal" solutions.
4. **Solution** – describes the nature of the solution required: a schedule of single preferred options; a portfolio of preferred options, where the solution is not specified; or and adaptive strategy of alternate schedules and a set of metrics to monitor to determine between strategies.

UKWIR guidance provides a table of advantages and disadvantages of each method based on these four decision-making method components to help chose the right decision-making method. For the decision-making tool itself, we have selected to use **Modelling to Generate Alternatives (MGA)** as the principle aggregated decision-making tool, to fit within the broader hybrid "best-value" decision-making process. MGA was selected in this case because there is a need to assess multiple future scenarios, depending on different policy drivers and future uncertainties to be able to develop an adaptive plan.

2.5.5 Risk Composition and Uncertainty Assessment

In addition to determining the appropriate decision-making method, the problem characterisation also determines the adoption of a **Risk Composition**, which determines the **Integration Methods** we adopt to handle risk and uncertainty in development of supply, demand, and investment forecasts to appropriately feed into the selected decision-making tool. The processing stages for selecting a risk-composition are set out in the risk-based planning guidance[12] that accompanies the UKWIR decision-making guidance.

The three risk-compositions are as follows:

- **1. Conventional Plan –** supply capability based primarily on the historic record with conventional supply-demand balance calculations.
- **2. Resilience Tested Plan** – Drought events beyond the historic record are used to test the plan and inform the "best-value" investment programme.
- **3. Fully Risk-Based Plan** – More advanced analysis of datasets and drought to explore yield response to different drought patterns.

As captured in the problem characterisation assessment, regulatory planning guidance now requires companies to plan to a 1 in 500 level of service for level 4 drought restrictions (standpipes and rota cuts). This means a move to analysis beyond those events in the

[12] UKWIR (2016) WRMP19 Methods - Risk Based Planning (Report Ref: 16/WR/02/11)

historical record, which rules out the adoption of Risk Composition 1 for development of WRMP24.

Risk Composition 2 and 3 primarily differ based on how they conceptually handle future uncertainties: whereas Risk Composition 3 expresses future uncertainty primarily in probabilistic terms, Risk Composition 2 adopts a scenario approach, given deep uncertainties, to handle uncertainty in terms of a plausible set of drought events and demand scenarios to test a range of investment portfolios under a range of future scenarios.

Based on a review of the risk-based planning guidance **Risk Composition 2** has been adopted for plan development, with a **Scenario-based integration method**. The integration method is compatible with the (potential) development of an adaptive plan, and an appropriate conceptualisation of deeply uncertain future uncertainties, where the plan can be structured to adapt to these uncertainties. This is particularly the case where there are discrete policy choices to consider alongside exogenous factors. The guidance states that **Risk Composition 2** is appropriate in cases where there are limited near-term uncertainties, and where there are not very significant concerns about the supply side “complexity factors” in the problem characterisation. The method is therefore deemed appropriate for Wessex Water’s supply system given the main drivers for supply-demand balance changes are future uncertainties in delivery of 1 in 500 drought resilience, environmental destination, and climate change impact in the period from 2039 to 2050. The dominance of environmental destination risks particularly supports this, as these tend to represent discontinuous risks, which are much better to evaluated through scenario approaches.

Whilst Risk Composition 3 is not adopted, the new regulatory guidance requirements for understanding drought resilience to a 1 in 500 level of service means that the approach taken to derive the 1 in 500 DO for the supply system is based on analysis of an artificial dataset. This means that the Deployable Outputs that feed into the aggregated modelling are consistent with Risk Composition 3. This baseline analysis will also be used to identify ‘drought libraries’ to test candidate portfolios in the system simulator under the latter stages of the hybrid approach.

A **scenario-based integration method** incorporates uncertainties in two primary ways, depending on whether the uncertainties considered are baseline uncertainties in system performance in drought, or future uncertainties in exogenous factors like climate change or policy choices:

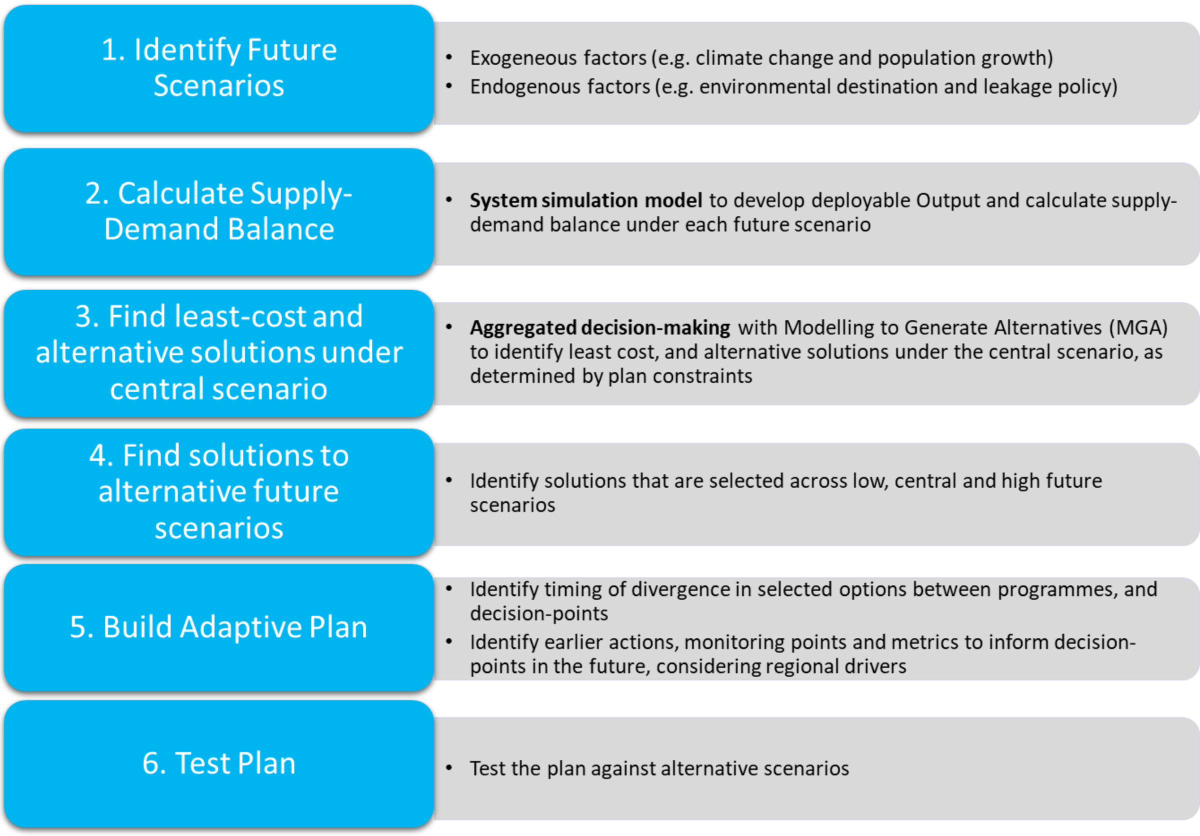
- A conventional **headroom allowance** is included into the supply-demand balance (and in system simulation at demand centres) to represent baseline uncertainties as a constant throughout the planning period (See Section 4)
- **Future scenarios** are used to handle future uncertainties in both exogenous and endogenous factors, as described in Stage 1 of the decision-making method (See Section 3).

The advantage of this approach is that rather than incorporate key future uncertainties into a target headroom allowance and chose a glidepath percentile, which somewhat hides the importance and significant of different future uncertainties, the choices are drivers for decision-making are more clearly exposed to the decision-maker.

2.5.6 *Chosen Decision-making method: approach based on modelling to Generate Alternatives*

Building on the problem characterisation and considerations of the supporting UKWIR guidance, Figure 2-4 shows a schematic of the WRMP24 decision-making process applied. Understanding plan sensitivity to key **factors** is a central theme to the regulatory planning guidance. Given future uncertainties in exogenous factors that will influence the plan (e.g. climate change and population growth), as well as endogenous factors – policy and company choices regarding the environment, timing of achieving drought resilience and demand reductions – as well as the potential need to trade-off in these choices, the decision-making process is framed with **scenario analysis** to explore option identification across a range of **potential futures** (Stage 1; See Section 3). Through scenario analysis multiple future supply demand balances have been generated (Section 5). System simulation modelling is used in Stage 2 with Wessex Water's detailed Miser system simulation model[13] to calculate deployable output for each of these scenarios.

Figure 2-4 Schematic of WRMP decision-making process



In stage 3, under the central supply-demand balance scenario **least cost** and **alternative solutions** are considered given constraints on the planning problem and performance of options across best-value planning metrics. Whilst conventional "least-cost" optimisation would seek to find the least-cost solution to the problem, this extended approach seeks to move away from identifying the least cost solution by exploring alternative solutions that may

[13] Wessex Water's Miser system simulation model includes all ~80 sources in the supply system and includes 132 demand nodes as well as all major transfers balancing resource use across sources.

be near to the least-cost solution but perform better in terms of other outcomes. To derive alternative solutions, prior to running the investment model, the feasible options available to solve the supply demand balance have been constrained by:

- Performance against environmental metrics
- Policy expectations on meeting leakage and demand reductions

Decision-Making Modelling

To derive a planning solution under alternative scenarios, we have adopted a hybrid decision-making approach, combining a least cost optimisation “EBSD” model, and our distributed system model for scenario testing. The decision-making approach proceeded as follows:

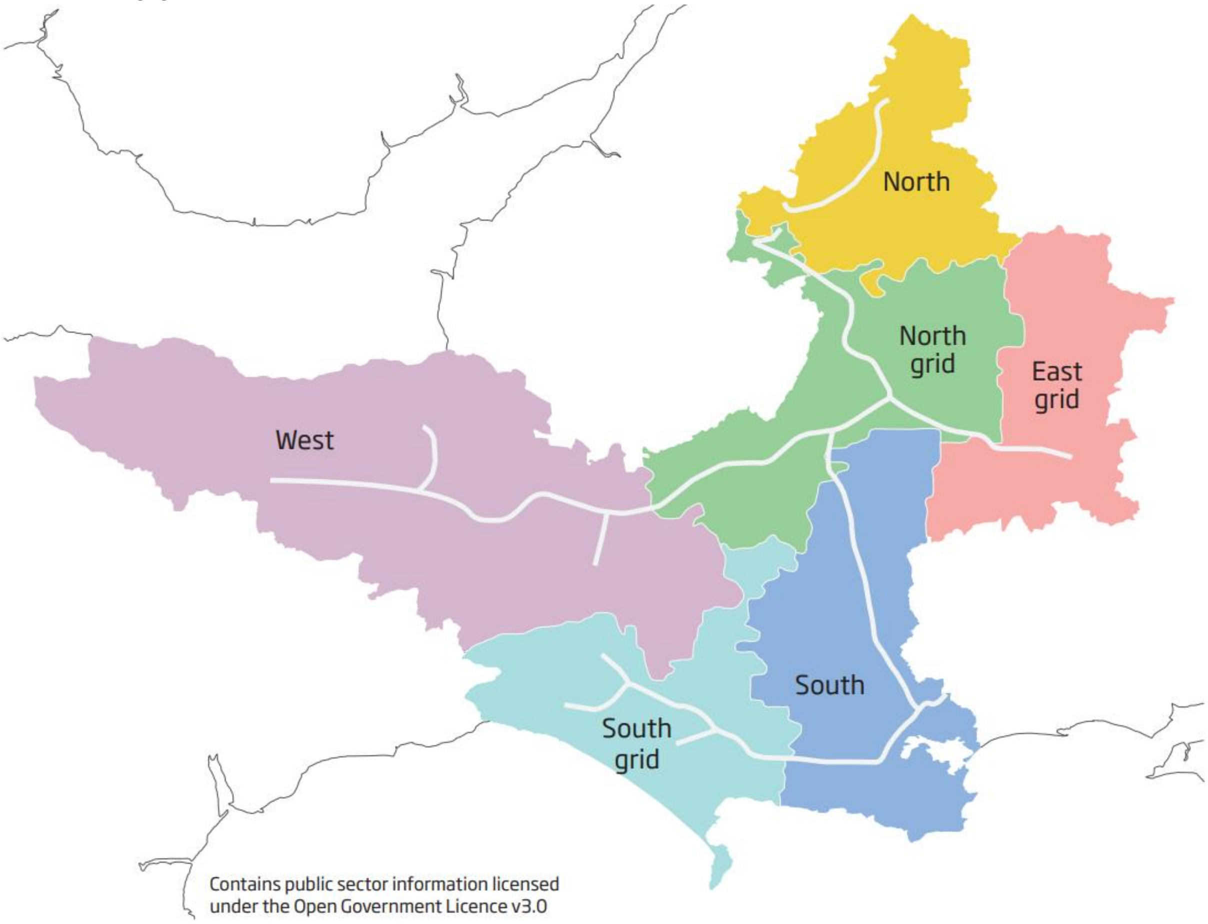
- **EBSD model testing –** run the least cost optimisation model for different supply-demand balance scenarios to identify solutions for different model run-types, including true least cost runs, and to derive alternative best-value scenarios that meet government expectations on demand management strategies and where the worst performing options environmentally are excluded from the optimisation (see Options Screening section Below). The model works by satisfying the constraints that the supply demand balance must be positive under both DYAA and DYCP planning scenarios simultaneously whilst finding the least cost solution. An aggregated decision-making approach was used to ensure that options were appropriately scheduled, and least cost solutions identified.
- **System simulation model testing** – test the chosen options at key time-slices through the planning horizon in our distributed system simulation model to ensure the model can satisfy all local deficits, given the spatially localised focus of the environmental destination licence losses
- **Scenario testing –** undertake alternative scenario testing of the identified plans, including in relation to the timing of 1 in 500 resilience, licence change scheduling, as well as in relation to additional needs from other users in the region – including MoD and Veolia Water Services.

To help circumvent the need for significant iteration between an aggregated least cost model, and system simulation modelling at specific points in the future to test the performance of the chosen solutions, we disaggregated the supply-demand balance into six Water Resources Sub Zones in the aggregated EBSD model (Figure 2-5). All new supply options were assigned to an individual sub-zone, and transfer options that would typically be linked to specific supply-side schemes were included as transfers between the different zones. Demand reduction options were selected globally across zones, with proportional benefit in each zone. The advantage of the approach taken is that it allows us to account for the “downstream” costs associated with transfer options to move water from where it is created through demand reductions (which will mainly be achieved in demand centres) to where it is needed associated with licence reductions, as opposed to any a priori assignment of specific transfer schemes to specific supply schemes.

Options Screening

Once we ran the true least cost optimisation runs, a key step in deriving the best value plan was to use some of the best value planning metrics to screen out unacceptable supply options from environmental grounds, prior to the best investment modelling. Based on the relative performance of options for WFD, SEA, carbon, Natural Capital and Biodiversity, options were initially grouped into three bands based on their annual average yield to ensure options were assessed comparability. The options were scored relative to the 50th percentile for each of the environmental metrics to allow the option performance against the average to be assessed. The worst performing options were removed from the investment model inputs, whilst some schemes were kept in based on qualitative assessment or if the scheme was a regional SRO. The decision-making tool was then re-run to derive alternative "best value" solutions given the constrained options set.

Figure 2-5 Wessex Water supply area, with 6 sub-zones used for investment modelling, and the existing grid connections between zones



In Stage 4, based on the outcomes of the optimisation for the central scenario, investment programmes are also found for alternative futures (see Section 8), and these are used to qualitatively build the adaptive plan through analysis of which options are selected across scenarios (those to be included in the Ofwat core pathway) and those which are selected specifically under alternative futures to inform the appropriate decision points for moving to these alternative pathways. Finally, the chosen plan is tested against alternative scenarios not used in the optimisation process (Section 9).

2.6 Step 5: Appraise and compare different programmes

Section 7 of this document explains how alternative programmes have been compared and appraised under the central planning scenario. Further information on the options screening and valuation can be found in the Options Appraisal Technical Appendix in support of decision making

2.7 Step 6: Accounting for Customer and Expectations

Customer expectations in each of the key plan areas is detailed in Section 6 of this document, with further details of the individual pieces of research used to support decision making detailed in the Pre-consultation and Customer Research Technical Appendix.

2.8 Step 7: Adaptive Plan

Section 8 of this document explains how the adaptive plan was developed

2.9 Step 8: Testing your plan

Section 9 of this document shows how the adaptive plan performs against alternative supply-demand balance scenarios.

3. Scenario Uncertainty

As described in Section 2, uncertainty in our planning is handled through two approaches: **future uncertainties** are handled through scenario uncertainty to derive alternative supply demand balances under different potential future scenarios, which are used to help develop an adaptive plan, and baseline uncertainties are handled through a conventional headroom allowance (Section 4).

Table 3-1 shows the future uncertainties that are considered in scenario uncertainty analysis, with reference to the plan section that provides further details of the derivation of the forecasts. Forecast uncertainty in water quality pollution was assessed, based on our nitrate trend modelling (Supply Forecast technical appendix Section 7.6), but in drought conditions, when groundwater levels are low, only one source was affected under a high scenario, where nitrates are not already dealt with through either treatment or blending, so this factor was excluded from the scenario analysis.

For each factor a low, central, and high forecast has been derived to represent the range of uncertainty in the factor in the future. Our main central forecast, or most likely plan, combines the central forecasts from each uncertainty factor in the supply-demand balance, and is presented in Section 5.1.

Table 3-1 Scenario Uncertainty Factors

Scenario Uncertainty	Description	Plan Section
Environmental Destination	Uncertainty in the level and timing of environmental destination and sustainability reduction licence losses	Supply Forecast Section 4
Per capita consumption	Uncertainty in future household demand	Demand Forecast Section 5
Climate change emissions uncertainty	Uncertainty in the impact of climate change on available supplies	Supply Forecast Section 3
Population and Property Growth	Uncertainty in future population and property growth in the supply area	Demand Forecast Section 4
Non-Household demand	Uncertainty in future non-household demand	Demand Forecast Section 6
Water quality pollution (e.g. future Nitrate changes)	Uncertainty in water quality pollution (Nitrates) driven supply availability in drought	Supply Forecast Section 7.6

Alternative scenarios have also been generated from the five scenario uncertainty factors. Generating all scenarios across the five factors would result in 243 alternative scenarios, which was too many to include within our decision-making. When looking at different alternative future reference scenarios, Ofwat's final guidance on long-term delivery strategies[14] states then when combining plausible extremes of different factors, combining them together risks producing a very low probability scenario, and also that scenarios may be usefully combined if they are considered relatively likely and produce a plausible future scenario.

[14] Ofwat (2022) Pr24 and beyond: Final guidance on long-term delivery strategies. PR24-and-beyond-Final-guidance-on-long-term-delivery-strategies_Pr24.pdf (ofwat.gov.uk)

With this guidance in mind, in addition to the central forecast scenario, we have generated nine alternative plausible future scenarios, combining the low, central, and high scenarios across different factors, as shown in Table 3-2, considering across factors where there may be a plausible probability of high "need" (high demand/low water availability in the future). The baseline supply-demand balances for these scenarios are shown in Section 5.

To develop the adaptive plan, we have chosen from the scenarios a low, central, and high scenario to represent the spread of potential future supply-demand balance need. These scenarios have been chosen following Ofwat's final guidance on long-term delivery strategies that states then when combining plausible extremes of different factors, combining them together risks producing a very low probability scenario. Therefore, we have chosen the low, central and high forecasts to avoid these extreme and implausible scenarios/combinations of uncertainty (e.g., scenarios 5, 7, and 8). For each of these scenarios we have run the investment model to identify alternative plans, and investments across those plans to construct the adaptive plan.

We have also undertaken sensitivity testing of the plan to some alternative scenarios, which includes:

- Additional need from Veolia Water and MoD in the Hampshire Avon catchment from 2035
- Delaying meeting the 1 in 500 level of service to 2049-50
- Delaying licence changes and abstraction reductions from 2035-36 to 2042 for non-Hampshire Avon sources and for all licence changes.
- Scheme availability and scheme environmental uncertainty

Table 3-2: SBD scenarios considered

SDB Scenario	Future Uncertainty Factors				
	PCC	Population and Property Growth	Non-Household Demand	Climate Change	Environmental Destination
1	Central	High	High	High	Central - main
2	Central	Central	Central	High	High - main
3 (central)	Central	Central	Central	Central	Central - main
4	Central	Low	Low	Low	Central - main
5	High	Central	Central	High	High - main
6 (high)	Central	High	Central	Central	High- main
7	High	High	High	High	High - main
8	Low	Low	Low	Low	Low- main
9 (low)	Low	Central	Central	Central	Low - main

4. Headroom Uncertainty

When calculating the supply-demand balance, the difference between total supply (Total Water Available For Use; TWAFU) and total demand (Distribution Input) is called Available Headroom, and if positive there is a surplus of supplies over demand. The components of the supply and demand forecast are inevitably uncertain, and so a margin of uncertainty, known as Target Headroom, is allowed for as part of the planning process. This Target Headroom is taken away from the Available Headroom as a planning buffer for uncertainty. A water resource zone is in supply-demand balance deficit if the available headroom falls below target headroom and is in surplus if the available headroom exceeds target headroom.

In our WRMP19 forecast, all uncertainties in the planning process were incorporated into target headroom. For this plan, we have divided how uncertainty is handled in the planning process: **future uncertainties** associated with uncertainty about future impacts of climate change and demand growth, for example, are incorporated into alternative supply-demand balance scenarios. **Baseline uncertainties**, associated with uncertainties in our understanding of the supply demand balance today, under drought conditions, are accounted for in the Target Headroom Allowance.

We contracted consultants Mott MacDonald to undertake the uncertainty analysis and modelling required to derive an appropriate target headroom allowance for our single resource zone. We used the 2002 (simpler) methodology developed by UKWIR: An improved methodology for assessing headroom. The methodology involves examining the uncertainty of each component as probability distributions that are then modelled using a Monte Carlo simulation.

The components of the supply demand balance that are included in the headroom assessment reflect the factors that could affect water available for use or actual demand. Here we summarise how each of the baseline supply-side and demand-side issues were considered in our analysis, prior to presenting the overall headroom allowance.

4.1 S6 Accuracy of Supply-side Data

A summary of the uncertainty allowances made for supply-side uncertainty is shown in Table 4-1. The uncertainty of all supply-side components remained constant over time.

Table 4-1 Supply-side data uncertainty components

Component	Planning conditions	Distribution	Minimum Loss in DO*	Modal Loss	Maximum Loss in DO	Assumption
S6-1 Licence-constrained DO	Both	Triangular	-2%	0	+5%	To reflect metering uncertainty - % factors as specified at WRMP19. Assume 25% of licence-constrained sources have separate abstraction meters to DI meters. Uncertainty for other 75% is captured under D1

S6-2 Yield-constrained groundwater DO	DYAA	Triangular	-3.99 Ml/d	0 Ml/d	+9.97 Ml/d	See Section 4.1.2
	DYCP		-21.09 Ml/d	0 Ml/d	+38.9 Ml/d	
S6-3 Infrastructure constrained DO	Both	Triangular	-2%	0	+2%	Applied to infrastructure constrained sources only, reflecting uncertainty in achieving peak outputs
S6-4 Meter error	Not used so as not to double count S6-1 components					
S6-5 Abstraction licence compliance DO	DYAA	Triangular	0	0%	+3%	Allowance to reflect difficulty of achieving precise annual licence abstraction volumes, when balancing abstraction across sources in the supply area
S6-6 Reservoir yield uncertainty	DYAA	Triangular	-1.16 Ml/d	1.17 Ml/d	3.67 Ml/d	See Section 4.1.1

*Negative denotes gain in DO

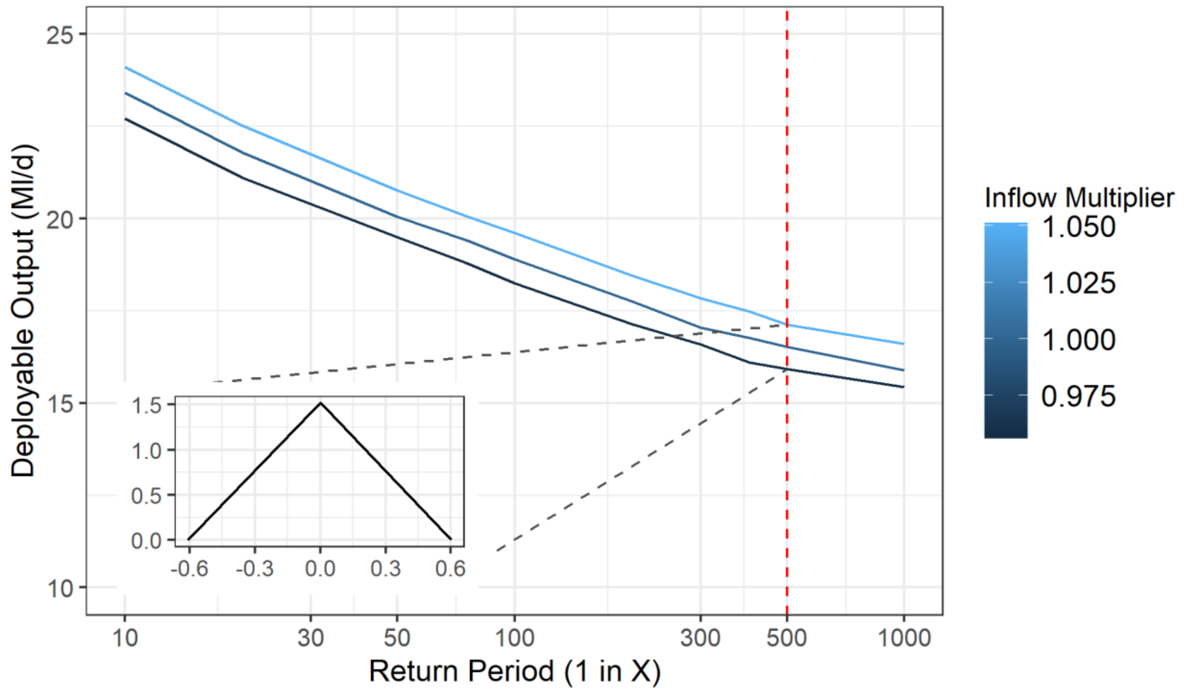
4.1.1. S6-6 Reservoir yield uncertainty

Yield uncertainty of reservoirs is primarily affected by the uncertainty in the calibration of hydrological models used to predict reservoir inflows, and the uncertainty in available reservoir pump storage. To account for this uncertainty, the following process was applied for each reservoir:

- uncertainty of the hydrological model calibrations used for reservoir inflows (see Technical Appendix on Supply Forecast) was assessed through comparison of the model prediction against the different sources of observed data considered in calibration (comparison of cumulative inflow predictions, primarily during periods when the reservoirs were not full – e.g. lower flows against reservoir mass balance data, regionalised inflows and Qube data) to identify plausible lower and upper bounds of cumulative reservoir inflow, and where relevant, uncertainty in available pump storage, as constrained by flow conditions (Table 4-2).

The lower and upper bounds of the uncertainties were used to derive multipliers of reservoir inflows, and additive/multiplicative terms of pump storage availability. For each reservoir, the stochastic dataset was run through the stand-alone reservoir model (see Technical Appendix on Supply Forecast) to assess the change in Deployable Output at different return periods as a result of inflow uncertainty. The lower, upper, and central predictions at the 1 in 500 return period were used to derive a triangular distribution of uncertainty (Figure 4-1).

Figure 4-1 Deployable Output Uncertainty for Clatworthy Reservoir at 1 in 500 DO return period



As the uncertainties in reservoir inflows for each site are related to independent gauge uncertainties, Monte Carlo sampling was conducted from the triangular distributions of uncertainty from each of the reservoirs, to derive an overall reservoir yield uncertainty triangular distribution to feed into the main headroom assessment (Table 4-2).

Table 4-2 Uncertainty in annual average reservoir yields

For security reasons reservoir names have been redacted in the version of this document published on our website.

Source	Inflow Uncertainty	Yield Uncertainty (Ml/d)		
		Low	Central	High
	Range in uncertainty comparing calibration performance (regionalised model) against mass balance data, Qube data and regionalised Washford gauge flows (upper = +5.1%, lower = -4.4%)	-0.61	0.00	+0.60
	Model calibration is close to mass balance, and regionalised currypool data, but below Qube and above regionalised Halsewater data (upper = + 12%, lower = -6%). Currypool inflows have RMSE error in validation of ±1.38Ml/d (used for upper and lower scenarios).	-1.61	0.00	+1.81
	Model calibrated to regionalise Penn Mill data, regionalised through regression to mass balance data, regressed primarily for low flows, due to uncertainties in higher flows when reservoir is full. Cumulative flows when off full under-estimate calibration data, but not at	-0.856	0.00	0.31

Source	Inflow Uncertainty	Yield Uncertainty (Ml/d)		
		Low	Central	High
	very low flows where fdc shows over-prediction (upper = +3.75%; lower = -13%). Pump Storage uncertain due to releases from Sherborne that may be constrained in a drought. Assume for lower scenario a 70% availability of pump storage.			
	Model inflow calibration when reservoir is not full sits close to the Regionalised Halsewater data, lower than Qube and Regionalised from Currypool, but higher than mass balance data (upper = +10% and lower = -10%). Canal pump storage may not always be available due to water quality and screen blockage, so assume for lower scenario 70% availability.	-2.52	0.00	0.00
	Fulwood inflows calibrated to multi-linear regression between nearby gauges and mass balance data, so errors in quality of regionalisation and mass balance data itself (upper = + 7.5% lower = -7.5%). Pump storage uncertainty assume lower scenario a 70% availability of pump storage.			
Total			**193.89**	

4.1.2. S6-2 Groundwater yield uncertainty

35 sources have hydrogeological yield constraints – that is yield in a drought is constrained as groundwater levels are low. These include spring sources and borehole sources. To model this constraint in our deployable output assessment the yield at each source is related to a regional observation borehole level (Ashton Farm or Woodyates borehole) through one, and in some cases two, linear relationships (see Technical Appendix on Supply Forecast). To predict the yield constraint at each source, a point groundwater model calibrated to the observed data at the regional borehole is run for the given drought event being simulated, and using the linear relationship(s), used to predict the maximum yield availability at the source. Two forms of uncertainty therefore need to be accounted for:

- Uncertainty in the regional groundwater level model
- Uncertainty in the relationship between the groundwater level and the yield at each source.

A triangular distribution of groundwater yield uncertainty from yield constrained sources was derived as follows:

- The mean and standard deviation of model error in the groundwater level models for Ashton Farm and Woodyates boreholes was derived. A separate uncertainty distribution was derived for low groundwater levels – where the groundwater levels would be in drought, in particular a critical period – and the average uncertainty across the range of observed groundwater levels, through comparison of observed and predicted levels for the available historical record.

- Upper and lower bounds for the uncertainty in each of the yield equations were assessed for low groundwater levels, through visual analysis of the quality of the empirical relationships between source yield and regional groundwater level. Alongside the central estimate, these were used to derive a triangular distribution of uncertainty in each of the source yield equations.
- The stochastic drought event closest to a 1 in 500 minimum summer groundwater level at Woodyates borehole was selected to derive critical period groundwater level uncertainty.
- 10,000 uncorrelated samples were drawn from the regional groundwater level model uncertainty distributions for Ashton Farm and Woodyates boreholes and used to perturb the modelled groundwater levels for the predicted groundwater event. This approach assumes that the error applied at each time-step of the drought event is correlated in time, which is reasonable given temporal persistency often seen in hydrological and groundwater model errors – as observed in the comparison of model predicted versus observed data.
- For each source, yield was calculated across the drought event using the relevant perturbed groundwater level and perturbed using an independent sample from the triangular distribution from each source. This was combined with the licence availability (annual average and maximum daily) and source production capacity to derive a maximum source yield availability.
- For each of the 10,000 samples, total available yield was summed, and used to derive an overall uncertainty distribution in yield constrained sources for both annual average and critical period planning scenarios.
- Appropriate distributions were fitted. A triangular distribution was fitted to the resultant yield distribution and used as input to the main headroom assessment.

4.2 Bulk Transfers

Two issues were specified in the headroom analysis to describe the uncertainty of import volumes from neighbouring water companies between 2025 and 2100.
The issues included were:

- Bristol Water to Bath – uncertainty over the possible loss of the imported volume of 4.4 Ml/d
- Affinity Water to Leckford – uncertainty over the possible loss of the imported volume of 2.74 Ml/d

Both issues were specified using a triangular distribution, applied to both DYAA and DYCP headroom and fixed at a constant value throughout the planning horizon (

Table 4-3).

Table 4-3 Bulk Transfer uncertainty allowances

For security reasons site names have been redacted in the version of this document published on our website.

Transfer	Planning conditions	Distribution	Minimum Loss in DO	Modal Loss	Maximum Loss in DO
Bristol Water -> Bath	Both	Triangular	0	0.44	4.4
Veolia Water	Both	Triangular	0	0.548	2.74

4.3 S3 Vulnerable licences

As specified in the WRMP guidance, no headroom allowance has been made for uncertainty associated with the renewal of time limited licences or other vulnerable licences.

4.4 S6 Gradual Pollution

No headroom allowance has been made for the impacts of gradual pollution on supply. This is addressed in scenario analysis outside of headroom.

4.5 S8 Climate change impact on supply

No headroom allowance has been made for the impacts of climate change on supply. This is addressed in scenario analysis outside of headroom.

4.6 D1-D3 Demand-side Uncertainty

A summary of the demand-side elements of uncertainty specified in headroom is shown in Table 4-4. Future uncertainties in demand associated with changing consumption and property and population growth, are accounted for through scenario analysis.

Table 4-4 Demand side uncertainty components

Component	Planning conditions	Distribution	Minimum Loss in DO	Modal Loss	Maximum Loss in DO	Assumption
D1 DI meter uncertainty	Both	Triangular	-2%	0	+2%	Percentage uncertainty as applied at WRMP19, applied to all demand.
D2-1 Leakage uncertainty	Not specified as baseline forecast is flat over the planning period so low uncertainty in expected achievement of current leakage, in part following leakage consistency work					
D2-2 Dry year adjustment uncertainty	DYAA	Triangular	-0.06%	+0.14%	+0.41%	Determined to reflect uncertainty peak factors: See Demand Forecast Section 3.9 Base Year Demand
	DYCP	Triangular	0	+1.97%	+3.03%	

						Uncertainty
D3 climate change uncertainty	Both	Triangular	Timeseries of percentage factors determined in line with UKWIR methodology, applied to time series of household demand			

4.7 Headroom analysis

Figure 4-2 and Figure 4-3 show, respectively, the DYAA and DYCP headroom distribution and how it changes over the planning horizon, coupled with selected target headroom profiles. The headroom distribution remains relatively constant over time in terms of the standard deviation, with a slight overall growth trend relating to demand side uncertainty components, which are proportional to overall demand which grows over time.

The target risk profile was determined by selecting the 85th percentile in the base year, 2019/20, and then calculating the associated headroom value (14.41 Ml/d DYAA and 28.61 Ml/d DYCP) as a percentage of the dry year annual average distribution input for the year. This resulted in a headroom percentage of 4.2% for DYAA and 7% for DYCP scenarios. By fixing target headroom as a fixed percentage of distribution input through the planning period the uncertainty percentile decreases with time meaning that a greater level of risk is accepted in the future. Table 4-5 shows the change in headroom allowance, with a slight growth in headroom over time reflecting the growth in distribution input in the future.

Table 4-5 Headroom Allowances over time

	2019/20	2024/25	2029/30	2034/35	2039/40	2049/50	2079/80
DYAA Headroom (Ml/d)	14.41	14.44	14.53	14.69	14.83	15.13	16.32
DYCP Headroom (Ml/d)	28.61	28.48	28.64	28.86	29.10	29.66	31.93

Figure 4-2 DYAA Headroom distribution change over the forecasting horizon and 85th percentile target headroom

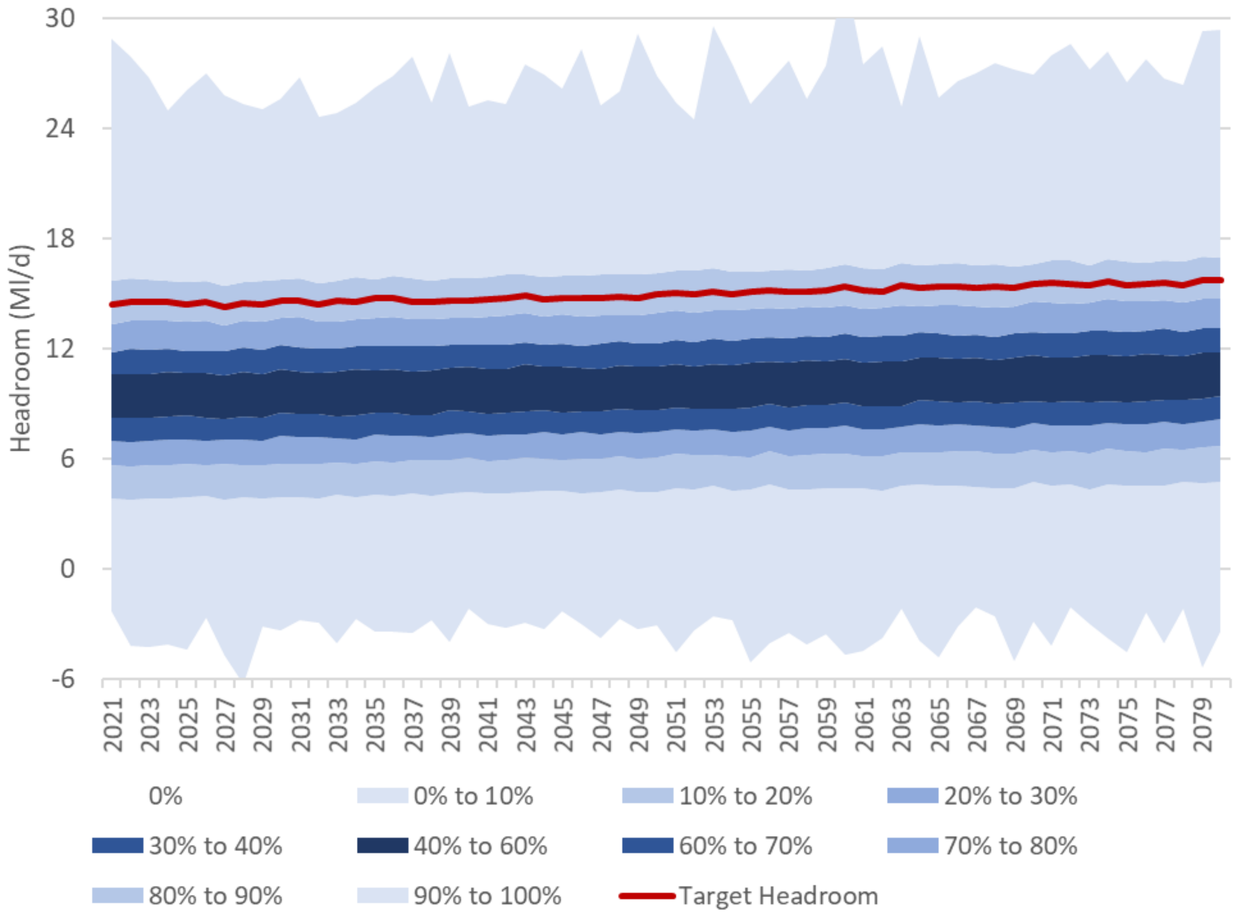

30
24
18
12
6
0
-6
Headroom (Ml/d)
2021
2023
2025
2027
2029
2031
2033
2035
2037
2039
2041
2043
2045
2047
2049
2051
2053
2055
2057
2059
2061
2063
2065
2067
2069
2071
2073
2075
2077
2079
0%
0% to 10%
10% to 20%
20% to 30%
30% to 40%
40% to 60%
60% to 70%
70% to 80%
80% to 90%
90% to 100%
Target Headroom

Figure 4-3 DYCP Headroom distribution change over the forecasting horizon and the 85th percentile target headroom

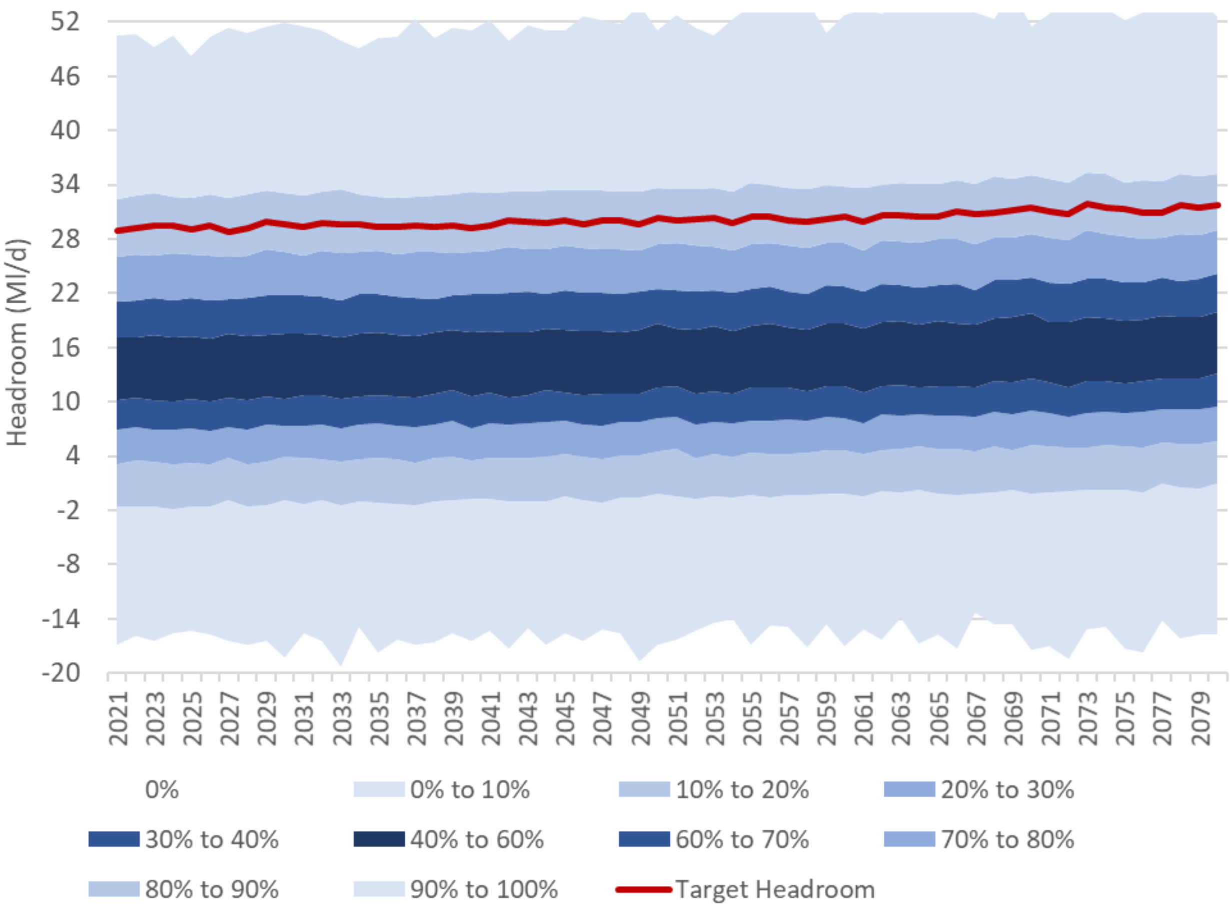


Figure 4-4 and Figure 4-5 show, respectively the contrinbution of different headroom components to overall headroom uncertainty. Supply uncertainties are the main component of DYAA uncertainty, with reservoir yield, groundwater yield, and annual licence use and management the main sources of uncertainty. For the DYCP scenario, uncertainty in groundwater yield is the main source of uncertainty followed by uncertainty in peak demand.

Figure 4-4 DYAA Component contribution to target headroom

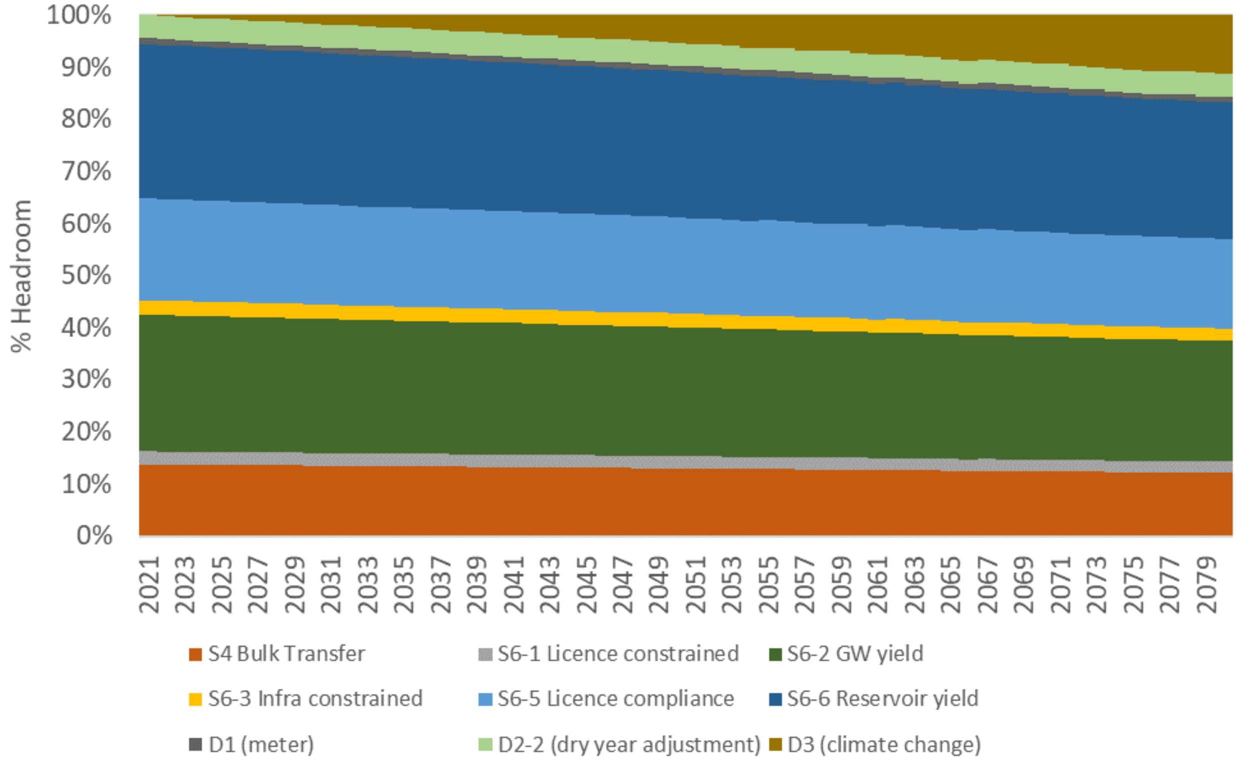
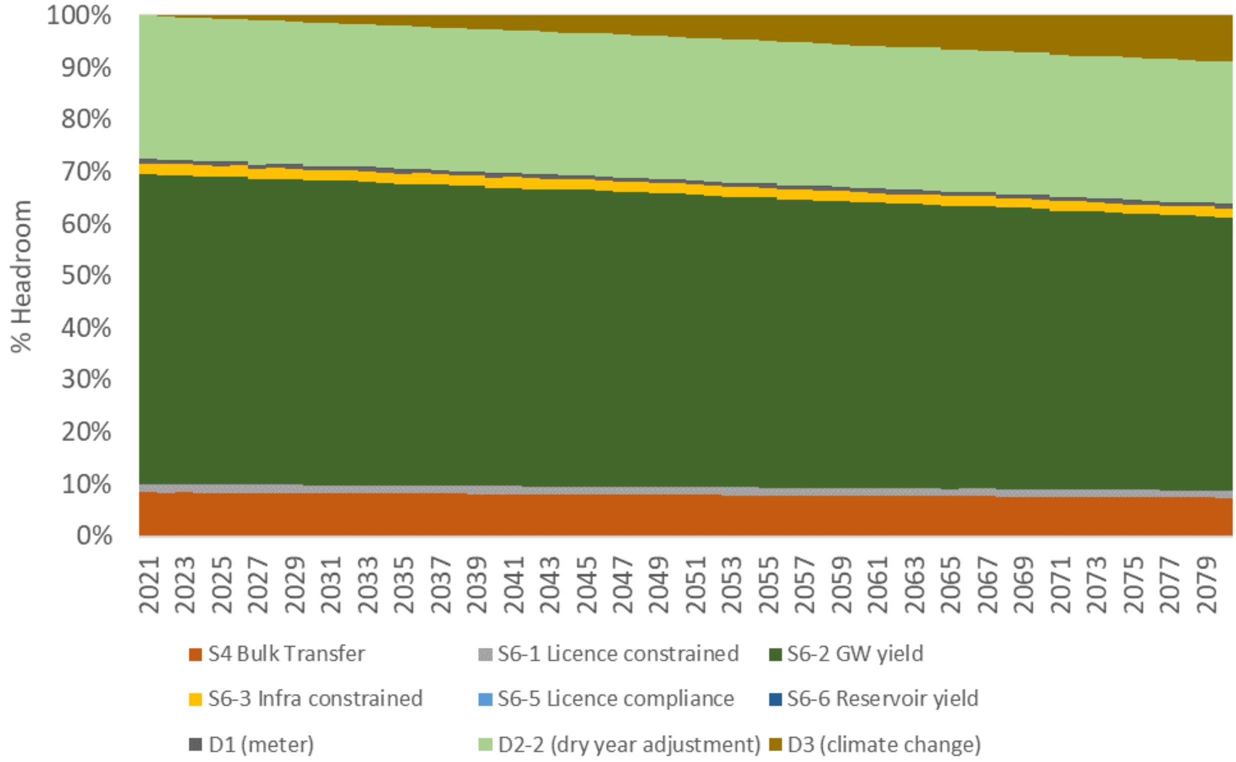


Figure 4-5 DYCP Component contribution to target headroom



5. Baseline Supply-Demand Balance

The Supply and Demand Forecast technical appendices, coupled with the derivation of the headroom allowance in Section 4, detail the approach undertaken in establishing the Supply Demand Balance (SDB). A central SDB has been generated, alongside a range of alternative futures, based on the future uncertainty factors and scenario analysis (Section 3).

5.1. Central SDB

This section presents the central SDB which forms the basis of the preferred plan. As per our planning guidance, our central baseline scenario looks at what would happen in the future if we did nothing apart from hold leakage steady at current levels and have no active water efficiency or metering policy beyond optional metering. The planning period starts with a surplus under the DYAA scenario, which gradually reduces over the planning period, resulting in an SDB deficit from 2035-36 under the DYAA scenario, and small deficits from 2025 under the DYCP scenario as a result of (Figure 5-1 and Figure 5-2):

- Continued gradual increase in demand over the planning period
- Step change reductions in available supply because of sustainability reductions, with the primary reductions in 2035

The supply demand balance is most constrained, and eventually in most deficit, under the critical period DYCP scenario (Figure 5-3).

This baseline position is strongly influenced by the need to give more water back to the environment to further protect Chalk streams (through licence reductions) as well as the requirement to plan for more extreme droughts than historically experienced (baseline supply demand balance based on 1 in 500 level of service for level 4 restrictions throughout the planning period), as well as the growing trend for increased demand associated with population growth in the future. Please note – the baseline supply-demand balance does not include the benefits of drought options and drought-related demand restrictions, nor the implementation of a 1 in 200 level of service.

Figure 5-1: Supply Demand Balance in the DYAA scenario

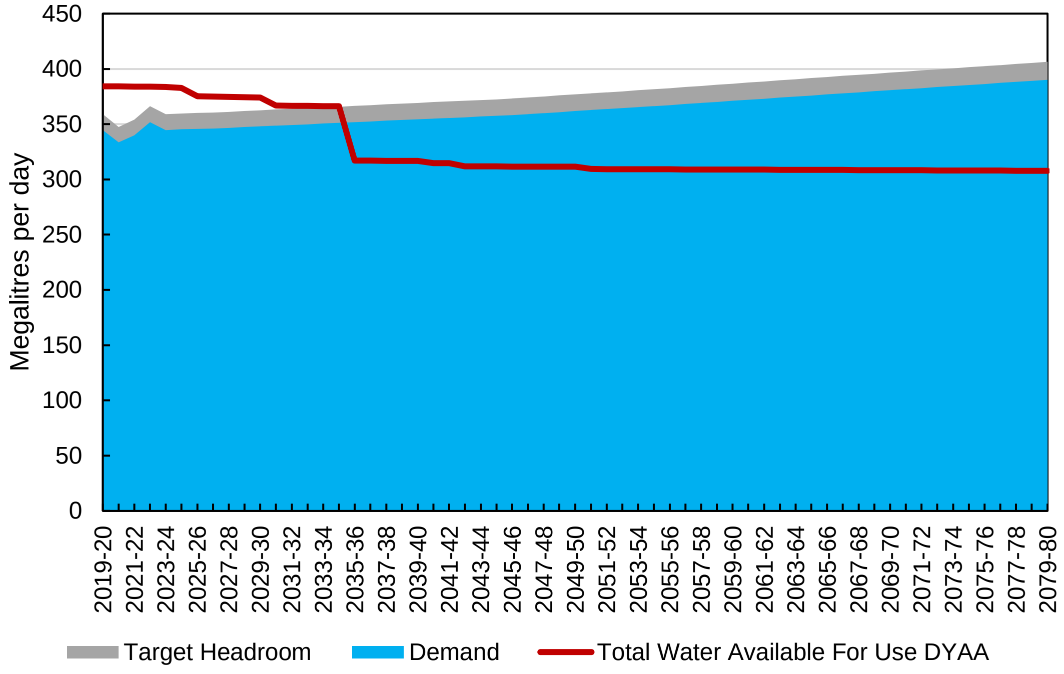


Figure 5-2: Supply Demand Balance in the DYCP scenario

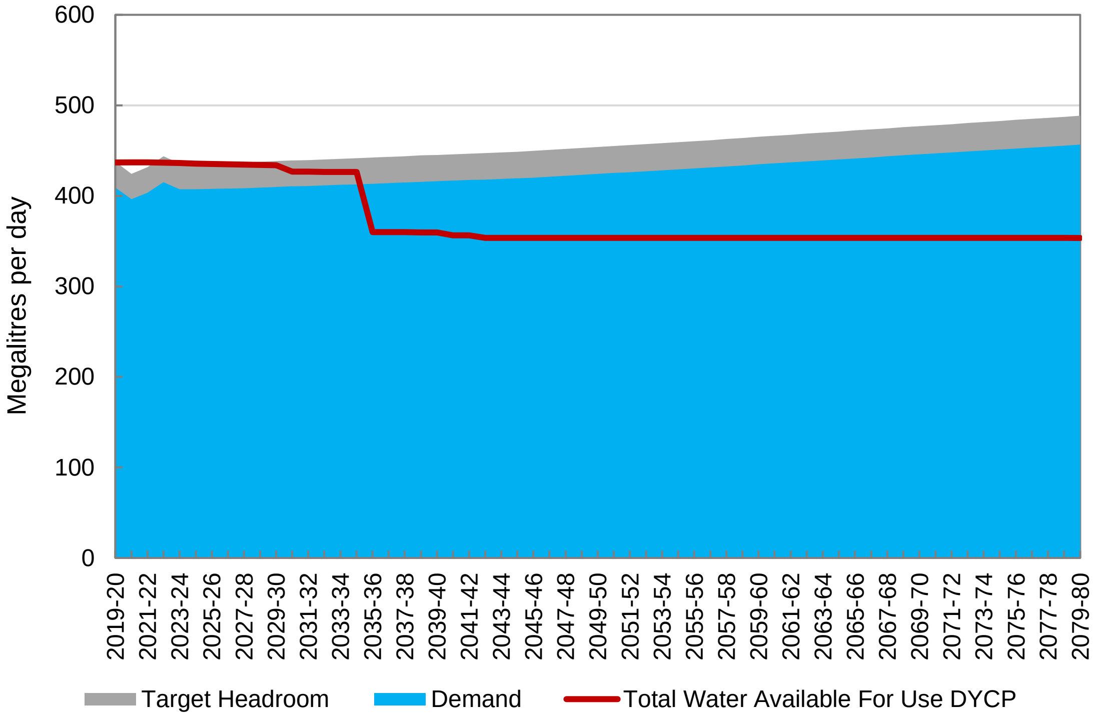
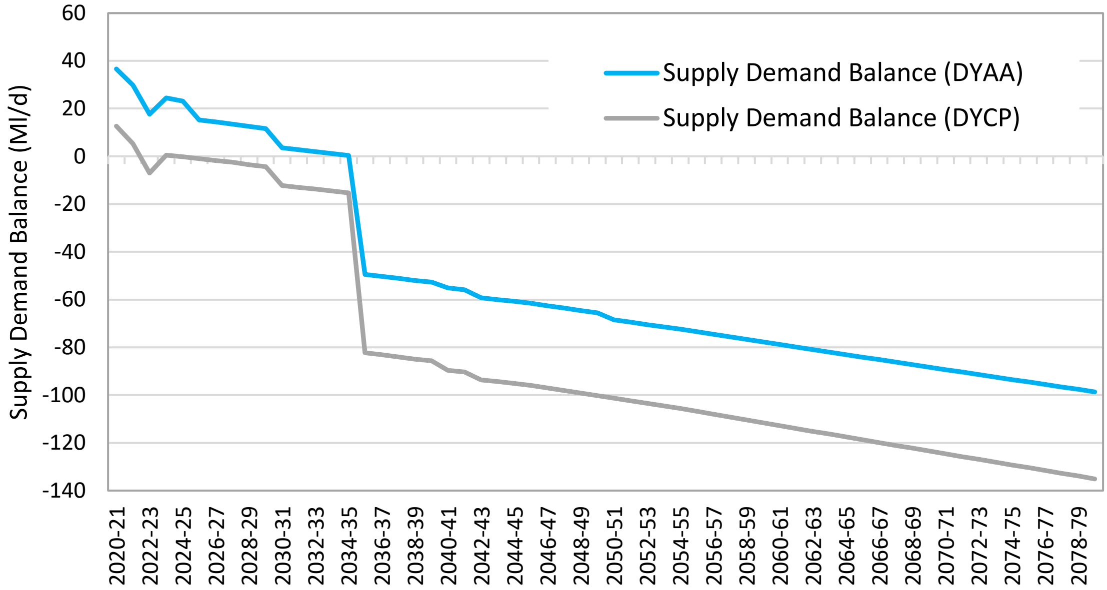


Figure 5-3: Supply Demand Balance for the DYAA and DYCP over the planning period.



The spatial distribution of deficit across the supply system in 2035-26, the point of main licence reductions, is shown in Figure 5-4 and Figure 5-5 under the critical period planning scenario, as derived by running the Miser system simulation model (see Supply Forecast Technical Appendix Section 2.3). As a result of licence changes, the main locations of supply-demand balance deficit are in the groundwater supplied parts of the supply system, mainly in the central and eastern part, and notably in the South of the supply system as a result of the more significant licence reductions in the Stour catchment. The more distributed map shows significant deficit in the Poole area, however this deficit is being driven by both Stour catchment licence reductions, and those further north on the integrated grid into the Hampshire Avon catchment and is therefore not driven by localised network constraints, as under normal operation during drought conditions, water would be sent north on the existing grid system built in 2018[15]. This is not the case, however, for the deficit in the Devizes zone, which is driven by two licence reductions in the western arm of the Hampshire Avon, and causing more significant localised deficits.

[15] The miser model choses to minimise overall deficit and spread this evenly proportional to demand at individual demand centres.

Figure 5-4 Spatial distribution of supply-demand balance deficit in 2035-36 under the DYCP planning scenario at a Water Resource Sub Zone Level

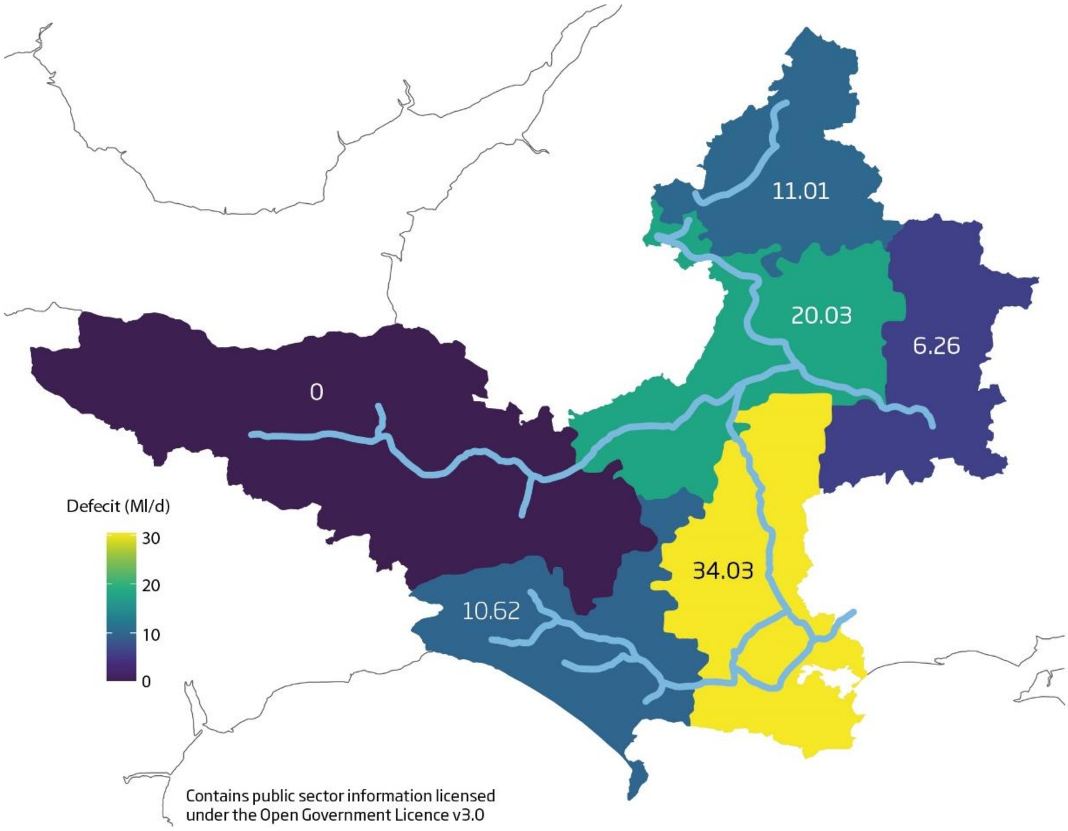
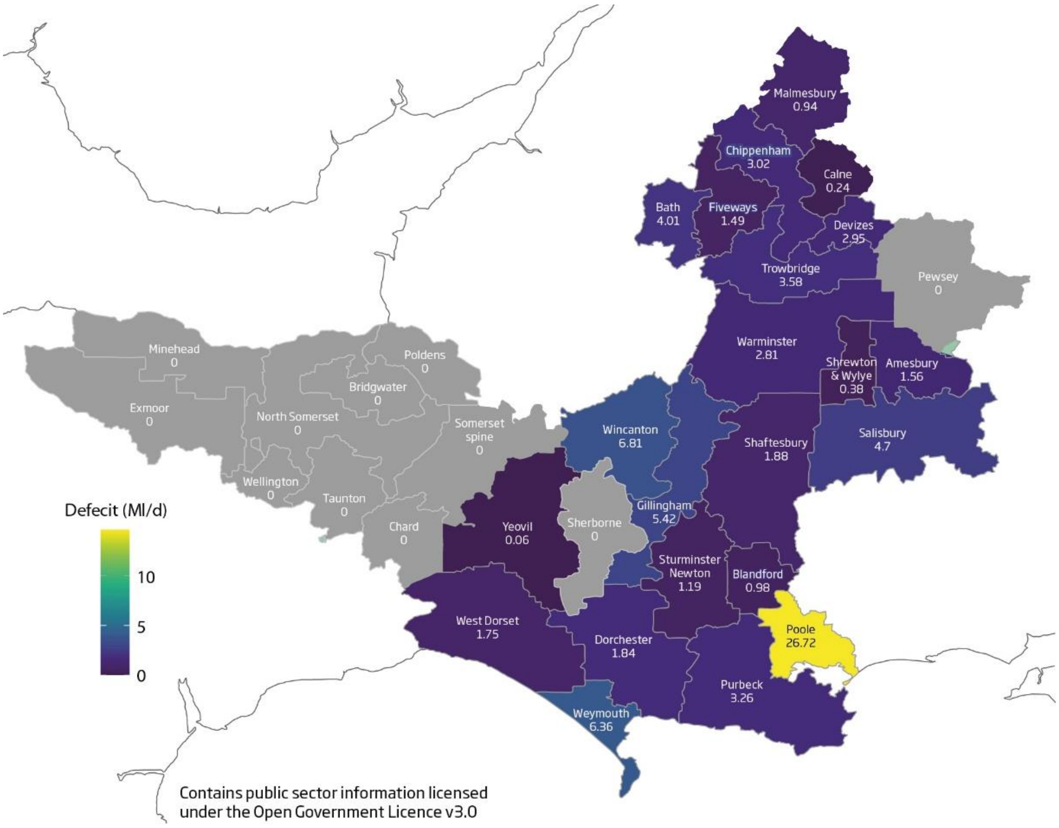


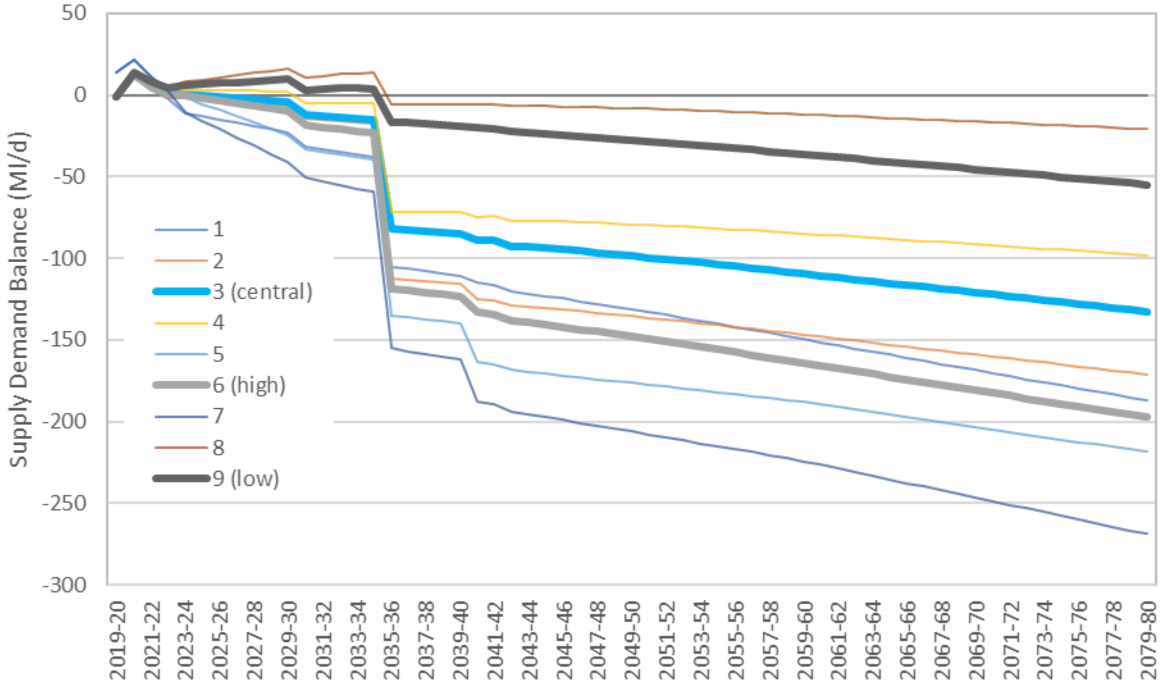
Figure 5-5 Spatial distribution of supply-demand balance deficit in 2035-26 under the DYCP planning scenario at a Water into Supply Zone level derived from Miser modelling



5.2. Alternative Supply Demand Futures

This section presents the alternative futures considered within WRMP24, as per the scenarios shown in Section 3. Figure 5-6 shows the supply-demand balance for the alternative future scenarios in the DYCP scenario (with the low, central, and high scenarios used for investment modelling shown in bold). The range in scenario results reflects the alternative future scenarios. The final deficit in 2079-80 under the DYCP scenario ranges in 2079-80 from approximately -21Ml/d to -268Ml/d. This range in these forecasts is primarily driven by different levels of demand growth, and the extent of licence reductions, which is the main driver of uncertainty in our plan and is reflected in the range of “step changes” in 2035-36. The difference in climate change impact is relatively small compared to the other factors. The low, central and high scenarios have been selected to avoid selecting alternative scenarios that are too extreme yet still plausible.

Figure 5-6 DYCP Supply Demand Balance under alternative future scenarios (low, central, and high scenarios in bold)



6. Customer Research

6.1. Overview

At the time of writing this revised WRMP we are undertaking the triangulation of customer insight from our wide-ranging programme of research which is described in 'WRMP24 Pre-Consultation and Customer Research'. The programme has explored a range of issues and employed a variety of research methods and followed the best practice guidance from Ofwat and CCW for high quality research principles, assurance and challenge. For transparency, all research reports are published on our customer insight webpage.

The following top line customer preferences have been identified and selected from our research and triangulation that are relevant for this Water Resources Management Plan – please note these may be subject to update as we progress towards our PR24 business plan submission later in 2023:

- Customers consider that their water bills generally represent good value for money and a key driver behind this view are high levels of service satisfaction.
- An increasing number of customers are facing financial difficulties as a result of the cost-of-living crisis and there has been a rise in anxiety relating to being able to pay current and future water bills.
- There is more willingness to pay from customers for improvements to environmental protection than in making significant customer service improvements.
- Customers are very satisfied with the current reliability of water services.
- Customer generally have a low awareness of the importance of water conservation, and many don't currently pay much attention to their usage. Some customers are interested in the benefits for bill management that smart meters can provide.
- Customers are willing to play their part in reducing the demand for water by taking action to make their homes and behaviours more efficient – but they don't know how to do this and are keen to receive practical help and advice that will help them manage their bills.
- Most customers now only pay for the water they use and believe metering is the fairest way to charge. Interest in having a smart meter grows when customers are informed of the benefits it could bring them particularly in relation to saving money, finding leaks and 'doing their bit' for the environment. Some customers are currently somewhat resistant to smart metering though owing to concerns of whether their bills will go up.
- Stakeholders including water retailers are keen to see the roll out of smart metering for households and non-households.
- Leakage is a commonly preferred solution for reducing demand.
- Customers are supportive of paying for investments that reduce reliance on more environmentally sensitive abstraction sources. They favour a combination of approaches rather than relying on a single solution to balance supplies and demand.
- Customer awareness and concern around the impacts of climate change is growing, particularly amongst future customers.
- Investments to maintain resilience in the face of challenges such as climate change are important – but need to be balanced with bill affordability in the near term.

- Customers have some awareness of future water supply challenges but have limited understanding of the potential impacts of extreme drought. They are generally comfortable with accepting the need to impose less severe water use restrictions, such as hosepipe bans, if the situation requires it. Severe water use restrictions such as rota cuts were perceived as difficult to cope with and unacceptable although there was not an overwhelming view that water supplies should aim to be resilient beyond a 1 in 200 year event.
- Customers want to see efforts from Wessex Water and other companies to reduce their emissions, however, this is perceived by many to be of less importance compared to other areas.

The research findings that underpin this summary are outlined in the sections that follow.

6.2. Key customer priorities – our outcomes

In 2021 we worked with Accent to identify customer and stakeholder priorities to support the development of our updated Strategic Direction Statement[16] that was published in early 2022.

The research[17] included an expert panel comprising a core group of Wessex Water key thinkers and external industry experts (from CBI, Environment Agency, universities, Rural England, Dorset Council, NFU, Wiltshire Wildlife Trust, Waterwise) to review the broad themes of the current SDS and areas to update. This was followed by qualitative work with inter-generational family groups and, later, workshops and depth interviews with a range of customers and stakeholders.

This qualitative phase generated a list of 12 outcomes, which was refined to the 11 shown in Figure 6-1 following the removal of “improving brand visibility” as Accent felt this was included in “high customer satisfaction”. Outcomes were identified through a spontaneous process and were customer-led.

A quantitative stage followed to seek respondents’ top two priorities. These mapped closely to the outcomes derived in the qualitative work and led to the following outcomes, grouped into three main areas shown below.

16 https://corporate.wessexwater.co.uk/our-future/our-strategic-direction
17 Accent (Oct 2021) Strategic Direction Customer Research Final Report

Figure 6-1: Eleven outcomes grouped into three areas co-created with stakeholders and customers in the strategic direction research

Serving every customer, by doing things such as:
- Delivering safe, quality drinking water
- Providing a continued, reliable water supply
- Providing high quality customer service so that any customer can easily access their services and support
- Ensuring bills are fair and affordable for all
- Keeping the sewage service working

Protecting and enhancing the environment, by doing things such as:
- Reducing the amount of water taken from local habitats
- Improving ecosystems and increasing biodiversity
- Reaching net zero by 2040
- Protecting and improving river and beach water quality

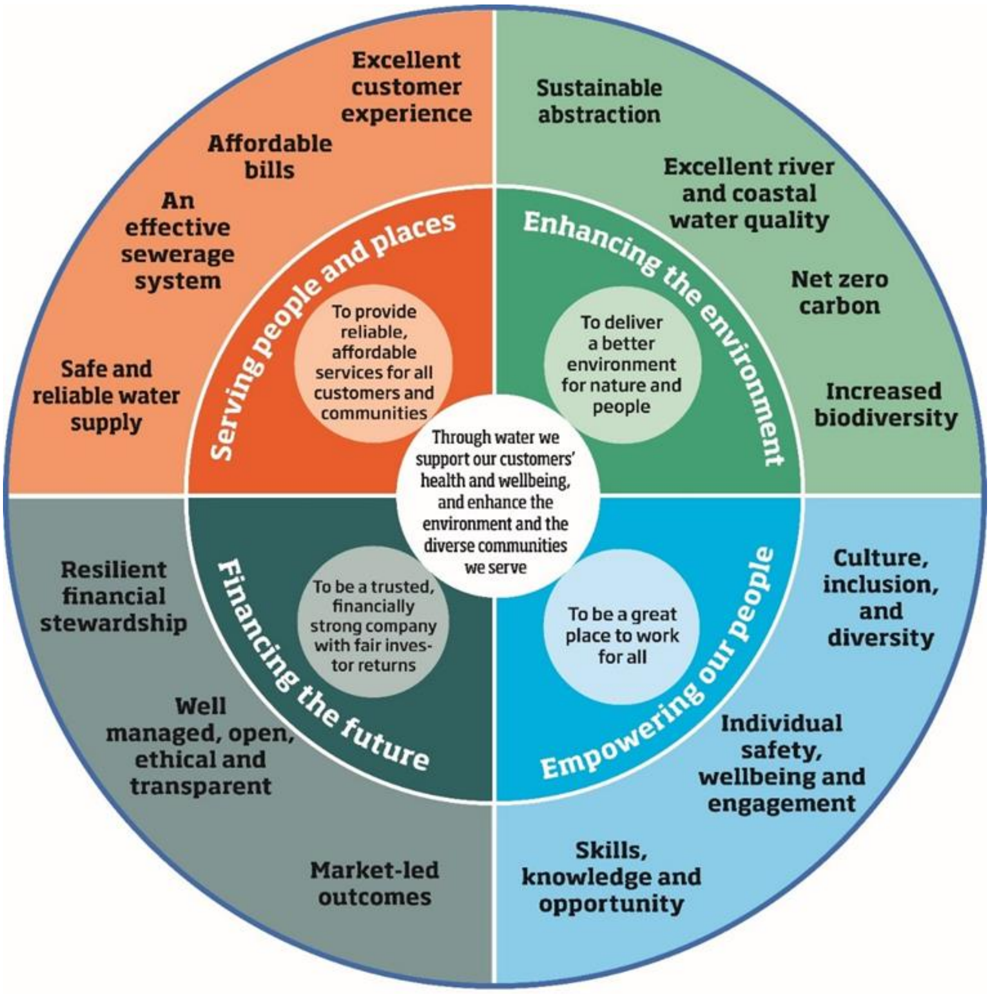
Serving Wessex Water's communities, by doing things such as:
- Improving the impact on local communities for example volunteering to support community schemes
- Improving customers' perceptions of the value of water

The quantitative survey also sought whether any of the outcomes should be excluded and whether there was anything missing. 87% of participants thought the list of outcomes for each area is complete and 87%-93% would not exclude any of the outcomes listed.

These co-created outcomes underwent further development into our strategic direction illustrated in Figure 6-2. The nine outcomes in the first two boxes of Figure 6-1 map directly to the eight outcomes on the top half of the 'wheel'.

The two items in the third 'community' box of Figure 6-1 are not included directly, as whilst clearly important, they are not true outcomes. However, they are key enablers to delivering our outcomes and feature in our community and communications approaches.

Figure 6-2: Wessex Water's 25-year strategic vision – eight outcomes (top half) and six enablers (bottom half)



The customer research that underpinned the development of the eight outcomes identified that customer expectations are for us to get the basics right in serving people and places to provide safe and reliable water supplies for the long term, whilst maintaining bills at an affordable level and providing great customer service. The research identified that customer expectations for environmental protection are growing and that ensuring sustainable abstraction through planning for the future, managing water demands through engagement with customers and maintaining infrastructure are supported by customers.

6.3. Drought resilience

6.3.1. Preferences for reducing the risk of drought measures like hosepipe bans

In the WCWR qualitative research undertaken in June-July 2021[18] customers said they were generally comfortable with accepting the need to impose less severe water use restrictions, such as hosepipe bans (also known as Temporary Use Bans, TUBs, if the situation required it.

Our longitudinal qualitative customer research on water saving and smart meters[19] in 2022 facilitated conversations with informed customers on hosepipe bans during the summer heatwaves, drought and the imposition of hosepipe bans in other parts of the UK. Anecdotally none of the eight households involved in the project were actively against the introduction of TUBs; in fact, most felt it made sense due to the extremely hot, dry summer with little rain.

Some customers in the research were voluntarily reducing the amount of water used in the garden due to a sense of responsibility to save water:

> *"As far as I'm concerned, I've already stopped watering garden & washing cars, when the water butt is empty the plants will have to suffer. I have not bought any plants that I would usually buy in the summer. We've all got to take responsibility to help conserve water."* Single household, over 65, retired.

This indicates the opportunity for customer engagement approaches to stimulate water demand reductions even without the need for the introduction of a TUB in the Wessex Water area. Customers reported that they were very aware of the drought communications and media reports in summer 2022 and they were having conversations with the family, friends, and colleagues about the drought.

However, some customers also referred to the responsibility that water companies have to plan for dry weather by investing in more infrastructure for additional water resources and fixing leaks too. This corresponds to the finding from the WCWR customer sample that hosepipe bans are acceptable 'if the situation requires it'. Customers will be more receptive to a hosepipe ban if water companies have 'done their bit too'.

However, observations of social media engagement in 2022 might suggest that for many customers in water company areas who have been subject to hosepipe bans, and who are perhaps less engaged in water issues, are extremely dissatisfied with the reduction in service.

[18] Eftec and ICS (May 2022) WCWR Customer Research Qualitative Research Report
Eftec and ICS (June 2022) WCWR Customer Research Summary Report
[19] Blue Marble (May 2022) Customer motivations: water efficiency and smart meters – combined report: qualitative and quantitative research.

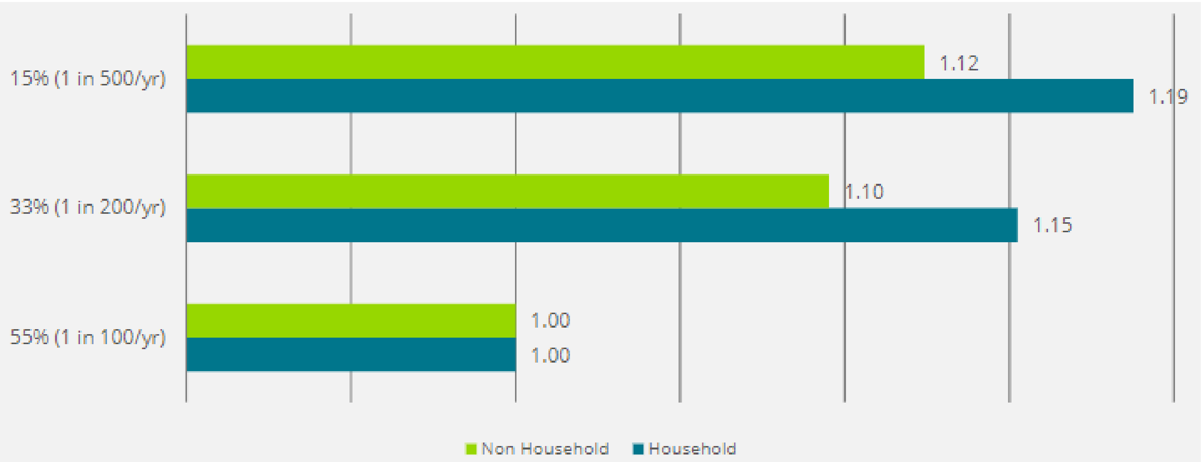
6.3.2. Preferences for reducing the risk of severe drought restrictions like rota-cuts

The WCWR research project explored customer views on severe water use restrictions. Discussions in the qualitative fieldwork found that customer understanding of what could happen in an extreme drought situation was limited. Many customers were surprised that measures such as rota-cuts could be implemented in the UK. The majority of customers felt that severe water use restrictions would be difficult to cope with and they were therefore not acceptable – see quotes below.

> *"I didn't realise how drastic it could get."*
>
> *Female, Aged 18-24, SEG C2DE, South West Water*
>
> *"I don't think that people would actually be able to cope with it if I'm honest. It's kind of like the lockdown, there was a lot of people who struggled with it and I think this would be another one of them that people would just struggle to be able to handle."*
>
> *Male, Aged 18-45, SEG ABC1, Bristol Water*

The WCWR quantitative survey and choice model analysis found that both household and non-households preferred 1-in -500 risk level for severe water use restrictions, but the additional weight (benefit) overachieving a 1-in -200 risk level was relatively marginal (Figure 6-3: WCWR quant survey results – preference weights for severe water use restrictions (odds ratios)) indicating the 1-in-200 level of service would be broadly acceptable.

Figure 6-3: WCWR quant survey results – preference weights for severe water use restrictions (odds ratios[20])



[20] Preference weights are calculated "odds ratios" from the main model estimation. Here they can be interpreted as quantifying the relative strength of preference (i.e. priority) that customers assign to each attribute level. The odds ratios show the relative weight of the level compared to a 'base case' or reference point (e.g. 1.15 x "better"). The base case has an odds ratio of 1: an odds ratio greater than 1 indicates that the level is preferred relative to the base; conversely an odds ratio less than 1 indicates that a level is not preferred relative to the base. The difference in odds ratio between each level shows the step changes (i.e. how much a level is preferred over another).

6.4. Environmental protection

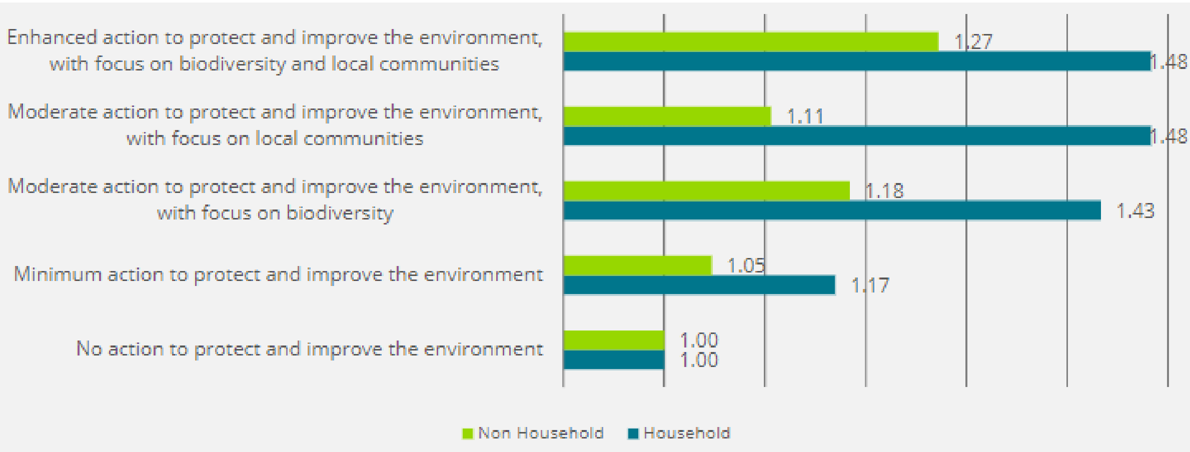
Our Strategic Direction research indicated that there has been a significant uptick in customer awareness of environmental issues in the last 5 years. The majority of customers are now conscious of 'climate change' and its relevance to their lives with media coverage of recent extreme weather events such as flooding in northern Europe and heatwaves in the UK. It is only a minority of customers that have a sense of urgency in how society should respond. There remains and awareness gap for many customers between climate change, rainfall, and the water cycle / infrastructure

The WCWR research identified that while customers don't always make the connection between their own water use and its environment impact, water in the environment was viewed as a precious resource that should be protected for wildlife and natural habitats – see quotes below.

> *"I think we wouldn't be here if it wasn't for the environment, if we don't take care of the environment, we're not going to last either."*
>
> *Female, Aged 65+, SEG C2DE, Wessex Water*
>
> *"We should always strive to improve levels of environmental protection"*
>
> *Female, Aged 18-45, SEG ABC1, Bristol Water*
>
> *If there's any way to increase protection of the environment, I don't see why you would turn it down"*
>
> *Male, Aged 18-24, Future customer, Wessex Water*

Household respondents showed a strong preference for going beyond the minimum level of action for protecting and improving the environment but there was limited distinction between the enhanced and moderate outcome levels. Non-household customers also had a strong preference for going beyond the minimum level of action, and also indicated clearer preference for achieving the enhanced level of actions, rather than moderate (Figure 6-4).

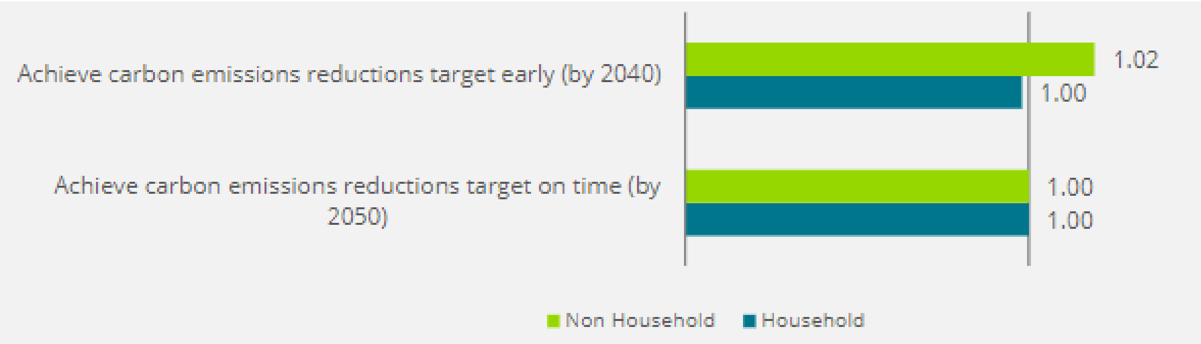
Figure 6-4: WCWR quant survey results – preference weights for protecting and improving the environment (odds ratios).



6.5. Carbon

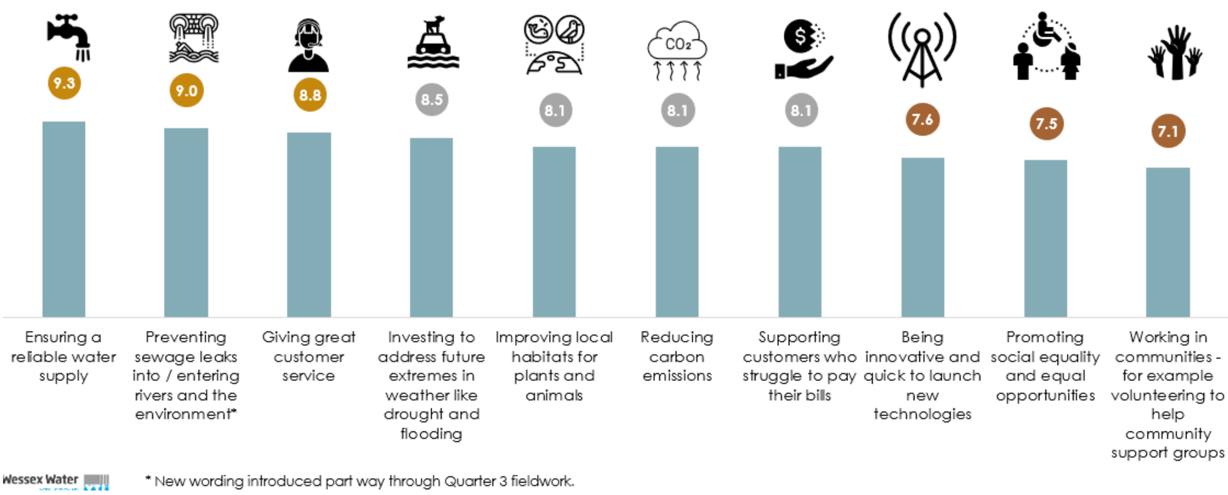
The WCWR research found that while doing more to protect and improve the environment has strong support with customers, there was limited support for the specific issue of whether we should aim to achieve carbon emission reductions at a faster pace than Government targets currently set out. Figure 6-5 shows that both household customers and businesses placed minimal additional weight on achieving carbon net zero targets by 2040 rather than 2050.

Figure 6-5: WCWR quant survey results – preference weights for reducing carbon emissions (odds ratios).



This is consistent with findings from our Customer Tracker survey – in 2021-22 reducing carbon emissions was given an average score of 8.1 out of 10 – which rates it as important to customers but not the highest of priorities for our business (Figure 6-6).

Figure 6-6: Results from Customer Tracker Survey 2021-22 – "How important do you think it is for Wessex water to focus on each of the following things?" Mean score (10 = 'top priority', 0 = 'not a priority')

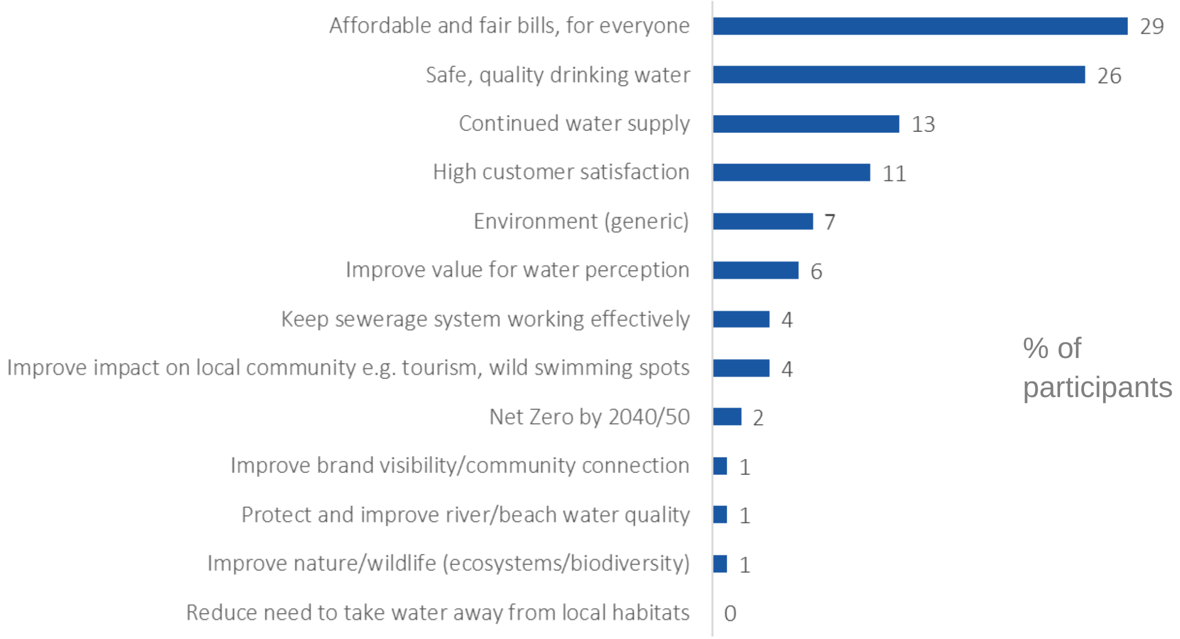


6.6. Cost

Managing the overall cost of water and sewerage bills is a key issue for customers. This is a top-of-mind issue for customers which has strengthened in recent months as the cost-of-living crisis deepens for many households.

In summer 2021, even before the recent energy price rises, ensuring that bills remain affordable and fair for everyone was the most common spontaneous response to what Wessex Water's priority should be over the next 25 years asked in our Strategic Direction research (Figure 6-7).

Figure 6-7: Strategic Direction Search – "What's your number one priority for Wessex Water?" (coded free text answers, n = 1,627)



Our most recent Customer Tracker survey results found that while there has been some abatement in financial pessimism in recent months, nearly half of the households in the Wessex Water region think they will be worse off in the next 12 months (Figure 6-8). While there have been some fluctuations in reported bill anxiety, there are significantly more households that worry about the affordability of their water bill today than they did two years ago (Figure 6-9).

Figure 6-8: Results from Customer Image Tracker Q: "Thinking about the current economic climate, do you expect your household to be better off, worse off or about the same in the next 12 months?"

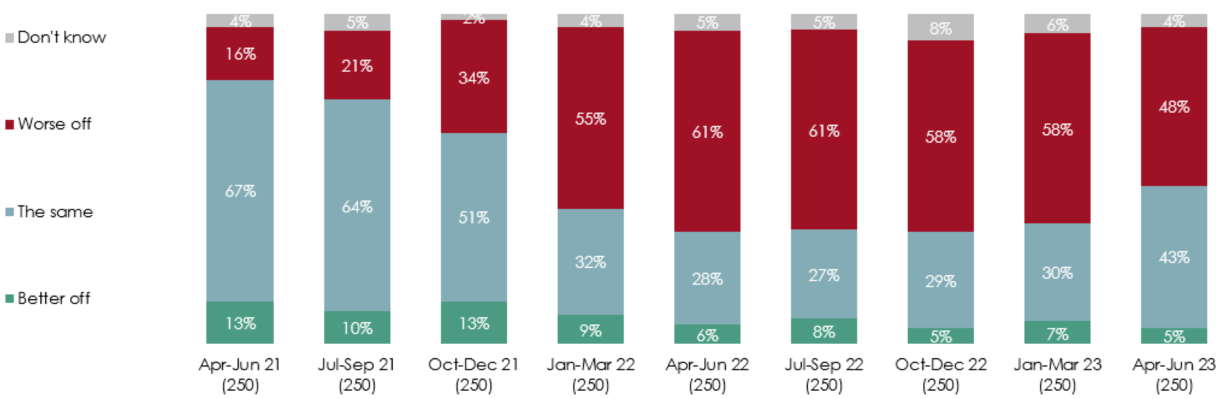
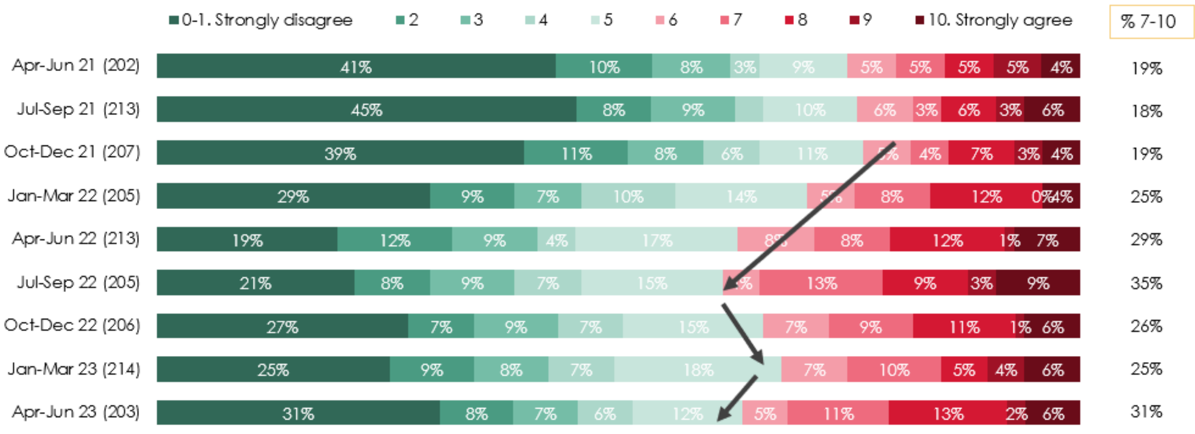


Figure 6-9: Results from Customer Image Tracker Q: "How strongly do you agree or disagree that you worry about being able to afford your water bill?"



6.7. Demand side measures – consumption and leakage

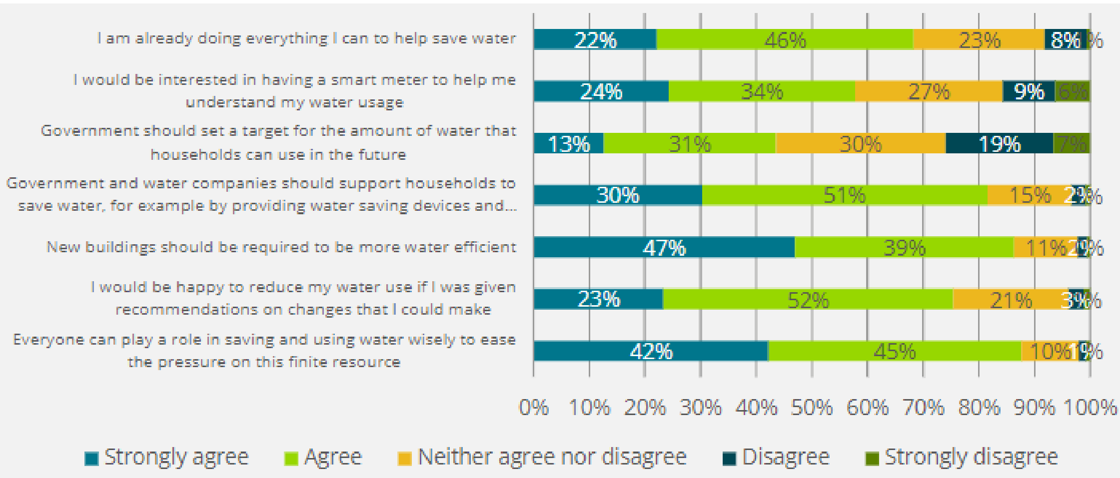
6.7.1. Household consumption

<u>Water efficiency</u>

Customers are keen to play their part in reducing their water use at home but need support to do so, because they don't know how they can reduce their usage.

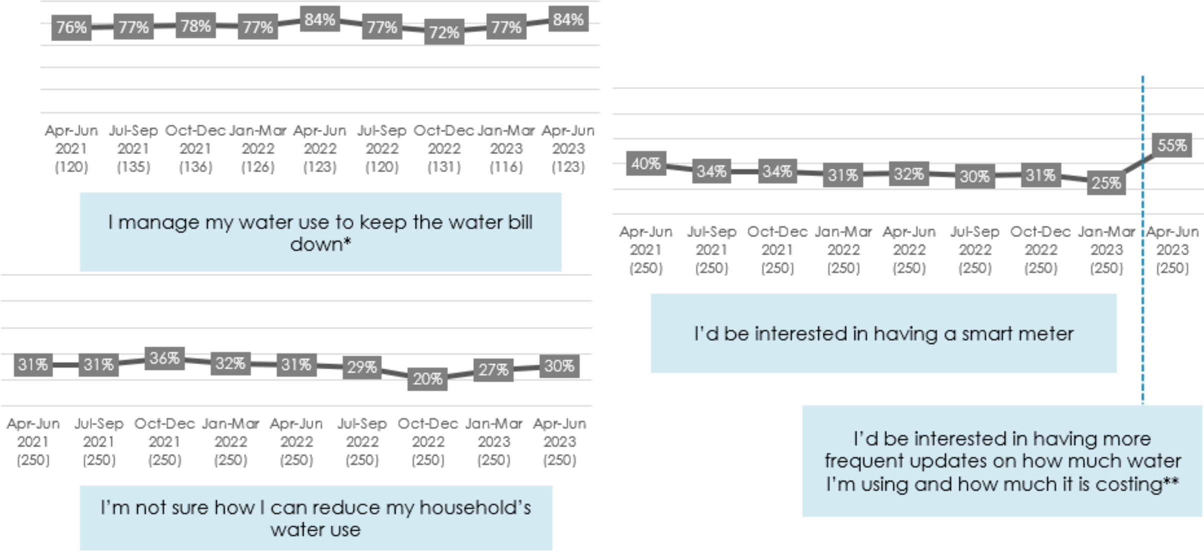
Figure 6-10 below shows results from the quantitative survey for the WCWR research – it shows that three-quarters of customers would be happy to reduce their water use if they are given recommendations on how to do so. They are willing but, don't know what changes they can make because 68% of customers feel they are already doing all they can to save water.

Figure 6-10: Attitudes towards reducing water use revealed by the WCWR customer research (n=1,504)



This insight is supported by findings from our customer tracker survey which indicates that customers with a meter value their ability to manage their water bill through managing their water use, but that around 30% of customers report not knowing how to reduce their water use (Figure 6-11).

Figure 6-11: Attitudes to water use and smart metering revealed in our customer tracker survey. "How much do you agree or disagree with…"?" Graphs show % rating 7-10 (10 = strongly agree) in each quarter. Sample size given in brackets.



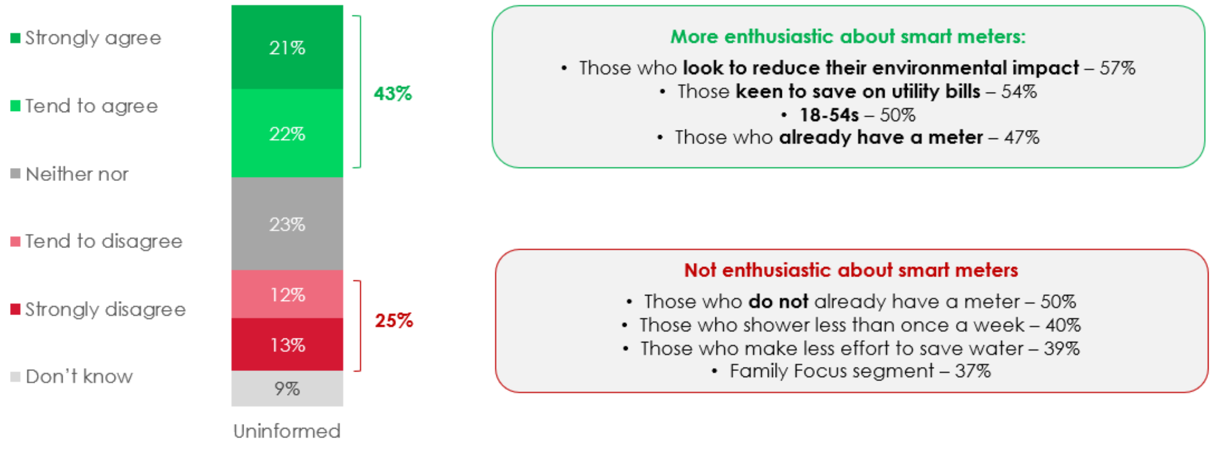
Our deep dive research project on water efficiency and smart metering[21] similarly found that most people already think they are already non-wasteful with water with 71% of our online panel claiming to make either 'a great deal' or 'a fair amount' of effort to save water.

Smart metering

In our bespoke deep dive research project on water efficiency and smart metering we explored customer appetite for smart meters (Figure 6-12). Interest in having a smart meter is relatively modest (4 in 10) with an uniformed audience. There's more enthusiasm amongst those keen to save on utility bills, the environmentally conscious and younger customers. However, half of those who do not already have a meter are not interested indicating a resistance to overcome.

[21] Blue Marble (May 2022) Customer motivations: water efficiency and smart meters – combined report: qualitative and quantitative research.

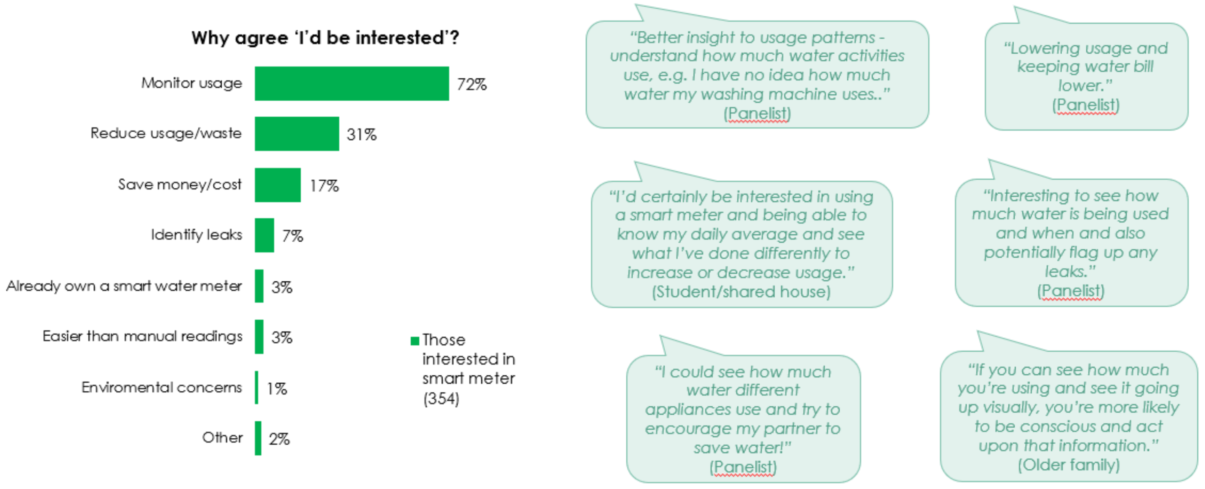
Figure 6-12: Smart metering research: How much would you agree or disagree with the following statements? I'd be interested in having a smart water meter (a meter that lets you see your households water use on a regular basis) n= 824.



These results are comparable to those from our Tracker survey to the end of 2022-23 shown in the right-hand chart in Figure 6-11. In April 2023 we change the wording in our tracker survey to test the impact of instead of asking if people want a smart meter directly but if they want more frequent information about their usage and bill – and interest rose significantly to 55%.

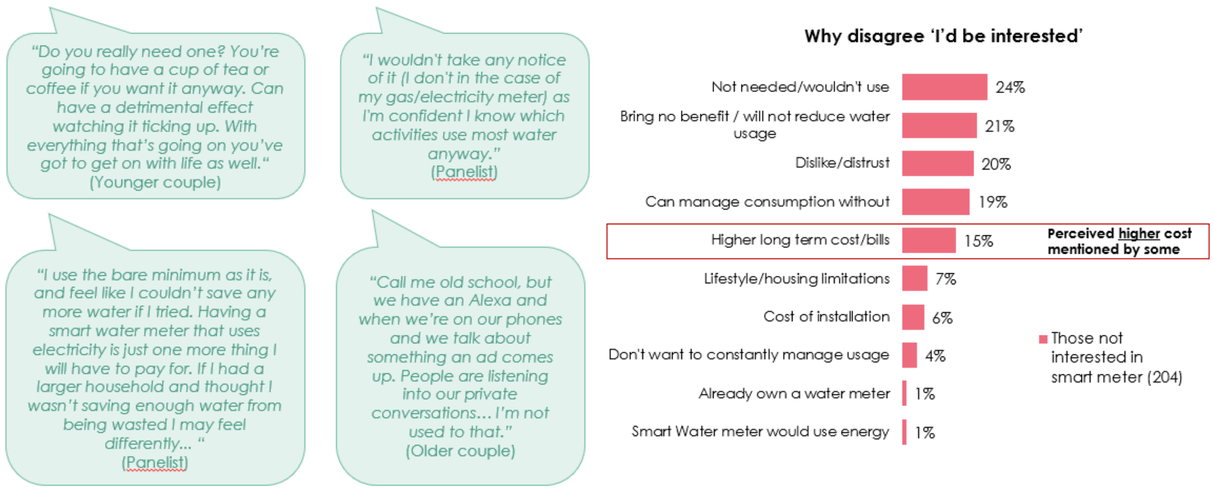
Of those interested in a smart water meter, aside from the functional benefit of being able to monitor water use, the main themes spontaneously mentioned were to reduce use / wastage, save money and for a smaller minority to identify leaks (Figure 6-13).

Figure 6-13: Smart metering research: What would the benefits be of having a smart meter?



Those less interested in having a smart meter often felt it would bring no benefit in water saving or they wouldn't use it (Figure 6-14).

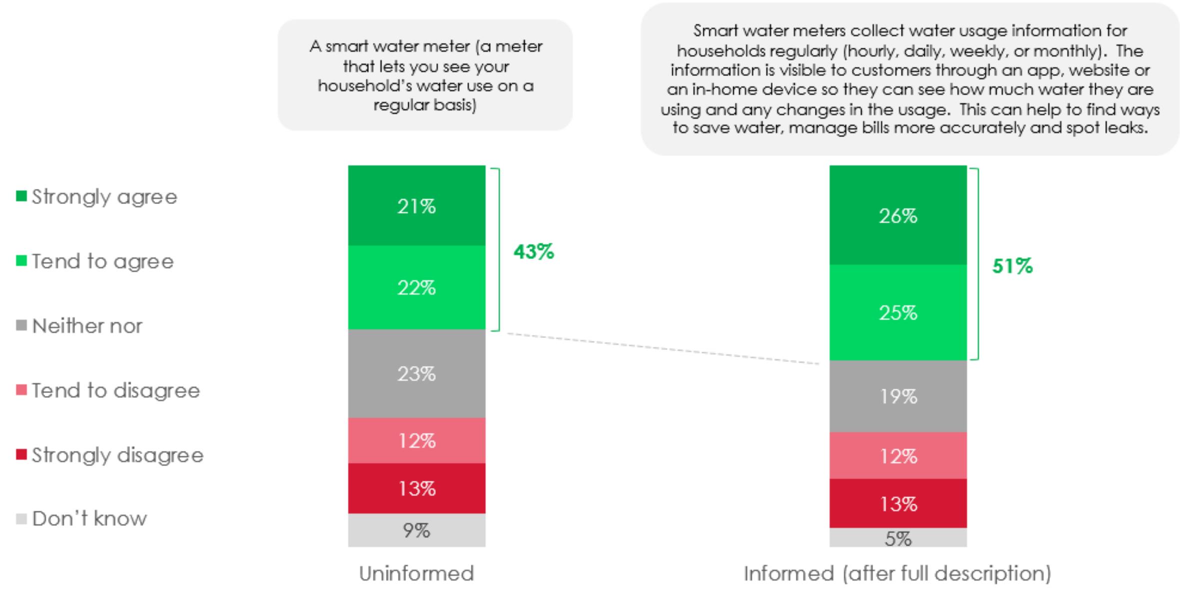
Figure 6-14: Smart metering research: Why are you not interesting in having a smart meter?



Our research identified that 15% of people would be concerned they would experience higher bills as a result of having a smart meter fitter which is somewhat lower than Waterwise's 2021 survey which found 37% of people would worry about higher bills arising from having a smart meter fitted[22]. This fear did not just come from households with larger occupancies – the attitude was spread across a range of household sizes indicative of the importance of customer engagement surrounding the benefits at the outset prior to roll out.

After being more informed about smart meters and the benefits they can bring, customer interest in having one rises slightly although 1 in 4 still actively disagree that they would be interested indicating a clear resistance amongst some customer groups (Figure 6-15).

Figure 6-15: Smart metering research: How much do you agree or disagree with being interested in having a smart water meter? *Asked after each description shown below. n=824*



[22] https://www.waterwise.org.uk/knowledge-base/public-attitudestowards-smart-meters/

6.7.2. Leakage

The deep dive leakage project we undertook in 2016 found that few customers had been directly affected by leaks and generally had higher water priorities. After much immersion in the issues regarding leakage, there was little appetite for Wessex Water to invest in reducing leaks further in the short term if it meant that bills would rise for little overall leak reduction. There were two minority positions at the extremes; do more (paid for or not by the customer) and do less (with a corresponding bill reduction).

Customers believed that in an ideal world there would be no leaks. They wanted Wessex Water to continue to find and fix leaks, and they liked to think that the organisation would still look for low-cost ways to reduce leaks in the future.

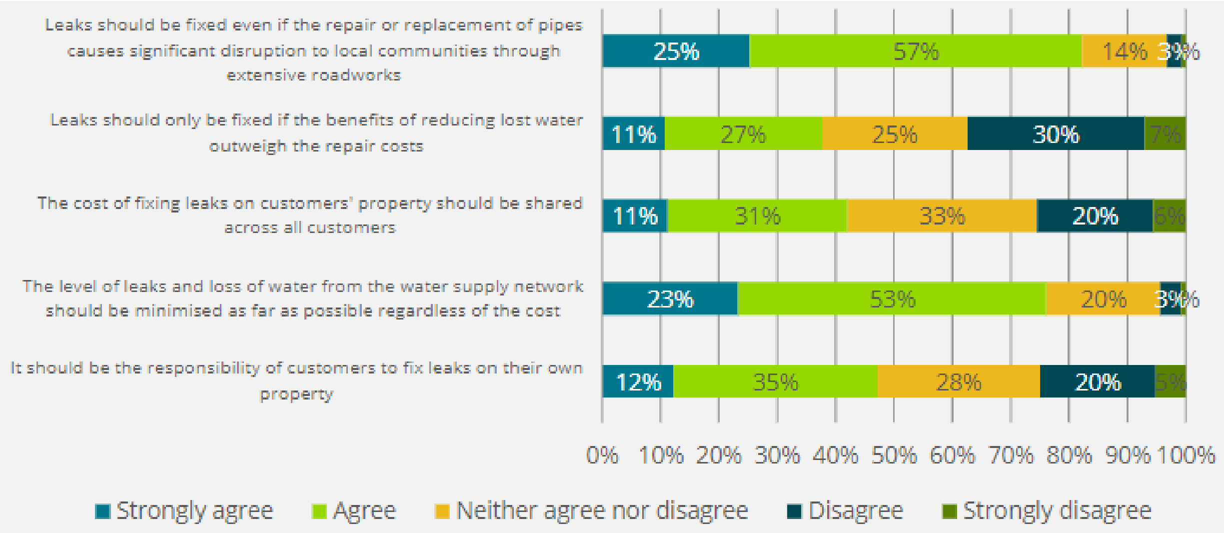
Most customers accepted the "economic" argument in cases where it costs more to fix a leak than the water costs to treat and distribute through the network. This made sound financial sense to most people as long as they could be reassured that the lost water doesn't create any damage.

The "environmental" argument that water isn't lost but goes back into the system was generally accepted by many customers, however savvier customers and some non-household customers argued that there is a still a waste regarding treatment of water.

Customers would like to see investment in innovative, technological solutions to better detect and repair leaks, empowering the customer to fix their leaks (ideally with subsidies), and education of the general public and children on how to use less water to ensure leaks do not challenge supply. Customers liked the idea of working in partnership with Wessex Water to help improve leakage together.

Our more recent WCWR customer research undertaken in 2021 explored preferences for leakage reduction alongside a range of other water resources issues and so customers had less time to deliberate on this single issue than Wessex Water's PR19 customer research. The WCWR results were somewhat split. In response to the statement 'Leaks should only be fixed if the benefits of reducing lost water outweigh the repair costs' a quarter of respondents had no view on this, 38% agreed or strongly agreed, and 38% disagreed or strongly disagreed. There is though, an inherent customer 'feeling' that leakage is 'wasteful' which is reflected in the response to the statement that 'The level of leaks and loss of water from the water supply network should be minimised as far as possible regardless of the cost' where just over three-quarters of customers agreed or strongly agreed with this statement. It should be noted however that this research was undertaken prior to the cost-of-living crisis.

Figure 6-16: Attitudes towards leakage reduction from the WCWR research (n = 1,504)



Our sustainable abstraction willingness to pay study aimed to identify customer preferences and associated willingness to pay for investments in activities that could help reduce abstraction from the most environmentally sensitive sources – i.e., improve sustainable abstraction – towards anticipated targets set by regulators. The potential activities included in the study included: leakage reduction, smart metering, household water efficiency, non-household water efficiency, government-led water use appliance labelling and building a new reservoir. The study identified that customers tended to place most value on leakage reduction and reservoir construction. There was no evidence to suggest that customers wanted to choose the least expensive approach, rather there was a general preference to towards leakage reduction, which was typically the most expensive method offered. However, once customers were more informed about the pros and cons of each option (e.g. cost effectiveness, impact on bill and carbon impact) they were slightly more likely to increase their preference for the less expensive activities relative to the more expensive options to achieve more impact on abstraction for the same overall bill impact. Customers also did not typically opt to implement only one or two activities, the majority had a preference of investing in four or more activities.

6.8. Triangulation of customer research evidence

The customer views identified by the projects described in the sections above are not considered in isolation – they have been triangulated following CCWs best practice guideline for triangulation for the water industry. At the time of writing, we have outputs from the draft triangulation of relevant insight prepared by Sia Partners for our October 2023 business plan. This is presented in Table 6-1 but may be subject to change as further triangulation is undertaken as part of the business plan.

Table 6-1 Summary of customer insight from Sia Partners' draft Triangulation Report, June 2023

Sustainable abstraction – customer insight		
Relative priority ranking: 8th Total number of people engaged: 18,594		
Robustness of evidence	High	**Key sources of insight** E001 Reviewing Strategic Direction and Social Purpose, Oct 21 E003 2021 Young People's Panel, Dec 21 E004 2022 Young People's Panel, Nov 22 E006 Garden Water Use, Nov 21 E007 Customer motivations: water saving & smart meters, May 22 E009 Best Value SW Water Resource Plan (qual research), May 22 E010 Best Value SW Water Resource Plan (quant research), Jun 22 E016 Estimating customers' WtP for Sustainable abstraction, May 23
Divergence of views	Low	
Regional differences	Low	

With a high number of sources used, the analysis includes the views of all customer segments and stakeholders resulting in the robustness of evidence score to be high. No significant and recurring divergence of views have been found, however, insight tensions have been identified regarding leakage. While leakage was not given great importance by customers, stakeholders have stated that they thought of leakage as a top concern. As for the difference between customer segments, household customers favoured increasing the investment in leakage reduction to achieve Wessex Water's 2050 goal, whereas non-household customers did not want to change the current level of investment. As for the regional differences, no significant variations have been identified.

Customers generally have a low awareness of the importance of water conservation.	• The majority of customers are just not engaged enough with the water conversation to commit to water conservation. [E001] • The need to preserve water is not totally unfamiliar territory but people are generally unaware that water stress is an urgent problem and feel they haven't been educated on the topic. [E006] • Attitudes towards waste don't necessarily ring true when it comes to water behaviour. [E007]
Customers either underestimate their water usage or don't pay attention to it at all.	• Customers revealed that many regularly carry out seemingly 'wasteful' water usage behaviours without thinking about how much they're wasting. [E007] • 2/3 of customers stated that they are not very water conscious [E001] • Most customers were shocked to hear how much they used each day and said that it seemed like a lot of water. However, customers were still unsure how their usage might compare to average usage; even though it sounds like a lot they're unsure if it's more or less than other people [E007] • Most struggled to even make an estimation as people don't really consider what volume of water they might be using day to day. [E006]
A common perceived benefit of installing smart meters is to save money on water bills.	• Of those interested in a smart water meter, aside from the functional benefit of being able to monitor water use, the main themes mentioned were to reduce use / waste, save money, and (for a smaller minority) to identify leaks. [E007] • A high proportion of customers with a meter (7 in 10) claim to want to reduce their bill by using less water. [E002]

	• Uninformed interest in smart water meters is reasonable amongst the panel – 4 in 10 are interested. There's more enthusiasm amongst those keen to save on utility bills, the environmentally conscious, and younger customers. [E007]
Leakage is commonly a preferred solution for reducing demand and reliance on abstraction.	• Reducing leakage and using education and awareness campaigns to encourage reductions in water usage were the most supported demand options. [E009] • Regarding the relative preferences expressed by customers between these alternative options, the evidence suggests that customers tend to place most value on leakage reduction and reservoir construction [E016]
Customers expressed strong support for reducing reliance on abstraction from vulnerable sources, even beyond the proposed targets for reduction, and to pursue a combination of alternative supply and demand options.	• There was a positive view on measures to protect and improve the environment by reducing the dependency of water supply on surface and groundwater abstractions. [E010] • Participants' preference for supply options was reinforced by a c.60:40 split between supply and demand options…customers recognise the need for multiple approaches for water resource planning, rather than rely on a single approach or solution. [E009] • Customers are willing to pay for improvements in these areas and expressed a desire to see Wessex Water going beyond the reduction target of 10ML/d. [E016] • Whilst cost was a secondary consideration for many, customers are more willing to choose a combination of less expensive methods in order to achieve more improvement in sustainable abstraction for the same overall bill impact. [E016]

7. The Preferred "Most Likely" Plan

This section describes how the best value **preferred "most likely" plan** has been chosen, prior to the development of the adaptive plan shown in Section 8, through assessment of the least cost plan and how this compares to alternative "best-value" programmes.

7.1. Options considered

This following section details the outputs of various plans and programmes assessed for the WRMP24. Each plan has been reviewed against the key metrics as detailed in Section 2.3. To address our deficit, we have considered 75 feasible options (7 demand management portfolios and 68 supply options). These have included:

- Demand options – including 7 portfolios of demand management activity for leakage, household and non-household water efficiency, and different levels of smart meter roll out, each achieving different levels of demand reduction, including scenarios that meet Defra DI targets and 2050 targets for leakage and PCC reduction.
- Supply options - including yield enhancement of existing sources, water recycling, desalination, aquifer storage and recovery, new reservoirs, network/transfer enhancements, and resurrecting old sources.

Please refer to the Options Appraisal technical appendix for further information on the options development and appraisal process to derive the feasible plan options.

7.2. Plans Considered

We have developed three different alternative plans to our **central** supply-demand balance to derive our **preferred "most likely" plan**, following the process set out in Section 2.5.6. These alternative plans are designed to help shape our chosen best value plan:

- **Plan 1** – the **true least cost** plan derived with no constraints on demand management strategy or consideration of environmental metrics
- **Plan 2** – plan options constrained to those that meets government expectations on 50% leakage reduction by 2050, 110l/p/d per capita consumption target by 2050, and the Defra 20% reduction in per capita distribution input (demand) by 2037/38
- **Plan 3** – plan that meets government expectations, and also derived with the worst performing environmental options screened out from the decision-making tool.

The decision-making tool was run based on the input/options constraints identified above for each plan to derive three alternative portfolios of options scheduled to solve the supply-demand balance across the planning period. Additional system simulation modelling was undertaken to test that the portfolio of options was successful in solving the spatially distributed supply demand balance at the 2035-36 time-slice – the main driver of supply-demand balance deficit (see Section 5).

7.3. Plan Metrics

When comparing plans the following metrics were considered, as summarised in Section 2.3.

Programme Costs / Customer affordability

The Net Present Value of the programme from the investment model outputs has been used to assess programme costs to ensure customer affordability has been considered in plan selection.

Drought Resilience
Each plan should ensure drought resilience of 1 in 500 is met by 2039-40 and by 2049-50 at the latest. Achieving this drought resilience means being not entering a position of needing to implement stand pipes and rota cuts – where continuous water supply to properties will be interrupted - more frequently than 1 in 500 years on average.

Biodiversity Net Gain and Natural Capital Metrics
Following the optimisation model being ran the plans were assessed against the BNG and NC metrics produced for each option. For the Biodiversity Net Gain Metric each supply option was score between 2 and 6, with options scoring 6 having the greatest expected habitat loss. For Natural Capital, the assessments considered expected habitat loss for three key Ecosystem Services which include Biodiversity, Climate regulation and Natural hazard regulation. Higher scores indicate higher potential Natural Capital losses.

Please note the NC and BNG metrics produced are based on unmitigated options and therefore some options may preform worse than if mitigated (for example, diverting a pipeline around a designated site). Therefore, the metrics needs to be viewed alongside qualitative assessments. The BNG and NC metrics were summarised in the following way:

- NC scores were summed and weighted by temporal and spatial effects with a 0.6 weighting applied to temporal scale as it is considered to have the greatest effect in comparison to spatial effects (0.4 weighting)
- BGN scores were summed for all options where BNG was present.

The lower the scores, the better the score and outcome for the metrics.

Abstraction reduction
Whilst the environment is considered in the options appraisal process for the options themselves, it is important to emphasise that the investment programme is being made to meet licence reductions that are required to meet environmental destination driven licence reductions to help protect the environment. The amount of licence reduction required, and the uncertainty within this (both because of uncertainty in how much water is needed to protect the environment given future uncertainties like climate change), is accounted for in the low, central, and high scenarios and alternative timings of reductions

Carbon emissions
Carbon was assessed via the sum total of the carbon for the overall plan based on the schemes selected and when they were selected within the planning period. This is assessed in terms of tonnes of CO_2 equivalent.

Government Policy Expectations on demand
Whether each plan meets government policy expectations for demand, which includes:

- Meeting Defra Distribution Input (or demand) target of a 20% reduction in demand per capita by 2037-38.

- Reduce leakage by 50% from 2017-18 baseline levels by 2050
- Reduce household per-capita consumption to 110 litres per person per day by 2050

7.4. Plan comparison and preferred plan

A comparison of the options selected for each of the three plans (Section 7.2) is outlined in Table 7-1.

Across plans a 1 in 200 level of service to 2039-40, Temporary use bans and Drought permit options are selected to 2050, alongside some smaller supply side enhancement schemes, a 7Ml/d import from Bristol Water, and a more significant change in our system to increase reservoir capacity in the West and transfer this, alongside surplus created through demand reductions, to the East.

Under the true least cost plan, one of the lowest demand reduction benefit scenarios - Demand Strategy 6 - is selected alongside Poole water recycling and a larger import from Bristol Water to solve licence change needs in 2035. Under Plan 2 (Meet demand targets) and Plan 3 (Meet demand targets + environmental screening) the same options are selected; selection of Demand Strategy 7 which includes more ambitious leakage, smart metering, and water efficiency activity to meet government demand targets is sufficient to meet most of the licence changes required in 2035, without investment of more significant and potentially environmentally damaging supply-side schemes. Therefore, in addition to the options selected across all scenarios, only two additional smaller supply side schemes are required and not until later in the planning period (from 2049).

Table 7-1: Types of options selected in the central scenario for each of the plans (first year of option benefit shown in brackets)

For security reasons this table has been redacted and edited for the version that is published on our website.

	Plan 1 - True Least Cost	Plan 2 - Meets Demand Targets	Plan 3 - Demand Targets + Environmental screening
Options selected across all scenarios	- 9.16 Temporary Use Bans (2025-26) - 9.19 Reduced Level of Service 1 in 200 to 2039-40, 1 in 500 from 2040-41 (2025) - 41.01 and 41.06 Drought Permit Options to 2050 (2025-26) - 59.01 Stream Support option – Upper Stour (2025-26) - 39.01 and 39.02 Under-utilised licences in North Bath and North Warminster (2063-64 and 2035-36, respectively) - 70.06 Increased peak reservoir capacity output and East Transfer (2035-36) - 70.01 Import Increase from Bristol Water and internal transfers (2035-36)		

Demand Management Strategy	**Strategy 6**: Total Demand Saving: • 2030: 6.89 Ml/d • 2038: 19.23 Ml/d • 2050: 44.43 Ml/d Leakage: Slow to 2050 Metering: 50% smart metering by 2050 HH WE: Home Check 1/6 largest feasible by 2050 NHH WE:1/6 largest feasible by 2050 WE labelling: Defra Scenario 1	**Strategy 7:** Total Demand Saving: • 2030: 28.48 Ml/d • 2038: 57.90 Ml/d • 2050: 91.61 Leakage: Linear to 2050 Metering: Full urban smart metering (75%) by 2030, rural by 2035. Non-compulsory measured billing. HH WE: Home Check largest feasible scale by 2030 NHH WE: largest feasible scale by 2030 WE labelling: Defra Scenario 1	**Strategy 7:** Total Demand Saving: • 2030: 28.48 Ml/d • 2038: 57.90 Ml/d • 2050: 91.61 Leakage: Linear to 2050 Metering: Full urban smart metering (75%) by 2030, rural by 2035. Non-compulsory measured billing. HH WE: Home Check largest feasible scale by 2030 NHH WE: largest feasible scale by 2030 WE labelling: Defra Scenario 1
Supply Options Selected	- 52.02 Poole Water Recycling and Transfer - Stour use - 50% (2035-36) - 70.03 Bristol Bulk Import and internal transfers (2035-36) - 38.11 Under-utilised Licence - East Dorchester Source (2040-41) - 34.1 Amesbury Boreholes (Hampshire Avon) (2035-36) -18.28 North Bath Resilience (2040-41)	- Under-utilised licence - East Weymouth Source (2063-64)	- Under-utilised licence - East Weymouth Source (2063-64)

The programme of options selected for each of the three plans has been reviewed against the key metrics in order to determine our preferred programme. The summary of the assessed plans and programmes, across metrics, is outlined in Table 7-2

Table 7-2: Comparison on plans in terms of best-value criteria (NC = Natural Capital; BNG = Biodiversity Net Gain)

Plan	Programme Cost (£NPVm)	Drought (1 in 500 resilience by 2039/40)	Environment		Carbon tCO_2 equivalent	Abstraction reduction - Environmental Destination	Government Demand Expectations
			NC	BNG			
Plan 1	£550M	2039/40	-76	22	290,724	Meets 2035 licence reductions	No

Plan 2	£834M	2039/40	-39	14	397,103	Meets 2035 and licence reductions	Yes
Plan 3	£834M	2039/40	-39	14	397,103	Meets 2035 licence reductions	Yes

All plans meet abstraction licence reductions in 2035 as well as providing drought resilience to 1 in 500 drought by 2039/40. Plan 2 and Plan 3 meet the government demand reduction targets, and in doing so achieve this at a greater programme cost and carbon cost. The higher programme cost is associated with the higher cost of the demand management strategy, and the higher carbon cost is mainly driven by the carbon cost over the whole planning horizon to 2080 of reducing leakage by 50% by 2050 and the carbon cost associated with holding this steady for the remainder of the planning period. In comparison the carbon cost of Plan 1 is smaller as the demand reduction strategy volume, coupled with new supply-side schemes is balanced slightly more by reduced carbon emissions associated with abstraction licence reductions.

As a result of fewer supply-side schemes, Plan 2 and Plan 3 score more favourably than Plan 1 in relation to Natural Capital losses and plans score similarly in terms of Biodiversity Net Gain, but with fewer losses as a result of fewer supply side schemes, and as a result of the screening process of environmentally worse options. The majority of the negative performance scores result from transfer options which are assumed could be mitigated via best practice construction methods and pipeline routes to avoid certain routes or habitats.

Of the demand management strategies that meet government policy expectations and the statutory DI target, Strategy 7 which is selected in Plan 2 and Plan 3 is more acceptable under our AMP8 affordability and acceptability testing for PR24 than the other strategies due to the slower roll out of smart metering.

Based on the assessment of least cost versus alternative best-value planning scenarios, Plan 3 is the preferred plan. Whilst the plan comes at a greater financial and carbon cost that the least cost plan, the plan meets government targets for demand reductions, and the higher costs for reducing demand are required to meet the statutory DI target on 2037/38. Whilst the plan comes with a larger carbon cost over the lifetime of the planning horizon, much of this carbon cost is associated with reducing leakage to 50% of 2017-18 levels by 2050 and holding steady for the remainder of the planning horizon. We expect much of this activity will have lower future carbon costs through our activity to achieve net zero carbon[23].

As part of Plan 3, Demand Management strategy 7 is considered to be the best value strategy as it:

- Meets government targets for PCC, leakage and non-household demand reduction
- Meets statutory government target for DI reduction
- Does not ‘over deliver’ on the above at significant cost to customers, through appropriate phasing of smart metering.

[23] Carbon and climate (wessexwater.co.uk)

- Is ambitious enough to impact on requirement for future supply side schemes in areas affected by licence reductions
- Is considered acceptable to customers, measured billing will be encouraged but only compulsory through change of occupier
- Associated programmes of work are considered deliverable

A key benefit of this strategy is that by meeting 2035 targets for licence reductions through demand management measures, the strategy is reducing abstraction from the environment whilst supply side schemes are put in place by 2035. This strategy therefore has more of a benefit in the short term on the supply demand balance and abstraction from the environment (Figure 7-1). This provides more of a benefit in the short term to chalk catchments such as the Hampshire Avon where the majority of sites targeted for licence reductions are located. In the Hampshire Avon, the need to offset future population growth through demand reductions to ensure no additional abstraction from the catchment is required is a key driver for preference of Plan 3.

Figure 7-1: Comparison of Supply-Demand Balances between plans

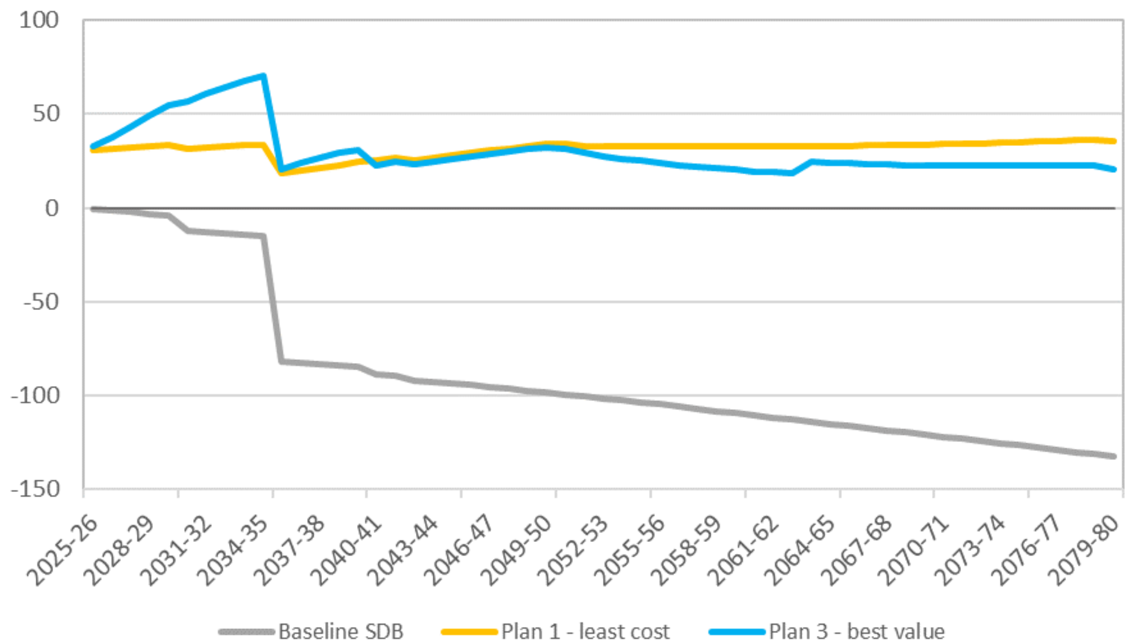
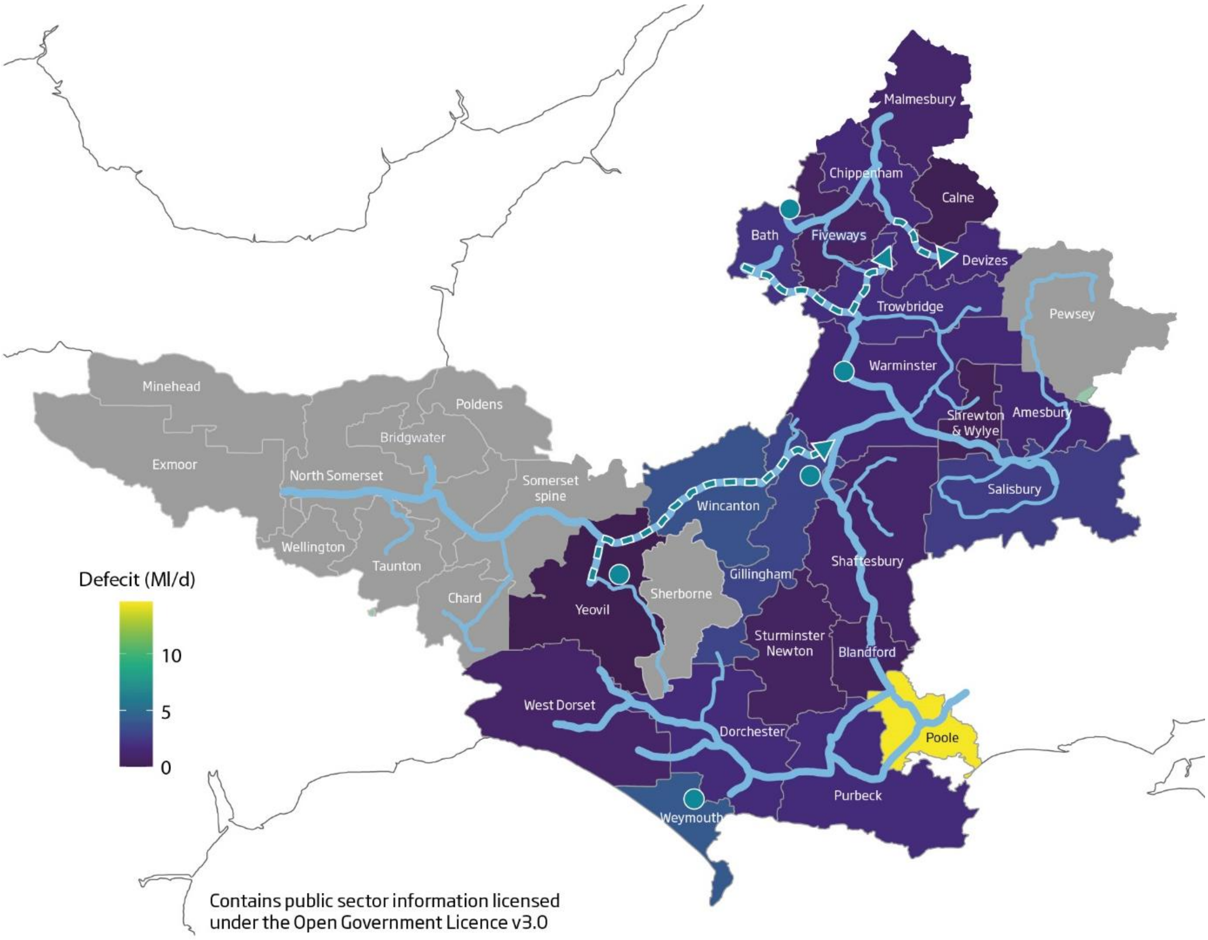


Figure 7-2 shows the spatial location of baseline supply-demand balance deficits under the central supply-demand balance scenario in 2035-36, overlain with the location of selected supply options. Demand management measures provide the main source of supply-demand balance benefit. By reducing demand at key demand centres, our existing grid system allows the benefit of these reductions to be moved through the supply system. The two key supply-side options that provide changes to the way in which the supply system will operate are option 70.06, which will increase peak reservoir output in the West and, alongside the benefit of demand reductions made in the West of the supply system, this water will be moved East from Yeovil towards Warminster to help meet peak demands in the groundwater dominated parts of our supply system. The other option is 70.01, which will increase the import of water from Bristol Water, and move this water into our supply system and onwards to the Devizes area to help meet the licence reductions in the Upper Western Arm of the Hampshire Avon catchment.

Figure 7-2 Spatial location of baseline supply-demand balance deficits overlain with location of selected supply sources and transfers under the preferred "most likely" plan



Whilst the preferred plan has been identified that meets the central planning scenario, there are key uncertainties in future need, as well as other drivers that need to be considered to derive our preferred adaptive plan, that are considered in Section 6. Demand management strategy 7 as selected in Plan 3 is also selected under the higher need future scenario, and therefore to adapt to a greater potential need for licence changes in 2035, it features under the core pathway.

Two of the three programmes making up demand management strategy 7, leakage reduction and smart metering, have been rephased between AMP8 and AMP9 for our final WRMP to align with the demand management strategy submitted as part of PR24 business plan. Our water efficiency programme remains unchanged from our revised draft WRMP. Hereafter in this document, demand management strategy 7 refers to the final version of this strategy – changes to leakage and smart metering are summarised in the table below.

Table 7-3 Final demand management strategy 7 – re-phased leakage and smart metering

	AMP8 2025-2030		AMP9 2030-2035	
	rdWRMP	final WRMP	rdWRMP	final WRMP
Smart meters installed (000s)	487.2	256.7	145.5	383.0
Total leakage reduction (Ml/d)	7.7	3.5	4.4	8.6

The key driver for the re-phasing of our leakage and smart metering programmes centres around deliverability, affordability and financeability in the context of our overall AMP8 investment programme. The final demand management strategy still enables us to meet our statutory 20% DI reduction target in 2037/38, halve leakage by 2050 and reduce abstraction to protect the environment. AMP8 activity will be focused in the Hampshire Avon catchment and connected areas where demand reduction will have greatest environmental benefit.

For further justification of these changes please see section 5.5 of our WRMP24 Main Plan.

8. The Preferred Adaptive plan

The analysis shown in Section 7 identifies our best-value **preferred "most likely" plan**, which has been derived for the main central supply-demand balance scenario, as shown in Section 5. In this section we consider alternative future scenarios to ensure our plan can adapt to future uncertainties. The key future uncertainties that have been considered in developing the adaptive plan are:

- **Supply demand balance scenarios –** alternative supply demand balances, as summarised in Table 3-1 and shown in Figure 5-6 where uncertainty in future licence reductions, demand growth and climate change are considered. We have developed our adaptive plan using plausible low and high supply-demand balance scenarios, as shown in Section 5.2.
- **Demand management strategy effectiveness –** the effectiveness of future demand management measures are uncertain, as demand is influenced by a range of factors beyond the control of the company, including future climate change, and as we have seen recently, changing demand resulting from post-covid changes in water use behaviour, as well as changing water consumption in response to changing economic circumstances and the recent cost of living crisis. To consider this, we have tested whether whilst investing in Demand Strategy 7, only half the benefits of the strategy are achieved.
- **Additional need from Ministry of Defence Sites and Veolia Water Services –** Alongside licence reductions in the catchment to achieve sustainable abstraction for Wessex Water, both the Ministry of Defence and Veolia Water Services may require additional volumes of water to meet their future needs that those already accounted for in our central supply-demand balance, which in part depends on the outcome of subsequent environmental investigations in the 2025-2030 period. To help ensure our plan can meet these needs, we have modelled scenarios where an additional 9.84Ml/d is required. These additional demands would be in the eastern part of our supply system in the Hampshire Avon.
- **Hampshire Avon options –** one solution to meet the needs of licence changes in the Hampshire Avon catchment for both Wessex Water and other users' needs is to combine existing abstractions and move them further downstream to different locations that have more water in the river and then supply this water back upstream to existing demand centres. A number of our feasible supply options (34.08, 34.11, 56.01 and 70.07) fall under this category. Whilst these options may be preferential to other options by meeting demand more locally, and therefore have a lower environmental impact, there is significant uncertainty about the impact they may have in the Hampshire Avon locally. Investigations are being taken forwards under the WINEP programme in the 2025-2030 period to assess option feasibility. Whilst these options have not been selected under our preferred "most likely" plan, it is important our plan adapts to uncertainty in availability under other plausible future scenarios.

Whilst these factors can be considered in isolation, it is important to consider them together, as combinations of these factors evolving in the future are plausible - e.g. additional need in the Hampshire Avon catchment but no additional options in the catchment available. Therefore, in addition the preferred "most likely" plan, and also based on some of the option selection under some scenarios, we have developed the following alternative scenarios to develop the adaptive plan[24]:

- **Lower Need scenario –** Supply-demand balance follows the low need supply demand balance.
- **Higher Need Alternative Programme 2 (AP2)** - Supply-demand balance follows a high need scenario (supply-demand balance scenario 6).
- **Higher Need Alternative Programme 3 (AP3) – Hampshire Avon options not available -** Supply-demand balance follows a high need scenario (supply-demand balance scenario 6), but not Hampshire Avon options are available to be selected
- **Central Alternative Programme 4 (AP4) – Demand Management Strategy 7 less effective** – supply-demand balance follows the central SDB scenario, demand savings achieved only follow the savings associated with Demand Strategy 3 (approximately half of the savings)
- **Central Alternative Programme 5 (AP5) – Demand management less effective + Hampshire Avon options not available** - supply-demand balance follows the central SDB scenario, the demand management strategy is less effective, and Hampshire Avon options are not available.
- **Central Alternative Programme 6 (AP6) – Additional need from MoD and Veolia** - supply-demand balance follows the central SDB scenario, and there is additional need in the Hampshire Avon from MoD and Veolia.
- **Central Alternative Programme 7 (AP7) – Additional need from MoD and Veolia and no Hampshire Avon Options**

To develop the adaptive plan, we have run the decision-making tool based on the above supply-demand balance scenarios and option constraints.

8.1. Options Selected Across Scenarios

The first step in developing the adaptive plan is to assess the options selected across alternative scenarios, to identify common options, and understand the start dates of the different options to inform decision-making and trigger timing. Table 8-1 shows the options selected under the alternative planning scenarios. With the exception of the demand management strategy, the options are ordered from top to bottom in the table by the frequency with which the option is selected.

Under the alternative central scenarios (AP1-4) Demand Strategy 7 is selected as a mandated scheme to explore alternative futures to the preferred "most likely" plan. However, the option is selected as the least cost option under high need SDB scenarios AP1 and AP2.

[24] We also considered the scenario where under the preferred "most likely" plan there was not Hampshire Avon options available, however these were not selected under the main pathway (Note: AP == Alternative Pathway and Cen == Central).

Please also note that the names of the alternative programmes has been selected to line up with the accompanying planning tables, and also to the Ofwat long term delivery strategy (PR24 long-term delivery strategies - Ofwat), where the preferred "most likely" WRMP plan is presented as an alternative programme to the Ofwat core programme. Therefore the preferred "most likely" plan in the WRMP is referred to as Alternative Programme 1 (AP1), and the alternative scenarios

Under the low future SDB, Demand Management Strategy 6 is selected, which has approximately a 3rd of the demand saving benefit of Strategy 7, alongside the 5 options that are included under all scenarios – drought measures, reduced levels of service and a stream support option.

Table 8-1 Options selected under alternative scenarios, as indicated by the date at which scheme development needs to start. Blue shading of option names indicated those options taken forwards in the Ofwat Core Programme

For security reasons this table has been redacted and edited for the version that is published on our website.

ID	Option Name	Preferred AP1	Low	High AP2	High AP3	Cen. AP4	Cen. AP5	Cen. AP6	Cen. AP7
57.07	Demand Strategy 7	2025		2025	2025	2025	2025	2025	2025
57.06	Demand Strategy 6		2025						
9.19	Reduced levels of service, moving to 1:500 to 1:200	2025	2025	2025	2025	2025	2025	2025	2025
9.16	Temporary Use Bans	2025	2025	2025	2025	2025	2025	2025	2025
41.01	Drought Permit - Stour catchment	2025	2025	2025	2025	2025	2025	2025	2025
41.06	Drought Permit - Bride catchment	2025	2025	2025	2025	2025	2025	2025	2025
59.01	Upper Stour Stream Support	2025	2025	2025	2025	2025	2025	2025	2025
39.01	Underutilised licence: North Bath	2056		2048	2028	2028	2028	2057	2053
39.02	Underutilised licence: North Warminster	2028		2028	2028	2028	2028	2028	2028
70.06	Increased Reservoir Capacity and East Transfer	2026		2026	2026	2026	2026	2026	
22.04	Weymouth Source Improvements	2054				2026	2026	2054	2054
52.02	Poole Water Recycling and Transfer – Stour use 50%			2025	2025	2025	2025		
70.01	Bristol Import and onwards transfer I	2026		2026				2026	2026
38.01	Underutilised licence due to water quality: Purbeck			2028			2053		2050
70.02	Bristol Import and onwards transfer II				2026	2026	2026		
38.12	East Weymouth Source – treatment improvements			2046	2046				

34.1	Amesbury boreholes			2025		2055			
32.36	New Reservoir: Bristol Avon			2034	2032				
33.01	Groundwater: Aquifer Storage Recharge - Wareham Basin			2043	2028				
18.1	West Somerset Reservoirs transfer upgrade			2056	2057				
30.02	Pump Storage - Quantock Reservoir			2051	2052				
21.13	Salisbury to Amesbury to Tidworth Transfer			2070	2057				
38.11	Underutilised licence: East Dorchester Source			2028	2028				
23.01	Yeovil Reservoir increased peak capacity								2027
18.28	North Bath Resilience				2029				
55.05	North Grid to South Grid reinforcements - 5.5Ml/d				2026				
54.06	Mendips to Grid – 50% capacity				2049				
21.12	Pewsey resilience			2049					
25.03	Grid reinforcements – Wylye valley				2057				
70.03	Bristol Import and onwards transfer III			2026					
70.04	Bristol Import and onwards transfer IV				2026				
70.05	Bristol Import and onwards transfer V								2026
70.07	Hampshire Avon Boreholes and Transfer							2025	

Under the two higher need scenarios, alternative programme 2 and 3, more options are selected to solve the supply-demand balance. In AP2, this includes 3 options brought forwards, two in to AMP8, that are also included in the preferred “most likely” programme (39.01, 39.02 and 70.06). In the shorter term, the largest options selected to meet the higher need environmental licence reduction need in 2035 include 52.02 Poole water recycling scheme, Amesbury boreholes scheme (34.1) in the Hampshire Avon, and an increased import from Bristol Water (70.03). There are also some larger schemes selected to meet longer term need (33.01 and 54.06). Under AP3 – where Hampshire Avon options are unavailable - scheme selection is similar; most schemes also selected under AP2 are brought forwards, and in addition an increased import from Bristol is selected alongside a longer-term transfer of 17.5Ml/d from Mendip quarries.

Under the central alternative programmes, a less effective demand management strategy (AP4) results in the selection of 52.02 Poole water recycling scheme, and increase in transfer from Bristol Water (70.02) instead of option 70.01 to move water further into the Hampshire Avon, alongside the selection of Amesbury boreholes in the Hampshire Avon (34.1) later on in the planning horizon in 2055. If the demand management strategy is less effective and the Hampshire Avon options are not available (AP5) then the same schemes are selected as with AP4, except instead of the Amesbury boreholes (34.1) option 38.01 underutilised licence at Belhuish is selected in 2053.

If under the central SDB scenario additional need is also required by the MoD and Veolia Water Services (AP6) then the new borehole option in the Hampshire Avon and onwards transfer is selected from 2025 (70.07). If, however there is additional need, but no Hampshire Avon options (AP7) then instead of a more local supply solution, then the primary plan change is to bring in additional water from Bristol Water (70.05) which distributes the water further into the Hampshire Avon catchment into Salisbury to meet the additional need from 2026.

8.2. Adaptive pathways

Based on the scenario analysis undertaken, the adaptive plan and associated pathways have been developed accounting for Ofwat's PR24 and beyond – Final guidance on long term delivery strategies[25]. The development of the adaptive pathways is as follows.

Ofwat Core Programme

All activities which are selected under all scenarios are considered no- and low-regret options and are included in a **core pathway** as these activities need to be undertaken to be ready for all plausible future scenarios. This includes:

All activities under the low scenario – the only option selected under the low scenario that differs to the other scenarios is the demand management strategy. However, given Demand Strategy 7 is required under the preferred "most likely" programme to meet government policy expectations, and is also required to meet needs under the two high SDB programmes (AP2 and AP3), and that the strategies are mutually exclusive, means **Demand Management Strategy 7** is selected under the core pathway. Further details about the Demand Management Strategy 7 can be found in the Demand Management Strategy technical appendix.

All activities selected under all scenarios – drought permit options (41.01 and 41.06), temporary use bans (9.16), the local stream support option (59.01) and reduced levels of service (9.19).

[25] PR24-and-beyond-Final-guidance-on-long-term-delivery-strategies_Pr24.pdf (ofwat.gov.uk)

Activities to be ready for all plausible future scenarios – Programmes AP2 to AP7 are included in the plan alongside the preferred "most likely" programme (AP1) as the plan alternative pathways/programmes. Under the core programme, in addition to those schemes being taken forwards across all scenarios, there are 12 additional schemes to be taken forwards under the core pathway in AMP8 2025-2030. These options are being selected in the core programme because across all pathways the earliest start date fall between 2025 and 2028, and therefore activity is required under those schemes to keep alternative future pathways open. The schemes selected in the core pathway are highlighted in Table 8-1.

For these schemes, to keep future pathways open, we plan to take these 12 options forwards through the design and development phases (enabling work) of the schemes towards the date of the next WRMP (draft in 2027 and revised draft/final plan in 2028) towards the **trigger point** for determining which future pathway to follow in 2030. Of the supply schemes being taken forwards in AMP8, a number of the schemes have common source and transfer elements – for example there are several schemes that utilise an import from Bristol Water and onwards transfer to different parts of the supply system. The costs included in the plan under the core pathway for scheme design and development do not duplicate these elements.

The key reason for needing to take a range of options forwards in AMP8 is due to the significant need that must be met in 2035 (see Section 5), and the key uncertainties that need to be resolved in the next planning period. Six options are also selected under the core pathway, which have their earliest start dates across pathways from 2028 (39.01, 39.02, 38.01, 33.01, 18.28 and 38.11). We will narrow down our future uncertainties by the time of the next draft plan in 2028, and use dWRMP28, and the information gathered to date, to determine whether these additional six schemes need to be taken forwards. For these schemes, depending on the outcome of dWRMP28 in 2027-28, we would seek AMP9 transition funding to take these options forwards to design and development, to inform our decision point in 2030.

The key areas of uncertainty, and therefore the key aspects that will be monitored on the core pathway, are as considered above for alternative pathways, and principally include:

Required licence reductions and other needs – the main driver for our supply-demand balance reductions is licence changes in 2035. However, there is significant uncertainty in the amount of licence changes required, which will only be resolved when the investigations into source sustainability are completed under the WINEP programme in AMP8. Overall there are 38 water resources WNEP investigations in AMP8. In addition, there is further need in the Upper Hampshire Avon catchment from MoD and Veolia water.

To identify the most appropriate solution for the catchment, as with other locations, it is important to have a complete understanding of all future needs so that future investment is efficient. To help achieve this, we have set up the Upper Hampshire Avon Water Resources Steering Group to align understanding of future catchment need and solutions that meet all needs to help protect the catchment in the long-term. Further detail can be found in the Upper Hampshire Avon Water Resources Strategy technical appendix. By the next WRMP, we will not have complete conclusions from investigations so will seek to use the information to date for the draft WRMP in 2027 and revised draft WRMP in 2028 to narrow down our

uncertainty in which future pathway will likely be followed, subject to a complete set of investigation outcomes by 2030 to determine which pathway and programme is to be followed.
Future demand – there is uncertainty about the forecast of future demand growth, as accounted for in the alternative SDB scenarios, as well as uncertainty in the effectiveness of demand side measures that will be implemented in the Wessex Water area – including in the effectiveness of smart metering, which will be rolled out in the Wessex Water area for the first time. Between now and the next WRMP development, and by 2030 we will monitor and gather data on demand reductions and demand forecasts.

Supply side scheme investigation – The design and development steps undertaken for those options in the Hampshire Avon will help inform feasibility of those schemes from an environmental perspective, to then determine whether these local schemes can be taken forwards. By the next WRMP we expect only interim outcomes of these investigations, but will use this information to inform the decision-making process for WRMP28.

Alternative Pathways

As identified under the core pathway above, work undertaken in AMP8 will help inform:

- a **decision point** in 2027-28, aligned and informed by the next WRMP as to whether alternative schemes need to progress for design and development from 2028 towards the trigger point in 2030
- a **trigger point** in 2030 where one of the alternative pathways will be followed.

Table 8-1 shows the options that will be selected under the different alternative programmes and implemented following the trigger point in 2030. Table 8-2 shows the approximate likelihood of following each pathway from 2030 (where the core is followed to 2030), and the Net Present Value (NPV) of following each pathway. As per progress our activity in AMP8, we will gather further information to narrow down the uncertainties on which pathway is most likely.

Table 8-2 Likelihood and NPV cost of the alternative pathways

Programme	Description	Approximate Likelihood Post 2030	NPV
Ofwat core	Ofwat Core Pathway	20%	£754m
AP1	Preferred “most likely” programme	21%	£834m
AP2	High Alternative Need	10%	£1,259m
AP3	Higher Alternative Need and Hampshire Avon Options Not Available	10%	£1,368m
AP4	Central need and Demand management less effective	10%	£917m
AP5	Central need, demand management less effective and Hampshire Avon options not available	5%	£923m

AP6	Central need and additional need from MoD and Veolia	12%	£921m
AP7	Central need, additional need from MoD and Veolia and no Hampshire Avon options available	12%	£932m

The key decision to be made to follow each pathway are summarised in Table 8-3 alongside the monitoring plan in Table 8-4. The adaptive plan is also shown schematically in Figure 8-1.

Table 8-3 Key Decisions to be made to determine which pathway is followed in 2030

Programme	Description	Conditions under which the pathway is followed
Ofwat core	Ofwat Core Pathway	Low future supply demand balance need
AP1	Preferred "most likely" programme	If volume of licence changes required and future demand forecasts follow the central supply-demand balance scenario, demand management strategy is effective, and there is no additional need in the Hampshire Avon, then this pathways is followed.
AP2	High Alternative Need	If volume of licence changes required and future demand forecasts follow the high supply-demand balance scenario, the demand management strategy is effective, and Hampshire Avon options selected are viable, then this pathway is followed.
AP3	Higher Alternative Need and Hampshire Avon Options Not Available	If volume of licence changes required and future demand forecasts follow the high supply-demand balance scenario, the demand management strategy is effective, and Hampshire Avon options are not viable, then this pathway is followed.
AP4	Central need and Demand management less effective	If volume of licence changes required and future demand forecasts follow the central supply-demand balance scenario, demand management strategy is less effective, Hampshire Avon options are viable, and there are no additional needs in the Hampshire Avon, then this pathway is followed.
AP5	Central need, demand management less effective and Hampshire Avon options not available	If volume of licence changes required and future demand forecasts follow the central supply-demand balance scenario, demand management strategy is less effective, Hampshire Avon options are not viable, and there are no additional needs in the Hampshire Avon, then this pathway is followed.
AP6	Central need and additional need from MoD and Veolia	If volume of licence changes required and future demand forecasts follow the central supply-demand balance scenario, demand management strategy is effective, Hampshire Avon options are available, and there are additional needs in the Hampshire Avon, then this pathway is followed.
AP7	Central need, additional need from MoD and Veolia and no Hampshire Avon options available	If volume of licence changes required and future demand forecasts follow the central supply-demand balance scenario, demand management strategy is effective, Hampshire Avon options are not available, and there are additional needs in the Hampshire Avon, then this pathway is followed.

Figure 8-1 WRMP24 adaptive plan showing alternative pathways and alternative investments (shown for reference against supply-side capex investment to see specific investment timing (as also shown in Table 8-1)

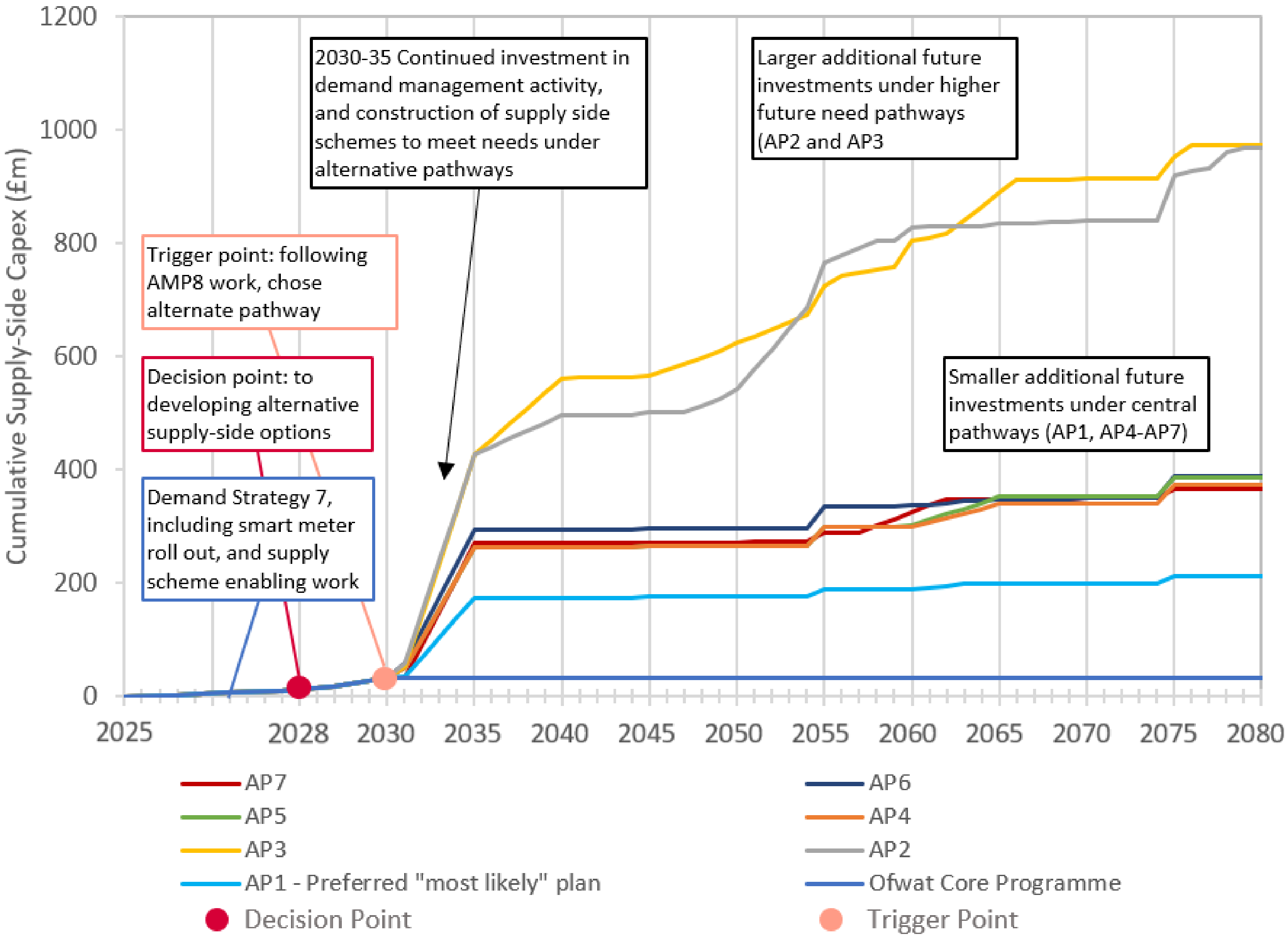


Table 8-4 Monitoring and enabling activities as part of the adaptive plan

Area	Monitoring/ Enabling Activity	Metrics being measured	Relation to Decision/Trigger Point
Supply and Demand Side Options Benefits	Design and development of all schemes that may progress under each pathway to construction in AMP9	Yield, Cost, Overall feasibility (planning/environmental barriers), notably environmental feasibility of options in the Hampshire Avon catchment	By 2027/28 inform WRMP29 scheme selection, and by 2030 to inform trigger point for following alternative pathways
	Strategic scheme investigations of Mendip Quarries and Poole Water Recycling Scheme	Yield, Cost, Overall feasibility (planning/environmental barriers), Proportional need across potential beneficiary companies	By 2027/28 inform WRMP29 scheme selection, and 2030 to inform trigger point
	Demand Management Strategy: Smart metering, water efficiency and leakage effectiveness.	Water saving benefits at household/non-household level of metering and water efficiency measures (both internally and nationally), cost, customer acceptability.	By 2027/28 inform WRMP29 scheme selection, and by 2030 to inform trigger point
	System modelling	- Regional and company modelling of internal transfers and strategic schemes	By 2027/28 to inform WRMP29 to inform scheme benefit assessment
Supply Demand Balance Components	WRMP annual review, and development of supply-demand balance components	Annual monitoring of: distribution input, non-household demand, household demand (as related to effectiveness of metering and water efficiency programmes), metering (installations compared to forecast) and leakage	By 2027/28 inform WRMP29 baseline for supply-demand balance scenarios and need of whether to progress additional schemes for design and development in AMP8.
	WINEP investigations	Licence losses required and associated drought Deployable Output, and timing of licence losses required	by 2027/28 inform WRMP29 supply demand balance scenarios, and 2030 to inform scheme feasibility of Hampshire Avon options and licence reductions needed
Policy direction and external developments	Population, Household growth and planning	- New Local Authority Plans and changing developments on household growth. - ONS census 2021 and updated forecasts	by 2027/28 inform WRMP29 and growth forecasts compared to low and high growth scenarios
	Regional and neighbouring company, and other user needs in shared catchments	Developments in licence changes required for South West Water in Stour and Hampshire Avon, and MoD/Veolia licencing requirements in Hampshire Avon.	By 2027/29 to inform WRMP29 strategic scheme benefit and selection, and whether we need to move to
	Liaison with Environmental Groups, Natural England, and the Environment Agency	Environmental policy changes, developments of chalk stream group (CABA) and Moors protection policies	by 2027/28 inform WRMP29 supply demand balance scenarios and licence loss policies
	Water efficiency labelling	Government policy on water efficiency labelling: implementation and likely savings	By 2027/28 inform WRMP29 scheme selection and yield benefits

8.3. Key Features of Our Preferred Adaptive Plan

Section 8.2 describes the adaptive plan with four alternative pathways. This section provides further details and justification for our preferred adaptive plan. Key features of the plan include:

- **Demand Management Strategy –** Our plan includes an ambitious demand management strategy to reduce demand to reduce abstraction from the environment and enable us to make licence reductions. The plan includes smart meter roll out, leakage reduction and household water efficiency home check visits. For further details, please see the Demand Management Strategy technical appendix. The demand management strategy also meets Defra's DI target by 2037-38, and 2050 targets for metering and leakage (See Section 8.3.5).
- **Hampshire Avon catchment –** The investments made in the adaptive plan, notably through the demand management strategy, will reduce pressure on the environment in the short term, prior to the development of supply-side schemes to meet needs in 2035. By focussing our demand management strategy for the benefit of the Hampshire Avon catchment, we can help to ensure that new growth can be met without increasing existing abstraction. For some areas in the Hampshire Avon, we need to invest in new connections to ensure licence changes can be met. There are also additional uncertainty relating to the needs of other users in the catchment, and so we are creating an upper Hampshire Avon water resources steering group to coordinate licence reduction and new supply scheme investigation work being undertaken in AMP8, to inform our next WRMP and adaptive plan as to the investments required in AMP9. Further details can be found in the Upper Hampshire Avon water resources strategy technical appendix.
- **Reducing uncertainties –** as described above, there are significant uncertainties in environmental need that will be reduced through environmental investigations in AMP8 in particular, alongside uncertainties in the effectiveness of demand side measures, as well as in the feasibility of the supply-side schemes that we are taking forwards under the core pathway to inform our decision and trigger points later AMP8.

8.3.1. Customer Research

Our customer research for the WRMP has been combined with that needed to additionally meet our regional water resources planning requirements. Table 8-5 summarises how the preferred adaptive plan meets customer expectations.

Table 8-5 How the plan meets customer preferences

<table>
<tr><th>Key customer insight</th><th>How our plan addresses the insight</th></tr>
<tr><td>Customers generally have a low awareness of the importance of water conservation.</td><td rowspan="3">The combination of smart metering roll out and wider water efficiency services for households (Home Check) and non-households will help customers understand their water usage, drive reductions in water wastage (leaking toilets and taps) and support behaviour change through enhanced engagement.</td></tr>
<tr><td>Customers either underestimate their water usage or don't pay attention to it at all.</td></tr>
<tr><td>A common perceived benefit of installing smart meters is to save money on water bills.</td></tr>
<tr><td>Leakage is commonly a preferred solution for reducing demand and reliance on abstraction.</td><td>Our preferred plan will see leakage reduce by 50% over the 25 year long term horizon</td></tr>
</table>

Customers expressed strong support for reducing reliance on abstraction from vulnerable sources, even beyond the proposed targets for reduction, and to pursue a combination of alternative supply and demand options.	The demand and supply measures we'll implement will mean we can accommodate licence reductions from the most sensitive sources.
An increasing number of customers are facing financial difficulties as a result of the cost-of-living crisis and there has been a rise in anxiety relating to being able to pay current and future water bills. There is more willingness to pay from customers for improvements to environmental protection than in making significant customer service improvements.	The measures contained in our plan focus on delivering environmental benefits to meet our regulatory obligations at a pace that is mindful of impacts to bills in the near future – wider testing of bill affordability is, at the time of writing, underway for our PR24 Business Plan.

8.3.2. Assessment of the Preferred (Best Value Plan)

This following section details the assessment of the preferred plan and why it is considered best value. This is summarised in **Table 8-6**
Table 8-6.

Table 8-6: preferred adaptive plan performance against WRMP24 best value plan expectations

Area	Covered in best value plan
Government policy and regulator expectations	The core pathway and preferred "most-likely" plan meet government expectations for 20% Distribution Input target per-capita reduction by 2037-38. See Section 8.3.5
Customers' preferences	See section 8.3.1
Protecting and meeting the needs of vulnerable customers	Our commitment to supporting vulnerable customers remains unchanged. Further information can be found here: Vulnerable customer contact - OUR FUTURE PERFORMANCE | Wessex Water Our Business Plan submission in October 2023 will set out how we plan to extend support to customers that struggle to pay their bills.
Environmental improvements	The Preferred Plan has been assessed against SEA and HRA but also BNG and Natural Capital. These selected supply-side schemes all perform well against the environmental metrics generated for the feasible options (see Options Appraisal report) relative to other new supply schemes. The plan will bring significant benefit to the environment by reducing demand significantly in the short term, and therefore by reducing abstraction from the environment, most notably in the Hampshire Avon catchment, whilst additional supply side schemes are developed. The worst performing supply side schemes from environmental assessment were excluded.
Biodiversity	Scheme meets the SDB need under the preferred "most likely" plan without new abstraction sources and therefore considered to have minimal impact on biodiversity. Licence changes and reduced abstraction from the environment will have a positive benefit for the biodiversity and the environment.
Benefits (both monetary and	

non-monetary) for customers, Environment, and society (such as public health, well-being, and recreation) and how these are distributed spatially and over time	The plan comes with more cost than the least cost plan, but some of this impact will be mitigated through reduced customer demand. Substantial demand reductions will benefit the local environment for the public.
Natural capital both short and long term risks and benefits, including delivery risk	See Natural Capital report.
The flexibility and adaptability of your options to meet future uncertainties	Plan results in large demand reductions which are considered no regret options. The enhancement of current production sites allows for increased resilience and also the ability to meet peak demands. The adaptive plan allows the plan to adapt as needed depending on which SDB future plays out.
The resilience of your network and supplies	The plan proposes investment at a number of existing abstraction sources and therefore brings resilience benefits for unplanned outages and meeting peak demands. Improved system inter-connectivity as a result of transfers internally and improved connectivity to Bristol Water will also provide an additional resilience benefit to source outages.
The regional and national need and the needs of other sectors	The final plan has been developed with liaison with South West Water/Pennon Group. The plan is aligned Pennon Group regarding additional imports from Bristol Water, the use of Cheddar 2 for South West Water need, and Poole Water recycling scheme. The plan also selects a 17Ml/d option from Mendip quarries under a lower probability, higher need scenario. Further work is required through the gates process to progress these schemes, reduce uncertainty in cost and feasibility, for inclusion as feasible options in WRMP28. The plan solves the supply-demand balance for all our customers, both household and non-household. The needs of other sectors is covered in the regional plan.
The impact of your preferred programme on the affordability of your customers' bills	Overall bill affordability is being tested as part of our wider business plan – results will be published on our customer insight webpage once completed and will form part of our Oct 2023 submission to Ofwat.
Achieving net zero and the climate emergency	The reduction in carbon from the preferred plan will be supported by our Net Zero ambitions. Further information can be found here: Wessex Water routemap to net zero carbon emissions
Ofwat's public value principles (Ofwat's Public Value Principles - Ofwat): further social and environmental value in the course of delivering core services beyond minimum statutory obligations.	The plan considers environmental and social value by delivering a plan which goes beyond the least-cost plan to provide protection for the environment and through delivering a best-value plan that considered objectives beyond least-cost.

8.3.3. Regulatory Environmental Assessments

For security reasons this section has been redacted and edited for the version that is published on our website.

The preferred plan has been subject to environmental assessments including HRA, SEA, WFD and INNS alongside the wider Biodiversity Net Gain and Natural Capital assessments. The details of the performance of the preferred plan in these assessments – which includes all options selected under the Core and Central "Most Likely" Pathways - is contained within the relevant supporting technical appendices and summarised here.

Strategic Environmental Assessment (SEA)

The preferred plan was assessed against the SEA Objectives and summarised with respect to construction and operation.

Construction

The supply side options and demand strategy will involve significant capital expenditure during the construction phase. This is considered to have a significant positive effect on the local economy through job creation and use of local supply chains which could provide the potential for a number of local businesses and SMEs to have sustained involvement and opportunities in construction. In combination, the scale of investment associated with the preferred options would be substantial and in consequence, the Preferred Plan has been assessed as having an overall significant positive effect on the local economy (SEA Objective 8). However, given the potential effects of construction on driver delay and disruption there are likely to be some negative effects from the preferred option programme.

No further significant positive effects from construction have been identified during the assessment of the Preferred Programme of options.

Likely significant negative uncertain effects on biodiversity (SEA Objective 1) were individually assessed for options 70.01 and 70.06 during the construction phase. This reflects that pipeline routes as currently proposed for the two options would lead to direct effects on some Wiltshire SSSI's (70.01) and Ancient Woodland (70.06). However, WWSL has agreed that further works will be undertaken on both options to avoid and mitigate effects at the scheme level which will include detailed routing that avoids effects, preferentially follows existing roads or other appropriate linear infrastructure and through the application construction best practice/mitigation. Taking these measures into account, overall it is not considered that the preferred programme would lead to significant negative effects on biodiversity.

Construction of the preferred programme of options will generate emissions to air (e.g. from vehicle movements and the operation of construction plant and machinery) which could affect local air quality. Effects are likely to be more pronounced at sensitive receptors along transport corridors and/or where development is located within or near Air Quality Management Areas (AQMAs) (although none of the preferred programme of options are situated within an AQMA). Overall, the construction of the preferred programme of options has been assessed as having a likely significant negative effect on air quality (SEA Objective

5) during the construction phase. This largely reflects that both options 70.01 and 70.06 were each individually assessed as having a significant negative effect on this objective, reflecting the large scale of the construction works envisaged for both options.

In total, the construction of the preferred programme of supply side options would require materials with 29,051 tCO2e embodied carbon. Construction would also generate a substantial volume of vehicle movements which, together with the operation of plant and machinery, will additionally contribute to carbon emissions. Additionally, the demand management, leakage and metering options would require significant quantities of materials with a total of 223,540 tCO2e embodied carbon. As such the preferred programme has been assessed as having a significant negative effect on greenhouse gas emissions (SEA Objective 6) during the construction phase. Two options (70.06 and 57.07) were individually assessed as having a significant negative effect on this objective.

Given the cumulative concrete, steel and plastics that would be required to construct the preferred programme of supply options, there is likely to be a significant amount of waste generated (although there is some potential for re-use of materials the presence and extent is uncertain). The preferred demand management, leakage and metering options are also anticipated to involve significant material requirements during their implementation. As such, the preferred programme has been assessed as having a significant negative effect on waste and materials (SEA Objective 11). Three options (70.01, 70.06 and 57.07) were each assessed as individually having a significant negative effect in this regard.

The preferred programme was assessed as having a significant negative effect on the historic environment (SEA Objective 12) during construction. This primarily relates to the effects of two options (70.01 and 70.06), which were individually assessed as having a significant negative effect on this objective as they would include new infrastructure proposals that could directly affect scheduled monuments, listed buildings and registered park and gardens. The proposed options would also be within 1km of a number of other sensitive heritage assets. It is however noted that effects could be avoided, minimised or mitigated through further review of proposed siting and pipeline routes, and for specific options, the proposed route follows the route of a pre-existing pipeline or existing roads and that where assets are crossed, works would take place on previously disturbed ground.

The construction and operation of the preferred programme of options was assessed as having a likely significant negative effect on landscape/townscape (SEA Objective 13). This reflects that a number of options are identified as being located fully or partially within designated landscapes and more generally, the potential for options to lead to negative effects on local landscape/townscape (particularly where they are situated within rural locations) and impact on visual amenity (particularly where they are situated in close proximity to residential receptors). Two options (70.01 and 70.06) were individually assessed as having a significant negative effect on SEA Objective 13 as they would involve significant works within the Cranborne Chase and West Wiltshire Downs AONB (70.06) and the North Wessex Downs AONB (70.01).

No further significant negative effects have been identified during the assessment of the Preferred Programme of options.

Operation

Cumulatively the preferred programme of options would increase the capacity by supply of 26.18 M/d, include a demand management reduction of 96.25 Ml/d, make a significant contribution towards securing a continual supply of clean drinking water and increase resilience of supply, increasing resilience and adaptability to the effects of climate change, supporting population and economic growth and human health and wellbeing. As such, the preferred programme was assessed as having a significant positive effect on climate change resilience (SEA Objective 7), economic and social wellbeing (SEA Objective 8), human health and wellbeing (SEA Objective 9) and water resources (SEA Objective 10). Two options (9.16 and 57.07) were individually assessed as having a significant positive effect against each of these objectives.

During operation, the preferred programme of supply options would, generate an estimated 2,171 tCO2e per annum (for example, associated with electricity required for the pumping and treatment of water) and although this would be offset to an extent by the demand management, leakage and metering options, it is assessed as being above the threshold for a significant effect on greenhouse gas emissions (SEA Objective 6).

A limited number of other preferred options were assessed as having more minor or moderate negative effects on biodiversity during operation. However, through the implementation of biodiversity net gain requirements the operational phase is expected to lead to some positive effects with regard to biodiversity, through for example, the provision of substantial off-site habitats. Overall, this is likely to have a moderate positive effect on this objective.

No further significant positive or negative effects have been identified during the assessment of the Preferred Programme of options.

Reasonable Alternative Plans

Wessex Water has developed different plan options and tested these under different future growth and demand scenarios to address the future predicted supply deficits. On the basis of those supply options most commonly selected if the revised preferred options were not available, an alternative best value programme has been identified comprised of options 30.02, 52.02, and 70.03.

Construction

Options 52.02 and 70.03, individually would require a significant capital investment (>£15m) to complete their construction and as such, were assessed as having a significant positive effect on economic and social well-being (**SEA Objective 8**), due to the potential for the generation of employment opportunities, supply chain benefits and spend by construction workers and contractors in the economy.

Options 52.02, and 70.03 were each assessed as having a significant negative or significant negative uncertain effect on biodiversity (**SEA Objective 1**) during construction as they would involve works that would cross designated sites such as SPA (52.02), SAC(52.02), Ramsar (52.02), SSSI (52.02), LNRs (52.02, 70.03) and Ancient Woodland (70.03) and would involve works in proximity to others. As such construction works could affect these designated features through direct landtake (where sites are crossed by the works), noise and disturbance, although such effects could be reduced through appropriate mitigation and best practice construction measures.

Option 70.03 was assessed as having a significant negative effect on soils, geodiversity and land use (**SEA Objective 2**) during construction, reflecting the significant loss of greenfield land including that which is 'best and most versatile' agricultural land, in addition to crossing nine areas identified as being historic landfill sites, with the potential to expose contaminated material during construction.

Construction of water resources infrastructure generates waste and requires materials/resource with associated embodied carbon, in addition to carbon emissions from construction vehicles and the use of plant and machinery, which also has the potential to affect local air quality. Given the scale of the construction works, options 52.02 and 70.03 were individually assessed as having significant negative effects on air quality (**SEA Objective 5**), greenhouse gas emissions (**SEA Objective 6**) and waste and materials (**SEA Objective 11**).

Option 70.03 was assessed as having a significant negative effect on the historic environment (**SEA Objective 12**) during construction. This reflects that the option would involve works crossing a number of heritage assets/sites (a World Heritage Site, a Scheduled Monument, 13 Listed Buildings, five Conservation Areas and a Registered Battlefield) and in close proximity to others, with the potential for impacts on the integrity (where crossed) and setting of said assets/sites. Additionally, the construction of option was assessed as having a significant negative effect on landscape (**SEA Objective 13**) as it would involve significant works within the Cotswolds AONB, with associated potential for effects on could affect the visual amenity of the designated landscape.

Operation

Options 52.02 and 70.03 were assessed as having significant positive effects against climate change (**SEA Objective 7**), economic and social wellbeing (**SEA Objective 8**), human health (**SEA Objective 9**) and water resources (**SEA Objective 10**) during operation, as the significant yield (water) they would provide would help to ensure a continual supply of clean drinking water, thereby supporting economic/population growth, generating a positive effect on human health and increasing adaptability to the effects of climate change. Overall the Reasonable Alternative Plan would have a significant positive effect on these objectives.

Option 52.02 was assessed as having a significant negative effect on water quality (SEA Objective 3), during the operational phase as the WFD assessment concluded that operation of the options would be WFD non-compliant due to the reduction in flows into Poole Harbour and the introduction of a new discharge on the Stour (Lower) Water Body.

The operational phase of option 70.03 was assessed as having a significant negative effect on greenhouse gas emissions (SEA Objective 6), as the operation of the option would result in significant carbon emissions (>2,000 tonnes CO2e) associated with the energy required for treatment and pumping of water.

SEA Conclusions

Wessex Water's baseline supply-demand balance in the final WRMP24 shows that as a consequence of further regulatory planning requirements, notably changes to licence reductions in 2035 and leakage and efficiency targets, that the deficit is forecast to be over 130 Ml/d by 2079/80 under the dry year critical period scenario.

The forecast deficit will be addressed through the implementation of the supply side, demand management and leakage options that comprise the preferred programme of WRMP24 options. Following the application of the decision-making tools and testing to the 86 feasible options, Wessex Water identified a total of 11 revised preferred options comprising of eight supply options, and three demand management option. Of this total, seven were previously included in the Draft WRMP24.

Overall, the final WRMP24 is considered to have significant positive operational effect against climate change resilience (SEA Objective 7), economic and social wellbeing (SEA Objective 8), human health (SEA Objective 9) and water resources (SEA Objective 10) as the additional design capacity (water) they 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.

All options included in the final WRMP24 are considered to be WFD compliant (both individually and cumulatively).

The HRA has provisionally concluded that options could either be screened out as not having any likely significant effects, or would not have adverse effects on the integrity of European sites following the implementation of established scheme-level mitigation.

Where negative effects have been identified, generally, these are expected to be either minor or moderate only, although uncertainties remain. The exception to this is in respect of air quality (SEA Objective 5), climate change (SEA Objective 6) waste and materials (SEA Objective 11), historic environment (SEA Objective 12) and landscape (SEA Objective 13) where significant negative effects have been identified during construction. With respect to SEA objectives 5, 6 and 11, these effects reflect the emissions to air, energy and resource use associated with the implementation of the water management measures which is to a large extent unavoidable (although effects may be reduced at the project stage through, for example, the use of renewable energy and sustainably sourced construction materials). With respect to the historic environment (SEA Objective 12) further work is required on pipeline routes to avoid designated sites. With respect to landscape (SEA Objective 13), further work is required to ensure the sympathetic and planning policy compliant design and screening of new above ground infrastructure when sited in AONBs.

Detailed mitigation and enhancement measures have been identified to help avoid, minimise, reduce or mitigate effects where identified.

When compared to the assessment of effects the reasonable alternative plan, Wessex Water's final WRMP24 performs better against the SEA objectives than the reasonable alternative options, and does not have a WFD non-compliance risk. Overall, it is considered to provide additional resilience to respond to a greater range of future scenarios and best able to support future population, household and economic growth within the Wessex Water region.

Habitats Regulations Assessment (HRA)

Appropriate assessments were undertaken for those European sites that may be significantly affected by WRMP options (or where there was uncertainty at the screening stage), alone or in combination.

For demand side measures, the only realistic mechanism for a negative effect would be through any construction required, but this cannot be meaningfully assessed at the strategic level since information on location specific intervention (leaks, households requesting meters) is not available without specific investigations. These measures are therefore “screened in”, with assessment necessarily deferred to the project level.

For the supply options, it can be concluded that there will be no adverse effects on any European sites as a result of the WRMP options, with the implementation of established scheme-level mitigation.

Therefore, it can be concluded that the final WRMP24 will have no adverse effects on any European sites, alone or in combination.

Water Framework Directive Assessment (WFD)

Of the 11 options outlined in the preferred programme, 10 were screened out during the Level 1 assessment and have thus not been considered further.

The one option under the preferred programme taken through to Level 2 assessment is provided further attention below:

- Underutilised licence due to water quality: North Warminster (39_02)

The current licence has been underutilised in recent years due to water quality issues and the option does not seek to change the licence. In this respect, it is considered a relatively low risk option. However, contemporary modelling of expected impact on groundwater and linked surface waters based on recent actual data would be recommended as a precautionary approach, to ensure no WFD deterioration is anticipated.

Invasive and Non-Native Species (INNS)

Of the 11 options outlined in the preferred programme, all were screened out during the INNS assessment initial screening as presenting no INNS risk.

8.3.4. Drinking Water Protected Areas

The regulatory guidelines states:

‘You must ensure that your plan takes account of: Section 68 of the Act, the duty to supply wholesome water. [footnote17] This section states: “It shall be the duty of a water undertaker…so far as reasonably practicable, to ensure, in relation to each source or combination of sources from which water is so supplied, that there is, in general, no deterioration in the quality of the water which is supplied from time to time from that source or combination of sources”. This primary duty may have implications for how you develop your plans, especially in relation to resilience and contingency planning’

In the short term the supply demand balance is met via leakage, demand reductions and increasing production output from existing sites and therefore it is considered no risk to meeting the objectives of the Drinking Water Safety Plan (DWSP) objectives. Section 7 of the Supply forecast details our business as usually approach to maintaining water quality. Further details can also be found in Section 8.2 of the main plan document, and also in our upcoming business plan.

8.3.5. Meeting Regulatory demand expectations and targets

There are several regulatory targets for demand management which have been set out under the Environment Act 2021 to reduce the use of public water supply in England per head of population by 20% by 2038 from the 2019/20 reporting year figures[26]. To achieve this, the target trajectory in Table 8-7 has been outlined. These are part of the trajectory to achieving 110 PCC, 50% leakage reduction and 15% non-household consumption by 2050, forecasts use the normal year planning scenario.

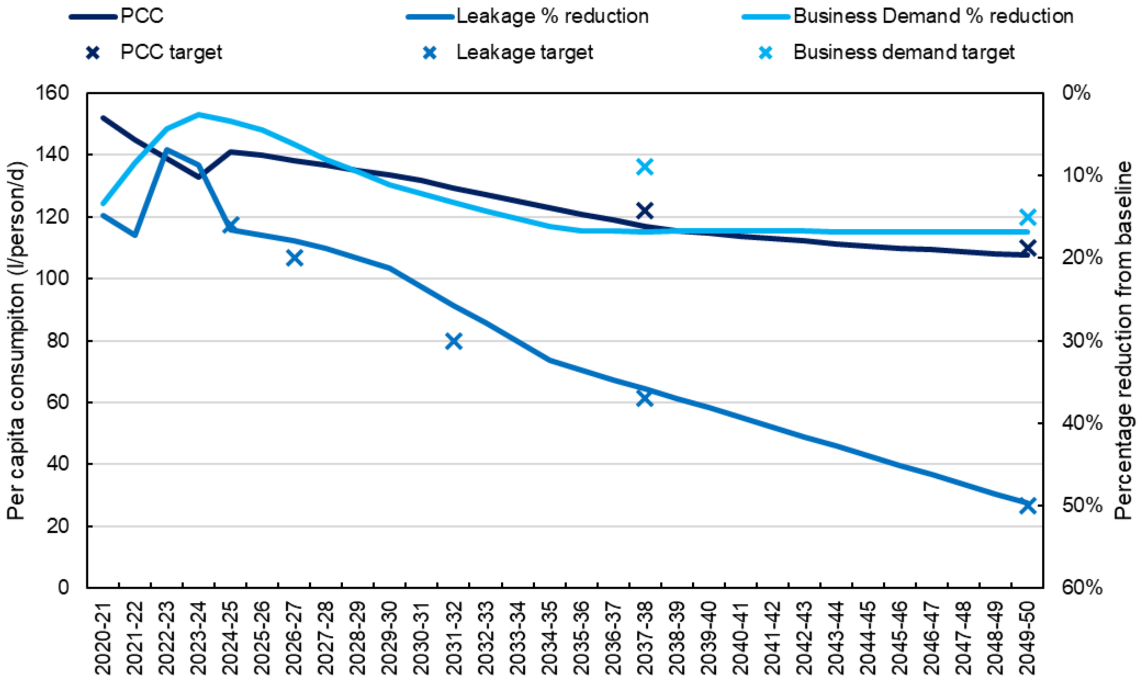
Table 8-7: Target trajectory to meet a 20% reduction in Distribution Input (DI) per head by 2038, and the targets to be met in 2050.

Target	Units	2024-25	2026-27	2031-32	2037-38	2049-50
DI per head	% reduction	-	9%	14%	20%	-
Leakage	% reduction	16%	20%	30%	37%	50%
PCC	l/person/d	-	-	-	122	110
Business Demand	% reduction	-	-	-	9%	15%

To achieve the water demand target, our preferred demand management strategy will reduce leakage, per capita consumption (PCC) and non-household consumption (business demand) in line or in excess of the statutory trajectory. The forecasted in year PCC figures and percentage reduction in leakage and business demand in the preferred plan are outlined in Figure 8-2. It should be noted that the PCC target is reflective of actual in year positions whereas leakage and business demand are percentage reduction targets from different baselines. The leakage baseline is the 2017-18 reported figure of 76.5 Ml/d; the business demand baseline is the three-year average reported in 2019-20, 81.6 Ml/d.

[26] Water targets Detailed Evidence report.pdf (defra.gov.uk); Environmental Improvement Plan (publishing.service.gov.uk); Plan for Water: our integrated plan for delivering clean and plentiful water - GOV.UK (www.gov.uk)

Figure 8-2: Reduction in PCC, leakage, and business demand against the government trajectory targets.



Each of these measures have their own performance commitment which will be reported annually and will ensure that we are on track to achieving overall reduction in distribution input per capita (Figure 8-3). The performance commitments are a measure of the percentage reduction of the three-year average from the 2019-20 baseline, current performance and forecasts up to the end of AMP9 are outlined in Table 8-8.

Figure 8-3: Distribution per capita in year forecast in the normal year planning scenario, and its percentage reduction from the 2019-20 baseline against the target trajectory.

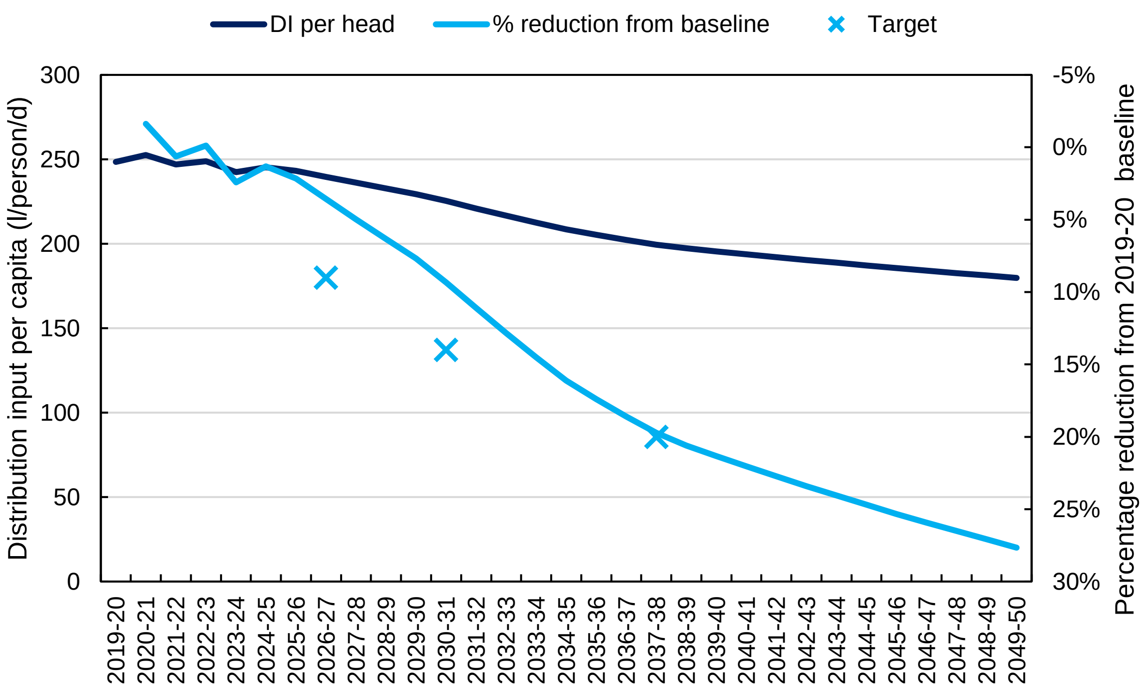


Table 8-8: Reported and forecasted values for the PCC, Leakage, and Business Demand performance commitments in AMP7 and AMP8.

		AMP7					AMP8				
		2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
PCC (l/person/d)	In year	151.8	144.9	138.8	132.9	140.8	140.0	138.2	136.6	135.1	133.6
	3-year average	143.1	145.0	145.2	138.9	137.5	137.9	139.7	138.3	136.7	135.1
	%reduction from baseline	-3.8%	-5.2%	-5.3%	-0.7%	0.2%	-0.1%	-1.3%	-0.3%	0.9%	2.0%
Leakage (Ml/d)	In year	65.1	63.3	71.2	69.8	63.8	63.3	62.8	62.0	61.2	60.3
	3-year average	69.5	65.4	66.5	68.1	68.3	65.6	63.3	62.7	62.0	61.2
	%reduction from baseline	5.2%	10.8%	9.3%	7.1%	6.9%	10.5%	13.7%	14.5%	15.4%	16.6%
Business Demand (Ml/d)	In year	70.6	74.6	78.0	79.4	78.8	77.9	76.5	75.0	73.8	72.5
	3-year average	77.8	74.8	74.4	77.3	78.7	78.7	77.7	76.5	75.1	73.8
	%reduction from baseline	4.6%	8.3%	8.8%	5.2%	3.5%	3.5%	4.7%	6.3%	8.0%	9.6%

So far in AMP7, the three-year average PCC has been increasing from the baseline which is attributed to the impacts on household water use in 2020-21 and 2021-22 from the Covid-19 pandemic. The 2022-23 in year PCC saw a reduction from the previous year and has returned to a level comparable to those seen in AMP6. Although working patterns have changed since before the pandemic, with more people now working from home for at least part of the week, the overall number of home-workers has declined since the height of the pandemic in 2020/21. In addition, the cost-of-living crisis and particularly increasing energy bills since September 2022 has resulted in customers making behavioural changes to reduce their use of water and especially hot water. We expect to see the three-year average PCC reducing from the 2019-20 baseline from 2027-28, yet in the in year values are on a reducing trajectory to meet to the 122 l/person/d target in 2038.

The three-year average leakage has decreased from the baseline through AMP7, ending 2022-23 with a 9.3% reduction. The 2022-23 in-year leakage increased for the first time following a steady decline from 2017-18 due to a major summer breakout due to ground shrinkage caused by the long hot summer, and further break out in December and January due to sever cold weather events. However, leakage is set to continue decreasing again from 2023-24 onwards to meet the 2038 and 2050 statutory reduction targets.

For Business Demand so far in AMP7, the three-year average has declined but in year values in 2021-22 and 2022-23 have increased since 2020-21. This can be attributed to a significant reduction in 2020-21 as a result of the Covid-19 pandemic, and the steady increase over the last two years reflects the return of workers and customers to businesses.

Demand rose in 2023-24 and is forecasted to stay at a similar higher level before reducing to levels similar to those seen before the pandemic, with reductions driven by our demand management strategy.

8.3.6. Carbon of preferred plan

The total carbon emissions of the preferred plan have been calculated based on the embodied operational carbon and annual operational carbon based on average utilisation. This is summarised in Table 8-9. Data was generated as per Table 4 planning tables.

Table 8-9: Total carbon emissions of preferred plan

For security reasons this table has been redacted and edited for the version that is published on our website.

Option ID	Option Name	Embodied carbon (tCO2 equivalent)	Average operational carbon (tCO2 equivalent)	First year of option use in preferred programme (year)	Operational carbon over plan	Total carbon (tCO2 equivalent)
9.16	Temporary use bans	NA	NA	2025-26	NA	NA
9.19	Reduced levels of service, moving to 1:500 to 1:200	NA	NA	2025-26	NA	NA
22.04	Weymouth Source improvements	359	61	2063-64	667	1329
39.01	Underutilised licence: North Bath	358	0	2063-64	0	358
39.02	Underutilised licence North Warminster	111	77	2035-36	3022	3521
41.01	Drought Permit - Stour catchment	0	0	2025-26	0	0
41.06	Drought Permit - Bride catchment	0	0	2025-26	0	0
57.07	Demand Strategy 7	223540	-79	2025-26	-3875	219270
59.01	Upper Stour Stream Support	52812	16	2030-31	716	53609
70.01	Bristol Import and onwards transfer I	6544	178	2035-36	6952	14388
70.06	Increased Reservoir Capacity and East Transfer	21626	1839	2035-36	71716	102536

9. Plan Testing

Timing of achieving 1 in 500 drought resilience

Achieving 1 in 500 drought resilience by 2039-40 is achieved across our plan pathways. The move to 1 in 500 drought resilience from a 1 in 200 resilience impacts on the supply demand balance by reducing available supplies by 4.03Ml/d during the annual average and 6.51Ml/d during the critical period. As a result, this is not one of the main drivers of the investment programme of the plan when compared to the main driver which is licence reductions. These reductions are of an order of magnitude greater than a move to 1 in 500 resilience, requiring 54Ml/d of reductions under the DYAA scenario, and 71Ml/d under the DYCP scenario, which occur earlier than a potential move to 1 in 500. In addition, the Defra DI target to achieve by 2037/38 also comes earlier, so there are other factors more significantly driving our near-term investment programme.

Delaying achieving 1 in 500 resilience to 2049-50 changes the preferred plan in one option - by bringing forwards investment in option 22.04 Weymouth source improvements from 2054 under the preferred "most likely" plan to 2033. The option is already being taken forwards for enabling works in AMP8 given its selection earlier under alternative pathways.

Alternative licence change reduction scenarios

In our main plan, we have scheduled the majority of licence reductions to 2035 because of regulatory requirements to achieve licence reductions in line with WFD and HRA regulations, and explored sensitivity to the magnitude of uncertainty in these reductions due to uncertainties in the outcomes of WINEP investigations in the next AMP period. Alternative scenarios of licence reductions are presented in Section 4.2. of the Supply forecast technical appendix.

Here, we consider the impact on our preferred "most likely" plan of postponing non-Hampshire Avon licence reductions (e.g. those driven by WFD as opposed to HRA requirements) to 2042, the earliest time at which alternative supply side schemes from Mendips will be available. When still selecting Demand Strategy 7 to meet regulatory demand targets, the same options are selected as in the preferred "most likely" plan.

Ofwat core pathways

To develop our long-term delivery strategy for the business plan, Ofwat require than the whole of the enhancement strategy under the adaptive plan is tested against eight common reference scenarios, which are set out two parameters of four material drivers of uncertainty around future enhancement spending (Figure 9-1). The two parameters for each pathway represent benign and adverse potential futures in terms of impact on the supply demand balance (and options selection) for four future drivers of enhancement spending. In addition, the plan should be tested against a wider set of scenarios, provided that these represent plausible alternative scenarios.

Figure 9-1 Ofwat common reference scenarios[27]

	Climate change	Technology	Demand	Abstraction reductions	Wider scenarios
'Adverse' scenarios	**High:** RCP8.5	**Slower:** slower development than expected	**High:** higher growth forecasts	**High:** 'Enhanced' scenario (in England)	Material **local or company-specific factors**, as appropriate
'Benign' scenarios	**Low:** RCP2.6	**Faster:** faster development than expected	**Low:** lower growth forecasts and legislation on building regulations and product standards	**Low:** Current legal requirements (in England and Wales)	Parameters **between the reference scenarios**, e.g. a 'medium' scenario, as appropriate

The factors that we have considered in our supply demand balance scenario testing were chosen to cover the impacts on the supply demand balance of the alternative benign and adverse scenarios for each of the future drivers, as summarised in Table 9-1.

Table 9-1 Mapping between WRMP scenarios and Ofwat common reference scenarios

Scenario	WRMP inclusion
Climate Change - Benign Low RCP2.6	Benign and adverse scenarios included in our SDB uncertainty factors as the **low** and **central** scenarios, with the high represented by the regional/global climate models. **Adverse scenario** already represented in the **central SDB scenario** and therefore the most likely "preferred" pathway.
Climate Change - Adverse RCP8.5	
Demand - Benign lower growth forecast	The benign ONS population and household projections is used as our **central SDB scenario**, and the adverse local authority forecast is used as our **high** scenario. Water labelling benefits with minimum standards are included in all demand management strategies, including the preferred strategy 7.
Demand - Adverse Higher growth forecast	
Abstraction Reductions Benign – Current legal requirements	Ofwat scenarios only cover policy uncertainty in future licence reductions, not the epistemic uncertainty in reductions required to meet licence changes that need to be resolved through WINEP investigations. These latter uncertainties are also accounted for in the WRMP scenarios that were developed beyond those provided in the national framework using latest WRGIS data and in liaison with local EA (see supply forecast technical appendix, Section 3). Therefore additional local and
Abstraction Reduction Adverse – Enhanced scenario	

[27] PR24-and-beyond-Final-guidance-on-long-term-delivery-strategies_Pr24.pdf (ofwat.gov.uk)

	regional analysis has been used to validate and build the scenarios. Given the majority of our sources are facing investigations to meet current legal requirements, our **central SDB scenario** represents the benign scenario, and our high SDB scenario represents the **adverse scenario.**
Technology Benign – Faster development	Alternative demand management strategies include different rates of smart meter roll out. Demand strategy 7 includes full smart meter roll out (all customers billed) by 2040 representing the adverse scenario. Demand strategy 1 included full smart meter roll out by 2030 – therefore meeting the 2035 requirement of the benign scenario
Technology Adverse – Slower development	

Climate change – Our preferred plan uses the adverse climate change scenario, which is used under our central SDB – we also used as our high scenario an average of the regional and global models to ensure our plan samples the full range of climate products available, noting that the probabilistic climate change products are relatively benign compared to the other scenarios. to use the lower climate change scenario compared to that used in our preferred plan (moving from adverse to benign) would reduce our SDB deficit in 2035 – the main driver of near-term investment – by less than 0.5Ml/d compared to DYAA and DYCP deficits, respectively in 2035-36 of 50Ml/d and 82Ml/d, so at most 1%. Our adaptive plan is therefore insensitive to the choice of benign and adverse scenario, given that near term AMP8 investment is being driven by licence changes and not climate change.

Technology - The main amount of licence reductions that is being made is in 2035 to meet the significant change in water available for use. The majority of the smart meter roll out under our preferred programme strategy 7, which will deliver full smart metering by 2040 (adverse scenario), occurs prior to 2035, with customers not compulsorily billed, but moved over to smart metering through change of occupier, where we will also see the benefit of smart metering on plumbing and supply pipe losses for all metered customers prior to 2035. To test our preferred "most likely" plan against the benign scenario would be to move more smart metering into AMP8, but would not change our overall plan given the need to meet licence changes in 2035, given the activity we are already undertaking under the preferred plan.

Demand - Our central "preferred" pathway already uses the benign demand scenario, as the ONS population and property projection is more consistent with our historical trajectories of demand growth. Our high SDB scenario, on which Alternative Programme 2 and 3 are optimised to meet, uses the local authority adverse scenario, alongside other "adverse" factors. If we isolate this single factor "adverse" demand scenario, and assess how this changes the investment in our preferred "most likely" plan, then this would increase NPV by £56m, and leads to the selection of supply side schemes already selected under the High need scenario programmes AP2 and AP3 (52.12, 38.12, 38.11, 34.10) and not earlier than their selection under those pathways. The adaptive plan therefore can adapt to meet the needs of the adverse scenario alone.

Abstraction Reductions – the overarching main driver of need in our plan – particularly in the near term – is the scale of licence reductions that need to be made to meet future demand. The long-term delivery strategy guidance requires using an adverse scenario equivalent to the EA's enhanced scenario from environmental destination, and a benign scenario using current known legal requirements. The guidance also states that additional local and regional analysis can be used to validate and build the scenarios.

As we have explained in the Supply Forecast technical appendix Section 3, the majority of our licence changes are not driven by future environmental needs either under climate change (environmental destination) or by future changes, but to meet current needs, as determined through current WFD needs and Habitats regulations needs, most notably in the Hampshire Avon – and as reflected in the request in the statements of response to the draft plan for Wessex Water to ensure existing abstractions do not increase above recent actual abstraction, prior to licence reductions, to avoid the imposition of water neutrality. This is reflected in the timing of those licence changes, which are occurring primarily in 2035, and also shown in Table 3-4 of the supply forecast technical appendix, the majority of sources have, alongside ED investigations in AMP8 for all sources, AMP8 regular or no-deterioration investigations as driven by WRMP or HRA driven investigations relation to rCSMG criteria.

The long-term delivery strategy guidance acknowledges that future abstraction required to protect the environment is uncertain, and acknowledges this is due to climate change and demand impact on the environment as well as future policy changes. Whilst the need to refine information is acknowledged, it does not, however, acknowledge the significant epistemic uncertainties that exist today in how much licence reduction is needed to protect the environment, than can only be reduced through detailed WINEP investigations that can take understanding beyond the relatively high level assessments of need undertaken in WRGIS, and therefore those included in the national framework that form the basis for the assessments of future need. These investigations are required so that there is evidence of the impact of licenced abstraction on both the flow regime (using more refined hydrological and hydrogeological models) and on the ecology – so that the relationship between ecological health and river flows is established in the river reaches in question. Our WRMP scenarios for licence changes have also accounted for this uncertainty in our scenarios when developing the low, central and high scenarios.

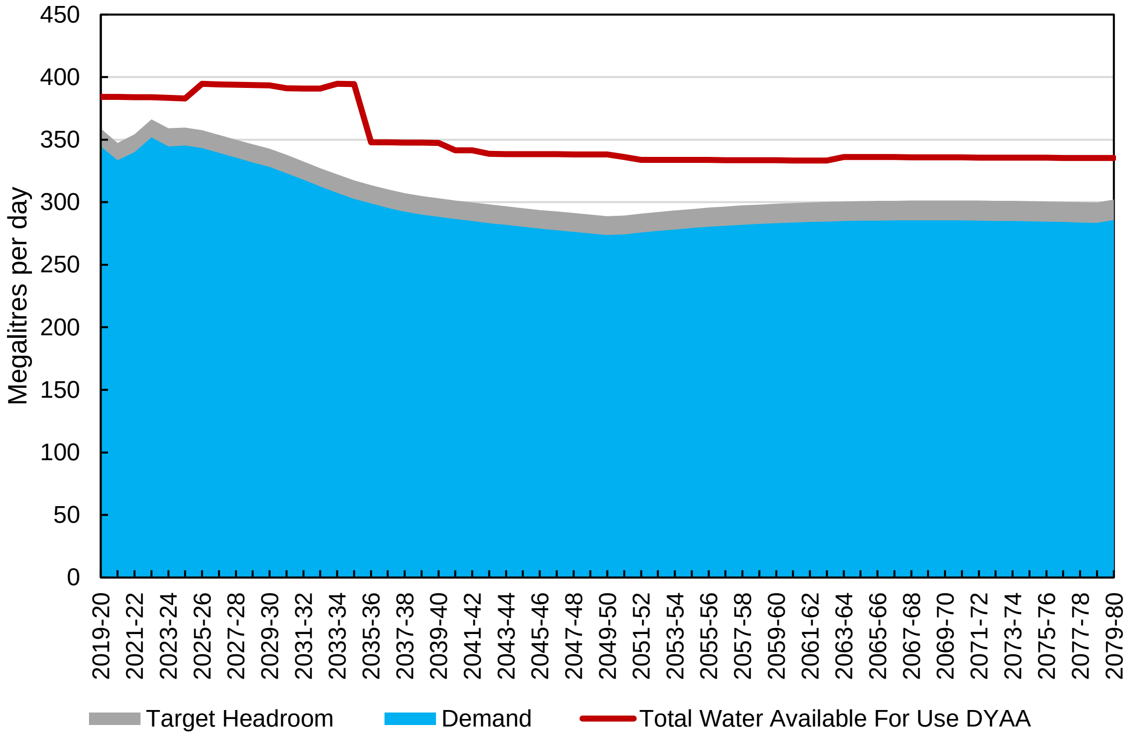
Based on the above, and given the significant need driven by short term needs by 2035, consistent with current legal requirements, our central planning scenario, and the scenario used to develop our preferred "most likely" pathway, is consistent with the benign abstraction scenario, and our high need scenario is consistent with the adverse abstraction scenario.

We have assessed the impact of the adverse scenario as part of our higher need scenario that represents a plausible high need scenario, for which adaptive programmes AP2 and AP3 meet the need. If we isolate this single factor "adverse" abstraction reduction scenario, and assess how this changes the investment in our preferred "most likely" plan (e.g. the difference between benign and adverse), then this would increase NPV by £193m, and leads to the selection of supply side schemes already selected under the high need scenario programmes AP2 and AP3 (52.02, 38.01, 38.11, 21.12 and 70.03) and not earlier than their selection under those pathways. The adaptive plan therefore can adapt to meet the needs of the adverse abstraction scenario alone.

10. Final Supply-Demand Balance

Figure 10-1 and Figure 10-2 show the final supply-demand balance difference between supply and demand in each scenario, and Figure 10-3 shows the residual balance between supply and demand + target headroom[28]. The benefit of demand side reductions gradually reduces demand in both scenarios from 2025-26 to 2050, which alongside additional supply side measures to 2035-36, allow the supply demand balance to me bet in 2035-36 from when the main licence reductions start.

Figure 10-1: Final Plan Supply Demand Balance in the DYAA



[28] Please note: in the charts prior to 2025-26, no benefits of hosepipe bans, drought permit options or 1 in 200 levels of service are shown, although they are applicable to the plan supply-demand balance prior to 2025-26 and mean the plan is in surplus throughout the planning period.

Figure 10-2: Final Plan Supply Demand Balance in the DYCP

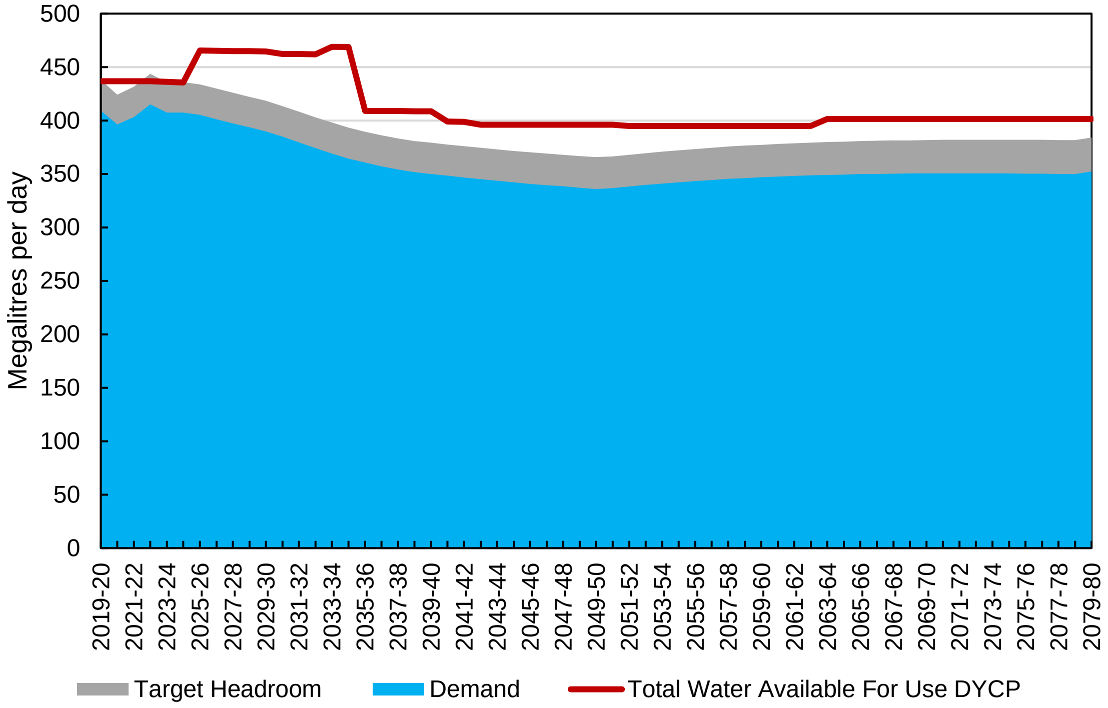
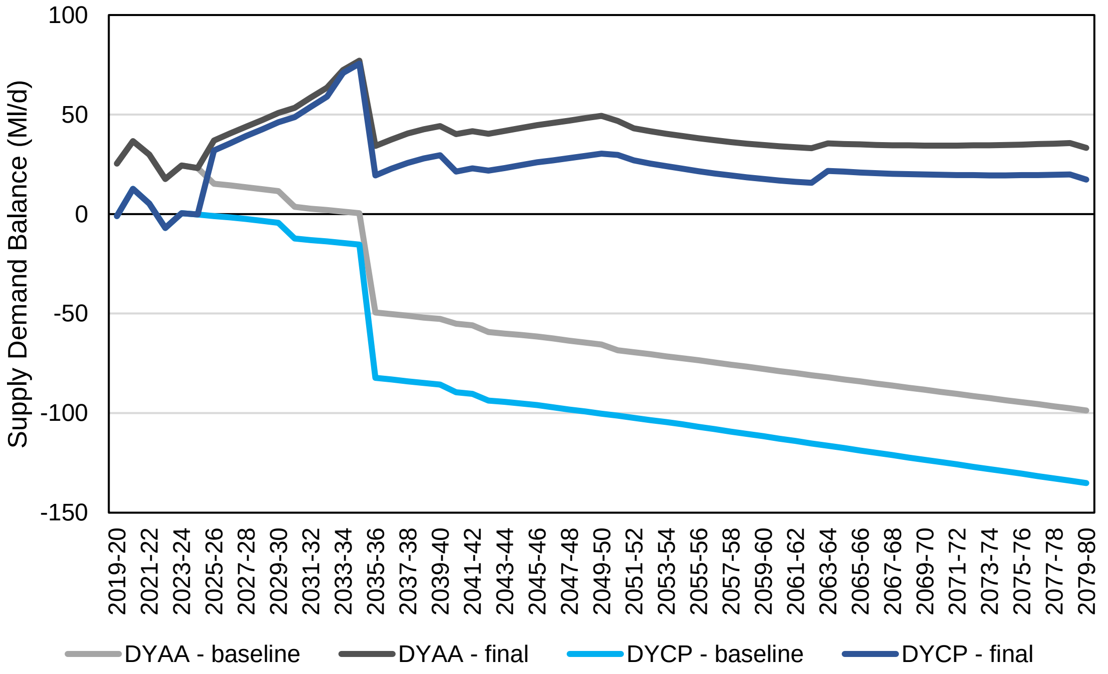


Figure 10-3: Baseline and Final SDB for the DYAA and DYCP



11. Calculation of plan levels of service

Defra direction 37A(3)(d) requires a water undertaken to include in its WRMP a description of the assumptions made to determine the estimates of risks under sub-paragraph (b), including but not limited to drought severity, in relation to temporary use restrictions, drought orders and emergency drought orders.

The levels of service for temporary use bans, drought permits/orders, non-essential use bans and emergency drought orders are stated in Table 2f: WC Levels of Service – Final Planning, as shown here.

Table 11-1: Overall planned levels of service

Plan Restriction	Likelihood	Average Annual Risk (%)
Temporary Use Bans	1 in 30	3.3%
Drought Permits/Orders	1 in 75	1.3%
Non-Essential Use Bans	1 in 100	1%
Emergency Drought Orders	1 in 200 (up to 2039-40) 1 in 500 (from 2040-41)	0.5% 0.2%

The methodology and assumptions in estimating the frequency of implementation of hosepipe bans, drought orders and non-essential use bans, is based on the drought event testing undertaken as part of the development of the company Drought Plan[29] to develop drought trigger curves, and additional modelling work undertaken as part of the WRMP process.

We ran the groundwater model, our main control trigger from the drought plan for the stochastic record to derive a ~20,000 year time-series of groundwater levels, the derivation of which is explained in the Supply Forecast Technical Appendix (See Sections 2.5 and 2.8 in particular). This is the same approach that was used to calculate the critical period deployable output return period, the main driver of our supply-demand deficit. Each stochastic replicate was compared to the drought curves to identify the frequency at which each of the curves was crossed over the whole stochastic record. This frequency was then used to inform the likelihood of implementing each of the restrictions shown in Table 11-3.

As per our Drought Plan, once each drought trigger level is reached, this does not automatically trigger the implementation of a plan restrictions associated with that level – rather, it triggers additional activities to assess whether the implementation is required. This decision depends not only on the state of our supply system – as indicated by the drought triggers themselves – but also the wider situation in the regional and nation both for other neighbouring companies, and also in the environment. Therefore, the trigger frequencies identify the earliest potential implementation. The frequencies shown in Table 11-3 reflect this consideration, and also the previously stated levels of service in our Drought Plan published in 2022.

[29] Drought Plan (wessexwater.co.uk)

The drought triggers for emergency drought orders is the only level of service that varies over time, and is dependent on the transition from 1 in 200 to 1 in 500 levels of service from 2040, as determined by our final plan.

Key assumptions:

- As with the overall Deployable Output Methodology, we have assumed that the stochastic dataset is an appropriate dataset for identifying return-periods in our supply system using a frequency-based approach, and therefore that the whole stochastic record can be treated as a single time-series.
- Given the relatively minor impact of climate change on our deployable output assessment, we have not included and assessment of the time-varying nature of climate change impact on changing levels of service over time.
- We have assumed that levels of service are constant over time for temporary use bans, drought permit orders and non- essential use bans.
- For the frequency assessment we are assuming the groundwater level trigger is a reasonable proxy also of our reservoir storage level in assessing overall return periods, an additional main trigger in our drought plan. Given the nature of demand-side reductions in our plan, the spatial location of licence changes in the groundwater dominated parts of our system, and that the western part of our supply area where our reservoir storage/trigger is located is not driving the initial supply-demand balance deficit, it is groundwater related drought issues that would drive the triggering of different restrictions.