Revised Draft Water Resources Management Plan 2024

Section 11 – The Overall Best Value Plan

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Background and Introduction

What's in this section?

In this section, we present our Overall Best Value Plan (BVP). As required by the National Framework, the Plan is fully consistent with the Regional Water Resources Plan for the South East of England as developed by the Water Resources in the South East Group. It is also compliant with the Water Resources Planning Guideline.

The Plan covers 50 years (2025-75) and addresses the supply demand deficits in each of the six water resource zones (WRZ) in our supply area. The Plan has been adopted as representing the overall best value balance of schemes for the Thames Water area and wider South East region, having regard to affordability, impacts on the environment, the preferences of customers, and the need to manage a range of risks. We have considered the Ofwat public value principles when deriving our plan and our consideration is that the plan aligns with these principles.

The Plan adopts a 'twin track' approach to address the predicted supply demand balance deficits and to meet policy objectives. It consists of demand management and resource development to ensure a resilient and robust plan. Initially the focus is on delivering ambitious programmes of demand management. In the longer-term, when demand management of the use of water can no longer keep pace with the increasing need for water, and therefore there is a deficit in water supply, the plan turns, as it must, to strategic resource development for Thames Water's WRZs and the South East region as a whole.

We set out below the details of the Overall Best Value Plan at Company and WRZ-level, including the profiles of demand management measures and the timings of resource developments and transfers.

The Plan is adaptive and consists of nine pathways. However, in accordance with the WRPG and following detailed and extensive discussions with our regulators, Ofwat and the Environment Agency, we are required to select a preferred programme along a pathway of our best value, adaptive plan. We describe what the best value plan is, following an adaptive approach which allows us to be flexible should future uncertainties prove more or less challenging than currently forecast, and set out our preferred programme along a pathway compliant with WRPG.

We set out the key decision points across the period, highlighting what decisions will be needed and how we will inform those decisions. There are decisions to be made now that will set the direction for water resources in the region and in our supply area. The 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.

We also include a Monitoring Plan that we will use in subsequent Annual Reviews to track our progress with delivering the plan to 2030. We will also use it to take stock as to whether the future is turning out as expected or if we need to change course to a different pathway.

Main changes between our draft WRMP24 and revised draft WRMP24:

Per Capita Consumption and Risk Mitigation

- In our dWRMP24 we identified that we could not describe a resilient and deliverable plan which we could be confident would result in achievement of the 2050 target of 110 l/h/d per capita consumption (PCC). Between dWRMP and rdWRMP our regulators have updated the Water Resources Planning Guideline (WRPG) such that it now states, "if you are a water company in England your preferred programme should deliver a PCC of 110 litres per person per day by 2050 under your dry year annual average scenario". Inclusion of this target in the WRPG is consistent with the national target set out in the Environmental Improvement Plan (HM Government, 2023). In accordance with this guidance, our preferred programme includes demand management measures to be taken by Thames Water and Government which are intended to reduce average PCC to 110 l/h/d by 2050. Decisive government action to deliver household consumption reduction is required to ensure the demand management targets are achieved and to ensure our plan's resilience.
- As described in the dWRMP, the actions which we as a company can take to help customers reduce their demand for water are limited to the installation of water meters, water efficiency interventions, including fixing wastage issues such as leaky loos, and (when sufficient meter penetration is achieved) introduction of tariffs which discourage the excessive use of water. The constraints on measures over which we have control have not changed and, as such, if the 110 l/h/d target is to be achieved, we must assume that the government will take decisive action to reduce household consumption. In our dWRMP, our assumption was that the government would introduce water labelling measures (as has already been committed to) and that this would reduce PCC by 6 l/h/d by 2050. In our revised draft plan, our assumption is that the government will introduce measures which will, in aggregate, reduce average PCC by 24 l/h/d by 2050. We anticipate that these measures will, in addition to introduction of water labelling of white goods, include the introduction of minimum standards on white goods and changes to buildings regulations.
- An average reduction of 24 l/h/d made by our 2050 forecast of over 12 million customers equates to around 300 million litres per day, or around 16% of our 2050 baseline forecast of water supply. This is clearly a very significant amount of water and we do not yet have confirmation from the government regarding the measures that they intend to implement, nor when such measures might be implemented. Placing such heavy reliance on measures outside our control clearly presents a risk to the security of supply in the future. To mitigate this risk, we have presented a comprehensive monitoring plan which looks to the longer-term and identifies when we may need to make additional interventions beyond those in our preferred plan, should the necessary actions not be taken by Government, and what those interventions would be.

Changes to Underlying Supply-Demand Balance

- Between our dWRMP and rdWRMP, we have revised our forecasts of supply and demand using the most up to date information available. Changes are in bringing forward some licence reductions (Farmoor and the River Lee) in our "Environmental Destination" scenarios in order to comply with our regulators' expectations that these will be in place by 2050 at the latest. This accelerates the pace at which new water sources are needed.

Management of Short-Term Risks

- As was highlighted in the Environment Agency's representation to our dWRMP24, there are a range of risks which we face in the short-term. These include the output from our Gateway desalination plant, issues around our ability to abstract from the Lower Thames during low-flow events which were highlighted in the 2022 drought and which may be exacerbated by the River Thames Flood Alleviation Scheme being developed by the Environment Agency and Surrey County Council, and confidence in our ability to sustainably reduce leakage and household consumption.
- To mitigate these short-term risks, we have identified a monitoring plan for the short-term, with trigger points to identify whether we need to make different investment decisions. We have also identified a series of small-scale interventions which we will proceed with in the short-term to further protect the security of our customers' supplies.

Scheme Selection

- As is described in Section 10 of our rdWRMP24, we have undertaken our programme appraisal process using revised information and acknowledging changes in the WRPG, and this has resulted in changes to our option selection decisions in our preferred programme. Our rdWRMP reflects the revised Regional Plan, with the only difference between our plan and the regional plan being that we have included three small options in addition to the WRSE Regional Plan in AMP8 to mitigate risk.

11.1 In this section we present and discuss the BVP as identified in Section 10.

11.2 As required by the National Framework, the plan is fully consistent with the Regional Plan for Water Resources in the South East of England. The revised draft WRMP24 as a whole is endorsed and approved by Thames Water's Executive Team and Board.

11.3 The structure of this section is as follows:

- Presentation of the plan at company-level
- Presentation of the plan at WRZ-level
- A plan summary discussing important overall characteristics of the plan such as:
  - The decision points
  - Environmental assessment
  - Cost (including an estimation of customer bill impact) and carbon emissions
  - Risk and uncertainties which could influence our plan
- The Monitoring Plan – how we will track delivery and changes to the forecast for reporting in Annual Reviews

- A Summary – What is our plan and why have we selected it?

11.4 The decisions made in our proposed BVP are broadly consistent with our WRMP19 and our dWRMP24 but inevitably there are differences (particularly between the dWRMP and rdWRMP), mainly for the reasons set out above due to changes in guidance from our regulators. Overall our conclusions remain consistent and, whilst by no means determinative, this continuity of conclusion helps to give us confidence in our planning processes.

Plans, Pathways and Programmes

11.5 In our WRMP19 we presented a programme of options for each WRZ for the period 2020 to 2100 and referred to the programmes collectively as the preferred plan. We also set out the investments that we would make when considering a single forecast of supply-demand balance for each WRZ. Our WRMP24 takes an adaptive approach, recognising that several of the key factors in our planning present very significant uncertainty in the medium to long-term, to such an extent that to plan for a single future supply-demand balance over a fifty-year period could be very likely to result in either an ineffective or inefficient plan. As described in Sections 6 and 10, we have considered different potential future scenarios of supply-demand balance in order to derive a fully adaptive BVP.

11.6 The nomenclature that we have used for WRMP24 is slightly different to that which we used in WRMP19, due to the application of adaptive planning techniques. We will refer to a ***programme*** of options as those investments which we would make under a given future supply demand balance **pathway** (e.g. invest in option A in 2025, option B in 2035, option D in 2050), and will refer to the combination of programmes of options, future pathways, and decision points as a ***plan***.

11.7 Our aim in deriving our preferred plan is primarily to establish the investment that we need to make in the next five years, while looking to the medium and long-term to make sure that we are making the right decisions in the short-term. As per Ofwat guidance on adaptive planning[1] we are looking to make:

- Low regret investments, that is to say:
  - Those investments which are needed to ensure supply-demand balance in the short-term
  - Investments which would form an efficient programme of investment across a wide range of plausible future scenarios
- Investment which is needed in order that we do not preclude achievement of a supply-demand balance in medium to long-term under future adverse scenarios
- Investments which may be needed in the longer-term under different future scenarios, giving consideration to how our short-term investment decisions may influence the decisions that we could make further into the future
- Investment which is required to keep future options open, for example enabling work or monitoring

[1] 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

Preferred Programme

11.8 There is an inherent tension currently present in the Water Resources Planning Guideline (WRPG[2]), which also exists in the way that we have presented our preferred plan, and preferred programme of options. We are using adaptive planning techniques which are designed to ensure that we have a robust, resilient plan which is efficient in the face of significant uncertainty, but should also describe a single preferred programme of options which we should lay out in the tables that accompany our WRMP. Section 1.1 of the WRPG states that we should present our preferred programme as the pathway through the 'most likely' future. Given that the major uncertainties present in our planning are exogenous factors which we cannot influence (population growth, the impact of climate change, and future licence reductions determined by environmental legislation, alongside risks posed by the requirement to plan on the basis of achieving a 50% reduction in leakage and 110 l/h/d PCC, both by 2050), careful consideration is necessary to determine what a 'most likely' future scenario would be. In the development of our draft plan we considered the WRPG and engaged in pre-consultation with the Environment Agency to determine which future pathway would be most suitable to consider when presenting our preferred programme.

11.9 As described in Section 10, rather than formulate our adaptive plan based on stochastic analysis of different future supply-demand balance pathways, we have, as part of the Water Resources South East (WRSE) regional group, decided to determine future supply-demand balance pathways as being formed of discrete scenarios associated with exogenous factors. We have a single supply-demand balance pathway for the immediate future, three supply-demand balance pathways in the medium term associated with different population growth scenarios, and nine supply-demand balance pathways in the long-term in which each of the three medium-term scenarios is split into three, considering different climate change and environmental destination scenarios. We have taken this approach because it allows us to best describe meaningful future pathways (e.g. ***"under a high population growth scenario"***, as opposed to ***"in the 75th percentile of possible future supply-demand balances"***), and because it allows us to show compliance with aspects of guidance.

11.10 We therefore have a choice of nine supply-demand balance pathways along which to describe our preferred programme of options, all of which are initially common. These pathways are presented and discussed in Section 6 and Section 10. We have chosen pathway 4, for the reasons described below.

11.11 Pathways 1-3 are based on high demand forecasts, pathways 4-6 are based on 'local authority plan-based' demand forecasts (identified in the WRPG as being what our planning should be based on and therefore a policy requirement for us to follow), and pathways 7-9 are associated with lower demand forecasts. As it is specified in the WRPG, our preferred programme needs to ensure a supply-demand balance assuming a local authority plan-based demand forecast, i.e. along either pathway 4, 5 or 6. Our programme appraisal has therefore emphasised the outcomes from plans and programmes associated with these pathways more strongly than outcomes for other pathways. The difference between these pathways is that pathway 4 considers 'High' environmental destination and climate change scenarios, pathway 5 'Medium', and pathway 6 'Low'.

[2] EA, Ofwat, Natural Resources Wales, 4th April 2022, 'Water resources planning guideline, version 10', page 91 - 92

11.12 The National Framework for Water Resources[3], published in March 2020 sets the environmental ambition required to address unsustainable abstraction between 2025 and 2050 on a national scale. The Framework sets out that Regional Water Resource Plans are required to develop an agreed environmental destination to achieve sustainable abstraction. WRSE worked with the Environment Agency and all water companies in the South East region to develop agreed Environmental Destination scenarios. Five scenarios were developed, of which three ("Low", "Medium" and "High") are incorporated into our supply-demand balance pathways and the Regional Plan. Supplementary guidance[4] states that companies and regional groups should use scenarios set out in Appendix 4 of the National Framework for Water Resources[5], which were developed by the Environment Agency on the basis of ensuring compliance with Environmental Flow Indicator (EFI) calculations, in essence applying the precautionary principle in planning required future licence reductions. The supplementary guidance states that the "BAU" scenario should be used as the starting point to demonstrate compliance with statutory and regulatory requirements, and the "Enhanced" scenario used "to identify where it may be necessary to provide enhanced protection to buffer from climate change impacts". For Thames Water, the "BAU+" and "Enhanced" scenarios give similar required abstraction reductions (of around 450 Ml/d for the BAU+ scenario and around 500 Ml/d for the Enhanced scenario) and so, as is described in Section 5 of our WRMP, we developed our "High" scenario to include reductions consistent with the "Enhanced" scenario, and developed "Medium" and "Low" scenarios using a different approach to ensure a range of scenarios is considered in our adaptive plan (recognising that a degree of uncertainty exists in identifying licence reductions which will be required in the future). In order to meet the requirements of the National Framework and guidance, and to meet the expectations of our regulators, we have adopted the "High" scenario in our preferred programme – this scenario features in pathways 1, 4 and 7.

11.13 In pathways 1, 4 and 7, a "High" climate change scenario is also used, which is around a 75th percentile of climate change impacts when considering all of the UKCP18 projections (all emissions scenarios). The Environmental Destination scenarios in Appendix 4 of the National Framework for Water Resources are based on a severe climate change scenario (the driest of the scenarios from the Future Flows[6] dataset) and thus use of this climate change scenario is consistent with use of the "High" Environmental Destination scenario.

11.14 In conclusion, given that, in accordance with the WRPG, we are required to follow local authority plan based population projections (pathways 4-6), and that the "High" environmental destination scenario should be adopted (pathways 1, 4 and 7), 'pathway

[3] Environment Agency, 2020, Meeting our future water needs: a national framework for water resources, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872759/National_Framework_for_water_resources_main_report.pdf

[4] Environment Agency, 2020, Long-term water resources environmental destination – Guidance for Regional Groups and Water Companies, https://wre.org.uk/wp-content/uploads/2021/02/201012-Long-Term-Destination-Guidance-FINAL.pdf

[5] Environment Agency, 2020, Water resources national framework – Appendix 4: Longer term environmental water needs, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872344/Appendix_4_Longer_term_environmental_water_needs.pdf

[6] Prudhomme, C., Dadson, S., Morris, D., Williamson, J., Goodsell, G., Crooks, S., Boelee, L., Davies, H., Buys, G., Lafon, T., and Watts, G., 2012, Future Flows Climate: an ensemble of 1-km climate change projections for hydrological application in Great Britain, Earth Syst. Sci. Data, 4, 143–148, https://doi.org/10.5194/essd-4-143-2012

4' is the future supply-demand balance pathway along which our preferred programme should be described, and is the pathway which we apply most consideration to in our programme appraisal.

Presentation of Preferred Plan

11.15 The way that we have presented our preferred plan has also changed slightly from WRMP19, due to the nature of the planning problem we are solving, and the methods that we have applied in solving this problem. In WRMP19 we presented a preferred plan for each WRZ individually, which was possible because the solutions identified were, to a reasonable degree, independent of one another, with our London WRZ having by far the largest supply-demand balance problem to solve and so dominating option selection decisions. The greater scale of potential supply-demand deficit in our Thames Valley WRZs, driven by the potential for large volumes of licence reduction under future "high" environmental destination scenarios, means that large supply-side solutions may be required for many of our WRZs in the next 25 years, and not only in our London WRZ. Additionally, Southern Water and Affinity Water have also forecast large needs for water in the future. These factors lead to the selection of large, strategic solutions which would serve customers across the WRSE region, rather than individual resources being built to serve customers of a single WRZ.

11.16 As required, our plan reflects the WRSE regional plan. Within this document, we have first presented the major schemes contained within the WRSE plan which are relevant to our supply area, described in the Section below as "The Plan at Company Level". We then present the preferred plan and preferred programme of options for each individual WRZ, with the WRZ-level plans being further cascaded versions of the regional plan.

11.17 The starting point for building our preferred plan has been the least cost adaptive plan for the WRSE region, described in Section 10. From this base we have used the programme appraisal approach to develop a BVP.

11.18 Consistent with WRMP19, demand management activities form the largest element of our plan for each WRZ, particularly in the short-term.

11.19 All plans presented assume that we improve our resilience to drought events over time, reducing the risk that we would need to impose emergency restrictions on our customers during an extreme drought event. We will move to a '1 in 200-year' level of resilience by the early 2030s (0.5% annual chance of occurrence of emergency drought restrictions), and a '1 in 500-year' level of resilience by 2039/40 (0.2% annual chance of occurrence of emergency drought restrictions) as required by the WRPG and government expectations. Alternative dates are tested as part of the sensitivity analysis.

Governance of the selection of our overall Best Value Plan

11.20 We presented our programme appraisal analysis to the Thames Water Executive and Board during 2021-2023, explaining our decision-making processes. We also held technical discussions with Executive and Board sub-committees.

11.21 In addition to governance within Thames Water, the WRSE governance groups, notably the Oversight Group and Senior Leadership Team, have unanimously approved the WRSE preferred plan, which our plan reflects, as required by the National Framework.

The Plan at Company-level

Demand Management

Our Customers' Views

11.22 Through both the consultation on our draft WRMP and via customer research, we have gained a firm understanding of what our customers think about leakage and consumption reduction, and what customers think the role of demand management in our overall plan should be. We have considered these views when building our plan.

11.23 Reducing leakage has been highlighted as being a top priority for customers. Customers find current levels of leakage unacceptable and think that we need to act decisively to reduce the amount of leakage. Customers largely support the government target of 50% leakage reduction by 2050. Some customers think that we should reduce leakage further or faster than our dWRMP, while others recognise that disruption may be caused if we fix a large amount of water pipes, particularly in a heavily populated area such as London, and so feel that 2050 is an appropriate target.

11.24 Customers generally support action to reduce water consumption, and as such are supportive of smart metering as an effective way of helping people become more water efficient, though customers tend to feel that Thames Water should reduce its leakage before it asks customers to reduce their usage. Some customers think that we should be lobbying the government to take more action on water efficiency by introducing water labelling, minimum standards, and buildings regulations changes. While the government's ambition of achieving 110 l/h/d per capita consumption (PCC) is supported, customers are also supportive of an approach which recognises that this is a very ambitious target, and that if it is not achieved the region could run out of water. As such, customers are supportive of Thames Water taking a proactive approach to mitigating risk in this area.

Our plan

11.25 In our dWRMP24 we identified that we could not describe a resilient and deliverable plan which we could be confident would result in achievement of the 2050 target of 110 l/h/d PCC. Between dWRMP and rdWRMP our regulators have updated the Water Resources Planning Guideline (WRPG) such that it now states, "if you are a water company in England your preferred programme should deliver a PCC of 110 litres per person per day by 2050 under your dry year annual average scenario". Inclusion of this target in the WRPG is consistent with the national target set out in the Environmental Improvement Plan[7]. In accordance with this guidance, our rdWRMP24 preferred programme includes demand management measures which are predicted to reduce average PCC to 110 l/h/d by 2050. Decisive government action and interventions to deliver household consumption reduction are required to ensure our plan's resilience.

11.26 As described in the dWRMP, the actions which we as a company can take to help customers reduce their demand for water are limited to the installation of water meters, water efficiency interventions including fixing wastage issues such as leaky loos, and (when sufficient meter penetration is achieved) introduction of tariffs which discourage the excessive use of water. The constraints on measures over which we have control have not changed, and as such, if the 110 l/h/d target is to be achieved, we must assume

[7] HM Government, 2023, Environmental Improvement Plan 2023, We met our leakage targets in 2021-22, https://www.gov.uk/government/publications/environmental-improvement-plan

that the government will take decisive action to reduce household consumption. In our dWRMP, our assumption was that the government would introduce water labelling measures (as has already been committed to) and that this would reduce PCC by 6 l/h/d by 2050. In our revised draft plan, our assumption is that the government will introduce measures which will, in aggregate, reduce average PCC by 24 l/h/d by 2050, which we think will require introduction of water labelling, minimum standards on white goods, and changes to buildings regulations.

11.27 In Section 8 of our WRMP, we describe in detail the different actions which we could take to reduce leakage and consumption of water, and how we have created different demand management programmes, including how we have prioritised different interventions within a given programme. We presented our investment modelling tool with 'high' and 'high plus' company-led demand programme options (we also presented the model with 'low' and 'medium' scenarios in sensitivity testing, although these programmes do not meet government policy expectations and so were not considered as "feasible" options). The 'high' demand management scheme was selected in cases where the model was presented only with programmes which meet government expectations, as the additional cost of making greater demand reductions in the 'high plus' scenario was shown to be prohibitive.

11.28 Our demand management programme is the largest component of our plan throughout the planning period, particularly so in the short-term (Figure 11-1). Everything aside from the bottom section of each bar is demand management in some form. This figure also demonstrates that significant government-led initiatives will be needed to drive household consumption reduction, and that government-led demand reduction alone represents 29% of our total supply-demand balance need by 2050.

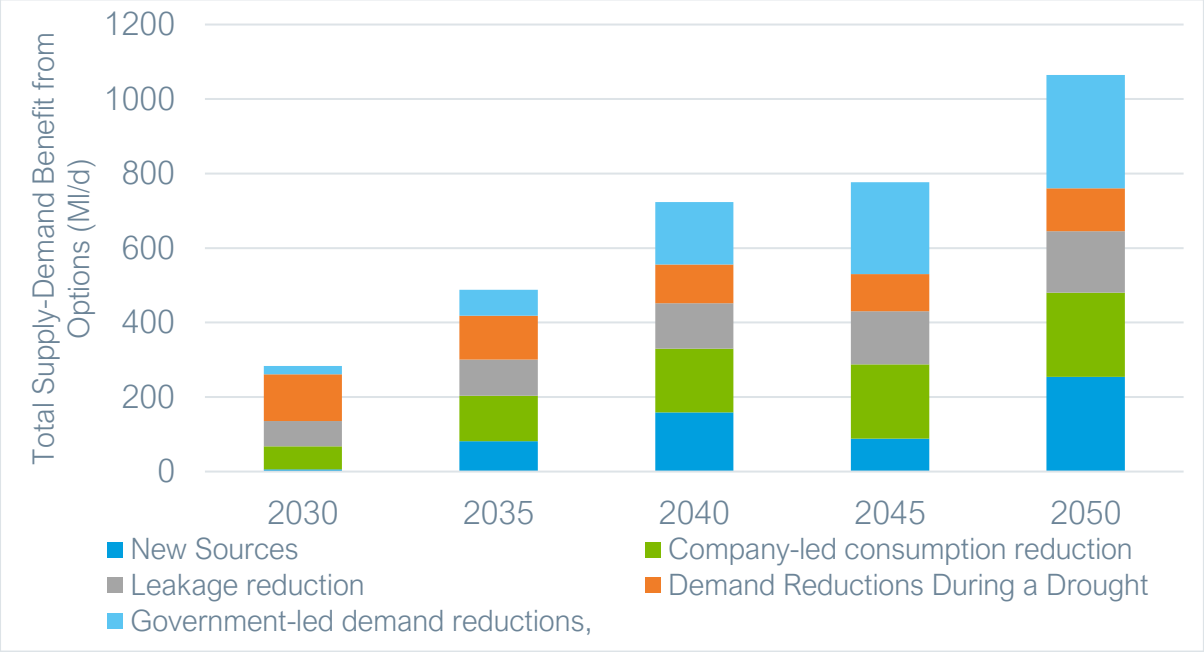

Figure 11-1: Contribution of Different Types of Option to our Preferred Programme

11.29 Overall, our plan contains more demand reduction activity than is economically optimal (i.e. more than a true least-cost plan would require), as was the case in the WRMP19,

driven by our policy objectives in this area. Future water mains rehabilitation programmes, which form a large part of our demand management programme, are necessary to reduce leakage by 50% when compared to 2017-18 levels. This activity is expensive relative to other options in delivering supply-demand balance benefit. The total volume of demand reduction in our "High" programme up to 2050 is shown in Figure 11-2. In our dWRMP, company-led demand management actions accounted for 324 Ml/d and government-led actions accounted for 73 Ml/d of demand reduction. In our rdWRMP, company-led demand management actions account for 430 Ml/d and government-led actions account for 305 Ml/d. The primary increase in our company-led demand reduction action is the volume of non-household (NHH) demand reduction, with planned NHH consumption reduction being 26 Ml/d in the dWRMP and 96 Ml/d in the rdWRMP, in order to facilitate achievement of the Environmental Improvement Plan targets of 9% reduction in NHH consumption by 2037-38, 15% NHH consumption reduction by 2050, and 20% reduction in Distribution Input per capita by 2038.

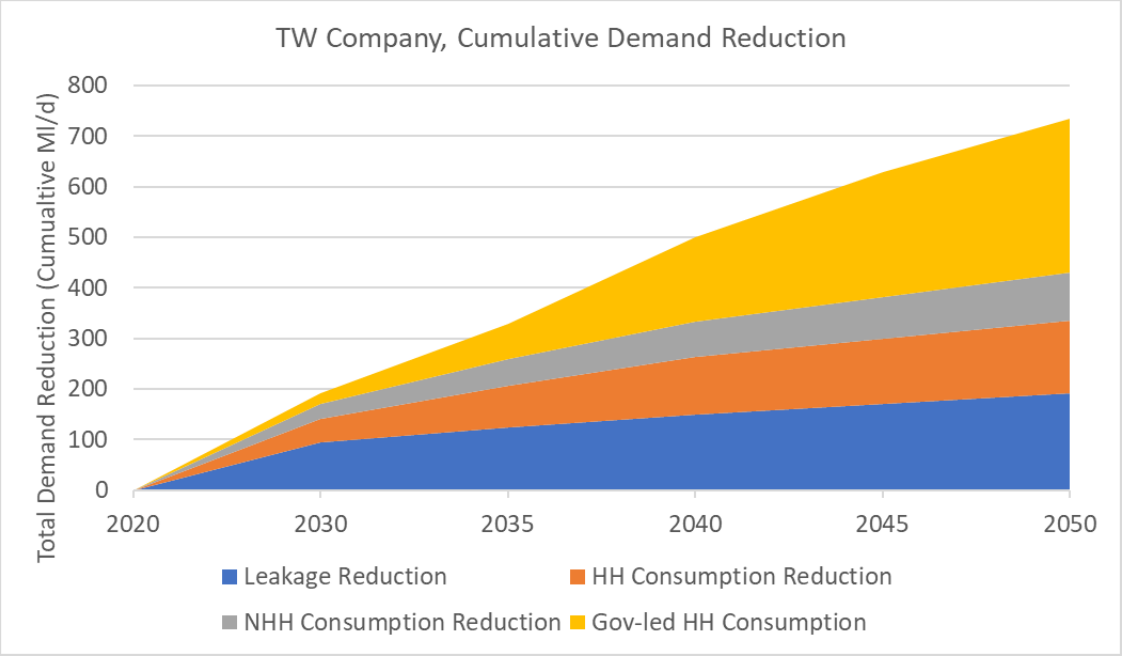

Figure 11-2: Total Demand Reduction (Company-level)

11.30 Our company-led programme is one that is evidence based and which we consider strikes a balance between ambition and the risk of under-deliverability of demand reductions. We have included leakage and consumption reductions that would be delivered through 'innovative' activities (which are not yet known) but have limited the volume of reductions that we assume would be delivered through these as yet unknown means. If we were to over-rely on these measures, there is a risk that these may not materialise, posing a risk to security of supply for our customers and further stress and pressure on the environment.

11.31 Company-led interventions alone, which we can be reasonably confident in, would result in a company-wide Dry Year Annual Average (DYAA) PCC figure of 132 l/h/d by 2050. There is a clear gap between the government ambition of 110 l/h/d by 2050 and the interventions that we as a water company can make in encouraging people to use less water. The 2022 summer heatwave and drought showed marked increases in customer water usage; the impacts of climate change on the likelihood and severity of future

droughts and heatwaves may mean that there is more to do to achieve the 110 l/h/d target which would require further government intervention.

11.32 We now break down our demand management programme by component: Leakage reduction, household demand reduction (company and government-led) and non-household (NHH) demand reduction, before providing a tabulated summary of activity.

Leakage Reduction

11.33 We met our leakage targets in 2021-22, but the hot and dry summer of 2022 (causing a high soil moisture deficit and thus soil movement, causing leaks) and December freeze-thaw event have contributed to significant increases in burst water mains and associated leakage, and as a result we fell short of our 2022-23 leakage target. Notwithstanding this, we have a leakage action plan which will see leakage reduce from 620 Ml/d (2022/23) to 507 Ml/d (2024/25).

11.34 Our leakage reduction programme delivers the industry ambition and government priority of 50% leakage reduction by 2050, compared to 2017-18 levels. This includes an 19% reduction (96 Ml/d) in AMP8. In 2030 our total company leakage will be 411 Ml/d, compared to 699 Ml/d in 2017-18 (a 40% reduction) and 620 Ml/d reported in 2022-23 (a 33% reduction).

11.35 The total leakage reduction activity required between 2025 and 2050 to meet the 50% leakage reduction target is 194 Ml/d. This is in addition to 123 Ml/d of leakage reduction that is being carried out during AMP7. Our leakage in 2050 will be 314 Ml/d, compared to 699 Ml/d in 2017-18.

11.36 In AMP8, a significant proportion of leakage reduction will be achieved through reduction in customer-side leakage, enabled by our smart meter upgrade programme. Installing smart meters allows us to see where leaks are likely to exist on customer-owned pipes by analysing data, and we are then able to undertake targeted fixes. This makes it a cost-effective activity.

11.37 When we have significantly reduced customer-side leakage and have exhausted the activities that we can take in active management of leakage, in order to make continued progress in leakage reduction we will need to undertake mains rehabilitation. This is the most expensive demand reduction option, but this action is necessary if we are to reduce leakage significantly.

11.38 Figure 11-3 shows how we plan to reduce our total company leakage across the planning period, and so how we will progress towards the target of 50% leakage reduction by 2050. By 2030, we will have made significant progress towards the 50% leakage reduction target and will already have reduced leakage by over 40% compared to 2017-18 levels by this point.

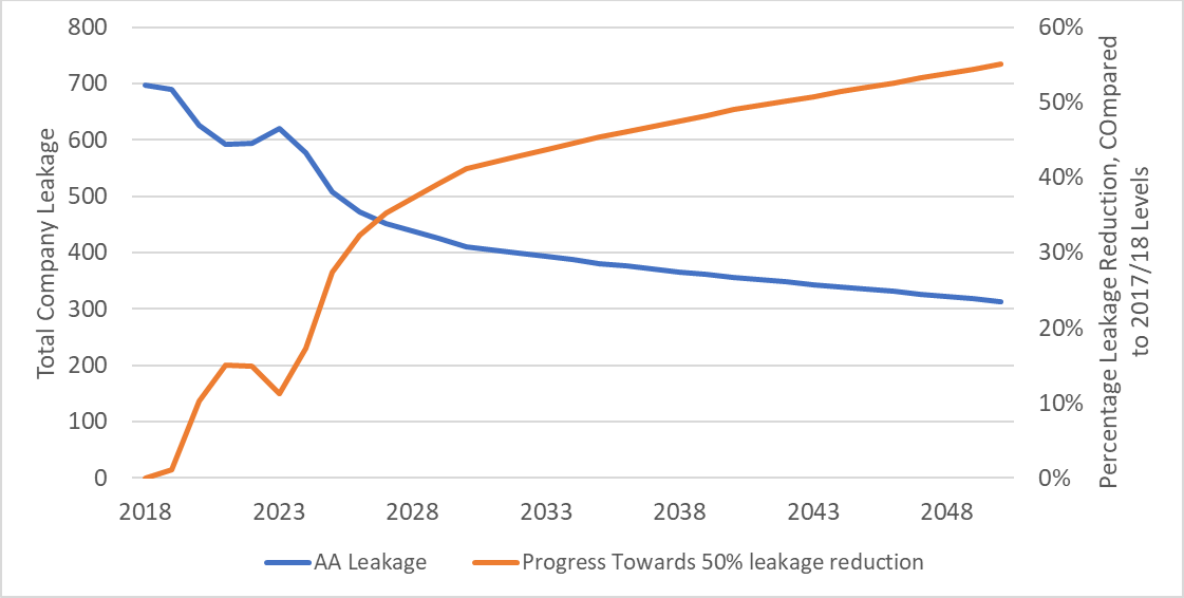

Figure 11-3: Leakage (Ml/d) and progress towards 50% leakage reduction target (Company-level)

Note: AA means Annual Average

Household Demand Reduction

11.39 Household demand reduction will be brought about by a combination of company and government-led measures.

11.40 We will install more meters in AMP7 than we set out in our WRMP19, with our 'Green Economic Recovery' (GER) programme aiming to install over 200,000 additional meters across our Thames Valley WRZs.

11.41 In AMP8, in addition to any carry-over activity which is necessary to complete our AMP7 metering programmes, we will install or upgrade over 800,000 meters. Around 650,000 of these will be upgrades from existing 'normal' meters to 'smart' meters. The installation of smart meters will give us an opportunity to detect wastage and leakage, allowing us to target fixes and communication where it will have the most benefit. In addition to these upgrades, we will install new meters on domestic properties, and bulk meters which will measure the water use of large buildings such as blocks of flats.

11.42 By 2030 we will have completed our main progressive metering programme (PMP, our compulsory metering programme) and will have finished most of our programme of smart meter upgrades. In the 2030s we will finish our programme of smart meter upgrades and will install more bulk meters, which will provide usage per building rather than individual billed property. During the 2030s we also aim to install an additional 900,000 meters in properties where it has so far been impracticable to do so. By 2030 we will have a 74% meter penetration, which will rise to 92% by 2040 (Figure 11-4).

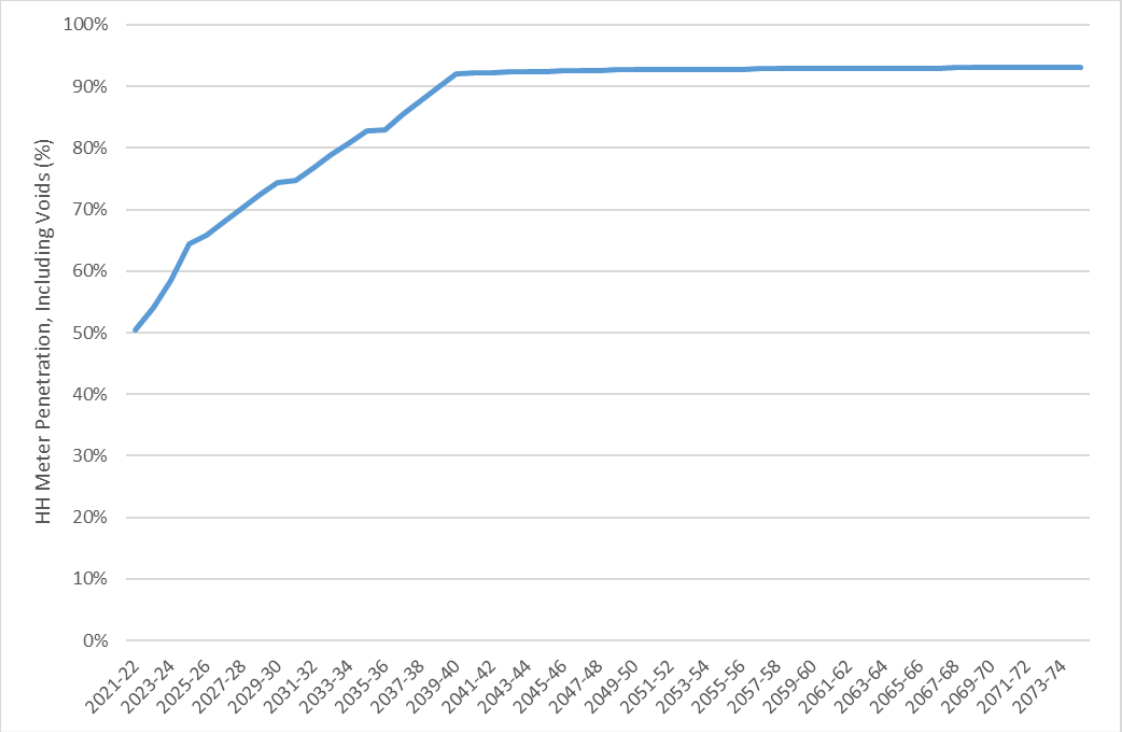

Figure 11-4: Thames Water Household Meter Penetration, Including Voids (%)

11.43 When we have a sufficiently high proportion of metered properties, we plan to introduce tariffs in which the cost of water will rise incrementally with water use. This will incentivise those who use an exceptionally high amount of water to reduce their usage, although evidence from abroad[8,9] suggests that the elasticity of demand for water may not be sufficient for tariffs to have a marked impact on overall PCC.

11.44 Throughout the planning period we will continue to promote water efficiency, building digital engagement tools to do so. Data obtained from smart meters will allow us to target engagement.

11.45 Figure 11-6 shows the total reduction in household demand that we anticipate due only to actions that we will undertake. Our Final Plan PCC forecast can be seen in Figure 11-5. In this figure, the role of government can be plainly seen, with separate PCC forecasts for a plan involving only company-led actions and a plan with company- and government-led actions.

[8] Reynaud, A. and Romano, G. (2018) Advances in the economic analysis of residential water use: An introduction, Water, 10, 1162-1172

[9] Joint Research Centre Technical Reports Modelling Household Water Demand in Europe. Insights from a cross-country econometric analysis of EU-28 countries. Arnaud Reynaud 2015 EUR 27310 EN

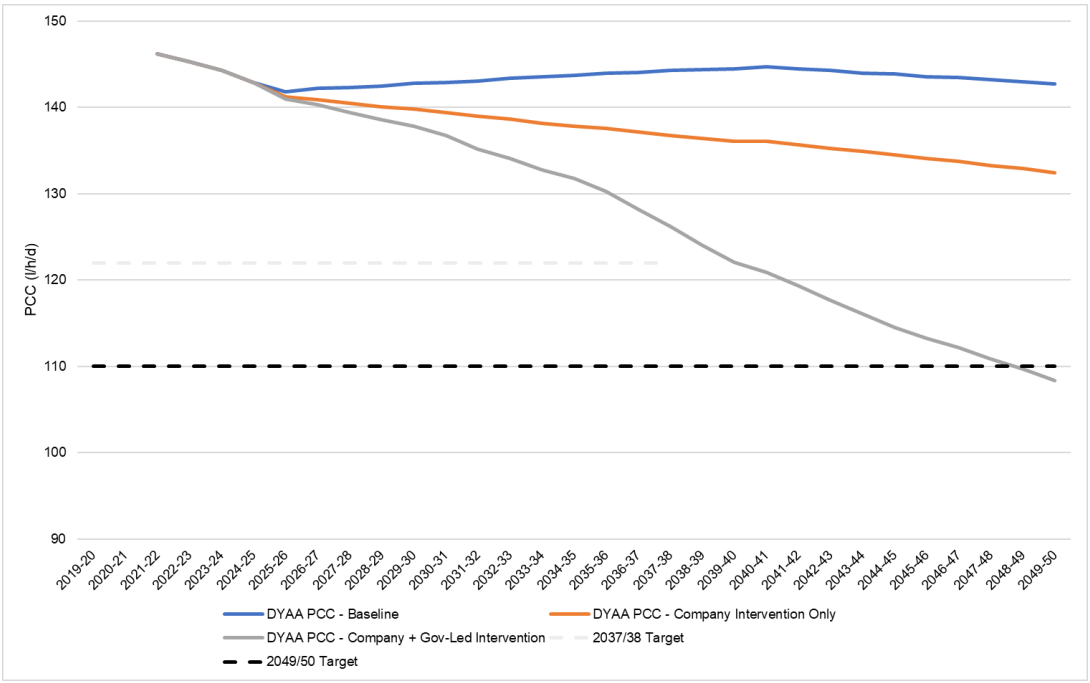

Figure 11-5: Company-wide PCC Projection

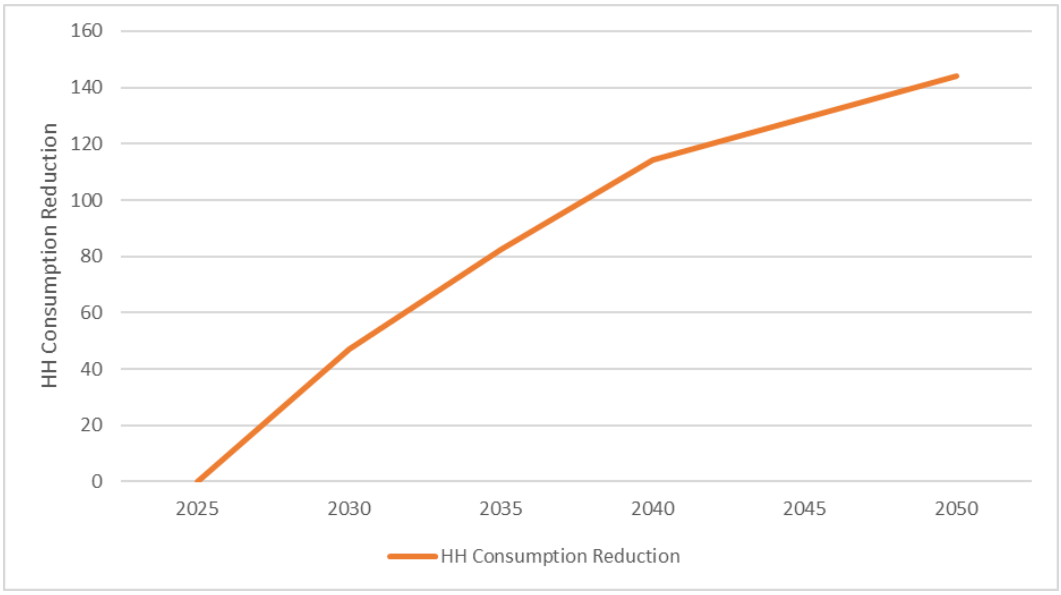

Figure 11-6: Company-led household demand reduction

Government-led Reductions

11.46 In addition to the activities that we can instigate, our plan relies on the government continuing, and expanding, its action to promote water efficiency. To inform estimates of how much water government-led actions could save, WRSE looked at different sources of evidence regarding the effectiveness of interventions which the government

could introduce[10], with the report being shared with government and wider stakeholders. The three main government policies that our plan relies upon are:

- Water labelling, without a requirement for minimum standards. We have assumed that this policy will be enacted very soon, beginning from 2025, with 6 l/h/d benefit delivered by 2035.
- Water labelling, including a requirement for minimum standards, enacted from 2030 with an additional 6 l/h/d benefit delivered by 2045.
- Full government support, including action to reduce water use in new developments, assumed to be in place from 2035, delivering an additional 12 l/h/d benefit by 2050.

11.47 Using methods and data analysis aligned with the WRSE Regional Plan, our plan assumes that government-led actions will result in reduced household consumption of 24 l/h/d by 2050, which in aggregate across our 2050 forecast of over 12 million customers equates to around 300 million litres per day, or around 16% of our 2050 baseline forecast of water supply, or 29% of our forecast supply-demand deficit. This is clearly a very significant amount and we do not yet have confirmation from the government regarding the measures that they intend to implement, nor when such measures might be implemented. Placing such heavy reliance on measures outside our control clearly presents a risk to the security of supply in the future. To mitigate this risk, we have presented a comprehensive monitoring plan (see later section) which looks to the longer-term and identifies when we may need to make additional interventions beyond those in our preferred plan.

Non-household Demand Reduction

11.48 As well as making efforts to reduce household consumption, we will continue to undertake significant activity to reduce NHH demand. This will include installation of smart meters on NHH properties (around 120,000 by 2035), water efficiency savings enabled by our Smarter Business Visits, targeted NHH continuous flow fixes, and the development of new NHH tariffs.

11.49 The NHH demand reduction profile set out in the rdWRMP is significantly larger than the NHH demand reduction programme from our dWRMP. The enhanced plan for reductions is in response to the Environmental Improvement Plan targets of 9% and 15% reduction in non-household usage by 2038 and 2050 respectively. This increase in planned reduction, a response to government policy to which our planning must adhere, again brings risk which is addressed through our monitoring plan.

Demand Management Programme Summary

11.50 Table 11-1 shows the activity and resultant benefit of our company-level demand management plan, as well as the number of meters that we will install, up to 2050.

[10] Water Resources South East, 2022, Government demand management savings and implementation profiles, https://www.wrse.org.uk/media/tp2jdo5o/wrse-defra-demand-management-savings-profile-report-november-2022.pdf - please note, an updated version of this report will be published to accompany the final WRSE Regional Plan

	Supply Demand Benefit (Ml/d)				
Company	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	26.00				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering CSL	1.68	2.04	0.00	0.00	0.00
Bulk metering CSL	22.65	2.79	1.82	0.00	0.00
Replacement metering CSL	12.25	3.74	0.00	0.00	0.00
Mains replacement	2.78	15.10	13.49	10.00	10.39
Leakage innovation	1.62	1.69	5.09	10.90	10.99
Metering innovation CSL	0.00	0.00	0.44	0.00	0.00
Advanced DMA Intervention	26.37	4.37	4.45	0.00	0.00
Total leakage reduction	93.36	29.74	25.28	20.90	21.38
AMP7 Carry-over metering	13.50				
Household metering	8.59	0.00	0.00	0.00	0.00
Non-household metering	0.47	2.35	0.00	0.00	0.00
Household water efficiency	17.61	7.92	0.00	0.00	0.00
Non-household water efficiency	28.40	22.00	16.50	14.00	12.00
Metering innovation	2.00	14.83	18.32	0.00	0.00
Innovative tariffs	5.21	12.66	13.69	14.70	15.00
Total usage reduction	75.78	59.75	48.51	28.70	27.00
Total benefit from DMP	169.13	89.49	73.80	49.60	48.38

	New & Replacement Meters				
Company	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	55,295	61,225	48,988	0	0
Household Metering (New)	191,786	323,901	416,528	0	0
Household Metering (Upgrades)	645,491	337,512	80,763	0	0
Non-Household Metering (Upgrades)	60,411	58,737	0	0	0

Table 11-1: Preferred Plan – Demand Management Programme – Company Level

Supply enhancement

Key Questions

11.51 The scale of supply-demand deficit in the Thames Water supply area and the wider WRSE region means that, despite the extensive and ambitious demand management programme which has been described, new sources of water supply will be required. In our planning we have considered the supply-demand balance needs under the nine pathways of the adaptive plan, but have given most consideration and weight to pathway 4, as this pathway aligns with guidance and the expectations of our regulators, and the supply-demand balance pathway along which we describe our preferred programme. In this pathway, while the need for new sources of water is not immediate, the long processes of planning, consenting, and construction mean that decisions must be made well in advance.

11.52 In Section 10 of our rdWRMP, a Candidate Overall Best Value Plan is identified. This plan was identified using the WRSE investment model, which is a regional-level decision support tool. This appraisal considered the overall costs of different plans and programmes, as well as carbon emissions and wider Best Value metrics. In Section 11 we take this candidate plan and appraise it more broadly to identify whether we should adopt this plan, or whether alterations should be made. Our consideration is that the Best Value approach taken aligns with Ofwat's public value principles.

11.53 Our programme appraisal journey, described in Section 10, has led us to consider that major supply-side investment will be required to provide additional sources of water for at least two key points in our programme, with the timing of the need for these new sources aligned with the major step-changes in our supply-demand balance. These are the early 2030s, when we aim to increase the level of drought resilience offered to our customers such that emergency restrictions would not be required more often than once every two hundred years, and 2040, when we plan to increase the level of drought resilience offered to our customers such that emergency restrictions would not be required more often than once every five hundred years. The decisions made regarding the provision of new supplies at these points in time should consider the other general trends in our supply-demand balance, which are a gradual deterioration of the supply-demand balance over time due to forecast population growth and climate change impacts, and a step-change (deterioration) in 2050 associated with supply reductions to enable our environmental destination.

11.54 As is discussed in Section 10, analysis of the investment model runs indicates that there are clear, low-regrets supply-side solutions that meet our needs for new supplies in the early 2030s and 2040. These are the Teddington DRA (a new abstraction on the River Thames close to Teddington Weir, with abstraction compensated for by the transfer of highly treated recycled water from Mogden sewage treatment works) and the South East Strategic Reservoir Option (also known as SESRO, a new storage reservoir which would be sited in the Upper Thames catchment, south west of Abingdon in Oxfordshire), respectively. These findings are consistent with our WRMP19 and dWRMP24.

11.55 In the draft WRMP24 we identified that we could reasonably proceed with either the 100 Mm^3 or 150 Mm^3 reservoir options, with the draft plan appraisal indicating that the 100 Mm^3 reservoir resulted in a plan which performed better from an environmental standpoint, and the 150 Mm^3 reservoir resulted in a plan which was more resilient to risks. As is described in Section 10 of our rdWRMP24, our revised programme appraisal (Section 10) leads us to consider that the 150 Mm^3 option should be adopted in our rdWRMP24 Candidate Best Value Plan.

11.56 In the draft WRMP24, regardless of whether we adopted a 100 Mm^3 or 150 Mm^3 SESRO, we identified that additional sources were required in the long-run (2050) to enable licence reductions to meet our environmental destination. Section 10 of our rdWRMP24 identifies that, if we adopt a reservoir larger than 75 Mm^3 and demand management interventions result in achievement of the 110 l/h/d target, further major investment is not required until at least 2060. However, we should consider whether additional investment would present best value to our customers and the region as a whole.

11.57 Based on the Candidate Plan identified in Section 10, in this section we provide a summary of the programme appraisal analysis, in order to answer the following questions:

- Question 1: Why is Teddington DRA the best value option for provision of 1 in 200-year drought resilience by the early 2030s?
- Question 2: Why is SESRO the best value option for the provision of 1 in 500-year resilience?
- Question 3: Why is 150 Mm^3 the preferred size of SESRO?
- Question 4: Are there additional supply-side options which may be needed after 2040 to provide a Best Value solution for the longer-term?

Decision-making process, and key decision-making factors

11.58 Having carried out our BVP analysis we have been able to distil the Thames Water portion of the regional planning problem into the questions listed above. We now summarise the programme appraisal journey and answer these questions, considering the modelled programme appraisal and incorporating considerations outside the modelling.

Investment Modelling - Least Cost Programme

As explained in Section 10, the first step in our decision-making was to find the 'least cost' adaptive plan which satisfied supply-demand balance in all years of the planning horizon, in all WRZs across the WRSE region. The specific definition of "least cost" specifically considers the net present cost (i.e., discounting future costs according to government guidance) of the options in the plan, including the monetised social cost of carbon emissions (again, calculated according to government guidance), but in this step we do not consider environmental or resilience metrics. The large options of relevance for Thames Water selected by the model for the least cost adaptive plan in 'Pathway 4' were as seen in Table 11-2.

Option Name	WRZ	DO	Year First Used
Teddington DRA	London	67	2033
SESRO, 150 Mm^3	London	271	2040
Oxford Canal	SWOX	12	2040
South East Water Import	Guildford	10	2050

Table 11-2: Large options (> 20 Ml/d for London and > 10 Ml/d for Thames Valley) Selected in Pathway 4 of Least Cost Adaptive Model Run

11.59 SESRO, 150 Mm^3 variant is used to provide water to a number of WRZs:

- Thames to Southern Transfer, 120 Ml/d variant, used from 2040 onwards
- Thames to Affinity Transfer, 50 Ml/d used from 2040 onwards, and an additional 50 Ml/d constructed for use from 2045
- Thames Water zones – London (from 2040, via the River Thames), SWOX (from 2040, via pipeline transfer), SWA (from 2050, via a new abstraction at Medmenham), and Kennet Valley (via the Thames to Southern Transfer spur)

11.60 This plan is similar to our dWRMP adaptive least cost plan, with other large options from 2050 removed, due to the assumed achievement of the 110 l/h/d target by 2050 in our rdWRMP leaving a diminished need for new sources, compared to the dWRMP which did not assume achievement of this target.

11.61 These options were selected by our investment model in this order because:

- Teddington DRA is the cheapest of the water resources options which can provide enough water for us to increase our drought resilience in London to a 1 in 200-year level, and which we can construct by the early 2030s. The option has both lower capital costs and lower operational costs than alternatives.

- Solving the regional supply-demand balance deficit in pathway 4 requires a major new resource development in the west of the Thames catchment due to the large deficit in the west of the WRSE region. We have investigated through sensitivity runs, and the magnitude of the deficit means that either a reservoir or the STT must be constructed. The least-cost way of fulfilling this need is with SESRO (150Mm^3). In order to establish why SESRO forms part of our least cost plan, we conducted a sensitivity test using the WRSE investment model where we excluded all SESRO options, which forced the selection of the Severn Thames Transfer. The "pathway 4" programme cost for the WRSE region is around £600 million more expensive in Net Present terms, highlighting that SESRO is a clearly more cost effective option for the WRSE region. The 150Mm^3 SESRO variant is selected because larger reservoir sizes are most cost effective and because the total regional need in pathway 4 exceeds the Deployable Output of even the largest reservoir size (i.e., some, more expensive, additional sources are needed in the WRSE region, and selection of larger reservoir sizes reduces the need for these more expensive additional solutions) – for example, a 150Mm^3 reservoir delivers around twice the supply benefit of a 75Mm^3 reservoir, for around only 25% additional cost. The cost difference between programmes involving different sizes of SESRO is less marked than the difference between the cost difference between SESRO and STT-centric plans, with "pathway 4" programme costs for plans including 125 Mm^3, 100 Mm^3, and 75 Mm^3 being £150m, £220m, and £310m more expensive than the "least cost" plan, respectively.
- In the dWRMP there was a sufficiently large supply-demand balance requirement to drive the selection of another large option in the Thames Water area in 2050, due to the large licence reductions in the "High" environmental destination scenario. In the rdWRMP these licence reductions remain (the supply-demand balance deterioration in our London WRZ alone between 2049 and 2050 is nearly 250 Ml/d), but our preferred programme is based, as it must be to comply with guidance, around the achievement of the government's 110 l/h/d PCC target. Achievement of this target would deliver sufficient supply-demand balance benefit to mean that, with the selection of a reservoir of more than 100 Mm^3, no further large supply-side schemes are required after 2040, except in the most challenging future pathway (pathway 1), in which a desalination plant and reuse plant would be required further in the future.

Investment Modelling - Best Value Criteria Runs

11.62 The next step in our decision-making process was to undertake investment model runs in which solutions to the adaptive regional plan problem were found while seeking improvements in metrics other than cost (e.g. improvement in environmental metrics, or resilience metrics). Section 10 contains more detail of the analysis carried out on these runs. The following broad conclusions were drawn:

- The model is able to find alternative solutions to the Least Cost Plan that offer improved performance on best value metrics, in a trade-off with cost.
- The picture is complicated at the individual metric level (there being 9 metrics other than cost which are considered, which can sometimes be traded off against one another), but the use of a summarised "Best Value Plan aggregate metric" allows for simplified comparative analysis.

11.63 Regarding the large options, the following commonalities were observed between the "least cost" and "best value metric" runs:

- Teddington DRA continues to be selected for use in 2033
- SESRO continues to be selected for use in 2040

11.64 There were, however, differences in option selection observed in these model runs, compared to the least cost model run which require consideration in the later stages of programme appraisal:

- The Grand Union Canal scheme (a scheme which would be delivered and used by Affinity Water, involving transfer of water from the Minworth Sewage Treatment Works in Birmingham to the South East via canal transfer) is selected at a 50 Ml/d size in the least cost plan, but a larger option variant (100 Ml/d) is selected in the best value metric runs.
- SESRO is selected at a 75 Mm^3 size, rather than the 150 Mm^3 size selected in the least cost run.
- The reduced contribution from SESRO is made up, in 2050, with additional supplies from desalination and/or the Severn Thames Transfer via pipeline

11.65 We explore this further in our sensitivity testing and do not expand on the results here for three reasons. Firstly, the best value metric runs involve changes in many option selection decisions not involving the large TW options; as such, sensitivity runs provide a better insight into the comparative performance of plans centred on different key options. Secondly, the model is not able to give an indication of the performance of the plan against the next-best alternative (or the trade-offs involved); as such sensitivity runs are preferred when assessing comparative performance differences. Thirdly, as noted previously, the investment model is a "decision support tool", not a "decision making tool" and as such it is important to thoroughly explore the implications of key decisions.

Investment Model Sensitivity Runs

11.66 Further runs were undertaken in which options were excluded or alternatives "forced in", in order to compare the modelled least-cost and best value outputs observed with other feasible alternatives. These runs either excluded the Teddington DRA option in order to help answer Question 1, excluded SESRO in order to help answer Question 2, or limited SESRO to a single option variant in order to help answer Question 3. A notable change in our programme appraisal approach between the dWRMP and rdWRMP is that in the rdWRMP we have considered sensitivity runs in which the 110 l/h/d target is not achieved, to explore whether our option selection should be influenced by the risk associated with this target, in order to help answer Question 4. All runs discussed are presented in more detail in Section 10.

Investment Model Sensitivity Run – Question 1

11.67 To help answer Question 1 (Why is Teddington DRA the best value option for provision of 1 in 200-year resilience by the early 2030s?), we first explore a model run in which the Teddington DRA scheme was ruled out, to determine the implications of moving to the next best alternative, which was, in the dWRMP, found to be the Beckton reuse scheme.

11.68 In contrast to the dWRMP, a plan where we simply exclude the Teddington DRA did not result in the selection of the Beckton Water Recycling scheme. Instead, in this model run, 1 in 200-year resilience for London was achieved via a large (50 Ml/d) licence trade with Affinity (enabled by the construction of the Grand Union Canal 100 Ml/d option, this licence trade option was not considered in our dWRMP), a large (25 Ml/d) transfer from

SES Water, and the development of seven groundwater schemes in South East London. This plan was found to be £250m more expensive, in net present terms, than the least cost plan, and our consideration is that this is not a plan which we can be confident would be resilient, as it is reliant on all three companies (Thames Water, Affinity Water, and SES Water) delivering ambitious demand management schemes, and it is reliant on the delivery of many individual schemes.

11.69 Due to the lack of resilience associated with the alternative plan found through exclusion of Teddington DRA, we explored further investment model sensitivity runs whereby we "force in" the construction of the Beckton Water Recycling scheme (we explored 50, 100 Ml/d and 150 Ml/d variants as they are the three feasible "phase 1" sizes). The results of these sensitivity runs (Table 11-3, more detailed results in Section 10) show that replacement of the Teddington DRA with the Beckton Water Recycling scheme would result in plans which would be £650-900m more expensive in Net Present terms than the least cost plan, depending on the size of the recycling plant developed. If Beckton Water Recycling is developed instead of Teddington DRA, there are marginal improvements in the environmental metrics (natural capital, biodiversity net gain and SEA benefit), but there would be an increase in carbon emissions (c.250,000-400,000 tonnes) and no change in the resilience metrics, and so our consideration is that replacing the Teddington scheme with Beckton does not present "best value", as it would not perform materially better when considering best value criteria (detailed metrics are presented in Section 10) and would involve significant additional expense for customers and higher carbon emissions. As is noted later in the "Monitoring Plan" section, Beckton Water Recycling nonetheless plays an important role in our adaptive plan and forms part of our alternative short-term plan.

	Least Cost	Force Beckton (50 Ml/d) Use in 2033	Force Beckton (100 Ml/d) Use in 2033	Force Beckton (150 Ml/d) Use in 2033
Large Options	Teddington DRA (2033)	Beckton 50 (2033)	Beckton 100 (2033)	Beckton 150 (2033)
	SESRO 150 (2040)	SESRO 100 (2040)	SESRO 75 (2040)	SESRO 100 (2040)
		Teddington DRA (2050)	Teddington DRA (2050)	Teddington DRA (2050)
			Crossness desal (2050)	
Cost (£bn)	19.05	19.70	19.94	20.02
Carbon Emissions (MtCO2e)	8.8	9.0	9.0	9.2

Table 11-3: Large TW resource options (> c.50 Ml/d) and key metrics for Pathway 4 of sensitivity runs used to explore Teddington DRA selection

Investment Model Sensitivity Runs – Question 2

11.70 From analysis of the need for water in the west of the WRSE region, we are led to consider plans where either SESRO or the STT is available for use from 2040, as there

is a need for water in Southern Water's western area and our SWOX WRZ by 2040, and a need in our Kennet Valley and SWA zones in the longer-term. In the longer-term it could be that both are required, and this is addressed in answer to Question 4. To help to answer Question 2 ("Why is SESRO the best value option for the provision of 1 in 500-year resilience?"), we explore investment model sensitivity runs in which we ruled out SESRO. Outputs from these runs (Table 11-4) indicate that, if we were to rule SESRO out we would indeed need to construct the STT for 2040.

11.71 In the run where SESRO is ruled out and STT's selection is required instead, construction of the STT is required by 2040, with Minworth (full 115 Ml/d) support required by 2041, and support from Vyrnwy phased from 2040 (phases 1 and 2) through to 2050, 2059 and 2070 (phase 3, 4 and 5 respectively). The "pathway 4" programme cost for the WRSE region is around £600m more expensive in Net Present terms, highlighting that SESRO is clearly a more cost-effective option for the WRSE region under the supply-demand balance challenge in pathway 4. A plan centred around the STT also results in more carbon emissions than plans in which SESRO is constructed, both on average across the nine pathways considered (by around 300,000 tonnes CO2e), and in pathway four (by around 1 million tonnes CO2e), and performs less well when considering other best value criteria, such as environmental and resilience metrics (e.g., STT-centric plans resulting a deterioration of 40,000-80,000 BNG units (which is c.20-40% worse) compared to SESRO-centric plans, and a deterioration of around 70-75m Natural capital units (a reduction of c.95%) compared to SESRO-centric plans.

11.72 If the STT is selected instead of SESRO, as discussed, water would be needed from both the Vyrnwy and Minworth support sources. We note that, due to environmental impacts, the Environment Agency have raised concerns regarding the feasibility of developing both a 100 Ml/d Grand Union Canal (GUC) transfer (water for the GUC transfer would be provided by Minworth) together with 115 Ml/d support to the STT from Minworth, demonstrating the risk that a plan centred around the STT would bring.

11.73 In order to answer this question more fully, we have also explored sensitivity runs where the PCC target is not achieved and where we again compare runs in which we exclude SESRO (results also in Table 11-4). If we consider a scenario in which our DYAA PCC reaches 126 l/h/d (compared to the 108 l/h/d by 2050 in our preferred programme), explored through the use of a government-led scenario with only 6 l/h/d savings by 2050 (compared to 24 l/h/d in our preferred plan), a plan excluding SESRO and instead focussed on the STT would be around £1bn NPV more expensive than one in which a 150 Mm^3 SESRO is built in a 'pathway 4' supply-demand balance, again with a marked reduction in "best value" metrics. This further confirms our preference for SESRO over STT. We return to Question 2 in sections below (Further considerations and risks) and so do not summarise our overall conclusions here.

	Least Cost (108 l/h/d 2050)	Least Cost (108 l/h/d 2050), No SESRO	Adverse PCC (126 l/h/d in 2050), SESRO 150	Adverse PCC (126 l/h/d in 2050), No SESRO
Large Options	Teddington DRA (2033)	Teddington DRA (2033)	Teddington DRA (2033)	Teddington DRA (2033)

	Least Cost (108 l/h/d 2050)	Least Cost (108 l/h/d 2050), No SESRO	Adverse PCC (126 l/h/d in 2050), SESRO 150	Adverse PCC (126 l/h/d in 2050), No SESRO
	SESRO 150 (2040)	STT 300 Pipeline + Netheridge (2040)	SESRO 150 (2040)	STT Pipeline + Netheridge (2040)
		Vyrnwy Phases 1 & 2 (2040)	STT 400 Pipeline + Netheridge (2050)	Minworth 115 Ml/d (2040)
		Minworth 115 Ml/d (2041)	Beckton Desaliantion 150 Ml/d (2050)	Vyrnwy Phases 1-5 (2042-2045)
		Vyrnwy Phases 3, 4 & 5 (2050-2070)	Beckton Recycling 50 Ml/d (2050)	Marsh Gibbon Reservoir, 30 Mm^3 (2047)
				Beckton Recycling 100 Ml/d (2050)
				Beckton Desalination 150 Ml/d (2050)
				Deephams Recycling 46.5 (2064)
Cost (£bn)	19.05	19.68	21.65	22.66
Carbon Emissions (tCO2e)	8.8	9.7	9.8	10.7

Table 11-4: Large TW resource options (> 50 Ml/d), cost and carbon for pathway 4 of sensitivity runs used to explore SESRO vs STT

Investment Model Sensitivity Runs – Question 3

11.74 Having explored through sensitivity runs why SESRO is the best value preferred option to solve the 2040 supply-demand balance problem due to its performance in terms of cost, carbon and other best value metrics, we are led to explore why the Candidate Best Value Plan, identified in Section 10, includes a 150 Mm^3 SESRO. To help answer Question 3 (Why is 150Mm^3 the preferred size of SESRO?), we explore the investment model sensitivity runs in which we limited the availability of the SESRO option to a single size variant (note: phased options are not preferred by the modelling or stakeholders and so were not explored). In these runs we did not force the model to select the SESRO

option (i.e. a plan involving STT and recycling/desalination was feasible), but it selected the available SESRO option for use from 2040 onwards in all cases. The selection of different sizes of SESRO can drive different timing and combinations of other schemes (2040-2050, and beyond) under pathway 4, and other pathways.

11.75 In the case where a 110 l/h/d PCC target is achieved by 2050, regarding schemes required for use by Thames Water, selection of a 75 Mm^3 reservoir would necessitate development of a 100 Ml/d desalination plant by 2050, selection of a 100 Mm^3 reservoir would mean no further large resource development would be needed until 2060 (at which point a small, c.50 Ml/d, water recycling plant would need to be developed), while selection of either a 125 Mm^3 or 150 Mm^3 reservoir would mean that only small groundwater schemes would be needed further in the future.

	150 only	125 only	100 only	75 only
Large Options	Teddington DRA (2033)	Teddington DRA (2033)	Teddington DRA (2033)	Teddington DRA (2033)
	SESRO 150 (2040)	SESRO 125 (2040)	SESRO 100 (2040)	SESRO 75 (2040)
			Deephams Recycling 46.5 (2061)	Beckton Desal 100 (2050)
Cost (£bn)	19.05	19.2	19.27	19.37
Carbon Emissions (tCO2e)	8.8	8.8	8.9	8.9

Table 11-5: Large TW resource options (> c.50 Ml/d), cost and carbon for pathway 4 of sensitivity runs used to explore SESRO size under preferred demand management future (108 l/h/d by 2050)

11.76 As these results demonstrate, the WRSE programme-level cost increases slightly as progressively smaller reservoirs are developed, as a result of needing to build additional resource options (noting that other companies in the WRSE region may need to build resources other than those included in the table, with SESRO providing water to Affinity and Southern Water) and/or needing to use more expensive sources more, while the total carbon emissions are close between different programmes.

11.77 There were differences in the other option metric outputs (detail presented in Section 10), but these were relatively minor. Programmes with smaller reservoirs perform slightly better (2-4m Natural Capital Units, 3-6% improvement, and 15,000-40,000 BNG units, 7-20% improvement). We note, however, that all SESRO schemes have positive Natural Capital contributions.

11.78 In order to ascertain whether the decision on SESRO size is impacted by the risk that household consumption will not fall to the government's target levels, we again explore sensitivity tests in which a 2050 PCC of 126 l/h/d (compared to 108 l/h/d in our preferred plan) is achieved. If PCC does not reduce as the government is aiming for and we follow a "Pathway 4" supply-demand balance trajectory (i.e., if we are required to make licence

reductions in accordance with the Environment Agency's "Enhanced" scenario), plans involving a larger reservoir option are more cost effective, with a plan built around a 150 Mm^3 reservoir being around £200m less expensive than a plan which built a 100 Mm^3 reservoir in this scenario (Table 11-6). We observe similar differences between the metrics as in the runs looking at different SESRO sizes with PCC at the preferred 108 l/h/d level by 2050 (i.e., selection of smaller reservoirs resulting in slight increases in carbon emissions, and small improvements in Natural Capital and Biodiversity Net Gain metrics).

11.79 In the model runs where we explored the implication of achieving 126 l/h/d PCC, rather than 108 l/h/d, SRO options in addition to SESRO were required in 2042 if we select the 75 Mm^3, 2045 if we select the 100 Mm^3 option, or 2050 if we select the 125Mm^3 or 150 Mm^3 options. The larger the reservoir size selected, the fewer/smaller the support options required, and the later they can be developed. Plans with larger SESRO schemes would thus allow us to better manage the risks associated with the potential for under-performance of demand management actions, the results of which are currently uncertain. If we find that, despite company-led and government-led actions, customers' PCC does not fall as quickly as we have planned for to accord with the WRPG, a reservoir larger than 100 Mm^3 would provide more resilience, allowing time to plan for and deliver required additional options; this means that we would be more able to adapt plans to react in a way that would be beneficial for the long-term if we build a reservoir larger than 100 Mm^3, but may need to react and build options quickly if we build a smaller reservoir (100 Mm^3 or less).

11.80 The factors of reduced overall programme cost under pathway 4, the better management of supply-demand balance risk, and the minimal difference in BV metrics between programmes incorporating reservoirs of different size led us to conclude that the 150 Mm^3 should be included in the Best Value Candidate Plan.

11.81	150 only	125 only	100 only	75 only
Large Options	Teddington DRA (2033)	Teddington DRA (2033)	Teddington DRA (2033)	Teddington DRA (2033)
	SESRO 150 (2040)	SESRO 125 (2040)	SESRO 100 (2040)	SESRO 75 (2040)
	STT 400 Pipeline + Netheridge (2050)	STT 300 Pipeline + Netheridge (2050)	STT 300 Pipeline + Netheridge (2045)	STT 300 Pipeline + Netheridge (2042)
	Beckton Desaliantion 150 Ml/d (2050)	STT Minworth Support 115 Ml/d (2050)	STT Minworth Support 115 Ml/d (2050)	STT Minworth Support 115 Ml/d (2050)
	Beckton Recycling 50 Ml/d (2050)	Beckton Desaliantion 150 Ml/d (2050)	Beckton Desaliantion 150 Ml/d (2050)	Beckton Desaliantion 150 Ml/d (2050)

11.81	150 only	125 only	100 only	75 only
	Vyrnwy Phase 1 (2065)	Deephams Recycling 46.5 (2061)	STT Vyrnwy Support Phases 1-3 (2050)	STT Vyrnwy Support Phases 1-5 (2050)
		Vyrnwy Phase 1 (2075)	Deephams Recycling 46.5 (2061)	Deephams Recycling 46.5 (2060)
Cost (£bn)	21.65	21.72	21.83	21.97
Carbon Emissions (tCO2e)	9.8	9.8	9.9	10.1

Table 11-6: Large TW resource options (> 50 Ml/d), cost and carbon for pathway 4 of sensitivity runs used to explore SESRO size under adverse demand management future (126 l/h/d by 2050)

Further Considerations and Risks

11.82 As set out in Section 10 of our rdWRMP, the investment model should be used as a decision **support** tool, not a decision **making** tool. Having summarised and explored the programme appraisal outputs detailed in Section 10 to identify reasons suggested by the modelling for adoption of the Candidate Best Value Plan, we now consider a broader view of programme appraisal. Model outputs should be considered alongside practical experience and judgement, based on our real-world knowledge of how new, large-scale infrastructure could best be delivered and operated. As such, alongside those factors which we can consider through programme appraisal modelling, it is important that we also consider programme appraisal from a holistic perspective, applying professional judgement. As such, we have had regard to the following considerations to apply to these questions, alongside the modelling outputs.

1. Simplicity is preferable to complexity, and consideration of operability
   - Our sources of water need to be reliable and available during drought periods. Based on our experience in maintaining and operating our existing assets, complex treatment processes require a great deal of maintenance, and can therefore sometimes be unavailable when they are most needed.
   - It is important that we consider how sources would be used during periods of drought, considering the regional picture. As an example, SESRO would be easier to operate than STT (particularly as a source for the Thames to Southern Transfer), with water in SESRO being available for release to multiple parties immediately, whereas water from STT would require fairly significant advanced notice.
2. Limitations of the investment model in considering supply-demand balance risk
   - The options selected by the investment model are generally those which perform best with regard to cost, carbon and environmental performance. It follows that the next-best options will perform less favourably.
   - The investment model is used to identify the solutions required under defined supply-demand balance pathways. The model is less able to answer the

question of how much additional supply-demand deficit would be required to trigger the development of additional (next-best) option(s).

- The 150 Mm^3 reservoir delivers 271 Ml/d of DO for an initial capital cost of around £2.4bn. The 75 Mm^3 reservoir delivers 149 Ml/d of DO for an initial capital cost of around £1.9 bn. As such, selecting the 150 Mm^3 reservoir, rather than the 75 Mm^3 reservoir means that we would deliver an additional 122 Ml/d DO for around £500m, or c.£4.1m capex per Ml/d of DO. This compares to around £1.15bn for 130 Ml/d DO from the 150 Ml/d Beckton Water Recycling scheme (£8.8m capex per Ml/d DO), £1bn for 133 Ml/d DO for the 150 Ml/d Beckton desalination scheme (£7.5m capex per Ml/d DO) or £1.4bn for 158 Ml/d DO from the construction of the 500 Ml/d STT interconnector and support from Netheridge (£8.9m capex per Ml/d DO), noting that these additional options all come with significant opex requirements. As such, if there is a risk of needing more water in the future, building the larger reservoir is clearly the lower regret option.
- Wider consideration of supply-demand balance "risk" is required, considering these limitations.

3. Policy requirements have become more challenging over time

- We have produced our WRMP24 in line with the Water Resources Planning Guideline, and programme appraisal has been undertaken according to the guidelines as they exist now. We are, however, aware that policies evolve in response to an increasingly uncertain and rapidly changing environment. We have seen increasingly stringent environmental and resilience measures be put in place over the last 10 to 15 years, and our consideration is that, in respect of future policies, we are more likely to end up with more supply-demand balance requirements than fewer, though uncertainty on this point clearly remains.
- Following public inquiry, we were required to revise our draft WRMP09 on the basis that we had included an allowance for future sustainability reductions beyond those that had been specifically included in the statutory WINEP programme at the time (with the WRPG at the time not requiring forward planning for licence reductions). The allowance that we had included in the draft WRMP09 was 100 Ml/d. In our WRMP24 we have been required by our regulator to consider future abstractions reductions of more than 400 Ml/d, demonstrating just how significant the policy change has been in this area in a relatively short period of time.

11.83 In addition to these further considerations, it is important that we consider the risks to our plan. In the Environment Agency's representation on our dWRMP, a range of risks to our plan were highlighted. In this section we discuss these risks and how they inform our programme appraisal decisions. Key risks highlighted by the Environment Agency were as follows and have informed the decisions in relation to the questions set out above.

1. The success of our demand management programme in the short-term

- In the short-term, our demand management programme is reliant on significant leakage reduction. By 2030 we will need to have reduced leakage by 33% compared to current levels to meet our plan. The Environment Agency highlights

that we will need to reduce leakage and then maintain leakage at significantly lower levels than we have previously achieved in order for customers' supplies to be secure. The Environment Agency states that we should consider a back-up plan with trigger points to mitigate the risk that we are unable to deliver forecast leakage reductions.
- It is notable that rdWRMP programme appraisal model outputs highlight that, in addition to our planned leakage and consumption reductions and Teddington DRA, additional water (c.10 Ml/d) will be required to ensure a 1 in 200-year resilience level in London. This indicates that there will not be excess capacity available from the Teddington DRA scheme when it is built.

2. The reliable capability of the Gateway desalination plant in London

    - The Gateway desalination plant was unavailable during the 2022 drought event due to required planned maintenance.
    - In the dWRMP we highlighted that we anticipate the plant to be available at a reliable 50 Ml/d during the period up to 2030, and 75 Ml/d from then on.
    - The Environment Agency's representation highlights that there is a risk that we may not be able to achieve these planned rates in either the short-term or long-term. The Environment Agency state that we should consider whether to continue operating the asset in the long-term.

3. Abstraction issues in the Lower Thames which were highlighted in the 2022 drought event, which will be exacerbated by the River Thames Scheme, a flood alleviation scheme which is planned for development by 2030

    - As is described in Appendix CC of our rdWRMP, during the 2022 drought event we experienced constraints on our abstractions which we did not anticipate. Abstraction in the Lower Thames above the confluence with the River Wey was limited due to the need to maintain water levels for navigation, while there was a surplus of water available below the confluence with the River Wey. The end result of this was that we were able to abstract less, in aggregate, than our hydrological modelling would tell us should be feasible, that the Teddington gauged flow was above the 300 Ml/d level on which our planning is based, and as such our reservoir storage levels in the 2022 drought were significantly below where we would have anticipated.
    - It is currently unclear whether none, some or all of the following are true:
        - The 2022 drought was unusual in respect of the inflows from different tributaries of the Lower Thames (e.g., perhaps a greater proportion of total flow was coming from the Rivers Wey, Ash, Mole, and Hogsmill)
        - The Environment Agency have altered their river management control protocols, meaning that 300 Ml/d Teddington gauged flow would once have been achievable but would now not be achievable. If this is the case, it is unclear whether river management protocols should be altered to allow achievement of 300 Ml/d gauged flow.
        - Changes in our abstraction capability, due perhaps to the installation of eel screens, mean that less abstraction is feasible at a given river level.

- The River Thames scheme will involve construction of new channels which will bypass one of our key abstraction points above the confluence with the River Wey (Laleham abstraction point, or Littleton Pumping Station) and weirs on the River Thames upstream of the confluence with the River Wey where maintaining appropriate river levels for navigation is an existing challenge. While the scheme would be built to mitigate flood risk, the new channels would become habitat for animals and plants and could not be left stagnant during drought periods, and as such an "augmentation flow" will be needed in these channels during drought periods. If it is the case that 300 Ml/d Teddington Gauged flow is already not achievable or would be a challenge to achieve, the River Thames flood alleviation scheme would exacerbate this situation.
- Should these constraints exist, or should the River Thames Scheme cause them, the following could be true:
    - We may have over-stated our Deployable Output in the London WRZ by up to 150 Ml/d: Studies are underway to review this risk and to understand the volume at risk.
    - The River Thames Scheme may cause an additional deterioration of up to c.90 Ml/d, with the magnitude of deterioration depending on modelling which the River Thames Scheme team are currently undertaking
    - The Teddington DRA scheme and Mogden Water Recycling scheme would not provide net Deployable Output benefit.

4. The success of household consumption reduction in the long-term:

    - This has been considered explicitly within our programme appraisal modelling, as discussed in preceding sections, but noting the limitations of the investment model it is important that wider consideration is given to this risk.
    - While our programme appraisal is able to consider the scheme selection implications of different deterministic scenarios of demand reduction, it is not able to identify the reduction in probability of needing to make additional investments under different circumstances. What is clear, however, is that adopting larger schemes in our plan will reduce the likelihood of needing to make further interventions in the future.
    - If the 110 l/h/d target is not met due to the failure of government to take the necessary steps to achieve it, then companies across the region and country will likely have supply-demand balance challenges alongside Thames Water.

5. The long-term viability of the West Berkshire Groundwater Scheme:

    - The Environment Agency have identified that the West Berkshire Groundwater Scheme is likely to continue to be operated until 2060, but that its future beyond this point is uncertain. This scheme contributes significantly towards Deployable Output in our London and Kennet Valley WRZs and, should it no longer be operable, would result in a requirement for additional resource of around 75 Ml/d for London.
    - Following its representation, the Environment Agency have also advised, through the WRSE Regional Group, that we should consider scenarios where the scheme's operation is stopped from 2050 and 2040.

6. Concerns over the environmental feasibility of the Teddington DRA scheme

   - While no specific environmental issues which cannot be mitigated have been found to date, there are several priority actions raised through the RAPID gated process that are being investigated with regulator involvement.
   - Since nothing has been found which would lead us to screen this option out of consideration, we will continue to consider it as a feasible option, but will continue progressing alternatives.

7. Doubts over the viability of the Severn-Thames Transfer

   - Concerns were raised in the Environment Agency's representation on our dWRMP which stated that the scheme has not been demonstrated to be either viable or environmentally acceptable. In the Environment Agency's representation to the WRSE draft Regional Plan, it is further highlighted that environmental concerns exist around using Minworth to provide water for both the GUC and STT schemes. Treated effluent discharges from Minworth currently comprise a significant component of the low flows in the River Trent.

11.84 Alongside risks highlighted by the Environment Agency in its representation, we have also considered the following additional risk:

8. Our ageing raw water storage reservoir asset base

   - As was noted in our WRMP19, our existing reservoir asset base is ageing, with several of our reservoirs being in excess of 100 years old. Consulting reservoir panel engineers from Atkins and Aecom highlighted that there is an increasing risk that these assets may need to be taken out of supply for an extended period at short notice (1 year or more), for either planned or unplanned maintenance. Our reservoirs in West London are up to around 30,000 Ml capacity, a significant proportion of our existing storage.
   - Our programme appraisal has demonstrated that Southern Water, Affinity Water and our SWOX WRZ all have such significant needs for water such that a 100 Mm^3 reservoir may not provide sufficient resource to also provide meaningful supply to London. As such, a larger reservoir contributes to a greater degree towards the mitigation of this risk.

11.85 Each of these risks is something which could have a detrimental impact on our customers' supplies. The chance that all of these risks materialise is small, however the chance of one or some of these risks materialising is significant and should factor in our decision making.

11.86 The implications of these additional considerations and risks for our decision-making are:

- Consideration 1 (preference for simplicity and regard to operability) and Risks 1 (short-term demand management success), 2 (Gateway desalination plant), 3 (Lower Thames risks), 6 (Teddington DRA feasibility): these factors concern our decision-making for new supply sources which will be needed to provide supplies in the relatively short-term.

  - Our preference is for the more operationally simple scheme, the Teddington DRA, rather than the operationally complex Beckton Water Recycling scheme.

  - Risks 3 and 6 question the viability of the Teddington DRA scheme. If the Teddington DRA scheme were to be found to be unviable, we would adopt the Beckton Water Recycling scheme as an alternative. These risks are, however, as yet unproven and our modelled programme appraisal demonstrates that our strong preference for short-term investment should be the Teddington DRA scheme. Our response to these risks is not to alter our preferred programme, but to highlight the importance of our monitoring plan and to identify preferred and alternative programmes for the short-term.
  - Risks 1 and 2 highlight that our preferred programme relies on the successful delivery of our leakage and consumption reduction programmes, and on the success of the maintenance programme at our Gateway desalination plant, both of which bring an element of uncertainty. Given that our preferred programme does not include the development of excess capacity for our early 2030s challenges, this brings into question whether we should adopt additional interventions or adopt an alternative solution which could deliver a greater volume of water. Our response to these risks is three-fold: firstly, we will look to proceed with the development of three schemes which are low-cost, but which will give us additional headroom in the very short-term. These schemes are Horton Kirby ASR (5 Ml/d, included in WRMP19 but not delivered due to diminished need – we will not request enhancement expenditure due to already having been funded to deliver this option), Addington Groundwater Scheme (2.7 Ml/d) and the RWE licence trade (22.6 Ml/d); secondly, we will continue to work with Affinity Water and SES Water to determine whether importing water is likely to be feasible and will proceed with discussions on the basis that imports from both companies may be required; thirdly, our monitoring plan (see later section) outlines how, in conjunction with the learning investigations required to mitigate Risk 3, we will determine whether to trigger our alternative plan.
  - Further explanation of our response to these risks is given in the Monitoring Plan section of this chapter.

- Consideration 1 (preference for simplicity) and Risks 7 (viability of STT) and 8 (ageing reservoir asset base): these factors concern our decision-making regarding the choice of SESRO over the STT. SESRO is an operationally and contractually simpler scheme than the STT, and so our preference for simplicity gives greater weight to the preferred programme which is suggested by our modelling The risks do not suggest that we should alter the preferred programme suggested by our modelling, and instead give greater weight to the preferred programme which is suggested.
- Considerations 2 (wider consideration of supply-demand balance risk) and 3 (increasing policy requirements over time), and Risks 2 (Gateway desalination plant capability), 4 (long-term success of household consumption reduction), 5 (long-term viability of West Berkshire Groundwater Scheme), and 8 (ageing existing reservoir asset base): these factors concern our decision-making regarding the size of reservoir which we should adopt in our preferred programme.

  - Given our programme appraisal now indicates that SESRO **or** STT is now required, rather than SESRO **and** STT, building a larger SESRO scheme and reducing the possibility of needing to make additional interventions should be our preference.

- These noted risks would all cause a deterioration of the supply-demand balance. As our programme appraisal has demonstrated, under more challenging supply-demand balance scenarios our preference should be for larger reservoir sizes. The larger the reservoir which we build, the smaller the probability that additional (more costly and carbon-intensive) resources will be needed in the future, and the longer we will have to establish whether other investments are required.
- Table 11-7 (explored further in the monitoring plan, see later section) shows the 2040 supply-demand balance impact of uncertain factors within our SDB forecast. More of these factors show supply-demand balance detriment than benefit, with many supply-demand balance detriments being very significant in the context of the benefit that different resources bring (e.g., 150 Mm^3 reservoir DO = 271 Ml/d while 100 Mm^3 reservoir DO = 185 Ml/d), and as such we should look to maximise the available buffer.
- As such, consideration of these risks does not alter our programme appraisal outcome, and instead strengthens our view that adoption of the 150 Mm^3 reservoir results in the best value plan for the South East.

Assessment Area / Risk	Range of scenarios	2040 Supply-Demand Balance Impact, Compared to "Situation 4" (positive = SDB improvement), Ml/d
Leakage reduction	50% success	-116
	75% success	-58
	100% success	0
	100% success, accelerated - 50% reduction by 2040	+43.5
Company-led consumption reduction	50% effective	-85
	75% effective	-43
	100% effective	0
Government action on demand reduction	Apathy	-96
	Moderate	-73
	Preferred plan	0
Population	Low demand & guidance changes[11]	+159
	Low demand	+89
	Preferred plan	0
Environmental Destination	High, accelerated	-372
	High	0
	Medium	+56
	Low	+56
Climate Change	Low	+87

[11] Note: Guidance change referenced here would be that we should plan on the basis of ONS forecasts and not local authority plans

Assessment Area / Risk	Range of scenarios	2040 Supply-Demand Balance Impact, Compared to "Situation 4" (positive = SDB improvement), Ml/d
	Medium	+40
	High	0
West Berkshire Groundwater Scheme	Available 2040	0
	Unavailable 2040	-77
Gateway desalination plant	75 Ml/d reliable	0
	50 Ml/d reliable	-8
	Decommission	-48
Reservoir outage	30,000 Ml reservoir unavailable	-c.110-160

Table 11-7: Magnitude of different risks to the supply-demand balance in 2040

Our Customers' Views

11.87 As is detailed in Appendix T of our WRMP, we conducted customer research alongside our statutory consultation. In this customer research, we found that there was strong support for our dWRMP overall, and, for the most part, the schemes contained within it. This customer research was undertaken in order to provide a balanced view from our whole customer base, as consultations tend to result in self-selection of respondents with strong views for or against certain proposals. According to our customer research, when our customers learn about the deficit of water supplies that we are facing in the Thames catchment and that water saving measures would not go far enough, they think that investing in new sources is the prudent thing to do.

11.88 Support was strongest for SESRO, with reservoirs viewed as a natural solution that could benefit the environment and provide a reliable water supply in the future. There were minor concerns about the impact building the reservoir will have on the local community and the environment however the concerns raised by the local community were not considered, by our customers, strong enough to prevent the build. Customers were, on the whole, disappointed that the proposal was for the smaller size (100 Mm^3) in our draft plan, as building a larger reservoir was thought to better protect the area from running out of water in the future. With no obvious downside bar the immediate disruption of the build, it was felt that having a larger reservoir seemed like the best approach to ensure a secure water supply for the future without the need for further investment.

11.89 Customers were supportive of the Teddington DRA scheme, on the basis that it is low cost, low carbon, and relatively quick to implement. Whilst there was some sympathy to the objections being raised by local communities, overwhelmingly customers felt the benefit to water supplies outweighed any local concerns around environmental harm to this part of the river.

11.90 Of the three strategic water resource schemes in our draft plan, the transfer had the least customer support. Customers felt the scheme was ambitious and there were

concerns that Thames Water would not be able to deliver this. The reliability of the scheme was also questioned, noting that it relies on other water catchments and suppliers, and concerns were raised as to whether it could cause potential water shortages elsewhere. There were concerns about the disruption and impact on the areas the pipeline will travel through. There were also significant environmental concerns that transferring water would impact negatively on wildlife. To gain support, there would need to be assurances it is feasible and will work, rather than something that could end up costing money but not delivering.

The Answers – Strategic Regional Options in the Overall BVP

11.91 Referring back to the previous section, our programme appraisal has delivered conclusions to the questions that we identified. In this section we also consider whether, having answered the question, we should make alterations to the Candidate Best Value Plan.

Question 1: Why is Teddington DRA the best value option for provision of 1 in 200-year drought resilience by the early 2030s?

11.92 The Teddington DRA is the best value option for us to move to 1 in 200-year resilience by the early 2030s, because it is an option which is deliverable on the required (relatively short) timescale, and which is inexpensive and low-carbon compared to other available options.

11.93 Our wider programme appraisal does not lead us to change the Candidate Best Value Plan with respect to selection of the Teddington DRA, as the option is more operationally simple than alternatives, and our consideration is that other risks can be managed through the development and implementation of a robust monitoring plan (see later section).

11.94 Recognising the risks which exist prior to the early 2030s, we have, however, made some small amendment to the candidate plan. These are to include the Didcot Licence Trade option (2026, 22.6 Ml/d, a continuation of an existing agreement), the Addington Groundwater Option (2028, 2.7 Ml/d), and the Horton Kirby ASR option (2030, 5 Ml/d). These options are included to manage the short-term risks to our supply-demand balance in the London WRZ.

Question 2: Why is SESRO the best value option for the provision of 1 in 500-year resilience?

11.95 SESRO is our preferred option for delivery in 2040 as it presents the best value solution considering the long-term needs of the region. Plans that do not involve SESRO would be more expensive, would involve greater carbon emissions, and would not deliver the same environmental or resilience benefits.

11.96 Our wider programme appraisal has strengthened our preference for SESRO over STT, as SESRO would be significantly simpler to operate, with water being available in the right location during times of need, and with the Environment Agency having raised concerns over the viability of the STT.

11.97 As such, our wider programme appraisal does not lead us to change the Candidate Best Value Plan with respect to selection of SESRO.

Question 3: Why is 150 Mm^3 the preferred size of SESRO?

11.98 The 150 Mm^3 option is preferred because plans with this reservoir size perform best with respect to cost in the supply-demand balance pathway of our preferred plan, and with

there being relatively little between the different options with regards to other best value metrics.

11.99 Our wider programme appraisal has strengthened our view that the candidate best value plan decision to adopt the 150 Mm^3 reservoir option is correct. The primary reason for this is that there are a large number of risks to our future supply-demand balance which we should consider when appraising the different solutions and which our regulator has highlighted, and selection of the largest reservoir option available provides the best mitigation of these risks. Selection of a smaller reservoir variant would increase the chance that additional, less preferable options would need to be selected in the future. The selection of the largest reservoir would also maximise the time available to appraise the success of company-led and government-led demand management measures. The selection of the largest reservoir, rather than a smaller variant, comes at a low marginal cost and is, as such, a low-regret decision. The largest reservoir also provides the best base for regional transfers, recognising that other companies in the South East also face a similar range of risks.

11.100 As such, our wider programme appraisal does not lead us to change the Candidate Best Value Plan with respect to selection of the 150 Mm^3 option.

Question 4: Are there additional supply-side options which may be needed after 2040 to provide a Best Value solution for the longer-term?

11.101 If we achieve the government target of 110 l/h/d, we will not need to develop additional large sources of water to ensure resilient supplies and as such our candidate preferred programme does not include the development of additional large supply-side sources (noting that several small groundwater sources are selected in the future). However, there is a risk that the 110 l/h/d target may not be achieved, and other noted risks may materialise.

11.102 Having selected the 150 Mm^3 reservoir option means that there is a supply-demand balance buffer available during the 2040s. We will be able to appraise whether risks materialise, and will be able to respond in an adaptive way.

11.103 As such, we do not consider that we should alter the Candidate Best Value Plan to include selection of additional large solutions in the longer term, as the selected plan allows for adaptive selection of additional solutions in the future, but minimises the need for additional solutions in the longer term.

Overall Best Value Plan

11.104 Our overall BVP, therefore, contains the following core, large schemes:

- Teddington DRA, 75 Ml/d variant, constructed to facilitate 1 in 200-year drought resilience by 2033
- SESRO, 150Mm^3 variant for first use in 2040
- Beckton desalination plant, 150 Ml/d, delivered in 2050 in pathway 1
- Deephams Water Recycling, in 2069 in pathway 1
- Thames to Affinity Transfer, capacity of up to 100Ml/d, with different volumes used in different pathways 1-5 and 7, and different utilisation across the planning period
- Thames to Southern Transfer, capacity of 120 Ml/d in pathways 1-9

11.105 In the following sections we present the plan in more detail.

The Overall BVP at WRZ-level

11.106 Having now described the decision-making process for our BVP at a high level, we describe in detail the schemes which make up our BVP in more detail, for each WRZ in turn.

West-Thames Strategic Hub

11.107 In our WRMP19 we had a large need for new resources in the London WRZ, a limited need in other zones, and a set assumption for transfers that would be needed by other companies. As such, we described major new water resources as being needed for London.

11.108 Our work with the WRSE regional group has shown that there is a need to consider the potential for Thames Water, Affinity Water and Southern Water to adopt integrated solutions which can yield benefits through both the conjunctive operation of water resource systems and the efficiency gains associated with constructing and sharing large assets. Additionally, the need to consider a 1 in 500-year drought scenario and large volumes of future licence reductions through Environmental Destination scenarios has led us to need to consider future scenarios in which our SWOX, SWA and Kennet Valley WRZs have a significant need for new resources.

11.109 As such, it is no longer appropriate to consider the major options that could be developed in the west of the Thames catchment as being mainly for the benefit of the London WRZ. We have, therefore, presented this initial section in which we describe our preferred plan and preferred programme for the supply options which would feature in the West of the Thames catchment and subsequently distributed to different companies and WRZs.

11.110 London Water Recycling schemes would be for the benefit of the London WRZ only, and so are not included in this description.

11.111 The large new resource options selected in the overall BVP in the west of the catchment are shown in Table 11-8. In order to be ready for use in 2040, the SESRO scheme will need to go through planning and detailed design before 2030, with construction starting in the early 2030s.

11.112 The strategic transfer options selected in the WRSE preferred plan are shown in Table 11-9. This shows that in the WRSE preferred plan there is a need, in all except the most benign future scenarios, for a 50 Ml/d transfer from the River Thames to Affinity Water, in some cases beginning in 2040 and in others up to 2053, with further expansion possible dependent on the scenario. This table also shows that there is a need for a 120 Ml/d Thames to Southern Transfer (T2ST), with this water being used to supply Southern Water primarily, with onward transfer to South East Water and Portsmouth Water in some scenarios.

Option	Max DO	Year Option is First Utilised in Pathway								
		1	2	3	4	5	6	7	8	9
SESRO 150 Mm^3	271	2040	2040	2040	2040	2040	2040	2040	2040	2040

Table 11-8: New resource options selected in West-Thames Hub

11.113 The variation in the transfer options selected demonstrates the adaptability of the WRSE plan, with different volumes being needed at different times by Southern and Affinity Water. This also demonstrates the ability for resource options which may appear static, such as SESRO, to provide an adaptable solution to a dynamic problem.

Option	Max DO	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
T2AT West First 50 Ml/d	50	2040	2040	2040	2045	2052	-	2053	-	-
T2AT West Second 50 Ml/d	50	2041	2050	-	2050	2052	-	-	-	-
T2AT East 50 Ml/d	50	2060	-	-	-	-	-	-	-	-
T2ST 50 Ml/d	50	-	-	-	-	-	-	-	-	-
T2ST 80 Ml/d	80	-	-	-	-	-	-	-	-	-
T2ST 120 Ml/d	120	2040	2040	2040	2040	2040	2040	2040	2040	2040
T2ST 200 Ml/d	200	-	-	-	-	-	-	-	-	-

Table 11-9: Transfers to Southern and Affinity Water in the Preferred Plan

Utilisation of the options in the preferred pathway

11.114 Here we demonstrate in more detail the utilisation of the options seen in Pathway 4 of our preferred plan, our preferred programme, Table 11-10 and Table 11-11 show the utilisation of new resource options, while Table 11-12 and Table 11-13 show the utilisation of transfers to Southern Water and Affinity Water (note: the T2ST is primarily used to supply Southern Water's customers, but there are also onwards transfers to South East Water and Portsmouth Water in some scenarios). The figures presented are for Deployable Output utilisation under the critical drought scenarios, "dry year annual average" and "dry year critical period".

11.115 The SESRO option would come online in 2040 in our preferred plan. At this stage in the planning period the utilisation information shows that there would be spare capacity for additional utilisation. In reality, however, a source with low operating costs and emissions such as the reservoir would be well utilised and would instead provide additional resilience to supplies across the region. The reservoir could also be used to provide additional supplies required should some of the risks we have identified above and noted in our monitoring plan materialise. In the longer-term, the capacity of the reservoir would be fully utilised. The SESRO option forms part of a fully adaptable plan when integrated with transfers and other supply options, providing an efficient, resilient, low-cost, and low-carbon source of water.

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
SESRO 150 Mm^3	0	0	92	177	271	271	271	271	271	271

Table 11-10: West-Thames option utilisation in Pathway 4, DYAA

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
SESRO 150 Mm3	0	0	45	150	232	245	254	262	255	262

Table 11-11: West-Thames option utilisation in Pathway 4, DYCP

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
T2AT First 50 Ml/d	0	0	0	50	50	50	50	50	50	50
T2AT Additional 50 Ml/d	0	0	0	0	8	20	23	17	20	22
T2ST 120 Ml/d (inc. spur to Kennet Valley)	0	0	18	59	68	70	71	72	73	74

Table 11-12: Transfers to Southern and Affinity Water in Pathway 4, DYAA

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
T2AT First 50 Ml/d	0	0	0	50	50	50	50	50	50	50
T2AT Additional 50 Ml/d	0	0	0	0	8	20	23	17	20	22
T2ST 120 Ml/d (inc. spur to Kennet Valley)	0	0	21	51	53	57	60	61	62	65

Table 11-13: Transfers to Southern and Affinity Water in Pathway 4, DYCP

11.116 We now detail our preferred plan and preferred programme for each of our WRZs.

London WRZ

11.117 Section 6 of our WRMP describes the supply-demand balance situation in the London WRZ across the planning period. In all future scenarios we are faced with a significant supply-demand balance challenge by the early 2030s, which grows to very large volumes in the future, particularly in scenarios 1, 4, and 7 (those which are based on a High Environmental Destination scenario). By 2050 the London WRZ's supply-demand balance challenges range from a deficit of around 360 Ml/d to a deficit of nearly 890 Ml/d.

11.118 The implementation of our preferred plan, a twin-track approach combining demand management with resource development, resolves the supply-demand deficit in all years of the planning period for the London WRZ.

Demand Management

11.119 Being consistent across all nine future scenarios, we will first describe our demand management programme for the London WRZ. Demand management is the largest component of our plan for the London WRZ, particularly in the short-term.

11.120 Table 11-14 shows a detailed breakdown of the demand management options adopted in our preferred plan for the London WRZ. Figure 11-7 shows our leakage forecast, Figure 11-8 shows our meter penetration forecast, and Figure 11-9 shows our PCC forecast, all for the London WRZ.

	Supply Demand Benefit (Ml/d)				
LON	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	26.00				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering CSL	1.21	1.46	0.00	0.00	0.00
Bulk metering CSL	21.07	2.42	1.53	0.00	0.00
Replacement metering CSL	6.48	1.84	0.00	0.00	0.00
Mains replacement	2.35	12.18	11.03	7.11	7.96
Leakage innovation	1.30	1.50	4.90	8.97	8.28
Metering innovation CSL	0.00	0.00	0.44	0.00	0.00
Advanced DMA Intervention	24.00	4.00	4.00	0.00	0.00
Total leakage reduction	82.40	23.39	21.90	16.08	16.24
AMP7 Carry-over metering	6.46				
Household metering	7.12	0.00	0.00	0.00	0.00
Non-household metering	0.33	1.87	0.00	0.00	0.00
Household water efficiency	11.11	5.63	0.00	0.00	0.00
Non-household water efficiency	26.70	20.68	15.51	13.16	11.28
Metering innovation	1.81	13.22	17.32	0.00	0.00
Innovative tariffs	4.72	9.69	8.89	14.01	15.00
Total usage reduction	58.26	51.10	41.72	27.17	26.28
Total benefit from DMP	140.66	74.49	63.62	43.25	42.52

	New & Replacement Meters				
LON	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	47,032	52,017	41,298	0	0
Household Metering (New)	161,304	294,535	397,450	0	0
Household Metering (Upgrades)	349,031	204,983	67,960	0	0
Non-Household Metering (Upgrades)	42,912	42,281	0	0	0

Table 11-14: London WRZ Demand Management Programme Breakdown

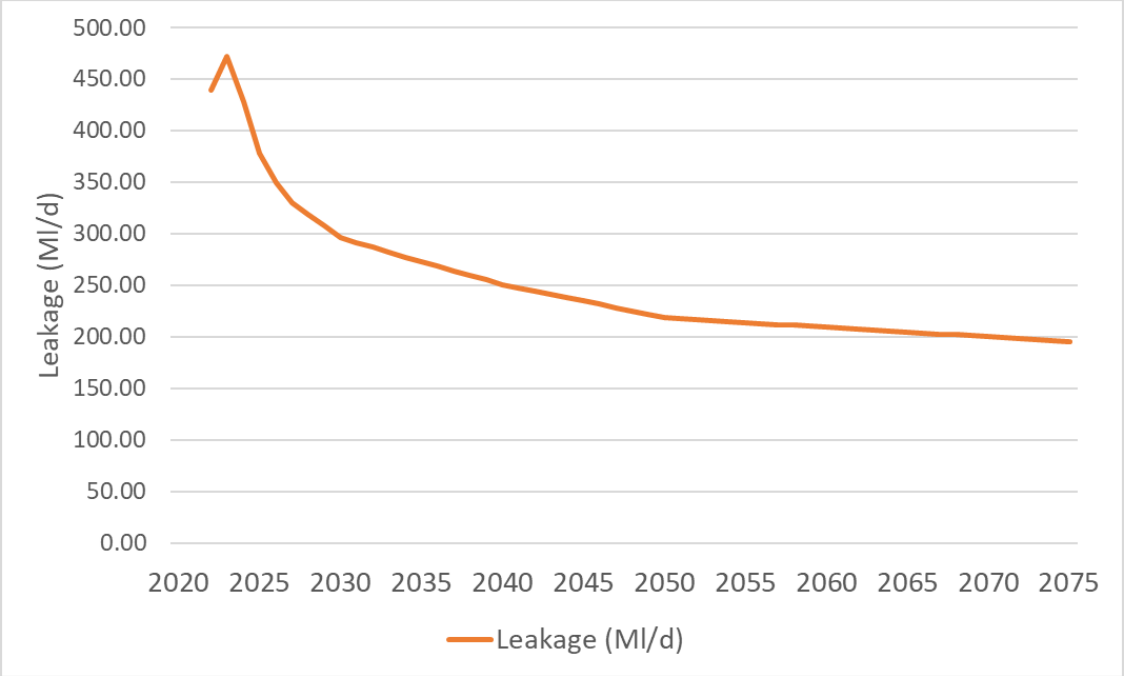

Figure 11-7: London WRZ DYAA Leakage

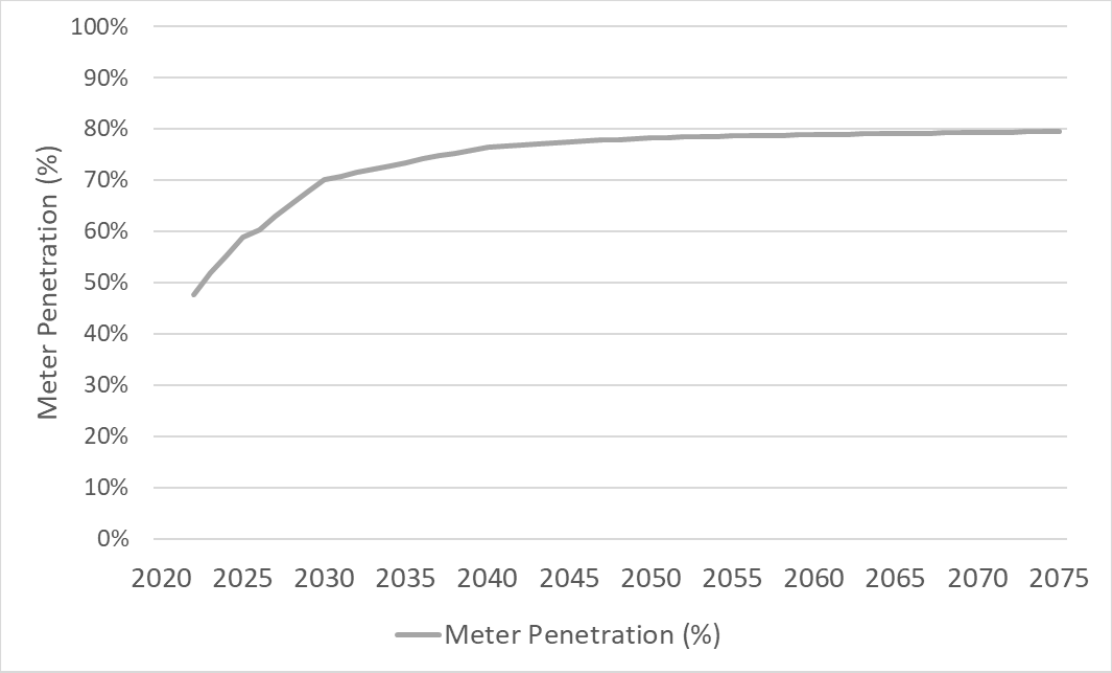

Figure 11-8: London WRZ Meter Penetration

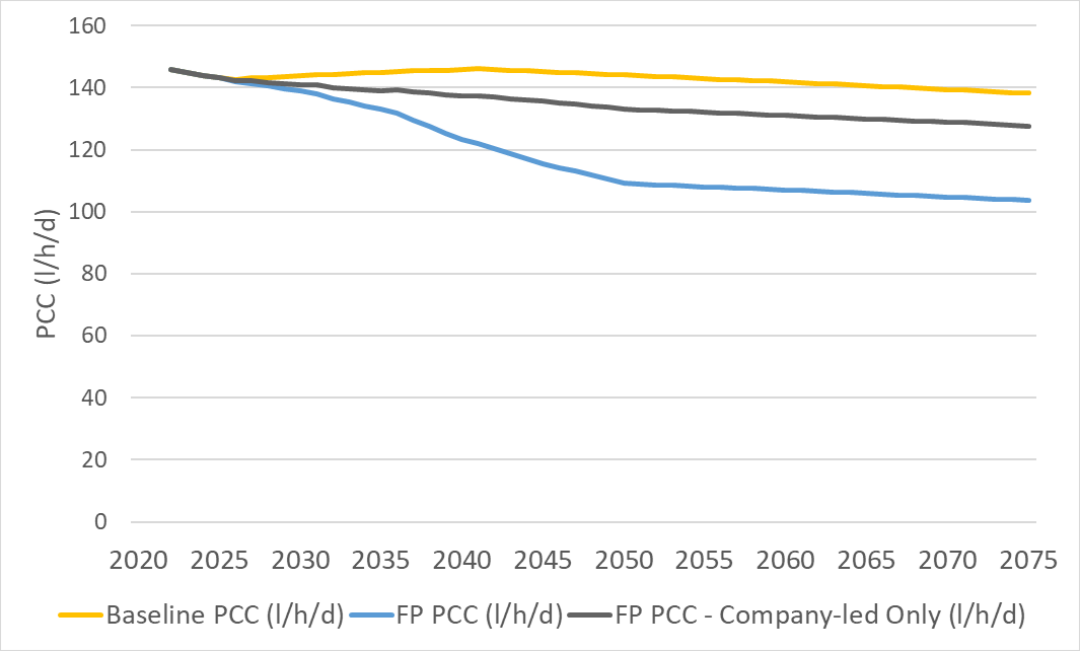

Figure 11-9: London WRZ DYAA PCC

Short-term – 2025-2030

11.121 We will continue our PMP, with 161,000 new internal household meters being installed in AMP8, finishing our main household PMP campaign, achieving a total meter penetration of 70% by the end of AMP8 (The large proportion of flats in the London WRZ makes it harder to meter properties here, and so our meter penetration is lower in London WRZ than other WRZs). We will also undertake a significant upgrade programme, replacing 326,000 old household meters with smart meters to ensure that we are able to harvest data about our customers' water use, allowing us to analyse this data to help customers reduce their water use.

11.122 We will reduce leakage by 82 Ml/d in the London WRZ during AMP8. In AMP8 a considerable amount of our leakage reduction will be enabled by our smart meter programme, which allows us to analyse data to predict where leaks may exist on customer-owned pipes and then fix these leaks on behalf of customers. In addition, we will undertake Advanced DMA leakage reduction, mains rehabilitation, and leakage innovation programmes to reduce our leakage.

11.123 We will continue our programme of Smarter Business Visits, helping businesses to use less water, resulting in a NHH demand reduction of 22 Ml/d across the AMP. In addition to this, we will target continuous flow where it is detected at NHH properties and look to work with retailers, delivering an additional 5 Ml/d reduction.

11.124 We will continue to promote water efficiency activity to help customers use water wisely, including the continuation of a reward-based incentive scheme introduced in AMP7 which promotes water efficiency.

11.125 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service. These actions bring around 90 Ml/d of benefit to our supply-demand balance.

Medium-term – 2030-2045

11.126 We will finish almost all of our metering activity in AMP9, continuing to install bulk meters, upgrading existing 'normal' meters to ensure that all metered customers are using smart meters, and will install new meters into flats. We will achieve a total meter penetration of 92% (including voids) by 2045.

11.127 With enough of our supply area being covered by smart metering, we will implement a financial incentive-based tariff scheme from 2035. This scheme will encourage those who use exceptionally high volumes of water to reduce their usage.

11.128 We will deliver further leakage reduction over this period, with an increasing proportion of our leakage reduction needing to be delivered through mains rehabilitation.

11.129 In our plan we will continue to promote water efficiency activity to help customers use water wisely, building on digital tools.

11.130 We will continue to deliver substantial NHH consumption reduction, in order to meet government targets.

11.131 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

11.132 Our plan relies on the introduction of government-led interventions from 2035 onwards, including both minimum standards on white goods and the introduction of amendments to buildings regulations. This will be required in order to achieve the government ambition of 110 l/h/d per capita consumption.

Long-term – 2045-2075

11.133 In the long-term we will continue to undertake mains rehabilitation to continue to drive down leakage. We expect that a greater proportion of our mains rehabilitation efforts will make use of innovative techniques in the long-term, reducing costs.

11.134 In the longer-term, our demand management programme relies heavily on the intervention of government, as described earlier in this chapter. When leakage has been reduced to very low levels, and we have undertaken those actions in our control which can influence customers' demand for water, actions will need to be driven by government to alter water use through societal changes, primarily through the adoption of minimum standards and amendments to buildings regulations.

11.135 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Supply enhancement

11.136 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11-15. This table does not highlight the new treatment or network assets that may be required under these scenarios, instead focussing on new resource options that will be required. Treatment and reinforcement options that would be required can be found in our WRMP tables and are discussed in Section 7.

11.137 Water which would come from SESRO is described as coming from "West-Thames sources", to align with our dWRMP description (where both SESRO and STT were selected).

Short-Term (2025-2030)

11.138 Through AMP8, if our demand management efforts are successful, there is no strict need for new supply-side interventions to be used in the London WRZ, with our demand management programme giving sufficient benefit to provide the level of drought resilience that is needed. However, given the range of risks which exist in the short-term, our consideration is that we should develop two supply schemes. The first is Horton Kirby Aquifer Storage and Recharge (ASR), an innovative scheme which will store water underground for use during droughts, providing 5 Ml/d of Deployable Output; the second is a scheme which would allow us to make use of existing licence headroom at our Addington groundwater source, providing 2.7 Ml/d of benefit during drought for annual average conditions, and 4.7 Ml/d additional peak capability. We will also continue an existing trading agreement with RWE, associated with Didcot Power Station. This is consistent with our WRMP19, in which we highlighted a need for new supply-side schemes to combat local resilience issues, but no new schemes to deliver a supply-demand balance.

11.139 These options present excellent value to customers. The Horton Kirby ASR option would be delivered under "base" expenditure (i.e., we would not increase water bills to deliver this option), and both the Addington and RWE Didcot licence trade options are very low cost when considering the supply benefit that they bring. These options can also be brought online quickly, with the licence trade extension being available immediately, and Addington and Horton Kirby ASR being deliverable within AMP8.

11.140 Additionally, AMP8 will be a time of great importance in working towards delivering schemes for the future. We will need to undertake planning, development, and begin construction of the Teddington DRA water recycling scheme, and we will need to progress through the consenting and design of SESRO.

Medium-Term (2030-2045)

11.141 In order to deliver our commitment of providing a 1 in 200-year level of drought resilience to our customers, we will need to expand the supply capability of the London WRZ, as we won't be able to reduce demand quickly enough to give this level of resilience with only our existing supplies. The option selected to provide this new resource is the Teddington DRA scheme.

11.142 The work that we have done to develop a programme to deliver the Teddington DRA option has shown us that the option will be deliverable during the early 2030s, with the exact date depending on the speed with which we are able to negotiate the planning and consenting processes. Our preferred plan assumes that we are able to meet the timescale of delivering the option by 2033.

11.143 Our WRMP includes selection of a 75 Ml/d Teddington DRA scheme. This is the largest Teddington DRA variant that we believe to be promotable at this time. We have previously found that significantly larger (300 Ml/d) scheme variants would not be environmentally acceptable.

11.144 In the mid-2030s we will also look to engage in a licence trade with Affinity Water. Affinity Water abstract from the Lower Thames, and this licence trade would involve Affinity Water abstracting less to leave more for us. Affinity Water will be developing the 100 Ml/d Grand Union Canal scheme in their preferred plan, and construction of this scheme would leave them with surplus water available for a short period in the 2030s, which they could transfer to us.

11.145 As described in the preceding sections, during AMP9 and AMP10 we will be constructing SESRO, ready to be used in 2040. In the medium term, the main new sources of water that would be used in the London WRZ are Teddington DRA (up to 2040), and then both Teddington DRA and SESRO (from 2040 onwards).

11.146 There are no actions that we would take to adapt to different demand forecast observations at 2030, with actions being common across all pathways in the 2030s. After 2035 we would, however, review the outcomes of investigations into licence reductions needed to protect the environment, such that we can make necessary licence reductions by 2050. At this point we will appraise the demand situation alongside our assessments for required licence reduction and may make different decisions depending on the situation that we face in the long-term (please see later section on our monitoring plan). If demand is very high then around 2035 we may also need to develop some small groundwater sources in London and begin a transfer with SES water in 2040. The balance of use of the SESRO option in the medium-term between different Thames Water WRZs and other companies would be dependent on the licence reductions identified as being necessary and the pace at which they must be made, the future demand scenario that we encounter, and the success of demand management efforts in different parts of the region.

Long-term (beyond 2045)

11.147 Our long-term water resources plan in the London WRZ is dependent on the scenario of future licence reductions that we identify as being necessary, and on the impacts of climate change. In all scenarios we will continue to make use of water from the SESRO scheme. Our dWRMP highlighted the need for the STT, and potentially other schemes, to be developed alongside SESRO to meet future supply-demand balance needs. The diminished need for new sources of water in our rdWRMP compared to the dWRMP, driven by the requirement to plan on the basis of achievement of the 110 l/h/d PCC target, means that very few sources will be required, unless demand is very high and we need to make licence reductions in line with the "High" scenario, in which case further desalination and water recycling schemes will be needed.

11.148 If the 110 l/h/d target is not achieved, then additional sources of water may be required, with the number, scale, and timing of options required depending on the degree to which the target is missed. As is described in our monitoring plan, there are also other factors which could lead us to need more sources of water in the future, for example if the West Berkshire groundwater scheme is decommissioned earlier than planned. If things don't go to plan with demand management or other factors, having selected the largest single-phase option available to us means that we will have time to properly appraise whether additional new sources are needed, rather than needing to rush the decision as may be required if we opted for a smaller SESRO scheme or the STT.

Option	Max DO	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
SESRO – as per West-Thames Option Table										
RWE Licence Trade	23	2026	2026	2026	2026	2026	2026	2026	2026	2026
Horton Kirby ASR	5	2030	2030	2030	2030	2030	2030	2030	2030	2030
Addington Groundwater	3	2028	2028	2028	2028	2028	2028	2028	2028	2028

Option	Max DO	Year Option is First Utilised in each Pathway								
Water from combination of West-Thames Options	N/A	2040	2040	2040	2040	2040	2040	2053	-	-
Teddington DRA	67	2033	2033	2033	2033	2033	2033	2033	2033	2033
Beckton Desalination 150 Ml/d	133	2050	-	-	-	-	-	-	-	-
Southfleet and Greenhithe	9	2040	-	-	2069	-	-	-	-	-
Deephams Reuse, 46.5 Ml/d	42	2069	-	-	-	-	-	-	-	-
London Confined Chalk	2	2075	-	-	-	-	-	-	-	-
Recommissioning Merton GW Source	2	2072	-	-	-	-	-	-	-	-
Addington MAR	3	2075	-	-	-	-	-	-	-	-
Kidbrooke MAR	8	2074	-	-	-	-	-	-	-	-
Merton MAR	6	2074	-	-	-	-	-	-	-	-
Licence Trade with Affinity Water	50	2033	2033	2033	2033	2033	2033	2033	2033	2033
Import from Cheam (SES) to Merton	15	2040	2040	2040	-	-	-	-	-	-
SE London Catchment Portfolio	1	2075	-	-	2075	-	-	-	-	-

Table 11-15: Options used in London WRZ

Utilisation in the preferred pathway.

11.149 Option utilisation in the preferred programme, i.e. the utilisation of options assuming that we follow the supply-demand balance in pathway 4, is set out in Table 11-16. Note that we have only set out utilisation under the DYAA scenario because we do not assess a DYCP supply-demand balance for London WRZ.

Short-term (2025-2030)

11.150 In the short-term, the London WRZ uses existing supplies, providing a 1 in 100-year level of resilience. Recognising the risks around delivery of our short-term demand management plan, we will continue our licence trade with RWE (associated with Didcot Power Station, which RWE have indicated is only available during AMP8 due to other possible uses of their abstraction licence), and will develop the Horton Kirby ASR and Addington groundwater schemes. During this period, we will export water to Affinity Water, continuing the use of assets constructed to facilitate construction of HS2, an efficient solution for Affinity Water's short-term supply needs. While our preferred plan includes export of water to Affinity, we are still in contractual discussions with them and note that inclusion of exports within our WRMP does not constitute an agreement that these exports will be made.

Medium-term (2030-2045)

11.151 In the early 2030s, we will begin using the Teddington DRA scheme. In 2033 (not seen in Table 11-16) we will use Teddington DRA at its full capacity, 67 Ml/d, but as demand management reduces our need for water through the 2030s our use of Teddington DRA shows some decline. In practice, we would utilise the option at its full capability throughout this period, offering a higher level of service to our customers during this period. In the mid-2030s our preferred programme also includes utilisation of a small licence trade with Affinity Water, facilitated by the construction of the Grand Union

Canal. With the Grand Union Canal providing enough water for all of Affinity Water's needs (and indeed more), we will cease the Fortis Green and Hampstead Lane transfers from 2031 onwards. From 2040 onwards, when we move to a 1 in 500-year level of resilience, we would begin to make use of water from the SESRO scheme.

Long-term (beyond 2045)

11.152 As we continue through the planning period, additional water would be supplied from SESRO. In the further future, groundwater sources will be needed to supplement supplies in London.

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
ASR Horton Kirby	5	5	5	5	5	5	5	5	5	5
Addington Groundwater	3	3	3	3	3	3	3	3	3	3
Didcot Licence Trade	23	0	0	0	0	0	0	0	0	0
Water from West-Thames Options, Incl. Conjunctive Benefit from T2AT	0	10	50	27	122	131	137	143	136	142
Teddington DRA	0	54	54	19	67	67	67	67	67	67
Southfleet & Greenhithe GW Source	0	0	0	0	0	0	0	0	9	9
SE London catchment scheme	0	0	0	0	0	0	0	0	0	1
Treated Exports to Affinity Water Zone 4	-7	0	0	0	0	0	0	0	0	0
Raw Export to Affinity Water Zone 4	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
Export to Affinity Water, Cockfosters	-5	0	0	0	0	0	0	0	0	0
Export to Affinity Water, Perivale	-10	0	0	0	0	0	0	0	0	0

Table 11-16: Option Utilisation in Preferred Programme, London WRZ

Swindon and Oxfordshire (SWOX) WRZ

11.153 Section 6 of our draft WRMP24 describes the supply-demand balance situation in the SWOX WRZ across the planning period. We are faced with supply-demand deficits in all future scenarios throughout the planning period. By 2050 the range of deficits we have considered ranges from around 30 Ml/d to over 110 Ml/d.

11.154 The implementation of our preferred plan, a twin-track approach combining demand management with resource development, will resolve the supply-demand deficit in all years of the planning period for the SWOX WRZ.

Demand Management

11.155 Being consistent across all nine future scenarios, we will first describe our demand management programme for the SWOX WRZ. The main components of our demand management programme are common across all of our WRZs, and so the narrative here is identical to that from the London WRZ. The figures presented in this section are specific to the SWOX WRZ.

11.156 Demand management is the largest component of our plan for the SWOX WRZ, particularly in the short-term.

11.157 Table 11-17 shows a detailed breakdown of the demand management options adopted in our preferred plan for the SWOX WRZ. Figure 11-10 shows our leakage forecast, Figure 11-11 shows our meter penetration forecast, and Figure 11-12 shows our PCC forecast, all for the SWOX WRZ.

	Supply Demand Benefit (Ml/d)				
SWX	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	0.00				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering CSL	0.26	0.31	0.00	0.00	0.00
Bulk metering CSL	0.56	0.06	0.03	0.00	0.00
Replacement metering CSL	3.18	0.94	0.00	0.00	0.00
Mains replacement	0.20	1.18	0.80	1.24	0.88
Leakage innovation	0.10	0.10	0.00	0.85	1.23
Metering innovation CSL	0.00	0.00	0.00	0.00	0.00
Advanced DMA Intervention	1.00	0.00	0.00	0.00	0.00
Total leakage reduction	5.29	2.58	0.84	2.09	2.11
AMP7 Carry-over metering	2.27				
Household metering	0.57	0.00	0.00	0.00	0.00
Non-household metering	0.07	0.16	0.00	0.00	0.00
Household water efficiency	3.43	1.07	0.00	0.00	0.00
Non-household water efficiency	0.00	0.00	0.00	0.00	0.00
Metering innovation	0.08	0.47	0.28	0.00	0.00
Innovative tariffs	0.18	1.89	2.27	0.06	0.00
Total usage reduction	6.59	3.59	2.55	0.06	0.00
Total benefit from DMP	11.89	6.18	3.39	2.15	2.11

	New & Replacement Meters				
SWX	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	1,024	1,130	879	0	0
Household Metering (New)	12,181	8,014	4,862	0	0
Household Metering (Upgrades)	162,778	64,446	6,239	0	0
Non-Household Metering (Upgrades)	9,336	8,538	0	0	0

Table 11-17: SWOX WRZ Demand Management Programme Breakdown

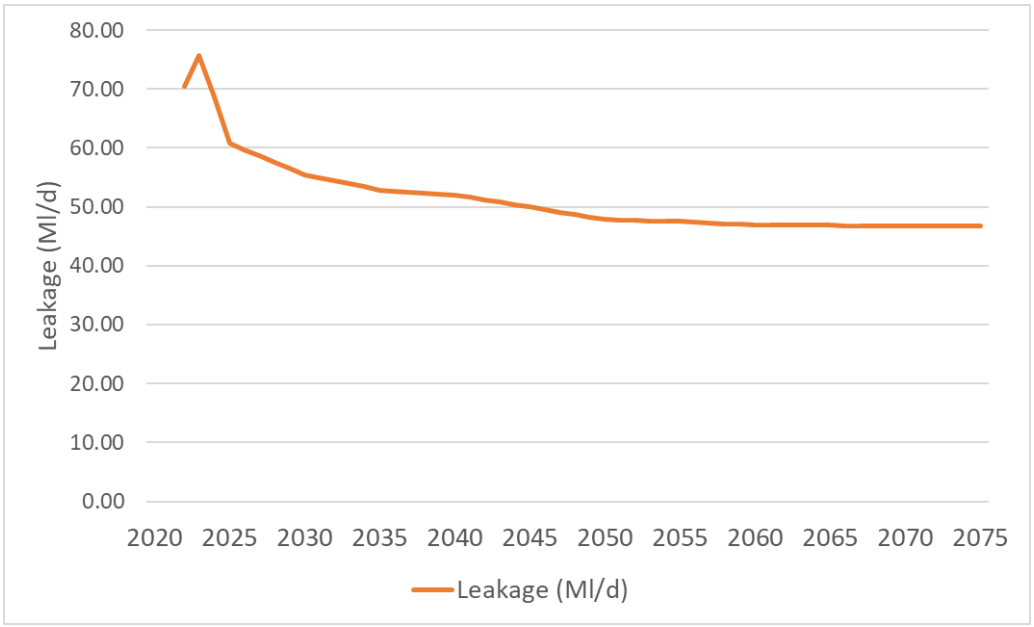

Figure 11-10: SWOX WRZ Final Plan Leakage

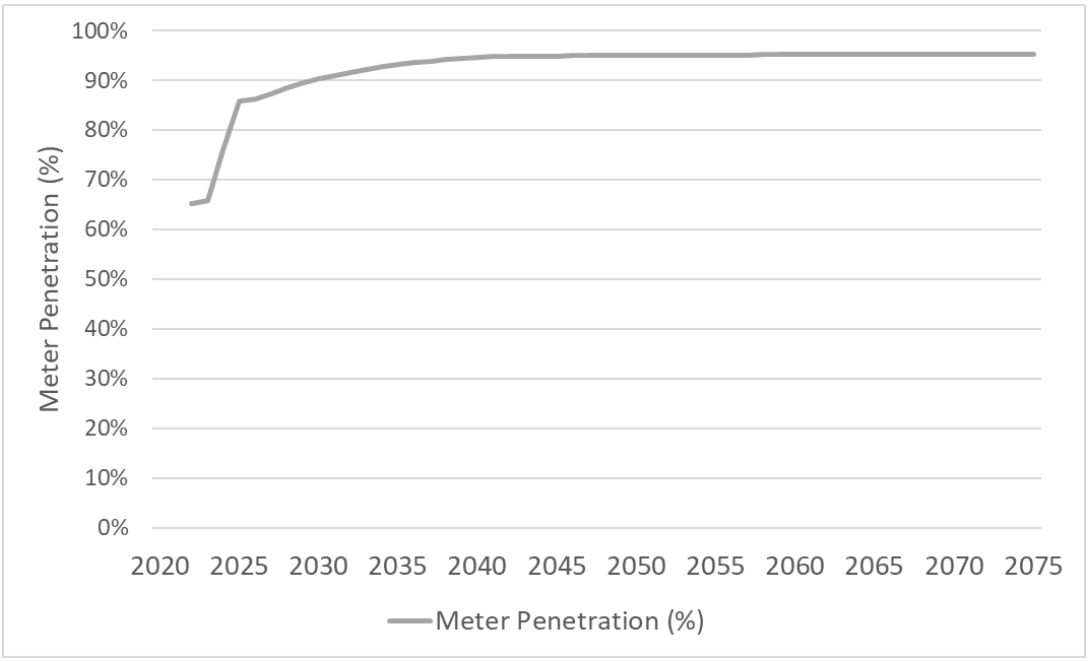

Figure 11-11: SWOX WRZ Final Plan Meter Penetration

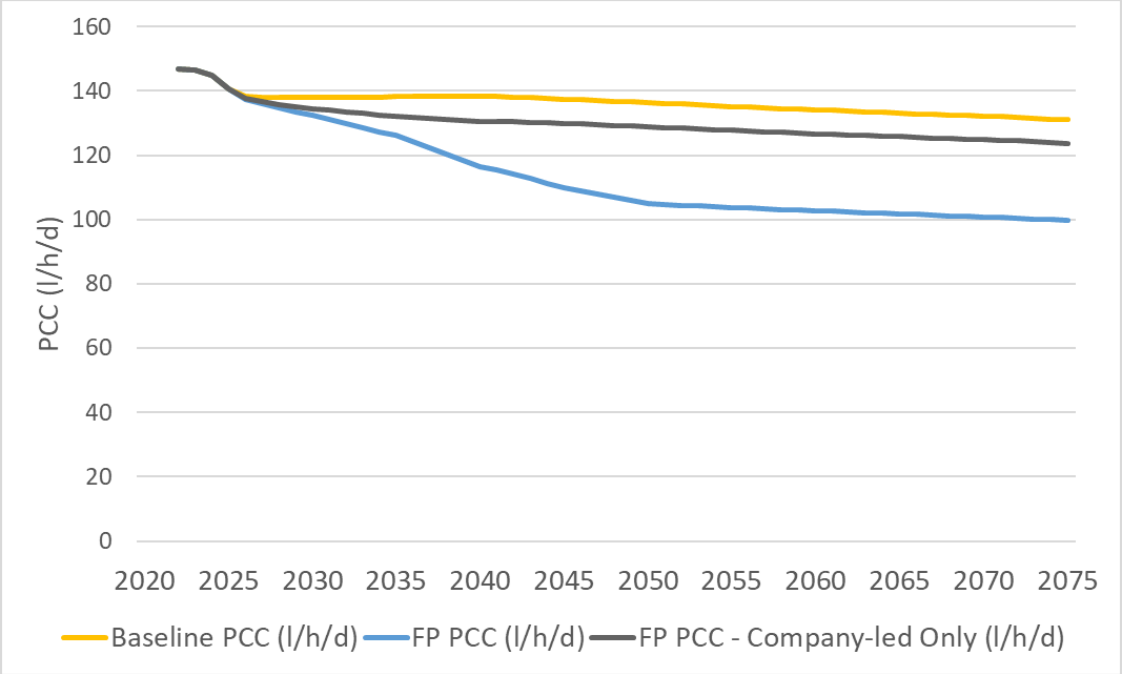

Figure 11-12: SWOX WRZ DYAA PCC

Short-term – 2025-2030

11.158 We will continue our PMP, with around 12,000 new household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 90% by the end of AMP8. We will also undertake a significant upgrade programme, replacing old meters with smart meters to ensure that we are able to harvest data about our customers' water use, allowing us to analyse this data to help customers reduce their water use.

11.159 We will reduce leakage by 5.3 Ml/d in the SWOX WRZ during AMP8. In AMP8 a considerable amount of our leakage reduction will be enabled by our smart meter programme, which allows us to analyse data to predict where leaks may exist on customer-owned pipes. In addition, we will undertake Advanced DMA leakage reduction, mains rehabilitation, and leakage innovation programmes to reduce our leakage.

11.160 We will continue to promote water efficiency activity to help customers use water wisely, including the continuation of a reward-based incentive scheme introduced in AMP7 which promotes water efficiency.

11.161 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Medium-term – 2030-2045

11.162 We will finish almost all of our metering efforts in AMP9, continuing to install bulk meters and upgrade meters to ensure that all metered customers are using smart meters. We will achieve a total meter penetration of 94% (including voids) by 2045.

11.163 With enough of our supply area being covered by smart metering, we will implement a financial incentive-based tariff scheme from 2035. This scheme will encourage those who use exceptionally high volumes of water to reduce their usage.

11.164 We will deliver further leakage reduction over this period, with an increasing proportion of our leakage reduction needing to be delivered through mains rehabilitation.

11.165 We will continue to promote water efficiency activity to help customers use water wisely.

11.166 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

11.167 Our plan relies on the introduction of government-led interventions from 2035 onwards, including both minimum standards on white goods and the introduction of amendments to buildings regulations. This will be required in order to achieve the government ambition of 110 l/h/d per capita consumption.

Long-term – 2045-2075

11.168 In the long-term we will continue to undertake mains rehabilitation to continue to drive down leakage. We expect that a greater proportion of our mains rehabilitation efforts will make use of innovative techniques in the long-term, reducing costs.

11.169 In the longer-term, our demand management programme relies on the intervention of government, as described earlier in this section. When leakage has been reduced to very low levels, and we have undertaken those actions which can influence customers' demand for water, actions will need to be driven by government to alter water use through societal changes and the adoption of minimum standards and buildings regulations changes.

11.170 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Supply enhancement

11.171 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11-18.

Short-term (2025-2030)

11.172 In the short-term, our existing supplies will be sufficient to provide our customers with a 1 in 100-year Level of Service. During this period, we will need to undertake the design and construction of the Moulsford groundwater source, in order to ensure that its output will be available in 2033.

Medium Term (2030-2045)

11.173 In order to facilitate achievement of a 1 in 200-year resilience level, in 2033 we will need to begin using the Moulsford groundwater source.

11.174 In 2035 we will need to appraise the outcome from all of the investigations that we will undertake to determine the future licence reductions that will be necessary at our existing sources. At this point we will also need to assess what population growth has occurred and the success of our demand management schemes.

11.175 Water is needed from SESRO in SWOX WRZ in all but the most benign scenarios, with water from SESRO being used in pathways 1-7. In some pathways, a transfer from Henley WRZ is also needed from 2040. In the dWRMP, both raw water and treated water were transferred from SESRO around SWOX WRZ. In the rdWRMP, our appraisal indicates that raw water transfer only is required, but we will monitor the need for new treatment and network assets in the SWOX WRZ according to the success of demand management and licence reductions which may need to be made. In a very adverse

scenario, we may require works to expand the capacity of our existing source, Woods Farm. If the 110 l/h/d target looks as though it will not be achieved, we may need to develop additional treatment assets to treat water from SESRO.

Long-Term (Beyond 2045)

11.176 In the long-term, if the 110 l/h/d target is hit, in many situations it is likely that water available from SESRO will be sufficient to provide SWOX with the water that it needs, along with construction of the Oxford Canal option being required in more adverse scenarios. If the 110 l/h/d target is missed, then SWOX will require more water from SESRO and we may need to construct additional treatment assets or transfer water from our other zones.

Option	Max DO Benefit (DYAA)	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
Water from West-Thames Options	N/A	2040	2040	2040	2040	2040	2040	2040	-	-
Moulsford GW Source	2	2033	2033	2033	2033	2033	2033	2033	2033	2033
Woods Farm GW Source	2	2040	-	-	2074	-	-	-	-	-
Import from Henley	5	2042	-	-	2040	2040	2040	-	-	-
Transfers with SWA	2	2026	2026	2026	2026	2026	2026	2026	2026	2026
Gatehampton Drought Permit	4	2033	2033	2033	2033	2033	2033	2033	2033	2033
Oxford Canal, Duke's Cut	12	2065	-	-	2040	-	-	-	-	-

Table 11-18: Options Used in SWOX WRZ

Utilisation in the preferred pathway

11.177 In the supply-demand balance scenario in pathway four, our supplies would be supplemented from the following sources (Table 11-19 and Table 11-20).

Short-term (2025 to 2030)

11.178 In the short-term, we would continue to use our existing supplies in the SWOX WRZ.

Medium-term (2030 to 2045)

11.179 From 2033 onwards, we would temporarily make use of the Gatehampton Drought permit, and would use water from a new groundwater source to move to a 1 in 200-year level of resilience. In 2040 we would then begin making use of water from SESRO, would transfer water from our Henley WRZ, and will construct and use the Oxford Canal scheme. Using SESRO for the SWOX WRZ will allow us to make a licence reduction at our Farmoor source and will facilitate a 1 in 500-year level of resilience.

Long-term (Beyond 2045)

11.180 In the long-term, we would continue to make use of water from SESRO and the Oxford Canal. If we follow our preferred programme pathway for the long-term, we will also upgrade our existing source at Woods Farm to provide supplies in the far future.

11.181 Compared to the dWRMP24, the volume of new sources required in the SWOX WRZ is significantly reduced, due to the preferred plan including achievement of the 110 l/h/d target.

Option	Option Utilisation by Year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Water from West-Thames Options	0.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0
Moulsford GW Source	0.0	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Woods Farm GW Source	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
Import from Henley	0.0	0.0	3.2	0.4	1.3	1.3	1.3	1.3	1.3	1.3
Oxford Canal	0.0	0.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Gatehampton Drought Permit	0.0	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Import from SWA, existing transfers	0.4	0.4	3.5	3.2	-0.3	0.3	0.1	0.9	1.9	0.2

Table 11-19: Preferred Programme Option Utilisation in SWOX WRZ, DYAA

Option	Option Utilisation by Year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Water from West-Thames Options	0.0	0.0	24.0	23.9	24.0	24.0	24.0	24.0	24.0	24.0
Moulsford GW Source	0.0	0.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Woods Farm GW Source	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
Import from Henley	0.0	0.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Oxford Canal	0.0	0.0	0.5	0.0	1.4	3.1	4.1	5.7	7.2	6.0
Gatehampton Drought Permit	0.0	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Net Import from SWA, existing transfers	0.4	0.7	3.5	3.2	3.2	3.2	3.2	3.2	3.2	3.2

Table 11-20: Preferred Programme Option Utilisation in SWOX WRZ, DYCP

Slough, Wycombe and Aylesbury (SWA) WRZ

11.182 Section 6 of our dWRMP describes the supply-demand balance situation in the SWA WRZ across the planning period. In the short-term we do not have a supply-demand imbalance in the SWA WRZ. In the long-term we would face a deficit in all scenarios. By 2050 the range of supply-demand balances that we have considered ranges from a 1 Ml/d deficit to a 53 Ml/d deficit.

11.183 The implementation of our preferred plan, a twin-track approach combining demand management with resource development, resolves the supply-demand deficit in all years of the planning period for the SWA WRZ.

Demand Management

11.184 Being consistent across all nine future scenarios, we will first describe our demand management programme for the SWA WRZ. The main components of our demand management programme are common across all of our WRZs, and so the narrative here is identical to that from the London WRZ. The figures presented in this section are specific to the SWA WRZ.

11.185 Demand management is the largest component of our plan for the SWA WRZ, particularly in the short-term.

11.186 Table 11-21 shows a detailed breakdown of the demand management options adopted in our preferred plan for the SWA WRZ. Figure 11-13 shows our leakage forecast, Figure 11-14 shows our meter penetration forecast, and Figure 11-15 shows our PCC forecast, all for the SWA WRZ.

	Supply Demand Benefit (Ml/d)				
SWA	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	0.00				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering CSL	0.10	0.12	0.00	0.00	0.00
Bulk metering CSL	0.40	0.11	0.08	0.00	0.00
Replacement metering CSL	1.54	0.60	0.00	0.00	0.00
Mains replacement	0.10	0.63	0.89	0.80	0.77
Leakage innovation	0.10	0.00	0.00	0.20	0.42
Metering innovation CSL	0.00	0.00	0.00	0.00	0.00
Advanced DMA Intervention	0.50	0.00	0.00	0.00	0.00
Total leakage reduction	2.73	1.45	0.98	1.00	1.19
AMP7 Carry-over metering	1.49				
Household metering	0.54	0.00	0.00	0.00	0.00
Non-household metering	0.03	0.10	0.00	0.00	0.00
Household water efficiency	1.76	0.73	0.00	0.00	0.00
Non-household water efficiency	0.00	0.00	0.00	0.00	0.00
Metering innovation	0.04	0.81	0.52	0.00	0.00
Innovative tariffs	0.13	0.02	1.01	0.14	0.00
Total usage reduction	3.99	1.66	1.53	0.14	0.00
Total benefit from DMP	6.72	3.11	2.50	1.14	1.19

	New & Replacement Meters				
SWA	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	2,420	2,699	2,265	0	0
Household Metering (New)	10,740	15,379	10,216	0	0
Household Metering (Upgrades)	79,016	39,911	3,291	0	0
Non-Household Metering (Upgrades)	3,529	3,337	0	0	0

Table 11-21: SWA WRZ Demand Management Programme Breakdown

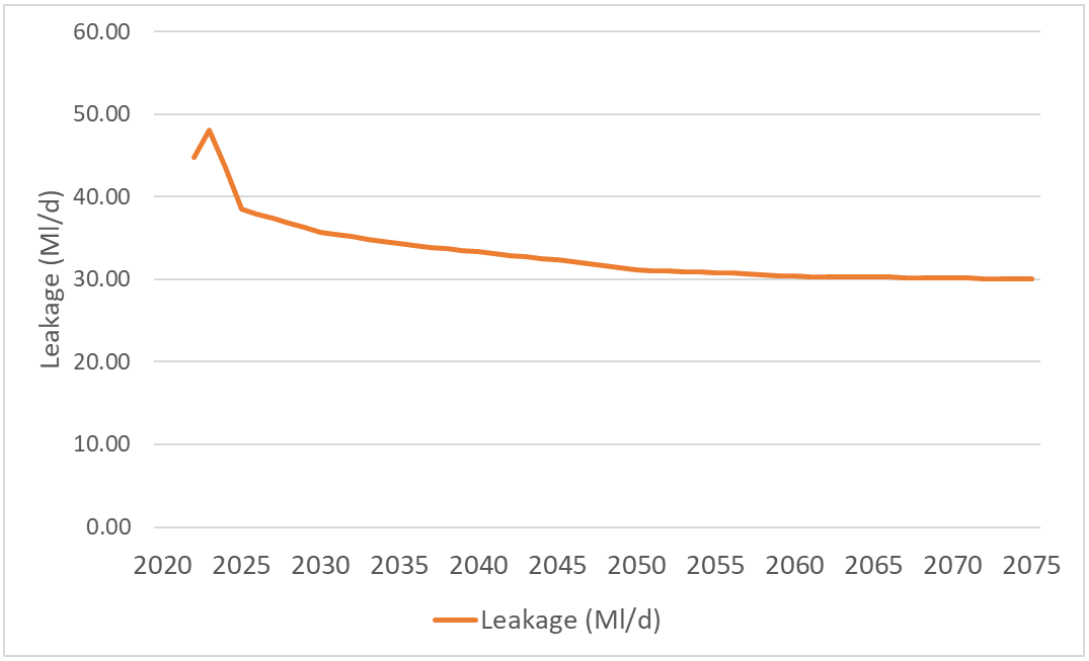

Figure 11-13: SWA WRZ Final Plan Leakage

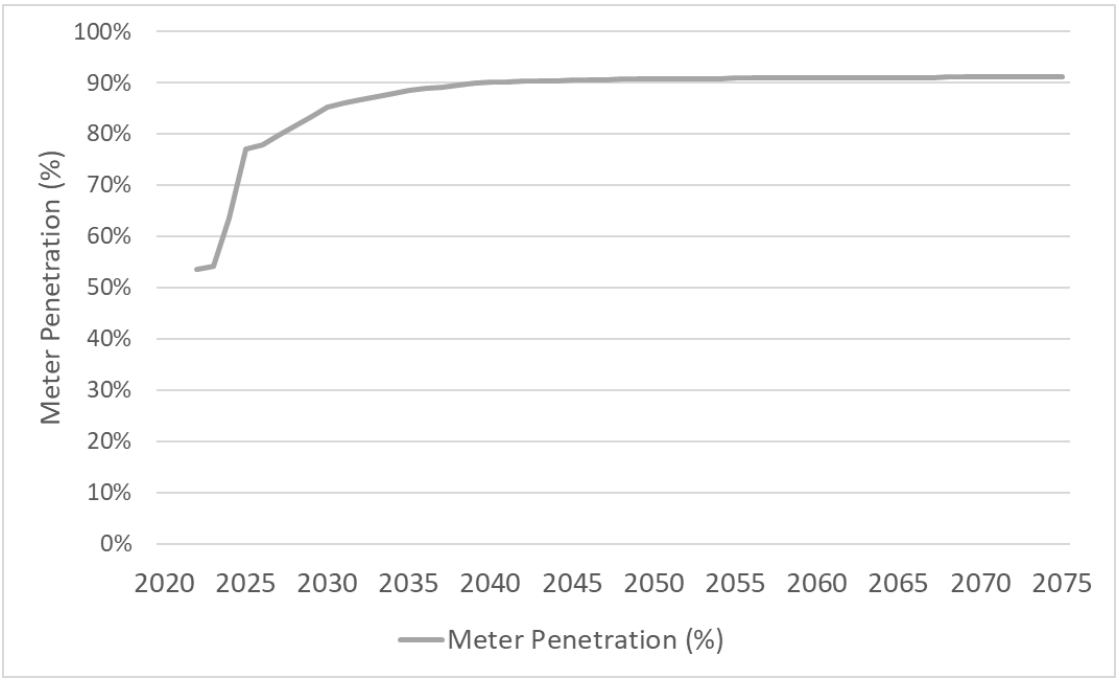

Figure 11-14: SWA WRZ Final Plan Meter Penetration

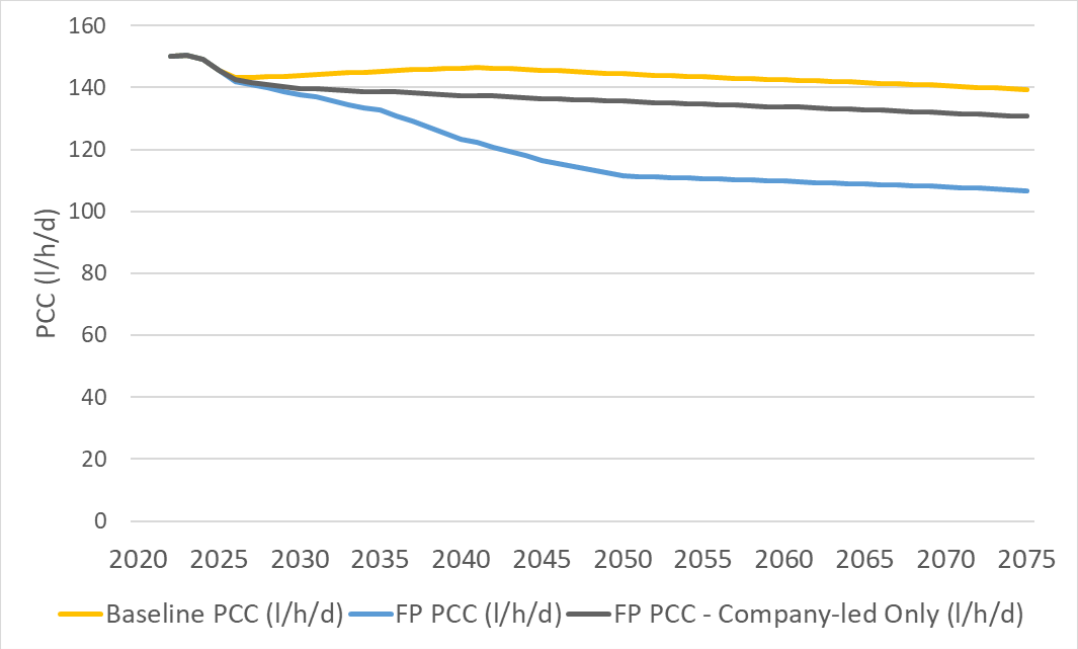

Figure 11-15: SWA WRZ PCC

Short-term – 2025-2030

11.187 We will continue our PMP, with around 11,000 household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 85% by the end of AMP8. We will also undertake a significant upgrade programme including installation of around 77,000 smart meters, replacing old meters with smart meters to ensure that we are able to harvest data about our customers' water use, allowing us to analyse this data to help customers reduce their water use.

11.188 We will reduce leakage by 2.73 Ml/d in the SWA WRZ during AMP8. In AMP8 a considerable amount of our leakage reduction will be enabled by our smart meter programme, which allows us to analyse data to predict where leaks may exist on customer-owned pipes. In addition, we will undertake Advanced DMA leakage reduction, mains rehabilitation, and leakage innovation programmes to reduce our leakage.

11.189 We will continue to promote water efficiency activity to help customers use water wisely, including the continuation of a reward-based incentive scheme introduced in AMP7 which promotes water efficiency.

11.190 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Medium-term – 2030-2045

11.191 We will finish almost all of our metering efforts in AMP9, continuing to install bulk meters and upgrade meters to ensure that all metered customers are using smart meters. We will achieve a total meter penetration of 97% (including voids) by 2045.

11.192 With enough of our supply area being covered by smart metering, we will be able to implement a financial incentive-based tariff scheme from 2035. This scheme will encourage those who use exceptionally high volumes of water to reduce their usage.

11.193 We will deliver further leakage reduction over this period, with an increasing proportion of our leakage reduction needing to be delivered through mains rehabilitation.

11.194 Our plan is to continue to promote water efficiency activity to help customers use water wisely.

11.195 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

11.196 Our plan relies on the introduction of government-led interventions from 2035 onwards, including both minimum standards on white goods and the introduction of amendments to buildings regulations. This will be required in order to achieve the government ambition of 110 l/h/d per capita consumption.

Long-term – 2045-2075

11.197 In the long-term we will continue to undertake mains rehabilitation to continue to drive down leakage. We expect that a greater proportion of our mains rehabilitation efforts will make use of innovative techniques in the long-term, reducing costs.

11.198 In the longer-term, our demand management programme relies on the intervention of government, as described earlier in this section. When leakage has been reduced to very low levels, and we have undertaken those actions which can influence customers' demand for water, actions will need to be driven by government to alter water use through societal changes and the adoption of minimum standards and buildings regulations changes.

11.199 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Supply enhancement

11.200 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11-22. Our plan shows that, assuming that demand management interventions are successful, no new sources of water would be needed in the SWA WRZ until 2050 at the earliest. In several future scenarios, there is no need for new sources of water in the SWA WRZ throughout the planning period. New sources of water would only be needed in the SWA WRZ in scenarios of "High" environmental destination.

11.201 In the dWRMP, the total amount of resource required across the SWOX and SWA WRZs meant that the best option was to transfer water from SESRO across SWOX and into SWA, via a treated water pipeline. In the rdWRMP, with less water being needed, construction of a new WTW at Medmenham, which would abstract water released by SESRO, is the more efficient option. If PCC reduction does not go as planned and more water is needed, we would choose to transfer treated water from SESRO across from SWOX, rather than build this new treatment works.

The utilisation of options in pathway 4 is shown in Table 11-23 and Table 11-24.

Option	Max DO	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
Water from West-Thames Sources, Treated at new Medmenham WTW	24	2050	-	-	2050	-	-	2050	-	-
Groundwater - Datchet	2	2064	-	-	2074	-	-	-	-	-

Table 11-22: Options Used in SWA WRZ

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Water from West-Thames Sources, imported via SWOX	0.0	0.0	0.0	0.0	11.6	11.8	10.8	11.2	11.7	8.0
Groundwater - Datchet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6
Net Export to SWOX	-0.4	-0.4	-3.5	-3.2	0.3	-0.3	-0.1	-0.9	-1.9	-0.2

Table 11-23: Preferred programme option utilisation in SWA WRZ, DYAA

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Water from West-Thames Sources, imported via SWOX	0.0	0.0	0.0	0.0	8.0	8.0	8.0	8.0	8.0	8.0
Groundwater - Datchet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Net Export to SWOX	-0.4	-0.7	-3.5	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2	-3.2

Table 11-24: Preferred programme option utilisation in SWA WRZ, DYCP

Kennet Valley WRZ

11.202 Section 6 of our dWRMP describes the supply-demand balance situation in the Kennet Valley WRZ across the planning period. We do not have a supply-demand deficit in the short-term, but as we transition to a 1 in 500-year resilience we anticipate a deficit in all future scenarios. By 2050 the range of deficits that we have planned for ranges from 5 Ml/d to 37 Ml/d.

11.203 The implementation of our preferred plan, a twin-track approach combining demand management with resource development, resolve the supply-demand deficit in all years of the planning period for the Kennet Valley WRZ.

Demand Management

11.204 Being consistent across all nine future scenarios, we will first describe our demand management programme for the Kennet Valley WRZ. The main components of our demand management programme are common across all of our WRZs, and so the narrative here is identical to that from other WRZs. The figures presented in this section are specific to the Kennet Valley WRZ.

11.205 Demand management is the largest component of our plan for the Kennet Valley WRZ, particularly in the short-term.

11.206 Table 11-25 shows a detailed breakdown of the demand management options adopted in our preferred plan for the Kennet Valley WRZ. Figure 11-16 shows our leakage forecast, Figure 11-17 shows our meter penetration forecast, and Figure 11-18 shows our PCC forecast, all for the Kennet Valley WRZ.

	Supply Demand Benefit (Ml/d)				
KVZ	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	0.00				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering CSL	0.08	0.09	0.00	0.00	0.00
Bulk metering CSL	0.36	0.05	0.04	0.00	0.00
Replacement metering CSL	0.86	0.23	0.00	0.00	0.00
Mains replacement	0.04	0.40	0.34	0.39	0.39
Leakage innovation	0.11	0.05	0.09	0.39	0.76
Metering innovation CSL	0.00	0.00	0.00	0.00	0.00
Advanced DMA Intervention	0.60	0.25	0.15	0.00	0.00
Total leakage reduction	2.06	1.08	0.62	0.78	1.15
AMP7 Carry-over metering	2.63				
Household metering	0.24	0.00	0.00	0.00	0.00
Non-household metering	0.02	0.04	0.00	0.00	0.00
Household water efficiency	0.96	0.29	0.00	0.00	0.00
Non-household water efficiency	0.24	0.19	0.14	0.12	0.10
Metering innovation	0.04	0.27	0.17	0.00	0.00
Innovative tariffs	0.11	0.65	0.90	0.47	0.00
Total usage reduction	4.25	1.43	1.21	0.59	0.10
Total benefit from DMP	6.31	2.51	1.83	1.38	1.25

	New & Replacement Meters				
KVZ	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	1,125	1,249	1,017	0	0
Household Metering (New)	4,949	5,040	3,352	0	0
Household Metering (Upgrades)	44,456	17,576	2,174	0	0
Non-Household Metering (Upgrades)	2,896	2,613	0	0	0

Table 11-25: Kennet Valley WRZ Demand Management Programme Breakdown

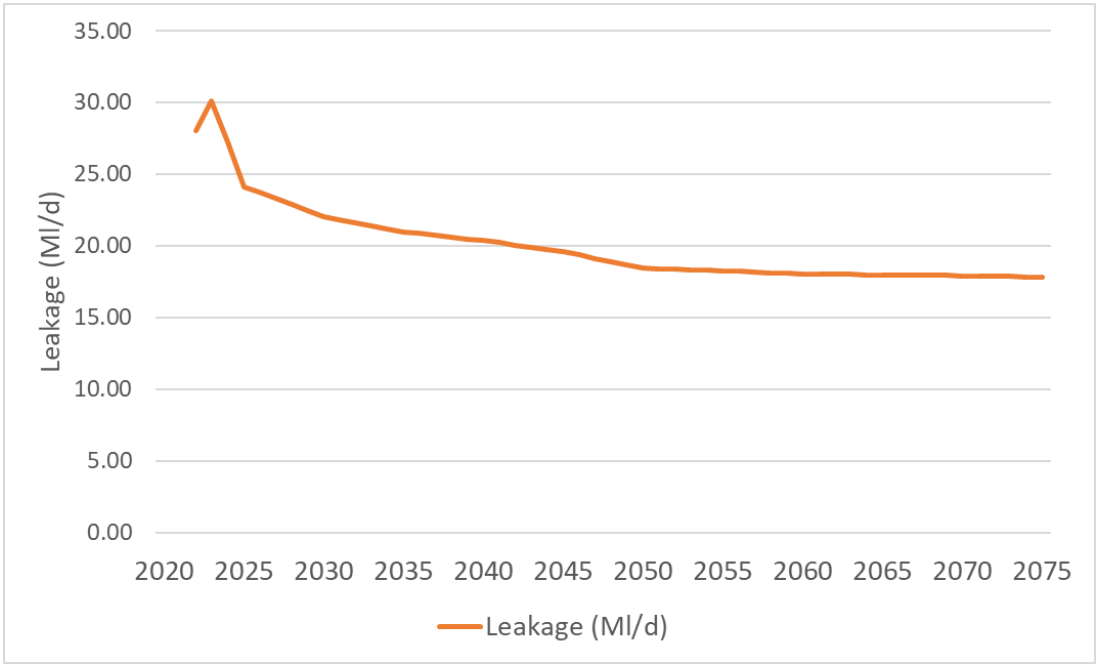

Figure 11-16: Kennet Valley Final Plan Leakage

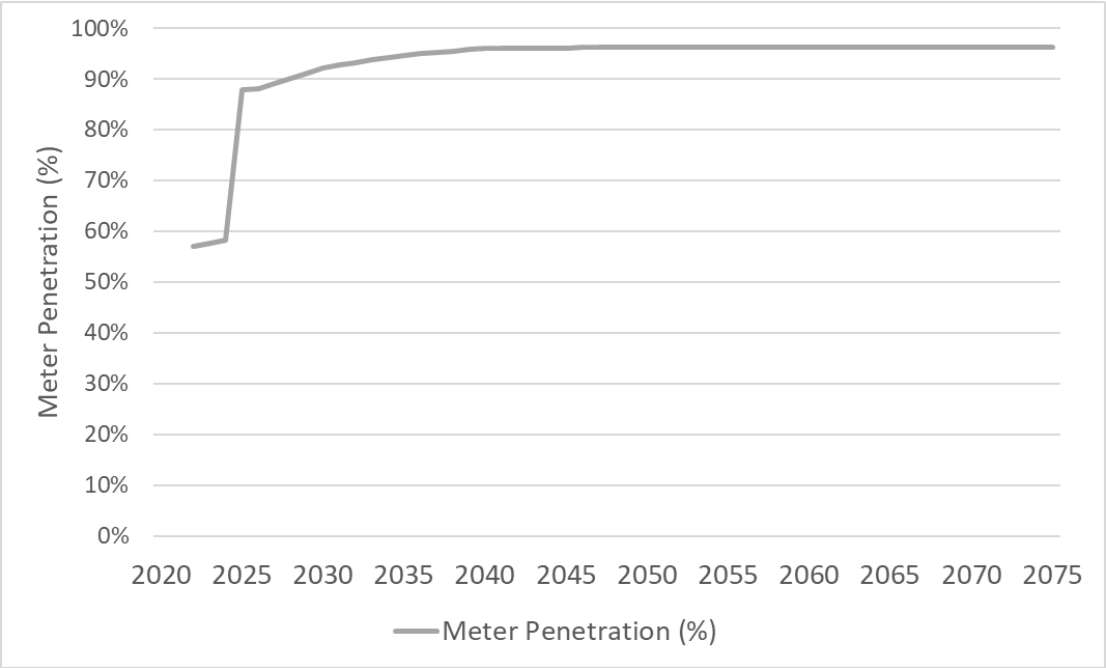

Figure 11-17: Kennet Valley Final Plan Meter Penetration

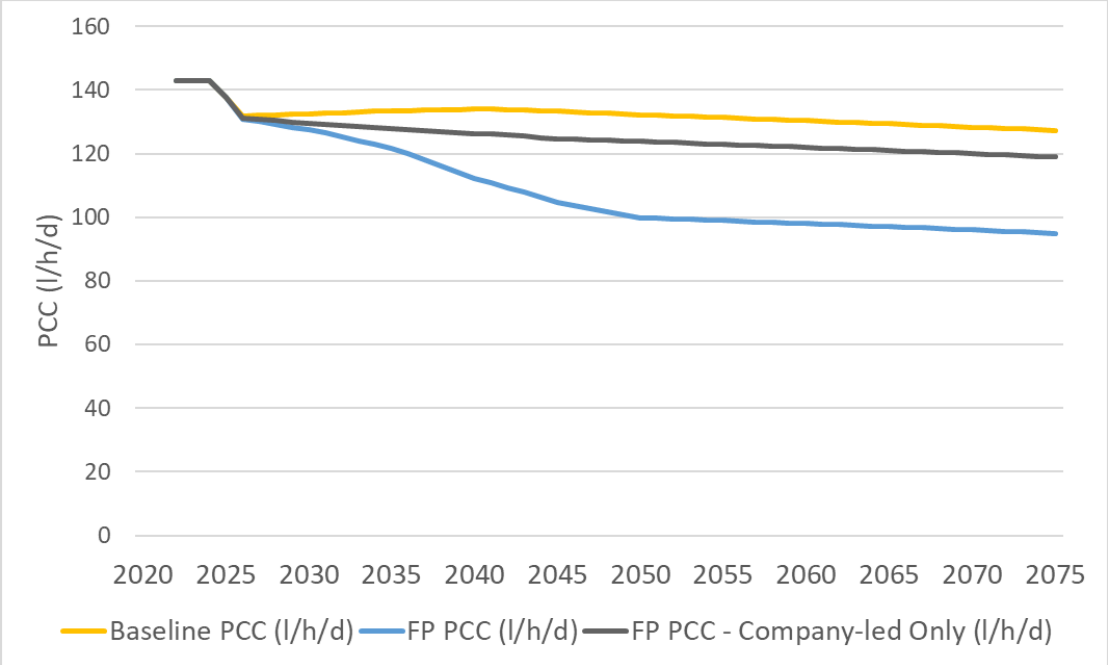

Figure 11-18: Kennet Valley WRZ PCC

Short-term – 2025-2030

11.207 We will continue our PMP, with nearly 5,000 new household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 92% by the end of AMP8. We will also undertake a significant upgrade programme, replacing over 43,000 old meters with smart meters to ensure that we are able to harvest data about our customers' water use, allowing us to analyse this data to help customers reduce their water use.

11.208 We will reduce leakage by 2.06 Ml/d in the Kennet Valley WRZ during AMP8. In AMP8 a considerable amount of our leakage reduction will be enabled by our smart meter programme, which allows us to analyse data to predict where leaks may exist on customer-owned pipes. In addition, we will undertake Advanced DMA leakage reduction, mains rehabilitation, and leakage innovation programmes to reduce our leakage.

11.209 Continue to promote water efficiency activity to help customers use water wisely, including the continuation of a reward-based incentive scheme introduced in AMP7 which promotes water efficiency.

11.210 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Medium-term – 2030-2045

11.211 We will finish almost all of our metering efforts in AMP9, continuing to install bulk meters and upgrade meters to ensure that all metered customers are using smart meters. We will achieve a total meter penetration of 97% (including voids) by 2045.

11.212 With enough of our supply area being covered by smart metering, we will be able to implement a financial incentive-based tariff scheme from 2035. This scheme will encourage those who use exceptionally high volumes of water to reduce their usage.

11.213 We will deliver further leakage reduction over this period, with an increasing proportion of our leakage reduction needing to be delivered through mains rehabilitation.

11.214 We will continue to promote water efficiency activity to help customers use water wisely.

11.215 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

11.216 Our plan relies on the introduction of government-led interventions from 2035 onwards, including both minimum standards on white goods and the introduction of amendments to buildings regulations. This will be required in order to achieve the government ambition of 110 l/h/d per capita consumption.

Long-term – 2045-2075

11.217 In the long-term we will continue to undertake mains rehabilitation to continue to drive down leakage. We expect that a greater proportion of our mains rehabilitation efforts will make use of innovative techniques in the long-term, reducing costs.

11.218 In the longer-term, our demand management programme relies on the intervention of government, as described earlier in this section. When leakage has been reduced to very low levels, and we have undertaken those actions which can influence customers' demand for water, actions will need to be driven by government to alter water use through societal changes and the adoption of minimum standards and buildings regulations changes.

11.219 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Supply enhancement

11.220 The new resources required under different pathways are detailed in Table 11-26. Utilisation in our preferred programme scenario is shown in Table 11-27 and Table 11-28.

11.221 These tables show that new resources would not be needed until after 2040 under any future scenario. We will need to monitor population growth and the success of our demand management interventions through the 2020s and 2030s to identify additional resources that may be needed from 2042. The main reason for new resources being needed after 2040 is the move to a 1 in 500-year level of resilience, which has a major impact on the water we can rely on from the run-of-river source in Reading.

11.222 If demand is high in the 2030s and we need to make licence reductions in line with the "High" scenario, we would need to recommission our groundwater source at Mortimer, for use in 2042.

11.223 If SESRO and the T2ST are built, it would be very efficient to add a spur from the T2ST to the Kennet Valley WRZ to supply Newbury, as the route for the T2ST is planned to be very close to Newbury, and this additional supply would add resilience to the Newbury area. Our supply-demand balance shows that, in situations where we follow the "High" environmental destination scenario, this transfer is needed from 2050.

11.224 In the longer-term, according to the need which South East Water have, we may need to transfer water to them.

11.225 If PCC reduction does not hit the 110 l/h/d target, then we may need to construct a tunnel from the Thames to our Fobney WTW.

Option	Max DO (DYAA)	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
Transfer from T2ST Spur	10	2050	-	-	2050	-	-	2050	-	-
Recommission Mortimer GW Source	5	2042	-	-	2042	-	-	-	-	-
Playhatch drought permit	4	2040	2036	2036	2031	2031	2031	2031	2031	2031
Export to SEW	4	2061	-	-	2070	-	-	-	-	-

Table 11-26: Options used in Kennet Valley WRZ

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Transfer from T2ST Spur	0.0	0.0	0.0	0.0	5.0	4.8	4.5	4.3	4.2	4.1
Recommission Mortimer GW Source	0.0	0.0	0.0	0.0	4.5	4.5	4.5	4.5	4.5	4.5
Playhatch Drought Permit	0.0	4.1	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Export to SEW	0	0	0	0	0	0	0	0	0	0

Table 11-27: Preferred programme option utilisation in Kennet Valley WRZ, DYAA

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Transfer from T2ST Spur	0.0	0.0	0.0	0.0	1.5	1.5	1.5	1.5	3.9	4.6
Recommission Mortimer GW Source	0.0	0.0	0.0	0.0	0.0	0.4	0.8	1.3	4.5	4.5
Playhatch Drought Permit	0.0	4.1	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Export to SEW	0	0	0	0	0	0	0	0	-5	-5

Table 11-28: Preferred programme option utilisation in Kennet Valley WRZ, DYCP

Guildford WRZ

11.226 Section 6 of our dWRMP describes the supply-demand balance situation in the Guildford WRZ across the planning period. We have a significant surplus in the Guildford WRZ in the short-term, which is maintained in all except the most severe future scenarios. By 2050 we could face a supply-demand balance of anything from a 14 Ml/d surplus to a 19 Ml/d deficit.

11.227 The implementation of our preferred plan, a twin-track approach combining demand management with resource development, resolves the supply-demand deficit in all years of the planning period for the Guildford WRZ.

Demand Management

11.228 Being consistent across all nine future scenarios, we will first describe our demand management programme for the Guildford WRZ. The main components of our demand management programme are common across all of our WRZs, and so the narrative here is identical to that from other WRZs. The figures presented in this section are specific to the Guildford WRZ.

11.229 Demand management is the largest component of our plan for the Guildford WRZ, particularly in the short-term, and is the only part of our plan that is required for the zone in many future scenarios.

11.230 Table 11-29 shows a detailed breakdown of the demand management options adopted in our preferred plan for the Guildford WRZ. Figure 11-19 shows our leakage forecast, Figure 11-20 shows our meter penetration forecast, and Figure 11-21 shows our PCC forecast, all for the Guildford WRZ.

	Supply Demand Benefit (Ml/d)				
GUI	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	0.00				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering CSL	0.05	0.06	0.00	0.00	0.00
Bulk metering CSL	0.23	0.15	0.12	0.00	0.00
Replacement metering CSL	0.05	0.11	0.00	0.00	0.00
Mains replacement	0.08	0.63	0.33	0.39	0.30
Leakage innovation	0.01	0.04	0.10	0.49	0.30
Metering innovation CSL	0.00	0.00	0.00	0.00	0.00
Advanced DMA Intervention	0.27	0.12	0.30	0.00	0.00
Total leakage reduction	0.70	1.11	0.86	0.88	0.60
AMP7 Carry-over metering	0.39				
Household metering	0.10	0.00	0.00	0.00	0.00
Non-household metering	0.02	0.18	0.00	0.00	0.00
Household water efficiency	0.21	0.14	0.00	0.00	0.00
Non-household water efficiency	1.46	1.13	0.85	0.72	0.62
Metering innovation	0.02	0.04	0.02	0.00	0.00
Innovative tariffs	0.05	0.31	0.62	0.02	0.00
Total usage reduction	2.24	1.80	1.49	0.74	0.62
Total benefit from DMP	2.94	2.90	2.35	1.62	1.22

	New & Replacement Meters				
GUI	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	3,519	3,935	3,365	0	0
Household Metering (New)	2,156	517	374	0	0
Household Metering (Upgrades)	3,144	7,780	853	0	0
Non-Household Metering (Upgrades)	1,652	1,877	0	0	0

Table 11-29: Guildford WRZ Demand Management Programme Breakdown

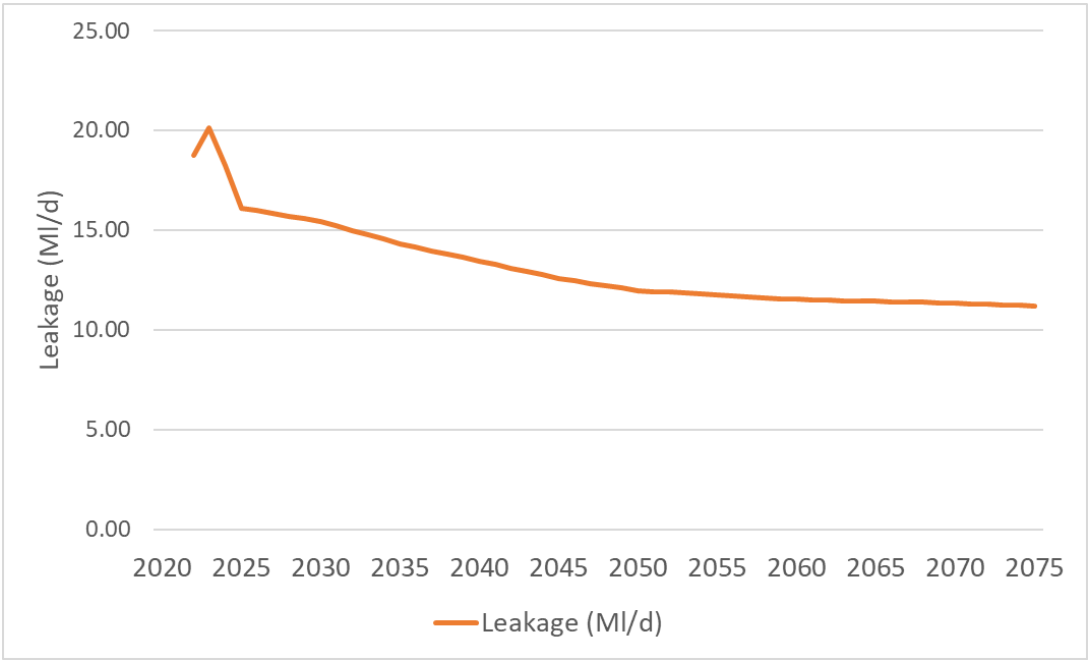

Figure 11-19: Guildford WRZ Final Plan Leakage

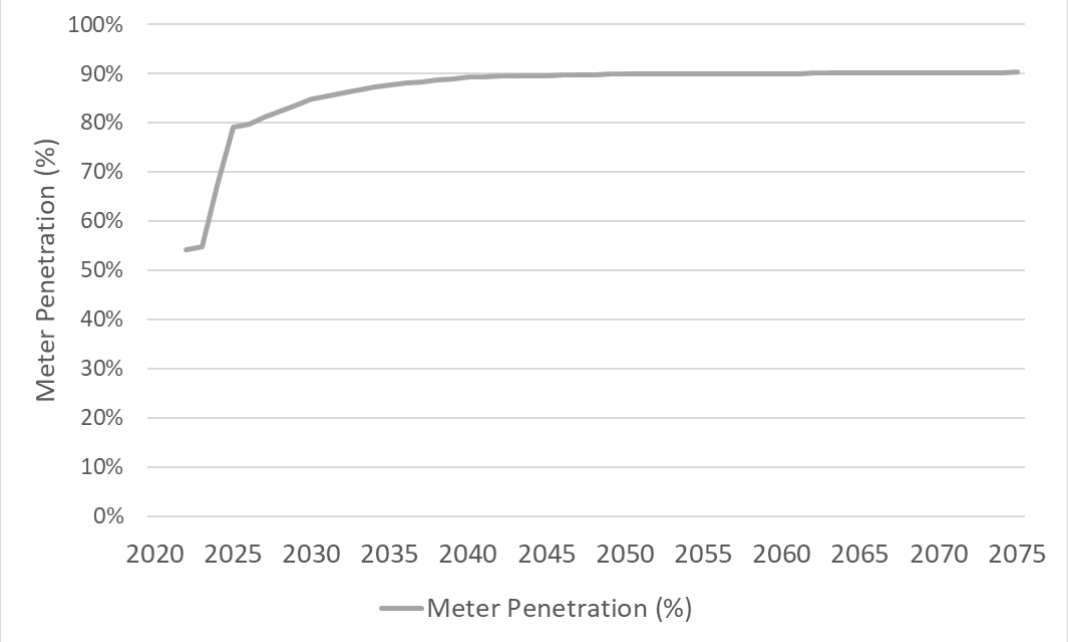

Figure 11-20: Guildford WRZ Final Plan Meter Penetration

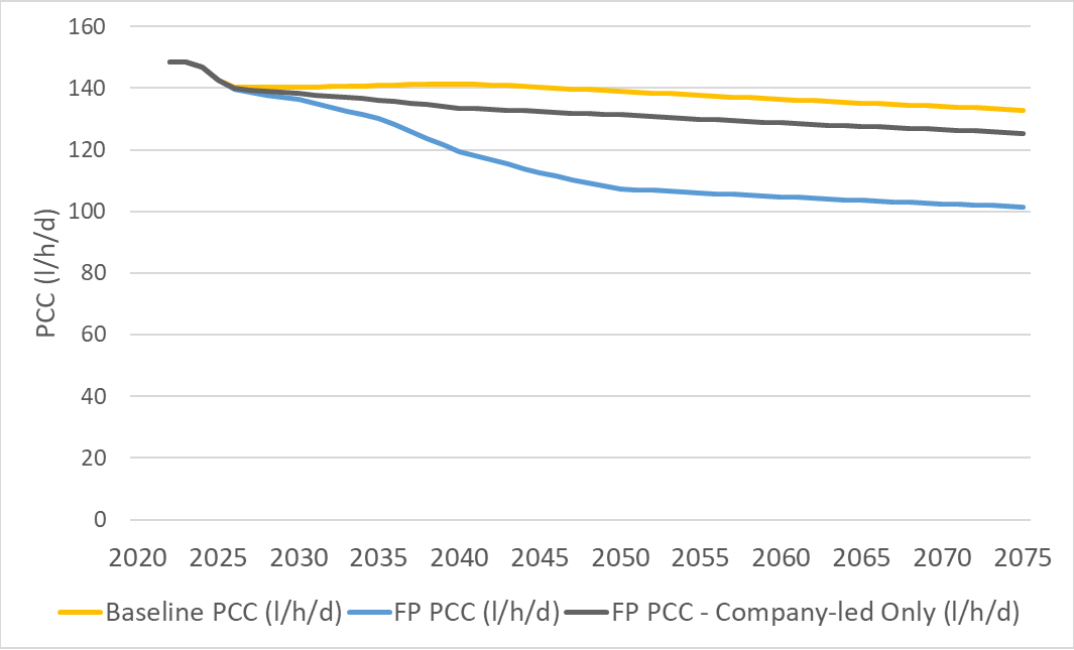

Figure 11-21: Guildford WRZ PCC

Short-term – 2025-2030

11.231 We will continue our PMP, with over 2,000 new household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 85% by the end of AMP8. We will also undertake a significant upgrade programme, replacing nearly 3,000 old meters with smart meters to ensure that we are able to harvest data about our customers' water use, allowing us to analyse this data to help customers reduce their water use.

11.232 We will reduce leakage by 0.7 Ml/d in the Guildford WRZ during AMP8. In AMP8 a considerable amount of our leakage reduction will be enabled by our smart meter programme, which allows us to analyse data to predict where leaks may exist on customer-owned pipes. In addition, we will undertake Advanced DMA leakage reduction, mains rehabilitation, and leakage innovation programmes to reduce our leakage.

11.233 We will continue our programme of Smarter Business Visits, helping businesses to use less water, resulting in a NHH demand reduction of 1 Ml/d across the AMP.

11.234 Continue to promote water efficiency activity to help customers use water wisely, including the continuation of a reward-based incentive scheme introduced in AMP7 which promotes water efficiency.

11.235 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Medium-term – 2030-2045

11.236 We will finish almost all of our metering efforts in AMP9, continuing to install bulk meters and upgrade meters to ensure that all metered customers are using smart meters. We will achieve a total meter penetration of 88% (including voids) by 2045.

11.237 With enough of our supply area being covered by smart metering, we will be able to implement a financial incentive-based tariff scheme from 2035. This scheme will encourage those who use exceptionally high volumes of water to reduce their usage.

11.238 We will deliver further leakage reduction over this period, with an increasing proportion of our leakage reduction needing to be delivered through mains rehabilitation.

11.239 We will continue to promote water efficiency activity to help customers use water wisely.

11.240 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

11.241 Our plan relies on the introduction of government-led interventions from 2035 onwards, including both minimum standards on white goods and the introduction of amendments to buildings regulations. This will be required in order to achieve the government ambition of 110 l/h/d per capita consumption.

Long-term – 2045-2075

11.242 In the long-term we will continue to undertake mains rehabilitation to continue to drive down leakage. We expect that a greater proportion of our mains rehabilitation efforts will make use of innovative techniques in the long-term, reducing costs.

11.243 In the longer-term, our demand management programme relies on the intervention of government, as described earlier in this section. When leakage has been reduced to very low levels, and we have undertaken those actions which can influence customers' demand for water, actions will need to be driven by government to alter water use through societal changes and the adoption of minimum standards and buildings regulations changes.

11.244 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Supply enhancement

11.245 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11-30. This table shows that the only new sources of water for the Guildford WRZ would be needed in future scenarios of severe future licence reduction in the zone. In these cases, an import from South East Water would be our preferred option. We will not need to make a decision on which of these options would be preferred until the 2040s. Our utilisation of the SEW transfer under pathway 4 is shown in Table 11-31 and Table 11-32.

Option	Max DO (DYAA)	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
Import from SEW	10	2050	-	-	2050	-	-	-	-	-
Shalford Drought Permit	5	-	2035	2035	2031	2031	2031	2031	2031	2031

Table 11-30: Options used in Guildford WRZ

Option	Option Utilisation by Year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Import from SEW	0.0	0.0	0.0	0.0	0.0	0.8	0.5	0.5	0.5	0.5
Existing Export to Affinity	0.0	-0.4	-2.3	-2.3	-1.2	0.0	-0.1	-0.5	-0.8	-1.1

Table 11-31: Preferred programme option utilisation in Guildford WRZ, DYAA

Option	Option Utilisation by Year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Import from SEW	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5
Existing Export to Affinity	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 11-32: Preferred programme option utilisation in Guildford WRZ, DYCP

Henley WRZ

11.246 Section 6 of our dWRMP describes the supply-demand balance situation in the Henley WRZ across the planning period. We have a significant surplus in the Henley WRZ in the short-term, which is maintained in all except the most severe future scenarios. By 2050 we could face a supply-demand balance of anything from a 7 Ml/d surplus to a 2 Ml/d deficit.

11.247 The implementation of our preferred plan, a twin-track approach combining demand management with resource development, resolves the supply-demand deficit in all years of the planning period for the Henley WRZ.

Demand Management

11.248 Being consistent across all nine future scenarios, we will first describe our demand management programme for the Henley WRZ. The main components of our demand management programme are common across all of our WRZs, and so the narrative here is identical to that from other WRZs. The figures presented in this section are specific to the Henley WRZ.

11.249 Demand management is the largest component of our plan for the Henley WRZ, particularly in the short-term. In almost all future scenarios, no investment in supply-side

schemes will be needed in the Henley WRZ, assuming that demand management interventions deliver the benefits that we anticipate.

11.250 Table 11-33 shows a detailed breakdown of the demand management options adopted in our preferred plan for the Henley WRZ. Figure 11-22 shows our leakage forecast, Figure 11-23 shows our meter penetration forecast, and Figure 11-24 shows our PCC forecast, all for the Henley WRZ.

	Supply Demand Benefit (Ml/d)				
HEN	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	0.00				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering CSL	0.00	0.00	0.00	0.00	0.00
Bulk metering CSL	0.03	0.01	0.01	0.00	0.00
Replacement metering CSL	0.14	0.04	0.00	0.00	0.00
Mains replacement	0.01	0.08	0.09	0.06	0.10
Leakage innovation	0.00	0.00	0.00	0.00	0.00
Metering innovation CSL	0.00	0.00	0.00	0.00	0.00
Advanced DMA Intervention	0.00	0.00	0.00	0.00	0.00
Total leakage reduction	0.18	0.13	0.10	0.06	0.10
AMP7 Carry-over metering	0.26				
Household metering	0.02	0.00	0.00	0.00	0.00
Non-household metering	0.00	0.00	0.00	0.00	0.00
Household water efficiency	0.15	0.04	0.00	0.00	0.00
Non-household water efficiency	0.00	0.00	0.00	0.00	0.00
Metering innovation	0.01	0.02	0.01	0.00	0.00
Innovative tariffs	0.01	0.10	0.00	0.00	0.00
Total usage reduction	0.45	0.17	0.01	0.00	0.00
Total benefit from DMP	0.62	0.29	0.11	0.06	0.10

	New & Replacement Meters				
HEN	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	175	195	164	0	0
Household Metering (New)	457	417	274	0	0
Household Metering (Upgrades)	7,067	2,815	247	0	0
Non-Household Metering (Upgrades)	87	92	0	0	0

Table 11-33: Henley WRZ Demand Management Programme Breakdown

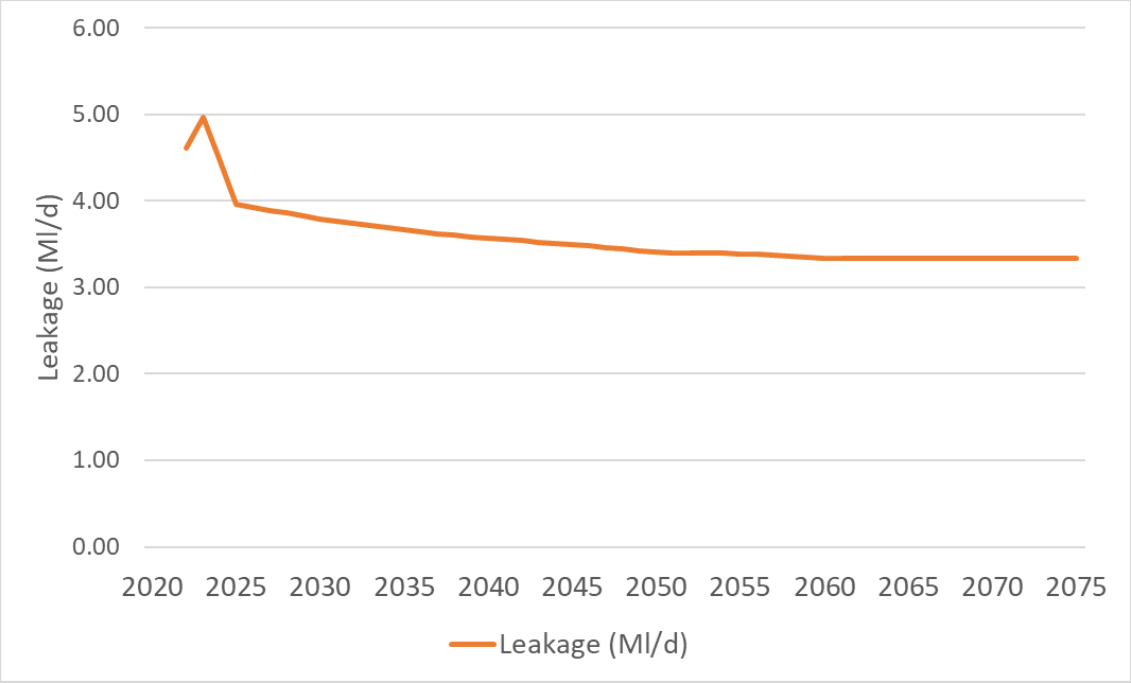

Figure 11-22: Henley WRZ Final Plan Leakage

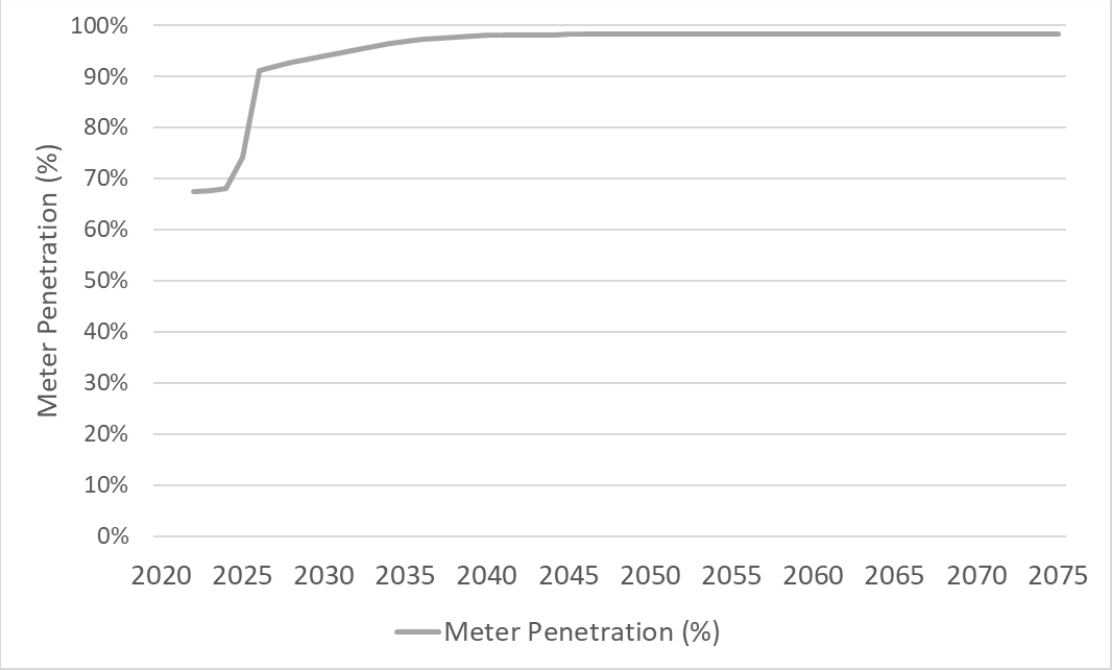

Figure 11-23: Henley WRZ Final Plan Meter Penetration

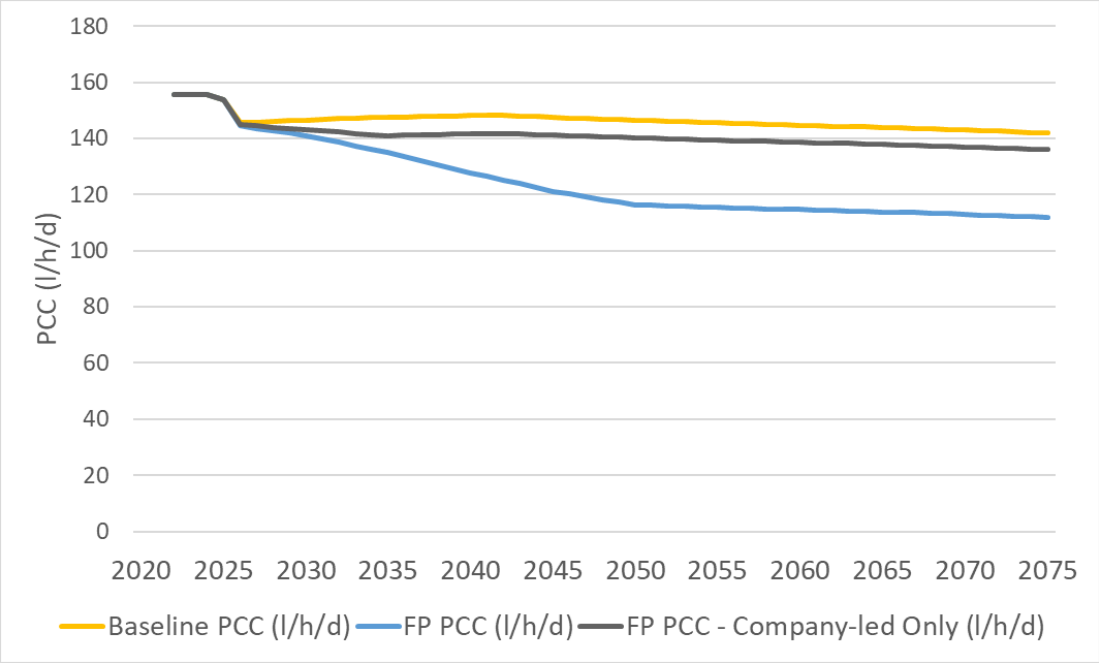

Figure 11-24: Henley WRZ PCC

Short-term – 2025-2030

11.251 We will continue our PMP, with nearly 500 household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 94% by the end of AMP8. We will also undertake a significant upgrade programme, replacing nearly 7,000 old meters with smart meters to ensure that we are able to harvest data about our customers' water use, allowing us to analyse this data to help customers reduce their water use.

11.252 We will reduce leakage by 0.17 Ml/d in the Henley WRZ during AMP8. In AMP8 a considerable amount of our leakage reduction will be enabled by our smart meter programme, which allows us to analyse data to predict where leaks may exist on customer-owned pipes. In addition, we will undertake Advanced DMA leakage reduction, mains rehabilitation, and leakage innovation programmes to reduce our leakage.

11.253 We will continue to promote water efficiency activity to help customers use water wisely, including the continuation of a reward-based incentive scheme introduced in AMP7 which promotes water efficiency.

11.254 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Medium-term – 2030-2045

11.255 We will finish almost all of our metering efforts in AMP9, continuing to install bulk meters and upgrade meters to ensure that all metered customers are using smart meters. We will achieve a total meter penetration of 97% (including voids) by 2045.

11.256 With enough of our supply area being covered by smart metering, we will implement a financial incentive-based tariff scheme from 2035. This scheme will encourage those who use exceptionally high volumes of water to reduce their usage.

11.257 We will deliver further leakage reduction over this period, with an increasing proportion of our leakage reduction needing to be delivered through mains rehabilitation.

11.258 We will continue to promote water efficiency activity to help customers use water wisely.

11.259 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

11.260 Our plan relies on the introduction of government-led interventions from 2035 onwards, including both minimum standards on white goods and the introduction of amendments to buildings regulations. This will be required in order to achieve the government ambition of 110 l/h/d per capita consumption.

Long-term – 2045-2075

11.261 In the long-term we will continue to undertake mains rehabilitation to continue to drive down leakage. We expect that a greater proportion of our mains rehabilitation efforts will make use of innovative techniques in the long-term, reducing costs.

11.262 In the longer-term, our demand management programme relies on the intervention of government, as described earlier in this section. When leakage has been reduced to very low levels, and we have undertaken those actions which can influence customers' demand for water, actions will need to be driven by government to alter water use through societal changes and the adoption of minimum standards and buildings regulations changes.

11.263 We will continue to use media campaigns, temporary use bans and non-essential use bans according to our current levels of service.

Supply enhancement

11.264 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11-34. This shows that supply-side investment will not be needed in the Henley WRZ.

11.265 In several future scenarios, water from existing sources in Henley WRZ would be exported to SWOX WRZ. Table 11-35 shows the utilisation of a transfer to SWOX in pathway four, which would need to be used from 2040 onwards.

Option	Max DO (DYAA)	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
Export to SWOX	5	2042	-	-	2040	2040	2040	-	-	-
Harpsden/Sheeplands Drought Permit	6	-	2036	2036	2031	2031	2031	2031	2031	2031

Table 11-34: Options selected for Henley WRZ

Option	Option Utilisation by Year (Ml/d) …									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Export to SWOX	0.0	0.0	-3.2	-0.4	-1.3	-1.3	-1.3	-1.3	-1.3	-1.3
Drought Permit – Harpsden and Sheeplands	0.0	5.6	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 11-35: Preferred programme option utilisation in Henley WRZ, DYAA

Option	Option Utilisation by Year (Ml/d) …									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Export to SWOX	0	0	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25	-0.25
Drought Permit – Harpsden and Sheeplands	0.0	5.6	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 11-36: Preferred programme option utilisation in Henley WRZ, DYCP

Plan Assessment

11.266 In this section we describe the different assessments of our plan that we have undertaken. This includes an assessment of the key decisions that we need to make, and when we need to make them, a description of the environmental assessment of our plan, the costs and carbon emissions arising from our preferred programme, and the risks and uncertainties that we have identified.

Decision points

11.267 The key decision points that we identify in our plan are aligned with our adaptive plan branch points. The summary decisions that we need to take in the future are:

Now

11.268 As discussed throughout this section, we need to decide which options to invest in for our medium-term security of supply, to build towards 1 in 200-year and 1 in 500-year levels of resilience. The large decisions that this involves have been detailed in the preceding sections and so we do not repeat the description of the current decisions here.

11.269 The investment decisions set out in our preferred plan provide a resilient, efficient solution to long-term regional planning issues. The key outcome we will need to be aware of in the short to medium term is the progress of leakage reduction and usage reduction, in order to assess whether our demand management schemes are resulting in the benefits that we anticipate, and so will need to make a risk-based decision as to whether further investment is needed to ensure the sufficiency of supply (see our monitoring plan for further details). In addition, we will need to appraise whether regulatory expectations shift between WRMP24 and WRMP29, whether local authority plans and government projections are significantly altered, and whether understanding regarding climate change impacts and extreme drought events progresses, and so whether our investment plan needs to be altered as a result.

2035-2040

11.270 Following the conclusion of our two-AMP programme of investigations, we will need to determine the licence reductions that need to be made at our existing sources to ensure environmental protection and enhancement for the future. Our adaptive planning scenarios mean that we have developed a plan which will be efficient and adaptable to a plausible range of future scenarios of licence reduction. At this point we will also need to use the latest climate evidence available to appraise how climate change has impacted drought risk and to examine what the latest science says about impacts for the future, and so determine the long-term decisions which we need to make to mitigate the risks of climate change to customer supplies and the environment.

11.271 In addition to consideration of climate change impacts and required future licence reductions, we will continually need to appraise the success (and anticipated future success) of demand management programmes, including action which the government takes. In our preferred programme no further schemes are required after 2040, but if key risks emerge then we may need to progress with the construction of further water resource schemes, such as the STT, Beckton Reuse or Beckton desalination schemes.

11.272 The uncertain factors of demand management and licence reduction act in opposite directions, insofar as it is unlikely that a PCC of significantly less than 110 l/h/d will be

achieved (but significant risk that this target will not be achieved, which would create an additional requirement for new water resources), but it could also be that fewer licence reductions are required to ensure environmental requirements are met (which would reduce the overall quantum of need). The different possible scenarios for these two factors are of similar overall magnitudes, and so we will need to consider these factors together when identifying action which is required.

Environmental assessment

11.273 We have carried out environmental assessment of all Constrained List option elements, including Strategic Environmental Assessment (SEA), Habitat Regulations Assessment (HRA), Biodiversity Net Gain (BNG), Natural Capital (NC), Water Framework Directive (WFD) and Invasive Non-Native Species (INNS) as relevant.

11.274 For all options considered in our investment modelling, we have carried out 'Stage 1' assessments of all six types listed above as relevant, based on the option information available. For options selected in our preferred programme (pathway 4) and pathways 1 and 8 of our BVP, as well as programmes from pathways 4 of the Best Environment and Society and Least Cost plans, we have then identified those options for which we needed to undertake more detailed, 'Stage 2', assessments, and have undertaken these assessments.

11.275 Our environmental assessments mean we have ensured that necessary mitigation measures to ensure compliance with the WFD and HRA have been identified, or that we have identified where further option development work is required, and that options that we have considered, if constructed, would meet the requirements of relevant legislation, subject to further investigations being carried out when more detailed design of options is undertaken.

11.276 As we have carried out ever more detailed assessments, engaging with regulators and stakeholders, we have inevitably identified issues that had not been foreseen at previous option development stages. In most cases we have been able to identify mitigation measures or design alterations, but in some cases we have needed to remove options from consideration. A notable example is that, in our WRMP19, we set out our preferred option for delivering 1 in 200-year resilience by the early 2030s as being the Deephams water recycling scheme. Through investigation and engagement with the Environment Agency, followed by the drafting of a statement of common understanding, we have identified that environmental impacts from this scheme present an ongoing risk, and so have screened this scheme out of consideration in our rdWRMP24 until such a time as other options can be put into place to provide sufficient compensatory flows in the River Lee to allow us and the Environment Agency to support promotion of this option. We have also rejected Teddington DRA 100Ml/d, Britwell Removal of Constraints, and Wansunt and Crayford drought options, on environmental promotability or acceptability grounds; full rejection reasoning is available in Appendix Q (Rejection register).

11.277 As well as having assessed the environmental impacts of individual schemes within our plan, we have also carried out an assessment of the environmental impacts of our plan as a whole and of the environmental impacts of our plan when considered alongside other plans and programmes.

11.278 We have identified reasonable alternative programmes through our programme appraisal, detailed in Section 10 of our rdWRMP24. As required by the WRPG, one of these alternative programmes was a plan deemed the 'Best for Environment and

Society'. We have carried out our plan-based environmental assessments on our Least Cost and Best for Environment and Society plans alongside the Best Value plan and these are included in Section 10 of the rdWRMP24.

11.279 Throughout the process of environmental assessment of our options and plans we have undertaken extensive discussion with our regulators and stakeholders, primarily Natural England and the Environment Agency. We are grateful for the advice and guidance received from our regulators.

11.280 For a more comprehensive discussion of the environmental assessments that we have undertaken and their results, please see Section 9 and Appendices B, C, D, AA, and BB.

SEA – Preferred Programme

11.281 The Best Value plan involves the construction of multiple infrastructure projects. There are 'standard' cumulative impacts associated with this construction activity (e.g. material use and waste generation, impact on soils, temporary impact on roads, cycle paths and national trails, and community facilities), and best practice mitigation for these impacts which we would implement as part of option delivery. These have been described in Appendix B.

11.282 The SEA cumulative effects assessment for the Preferred Programme identified cumulative positive effects for the SEA objectives on biodiversity, water quality and vulnerability to climate risks due to the inclusion of the 'High' Environmental Destination scenario, consumption reduction options, changes in levels of service to enhance water available for use (WAFU), i.e. media campaigns, TUBs, NEUBs, and leakage reduction. The cumulative effects of these options will result in more water being kept within the natural environment. Positive cumulative effects were also identified for the SEA objective on delivering reliable and resilient water supply to customers through delivery of new water supply options, increased capacity and improving transfers across the region.

11.283 The SEA cumulative effects assessment for the Preferred Programme identified cumulative negative effects for SEA objectives on soil due to cumulative loss of agricultural land, carbon due to construction and operational carbon emissions across the plan, and resource use due to the cumulative effects of materials and resource use and waste production across the plan. We will continue work to identify mitigation for these effects as we develop our options through to detailed design and delivery.

11.284 The SEA cumulative effects assessment identified several options with the potential for interactions with the same sensitive receptors. This was largely due to construction effects such as disturbance from noise, air and light pollution from different options where the construction periods overlapped. These sensitive receptors included Local Nature Reserves (LNRs), Sites of Special Scientific Interest (SSSI), heritage assets and community assets. However, it was concluded that with implementation of best practice construction techniques and a Construction Transport Management Plan, cumulative effects are not anticipated.

11.285 Further details of the SEA are included in Appendix B.

HRA – Preferred Programme

11.286 We have undertaken 'Stage 2' HRA assessments for options which feature in our preferred programme, where Stage 1 assessment has indicated that this is required.

11.287 The HRA identified two options within the Preferred Programme with low effects that were therefore taken forward into the in-combination effects assessment. Although the Appropriate Assessment concluded no adverse effects on site integrity (AESI) for these options alone, low level effects could combine to cause significant effects affecting site integrity and this was investigated through the in-combination effects assessment. Low effects on Cannock Extension Canal SAC were identified for the Oxford Canal to Dukes Cut option and low level effects on Oxford Meadows SAC from the Dukes Cut to Farmoor option. The two options affect different Habitats Sites and, therefore, there are no in-combination effects. No other options in the Preferred Programme had low level effects, therefore, in line with UKWIR guidance no other options were not required to be included in the in-combination effects assessment.

11.288 Further details of the HRA are included in Appendix C.

WFD – Preferred Programme

11.289 One waterbody was assessed to have the potential for an increased risk of WFD deterioration due to the impacts of multiple options; this is water body GB40601G600900 Berkshire Downs Chalk. T2ST is likely to require dewatering, which could lead to temporary reduced groundwater levels in this water body (construction between 2038 and 2050). Woods Farm Increase DO will involve a new abstraction and installation of a new pipeline (bringing a DO benefit of 2.4Ml/d by 2074). Moulsford will involve drilling of new boreholes and a new abstraction licence (peak DO benefit of 3.5Ml/d by 2033). All of these options could therefore lead to reductions in groundwater levels (water balance) and could lead to a reduction in flow in surface water bodies supported by this groundwater body (cumulative abstraction DO will be 5.9Ml/d). This water body already has a Poor status for qualitative dependent surface water body status so this could further exacerbate the issue. The environmental destination scenarios include closure of Bradfield and licence reduction at Pangbourne (reducing abstraction by 1.64Ml/d by 2030 and a further 5Ml/d by 2035 respectively) in this water body. These environmental destination reductions will help to reduce the cumulative impact of these options, and it is anticipated that with appropriate mitigation there would be no increased risk of deterioration. Further investigation will be undertaken (such as scenario modelling, hydroecology assessment etc) to confirm this.

11.290 Further details on the WFD assessments undertaken are available in Appendix D.

Natural Capital and Biodiversity Net Gain – Preferred Programme

11.291 Regarding Natural Capital, a number of natural capital stocks are likely to be temporarily and permanently impacted by the Preferred Programme in the absence of mitigation. The preferred programme is likely to generate the loss of natural capital stocks during construction of some supply options. Habitat is expected to be reinstated and/or compensated for to pre-construction conditions following best practice techniques, and therefore will likely have no permanent impact to the provision of ecosystem services. The unmitigated predicted permanent impact on the provision of ecosystem services for the Preferred Programme Non-SRO options is -£25,777.12 (overall change in value in £/year). This being said, via application of best practice mitigation the preferred programme presents an opportunity to improve existing habitats through post-construction remediation and replacement of low value habitats with higher value habitats. The planned BNG associated with options will also help support provision of ecosystem services. The plan crosses several Natural England Habitat Network Enhancement Zones and is therefore suitable for the planting of new high value habitats.

For the SROs, as part of the Gate 2 process additional site-specific information was used that led to different assumptions within the method for the assessment. Therefore, it was not comparable to add these into the Non-SRO cumulative effects assessment. The Teddington DRA scheme is likely to provide overall environmental benefits in relation to climate regulation, natural hazard regulation and agriculture ecosystem services. The estimated 30-year net present value (NPV) benefits are £219,311. For SESRO, in the absence of mitigation, disbenefits are seen for food production, air pollutant removal, and natural hazard regulation services. Details of planned mitigation are available in Appendix AA. SESRO has an overall positive impact on climate regulation, water purification, and recreation ecosystem service provision. The estimated change in present net value benefits of ecosystem service provision is £32,005,000.

11.292 Regarding Biodiversity Net Gain (BNG), the Preferred Programme is expected to result in an unmitigated predicted 19.80% net loss of biodiversity units from Non-SRO options, as a result of most options generating a net loss of biodiversity as part of construction. It should be noted that the desk-based BNG assessments have been carried out using open-source data. Habitat identification will need to be refined at the project level with both habitat survey data and further development of habitat mitigation/enhancement proposals as the options progress through further development through to planning (as relevant) and delivery. The number of units required to achieve a 10% BNG is estimated at 786.394 for the Non-SRO options. However, several of the selected options fall within Local Planning Authorities (LPA) with a higher minimum BNG requirement including 20% and 30%. The BNG assessments have been updated to take into account the LPA requirements and assumptions around the BNG Metric trading rules. A BNG Strategy has been developed for the Preferred Programme options selected up to and including 2045. The BNG Strategy, included within Appendix AA, describes how we plan to deliver this gain following the mitigation hierarchy. The SROs used different BNG assumptions as part of the Gate 2 process as there was more site-specific information available on habitats, habitat condition and strategic significance (which affect assumptions made in the BNG Metric and the BNG units achieved). Therefore, it was not comparable to add these into the non-SRO cumulative effects. The mitigation required to achieve a minimum of 10% BNG was calculated for each SRO. The Teddington DRA SRO is estimated to provide a net increase of 2.37 habitat units and a net loss of -0.12 river units. Mitigation measures to enhance off-site sections of river will be required to deliver a minimum of 10% net gain, such as enhancing 1.8km of 'other river and stream' located outside the catchment. Enhancement may include the removal of structures within the watercourse to reduce the encroachment, planting, removal of invasive non-native species or restoration measures. Plans to deliver this gain will be further developed as part of the next stages of the RAPID gated process.

11.293 It is noted that all sizes of SESRO will cause the permanent loss of an ancient crack willow (Salix fragilis) tree which is situated within the reservoir footprint for all sizes. This habitat is irreplaceable, and so compensation cannot be provided on a 'like for like' basis that would reduce the impact on those habitats to neutral. Compensation will need to be designed in recognition of the nature and extent of the loss or damage, so that the compensation is considered proportionate, and will be agreed with the relevant conservation bodies. This will not replace the habitat lost but can retain some of the local genetic material stock of ancient plants, soil biota and other attributes.

11.294 As the project will result in the loss of one ancient tree, which is categorised as irreplaceable habitat, the scheme cannot achieve BNG at the 'project level'. However,

the project will generate meaningful gains for other biodiversity features, such as neutral grassland, wet woodland and wetland areas.

11.295 SESRO (150Mm^3) is estimated to provide a net unit increase of 1,629.34 habitat units equating to a net gain of 33.09%. As much of the baseline habitats will be lost to the reservoir, this significant net gain in biodiversity indicates that the replacement habitats and future landscape surrounding the reservoir will be more beneficial to biodiversity than the current landscape. This is because the habitats to be created, such as the ponds and wetland habitat mosaic, will provide habitat for a range of species from invertebrates and amphibians to riparian mammals and breeding and wintering birds. The species rich grassland habitats will attract birds and invertebrates and the woodland habitats will develop into highly biodiverse areas. SESRO will also result in a net unit loss of 96.45 hedgerow units (21.91% loss). Consequently, off-site compensation for the loss of these hedgerow units will be sought, and at a minimum, an additional 143 hedgerow units will need to be gained to achieve a ≥10% net. This will be undertaken within a location where hedgerows will improve ecological connectivity in landscapes nearby to the scheme impact. The current metric does not take account of any potential advanced planting of hedgerow and tree lines which is likely to occur in order to maintain connectivity across the site during construction. Opportunities for advanced planting will be discussed during further iterations of Abingdon Reservoir masterplan. SESRO is also estimated to provide a net unit increase of 70.26 river units (16.41% net gain). The more naturalised planform and enhanced connectivity of the river channel to wetland floodplain habitats will significantly improve the quality and natural functioning of the river compared to the artificial conditions present currently.

11.296 Further details on the NC and BNG assessments are available in Appendix AA.

Invasive Non-Native Species – Preferred Programme

11.297 The INNS in-combination effects assessment identified several combinations of options where raw water with potential for INNS transfer would be discharging to the same water bodies. In-combination effects were identified for the Abingdon to Farmoor and Duke's Cut to Farmoor options. Mitigation such as a water treatment works at Abingdon was discussed as part of the Level 2 assessments and would help reduce effects. In-combination effects were also identified for Oxford Canal to Duke's Cut, Duke's Cut to Farmoor, Abingdon to Farmoor and SESRO. These options are connected to transfer water around the network and it is likely that mitigation measures can be incorporated into the options design and through discussion with the Environment Agency to reduce risks. In-combination effects were also identified for the Duke's Cut to Farmoor and Medmenham Intake options, and the Duke's Cut to Farmoor and Teddington DRA options. However, given the distances between these options further investigation is likely to conclude no additional effects and therefore, mitigation is unlikely to be needed.

11.298 The Environment Agency SAI-RAT tool used for the assessment makes a number of recommendations for biosecurity mitigation measures which can be implemented to reduce effects. These can be found in Appendix BB. It is likely that mitigation measures are available which will reduce INNS transfer risk across the plan. These will be incorporated into option design as each option is progressed and discussed with the Environment Agency.

11.299 Further detail on the INNS assessments are available in Appendix BB.

In-combination Effects of our Preferred Programme with Other Plans and Programmes

11.300 In addition to rdWRMP24, Local Plan allocations, other major planning applications and projects along with other water company WRMP options could lead to the potential for in-combination effects to some receptors. The WFD in-combination effects assessment identified 14 water bodies where multiple options and other plans occur. The in-combination effect assessment indicated that only one of these water bodies (GB40601G604100: Chiltern Chalk Scarp) is at risk of further WFD deterioration due to the combination of options and planning projects. Further information on the implications of HS2 phase 1 on the waterbody would be required to quantify the in-combination effects on this water body. The HRA concluded that no in-combination effects on Habitats Sites are likely with other plans and programmes. The SEA identified potential negative cumulative effects on sensitive receptors relating to construction; in particular for objectives on Biodiversity, Soil, Landscape and Historic environment; all identified effects can likely be mitigated with best practice construction mitigation and the developments themselves will go through a design and planning process to develop their own mitigation.

Environmental Net Gain Provided by our Preferred Programme

11.301 The WRMP24 will deliver a number of environmental benefits.

11.302 Within our plan we have proposed reducing abstraction from our vulnerable chalk streams and other watercourses in order to improve flows and the habitats for fish and other wildlife. We plan to reduce abstraction to sustainable levels by 2050, and our preferred programme would involve taking over 500Ml/d less water from sensitive rivers and waterways.

11.303 Options such as demand management and maximising use of existing capacity within the network will have benefits to a number of different elements of the environment such as biodiversity and water quality. This is achieved through leaving more water in the natural environment, helping to support terrestrial and aquatic habitats and species, water environments and the resilience of these environments to climate impacts such as drought conditions. These options also have benefits for climate, carbon and resource (materials) use by reducing the need for new supply side options.

11.304 Where new supply side options are required, the WRMP24 makes a commitment to achieving environmental net gain through delivery of BNG and provision of ecosystem services associated with habitat creation and enhancement, such as new woodland sequestrating carbon and reducing run-off rates.

11.305 We are committed to achieving a minimum BNG of 10% across our plan and for certain options this will be higher due to Local Planning Authority (LPA) requirements. We have developed a BNG strategy to guide delivery for the WRMP24; this strongly prioritises achieving effective BNG on-site where possible. Where this is not possible, we plan to deliver BNG within the same LPA as part of measures to enhance and connect existing wildlife areas, only delivering outside of these areas if delivery within the LPA is infeasible. Certain options within the WRMP24 such as SESRO will deliver substantial environmental and social benefits through multi-benefit design such as new landscaping and habitat creation, providing benefits and support for diverse local wildlife populations and recreational and health benefits for the community and visitors, and leaving a lasting positive legacy for the environment.

Environmental Assessments - Best Value Plan – Situations 1 and 8

11.306 Environmental Assessments were also undertaken for the Best Value Plan (BVP), situations 1 and 8, as they were considered to be representative of the range of ways in which the eight other pathways for the Best Value Plan differ to Situation 4. These Situations encompass all of the options selected across the nine Best Value Plan pathways. Further details on all assessments for the Best Value Plan scenarios 1 and 8 are in the environmental appendices (Appendix B for SEA, Appendix C for HRA, Appendix D for WFD, Appendix AA for NC & BNG, Appendix BB for INNS).

SEA – Best Value Plan Situations 1 and 8

11.307 The outcomes of the SEA cumulative effects assessment for BVP Situations 1 and 8 were very similar to those for the Preferred Programme. Situation 8 has fewer supply side options and therefore, the magnitude of cumulative effects is smaller. Situation 1 includes Beckton desalination; we have considered the potential for this option to have cumulative effects on water quality and Habitats Sites with other water company desalination options, and given the location and size of other water company options proposed, we do not expect any cumulative effects to be present.

HRA – Best Value Plan Situations 1 and 8

11.308 Similar to the Preferred Programme, the HRA identified two options within the BVP Situation 1 with low effects that were therefore taken forward into the in-combination effects assessment. Although the AA concluded no adverse effects on site integrity (AESI) for these options alone, low level effects could combine to cause significant effects affecting site integrity and this was investigated through the in-combination effects assessment. Low effects on Cannock Extension Canal SAC were identified for the Oxford Canal to Duke's Cut option and low level effects on Oxford Meadows SAC from the Duke's Cut to Farmoor option. The two options affect different Habitats Sites therefore, there are no in-combination effects. No other options in the BVP Situation 1 had low level effects therefore, in line with the UKWIR guidance, were not required to be included in the in-combination effects assessment. The BVP Situation 8 does not contain the two options mentioned above or any other options with low level effects, therefore, there will be no in-combination effects.

WFD – Best Value Plan Situations 1 and 8

11.309 When compared to the preferred programme, the cumulative effects assessment has not identified any additional water bodies at increased risk of WFD deterioration due to the combinations of options selected in BVP (Situation 1). The BVP (Situation 8) does not include any options not already considered in the core BVP (Situation 4) and therefore no new cumulative effects on any water bodies are anticipated.

Natural Capital and Biodiversity Net Gain – Best Value Plan Situations 1 and 8

11.310 Regarding Natural Capital, as with Preferred Programme, BVP Situations 1 and 8 will likely result in a number of natural capital stocks being temporarily and permanently impacted in the absence of mitigation. The BVP Situations 1 and 8 are likely to generate the loss of natural capital stocks during construction of some supply options. Habitat is expected to be reinstated and/or compensated for to pre-construction conditions following best practice techniques and will likely have no permanent impact to the provision of ecosystem services. The unmitigated predicted permanent impact on the provision of ecosystem services for the BVP Situation 1 non-SRO options is -£41,050.53 (overall change in value in £/year) and for the BVP Situation 8 -£181.41. Via application

of best practice mitigation both Situations present an opportunity to improve the existing habitats through post-construction remediation and replacement of low value habitats with higher value habitats. The planned BNG associated with options will also help support provision of ecosystem services. The plan crosses several Natural England Habitat Network Enhancement Zones and is therefore suitable for the planting of new high value habitats. The SRO effects on natural capital are the same as for Situation 4.

11.311 Regarding Biodiversity Net Gain, the BVP Situation 1 is expected to result in an unmitigated predicted 19.28% (-509.95 net unit change) net loss of biodiversity units from Non-SRO options, as a result of most options generating a net loss of biodiversity during construction. The number of units required to achieve a 10% BNG for this programme is estimated at 774.426 for Non-SRO options. The BVP Situation 8 is expected to result in an unmitigated predicted -34.63% (-4.78 net unit change) net loss of biodiversity units from non-SRO options, as a result of most options generating a net loss of biodiversity during construction. The number of units required to achieve a 10% BNG is estimated at 6.16 for non-SRO options (the relatively small number is due to fewer options being included in Situation 8 resulting in a relatively small baseline amount compared to the other situations). The SRO effects are the same as for Situation 4 across both Situations 1 and 8.

INNS – Best Value Plan Situations 1 and 8

11.312 The INNS in-combination effects for Situation 1 are similar to Situation 4. Situation 8 contains fewer options with potential INNS risk interactions. Mitigation for these risks is again proposed within Appendix BB.

Costs and Carbon emissions

11.313 As part of our options appraisal, we have undertaken the most detailed cost and carbon emissions assessments for our options that we have ever undertaken in a WRMP. Details of methods used in these assessments can be found in Section 7 of our rdWRMP24. As with our environmental assessments, cost and carbon assessments are undertaken at a level of detail commensurate with option salience and maturity.

11.314 We have undertaken cost and emissions assessments at the option level, considering the embedded carbon and capital cost associated with construction of each option, and the operational carbon and costs that would be associated with each option's use. These option-level assessments have been used to appraise the overall costs and carbon emissions associated with plans and programmes of options. We have included the costs and emissions associated with the use of electricity, incorporating government guidance on the forecast decarbonisation of the grid to ensure that we do not unduly bias against options with a high need for electricity based on the emissions of today's electricity grid. Using the option-level emissions assessments, which identify the capital carbon emissions, fixed operational carbon emissions, and variable operational carbon emissions associated with the construction and use of each option, alongside the investment model which identifies when each option should be constructed, and how it should be used, we are able to identify the carbon emissions associated with our preferred programme as a whole.

11.315 We have also incorporated the social cost of carbon emissions into the programme cost that we consider when determining a programme's total Net Present Value (NPV) cost, ensuring that externalities from carbon emissions are embedded within our economic decision-making processes.

11.316 The costs of, and carbon emissions associated with, our different options can be found in the WRMP tables. These tables incorporate a step-change in the level of detail in cost visibility compared to WRMP19.

11.317 The impact that our plan has on customers' bills is a key consideration when determining our preferred plan. The profile of bill impact associated with our preferred programme can be seen in Table 11-37, with the investment required shown in Table 11-38. It is important to note that bill impact calculation incorporates all expenditure that would go towards implementing actions identified in our preferred programme, but that this does not necessarily imply a commensurate increase in water bills. In our Price Review 19, Ofwat for the first time dictated to us that we could not raise water bills in order to reduce leakage, considering that it was part of the 'base' expenditure associated with operating our business. Ofwat will make a determination regarding expenditure that can be considered to deliver an 'enhancement' and expenditure that we should consider as 'base', and this balance will determine the increase in water bills that will be seen in the future. As an example, in the table below, approximately £10 of the £15 total increase is forecast to come from "base" expenditure, implying a bill increase requirement in AMP8 of around £5 from the WRMP.

	2026-30	2031-35	2036-40	2041-45	2046-50	2071-75
Demand Management (£)	12.50	15	40	60	85	85
Supply-side Schemes (£)	2.50	10	15	15	20	20
Total Cumulative Bill Impact, per year (£)	15	25	55	75	105	105

Table 11-37: Estimated Impact of Programme on Water Bills

Note: This is an estimated bill impact calculated assuming an asset life for each option, and is not a forecast of actual bill increases. This bill impact calculation only accounts for increased investment set out in the WRMP, and other bill increases will be needed to support investment in other aspects of our business.

	AMP8	AMP9	AMP10	AMP11	AMP12
Capex (£m)	800	2300	2350	1950	2450
Opex (£m)	100	100	110	170	200

Table 11-38: Preferred Programme Cost, Split into Capex (including land) and Opex, rounded to nearest £50m for capex and £10m for opex

Note: this table describes investment needed in each AMP, and does not describe the cumulative investment required. This table details all investment required, including investment required to replace assets.

11.318 Table 11-39 shows the profile of carbon emissions from options that we would feature in our plan across the planning period. Table 11-40 shows the embodied carbon emissions associated with different options in our preferred plan. This table includes the need for 'repeat' emissions (the emissions associated with replacing sub-components

of options, for example pumps, at the end of their designed asset life). Please note that the inclusion of 'repeat' emissions across the preferred programme means that a like-for-like comparison between options cannot be made based on this table (e.g. Teddington DRA features in the preferred programme from 2033 onwards, but SESRO from 2040 onwards). In order to compare the carbon emissions of options in a like-for-like way, please refer to our WRMP tables.

11.319 We, along with the rest of the water industry in England, are aiming for net-zero operational carbon emissions by 2030, and will incorporate the operational emissions anticipated to arise from the WRMP into our net zero pathway; our journey towards net-zero will support the delivery of the national and company-level overall net-zero target of 2050. In further developing options, we will investigate where the use of low-carbon materials or construction techniques may be feasible (discussed in more detail in Section 7 of our WRMP); further decarbonisation of construction materials/techniques will further help us and the UK to meet our net-zero commitments. Our company net-zero strategy[12] describes the actions which we are taking to meet our net-zero targets, including reducing fossil fuel usage, harnessing solar power, and improving energy efficiency.

11.320 In the reporting year 2022/23, our net operational emissions (Scope 1 and 2 emissions as CO_2e and including outsourced Scope 3 emissions) were 321.9 kT CO_2e, while our total capital carbon emissions for the year 2022/23 were 423.9kT CO_2e. Noting that the figures in the Tables below are either for whole AMP (5-year) periods (Table 11-39), or for the whole 50-year planning period (Table 11-40), in the context of our overall operational emissions, those required to ensure a reliable supply of water is maintained are relatively small. In AMP8, the net operational emissions introduced by the new interventions in our WRMP will result in 0.015 kTCO_2e per annum (0.005% of our total current operational emissions), increasing to 2.2 kTCO_2e per annum (0.7% of our total current operational emission) by 2045-2050, with the operational emissions increasing as more new sources come online. As such, our consideration is that the new interventions will not hinder achievement of the 2030 operational net-zero target. It can be seen that the capital emissions associated with the delivery of the WRMP (37kT CO_2e per annum in AMP8, c.60-70 kT CO2e per annum in the 2030s, and c.45-60 kT CO_2e per annum in the 2040s) are more significant, with these figures ranging from around 9-17% of our current capital carbon emissions. As such, measures to reduce the capital emissions associated with new options' construction, noting ongoing investigation by the SRO projects into low-carbon construction methods, are likely to yield the most benefit in ensuring achievement of total net-zero targets.

11.321 While carbon emissions will arise from the implementation of the WRMP, we note three factors. Firstly, as highlighted earlier, programmes which substitute the two largest supply-side options in our plan (Teddington DRA and SESRO) with alternatives would result in higher total emissions levels. Secondly, our plan ensures supply-demand balance is maintained subject to the requirements of national policy and guidance (e.g., ensuring compliance with statutory and regulatory requirements regarding required licence reductions, and ensuring that higher levels of drought resilience are achieved); meeting policy and guidance will require new interventions which result in emissions. Thirdly, the largest sources of carbon emissions in our plan are demand management interventions, with the primary carbon source being our mains rehabilitation programme;

[12] Thames Water, 2021, Our journey to net zero carbon and beyond, https://www.thameswater.co.uk/media-library/home/about-us/responsibility/net-zero/our-journey-to-net-zero.pdf

our demand management programmes have been designed in order to ensure achievement of government targets (e.g. 50% leakage reduction) and as such complying with policy is again driving emissions in our plan.

	AMP8	AMP9	AMP10	AMP11	AMP12	Total AMP8-12
Capital Emissions (tCO_2e)	185,037	352,270	312,714	223,787	295,027	1,368,834
Operational Emissions (tCO_2e)	75	6,055	6,874	5,971	11,226	30,202
Total Emissions (tCO_2e)	185,112	358,325	319,589	229,758	306,253	1,399,036

Table 11-39: Emissions from Options in Thames Water Plan

Scheme	Capital Carbon	Operational Carbon	Total Emissions (tonnes CO_2e)	Scheme Yield / Capacity	Year First Used
Addington Groundwater Source	880	66	946	3	2028
Datchet GW Source DO Increase	804	2	806	2	2074
Guildford WRZ Demand Management Programme	39906	0	39906	11	2026
Henley to SWOX Transfer	3610	163	3773	5	2040
Henley WRZ Demand Management Programme	8535	0	8535	1	2026
Kempton WTW Enhancement - 100 Ml/d	42287	134767	177053	100	2040
Kennet Valley WRZ Demand Management Programme	45116	0	45116	13	2026
London WRZ Demand Management Programme	893987	0	893987	365	2026
Medmenham WTW and Intake	36284	21938	58222	24	2050
Mortimer GW Source Recommissioning	1913	66	1978	5	2042
Moulsford Groundwater Source	2093	27	2120	2	2033
Oxford Canal	13064	166	13230	12	2040
Ring Main - New River Head Pump	439	524	963	-	2050
SESRO 150 Mm3	238311	585	238896	149	2040
SESRO to Farmoor Pipeline	13323	454	13778	24	2040
South East Water to Guildford Transfer	1753	4	1757	10	2050
Southfleet and Greenhithe	3615	326	3941	9	2069
SWA WRZ Demand Management Programme	83022	0	83022	15	2026
SWOX WRZ Demand Management Programme	137129	0	137129	26	2026
T2ST Spur to Kennet Valley WRZ (Speen)	178	0	178	10	2050
Teddington DRA	90830	74732	165562	67	2033
Woods Farm DO Increase	889	3	891	2	2074
Didcot Licence Trade	0	0	0	23	2026

Scheme	Capital Carbon	Operational Carbon	Total Emissions (tonnes CO_2e)	Scheme Yield / Capacity	Year First Used
Horton Kirby ASR	3558	357	3914	5	2030
Total	**1,661,527**	**234,179**	**1,895,706**		

Table 11-40: Embodied Emissions from Supply-Side Schemes in the Preferred Programme, 2025-2075

Please note that, for SESRO, as it is a shared option, the carbon emissions in the table above reflect an estimation of Thames Water's share in the use of that option. As such, 55% of the emissions from SESRO and 55% of its DO benefit are stated in the table above. In the WRSE programme appraisal 100% of the carbon emissions have been taken into account, and the 55% proportion reflects the anticipated allocation to Thames Water for our WRMP reporting only.

Risks and uncertainties

11.322 Although we are confident that our preferred plan presents the best value solution to securing water supplies for our customers, and for the wider South East region, there are a number of risks and uncertainties which we have evaluated, and which we will monitor through the implementation period of our plan. In line with the WRPG, these are described below:

Risk: Demand Management

11.323 Our plan incorporates nearly 130 Ml/d of company-level demand reduction during AMP8, in addition to 40 Ml/d of 'carry over' activity from AMP7, alongside 22 Ml/d of government-led activity delivered through the introduction of water labelling. In the longer-term, our plan involves 430 Ml/d of company-led demand reduction up to the year 2050, incorporating over 190 Ml/d of leakage reduction and over 140 Ml/d of household demand reduction. In addition to this company-led activity, in the expectation that the government will act to ensure that the 110 l/h/d target is met with the recognition that there is a limited range of activities which we can take to reduce household demand for water, we have assumed that over 300 Ml/d (24 l/h/d) of demand reduction will be brought about by societal change and government-led intervention.

11.324 While we have a significant degree of control over leakage, reducing leakage to a very low level and keeping it there would require us to rehabilitate a large proportion of our existing ageing network, which is currently vulnerable to climatic shocks.

11.325 The volume of demand reduction in our plan will require an unprecedented shift in society's priorities, will require significant support from government, and will be costly to implement. While we have based our company-led demand reduction programme on available evidence and reasonable assumptions, the lack of firm commitment from the government regarding policy changes to help meet the 110 l/h/d by 2050 target means that there is a significant risk that we may not see the reductions that we anticipate, a risk that was made clear when household consumption increased significantly during lockdown periods in 2020 and 2021, to levels that we did not expect.

11.326 In response to short-term risks around demand management we will extend our contract for licence trading with RWE (Didcot Power Station) in order to offset the risk of short-term under-achievement of demand management actions, and will invest in an

expansion of an existing groundwater source and an innovative Aquifer Storage and Recovery scheme in South East London.

11.327 As is described in our monitoring plan, we have a mitigation plan for long-term risks and as such, while demand reduction does not represent a risk to the security of supply in the long-term, there is a risk that further investment will be necessary if policy changes are not implemented by the government over the next 10 years.

Risk: Capability of Thames Gateway Desalination Plant

11.328 The Thames Gateway desalination plant has faced a number of outage issues during recent years and was unavailable throughout 2022 due to a planned maintenance upgrade. Section 4 of our WRMP identifies current and future investments to improve the reliability of the plant, and to ensure it is capable of achieving the required outputs included in our plan.

11.329 Progress on Gateway has been incorporated into our monitoring plan (see next sub-section). Updates will be provided to cover the overall progress on planned investment and plant performance. The current investment programme included in our business planning is aimed at achieving the targets included in our planning, achieving 50Ml/d up to 2030 and 75Ml/d from there onwards.

Risk: Obtaining planning consent

11.330 Our plan includes the development of SESRO by 2040, and the Teddington DRA by the early 2030s. The SESRO scheme has a lead time of approximately 15 years and the Teddington DRA has a lead time such that 2033 is the earliest delivery date that we can be confident in (both including the time taken to acquire planning consent). As such, we must proceed with consenting these options.

11.331 As such, it is critical that our WRMP24 is robust and properly evidenced, and finalised in a timely manner, in order that the "need" for these schemes, both of which are nationally significant infrastructure projects (meaning they need to go through the Development Consent Order process to be consented), is properly established - as stated in Section 1.4.5 of the National Policy Statement for Water Resources Infrastructure[13], which would allow us to continue with confidence into the Development Content Order process.

11.332 As is detailed in the monitoring plan, we have a back-up option for both schemes, in order to mitigate the security of supply risk associated with the denial of consent.

Risk: WRZ integrity under severe environmental destination scenarios

11.333 We have considered the supply-demand balance implications of an environmental destination scenario which would mean that EFIs across the Thames catchment are achieved. Due to the scale of licence reductions in these scenarios, and the complex networks within our WRZs, it has not been possible to assess whether WRZ integrity (see Appendix A for further details) would be maintained under all severe scenarios of future licence reduction. WRZ integrity is achieved when all customers in a WRZ experience the same level of risk of failure; this is generally achieved through interconnected networks which mean that customers can be supplied from different

[13] Department for Environment, Food & Rural Affairs, 2023, National Policy Statement for Water Resources Infrastructure, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1150075/E02879931_National_Policy_Statement_for_Water_Resources.pdf

sources. Severe licence reductions implemented across a WRZ could, however, result in these networks needing to be significantly modified to ensure that all customers remain in supply, in addition to new water resources schemes being necessary to maintain supply-demand balance. While we would not alter our plan for new water resources investments that we would make if we found that WRZ integrity would be compromised, if we find that the combination of licence reductions that need to be made result in loss of integrity for our existing WRZs, we could need to resort to additional network solutions which may not have been incorporated into our WRMP24, meaning that an additional burden of cost would be placed on customer bills.

11.334 The current Environmental Destination guidance sets out that licence reductions should be made by 2050. As long as sufficient time is available between when licence reductions are confirmed and when they are expected to be implemented, we will be able to respond and maintain WRZ integrity. Should timescales be too short for us to plan and implement network solution then we would face WRZ integrity issues.

Risk: Re-assessment of option costs and benefits

11.335 As we continue the option development process and undertake more detailed design of options, we may find that cost and benefit estimates for the options within our plan change. We have also seen changes to our mains rehabilitation costs due to increasing inflationary effects in recent years.

11.336 However, our consideration is that these risks have been minimised in our plan due to the inclusion of "optimism bias" (an allowance made to reflect cost uncertainty) and due to the many years' worth of cost estimations that have been undertaken for many of the schemes in our plan.

Risk: Lower Thames Abstraction Issues and the River Thames Scheme

11.337 During the 2022 drought event, we were not able to abstract as much water as our water resources modelling indicated should have been possible. The need to maintain levels for navigation in some sections of the River Thames meant that we had to switch off pumps in the reach of the Thames between Windsor and Weybridge. This meant that some of our larger reservoirs, which abstract from this reach, reached low levels. Our reservoirs which abstract from points on the River Thames below Weybridge, after the confluence of the River Wey with the River Thames, and those in the Lee Valley, were largely full and as such we were unable to abstract the surplus water available below the confluence with the Wey. This meant that more water was left over Teddington Weir than is expected during a drought period, with around 500 Ml/d going over the weir compared to expected flows of 300 Ml/d.

11.338 In the past we have been able to abstract volumes of water which are in line with our hydrological modelling, with a 300 Ml/d Teddington flow (or less) having been achieved for extended periods in 1921, 1934, 1976, and 1990. We are currently unsure whether the issues experienced during the 2022 drought event were due to unusual hydrological circumstances (there perhaps being a greater proportion of flow coming from the Rivers Wey, Mole and Hogsmill than may be usual in a drought), changes in the Environment Agency's management in the river, deterioration of river management structures owned by the Environment Agency, or other changes in our ability to abstract. There is, however, a risk that something may have changed over recent years which could mean that our supply capability during drought conditions may be less than we currently think.

11.339 Exacerbating this risk is the proposed flood alleviation scheme being developed by the Environment Agency and Surrey County Council, the River Thames Scheme[14]. This scheme, the Development Consent Order submission for which is due to be submitted in 2024 and which would be constructed by 2030, would involve the construction of new channels in the Lower Thames which would take water from the Thames above the confluence with the Wey and divert it to a point below this confluence. This would clearly exacerbate the issues experienced in 2022, with the potential flow required in these channels during dry periods being around 90 Ml/d.

11.340 Our response to this risk is described in more detail in the Monitoring Plan section below, but it broadly involves:

- Learning: We have begun a programme of learning and modelling to identify the magnitude of issues which may exist. We will also identify the extent to which the River Thames Scheme may create or exacerbate issues
- Solutioneering and options development: We have also begun a programme of option identification and development, whereby we will design solutions which will create greater connectivity in our raw water abstraction network to solve problems, should they exist
- Making the right decisions: We have explored the implications of the issues which may exist within our programme appraisal and investment modelling and have established preferred and alternative solutions, as is set out in the monitoring plan. We have confirmed that, regardless of whether an additional intervention is required to overcome these issues, our plan is the Best Value solution
- Taking action: If we identify that a solution is required, our proactive options development will mean that we will be in a position to progress towards implementation

Uncertainty: Acceleration and changes in policy ambitions.

11.341 We have seen increasing policy ambitions from government, promoting greater protection for the environment and resilience for customers, which we support. Our plan is based on policy ambitions as we know them today, and while it is adaptive, it is nonetheless based on scenarios of 'known unknowns', rather than 'unknown unknowns'. Should new policy ambitions emerge, or our existing policy position be required to change leading to a further need for water, we may need to adapt our plan to account for the change.

11.342 We consider policy changes as an uncertainty, rather than a risk, because we have seen the Environment Agency and Ofwat generally looking to implement policies in the longer-term, allowing our plans to adapt, rather than rushing policies through to implementation on a short timescale. The exception to this is the recent introduction of the 'licence capping' policy, where the policy was finalised 2022 with the expectation that we would plan for implementation by 2030. While the timescale between policy finalisation and the expected date of implementation is short, Environment Agency colleagues have been helpful and pragmatic in setting out expectations and making allowances for licence reductions that would be feasible and infeasible on such a short timescale.

Uncertainty: Population Growth, Environmental Destination and Climate Change

11.343 The uncertainties of population growth, environmental destination and climate change have all been considered within our adaptive planning framework. These are the major

[14] https://www.riverthamesscheme.org.uk/

planning uncertainties that we face in the future. Our adaptive planning approach means that our plan will be resilient and efficient under a range of plausible scenarios of all three of these factors, but we will need to monitor and respond to changes that we see. As noted in our programme appraisal, these are the factors which are considered within our adaptive planning framework, but there are other risks and uncertainties to our supply-demand balance that we will need to consider alongside these.

Uncertainty: West Berkshire Groundwater Scheme

11.344 Water supply under drought conditions in our Kennet Valley WRZ is particularly dependent on the availability of the West Berkshire Groundwater Scheme. Our London WRZ also depends to a significant degree on water supplied through this scheme.

11.345 The WBGWS is made up of a large number of boreholes which are owned, maintained and operated by the Environment Agency. In drought conditions the WBGWS is used to abstract water from a number of chalk aquifers and augment river flows.

11.346 During AMP8 we will be undertaking a programme of collaborative investigation with the Environment Agency into the long-term feasibility of continued use of the WBGWS. Alongside this we will look to investigate the potential for amendment to the operating triggers for WBGWS such that the scheme can continue to be effective.

11.347 The Environment Agency have indicated that they will look to keep the WBGWS in operation until 2060, but have stated that this is subject to "future policy changes (e.g., long-term sustainability of river support schemes in relation to climate change)". As such, it is important that our plan is resilient to the potential closure of this scheme after 2060, and perhaps before.

11.348 After discussion with the Environment Agency, and as a result of representations raised on our dWRMP24, we have explored whether our plan would be impacted by closure of the WBGWS in 2040, 2050, or 2060. Our plan, and in particular the selection of the 150 Mm^3 SESRO scheme, mitigates the risk which is posed.

Monitoring Plan

11.349 Over the period building towards WRMP29 we will put in place a system of monitoring and reporting to give regulators and stakeholders visibility of our progress delivering our plan. This will facilitate stakeholder input and engagement to the overall work programme.

11.350 We propose that the existing WRMP Annual Review process is the obvious place to review the progress with the Monitoring Plan. We will continue to report progress through our Water Resources Forum and associated stakeholder meetings. We will in addition submit quarterly progress reports to the Regulators' Alliance for Progressing Infrastructure Development (RAPID) relating to the work programme associated with investigations of the SROs.

11.351 Our proactive work with WRSE, as well as RAPID, will ensure our work programme is aligned with neighbouring water companies as well as those further afield who are working with us to investigate and develop the SROs.

11.352 We will report the outcomes of our monitoring plan into WRSE, in order to inform the regional monitoring plan.

11.353 As has been discussed, there are risks which we are facing in the short-term (e.g., reducing leakage from 620 Ml/d in 2022-23 to 417 Ml/d in 2029-30, or by around a third), and those which are of more relevance for the long-term (e.g., reducing PCC to 110 l/h/d by 2050 and the resultant c.300 Ml/d supply-demand reduction which we are relying on the government to drive). There being risks of relevance for the long-term and short-term is also aligned with the decisions we need to make, i.e., determining the supply option that should provide new supplies for the early 2030s (relatively short-term), the option we should develop to provide new supplies for 2040 (a decision which we must make now, considering long-term risks), and whether additional supplies are required in the future (a decision which we do not need to make now, but which factors into the decisions which we are making now). As such, we have designed a monitoring plan, detailed here, with two phases of focus:

- Short-term monitoring plan:
  - **Aims:** ensuring that the decisions to progress with the selected SRO schemes 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

Monitoring Plan Stage 1: Short-term

11.354 We have split our short-term monitoring plan into two sub-phases, recognising the two primary focuses in the short-term: obtaining consent for the Teddington DRA scheme (Stage 1a) and obtaining consent for the SESRO scheme (Stage 1b).

11.355 Our preferred programme is the programme of options which we consider delivers Best Value to customers and the environment, subject to the best evidence currently available and assuming we successfully deliver our demand reduction plans. In the following sections we highlight some areas of uncertainty which may cause us to change to an alternative plan, but we stress that, according to the best information we have available, both the Teddington DRA and SESRO are the best value solutions to our planning problem.

11.356 Stage 1a of monitoring plan (Figure 11-25) is a learning and monitoring phase and covers the period from now until we are able to confidently determine whether a solution is needed to maintain our currently stated Deployable Output for the London WRZ, accounting both for issues identified in the 2022 drought (see Appendix CC) and any exacerbation of these issues by the River Thames Scheme. This stage of the monitoring plan is required because, subject to the outcome of these investigations, Teddington DRA (our preferred solution) could be found to be infeasible.

11.357 Our current schedule for the Teddington DRA scheme involves submission of a consenting application by late 2025, in order for the scheme to be operational by 2033. As such, our aim is to have completed Stage 1a of the monitoring plan to align with the consenting schedule. The 2033 date is driven by the need to have new supplies to provide a 1 in 200-year level of resilience for our customers. The date of 2033 is a company target, not a statutory target. We have established through sensitivity testing that Teddington DRA remains our preferred solution, even if we delay this date up to 2035. As such, if Stage 1a of our monitoring plan is not complete by late 2025 we may delay our consent application and would accordingly delay our anticipated date for achievement of 1 in 200-year resilience, but would not alter our option selection.

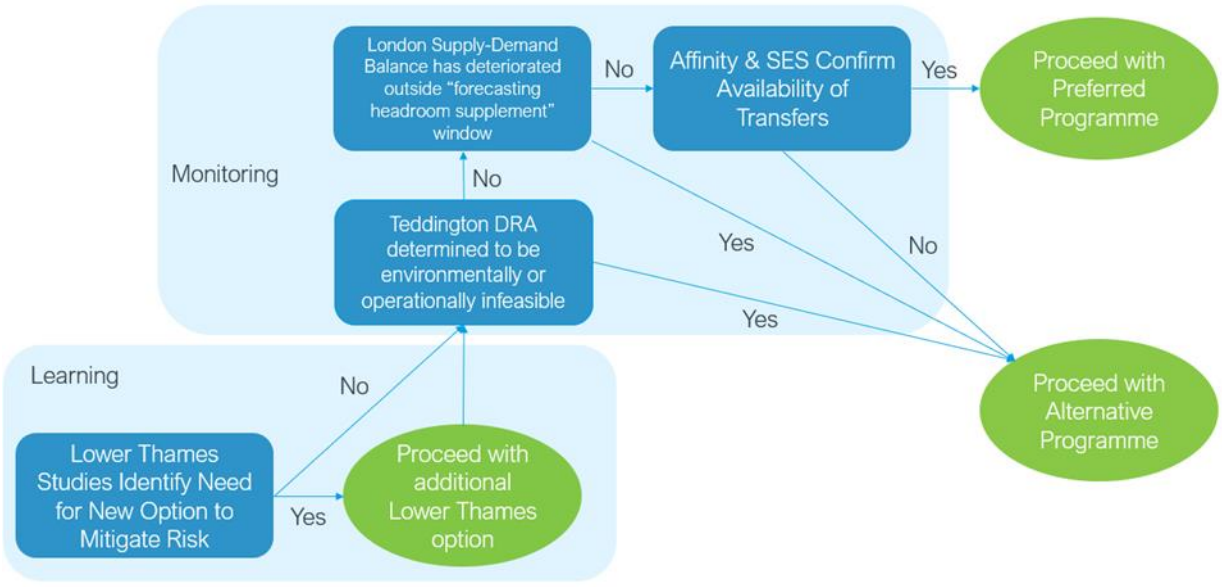

Figure 11-25: Monitoring Plan, Stage 1a

11.358 Our alternative programme for monitoring plan Stage 1a substitutes the Teddington DRA option with the Beckton Water Recycling scheme. Beckton Water Recycling is significantly more expensive than Teddington DRA (relying on membrane treatment and involving the construction of two long tunnels), but is modular and could, over time, be

scaled up to a 300 Ml/d recycling plant (the maximum feasible Teddington DRA size is, by contrast, 75 Ml/d). The modularity of the Beckton Water Recycling plant means that it could be scaled up should it be found that additional water is needed in the short to medium term. The 150 Mm^3 SESRO option is our preferred option for delivering long-term security of supply, regardless of whether we adopt the Beckton Water Recycling option or the Teddington DRA, and so both our preferred and alternative plans for this monitoring phase include the SESRO 150 Mm^3 scheme.

11.359 The learning phase of our stage 1 monitoring plan involves investigation, research, and modelling to determine: whether there are constraints on our abstraction which we do not currently capture within our water resources modelling; whether the River Thames Scheme (a flood alleviation scheme being developed by the Environment Agency and Surrey County Council) will exacerbate these constraints; and whether these constraints can be mitigated by operational changes by Thames Water and/or the Environment Agency, or if engineering interventions are necessary to remove these constraints. If engineering interventions are necessary, then an options appraisal process, which will run in parallel to the problem identification process, will determine the preferred option for mitigating the risks which are identified. We have confirmed, through sensitivity testing, that the Teddington DRA scheme remains the best option to provide 1 in 200-year resilience if constraints on the River Thames do not exist or exist but are mitigable through operational changes (either of these would be our preferred plan), or are found to exist but are mitigable by an engineering solution. If, however, we identify that constraints on our Lower Thames abstractions exist or will be created by the River Thames Scheme, and that an engineering solution is infeasible, we will need to revisit the decision made regarding option selection for the early part of the WRMP24 planning period (up to 2033).

11.360 The outcome of the learning phase will identify whether a new option is needed to mitigate issues around our Lower Thames abstractions, and whether such an option would be feasible. At this point, we will consider the following three checks which will determine whether we will adopt our preferred or alternative programme for the short-term.

11.361 The first monitoring check is whether, during the learning phase, ongoing environmental and operational feasibility investigations (carried out by the SRO team as part of the EIA or other assessments) have determined that the Teddington DRA is infeasible. If the Teddington DRA has been found to be infeasible, we will adopt our alternative plan and undertake monitoring checks two and three to determine the scale of the Beckton Recycling option required.

11.362 The second monitoring check is whether the central forecast of our supply-demand balance trajectory for the early- to mid-2030s indicates that we are outside the "forecasting headroom supplement" envelope in the London WRZ. We undertake a Target Headroom forecast to ensure that we leave an appropriate buffer to account for future risks. Our Target Headroom allowance for the short- to medium-term future is larger than the 'base year' (the year in which we undertake the assessment) because forecasting forward is more uncertain than making assessments of the current situation. It is not the case that we would anticipate having a headroom allowance as large as the forecast target headroom in future years, and we would instead expect to have a headroom allowance approximately equal to the 'base year' allowance when we assess our security of supply at a point in the future. We have split our Target Headroom

forecast into a 'base year' allowance and a 'forecasting supplement' (Figure 11–26). At the point at which we undertake our monitoring checks, we will adjust our WRMP24 final plan supply-demand balance trajectory to account for the major short-term uncertainties in our plan, which are: the overall distribution input at the point in the future when we undertake the monitoring checks; our forecast leakage, informed by the success of our leakage reduction plan for the rest of AMP7; our forecast household consumption, informed by the success of our PCC reduction plan and updates to population forecasts; our forecast of the availability and capability of the gateway desalination plant, and; amendments made to our baseline supply capability following assessment of feasible abstraction in the Lower Thames. If we find that the combination of these factors leads to a deterioration in our supply-demand balance of more than the "forecasting supplement" in the early- to mid-2030s, then we will proceed with the Alternative Programme, and at this point will determine the size of the Beckton Water Recycling option needed by considering the deficit compared to the forecasting headroom supplement.

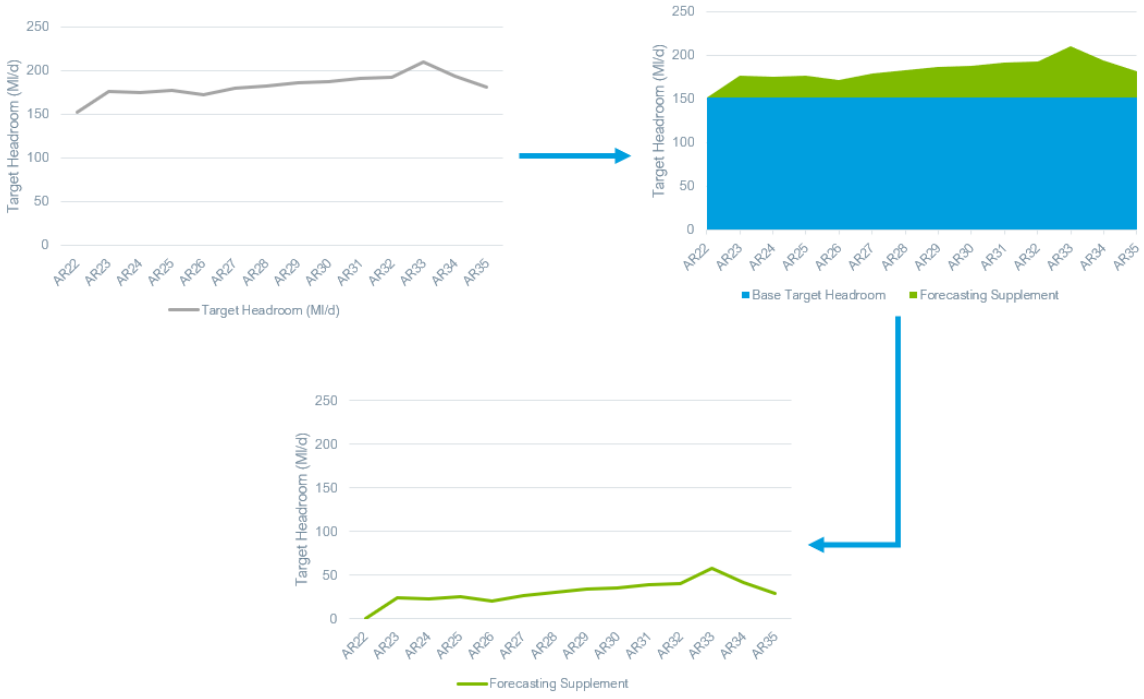

Figure 11–26: Forecasting Headroom Supplement Calculation

11.363 The third monitoring check to be undertaken will be that the licence transfer option from Affinity Water (or an alternative transfer option, from SES Water) is still available. The transfer capacity required across these transfers would be around 10 Ml/d, and so we need to be sure that the transfer donor is confident that they will be able to offer this transfer. This transfer is dependent on Affinity (or SES) achieving their demand reduction goals and, in the case of Affinity Water, gaining consent and successfully developing the Grand Union Canal SRO. Unless our supply-demand balance forecast position has improved by more than the total maximum transfer requirement in our preferred programme, if the Affinity Water (or SES water) transfer is unavailable, we will move to our alternative programme and determine the size of the Beckton Water Recycling scheme that is needed.

11.364 If we find that all three monitoring checks are passed, then we will proceed with our preferred programme.

11.365 Stage 1b of our monitoring plan concerns the SESRO development consent order. We have identified that the 150 Mm^3 SESRO scheme is the best value option to provide long-term resilience for our customers' supplies and for improving the environment, considering the different potential outcomes of Stage 1a of the monitoring plan. The 150 Mm^3 scheme, being the largest single-phase option which we can develop, also offers the greatest supply-demand balance benefit and so its selection as the best value option should proceed regardless of change in our forecast supply-demand balance resulting from the issues noted as short-term risks (e.g., achievement of demand management targets in the short term, Gateway desalination plant capability). Stage 1b of the monitoring plan concerns the consenting progress of the SESRO SRO and associated assessments. Should the 150 Mm^3 SESRO be found to be infeasible or be denied consent we should seek consent for and develop an alternative SESRO size (the largest feasible size), and if SESRO is denied consent overall we will switch to our alternative plan and proceed with development and consenting of the Severn Thames Transfer SRO.

Monitoring Plan Phase 2: Long-term

11.366 Through Phase 1a of our monitoring plan, we will ensure the robustness of our supplies up to 2035, by adopting our alternative plan (Beckton Water Recycling, sized appropriately) if our short to medium term supply-demand balance challenge is forecast to grow beyond our preferred plan forecast. As such, the second phase of our monitoring plan concerns the longer-term.

11.367 In our long-term planning, decisions which we make will always necessarily be based on a combination of observations and forecasts (with these forecasts being informed by regulatory guidance). This is because the large supply-side interventions which we can implement will take of the order of 10 years to develop, and so we must forecast ahead to highlight when investment is needed. This is particularly important when considering climate change impacts, as the impacts of climate change on drought risk to date are only observable through detailed climate modelling (i.e., they are not directly observable), and observable thresholds (e.g. total emissions or temperature rise) correlate poorly with drought risk outcomes (see WRMP24 Appendix U).

11.368 In addition, the overall supply-demand balance is clearly influenced by multiple factors. When determining whether investment is required, we must consider the cumulative impact of different factors. As such, in our monitoring plan, we should clearly not identify triggers/thresholds associated with individual metrics on which we would alter our plan. Instead, we should consider risks in the round when making investment decisions.

11.369 In Table 11-41, we have identified the principal factors which we will monitor. For each factor, we have identified representative scenarios of outcomes which could occur, a 2027-28 indicator value (2027-28 being five years from the submission of our rdWRMP24, and so being around the likely date for publication of our WRMP29), and the impact on our supply-demand balance in 2040 if this scenario were to be realised.

11.370 This table demonstrates that combinations of different factors could lead to very similar outcomes for our overall supply-demand balance. For example, a future in which we follow our preferred plan, but the government does not implement policy beyond water

labelling and West Berkshire groundwater scheme is forecast to be unavailable from 2040 (total 2040 SDB change = -173 Ml/d) gives approximately the same overall impact as a future in which we follow our preferred plan, but our leakage reduction plan is only 50% as effective as we would like and the Gateway desalination plant is decommissioned (total 2040 SDB change = -164 Ml/d).

11.371 Through our annual review process we will track and report on these indicators, and will track progress towards the stated 2027-28 indicator values to give an idea of the likely future scenario we are facing. Our tracking will indicate whether we need to make interventions in addition to the selected SROs.

11.372 It is notable that many of the future scenarios listed would result in supply-demand balance detriment, which reflects the ambitious, policy-driven targets for demand management (e.g., there is a larger chance of under-delivery than over-delivery of PCC reduction).

11.373 As can be seen in this table, the single largest supply-demand change that we could experience would be if the Environment Agency were to confirm sustainability reductions being required in accordance with the High scenario, with the delivery date accelerated to 2040. In this scenario, we would need to develop additional new resources.

11.374 A benefit of our preferred plan is that, in the 2040s, there exists a surplus of resource (note that this surplus does not exist from 2050 onwards), meaning that we could absorb some scenarios of adverse supply-demand balance impact without needing to resort to additional resource development in the medium-term. The surplus from the 150 Mm^3 SESRO and 75 Ml/d Teddington DRA together would be around 190 Ml/d in 2040, 140 Ml/d in 2045, and 0 Ml/d in 2050. As such, aside from the "High accelerated" environmental destination scenario, more than one adverse factor would need to impact our supply-demand balance for additional resource to be required. By 2050, resource from the 150 Mm^3 SESRO and 75 Ml/d Teddington DRA would be fully utilised or very nearly fully utilised, meaning that no/little excess capacity would exist. The resilience to future medium-term risks but long-term efficiency is a clear benefit of our preferred programme and demonstrates that the schemes presented are an adaptable, efficient solution to the planning problem with which we are faced.

11.375 With Phase 1a of our monitoring plan ensuring delivery of the required supplies up to 2035, and the forecast surplus of supply for a period in the 2040s, our long-term monitoring plan's main focus is the period 2035-39. Tracking of indicators will highlight whether, for example, additional intervention is needed to reduce leakage more quickly, whether tariffs should be introduced earlier, or whether additional supply options (small or large) may be required during this period. We will, however, of course ensure sufficiency of supply is forecast for 2040 and will respond if required. We cannot present defined additional schemes which we would implement according to future scenarios over the long-term, as the schemes required would depend on the combination of different factors (there are too many possible combinations of scenarios to consider) and so the overall scale of need, as well as the location of need.

Assessment Area	Monitoring Activity and metric	Range of scenarios	2027-28 indicator	2040 Supply-Demand Balance Impact, Compared to "Situation 4" (positive = SDB improvement), Ml/d
Leakage reduction	Leakage, Ml/d	50% success	531	-116
		75% success	493	-58
		100% success	456	0
		50% reduction by 2040	<430, and innovative solutions identified	+43.5
Company-led consumption reduction	PCC, l/h/d	50% effective	143	-85
		75% effective	141	-43
		100% effective	139	0
Government action on demand reduction	Policy Commitment	Apathy	Water labelling implemented, no further commitment	-96
		Moderate	Water labelling implemented, commitment to minimum standards on white goods in 2030	-73
		Preferred plan	Water labelling implemented, commitment to minimum standards on white goods in 2030 and indication that buildings regulations changes will be made	0
Population	Population (000's) and guidance	Low demand & guidance changes	Growth follows ONS trajectory, guidance changes to require ONS forecast use	+159
		Low demand	Growth follows ONS trajectory, guidance still requires forecast using local authority plan	+89
		Preferred plan	Growth follows Local Plan Trajectory	0
Environmental Destination	Investigation indications and policy	High, accelerated	Investigations confirm reductions necessary, policy changes to accelerate all reductions to 2040	-372
		High	Investigations indicate all reductions necessary	0
		Medium	Investigations indicate medium scenario likely	+56
		Low	Investigations indicate low scenario likely	+56
Climate Change	Latest forecasts and guidance	Low	Forecasts and guidance suggest low scenario appropriate	+87
		Medium	Forecasts and guidance suggest medium scenario appropriate	+40
		High	Forecasts and guidance suggest high scenario appropriate	0
		X High	Forecasts and guidance suggest impacts higher than high scenario	-75
West Berkshire	EA communication and policy	Available 2040	Scheme likely to be available in 2040	0

Assessment Area	Monitoring Activity and metric	Range of scenarios	2027-28 indicator	2040 Supply-Demand Balance Impact, Compared to "Situation 4" (positive = SDB improvement), Ml/d
Groundwater Scheme		Unavailable 2040	Scheme likely to be decommissioned by 2040	-77
Gateway desalination plant	Site capability and reliability	75 Ml/d reliable	50 Ml/d reliable. Good progress towards 75 Ml/d	0
		50 Ml/d reliable	50 Ml/d possibly reliable, but indication that 75 Ml/d unlikely	-8
		Decommission	Indication that plant will be decommissioned	-48
Supply-demand balance	Supply-demand balance, DI, and WAFU, in Ml/d	Better than forecast	Surpluses larger than forecast	Dependent on combination of factors above
		Preferred plan	Supply-demand balance	0
		Worse than forecast	Deficits in some zones	Dependent on combination of factors above

Table 11-41: Monitoring Plan Components

11.376 The final step in our monitoring plan will be undertaken when we produce WRMP29. At this point we will undertake a reconciliation exercise of our supply-demand balance trajectories against those included in WRMP24. This exercise will exclude changes in guidance introduced in the interim but will include consideration of the direction of travel for key drivers, alongside whether actions have been completed and whether these actions have resulted in the outcomes which we anticipated. We will reconcile our forecast supply-demand balance position in order to indicate the supply-demand balance trajectory that we look most likely to follow in order to indicate, based on current (WRMP24) guidance, the decisions that our WRMP24 would trigger us to make, as well as making an estimate of the outstanding uncertainty, and so comparing the envelope of forecasts that we would consider according to WRMP24 guidance. This will allow us to explain the impact of changes in policy and guidance made between WRMP24 and WRMP29. The factors considered and key questions which will be answered are listed in Table 11-42.

Factor	Factors Considered	Metric(s)
Leakage	Have we achieved our leakage reduction targets?	Ml/d
Meter installations and water efficiency	Have we met our targets for water meter installations and water efficiency visits? Have we seen the usage reductions we anticipated?	000's l/h/d
Population growth	How does population and the number of properties compare with our forecasts?	000's
Low-flow investigations	Do low-flow investigations carried out suggest that the "High", "Medium", or "Low" forecast is most likely?	Ml/d
Licence reductions – monitoring	Does our post-implementation of monitoring of licence reductions made suggest that they are effective in delivering ecological gain?	Qualitative/ quantitative discussion
Water labelling	Has water labelling been implemented? Has research shown that this introduction has been effective?	Yes/no l/h/d
White Goods – Minimum Standards	Have minimum standards on white goods been adopted?	Yes/no

Factor	Factors Considered	Metric(s)
Changes to buildings regulations	Will buildings regulations be updated to promote greater water efficiency?	Yes/no
Desalination plant availability	How well have we performed in our maintenance programme? What is our forecast for the plant's capability?	Update Ml/d
Climate change – demand	Have new climate change forecasts been released? Does observed and forecast warming indicate that we should alter our demand uplift approach?	Yes/no Ml/d
Climate change – supply	Have new climate change forecasts been released? If yes, do the revised forecasts alter our view of likely impacts?	Yes/no Ml/d
SRO	Have we obtained development consent for the SROs in our plan?	Yes/no

Table 11-42: WRMP29 Reconciliation – Factors Considered

Summary – What is our plan, and why have we selected it?

11.377 In this section we have presented our preferred Best Value plan, and preferred programme. We now summarise the key parts of our plan and the decisions that we have made.

11.378 Our plan reflects the revised Regional Plan, with the only difference between our plan and the regional plan being that we have included three small options in addition to the WRSE Regional Plan in AMP8 to mitigate risk.

Demand Management

11.379 Demand management is the most important component of our WRMP24. If we deliver our demand management programme during the rest of AMP7 and deliver the programme we have set out for AMP8, then we will achieve a supply-demand balance in all WRZs up to the year 2030.

11.380 Our company-led demand management programme is ambitious but achievable. It includes significant reductions in leakage, and a range of actions which encourage and help our customers to use less water. The demand reductions that we have set out in our company-led plan are based on evidence of achievable reduction and include a reasonable allowance for demand reductions from future innovations. In accordance with the Water Resources Planning Guideline and government policy, our preferred programme includes demand management measures which are predicted to reduce average PCC to 110 l/h/d by 2050. The constraints on measures over which we have control mean that, if the 110 l/h/d target is to be achieved, we must assume that the government will take decisive action to reduce household consumption. Our assumption is that the government will introduce measures which will, in aggregate, reduce average PCC by 24 l/h/d by 2050. We anticipate that these measures will include the introduction of water labelling of white goods, the introduction of minimum standards on white goods and changes to buildings regulations.

11.381 We have set out a leakage reduction programme which would see us achieve the target of 50% leakage reduction, compared to 2017-18 levels, by 2050. Our programme begins by focussing on the most cost-effective actions, such as using smart meter data to identify leaks, transitioning to a programme of mains rehabilitation in the longer-term in the expectation that developments in technology will mean that a major mains rehabilitation programme will become more affordable in the future. Focussing on cost-effective interventions early in the programme will minimise the bill impact of our programme in the near-term.

11.382 Our company-led house consumption reduction programme is centred on household metering and water efficiency programmes in the shorter-term, and includes the introduction of tariffs when a sufficiently large proportion of our customer population are metered to allow tariffs to be equitably introduced.

11.383 There is a risk that the government may not take the action required to allow the 110 l/h/d per capita consumption target to be achieved. If the target is missed then we may need to invest in additional supply-side solutions beyond those detailed in our preferred programme.

Teddington DRA

11.384 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.

11.385 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 relatively inexpensive compared to other available options.

11.386 Our plan involves proceeding with obtaining consent for and constructing the Teddington DRA scheme for use in the early 2030s.

SESRO

11.387 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 in order to build a best value adaptive plan.

11.388 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.

11.389 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.

11.390 The SESRO option, would be used to provide supplies for our London WRZ, Affinity Water, and Southern Water, with supplies also provided to our SWOX, Kennet Valley, and SWA WRZs and elsewhere in the WRSE region under some scenarios.

11.391 We have examined a range of possible future scenarios and have considered the wide range of risks that we may encounter in the future. As set out in the draft plan, smaller reservoir sizes reduce local impacts while larger sizes offer increased regional resilience. Our consideration is that the 150 Mm^3 SESRO is the best value option as the marginal cost of building a reservoir of this size (rather than a smaller reservoir) is small in comparison to the benefits gained, and due to the fact that the larger reservoir provides a larger capacity to provide resilience against the many adverse future scenarios which could be encountered. With around 80% of our future supply-demand balance need planned to be delivered through currently uncertain demand management measures

(not all within our control), in order to protect the security of supply for the south east, the 150 Mm^3 reservoir is the right choice.

11.392 In the longer-term, if the 110 l/h/d target is achieved and additional risks do not materialise then we are not likely to require additional sources of water alongside selection of the 150 Mm^3 reservoir. If, however, PCC does not reduce to levels which the government are aiming for, or if other risks materialise, then we made need to invest in additional sources of water.

11.393 Overall, we consider that the major elements highlighted here, described in more detail throughout this document, present the BVP for our customers and as part of the solution for the WRSE region as a whole.


Thames
Water