# TMS27 Enhancement Case: WRMP Supply Options

# 1 Summary

This enhancement case (EC) sets out the need for AMP8 investment in supply side options to enhance our supply demand balance and ensure there is a robust supply of water for our customers. The proposed investment in supply options will enable us to provide a higher standard of drought resilience to our customers and will protect the environment by reducing our abstraction in vulnerable catchments. This document outlines the need for this investment, how this need has been assessed and quantified, customer preferences and the wide range of options we have considered before deciding our preferred plan.

The information presented in this Enhancement Case (EC) is a high-level summary of the outputs from the statutory process that governs Water Resource Planning. Namely, the development of our Water Resource Management Plan (WRMP) and the WRSE Regional Plan - both of which are published and have been through consultation with our regulators, stakeholders, and customers. These plans are developed in accordance with the legal requirements and regulatory guidelines, including the Water Resources Planning Guideline (WRPG)[1].

Most of the options included in our AMP8 investment plan are sufficiently large to be part of RAPID's[2] gated process for developing new Strategic Resource Options (SRO). This process was established at PR19 to simplify regulation and accelerate the development of new water infrastructure. RAPID is comprised of representatives from Ofwat, the Environment Agency and the Drinking Water Inspectorate. Companies have been given ring-fenced funding to investigate and develop options through the SRO process and a gated process has been designed to ensure the funds are spent on time and to quality standards. Our SRO's schemes have successfully passed through Stage Gate 2 and rated as good by Ofwat[3].

This EC needs to be read in conjunction the following documents:

Our revised draft Water Resource Management Plan (WRMP):

- Section 6 which explains how we have allowed for risk and uncertainty and determined our baseline supply demand balance.
- Section 7 which explains in detail the process that we have undertaken for identifying, screening, and developing supply-side options
- Section 10 which explains our approach to programme appraisal and scenario testing
- Section 11which sets out the process of deriving our overall best value plan
- Annex P which presents the list of all options we have considered

[1] Environment Agency, Ofwat and Natural Resources Wales, Water Resources Planning Guideline: July 2022 and updated March 2023

[2] Regulators' Alliance for Progressing Infrastructure Development (RAPID). The gated process relates to the funding of investigations and development of water resource solutions from April 2020 until March 2024

[3] www.ofwat.gov.uk/publication/letter-to-thames-water-on-final-decisions-for-gate-two/"

- Annex Q which presents the scheme rejection register
- Annex R scheme dossiers for the feasible list of options as well as option feasibility reports

Water Resources Southeast revised draft Regional Plan

RAPID Strategic Resource Option Stage Gate 2 reports

TMS28 Enhancement Case: WRMP Demand Reduction

## 2 Description of the proposed enhancement

Through our Water Resource Management Plan (WRMP24) and working with Water Resources Southeast (WRSE) to develop the Regional Plan, we have identified preferred new water supply options for our Region. These options include building a new storage reservoir in the Upper Thames catchment, southwest of Abingdon in Oxfordshire (called southeast strategic reservoir or SESRO), and a new abstraction sited on the River Thames close to Teddington weir (called Teddington Direct River abstraction or Teddington DRA).

New supply options take many years to develop and span several investment cycles. The work we are planning to deliver in AMP8 to develop these options includes progressing the design, planning, and permitting and land acquisition. Teddington DRA will be completed during AMP9 circa 2033 whilst SESRO will be completed circa 2040.

There is a risk that these options may not receive the planning consents required for them to progress to construction. There are also inherent uncertainties in our supply and demand forecasts that may require us to adapt our plans at a future point and switch to a different supply option. It is therefore important that we continue to develop other supply options as an alternative to our preferred options so that these are viable should they be required. Therefore, our plan also includes investment to progress the development of the Severn Thames Transfer (STT) as an alternative option to SESRO and Beckton water recycling scheme as an alternative option to Teddington DRA.

We have two much smaller supply schemes in our AMP8 enhancement programme: a raw water transfer from the Didcot power station via a water purchase agreement with RWE, and new groundwater supply at Addington. Both schemes will be fully delivered during AMP8.

It is important to note that whilst we are not planning to bring any major new water resource schemes into supply during AMP8, significant benefits to our supply demand balance will be delivered via our ambitious demand reduction programme which includes both leakage reduction and measures to help our household and non-household customers to reduce their water use. There is a separate Enhancement Case for our WRMP demand reduction programme.

The root causes of the need for investment in water resources are exogenous. Activities included within base expenditure, such as maintaining our existing assets, are incorporated into our supply forecast, and so the additional investment required to meet these drivers sits outside our base expenditure allocation. If we were not to make enhancement investments, then our customers would face an unacceptably high level of drought risk and the environment may suffer.

Our £411M AMP8 enhancement programme for water resources supply options is summarised in Table 1: AMP8 Investment plan summary WRMP supply side options, this table includes our preferred options and the alternative options.

*Table 1: AMP8 Investment plan summary WRMP supply side options*

| Option | Benefit (Ml/d) | Year delivered | Lead time | Cost £million AMP8 [pre FSE][4] | Preferred option | Strategic Resource Option | Suitable for DPC | AMP 8 investment summary |
|---|---|---|---|---|---|---|---|---|
| Teddington direct river abstraction (DRA) 75 Ml/d | 67 | 2033 | 6-8 years | 118.6 | Y | Y | N | Obtaining consent for and constructing the Teddington DRA scheme |
| Southeast Strategic Reservoir Option (SESRO), 150Mm$^3$ | 271 | 2040 | 15 years | 164.5 | Y | Y | Y (SIPR) | Obtaining consent for the scheme, acquiring land, and undertaking procurement exercises. |
| Continuing the development of Severn Thames Transfer (STT) | N/A | N/A | Ongoing | 10.6 | N (SESRO alternative) | Y | Y | Continue investigations to ensure that we would be able to quickly move to consenting the Severn Thames Transfer, should this be necessary. |
| Continuing the development of Beckton Water Recycling schemes | N/A | N/A | Ongoing | 58.3 | N (Teddington alternative) | Y | Y | Continue investigations to ensure that we would be able to quickly move to consenting a Water Recycling scheme, should this be necessary. |
| Lower River Thames to West London Reservoirs | TBC | Mid 2030s | TBC | 36.7 | Y | TBC | Y | Continue investigations and develop solutions |
| Agreement with RWE, Didcot Power Station | 23 | 2026 | 0 years | 21.8 | Y | N | N | This investment is to enable this agreement. |
| Addington groundwater | 3 ave, 6 peak | 2028 | 3 years | | Y | N | N | This investment is to deliver this entire scheme. |

[4] The costs for developing SESRO and STT are shared between water companies as explained in Section 6.1; the cost shown in this table is Thames Water's share of the total cost.

# 3 Need for enhancement

## 3.1 Ambition: where we want/need to get to

The investment identified through our WRMP will deliver significant benefit to our customers and enable us to provide improved protection against drought events, in the face of climate change and population growth. Specifically, our customers will benefit from:

- 50% reduction in drought risk by the early 2030s, compared to current level of resilience, with emergency drought restrictions not being required more often than once every 200 years.
- 80% reduction in drought risk by 2040, compared to current level of resilience, with emergency drought restrictions not being required more often than once every 500 years.

We have considered government's policy expectations[5] in developing the plan. A central policy objective for this round of plans is the need to contribute to a protected and enhanced environment. This has been translated into:

- Setting an environmental destination which describes how we aim to achieve and maintain sustainable abstraction to 2050 and beyond.
- Consideration of the environment and society in decision making.

In addition to improved resilience, the investment means that we would be able to improve our customer levels of service for hosepipe bans (known officially as Temporary Use Bans) and non-essential use bans. Our current levels of service are that we will not impose hosepipe bans on our customers more than one every 10 years, and we won't impose non-essential use bans more than one every 20 years (Drought Direction 2011, DD11 measures).

In developing our WRMP, we have worked with the Environment Agency, Natural England and other organisations to develop scenarios that reduce the amount of water we take from the environment. These scenarios take account of the commitment we have already made and are based on learnings from previous investigations of the effect of climate changes on sources.

## 3.2 Investment driver: why we need to act

We have a duty, as set out in Sections 37A-37D of the Water Industry Act 1991[6], to prepare and maintain a Water Resources Management Plan (WRMP). Our current plan, WRMP19, was approved for publication by the Secretary of State for the Environment, Food and Rural Affairs in March 2020. We must update our WRMP every five years to ensure that it remains up to date and that it meets the needs of any new policies set by the government, and as we have published our new Water Resources Management Plan WRMP24. Our WRMP sets out how we intend to achieve a secure supply of water, ensuring that this supply is robust to severe drought events, and how we intend to ensure that we protect and enhance the environment.

We supply around 2.6 billion litres of water per day, providing water for over 200,000 businesses and 3.8 million homes across London and the Thames Valley. Running out of water would cost

[5] Defra, Government expectations for water resource planning, May 2022

[6] UK Government, 1991, Water Industry Act 1991, https://www.legislation.gov.uk/ukpga/1991/56/contents

London's economy alone around £500m per day, and so it's imperative that we safeguard future supplies. The water resources that we rely on are under pressure, and we need to plan to manage a growing population, changing climate and increasing drought risk, as well as making sure we can protect our environment. Population is projected to grow by more than two million people to 11.8 million by 2045 and increasing water availability uncertainty due to a changing climate, means that projected demand will exceed our water supply capability giving a total demand deficit of 326 Ml/d (London) by 2045.

Our WRMP sets out a long-term strategy to meet our region's supply-demand deficit, with pressures from climate change, population growth, a requirement for reducing abstraction and a need to improve resilience. Our future security of supply is reliant on a twin-track approach of new water resources and reducing demand. In the short term, we will focus on reducing leakage and helping our customers to reduce their demand for water, but we will also need to invest in new sources of water to ensure security of supply for the long-term.

The key factors driving the need for investment in water resources are:

- Increasing drought resilience for our customers: The Water Resources Planning Guideline states that we must plan to deliver a 1 in 500-year level of resilience for our customers, by 2039 at the latest. We project that we will need an extra 320 million litres of water per day to deliver this level of resilience, as currently our customers are protected from around 1 in 100-year drought events.
- Adapting to climate change: Climate change is forecast to increase drought risk, impacting our supply capability during drought. Our projections show that climate change is likely to drive a need for around 140 million litres per day of new capacity by 2050, although with climate change being uncertain the need could be higher.
- Supplying a growing population: Population growth forecasts suggest that we will need to provide a resilient supply of water to a larger number of people. We currently provide water to over 10 million people across our supply area, but projections show that we'll need to provide water for between 11.1 million and 12.3 million people by 2050, so around 10-20% more than now.
- Protecting the environment (abstraction licence reductions): We will undertake investigations, through our WINEP3 programme in AMP8 and AMP9 to investigate the impact of our abstractions on the environment and where we find that our abstractions are having a negative impact on the environment, we will need to reduce the amount of water that we take.

The impact of the above drivers on the amount of water we have available (deployable output) and the demand for water is shown in Table 2.

*Table 2: Summary of changes to water supply and demand against the 2024/25 baseline position (Ml/D)*

| Drivers | 2030 | 2035 | 2050 | 2075 |
|---|---|---|---|---|
| Increase in demand (primarily driven by population growth) | 73 | 170 | 324 | 320 |
| Reduction to deployable output (water available) due to climate change | 58 | 69 | 140 | 198 |
| Reduction in deployable output to enable environmental improvements | 34.5 | 51 | 438 | 438 |
| Additional deployable output required to improve resilience | 0* | 142 | 320 | 320 |

*1 in 500 resilience standard is not required in 2030.

## 3.3 How we determined the investment need

The methods that we use in producing our WRMP are prescribed by the Water Resources Planning Guideline[7] (WRPG) and are documented in detail in our WRMP. The process that we follow in identifying the need for investment and how we will meet this need is illustrated in Figure 1, and can be broadly summarised as:

- **Establish Baseline Supply-Demand Balance(s):** We calculate our supply capability under severe drought conditions and compare this with the demand for water (allowing a buffer to account for uncertainty) that we anticipate. We forecast both supply capability (WRMP Section 4 supply forecast, with the baseline supply forecast for each water resource zone shown on pages 56-60) and demand (WRMP Section 3 demand forecast, with the baseline demand forecast shown on pages 66-68) far into the future, and so establishing our baseline requires consideration of long-term climate change impacts, population growth forecasts, our demand reduction programme and reductions in abstraction licences that we may need to make in the future to protect the environment.
- **Undertake Options Appraisal:** We consider all the available options to meet any forecast supply-demand deficits. These options include reducing our leakage and helping customers to reduce their consumption through metering and water efficiency, as well as investment in new sources of water, such as water recycling plants, new reservoirs, transfers of water from other companies, or new groundwater sources. In appraising options, we consider the water resources benefit that they bring, their cost, the emissions that constructing and using different options would result in, their impact on the environment through strategic environmental assessment (SEA), Biodiversity Net Gain (BNG) and Natural Capital (NC) assessments, and wider resilience benefits.
- **Investment Planning:** We use mathematical optimisation to determine the lowest cost way that we can ensure that we have supply-demand balance over the long term, while meeting policy goals. We consider a long planning period (up to 2075) because the construction of water resources schemes can take a long time (up to 15 years in some cases), and because these options will be used for a long time, with different options

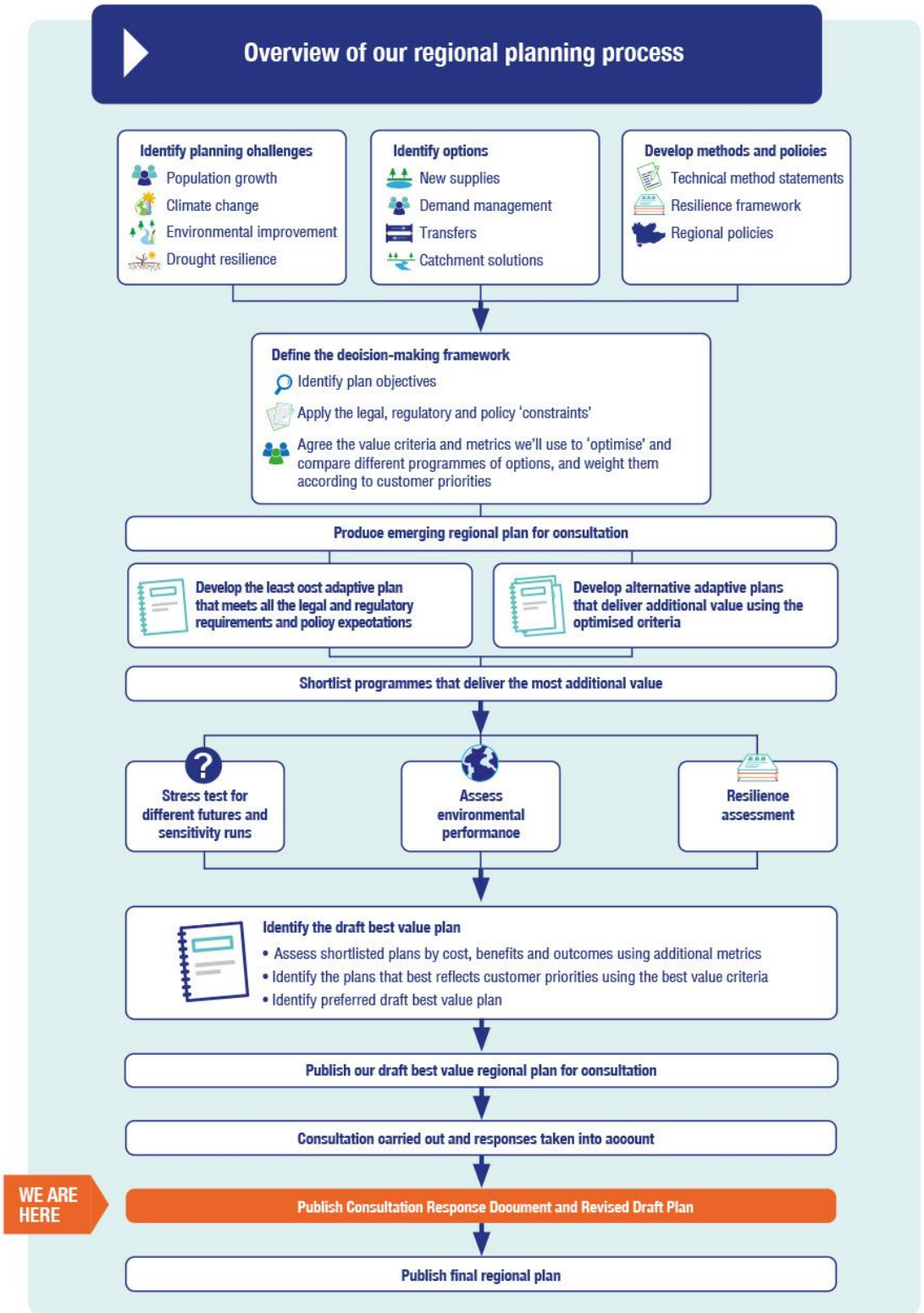
[7] Environment Agency, 2022, Water Resources Planning Guideline, https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline

having different balances of up-front and ongoing costs and emissions. Our WRMP24 takes an adaptive planning approach, aligned with Ofwat's guidance on Long Term Delivery Strategies[8]. Climate change, population growth and the need to reduce abstraction to protect the environment all pose significant uncertainty for our planning decisions and it is important that we make investment decisions that we won't regret in the future. We would have a very different plan for ensuring supply demand balance if we knew that we needed to provide water for 2 million more people than if we knew that our customer population was not going to grow. The uncertainty that these different factors pose is so great that considering a single future supply-demand balance pathway is not appropriate and would be bound to result in an inefficient plan, with a risk that our plan could be ineffective if we are unable to adapt to potentially severe future outcomes. Our WRMP24 considers multiple future pathways of supply-demand balance and determines a plan which is suitable for the range of uncertainty that we are presented with.

- Best Value Planning: We consider whether there are different plans that we could implement which might be more expensive, but which would offer better overall value to customers, considering environmental and resilience metrics, and considering our customers' preference for different options.
- Consultation: Our WRMP goes through a statutory public consultation process. We publish a Draft WRMP which our customers and regulators can read and respond to with their views. We take our stakeholders' views into account and amend our plan where necessary. We then publish a final WRMP, which is approved by the Secretary of State for the Environment, Food and Rural Affairs. The outcome of the statutory consultation process is documented in our Statement of Response, and we have produced a shorter summary document for our customers.

[8] Ofwat, 2022, PR24 and beyond: Final guidance on long-term delivery strategies, https://www.ofwat.gov.uk/wp-content/uploads/2022/04/PR24-and-beyond-Final-guidance-on-long-term-delivery-strategies_Pr24.pdf

*Figure 1: Summary of planning process (source WRSE)*



## 3.4 Why action is needed now

Section 6 of our WRMP presents the baseline supply-demand balance for Thames Water and for each of our six Water Resource Zones (WRZs) and explains how this has been derived and how risk and uncertainty has been assessed. The baseline supply demand balance for each of WRZ is presented from page 53 onwards.

This section shows that there is an immediate and increasing supply-demand deficit in the London WRZs. All other WRZs start in a position of surplus, with deficits appearing in all zones under future scenarios. In the shorter term, increasing deficits are caused by population growth and a need for us to provide a higher level of drought resilience. In the longer term, deficits are driven by the impacts of climate change and licence reductions that may be required to protect the environment.

The supply demand balance for the whole of the Thames Region is shown in Table 3: Company-level baseline supply demand balance. The supply demand balance shown is for the dry year annual average scenario (DYAA) and expressed as mega litres per day (Ml/d). The negative numbers mean that we have a deficit in supply to meet the forecast demand.

*Table 3: Company-level baseline supply demand balance*

| Supply Demand Balance (DYAA, Ml/d) | | | | | |
|---|---|---|---|---|---|
| 2030 | 2040 | 2050 | 2060 | 2070 | 2075 |
| -133 | -669 | -1,059 | -1,088 | -1,108 | -1,126 |

## 3.5 Planning for an Uncertain Future

We are facing significant challenges and whilst we don't know exactly what the future holds, we do know that we need to get started on planning new infrastructure as some schemes could take up to 15 years to progress through planning and construction before they can be brought into supply. In developing our plan, we have considered nine possible futures, which consider different population forecasts, the effects of climate change, and different levels of abstraction reduction that may be necessary to ensure environmental protection. The methodology and approach for defining the nine future pathways is discussed in our WRMP Section 10 Programme Appraisal and Scenario Testing, Section 10.79-10.115.

The nine future pathways generate different supply demand balance deficits as shown in Figure 2: Illustration of our adaptive planning branched pathways developed for our dWRMP. The figure shows the amount of additional water required under each pathway by 2075. The preferred option presented in this enhancement case (and supported by our WRMP) is designed to address the deficits in the pathway highlighted in dark orange in the figure (pathway 4) and shown in Table 3 above. The reasons for selecting this pathway are explained in WRMP Section 11, section 11.8-11.14.

To assess efficient plans across the range of future supply demand challenges, we have developed branched pathways through the range of future forecasts. These branched pathways form 'situation trees' with branch points at 2035 and 2040 and decision points five years earlier in 2030 and 2035 respectively. These timings allow focus initially on the variability caused by different growth forecasts and then on resilience, environmental destination, and climate change.

The branch to 2035 has been selected to be in line with regulatory guidance. It includes growth based on Housing Plans developed by Local Authorities, licence reductions that would be

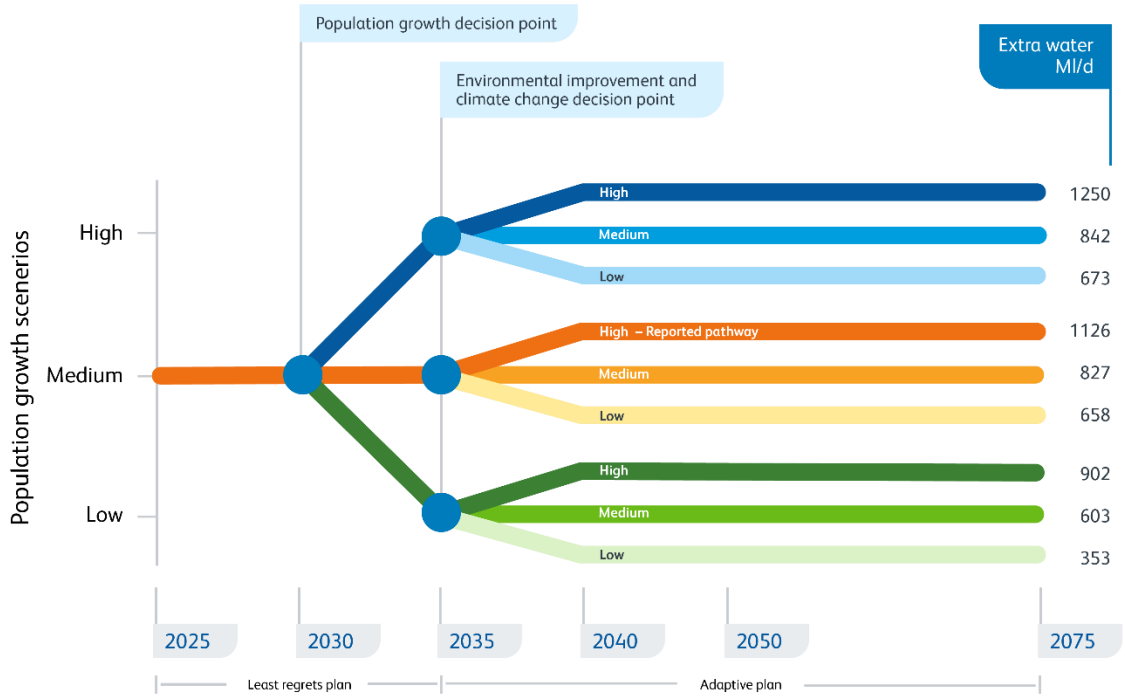
required to comply with currently known legal requirements (including the potential impact of licence capping) and median climate change impacts.

At 2035 there is a split into three branches after a decision point in 2030. This aligns with the Business Plan cycle and guidance that after this point growth forecasts beyond Local Authority housing plan should be considered.

At 2040 the split to nine branches occurs after a decision point in 2035. Here the focus is on environmental destination and climate change where we use a high projection in the upper branches of each set, medium (median, for climate change) in the middle branches and low in the lower branches.

In the short term we are reasonably certain the investment required to provide a resilient water supply to our customers and to protect the environment Therefore we have set a single pathway for the first 10 years to 2035. Our adaptive plan contains least regrets resource options that need to be either completed or commenced in the first ten years of the plan irrespective of future uncertainties or changes to different pathways.

*Figure 2: Illustration of our adaptive planning branched pathways developed for our dWRMP*




We have developed a Monitoring Plan presented in Section 11 of our WRMP, the Overall Best Value Plan, section 11.349-11.376, that we will use in our Annual Review of the WRMP to track our progress with delivering the plan to 2030. We will also use it to evaluate whether the future is turning out as expected, or if we need to change course to a different pathway.

We have aligned the scenarios considered within our adaptive plan with those set out in Ofwat's guidance on Long Term Delivery Strategies[9] which is presented in Section 7 of this document. In our WRMP we have combined different scenarios of climate change, abstraction reduction, and

[9]https://www.ofwat.gov.uk/wp-content/uploads/2022/04/PR24-and-beyond-Final-guidance-on-long-term-delivery-strategies_Pr24.pdf

population growth, to ensure that we have a resilient plan which meets the requirements of the Water Resources Planning Guideline. We have also tested the impact of individual factors within the Long-Term Delivery Strategy Framework[10].

## 3.6 Customer support

Research into all Enhancement Cases has been conducted to understand our customer, community and stakeholder views on the need for enhancement and as well as their preference of proposed solutions, where appropriate. Our engagement approach has combined an ongoing, iterative triangulation of insights over the course AMP7 as well as targeted research on specific Enhancement Cases for our PR24 plan including those related to our Water Resources Management Plan. A full list of sources used is available in TMS04 What Customers, Communities and Stakeholders Want (WCCSW), which is our single unifying customer insight framework, underpinned by detailed insight.

In addition to our targeted enhancement case research for PR24, in developing the draft regional plan (WRSE) and our draft WRMP, we've engaged with our customers to make sure we understand and have reflected their priorities. We've also consulted a wide range of stakeholders to incorporate their knowledge and expertise. The consultation process for our draft is summarised in Figure 3: Summary of the consultation on our draft WRMP, and in detail in our Statement of Response – our response to the consultation on the draft water resource management plan.

*Figure 3: Summary of the consultation on our draft WRMP*


Through regionally led research[11], we found that customers are supportive of the collaborative and coordinated approach taken in Water Resources Southeast, and that there is a strong expectation that we will plan for the future. Customers want us to reduce dependency of our water resources system on the environment and recognise that we should build additional capacity to ensure resilience in the face of wider uncertainty. From this research, we also established that

[10] See TMS06 Our Long Term Delivery Strategy
[11] SP1-5,SP13-14,SP19,22 WRSE Water resources Research, June 2021 to June 2023

customers find interventions such as hosepipe bans acceptable, at current levels of frequency, but that they find the risks posed by extreme drought measures (rota cuts/standpipes) to be intolerable. We summarise key findings from our research supporting the need for enhancement below.

| Insights: WRMP Supply | |
|---|---|
| Support the need | • Most customers are unaware of the challenges to ensuring future water supplies and that demand is projected to exceed supply. When they are informed, customers want plans to ensure sufficient supply to meet future demand. (PR19-61)<br>• 38% of customers are concerned about water shortages now and 67% are concerned about water shortages in the future. Some customers feel Thames Water's track record is poor here and so view they promises with scepticism. Customers want timescales to show how we are making meaningful progress, and don't want us to hide behind ambiguity. (SP1)<br>• Customers' overall view is that water companies should not plan to harm the environment. They deem it unacceptable that long term plans to secure water supplies and improve the resilience of the water system to drought and unexpected events would be at the expense of the environment. (PR19-61)<br>• Customers prefer supply options that have a net positive environmental impact and deliver wider public value, for example recreation. Use of chemicals, high energy use, and other environmental impacts are key reasons why customers favour some options less. Wherever possible, the resource plans should adopt options that contribute to the recovery of nature (e.g. supporting Local Nature Recovery Strategies). (PR19-58)<br>• Customers' top priority is foremost to ensure the long-term security of supply in the region, both for public supply purposes and other sectors. Ranking just below this are the key considerations for improving the efficiency of the water supply system in terms of reducing leakage and reducing its dependency on sensitive habitats and groundwater sources, along with the cost and customer affordability constraints for the plan. (SP19)<br>• Customers value the benefits that are brought through the WRMP. Two of our customers' highest priorities are that we provide a constant supply of water, and that we ensure that our supplies are resilient into the future (PR24-12, SP19). In addition, our customers want us to be environmentally responsible, reducing abstraction from sources in vulnerable catchments where we have evidence that this will result in environmental benefit. (PR24-7) |

# 4 Best option for customers

## 4.1 Options considered

The process that we have undertaken for identifying, screening, and developing supply-side options is described in detail in our WRMP Section 7 , Appraisal of Resource Options, while Section 8 Demand Options, details the same steps for demand-side options. The list of all options we have considered (WRMP Annex P, Options List), the rejection register is presented in WRMP Annex Q, which details why we have screened individual options out), and scheme dossiers for the feasible list (WRMP Annex R ), as well as option feasibility reports are all easily available throughout our public consultation.

Our options identification, screening, development, and appraisal process is robust and transparent, with assurance carried out throughout the process. The steps in the development of our investment programme are:

- Option Identification: We initially develop an 'Unconstrained List' of potential water resources options. This initially involves the consideration of generic option types (37 generic supply-side option types have been considered in WRMP24) and screening out generic option types which are infeasible, before identifying specific options within generic categories that pass screening. More than 200 supply-side options are identified in our unconstrained list.
- Screening: Individual options are screened for feasibility using a four-step process. The screening decisions are documented in option feasibility reports to ensure transparency. Screening out options which are infeasible, and further screening those options which are undesirable when compared to other options, allows us to focus effort in developing those options which show most promise.
- Option Development: Those options which feature in the feasible list are subject to consideration of their benefit and cost, as well as investigation into carbon emissions and their environmental impact. Several of the options considered within our WRMP are Strategic Resource Options (SROs). These are large options (>50 Ml/d benefit), and so are subject to more extensive option development.
- Programme Appraisal & Best Value Planning: We use all options from our constrained list as inputs into the WRSE 'investment model'. The investment model takes time-series of our supply-demand balances for each WRZ and considers the magnitude of any deficits over time. The model uses mathematical optimisation to derive the most efficient programme of options to ensure that we have supply-demand balance in every future year of our planning period (across the whole WRSE region), while minimising overall programme cost. We then consider whether we could improve outcomes from our planning by considering different programmes of options which also solve our supply-demand balances, but which deliver better outcomes in terms of carbon emissions, resilience, or environmental metrics.
- Executive and Board Assurance: We discuss the development of our WRMP with our executive and board and receive constructive criticism on our planning methods and the resultant plan.

We have considered a wide range of options that are available to us, from catchment management schemes through to new reservoirs and emergency options such as tankering.

Through our Bid Assessment Framework (BAF), third parties are also able to develop options in collaboration with us. Overall, we have considered hundreds of potential options.

We screen options according to a robust three-stage framework:

- Stage 1: options screened against absolute constraints (to identify unviable options)
- Stage 2: option performance is compared qualitatively against criteria that differentiate between options of the same type, to identify the most promising candidate options within option sub-types
- Stage 3: an extension of stage 2, in which the performance of options is assessed in further detail, including estimating option costs

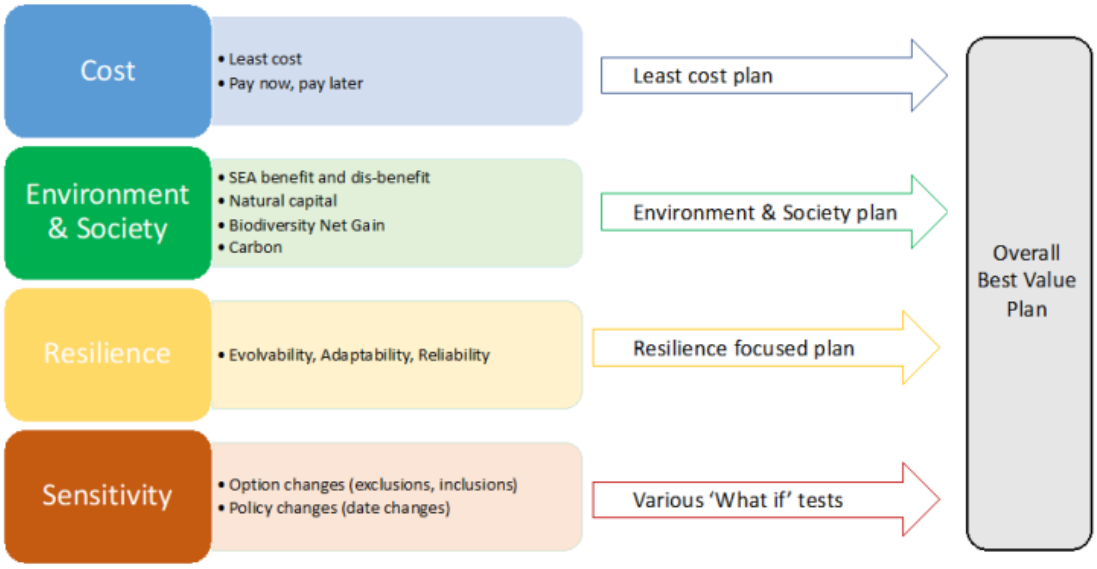
Options are costed based on their conceptual design, with the scale and maturity of options considered when determining how detailed conceptual designs should be when costing options. Our costing methodology follows that developed by the All Company Working Group (ACWG, a group comprised of all water companies who are developing major water resources options), ensuring that our option costs are developed in a consistent way (meaning that they are comparable with one another) and that they are comparable with option costs developed by other water companies. We ensure that less mature options' costs are comparable with more well-developed options by including allowances for costed risk and optimism bias (there being greater potential for additional costs when option designs are immature and when we have less experience in delivering options of a given type), again in line with the ACWG costing methodology.

Alongside cost assessment, options also undergo assessment to determine the carbon emissions associated with their construction and use, and a range of environmental assessments to determine the Biodiversity Net Gain and Natural Capital associated with each option, as well as option-level SEA to identify mitigation measures which need to be built into option design. Outputs from all option assessments, whether costs, emissions, environmental or resilience, are publicly available, traceable, auditable, and assured.

## 4.2 Programme appraisal, and Best Value planning

Section 10 of our WRMP transparently explains the decision-making process that we have followed, as part of the overall regional planning approach, to arrive at our Best Value plan, and documents other feasible solutions to the regional planning problem. Our Best Value Plan is derived by a multi-objective optimisation exercise considering many water resource options of all types, optimising based on cost, carbon, environmental impacts, customer acceptability, inter-generational equity, and other metrics. A comprehensive analysis has been carried out to test the potential future scenarios against these metrics. The overall approach we have taken to derive the plan is illustrated in Figure 4.

*Figure 4: Approach taken to identify the overall best value plan.*




The result of the application of the Best Value, adaptive, regional planning framework is that the options selected in the short term are those which are low regret (considering the scale of the regional planning horizon and scenarios outlined in the Long-Term Delivery Strategy guidance), environmentally favourable, and flexible (either being solutions which are adaptable or which can be used flexibly across the region). While other feasible solutions to the regional planning problem exist, they would be most expensive, more carbon intensive, and would deliver fewer environmental benefits.

Our programme appraisal has been undertaken primarily at the regional level, through the identification of the Best Value Regional Plan for the Southeast[12]. Undertaking planning at the regional level, as part of the WRSE regional planning group, means that our plan is best value for customers across the WRSE region, and considers the benefits associated with shared resources (such as SESRO and STT) and the efficiencies that can be made by considering intra-regional transfers. Being part of the WRSE regional group also means that our plan is well aligned with other companies in the WRSE area, both in terms of the methods and models used in the generation of the plan, and in the plan itself.

Our Overall Best Value Plan (BVP) is presented in detail Section 11 of the WRMP and summarised in parts 11.377-11.393.. As required by the National Framework, the Plan is fully consistent with the Regional Water Resources Plan for the Southeast of England as developed by the Water Resources in the South East Group. It is also compliant with the Water Resources Planning Guideline.

We have a need for new water resources to be developed for use from the early 2030s onwards, in order that we can increase the resilience of our customers' supplies to drought events to a level

12 https://www.wrse.org.uk/media/3oah3rep/wrse-best-value-planning-method-statement-december-2022.pdf

at which we would not need to impose emergency restrictions more often than once every two hundred years. The Teddington DRA scheme is the best value option for us to move to 1 in 200-year resilience by the early 2030s, because it is deliverable in a short timescale and will deliver a sufficient volume of water to improve our London WRZ's drought resilience and is relatively inexpensive compared to other available options.

In the medium and long-term, we have considered different pathways of future demand and supply capability to reflect the uncertainty that exists around population growth, the impacts of climate change on drought risk, and abstraction licence reductions that may be necessary to ensure environmental protection and improvement. We have used modelling to analyse the costs and benefits of different solutions to the supply-demand balance challenges that these pathways pose for the WRSE region and have considered outputs from this modelling alongside other factors to build a best value adaptive plan.

From this analysis, we have established that we should start obtaining consent for SESRO as soon as possible, in order that it can be used by 2040. This is in order that we, and others in the region, can increase the drought resilience of our customers' supplies to a level at which we would not need to impose emergency restrictions more often than once every five hundred years, and so that we can plan for the level of environmental protection which guidance indicates will be required.

Our decision to promote construction of SESRO instead of STT is based on the assessment that plans in which the STT is used in place of SESRO are more expensive, result in more carbon emissions, and do not deliver the same environmental or resilience benefits, particularly under severe future scenarios. The SESRO scheme provides a resilient source of water with low operating costs that can facilitate transfers within the WRSE region, and so provides the ideal base of an adaptive plan for an uncertain future.

## 4.3 Preferred Option

The WRSE and WRMP process has established the need for and mix of supply side options, a combination of Strategic Resource Option (SRO) schemes and non-SROs. The SROs are being developed across the Southeast region to address forecast increases in demand caused by population growth and climate change. Thames Water will take the lead on several of these schemes based on the need identified in our WRMP.

A full list of the assessed options is included in the WRMP24 Tables 5a-C. PR24 data table CW8 presents the selected mix of SROs, the funding we require to progress the schemes through AMP8, and other information such as benefits. All schemes with a TOTEX greater than £200m are DPC candidate schemes and details are provided in data table SUP12 together with supporting commentaries. A description of each of the options is provided

Table 4: Summary of supply options included in AMP8.

There are ongoing risks to the delivery of Teddington Direct River Abstraction (DRA) and the Southeast Strategic Reservoir Option (SESRO). If these risks are not able to be mitigated as we move from conceptual to detailed design and meet the requirement of the planning process, we have continued to develop the alternatives of Beckton water recycling for Teddington DRA, and the Severn Thames Transfer (STT) for SESRO. This aligns with the principles of RAPID and the gated process to provide resilience by considering multiple options.

We have assessed the budgetary impacts of making either switch. If we switch to Beckton then we have assumed that we can use all the allocated Teddington budget to progress this scheme but forecast the requirement for additional cost to deliver the plan of work required for Beckton.

If we switch to STT then we assume that the unspent SESRO budget will be sufficient to deliver the AMP8 requirements without the need for additional budget. For STT we have included the costs required to keep this scheme going to the point where the decision to switch is made.

Irrespective of whether we switch to STT we include in the AMP8 a small amount of budget to fund risk mitigation work to enable us to ramp up activity should future WRSE modelling require us to do so.

The Lower River Thames to West London Reservoirs scheme is a potential new SRO. Early feasibility work is underway and if this confirms the need for a scheme then this would be required by the mid-2030s.

The AMP8 funding included in data table CW8 reflects the WRMP24, the procurement route (In-house or DPC/SIPR) and the Thames Water component of the forecast budget.

- We fully fund Teddington DRA (development and delivery)
- We fully fund Beckton development costs but then, in delivery, for only contract management as Beckton construction would be funded via DPC.
- For SESRO, we have agreed a 55:30:15 split of the costs between Thames Water, Southern Water and Affinity Water respectively for non-land and property costs and agreed that we will fully fund the anticipated land and property costs up to SIPR contract award.
- For STT we have agreed an 80:10:10 split of the AMP8 costs between Thames Water, Severn Trent Water and United Utilities respectively to jointly fund the AMP8 work.
- We fully fund the smaller schemes: Addington groundwater and the RWE Didcot raw water import.

A summary extract of the CW8 investment for AMP8, for the SRO schemes is included in Table 5: Summary Extract from Data Table CW8 - Totex (Thames Water contribution only). The best value plan proposes that Teddington DRA and SESRO are taken forward during AMP8. Both schemes would move through planning, consents, and procurement and into delivery but to different timescales and following different procurement routes.

*Table 4: Summary of supply options included in AMP8*

| Item | Benefit (Ml/d) | Year delivered | Why is it needed, and why now? |
|---|---|---|---|
| Teddington direct river abstraction (DRA) | 67 | Early 2030s, delivery date dependent on planning route | We have a need for new water resources to be developed for use from the early 2030s onwards, in order that we can increase the resilience of our customers' supplies to drought events to a level at which we would not need to impose emergency restrictions more often than once every two hundred years. The Teddington DRA scheme is the best value option for us to move to 1 in 200-year resilience by the early 2030s, being an option, which is deliverable in a short timescale, would deliver a sufficient volume of water to improve our London WRZ's drought resilience, and which is inexpensive compared to other available options.<br>Our plan for AMP8 involves proceeding with obtaining consent for and constructing the Teddington DRA scheme as soon as possible. |
| Southeast Strategic Reservoir Option (SESRO), 150Mm$^3$ | 271 | 2040 | The Southeast Strategic Reservoir Option (SESRO) is a raw water storage option in the upper catchment of the River Thames. It provides a resilient supply of raw water during periods of low flow. It would be used as a regulating reservoir (discharging water into the river during periods of low flow) for London and Affinity Water and would provide direct supply to our SWOX zone and Southern Water's customers. SESRO is a key part of the WRSE regional plan, and would be used by Thames Water, Affinity Water, and Southern Water. It is required to facilitate 1 in 500-year resilience in our London WRZ, and to enable licence reductions in our London, SWOX, SWA and Kennet Valley zones, Southern Water's Western Area, and at Affinity Water's chalk sources.<br>Our plan for AMP8 includes obtaining consent for the scheme, acquiring land, and undertaking procurement exercises, with construction (undertaken by the selected Competitively Appointed Provider) due to begin around 2029. |
| Continuing the development of Severn Thames Transfer (STT) | N/A | N/A | A transfer of water from the River Severn to the River Thames, potentially supported by transfers from United Utilities and Severn Trent Water, used to provide water to Thames Water, Affinity Water (via Thames to Affinity Transfer), and/or Southern Water (via Thames to Southern Transfer).<br>There is a risk that SESRO may be denied planning consent through the DCO process. If this were to happen, we would need to immediately progress the STT. As such, it's essential that we continue investigations into these schemes.<br>The AMP8 investment is to continue investigations to ensure that we would be able to quickly move to consenting the Severn Thames Transfer, should this be necessary. |
| Continuing the development of Beckton Water Recycling schemes | N/A | N/A | There is a risk that Teddington DRA may be denied planning consent, or that we may (in the short-term) find that a larger scheme is needed. If this were to happen, we would need to immediately progress an alternative water |

| | | | |
|---|---|---|---|
| | | | recycling scheme, with our proposed alternative scheme being Beckton Water Recycling. As such, we think it's essential that we continue investigations into water recycling schemes through AMP8.<br>The AMP8 investment is to continue investigations to ensure that we would be able to quickly move to consenting a Water Recycling scheme, should this be necessary. |
| Lower River Thames to West London Reservoirs | | | In the 2022 drought, we saw constraints on our abstraction. These constraints imply that there could be less water available to supply during a drought than we anticipate, and so may mean that we have a supply deficit. These issues would be exacerbated by the River Thames Scheme, a flood alleviation scheme being developed by the Environment Agency and Surrey County Council. We do not, however, currently have a full understanding of the issues and note that in previous severe drought events these constraints do not appear to have existed.<br>If these constraints are confirmed, then we will need to invest in our raw water transfer network to ensure the security of supply.<br>The AMP8 investment is to continue investigations into these issues, and to develop solutions which could be consented for during the AMP8. Should it be found that constraints can be mitigated via other means, e.g., changes in river management by the Environment Agency, this investment would be returned to customers. |
| Agreement with RWE, relating to Didcot Power Station | 23 Ml/d | 2026 | Didcot Power Station abstracts water from the River Thames for evaporative cooling purposes. If we enter into a contractual agreement with RWE then during drought periods we can request that they reduce the amount of water which is consumed. This brings additional resilience to our supply-demand balance position.<br>This investment is to enable this agreement. |
| Addington groundwater | 3 Ml/d average, 6 Ml/d peak | 2028 | The Deployable Output of our Addington source in South London is currently limited by our ability to abstract, with additional licence available above our current abstraction capability. If we were to develop a new borehole and improve the WTW's processes, we could supply more water from this source.<br>To give our supply-demand balance position more robustness to the risks which are faced, and to provide water into an area with resilience concerns (South London), our proposal is that we develop this scheme as soon as possible within AMP8.<br>This investment is to deliver this scheme. |

*Table 5: Summary Extract from Data Table CW8 - Totex (Thames Water contribution only).*

| Option | Preferred option | Strategic Resource Option (SRO) | Suitable for DPC[13] | Pre AMP 8 Spend (£M) | Profiled AMP 8 spend (£M) | | | | | Total AMP8 spend (£M) | Post AMP8 Spend (£M) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | FY26 | FY27 | FY28 | FY29 | FY30 | | |
| Teddington DRA | Y | Y | N | 28.1 | 11.5 | 9.8 | 14.1 | 29.7 | 53.4 | 118.6 | 160.7 |
| SESRO | Y | Y | Y (SIPR) | 40.4 | 39.5 | 39.8 | 40.1 | 35.8 | 9.2 | 164.5 | 82.9 |
| Severn Thames Transfer (STT) | N | Y | Y | 17.0 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 10.6 | 0.0 |
| Beckton Water Recycling schemes | N | Y | Y | 13.7 | 11.7 | 12.7 | 6.1 | 52.8 | -25.0 | 58.3 | 0.0 |
| Lower River Thames to West London Reservoirs | Y | TBC | Y | 2.7 | 4.1 | 7.2 | 7.3 | 7.3 | 10.8 | 36.7 | 51.1 |
| **Subtotal SRO schemes (£M)** | | | | **101.9** | **68.9** | **71.7** | **69.8** | **127.8** | **50.6** | **388.7** | **294.7** |
| Non-SRO schemes: Groundwater Addington & Didcot Raw Water purchase | Y | N | N | 0.0 | 4.0 | 5.4 | 5.6 | 3.3 | 3.4 | 21.8 | 544.9 |
| **Total SRO & non-SRO schemes (£M)** | | | | **101.9** | **73.0** | **77.0** | **75.4** | **131.1** | **53.9** | **410.4** | **839.6** |

[13] Refer to TMS38 Direct Procurement for Customers .

### AMP8 Outputs SRO schemes

The SRO schemes have been progressed through the RAPID governance process for Gates 1-4 drawing down on the PR19 determinations for each SRO during AMP7. The RAPID guidance provides detailed output requirement for Gates 1 and 2 with less prescription for Gate 3 and Gate 4 (which is broadly aligned with submission of a planning consents application) and beyond. The Gate 2 Reports set out phasing strategies through development beyond Gate 4 to consents and contract award and into delivery, along with anticipated timeframes. This information together with Ofwat's guidance for DPC stage approvals was used to develop the AMP8 delivery plans and cost forecasts.

The main outputs and outcomes from the AMP8 funding may be summarised as in Table 6: AMP8 outputs for SRO schemes.

*Table 6: AMP8 outputs for SRO schemes*

| Option | FY26 | FY27 | FY28 | FY29 | FY30 | AMP8 Outcomes |
|---|---|---|---|---|---|---|
| Teddington 75 DRA | Consents Submission<br>ITT preparation | Consents Award<br>Works procurement | Contract Award<br>Start of Construction | Detailed Design<br>Enabling Works | Main Works | Construction underway with In-house funding |
| SESRO 150 | Statutory Consultation<br>Consents design<br>ITT preparation | Consents Submission<br>Approval to tender | Consents Award<br>Works procurement | SIPR Licence<br>Contract Award / Financial Close<br>Start of Construction | Detailed Design<br>Enabling Works | Construction underway with SIPR funding |
| Beckton water recycling | | | | | | |
| STT | Annual status updates will be provided | | | | | N/A |
| LTWLR | Feasibility | Options Assessment | Consents & Procurement plans | Consents & ITT preparation | Consents submission<br>ITT | Assured plan for Delivery |

## 4.4 Customer and stakeholder engagement

Section 1 and Annex S of our WRMP outline the extensive programme of stakeholder and customer engagement and research that underpins our plan. Customer research is carried out at regional and company levels, as well as scheme-specific engagement. We have used independent agencies to conduct our customer engagement, ensuring expert input and challenge, as well as helping to shape innovative approaches. We also consult our Customer Challenge Group (CCG) on the development of our WRMP.

We have conducted research into customer support for our planning principles and approaches. It is important to note that many of the factors that we are planning for are a statutory requirement; where we are required by law or by the Water Resources Planning Guideline to plan on a certain

basis or using a given framework (e.g., 1 in 500-year resilience, or compliance with the water framework directive). Where this is the case, we haven't consulted our customers, as this would present a false choice to them.

We have engaged with our customers through regional, company, and scheme-specific work. With respect to option selection and criteria considered, WRSE-led customer research[14] has shown us that customers see ambitious and extensive leakage and water saving measures as a higher priority than new sources of supply. After this, the right supply options are by our customers to be those which are reliable, avoid environmental harm, and provide wider benefits including enhancing local amenity and recreation opportunities.

From existing research, customer views on sources of water - water transfers (including reservoirs) included a preference for a simple process that mainly uses existing infrastructure. This is seen as a logical solution to water shortage, making the most of existing supply and seen to have limited environmental impacts. Relies on other companies, so less reliable. Some health concerns about use of pipes for transfers vs. canals, and about of 'exporting' problems to other areas.

WRSE-led research has informed the best-value criteria that we have used in the development of the best value regional plan. Customers place most weight on the delivery of a secure supply of water, then on cost and environmental improvement, then on wider resilience aspects (adaptability/flexibility).

Scheme-specific research has been carried out across the SROs[15] and, recognising that it is the most polarising of the SROs in terms of customer acceptability, water recycling[16]. From this research, we found that customers are generally not able to detect changes in their water sources, but they do want to be informed about changes.

We consulted on our draft WRMP and at the same time conducted customer research to ensure the views and preferences from the Thames Water catchment area, that are representative of Thames Water's customer base, are heard. This is very important noting that consultations are often completed by those who are very engaged with the issues either because they are part of an organised group or because planned developments will directly impact where they live and as such, the feedback to consultations is not always representative of the general population. Through this research, we established:

- Customers think that action should be taken sooner rather than later to ensure a secure and sustainable water supply, despite the likely disruption and bill impact.
- After learning about the water deficit faced in the Thames Water catchment and that water saving measures would not go far enough to ensure resilience, investing in new water sources was thought to be prudent and none argued against the need for development.
- Customers support the main investments in our plan, the Teddington DRA and SESRO.

We have undertaken an extensive consultation process to arrive at our PR24 water resources investment programme, including consultation on:

- Our Vision 2050, 2022
- Water Resources South East Regional Plan, 2022 / 2023
- Water Resources Management Plan 2024

[14] SP4 WSRE - Customer Preferences to Inform Long-term Water Resource Planning, Mar 21
[15] Changing water sources, Britain Thinks, July 2022
[16] Thames Water, Customer Voices, Water Recycling, Verve, August 2022

- Strategic Resource Option Gated Submissions
- Drought Plan 2022
- PR24 Acceptability and Affordability Testing 2023

These consultations have given our customers a chance to have their say on our plans for the future, with the different submissions having different areas of focus. Throughout the development of all these plans, we have also undertaken customer insight work to ensure that the outcomes of each plan align with customer priorities.

For our PR24 business plan, when gathering customer views on proposed enhancements across our draft plan as part of our PR24 Acceptability and Affordability Testing in May 2023[17], we found that there was strong support from customers on solutions proposed in this area:

- There is high support for this enhancement (water resources management), driven by fears over water security, population growth and the impacts of climate change. (PR24-14)
- Customers are generally comfortable with the costs and feel this offers good value for money. (PR24-14)

## 4.5 Delivering Public Value

Delivering public value is about maximising the positive impact we have on customers, communities and the environment, as we provide water and wastewater services. It is about us being a force for good in our communities and the environment.

For us, public value is made up of all the things we do to make life better – through our essential services and our wider impact. It's about finding ways to make the biggest positive difference to customers, colleagues, communities, and the environment.

To deliver our purpose, we have committed to incorporating public value within our investment thinking. With this approach we can identify every opportunity to make the biggest positive difference to customers, colleagues, communities, and the environment as we deliver our service.

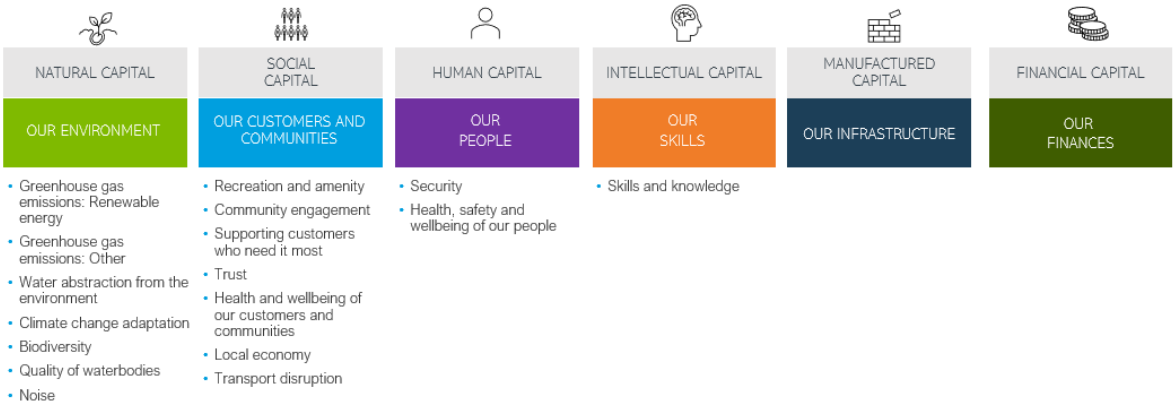
We're starting to implement a new approach to guide and measure both the public value we create and the delivery of our purpose. The public value framework helps us identify, evaluate, and deliver public value which balances cost and value to customers, community, and the environment over the long-term.

Our public value framework uses the capitals approach, an international decision-making framework. The capitals are categories of value that can be impacted by our activities.

Our framework uses this approach to understand how our success is directly or indirectly underpinned by natural, social, human, and intellectual capital, as well as the traditional consideration of manufactured and financial capital. The capitals, along with Thames Water's customer-facing language for them and what is considered under each capital is set out in Figure 5.

[17] PR24-14 Acceptability and Affordability Testing (Qualitative findings), May 2023

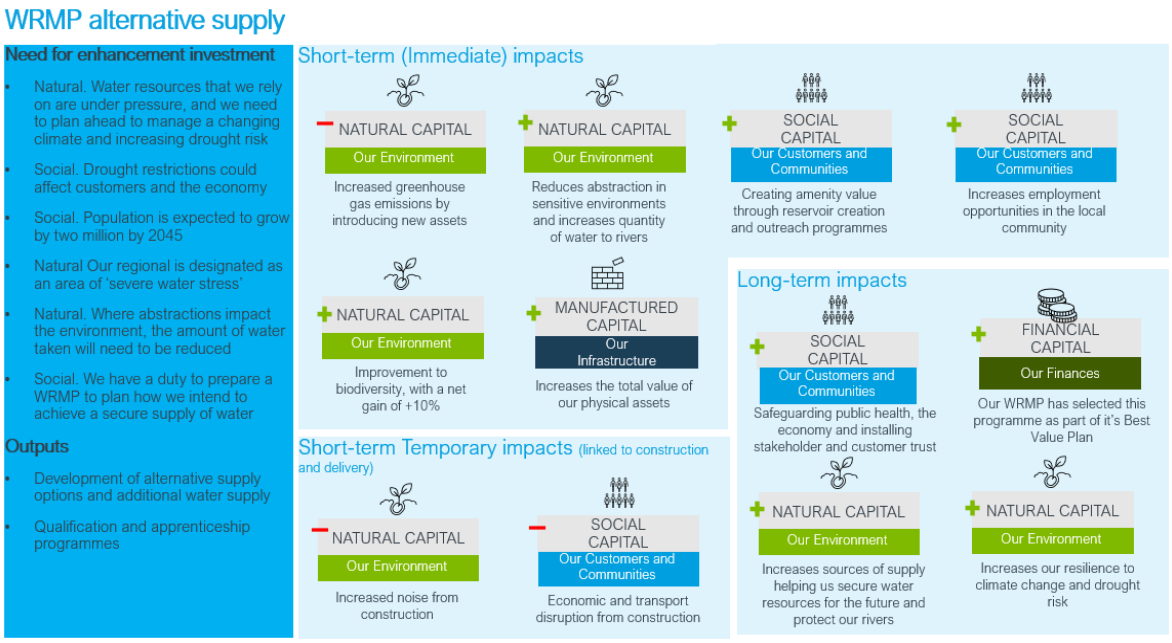
*Figure 5: The capitals*




We applied the public value framework here to fully understand how the investment leads to impact on the six capitals. Note, the public value framework was only used here to determine the public value offering and not used to optioneer value. This case has used the statutory process that governs Water Resource Planning to determine the investment required.

This investment grows value in natural, social, and manufactured capital. We discovered a range of short-term temporary, short-term immediate and long-term impacts. The theory of change infographic in Figure 6 shows how this investment leads to impact on the six capitals and delivers public value.

*Figure 6: The short-term temporary and immediate, and long-term impacts on the six capitals associated to the WRMP alternative supply enhancement case.*



Our public value framework uses a semi-quantitative, multi-criteria analysis approach, where values are weighted using customer preferences[18]. There are nineteen measures in our public value framework which are used to assess an option.

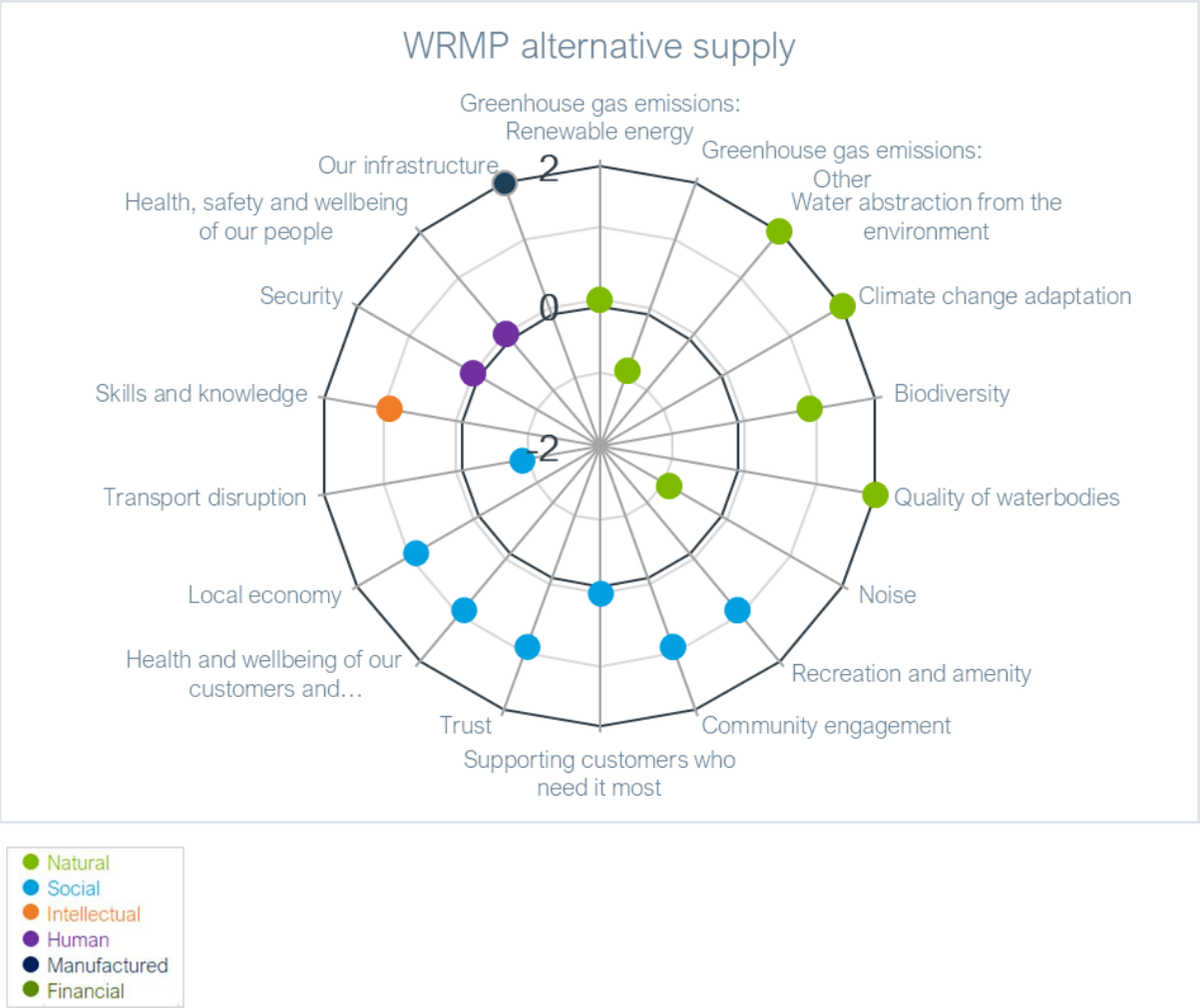
The public value framework assessment includes a wide range of measures such as biodiversity, waterbody quality, recreation, amenity, and local economies, while the financial capital measure continues to be captured in other parts of our investment planning processes. The framework considers both short and long-term impacts, looking approximately 30 years ahead.

The degree of impact between the capitals varied. These are outlined in Figure 7 below.

- The investment strongly benefits natural capital across more than one measure. The solutions increase sources of supply helping us secure water resources for the future, improve our resilience to climate change and drought risk and protect our rivers. The investment will also us to abstract less water from sensitive sources which will prevent damage to the environment and all schemes will deliver a biodiversity net gain of 10%.
- There is also a strong benefit to manufactured capital. The new assets increase the total value of our assets while the increased supply alternatives allow greater operational flexibility in outages.
- There is positive benefit to social capital. Customer and stakeholder trusts will increase as we secure sources of supply for the future while protecting our chalk streams. The new reservoir will create recreation and amenity opportunities, while outreach, educational events and job opportunities will benefit the local community. Securing supply acts to protect public health and economic development.
- There is a positive benefit to intellectual capital as we expect to use the construction procurement process to drive additional skill creation.
- An overview on financial capital is included in Section 5 of this document.
- Dis-benefits include an increase in embodied and operational carbon output as we introduce new assets into operation. Construction introduces short-term dis-benefits including transport and economic disruption with road diversions likely during the one-off installation period, and increased noise.
- No impact is expected on human capital.

[18] Public value research, May 2022 Verve

*Figure 7: The results of the public value scoring for WRMP alternative supply.*




We will continue to seek public value opportunities through detailed design and delivery, for example through stakeholder engagement.

# 5 Cost efficiency

## 5.1 Overview of proposed costs

This section should be read in conjunction with WRMP Section 7. All the costs included in this document are expressed in FY2022-23 terms, meaning that they reflect the cost increases caused by high levels of inflation over the last couple of years.

We have undertaken a robust approach to costing our water resources options, including appropriate audit and assurance. Cost estimates for many of our water resources options have been refined over several AMPs. The method used for estimating cost and carbon is based on the conceptual design of options and uses a method agreed by the All Company Working Group (a group attended by all English water companies). Our approach to option costing has been assured to Board level.

Our costing method involves breaking the scheme[19] down into its constituent parts and then applying either a standardised company database (Engineering Estimating System, with evidence based on past delivery) to build up the solution cost or apply a bespoke cost estimation if the component parts of options sit outside of the range of items typically delivered by Thames Water.

Our largest options have had the most attention paid to their costing, and the costing of SRO options is most mature. Our water resources options include allowances for costed risk and optimism bias. These are there to account for currently unknown costs, and to ensure that inflation of costs does not occur.

Optimism bias is scaled to account for how much detail has been applied in costing, and to account for the confidence in our knowledge of how options would be delivered (e.g., water recycling plants, which we don't have a great deal of experience in designing or delivering, would attract a larger optimism bias than a new groundwater source, which we have significant experience in delivering).

## 5.2 Cost efficiency assessment

At the plan level, our costs are efficient, with the plan having been produced using a model which optimises based on cost, and which has been externally assured. While our plan is a Best Value plan, rather than a least-cost plan, the net present cost is very similar to the cost of the least cost plan.

For those options which meet the DPC criteria, we are ensuring that the procurement model selected is the one which delivers the best overall value to customers. Cost efficiency associated with DPC and SIPR processes, derived through competitive tendering of delivery and appropriate risk transfer, weighed against the additional complexity and cost associated with running large procurement exercises, is a key consideration in determining whether DPC, SIPR or neither is the most appropriate procurement model.

Regarding development phase cost efficiency, we described our approach in our RAPID Gate 2 reports. We presented our achievements against a series of efficiency principles including control of work, use of standard methodologies agreed with the All Company Working Group (ACWG),

[19] https://www.wrse.org.uk/media/u4gf5pye/acwg-cost-consistency-methodology.pdf

use of the industry's WRSE models, application of common procurement principles and competition, use of portfolio approaches and project controls.

We have applied the same approach in planning for AMP8. We have built our capability and capacity through establishing an SRO Client team and tailoring our plans, processes, systems and governance to deliver against regulatory requirements (RAPID and DPC) and to satisfy internal and external stakeholders needs. We have procured and are procuring through FY24 new technical and project management professional services suppliers to support delivery of the AMP8 plans, and to prepare for and commence the construction phase.

In forecasting our development phase cost forecasts for PR24 we used our RAPID Gate 3 forecasts (included in the Gate 2 Reports) and the PR19 budget allowances for Gate 4, covering the period up to planning consents and the start of the ITT stage. We then added forecasts to cover the period through to the start of construction based on an assessment of resources and to deliver each SRO's work plan, assuming continued application of the above-mentioned efficiency principles.

We have also undertaken a high-level benchmarking exercise comparing our forecast development spend for each SRO alongside other major infrastructure projects and satisfied ourselves that the SRO spend as a % of CAPEX compares favourably.

For AMP8 we also propose to manage the SRO budget at a portfolio level (discussed in Section 1.6 Customer protection). This will enable us to respond to emerging issues and changing priorities, providing updates to Ofwat on a quarterly basis and where mandated through formal submissions as part of the RAPID gated process and Ofwat's DPC staged process.

## 5.3 Third-party assurance

We have and will continue to use a three lines of defence model for assurance scheduling assurance reviews in an integrated assurance and approvals plan (IAAP) aligned with key milestones on each programme such as the RAPID Gates and DPC Stages. Third party assurance of our approach and expenditure was undertaken and reported on the RAPID Gate 2 Reports stating (based on the information made available) alignment with Gate 2 requirements and that expenditure appeared efficient and relevant.

Since Gate 2 we have undertaken targeted benchmarking exercises on subjects including reference class forecasting for reservoirs and pipelines and targeted independent reviews of the SESRO construction schedule and land and property estimate.

For our PR24 submission we have used the assured Gate 2 cost data and undertaken 1st and 2nd line assurance of both data tables and accompanying narratives.

# 6 Customer protection

We have reviewed Ofwat's guidance on price control deliverables for PR24[20] and confirm that our WRMP supply side enhancement spend meets the 1% materiality threshold for wholesale water and consider that customer protection is essential.

There are no common performance commitments (PCs) / outcome delivery incentives (ODI) that apply to the WRMP supply side enhancement spend, and we are not proposing any bespoke PCs/ODIs for this in AMP8. This is because most of the spend (95%, £398M out of £411M) is for developing our SRO's and therefore customer protection will continue to be provided through the existing mechanisms set up for RAPIDs gated process, detailed at the end.

We have two schemes that are non-SROs and therefore outside of RAPID's gated process. However, we do not consider setting a price control deliverable (PCD) to be appropriate for these schemes; this is because:

- The spend included for Didcot RWE import is to enable the payment of an agreed fee to RWE. This will be covered by a binding contract.
- The Addington groundwater scheme will be fully delivered in AMP8. This is too small to warrant a separate PCD.

### RAPID Gated Process Customer protection

Significant scrutiny of the SROs is provided by RAPID and the requirement for each of the schemes to go through a gated process. At each gate, companies must submit information about their work on a solution, which is assessed to ensure companies are making progress on investigation and development of solutions. Ofwat also decides whether companies should continue to be allowed funding to further investigate and develop a solution to the next gate.

The purpose of the gated process is to ensure at each gate that:

- Companies are progressing strategic water resource solutions that have been allocated funding.
- Costs incurred in doing so are efficient.
- Solutions merit continued investigation and development.

The key elements of the customer protection provided through RAPID's gated process are:

- The customer protection varies at each gate.
- There is a mechanism to return unrequired funds where schemes no longer proceed.
- There are penalties of up to 30% to incentivise on time and high-quality submissions.
- Cost sharing mechanisms are included from Gate 3 onwards.
- The process allows companies to justify and increase funds.

[20] IN-2305-Further-guidance-on-price-control-deliverables-for-PR24.pdf (ofwat.gov.uk)

*Table 7: Summary of the different stage gates and the customer protection provided*

| Stage gate | Customer protection provided |
|---|---|
| Gate 1 – initial concept design and decision making | Up to 30% of each company's total efficient spend (for the gate) as a penalty for submission delay or poor-quality deliverables (incorporating completion of gate activities and required certainty of outputs). |
| Gate 2 – detailed feasibility, concept design and multi-solution decision making | Up to 30% of each company's total efficient spend (for the gate) as a penalty for submission delay or poor-quality deliverables (incorporating completion of gate activities and required certainty of outputs). |
| Gate 3 - Developed design, finalised feasibility, pre-planning investigations and planning applications. | Up to 30% of each company's total efficient spend (for the gate) as a penalty for submission delay or poor-quality deliverables (incorporating completion of gate activities and required certainty of outputs).<br>For solutions that progress to gate three and beyond, cost sharing is applied to the ring-fenced development allowance for each solution on a cumulative basis. This cumulative cost sharing after gate two applies to efficient underspend or overspend and will use a 50% sharing rate[21] with customers. |
| Gate 4 - Planning applications, procurement and land purchase | TBC by RAPID |
| Gate 5 - | TBC by RAPID |

Thames Water is working collaboratively with other partners on five SROs – Severn to Thames Transfer; London Water recycling; Southeast Strategic Reservoir Option; and transfers to Affinity Water and Southern Water. The gate 2 reports for each of the SROs were submitted to RAPID on 14 November 2022 and published on our website[22]. RAPID published its final decision at the end of June 2023. with agreement that all expenditure to date has been efficient and was not subject to any penalties. Our plans to proceed with developing solutions to the next RAPID Gate 3 were also endorsed.

As can be seen in Table 8: Planned dates for our Stage Gate submissions the current forecast for Gate 3 submissions for all the SRO schemes Thames Water are leading, fall late in AMP 7 so should ensure that expenditure between Gate 3 and Gate 4 is efficient and based on robust plans developed for the Gate 3 submission. Gate 4 and, if needed, Gate 5 submissions will fall within AMP8 and will again ensure that plans are robust, options are viable, and costs are efficient in the development phase of the SRO projects up to the projects being construction ready.

[21] 50% share applies to all TW SROs excluding STT which has 0% or no cost sharing for Gate 3 as set out in the STT Gate 2 final decision stt-solution-gate-2-final-decisions.pdf (thameswater.co.uk)

[22] Strategic water resource solutions | Regulation | About us | Thames Water

*Table 8: Planned dates for our Stage Gate submissions*

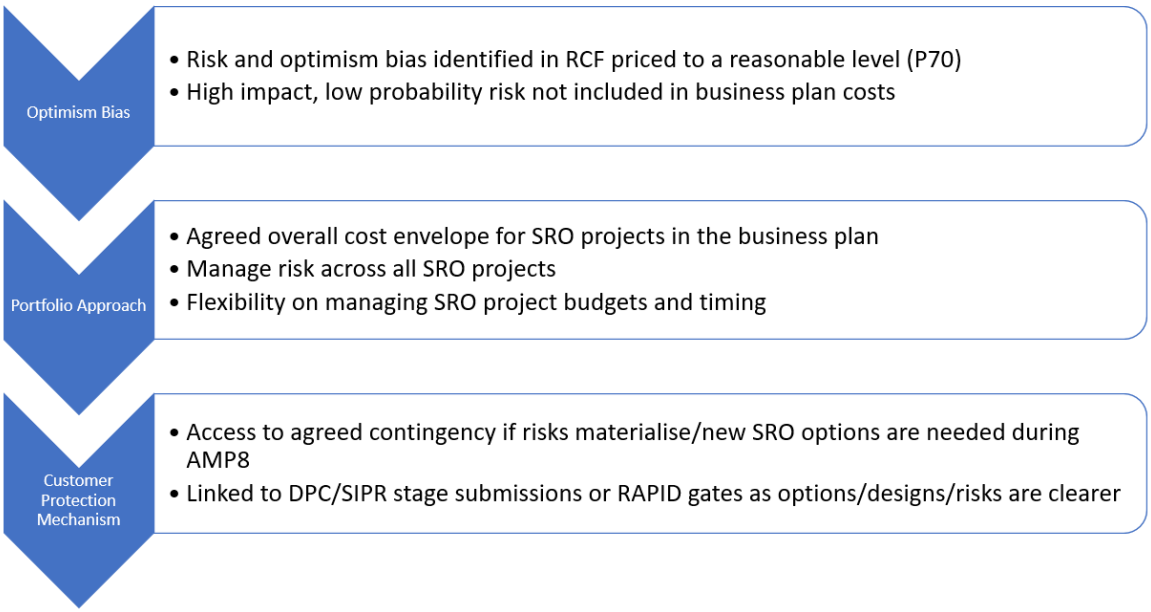
| Scheme/RAPID stage gate | Gate 3 | Gate 4 | Gate 5 |
|---|---|---|---|
| SESRO | January 2025 | November 2026 | July 2027 |
| Teddington DRA | Summer 2024 | Spring 2026 | N/a |
| STT | March 2025 | September 2026 | August 2025 |
| London Recycling (Beckton) | Gate 3 checkpoint only, no Gate 3 date set | Not set | Not set |

To protect customers during AMP8 we are seeking to reduce the uncertainty associated with the SROs to economic levels. While development of the SROs is progressing to plan, at this early stage of solution development there exists significant uncertainty about the composition and timing of the portfolio of SRO projects and significant risk associated with the delivery of each project.

[redacted]

We have commissioned a Reference Class Forecasting study to help understand cost uncertainty at this stage of the development of similar projects to the SROs. This uses outturn data to show the effect of all risks that have arisen in the reference schemes, including strategic risk. This analysis shows that there is still significant risk exposure more than the current contingency allowances. We understand that it is uneconomical for customers to fully fund all the uncertainty at this stage of development of the SRO programme so are therefore proposing a mechanism which provides controlled access to additional funding in the event of excess risk crystallising. Our approach to managing uncertainty and protecting customers from excessive cost is summarised in Figure 8. Our approach is discussed in more detail in Annex A.

*Figure 8: Proposed approach to managing uncertainty.*




To help us deliver the SRO programme to time and cost, a programme partner will be appointed. The programme partner will bring expert knowledge to the development and delivery of major projects and will help projects to be delivered efficiently and using best practice techniques. Where appropriate we will structure partner arrangements, so they are incentivised for their outperformance incentives linked to programme health for driving the right behaviours. They will always follow the principle that there must be a proven benefit to customers either on time or cost or a benefit to wider society. While we have included the cost of these incentives in the development and delivery budget of the SROs, and we intend that incentive payments will be paid out of any savings to the programme because of overperformance by the programme partner against set targets or from us being able to mitigate certain programme risks.

# 7 Adaptive planning

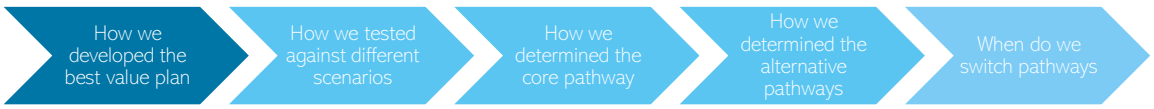
Adaptive planning ensures that the preferred programme identified in the WRMP is flexible and resilient to different futures. Our approach identifies where thresholds and trigger points for alternative adaptive pathways exist, providing the basis for monitoring and review of the strategy and interventions, mitigating the risk that short-term decision making might reduce or jeopardise choices in the future.

Adaptive pathways provide clarity on the decisions that may need to be taken to address future uncertainties, and agility/flexibility to respond to the latest data; for example, climate science, population growth, or policy goals for environmental improvement and providing increased drought resilience. This avoids the risk of being 'locked-in' to specific inflexible solutions and helps communicate and make more timely decisions on investment.

We have followed Ofwat's Long Term Delivery Strategy (LTDS) guidance by prioritising no or low regret activities, demonstrating the benefits of planned investment against future uncertainties and risks, and by optimising investment appropriately to profiles of the investment drivers. Our approach to adaptive pathway planning has considered:

- A wide range of plausible futures
- A substantial range of feasible solutions that could be deployed to meet the future scenarios
- Thresholds and trigger points that determine alternative decisions or pathways
- A framework for monitoring against those thresholds and trigger points
- Those solutions that are common to all futures and which may form the core of the strategy formulation
- The range of alternative decision or pathways and the potential trade-offs and risks of investing in emerging options sooner or later

## 7.1 How we developed our best value plan




A best value plan is defined within the regulatory guidelines for water resources planning and is described as one that, 'considers factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and society'[23]. We have utilised this approach in developing our optioneering stage via the DWMP framework.

The best value planning methodology was developed through Water Resources Southeast (WRSE) and has been subject to external audit, as outlined in the WRSE quality assurance method statement[24]. The process for generating, testing, and identifying the best value plan can be summarised into the following seven key stages:

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[23] *Water Resources Planning Guidelines*

[24] Method statements and audit reports are available on the WRSE website Supporting documents | Water Resources Southeast (engagementhq.com)

Stage 1: Data validation

In the data validation stage, a data landing platform (DLP) tool was used to collate and check the input data required to feed the optimisation model. This ensures consistency across the different data sources. In the main this data falls into two categories:

- Information used to identify the planning challenges (i.e. data that enables us to identify the problem)
- Information on potential options that could be used to meet the planning challenges [i.e. data on our options to solve the problem)

Stage 2: Decision Making Framework

To develop a Best Value plan, we first need to set its objectives – these are the specific goals that the regional plan and out WRMP must aim to deliver relating to 'Best Value'. We've used insight from water company customers and stakeholders across the Southeast to help us understand their priorities, so our objectives are representative of what matters most to them.

Each objective is represented by a set of value criteria (i.e. categories against which the objective can be tested) which, in turn, each have an associated metric that will measure the additional value it delivers. The value criteria represent a broad range of assessment criteria, for example SEA benefits and disbenefits, natural capital and biodiversity net gain. We use the criteria and metrics to assess the different water resource programmes that are produced through our investment modelling.

We set out our objectives, criteria, and metrics, making it clear what things our plan must do (constraints), should do (a combination of both constraints and decisions), and could do, which we can make decisions on to produce a balanced best value plan that meets those objectives.

Stage 3: Baselining and solution development

In this stage we explain the range of modelled potential alternative futures and how we have established a baseline position. We also describe how we develop programmes of options to meet those futures.

Stage 4: Assess solutions

We use visualisation tools to help us display, filter, and identify alternative solutions for further investigation, potentially trading-off performance against each of the value criteria to identify a set of alternative plans based on cost and best value performance.

Stage 5: Sensitivity testing

The alternative plans are examined in more detail to see how they perform and how robust they are. This included:

- Stress testing (i.e. how would the solution change if key options were no longer available or if we make different policy assumptions)
- Environmental review (i.e. examining in-combination effects of the options selected in certain programmes)
- Resilience review (i.e. examining the sub-metrics and wider hotspots)

Each alternative plan has different metric outputs. We must consider how these alternative 'best value plans', trade off benefits and dis-benefits between value criteria, and confirm priorities in selecting a candidate overall Best Value Plan.

Stage 6: Select the Candidate Overall Best Value Plan

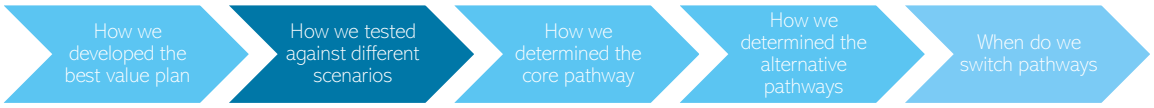
We select a candidate overall best value programme, based on the modelling output (in this section), and then confirm or change this based on wider considerations and feedback (in Section 11 of the WRMP Main Report[25]).

Stage 7: Consultation

We have carried out a public consultation on our draft proposals and produced a Statement of Response detailing our consideration of and response to the feedback provided.

Due to changes in base information and updates to policy, we have repeated the programme appraisal process (Stages 1-6) and re-stated the updated findings in the revised WRMP24.

## 7.2 How we tested against different scenarios




Before developing a plan and testing it, it is necessary to consider which tools and methods are used to develop future scenarios and solve any supply demand problems identified. The Water Resources Planning Guideline (WRPG) advocates a risk-based approach. Our problem characterisation stage of WRMP concluded that the region as a whole is at high risk and that complex methods for examining and solving the problems identified are warranted.

As such, we developed a more complex technical approach to adaptive planning than that set out in the LTDS. The main difference is that our approach can model multiple different futures, upfront, simultaneously, then brings them together to justify a preferred plan.Both techniques seek to identify low regret solutions through an adaptive planning approach.

Our WRMP and the Regional Plan for Water Resources on which it is based considers 50-year projections for population growth, environmental need, climate change impacts. It also considers key policy dates, such as for increasing drought resilience to a 1:200 return period as soon as possible, and a 1:500 return period by 2039/40.

We have derived:

- Five different population growth scenarios (Housing-plan based and trend-based)
- Twenty-eight (+ median) climate change scenarios
- Four different environmental scenarios

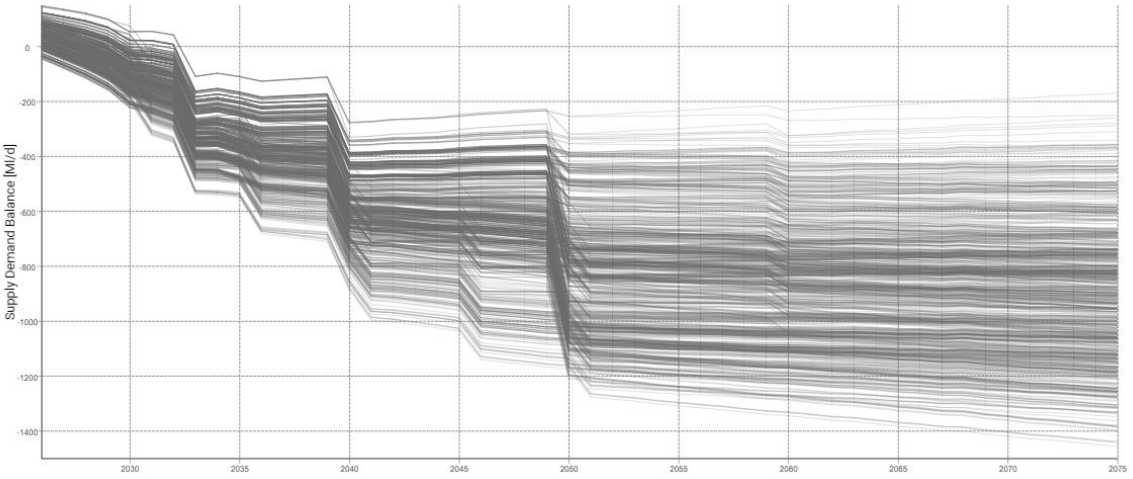
We do not know how these different scenarios may combine in the future, and there is therefore considerable uncertainty and a wide range of potential future challenges that we need to plan for. We will continue to monitor and update these scenarios over future iterations of the plan, but we need to plan now for the full range of potential futures we face.

To ensure that the full range of potential future challenges is planned for, we combine the population growth, climate change and environmental scenarios together in differing

[25] Section 11 The overall best value plan, revised draft WRMP August 2023

combinations. This results in many different potential future water need pathways, covering the full range of challenges that we face.

*Figure 9: Range of future forecast supply demand balances (TWUL, DYAA)*



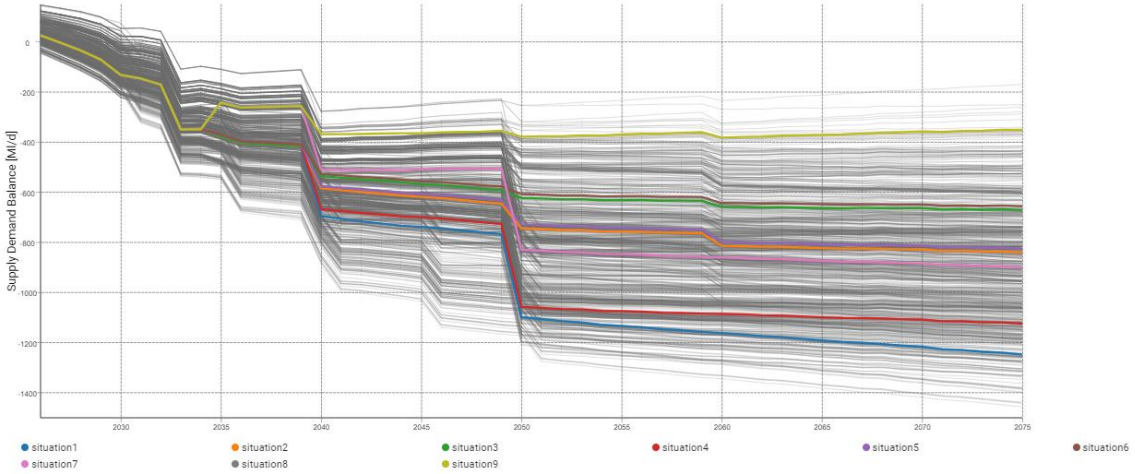

We can see that in the early part of the planning period the lines are relatively closely grouped, as there is less variability in the forecasts in the short term. However, by the middle of the planning period the spread between the lines increases, as the range of potential futures, and the corresponding impacts on the supply demand balance, increases. By the end of the planning period the range between the most challenging and least challenging future is very significant.

It is therefore not only the magnitude of the individual potential future challenges, but also the range between them and how this could change over time, which drives investment choices.

We can test individual futures (as per the LTDS framework) or we are able to choose a set of branched pathways (9) across the range of futures and solve them simultaneously (as is done for the WRMP). With the WRMP approach:

- there is a single core pathway between 2025 and 2035
- from 2035 there are three pathways are based on high, medium and low scenarios for demand
- from 2040 each of these pathways subdivides into three pathways based on assumptions for high, medium and low climate change and environmental destination assumptions. Maximum and minimum demand assumptions are also factored in to the most adverse and most benign of the nine pathways from this date.
- assumptions. Maximum and minimum demand assumptions are also factored in to the most adverse and most benign of the nine pathways from this date.

*Figure 10:Range of future forecast supply demand balances, with pathways highlighted (TWUL, DYAA)*




The LTDS common reference scenarios are a set of benign and adverse scenarios covering four material drivers of uncertainty (climate change, technology, demand and abstraction reductions).

How these align with the WRMP/WRSE scenarios (in red) is shown in the figure below.

*Figure 11: Mapping LTDS and WRMP scenarios*

| | Climate change | Technology | Demand | Abstraction reductions | Wider scenarios |
|---|---|---|---|---|---|
| 'Adverse' scenarios | High: RCP 8.5<br>WRSE CC: 15 | Slower: slower development than expected<br>Companies scheme costs | High: higher growth forecasts.<br>WRSE: Hplan + Gov policy C+ | High: 'Enhanced' scenario (in England)<br>WRSE: Enhanced ED | Material local or specific factors as appropriate<br>WRSE: Cost and timing IVM tests |
| 'Benign' scenarios | Low: RCP 2.6<br>WRSE CC: 27 | Faster: faster development than expected<br>Companies scheme costs | Low: lower growth forecasts and legislation on building regulations and product standards<br>WRSE: ONS18 + Gov policy C+ | Low: Current legal requirements (in England and Wales)<br>WRSE: BAU+ | Parameters between reference scenarios. E.g. medium scenario as appropriate<br>WRSE: scheme scenarios |

Given the combination of growth, climate change, delivery dates and technology solutions there are 120 different scenarios. The range of future challenges considered by the LTDS compared with those in the WRMP / Regional Planning process are different, with LTDS only considering a narrower range in the upper quartile of the possible ranges.

## 7.3 What we learned from our testing (LTDS, single future)

The table below sets out the supply enhancement investment under different common reference scenarios, single future, non-adaptive. Technology is not included as this scenario is about the speed of solution delivery and is more directly applicable to demand management measures rather than supply enhancement.

*Table 9: Outputs for LTDS scenarios (single future)*

| | Benefit, Date Online | | | | | |
|---|---|---|---|---|---|---|
| Investment | Climate Change Adverse | Climate Change Benign | Demand Adverse | Demand Benign | Abstraction Reductions Adverse | Abstraction Reductions Benign |
| **Drivers** | | | | | | |
| Demand | Benign | Benign | Adverse | Benign | Benign | Benign |
| Reductions | Medium | Medium | Medium | Medium | Adverse | Benign |
| Climate Change | Adverse | Benign | Median | Median | Median | Median |
| **Supply options** | | | | | | |
| Teddington DRA* | 67Ml/d 2033 | 67Ml/d 2033 | 67Ml/d 2033 | 67Ml/d 2033 | 67Ml/d 2033 | 67Ml/d 2033 |
| SESRO | | 30 $Mm^3$ 36 Ml/d 2040 | 30 $Mm^3$ 36 Ml/d 2040 | 30 $Mm^3$ 36 Ml/d 2040 | 75 $Mm^3$ 82 Ml/d 2040 | |
| Severn-Thames Transfer | 104 Ml/d 2060 | | | - | | 104 Ml/d 2055 |
| Beckton water recycling | | | | - | | |
| Other supply schemes 2025-35 | | | | | | |
| Other supply schemes 2035-40 | | | | | | |
| Other supply schemes 2040-50 | | | | | 1 scheme 4.5 Ml/d By 2050 | |
| **Cost** | | | | | | |
| All Plan NPV** | 5,113 | 5,272 | 5,578 | 5,260 | 5,528 | 5,170 |
| Variance to base (%) | -3% | +0.2% | +6% | Base | +5% | -2% |
| Totex to 2075 (£m) | 1,521 | 1,051 | 1,722 | 1,051 | 1,702 | 1,572 |
| Variance to base (%) | +45% | 0% | +64% | Base | +62% | +50% |

* Our decision support tool does not automatically select Teddington DRA under each of the scenarios listed above. Instead, the model opts for many small schemes and a reliance upon other companies' leakage reduction. We are concerned about the deliverability and resilience risks associated with this selection. In the round, we firmly believe that Teddington DRA is the most appropriate project to be selected, as it leaves us with greater certainty of becoming resilient to a 1:200-year drought by 2033. Therefore, it is included in the option section of the scenarios shown above (i.e., where Teddington DRA is selected, there is no credible alternative in that scenario).

** 2020/21 Price base.

From this we can see that demand adverse is a key trigger for resource development in the period to 2035, abstraction reduction adverse is a key driver for the size of the SESRO scheme in 2040 and that in some cases, Severn-Thames Transfer is selected instead of SESRO, later in the planning period.

The table above is a helpful mechanistic view of the impact of individual scenarios on the plan. It flags that abstraction reduction and demand could have most impact on the plan. Our WRMP models a more complex reality that considers the likely combination of adverse and benign scenarios that could occur, as shown in Table 10.

The table below sets out the supply enhancement investment (overall BVP) under the 9 different adaptive pathways developed for the WRMP. When finding a solution, our investment model considers all pathways at the same time rather than considering pathways individually. As such, the model determines whether it is better to hedge against future adverse scenarios or better to wait to develop short lead time solutions in adverse pathways only.

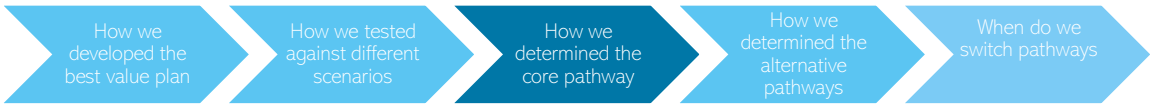
The modelling suggests that it is better to build large cost effective, long lead time solutions to manage the risk of adverse future scenarios and therefore the Teddington DRA and SESRO 150 $Mm^3$ options are selected across all pathways. Because SESRO has a circa 15-year lead time, and because there is a need for water by 2040, a decision about whether to develop this option needs to be made now.

In adverse scenarios, additional investments that are not common to all pathways are made (mostly) post 2040. These investments connect these large schemes to additional parts of our supply network to provide greater resilience across the Region. It is primarily these network investments that account for the difference in totex between the pathways from 2040 onwards.

*Table 10: Outputs for WRMP scenarios (adaptive)*

| | Benefit, Date Online | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Investment | Pathway 1 | Pathway 2 | Pathway 3 | Pathway 4 | Pathway 5 | Pathway 6 | Pathway 7 | Pathway 8 | Pathway 9 |
| **Drivers** | | | | | | | | | |
| Demand | Max | Adverse+ | Adverse+ | Adverse | Adverse | Adverse | Benign | Benign | Min |
| Reductions | Adverse | Medium | Benign | Adverse | Medium | Benign | Adverse | Medium | Benign |
| Climate Ch. | Adverse | Median | Benign | Adverse | Median | Benign | Adverse | Median | Benign |
| **Supply options** | | | | | | | | | |
| Teddington DRA | 67 Ml/d 2033 | 67 Ml/d 2033 | 67 Ml/d 2033 | 67 Ml/d 2033 | 67 Ml/d 2033 | 67 Ml/d 2033 | 67 Ml/d 2033 | 67 Ml/d 2033 | 67 Ml/d 2033 |
| SESRO | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 | 150 $Mm^3$ 149 Ml/d 2040 |
| Severn-Thames Transfer | - | - | - | - | - | - | - | - | - |
| Beckton Desalination | 133 Ml/d 2050 | - | - | - | - | - | - | - | - |
| Other supply schemes 2025-35 | 2 - 52 M//d | 2 - 52 M//d | 2 - 52 M//d | 2 - 52 M//d | 2 - 52 M//d | 2 - 52 M//d | 2 - 52 M//d | 2 - 52 M//d | 2 - 52 M//d |
| Other supply schemes 2035-40 | 4 - 29 M//d | 1 - 15 M//d | 1 - 15 M//d | 2 – 17 Ml/d | 1 – 5 Ml/d | 1 – 5 Ml/d | | | |
| Other supply schemes 2040-50 | 6 – 55 Ml/d | | | 6 – 53 Ml/d | | | 2 – 34 Ml/d | | |
| **Cost** | | | | | | | | | |
| All Plan NPV | 7,162 | 5,851 | 5,848 | 6,249 | 5,863 | 5,860 | 5,964 | 5,820 | 5,820 |
| Variance to Core (%) | +23% | +0.5% | +0.5% | +7% | +0.7% | +0.7% | +2% | Core | 0% |
| Totex to 2075 (£m) | 6,635 | 2,119 | 2,108 | 3,437 | 2,136 | 2,128 | 2,511 | 2,050 | 2.050 |
| Variance to Core (%) | +324% | +3% | +3% | +68% | +4% | +4% | +22% | Core | 0% |

## 7.4 How we determined the core pathway

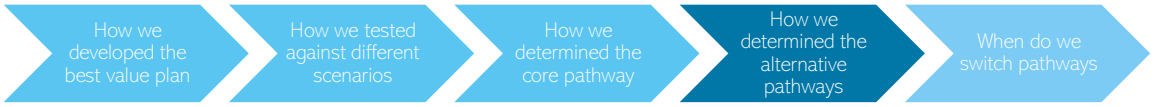



We have used the LTDS, single future, scenarios as a first step to understand the relative importance of each key driver of the supply demand balance. To derive the core pathway, we have assessed the nine pathways developed under the complex WRMP adaptive planning approach.

We have identified 'pathway 8' as being the 'core pathway', as it is required due to the lead in times that would be needed to meet more adverse scenarios. If we do not start with these enhancement cases now, there will be no efficient means of solving future supply gaps should the adverse scenarios materialise. This aligns to the 'needed in the short term' and 'needed to keep future options open' criteria of the core pathway definition.

Importantly, because of the adaptive basis of the assessment the outcomes of the first 10 years of the assessment are stable, with significant programmes of demand management (company and government-led) supported by the Teddington DRA scheme and the transfer of licence from Affinity Water (associated with their Grand Union Canal transfer scheme) and minor groundwater development in the Thames Valley.

## 7.5 How we determined the alternative pathways




Having established our reporting pathway (4), core pathway (8), and 7 other adaptive pathways based on combinations of projections for key supply demand drivers at the outset of our assessment, we model the outcomes adaptively across all pathways, based on cost and on best value performance (environmental and societal metrics and resilience). We also undertake sensitivity testing to understand variations caused by changes to:

- the availability of resource development options to form the solutions (e.g., SESRO, Teddington DRA, Severn-Thames Transfer, Beckton water recycling scheme)
- the potential for underperformance in company and government-led demand management measures
- key policy dates (e.g., Dates for achieving uplifts in drought resilience)
- base supply capabilities (e.g., Gateway desalination, Lower Thames risk and the availability of the West Berkshire Groundwater Scheme).

In all, hundreds of alternatives have been run in the WRSE modelling, which are used to support the overall outcomes put forward and justified in the Regional Plan for Water Resources and individual company WRMPs. This includes sensitivity testing to investigate plans based around alternative strategic solutions.

The investment profile of the nine adaptive pathways within the Overall Best Value Plan, and three alternative pathway 4s containing different option availability, is shown in the table below.

*Table 11:Cumulative totex cost (£m) of each pathway (supply enhancement cost only, price base 20/21)*

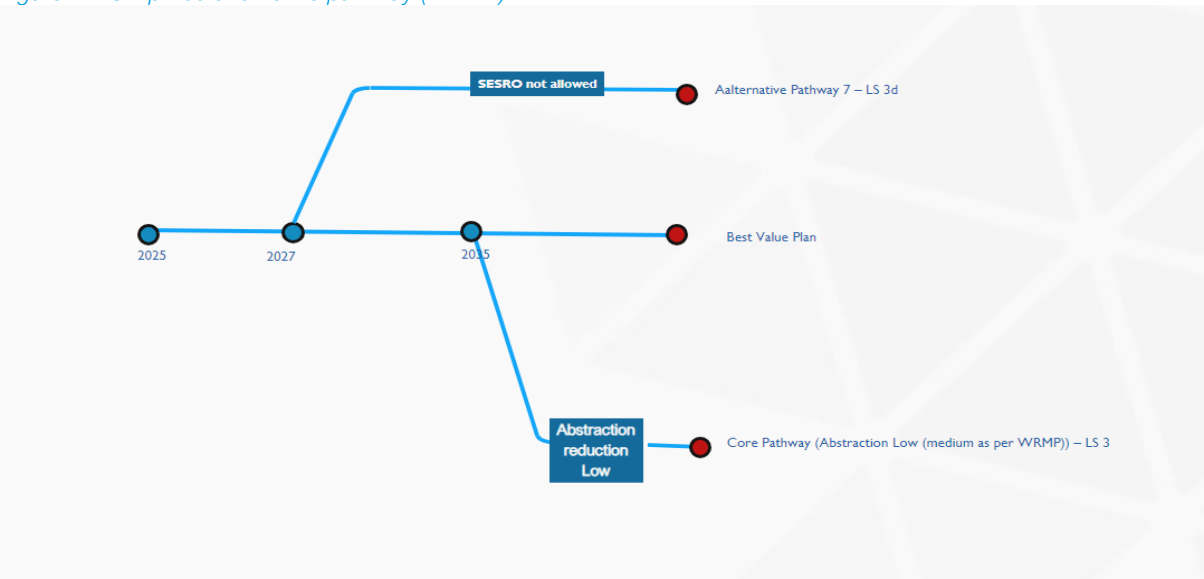
| Pathway | Cumulative totex cost (£m) up to | | | | | |
|---|---|---|---|---|---|---|
| | End 2030 | End 2035 | End 2040 | End 2045 | End 2050 | End 2075 |
| 1 | 305 | 1280 | 1777 | 2283 | 3169 | 6635 |
| 2 | 305 | 1280 | 1692 | 1721 | 1750 | 2119 |
| 3 | 305 | 1280 | 1691 | 1720 | 1748 | 2108 |
| 4 – Reporting | 322 | 1312 | 1783 | 1935 | 2298 | 3437 |
| 5 | 305 | 1295 | 1715 | 1743 | 1771 | 1887 |
| 6 | 305 | 1295 | 1715 | 1742 | 1770 | 2128 |
| 7 | 305 | 1275 | 1661 | 1717 | 1910 | 2511 |
| 8 – Adaptive Core | 305 | 1275 | 1652 | 1679 | 1704 | 2050 |
| 9 | 305 | 1275 | 1652 | 1679 | 1704 | 2050 |
| Sensitivity testing - Different option availability | | | | | | |
| 4 – No SESRO | 123 | 609 | 1750 | 2468 | 3387 | 9021 |
| 4 – Low Gov-led DM | 334 | 1392 | 2052 | 3111 | 6136 | 10799 |
| 4 – Beckton 100 (2033) | 621 | 1825 | 2334 | 2825 | 3721 | 6286 |

As discussed above, the development of the two large strategic resource options (SESRO and Teddington DRA) is common to each pathway and provides a cost-effective core to our plan. The costs across all pathways are broadly the same until 2040. The costs diverge at this point, and our selected pathway (pathway 4) includes additional investment in infrastructure to enable the connection of these large schemes to more widely across the supply network to provide greater resilience.

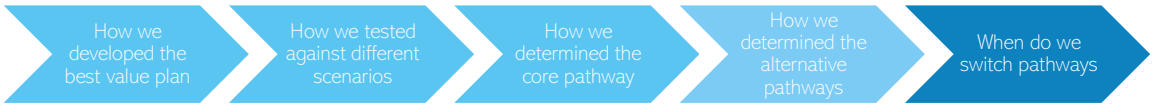
The sensitivity testing on our selected pathway confirms that developing Teddington DRA rather than Beckton water recycling scheme is the most cost-effective option for meeting the 2030s requirement. It confirms that developing SESRO rather than the alternative of the Severn Thames Transfer is the best value option because of lower operating costs. It also shows the importance of achieving the significant demand reductions that will be delivered through the company and government led demand management programmes.

We have simplified this into 3 pathways for LTDS reporting purposes: Adaptive core (pathway 8), Reporting/best value (pathway 4) and no-SESRO (pathway 4 but with no SESRO options available in the option set), as shown in the figure below.

*Figure 12: Simplified alternative pathway (WRMP)*




## 7.6 When do we switch pathways?




Our WRMP incorporates key decision points related to changes in baseline projections in 2030 (growth) and 2035 (abstraction reduction). We have also developed and published Monitoring Plan as part of our WRMP that incorporates this, and timelines related to the development of key options such as Teddington DRA and SESRO.

Our monitoring plan contains two parts: a short-term and long-term plan:

- Short-term monitoring plan:
  - Aims: ensuring that the decisions to progress with the selected Strategic Resource Options are robust, and that consenting is successful
  - Focus: reacting to new information
- Long-term monitoring plan:
  - Aim: identifying whether additional investment, beyond our preferred programme, is required to ensure resilient supplies
  - Focus: assessing progress with delivery, appraising new information, and responding if required

For further information please refer to Section 11[25] of the WRMP Main Report.

# Appendix A: Strategic Resource Option uncertainty and Customer Protection Mechanism

## Background

The Strategic Resource Options (SROs) are being developed across the Southeast region to address forecast increases in demand caused by population growth and climate change. Thames Water will take the lead on several of these schemes based on the need identified in the Water Resources Management Plan (WRMP). Now these schemes consist of the Southeast Strategic Reservoir Option (SESRO), a reservoir in Oxfordshire, the London Recycling schemes and the Severn Thames Transfer. While development is progressing on schedule, at this early stage of solution development there exists significant uncertainty about the composition and timing of the portfolio of SRO projects and significant risk associated with the delivery of each project. To enable effective management of uncertainty we are proposing measures that include a portfolio approach to managing risk across the SROs, and a customer protection mechanism, which will allow additional funding to be accessed provided the effects of unbudgeted uncertainty are evidenced.

## PR24 allowances for uncertainty

The PR24 submission contains forecast costs for the preferred plan set out in the revised draft WRMP (Aug 2023). It includes costs for development, enabling works, land and property and construction costs for non-DPC/SIPR schemes. Those forecasts provide for project uncertainty by including contingency sums - based on principles established in HMT Green Book guidance.

The definition of project risk is assumed to follow standard risk allocation practice in infrastructure projects. Consequently, no allowance is made for the impact of strategic risks. Examples of strategic risks include Adverse Government action (e.g. delays to approval of WRMP or referral to Public Enquiry), changes in legislation/policy, market failures and differential inflation.

PR24 does allow for the full development of SESRO at 150Mm3 and Teddington Direct River Abstraction (TDRA). In addition, limited funding is included for the partial development of Severn to Thames Transfer (STT) and Beckton, to be available as alternatives to SESRO and TDRA, if required. A further allowance is included to acquire additional land at Beckton, should that scheme progress. An allowance is also included for the Lower Thames to the West London Reservoirs scheme, which has yet to be fully defined. PR24 does not allow for the introduction of additional scope to the SRO portfolio or increases in cost as a result of revisions to delivery into service dates resulting from external factors (e.g. Public Enquiry).

## Understanding overall uncertainty

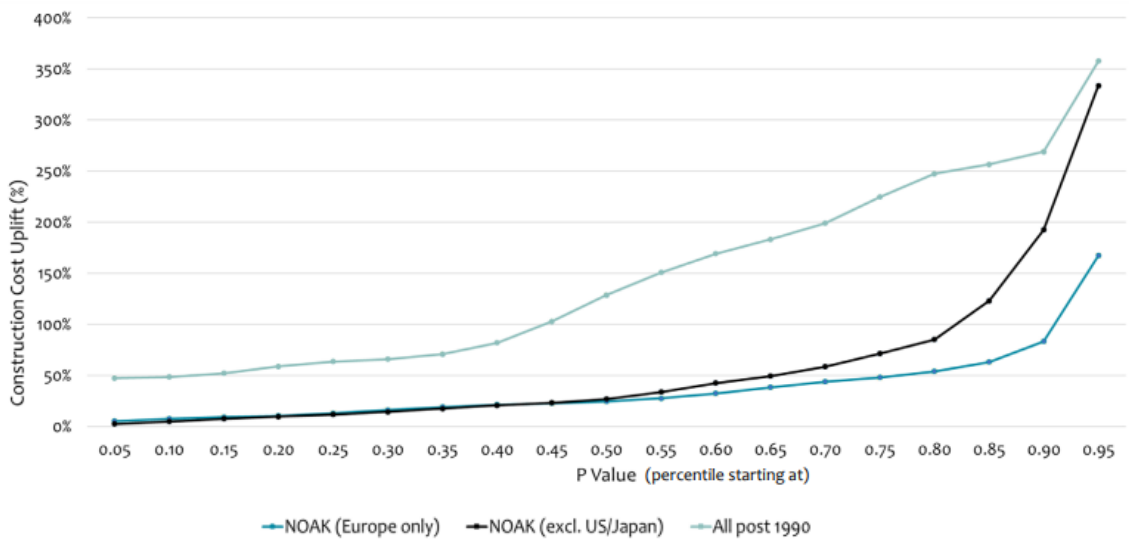
Reference Class Forecasting is a proven benchmarking methodology, which considers overall uncertainty at different stages of the development process. A Reference Class Forecasting (RCF) study was commissioned for the Thames SROs by Oxford Global Projects, covering both pipelines and reservoirs. For reservoirs, outturn cost data from 607 international reservoir and earthwork projects was compared to the cost estimates which were current at the Strategic Outline Case (SOC), Outline Business Case (OBC) and Final Business Case (FBC) stages. For pipelines, 69 projects were considered.

The study shows that by plotting the past historical overrun of projects an appropriate level of contingency can be calculated to match a desired confidence level. We have used this

methodology at PR24 to calculate levels of contingency for SESRO and STT and to enable an understanding of the level of confidence that provides.

An example of RCF can be found in the NIC[26] study on next-of-a-kind (NOAK) nuclear power plants. The graph can be read in several ways. If a desired confidence level is selected on the x-axis, then by reading up to the curve and across to the y-axis and appropriate level of contingency (more than the base cost) can be determined. Alternatively, if the contingency amount is known that can be selected on the y-axis and read across to the curve and down to the x-axis to give a confidence level.

Figure 1. Reference class forecasts – construction cost overruns for NOAK (excl. US/Japan), European NOAK and plants built after 1990.




The 'Major Projects and Direct Procurement for Customers' SUP12 Data table includes allowances for uncertainty based on optimism bias principles, set out in HM Treasury guidance. For Thames' SRO projects, if it is assumed Gate 2 is comparable to a SOC, then the Oxford Global Projects RCF analysis illustrates there is approximately a 70% chance that those allowances will not be exceeded. This is comparable to other major projects when Optimism Bias has been used to estimate contingency allowances at an early stage.

It is important to emphasise that because the RCF uses outturn data it includes the effect of all risks that have arisen in the reference schemes, including strategic risk (e.g. political, decision making, macro-economic conditions, policy objective/scope change etc.). Risks which are typically excluded from project risk allowances.

For the SROs, the Oxford Global Project RCF analysis illustrates that there is a significant proportion of total risk exposure more than current contingency allowances. Typically, it is uneconomic to fund projects to high level of confidence relative to total risk exposure. For

[26]NIC Estimating comparable costs of a nuclear regulated asset base versus a contract for difference financing model page 16 NIC_RAB_Paper_October_2019-3rd-Layout-003.pdf

example, to be 95% confident in the costs of a reservoir scheme at OBC (akin to Gate 3), the analysis would suggest a contingency of approximately 100% is allowed. Instead, it is usual to fund projects to a reasonable level of confidence, often P70-P80, but then recognise that risk more than that will require separate funding or insurance cover should it not be mitigated by other means.

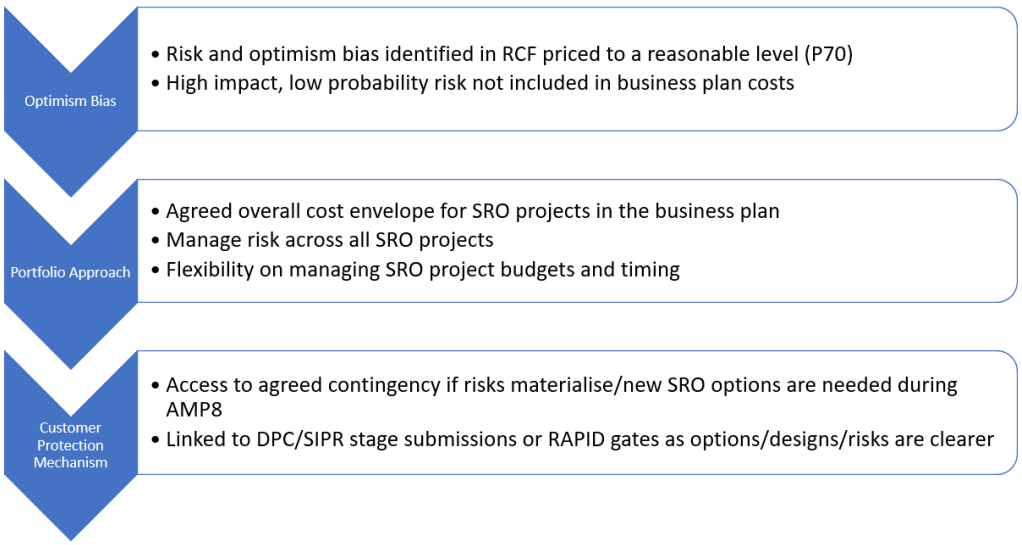
The RCF analysis looks at the whole life costs of reservoir and pipeline projects. If SRO projects are delivered either through Direct Procurement for Customers (DPC) or the Specified Infrastructure Projects Regulations (SIPR) construction costs will be incurred by the Competitively Appointed Provider (CAP) or Infrastructure Provider (IP). While these construction costs are not be included in TWULs PR24 costs, much of the risk mitigation will take place during the development phase of the SRO projects in AMP8 and there are likely to be instances when it is beneficial to increase development expenditure to ultimately lower overall project costs/risk, flexibility to make those trade-offs is important to ensure overall cost efficiency.

### Proposed approach to funding uncertainty

From the RCF analysis it would be uneconomic for customers to fully fund total uncertainty at this stage of development of the SRO programme. In fact, the purpose of the development phase is to reduce that uncertainty to economic levels. Hence, it is proposed that a tiered approach to the funding of uncertainty could be established, which places the emphasis on the project team to manage risk within PR24 allowances, but which then provides controlled access to additional funding should the projects experience risk more than those allowances. Those allowances would then be reviewed as the project progresses through OBC and FBC.

In more detail, it is proposed that, first, allowances are made for reasonable levels of project uncertainty (say P70-80), second, that those allowances are used to manage risk across the portfolio, and finally, that a mechanism is establish to control the availability of additional funding from customers in the event of excess risk crystallising - illustrated in Fig 2.

### Fig 2 – Proposed Approach to Uncertainty



## Portfolio Approach

### Portfolio Management of Risk

It is a well-established[27] principle that for a portfolio of projects, with similar risk profiles, then it is more efficient to manage contingency at the portfolio level. This is because there are some classes of risk that are unlikely to be experienced to the same extent on all projects in the portfolio, and there are some risks that can be better managed by portfolio level action. Consequently, for a given amount, a greater risk exposure can be managed at the portfolio level than by individual project allocations, delivering an efficiency of spend.

In practice, rather than ring-fence discrete allowances against each project, the portfolio approach would see contingency being pooled across the programme, being controlled centrally, and deployed in accordance with the needs of the overall programme. The additional discipline imposed has the further benefit of regulating expenditure.

### Customer Protection Mechanism

To ensure customers do not fund excessive risk without control, it is proposed that a mechanism is established which would require evidence that risk more than that funded has materialised before access to additional funding is provided – to be known as the Customer Protection Mechanism (CPM). An ancillary benefit would be the increased viability of the drawdown of contingency provided to Regulators.

The CPM would provide a clearly defined means of regulating increases in SRO funding in the event that cost overruns cannot be managed within the budgeted risk allowances. In practice, a change process would be established that relies on the project team providing compelling evidence to RAPID of the impact of risks.

It is not proposed that an exhaustive list of qualifying risk is developed - there will be risks that are unknowable. However, risk that might give cause to apply to the CPM could include:

- Late approval of the WRMP impacting submission of a DCO application.
- Referral of the WRMP to Public Enquiry causing delay to the DCO application.
- Changes in legislation or policy causing additional work or delay.
- Market failure – lack of appetite or inability to establish VfM.
- Differential inflation, more than assumptions in PR24.
- Additional scope – New SROs, development of alternative SROs and/or material scope change driven by external factors.
- Force Majeure.

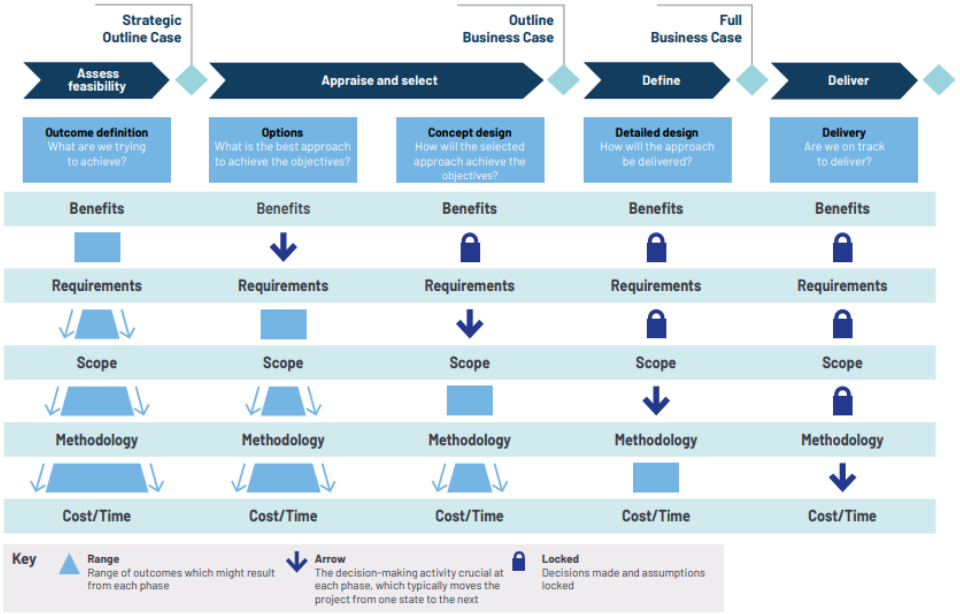
It is anticipated that the high impact nature of such risks will enable agreement to be reached that additional funding is realised from the CPM without excessive calls for evidence.

[27] HMT Route Map Risk Management Module Page 32 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1080243/Risk_Management_-_FINAL.pdf

## Review Points

The RCF analysis shows how uncertainty reduces at projects pass through the development phase. The HMT Route Map illustrates the same point, as shown below:

### Figure 3 – HMT Route Map




PR24 forecasts are based on the Gate 2 submissions, akin to SOC, with Gate 3 equating to OBC and contract award being FBC. It is proposed that the gates could also be used to reconcile costs as projects progress to ensure that they are funded for efficient delivery, while not putting customers at risk of funding excess risk or unviable solutions.

## Final Determination

We have submitted costs in to PR24 based on the emerging revised draft WRMP. Prior to the Final Determination we would propose further cost and risk update which would allow refinement of the allowances for each SRO and allowances at portfolio level. At the same time the unfunded risk could be better quantified and process for the operation of the CPM defined, with the aim of including that in the Final Determination.


Thames
Water