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 draft 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, the preferences of customers, the need to minimise impacts on the environment, the need for flexibility in managing a range of risks including a drought and the need to facilitate sustainable development.

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 demand for water and therefore the deficit in water supply, the plan turns, as it must, to strategic resource development for 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, and in 2030 and 2035 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

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 draft Regional Plan for Water Resources in the South East of England. The 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 Our proposed BVP is broadly consistent with our WRMP19. 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

[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

- 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

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 which are likely to be determined by future environmental legislation), it is difficult to determine what a 'most likely' future scenario would be. We have considered the WRPG and engaged in pre-consultation with the Environment Agency and Ofwat 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.

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 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

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

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'.

11.12 Our 'high' environmental destination scenario (which features in pathways 1, 4, and 7) has been developed on the basis of calculating future licensable volumes according to Environmental Flow Index calculations across the Thames Catchment under the Environment Agency's 'Enhanced' scenario (see Section 5). We did not determine our 'medium' environmental destination scenario by using the 'BAU' or 'BAU+' scenario and applying the same methods because doing so would have resulted in very similar forecasts for future abstraction reduction, of around 450 Ml/d for BAU+ and around 500 Ml/d for Enhanced (giving little variation on a topic around which there is much uncertainty). Instead, we determined the 'medium' (pathways 2, 5, 8) and 'low' (pathways 3, 6, and 9) scenarios on the basis of bottom-up analysis of catchment vulnerability, an assessment of the likelihood of impact of abstraction, and insight from previous investigations.

11.13 Through pre-consultation discussion with our regulator, the Environment Agency, the advice that has been given to us is that we should, in the absence of findings from investigations, assume that licence reductions would need to be made where identified by EFI-based calculations in identifying the pathway for our preferred programme. This means that the "high" environmental destination scenario referred to above should be used. As such, we have followed the regulator's guidance, which in essence applies a precautionary principle in our planning of likely future licence reductions. Where licence reductions are proposed, recent precedent suggests that it is generally incumbent on water companies to prove that abstractions do not have a detrimental impact on the environment in order to make the case for why licence reductions should not be made, rather than to find evidence of impact and make licence reductions in response.

11.14 We will be carrying out necessary environmental investigations during the period 2025-2035 to evidence the level of abstraction reductions required. Given that, in accordance with the WRPG, we are required to follow local authority plan based population projections (pathways 4-6), and that following discussions and advice from the environmental regulator a "high" environmental destination scenario should be adopted (pathways 1, 4 and 7), 'pathway 4' is the future supply-demand balance pathway along which our preferred programme should be described.

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 solutions may be required for many of our WRZs in the next 25 years, not only London. Additionally, Southern Water and Affinity Water are also likely to have 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 directly 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 as required by the WRPG and direction from Defra. Alternative dates are tested as part of 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 and 2022, 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

11.22 We presented our investment modelling tool with 'deliverable', 'high', and 'high plus' demand programme options, as described in Section 8. The 'deliverable' demand management scheme was selected in all cases, as the additional cost of making greater demand reductions in the short term was shown to be prohibitive.

11.23 Our demand management programme is the largest component of our plan throughout the planning period, particularly so in the short term (Figure 11 - 1).

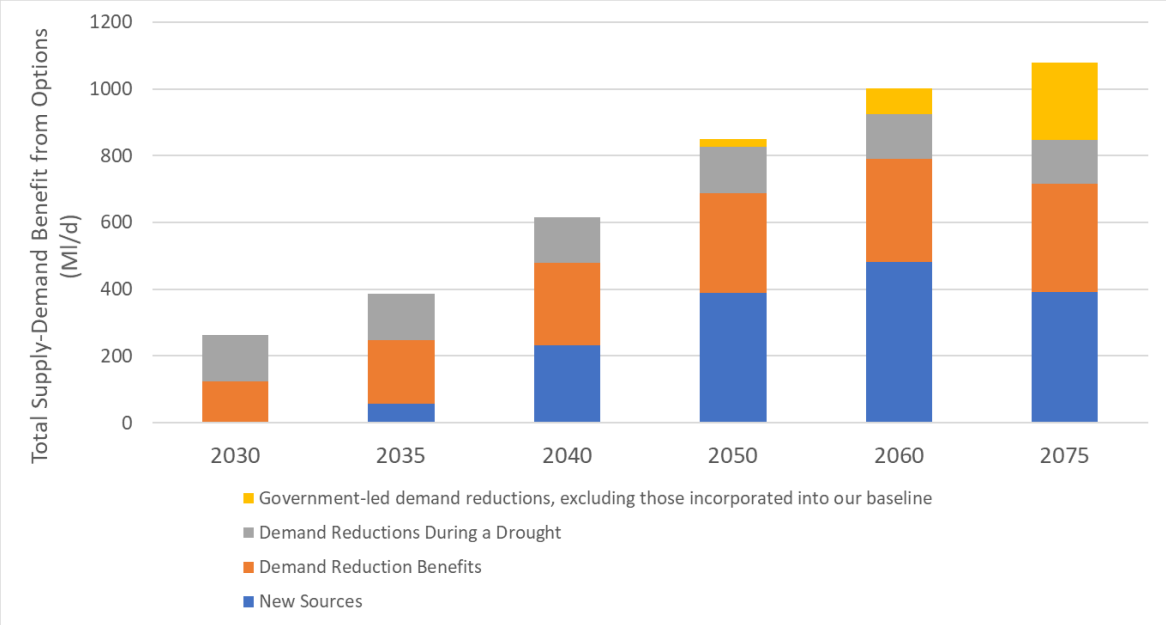

Figure 11 - 1: Contribution of Different Types of Option to our Preferred Programme

11.24 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 of our policy objectives in this area. Future water mains rehabilitation programmes, which form a large part of our demand management programme, are necessary in order 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.

11.25 The total volume of demand reduction in our deliverable programme up to 2050 is shown in Figure 11 - 2. This excludes demand reductions which we assume that the government will lead.

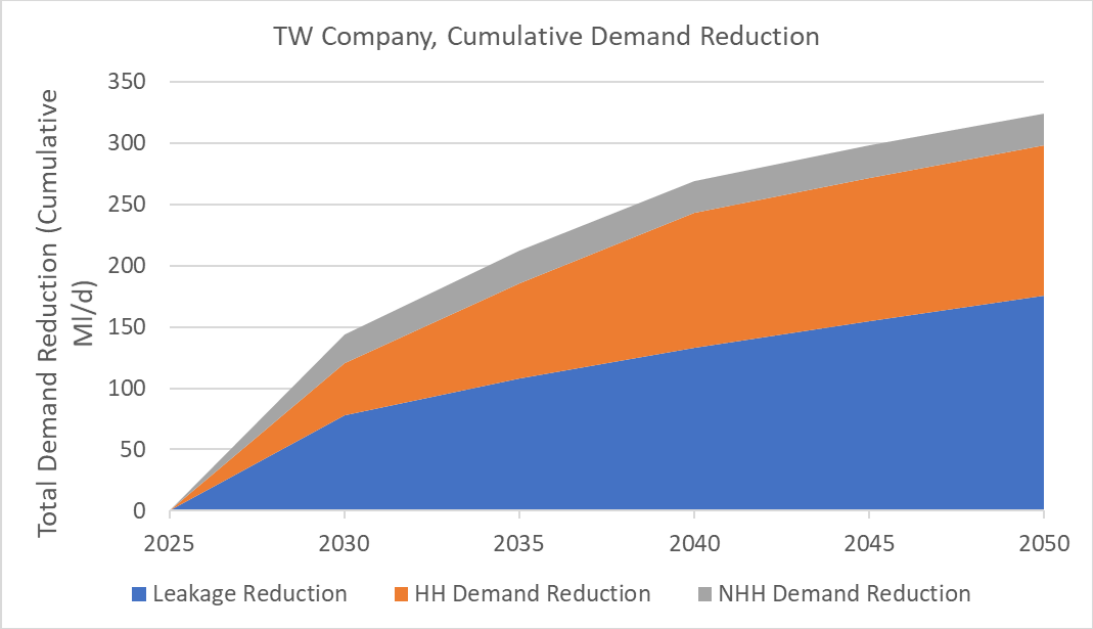

Figure 11 - 2: Total Demand Reduction (Company-level)

11.26 Our programme is one that is evidence based and which we consider strikes a balance between ambition and the risk of under-deliverability of reductions. If we were to over-rely on as yet unknown innovative techniques, 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.

11.27 As such we have developed an evidence-based approach, considering programmes of delivery of demand options that are feasible, and using evidence-based assumptions to derive total demand reduction volumes that we can be confident in. 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.

11.28 Being based on evidence of achievable demand reductions, we did not build the household demand reduction component of our demand management plan around achievement of a nominal per capita consumption (PCC) target. Instead, we built a programme of actions that we are confident we will be able to deliver and have calculated the household demand that this programme of actions would result in, using the available evidence. This means that our demand management programme does not include a reduction of PCC to 110 l/h/d by 2050. This is not due to a lack of ambition but is rather due to a lack of evidence that achieving such a target is realistic, or that it presents best value to customers. Our evidence suggests that achieving this target would require government-led or as-yet-unknown company-led actions to deliver almost 150 Ml/d of demand reduction by 2050, a considerable volume. If we were to assume that we would meet 110 l/h/d we would not be able to define a programme of actions that would achieve that with any confidence, and there would be a significant risk that we would not meet supply-demand balance in the future.

11.29 The recent summer heatwave and exceptional dry period, noted by the Environment Agency as a period of drought in our region, has shown marked increases of customer water usage. Whilst we can proactively influence household behavioural water use through our smart metering and water efficiency activity up to a point, it is not something that is directly within our control. This needs to be considered and understood in how we commit to increasing reductions so we know

we can depend on them under drought conditions in the future, which are forecast to become more extreme in response to the impacts of climate change.

11.30 We have taken a different approach in developing our leakage and household consumption programmes, i.e. building the leakage plan around achievement of policy goals but not taking the same approach for household consumption, for two key reasons:

- We are able to build an evidence-based programme of leakage reduction actions which leads to achievement of the policy ambition. Using currently available evidence, we cannot build such a programme for household demand reduction
- While we can directly reduce leakage through fixing leaks, we can only influence our customers to reduce their demand, and so do not have the same level of direct control over household consumption as we do for leakage. As such, if our leakage reduction efforts are less effective than we anticipate, we would be able to invest a greater amount and undertake more leakage reduction activity, but we are not able to respond in the same way to household consumption reduction

11.31 While our household consumption reduction plan contributes to the national aim of reducing average UK household demand to 110 l/h/d, we recognise that not setting out a demand reduction programme that assumes that we hit the 110 l/h/d target at the company level by 2050 may not meet the expectations of some stakeholders. We predict that PCC could reach 110 l/h/d in an average year in the late 2060s (or in 2070 if looking at dry year PCC), but this would be reliant on continued intervention from government to amend buildings regulations, and in 2050 we estimate that our PCC will be 123 l/h/d (in a dry year).

11.32 We now breakdown 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 Our leakage reduction programme delivers the industry ambition and government priority of 50% leakage reduction by 2050, compared to 2017-18 levels. This includes a 15% reduction (78 Ml/d) in AMP8. In 2030 our total company leakage will be 447 Ml/d, compared to 698 Ml/d in 2017-18, a large difference.

11.34 The total leakage reduction activity required between 2025 and 2050 in order to meet the 50% leakage reduction target is 176 Ml/d. This is in addition to 127 Ml/d of leakage reduction that is being carried out during AMP7. Our leakage in 2050 will be 349 Ml/d, compared to 698 Ml/d in 2017-18.

11.35 Our plan involves reducing leakage in the most cost-effective way available in each AMP. As we reduce leakage it becomes progressively more difficult to find leaks, and so more expensive to further reduce leakage.

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 we are reviewing a strategic multi-AMP delivery programme and innovation methods to achieve cost reductions. We are also delivering in AMP7 a Conditional Allowance mains rehabilitation programme which is aimed at improving resilience of our network to such things as winter or summer weather shocks. This strategic programme is in development to cover multiple AMPs, and will be taken into consideration alongside this plan. Both will assist with improved cost of the mains rehabilitation option.

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 a third compared to 2017-18 levels by this point.

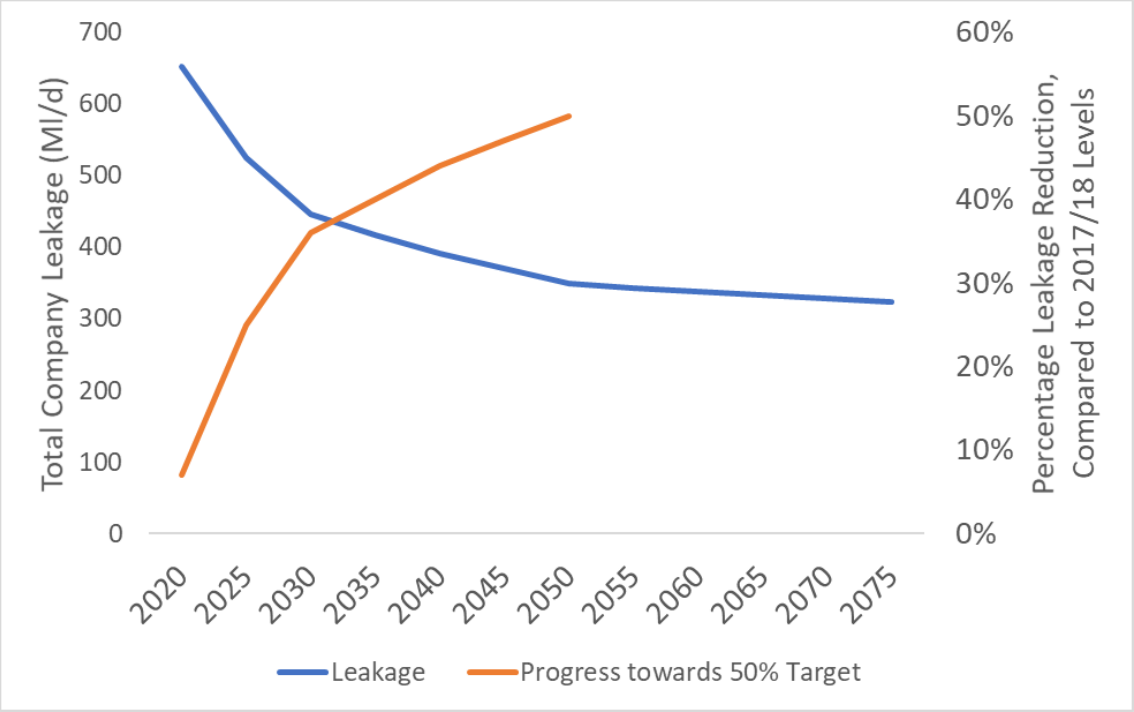

Figure 11 - 3: Leakage and progress towards 50% leakage reduction target (Company-level)

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 and AMP7 metering programmes, we will install or upgrade over 900,000 meters. Around 630,000 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) 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. By 2030 we will have a 73% meter penetration, which will rise to 91% by 2040 (Figure 11 - 4).

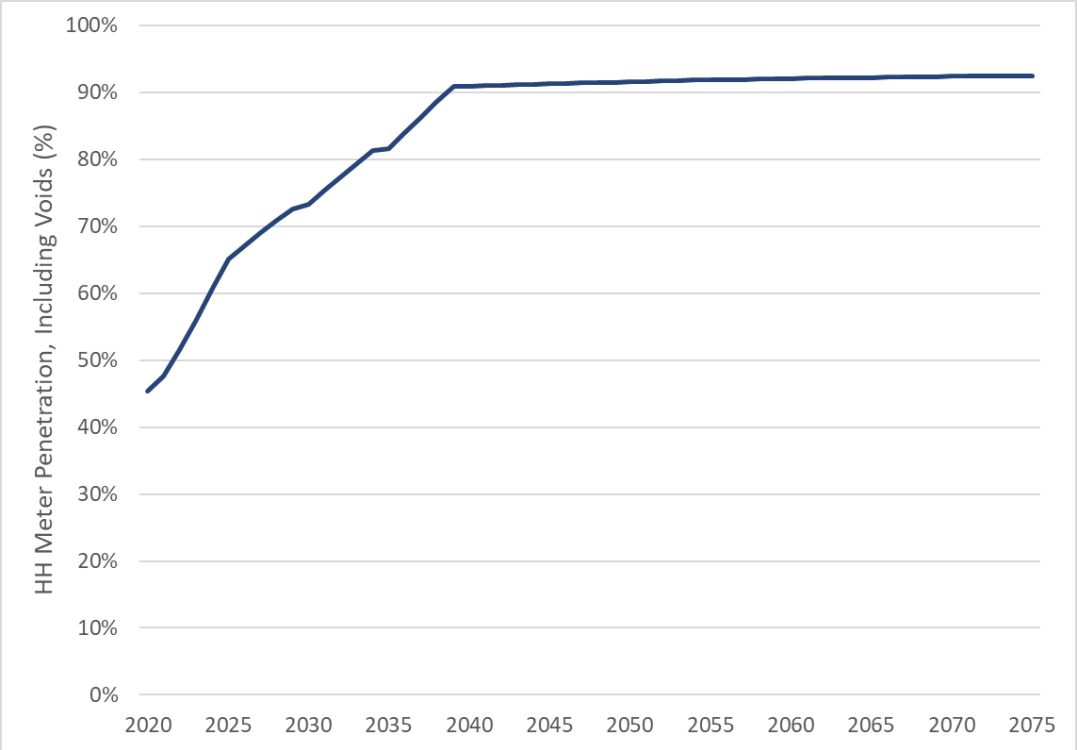

Figure 11 - 4: Thames Water Household Meter Penetration, Including Voids (%)

11.43 When we have a sufficiently high proportion of metered properties, we will 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 does not suggest that the elasticity of demand for water is 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.

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. The declining baseline PCC profile here points to the government-led water efficiency measures that we have incorporated into our baseline demand forecast, while the gap between the baseline and final plan PCC profiles shows the impact of measures that we can implement (broadly before 2045) and further measures which we have assumed that the government will bring in (broadly after 2045).

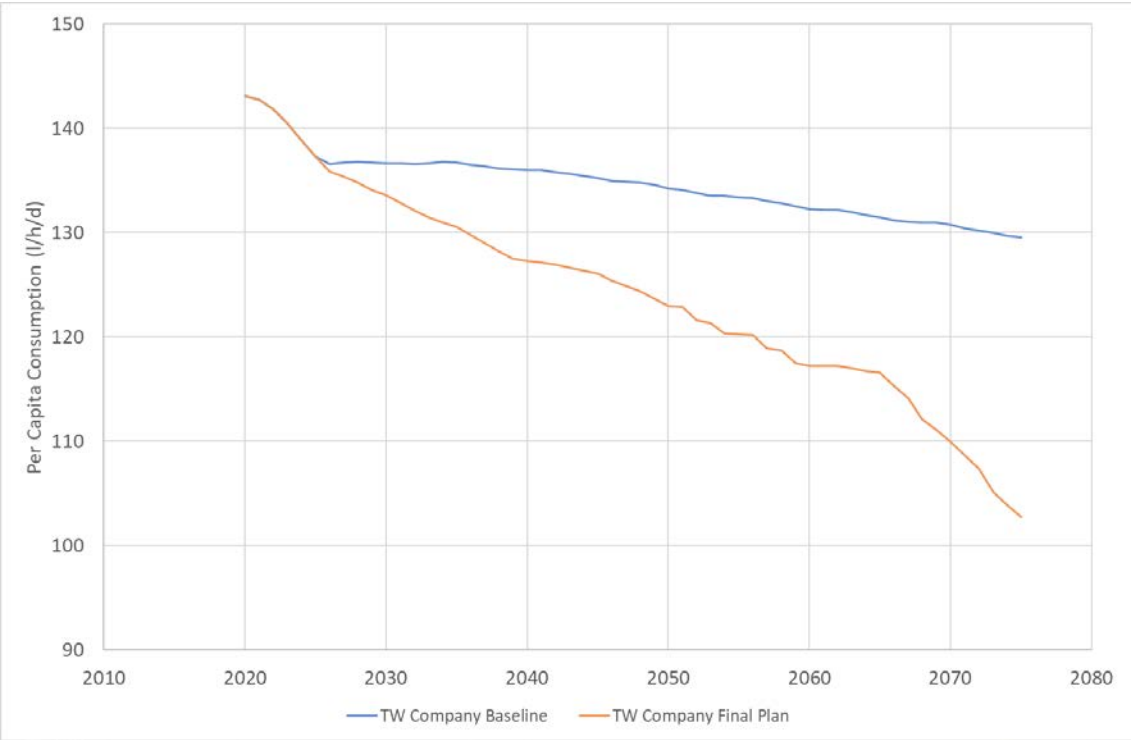

Figure 11 - 5: Company-wide PCC Projection

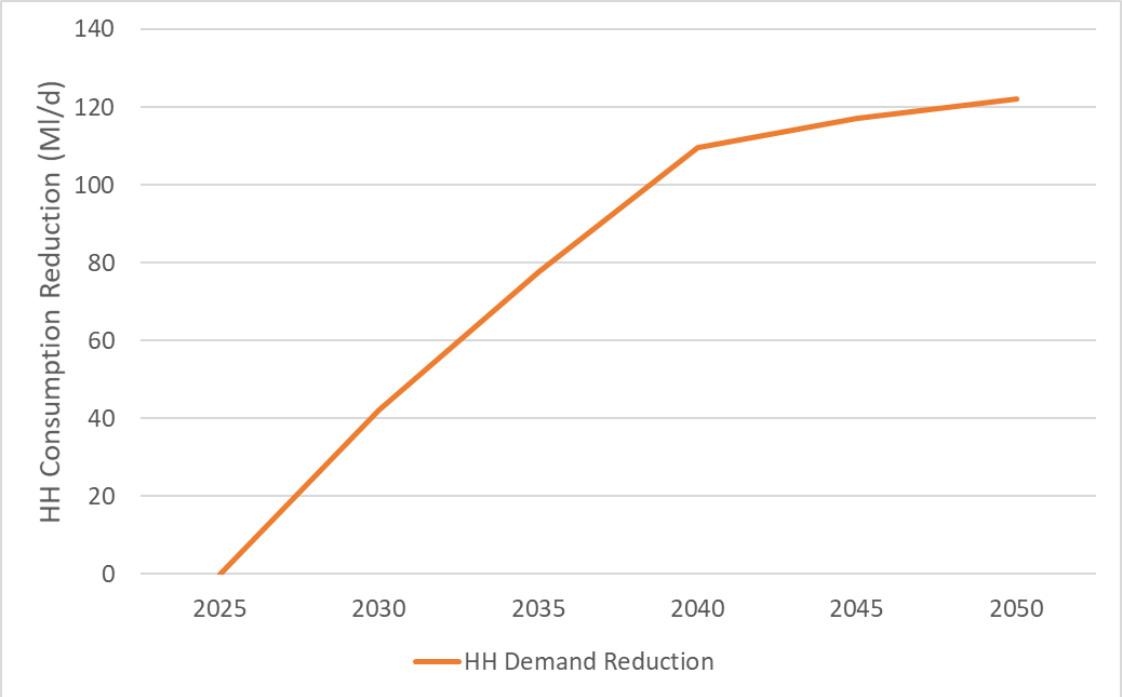

Figure 11 - 6: Company-led household demand reduction

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. The three main government policies that our plan relies upon are:

- Water labelling, without a requirement for minimum standards. We consider that the trend-based element of our demand forecast means that we have incorporated this policy into our baseline demand forecast. We have assumed that this policy will be enacted very soon, beginning from 2025
- Water labelling, including a requirement for minimum standards, enacted from 2045
- Full government support, including action to reduce water use in new developments, assumed to be in place from 2060 onwards

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 around 13 l/h/d by 2050 (around 160 Ml/d of benefit) through the introduction of water labelling and minimum standards on appliances. We have included around 11 l/h/d of these savings within our baseline demand forecast through the trend-based adjustment factor that we discuss in Section 3 and Section 8, consistent with our WRMP19 approach. As such, while the 'government-led reductions' profile that can be seen in our WRMP tables shows only around 2 l/h/d reduction by 2050, the combination of our baseline assumptions and inclusion of this added profile of benefit total around 13 l/h/d of government-led reduction by 2050. In the longer term, our plan assumes that the government will amend buildings regulations.

11.48 If government-led actions fail to reduce people's consumption as much as we anticipate, we will need to respond by investing in more new sources of water than set out in our preferred plan.

Non-household Demand Reduction

11.49 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) and water efficiency savings enabled by our Smarter Business Visits.

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.

	Supply Demand Benefit (Ml/d)				
Company	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	11.70				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering	1.00	2.73	0.00	0.00	0.00
Bulk metering CSL	22.65	2.79	1.82	0.00	0.00
Replacement metering CSL	11.98	3.70	0.00	0.00	0.00
Mains replacement	2.79	14.71	13.31	10.72	10.26
Leakage innovation	1.62	1.69	5.09	10.68	10.99
Metering innovation	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	78.11	30.00	25.11	21.40	21.25
AMP7 Carry-over metering	8.73				
Household metering	8.64	0.00	0.00	0.00	0.00
Non-household metering	0.55	2.25	0.00	0.00	0.00
Household water efficiency	17.61	7.93	0.02	0.03	0.03
Non-household water efficiency	23.40	0.00	0.00	0.00	0.00
Metering innovation	2.00	14.83	18.32	0.00	0.00
Innovative tariffs	5.21	12.66	13.69	7.45	5.00
Total usage reduction	66.14	37.66	32.03	7.48	5.03
Total benefit from DMP	144.25	67.66	57.14	28.88	26.28

	New & Replacement Meters				
Company	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	54,375.00	61,225.00	48,987.86	0.00	0.00
Household Metering (New)	192,945.67	323,901.25	416,528.40	0.00	0.00
Household Metering (Upgrades)	631,987.02	335,128.65	80,763.33	0.00	0.00
Non-Household Metering (Upgrades)	50,987.15	67,395.53	0.00	0.00	0.00

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

Supply enhancement

Key Questions

11.51 As is discussed in Section 10, analysis of the investment model runs indicates that there are three key supply-side decisions to be made in the short term. The first two of these are:

- **Question 1: Which supply-side option(s) provide(s) the Best Value solution to the short-term planning problem which we face in our London WRZ?** We will need to increase our supply capability in London by around 70 Ml/d by the early 2030s in order to provide our customers with a 1 in 200-year level of resilience to drought events, assuming that we are able to deliver the c.100 Ml/d of demand reduction that we anticipate making during AMP8
- **Question 2: Which supply-side option(s) do we need to construct first, by 2040, to provide the Best Value solution to the longer-term (2040 and beyond) planning problems that we face, when considering the wide range of uncertainty associated with our future forecasts?** For Thames Water, the potential long-term need ranges from a moderate need in only the London WRZ in low-growth scenarios, to a significant need across many of our WRZs in the supply-demand balance pathway for our preferred programme.

From analysis of the 'need', we are led towards considering developing the Severn-Thames Transfer (STT) resource option, or the South East Strategic Reservoir Option (SESRO). In 'High' environmental destination scenarios, by 2050, there is a significant need for water in our Swindon and Oxfordshire (SWOX), Kennet Valley and Slough, Wycombe and Aylesbury (SWA) WRZs, as well as a need for an import into Southern Water's Western Area from the Thames catchment. This means that effluent reuse or desalination options in London alone will not meet regional resource needs, and so the delivery of the STT or SESRO will be required, with both potentially being needed

11.52 The third question is dependent on the answer to the second question:

- **Question 3a: If STT is the preferred option for delivering water by 2040, what size of STT scheme should be developed, and what support options should be brought online? Or,**

  Question 3b: If SESRO is the preferred option for delivering water by 2040, what size of reservoir should be developed?

11.53 In addition to these three decisions to be made in the short term, a longer-term question which we need to answer is:

- **Question 4: Which additional supply-side options may be needed after 2040 to provide a Best Value solution to our longer-term planning problems under different future pathways?**

Decision-making process, and key decision-making factors

11.54 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. Using our programme appraisal analysis we now answer these questions.

Investment Modelling - Least Cost Programme

11.55 The first step in our decision-making was to find the 'least cost' plan which satisfied supply-demand balance in all years of the planning horizon, in all WRZs across the WRSE region. The large options of relevance for Thames Water that this run contained in 'Pathway 4' were:

- Teddington DRA, 75 Ml/d variant, used from 2031 onwards
- SESRO, 150 Mm^3 variant, used from 2040 onwards, 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, SWOX, SWA, and Kennet Valley
- SST, 300 Ml/d pipeline variant, used from 2050 onwards initially supported only with a sweetening flow provided by support from Netheridge wastewater treatment works, later supported more fully with water from both Lake Vyrnwy and Minworth wastewater treatment works
- Deephams Water Recycling Plant, 46.5 Ml/d scheme, used from 2061 onwards

11.56 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
- Solving the regional supply-demand balance deficit in pathway 4 requires at least one of the STT and SESRO due to the large deficit in the west of the WRSE region, and two large options overall (i.e. SESRO and STT, or SESRO and a recycling/desalination scheme, or STT and a recycling/desalination scheme). The least-cost way of fulfilling this need is with SESRO (150Mm^3) followed by STT, with these two options being the most cost-efficient large options. SESRO having a lower operating cost than STT means that it makes sense for it to come first. STT being brought on in a phased manner means that the relatively high fixed operating costs associated with purchasing water from support sources are deferred until later in the planning period. The 150Mm^3 SESRO variant is selected because larger reservoir sizes are most cost effective – for example, a 150Mm^3 reservoir delivers around twice the supply benefit of a 75Mm^3 reservoir, for around only 25% additional cost

  In some alternative pathways (pathways 2, 3, 5, 6, 7, 8) there is a need for only one large option. The WRSE investment model considered costs across all nine future pathways and delivery of the 150Mm^3 SESRO option in 2040 was given by the model as the lowest cost solution when considering the nine future pathways
- Our "High" environmental destination scenario includes a large licence reduction on the River Lee in 2060, giving a step-change in the need for water at this point. While the Deephams water recycling plant is more cost effective than even the Teddington DRA (and so was our preferred option for delivered 1 in 200-year resilience by the early 2030s in WRMP19), we have agreed a position of common understanding with the Environment Agency whereby the Deephams water recycling plant cannot be assumed to be environmentally acceptable until a large licence reduction on the River Lee is made. In the year 2060, therefore, when we assume this licence reduction will be made (this licence reduction would be large, and would require modifications to a large, concrete flood relief channel to enable ecological gain, so we do not consider it likely that this reduction would be made before this point), the Deephams reuse scheme is assumed to be viable and is by far the cheapest scheme available to us at this point.

Investment Modelling – Best Value Criteria Runs

11.57 The next step in our decision-making process was to undertake BVP investment model runs, in which a least cost solution was sought while setting minimum/maximum thresholds on metrics other than cost (e.g. asking the investment model to find the least cost solution subject to finding a plan with 10% less carbon emissions than the least cost plan). Section 10 contains significantly more detail of the analysis carried out on these runs, but the broad conclusion that we found was that the large schemes that we would construct did not change when we looked to improve our plan according to other metrics, indicating that our initial least-cost plan performed well when assessed against other metrics, but that we may select some options earlier, in order to build resilience. We were initially surprised by the degree to which options did not change in these runs, but on further inspection noted that the options selected in the least cost run score relatively highly on most BVP metrics.

Investment Model Sensitivity Runs

11.58 Further runs were undertaken in which options were excluded, 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 3b.

Investment Model Sensitivity Run – Question 1

11.59 To help answer Question 1, we undertook a model run in which the Teddington DRA scheme was ruled out, in order to determine the implications of moving to the next best alternative, which was found to be the Beckton reuse scheme.

11.60 Results from this run show that a plan involving construction of the Beckton reuse scheme in place of the Teddington DRA scheme would be around £300-400m more expensive in Net Present Value (NPV) terms, and that such a plan would not perform materially better when considering best value criteria.

Investment Model Sensitivity Runs – Question 2

11.61 To help to answer Question 2, we undertook investment model sensitivity runs in which we ruled out SESRO. Outputs from these runs indicate that, if we were to rule SESRO out we would need to construct the STT for 2040, and would later require construction of recycling and desalination schemes in pathway 4.

11.62 Outputs from these runs show that these plans are more expensive on average across the 9 pathways that we are considering, and are significantly (£500-800m NPV) more expensive under our preferred programme scenario, pathway 4. These plans also involve more carbon emissions than plans in which SESRO is constructed, both on average across the nine pathways considered (by between 100,000 and 350,000 tonnes), and in pathway four (by between 300,000 and 600,000 tonnes), and perform less well when considering other best value criteria, such as environmental and resilience metrics.

11.63 We also undertook investment model sensitivity runs in which we forced the model to build the STT pipeline such that it would be available in 2040, in order to determine the implications of choosing the STT before SESRO. As is described in more detail in Section 10, the plans that these investment model runs resulted in produced higher costs and carbon emissions than those in which the model was free not to build the STT for 2040.

Investment Model Sensitivity Runs – Question 3

11.64 To help answer Question 3b, we undertook investment model sensitivity runs in which we limited the availability of the SESRO option to a size variant. 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 drives different timing and combinations of other schemes (2040-2050, and beyond) under pathway 4, and other pathways.

11.65 A key output that was observed in runs comparing plans built around different sizes of SESRO was the lack of a significant difference between costs when individual programme costs are averaged across the nine pathways, but significant differences in cost for different plans in a given pathway. As an example, a plan with a 75Mm^3 reservoir would only be around £50m Net Present Value (NPV), around 0.4% of the whole plan average programme cost, more expensive than the least-cost plan if programme costs for all nine pathways are averaged, but the cost for a programme containing a 75Mm^3 reservoir would be £300m (NPV) more expensive should we

encounter the 'pathway 4' supply-demand balance. Plans in which a SESRO scheme smaller than 100Mm^3 is opted for would need to be accompanied by further investment to solve the supply-demand deficit in 2040, with the model selecting the Beckton desalination scheme in 2040 to accompany a 75Mm^3 reservoir, resulting in more expensive programmes, particularly for more severe future pathways. If the future is more favourable and we do not need to build additional infrastructure in the longer term (if we follow, for example, pathway 6), if we were to build a smaller reservoir then the slightly lower cost of building a smaller reservoir option results in a smaller programme cost.

11.66 There were also differences in the other option metric outputs. Plans built around larger SESRO options perform relatively very well on some metrics, with plans involving the 150Mm^3 reservoir performing particularly well on resilience metrics, but relatively poorly on some others. Plans built around a 75Mm^3 reservoir perform moderately on environmental performance but poorly on resilience. A plan built around a 100Mm^3 reservoir performs relatively favourably for all metrics.

11.67 Plans with larger SESRO schemes would 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 anticipate, 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 larger reservoir, but may need to react and build options quickly if we build a smaller reservoir. Our plan relies on around 100 Ml/d of household demand reduction and 120 Ml/d of leakage reduction between 2025 and 2040, and if either of these efforts were to under-deliver we could be left with a sizeable risk. Construction of a smaller SESRO scheme would also give an opportunity for landscaping and dialogue with local stakeholders, with the potential for lower embankments or a smaller footprint than a large capacity SESRO scheme.

The Answers – Strategic Regional Options in the Overall BVP

11.68 Referring back to the previous section, our programme appraisal delivered the following high-level conclusions to the questions that we identified:

- Question 1: The Teddington DRA 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, and which is inexpensive compared to other available options
- Question 2: 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
- Question 3: The volume of new resources needed in 2040 means that we would need a reservoir of at least 100Mm^3. If we were to build a reservoir smaller than this, we would need to construct additional schemes for 2040, resulting in a more expensive plan. We could reasonably adopt a plan with any SESRO size of 100Mm^3 or greater, with a 100Mm^3 reservoir giving a plan which would perform better through an environmental lens and which would give us more options in landscaping the reservoir, or a 150Mm^3 reservoir which would perform better from a resilience perspective and which would give us more leeway should our demand management programme be less effective than we anticipate. On balance, we have selected the 100Mm^3 variant in our overall BVP

- Question 4: If we follow the supply-demand balance pathway identified in pathway 4, the SST would follow SESRO, with the STT being used from 2050 onwards and developed in a modular way with support from Vyrnwy and Minworth being brought online through the 2050s, up to 2060. The Deephams Reuse scheme could then follow the STT, if abstraction reductions are made in the River Lee which make it environmentally feasible. If we identify that fewer licence reductions are needed, or if we find that population growth is lower than in this scenario (pathways 2, 3, 5, 6, 8), then the STT may not be necessary. If population growth is extremely high (pathway 1), we may need the Beckton desalination plant as well as the STT in 2050

11.69 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
- SESRO, 100Mm^3 variant for first use in 2040
- SST in pathway 1 (400 Ml/d tunnel) and 4 (500 Ml/d tunnel), i.e. 'High' environmental destination scenarios, for first use in 2050

  Initially unsupported (aside from sweetening flow provided by Netheridge) for the period 2050-2060, with subsequent support arriving in stages, from both Vyrnwy and Minworth between 2053 and 2060 in pathway 4, and in 2060 in pathway 1
- Beckton desalination plant, 150 Ml/d, delivered in 2050 in pathway 1
- Deephams Water Recycling, in 2061 in 'High' Environmental Destination scenarios, pathways 1, 4
- Thames to Affinity Transfer, capacity of up to 100Ml/d, beginning in 2040 (developed in phases), with different volumes used in different pathways 1-7, and different utilisation across the planning period
- Thames to Southern Transfer, capacity of 120 Ml/d in pathways 1 and 4, and a capacity of 80 Ml/d in pathway 7, available from 2040 onwards, and a transfer of capacity of 50 Ml/d in pathway 5, available from 2049 onwards

The Overall BVP at WRZ-level

11.70 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

11.71 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.

11.72 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.

11.73 As such, it is no longer appropriate to consider the major options that would be developed in the west of the Thames catchment (SST and SESRO) 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. As described previously, the large supply-demand deficits seen in many WRZs in the west of the WRSE region mean that the SESRO and STT schemes would both be necessary under a 'High' Environmental Destination scenario.

11.74 London effluent reuse schemes would be for the benefit of the London WRZ only (with the Eastern Thames to Affinity Transfer option not being selected in all but one future scenario), and so are not included in this description.

11.75 The large new resource options selected in the overall BVP in the west of the catchment are shown in Table 11 - 2. 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.

11.76 We will conduct investigations to determine those licence reductions which need to be made in the future, setting out our Environmental Destination up to 2050 by 2035. In 2035 we will then be able to make a decision as to whether the STT scheme and/or the Oxford Canal schemes are also needed.

11.77 The Oxford Canal option can either be constructed to be for the benefit of SWOX WRZ only (known as the Duke's Cut variant), or for the benefit of WRZs further downstream (known as the Cropredy variant). Both option variants are selected in our preferred plan, but only one variant can be selected in a given programme of options. The Duke's Cut variant is selected in situation 5, while the Cropredy variant is selected in situations 1 and 7. The Duke's Cut variant is described in the SWOX preferred plan section, while the Cropredy variant is described in this section, due to the WRZs of interest.

11.78 The strategic transfer options selected in the WRSE preferred plan are shown in Table 11 - 3. 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, beginning in 2040, with

further expansion possible dependent on the scenario. This table also shows that, in High Environmental Destination scenarios there is a need for a large, 80 or 120 Ml/d, Thames to Southern Transfer (T2ST), with the potential that a T2ST could be needed in more moderate scenarios. The timing of the option selection here demonstrates part of the driver for the need for new water resources by 2040.

Option	Max DO	Year Option is First Utilised in Pathway								
		1	2	3	4	5	6	7	8	9
SESRO 100 Mm^3	185	2040	2040	2040	2040	2040	2040	2040	2040	-*
Unsupported STT – 300 Ml/d Pipeline	80	-	-	-	-	-	-	-	-	-
Unsupported STT – 400 Ml/d Pipeline	107	2050	-	-	-	-	-	-	-	-
Unsupported STT – 500 Ml/d Pipeline	134	-	-	-	2050	-	-	-	-	-
STT Support – Netheridge (35 Ml/d)	24	2050	-	-	2050	-	-	-	-	-
STT Support –Vyrnwy First 25 Ml/d	14	2055	-	-	2053	-	-	-	-	-
STT Support – Vyrnwy Additional 35 Ml/d (60 total)	20	2058	-	-	2054	-	-	-	-	-
STT Support – Vyrnwy Additional 15 Ml/d (75 total)	9	2060	-	-	2055	-	-	-	-	-
STT Support – Vyrnwy Additional 30 (105 total)	17	2060	-	-	2060	-	-	-	-	-
STT Support – Minworth Phase 1 (58 Ml/d)	35	2060	-	-	2060	-	-	-	-	-
STT Support – Minworth Phase 2 (additional 57 Ml/d, totalling 115)	35	2060	-	-	2060	-	-	-	-	-
Oxford Canal, (LON)	10	2045	-	-	-	-	-	2060	-	-

Table 11 - 2: New resource options selected in West-Thames

*In Situation 9 the SESRO 100Mm^3 scheme is constructed, but is not utilised in our modelling due to the low need for water in this exceptionally low demand and low environmental destination scenario. In reality, the reservoir would be made use of in this scenario due to the nature of our supply system, and our customers would instead be afforded a greater level of resilience.

11.79 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 and unadaptable, such as SESRO, to provide an adaptable solution to a dynamic problem, particularly when the ability for the SESRO and STT options to work conjunctively together to provide a regional solution for severe future situations is considered.

Option	Max Capacity	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	2040	2040	2040	2045	-	-
T2AT West Additional 50 Ml/d	50	2042	2050	-	2045	2050	-	2060	-	-
T2AT East 50 Ml/d	50	2056	-	-	-	-	-	-	-	-
T2ST 50 Ml/d	50	-	-	-	-	2049	-	-	-	-
T2ST 80 Ml/d	80	-	-	-	-	-	-	2040	-	-
T2ST 120 Ml/d	120	2040	-	-	2040	-	-	-	-	-
T2ST 200 Ml/d	200	-	-	-	-	-	-	-	-	-

Table 11 - 3: Transfers to Southern and Affinity Water in the Preferred Plan

Utilisation of the options in the preferred pathway

11.80 Here we demonstrate in more detail the utilisation of the options seen in Pathway 4 of our preferred plan, our preferred programme. Table 11 - 4 shows the utilisation of new resource options, while Table 11 - 5 shows the utilisation of transfers to Southern Water and Affinity Water. These tables show that, once constructed, the 100Mm^3 SESRO option is utilised at its full capacity throughout the planning period, as are the Unsupported STT and Netheridge support options, demonstrating the large, persistent need for water in the WRSE region in this scenario. Further STT support options are called for as further need arises, and late in the planning period the large assumptions around government-led reductions lead to a reduced need for high-opex STT support options. Table 11 - 5 shows that the need for transfers to both Affinity Water and Southern Water initially grows over time, with the need for transfers later in the planning period diminishing for Affinity Water, again due to large reductions in demand associated with government-led reductions.

11.81 The stability of utilisation seen from the core SESRO and Unsupported STT components despite a changing need for transfers to several water companies demonstrates that our plan is adaptive and can evolve. STT support options and other options in Thames Water, Affinity Water and Southern Water supply areas can be brought online as needed to fill supply-demand balance gaps as and when they appear, with best use being made of more efficient, low-opex solutions throughout the planning period. 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 100 Mm3	0	0	185	185	185	185	185	185	185	185
STT 500 Ml/d Pipeline Unsupported	0	0	0	0	134	134	134	134	134	134

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
STT Support – Netheridge (35 Ml/d)	0	0	0	0	24	24	24	24	24	24
STT Support – Vyrnwy First 25 Ml/d	0	0	0	0	0	14	14	14	0	0
STT Support – Vyrnwy Additional 35 Ml/d (60 total)	0	0	0	0	0	20	20	20	0	0
STT Support – Vyrnwy Additional 15 Ml/d (75 total)	0	0	0	0	0	9	9	9	0	0
STT Support – Vyrnwy Additional 30 (105 total)	0	0	0	0	0	0	17	17	0	0
STT Support – Minworth Phase 1 (58 Ml/d)	0	0	0	0	0	0	35	35	35	26
STT Support – Minworth Phase 2 (additional 57 Ml/d, totalling 115)	0	0	0	0	0	0	35	35	33	6

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

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
T2AT First 50 Ml/d	0	0	50	48	50	50	50	50	47	34
T2AT Additional 50 Ml/d	0	0	0	15	21	21	32	40	15	15
T2ST 120 Ml/d	0	0	48	73	69	97	96	104	103	102

Table 11 - 5: Transfers to Southern and Affinity Water in Pathway 4

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

London WRZ

11.83 Section 6 of our dWRMP 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 225 Ml/d to a deficit of nearly 650 Ml/d.

11.84 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

11.85 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.

11.86 Table 11 - 6 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. The declining baseline PCC profile here points to the government-led water efficiency measures that we have incorporated into our baseline demand forecast, while the gap between the baseline and final plan PCC profiles shows the impact of measures that we can implement (broadly before 2045) and further measures which we have assumed that the government will bring in (broadly after 2045).

	Supply Demand Benefit (Ml/d)				
LON	AMP8	AMP9	AMP10	AMP11	AMP12
AMP7 Carry-over leakage	11.70				
Household metering CSL	0.00	0.00	0.00	0.00	0.00
Non-household metering	0.43	1.98	0.00	0.00	0.00
Bulk metering CSL	21.07	2.42	1.53	0.00	0.00
Replacement metering CSL	5.98	1.75	0.00	0.00	0.00
Mains replacement	2.40	12.74	10.92	8.76	7.97
Leakage innovation	1.30	1.50	4.90	8.97	8.28
Metering innovation	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	66.88	24.39	21.79	17.73	16.25
AMP7 Carry-over metering	0.98				
Household metering	7.29	0.00	0.00	0.00	0.00
Non-household metering	0.34	1.75	0.00	0.00	0.00
Household water efficiency	11.11	5.64	0.02	0.02	0.02
Non-household water efficiency	22.00	0.00	0.00	0.00	0.00
Metering innovation	1.81	13.22	17.32	0.00	0.00
Innovative tariffs	4.72	9.69	8.89	7.10	5.00
Total usage reduction	48.26	30.29	26.23	7.12	5.02
Total benefit from DMP	115.14	54.69	48.02	24.86	21.27

	New & Replacement Meters				
LON	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	46,256.11	52,016.63	41,298.46	0.00	0.00
Household Metering (New)	165,399.99	294,535.10	397,450.04	0.00	0.00
Household Metering (Upgrades)	323,914.00	200,550.45	67,959.86	0.00	0.00
Non-Household Metering (Upgrades)	35,556.06	50,830.02	0.00	0.00	0.00

Table 11 - 6: London WRZ Demand Management Programme Breakdown

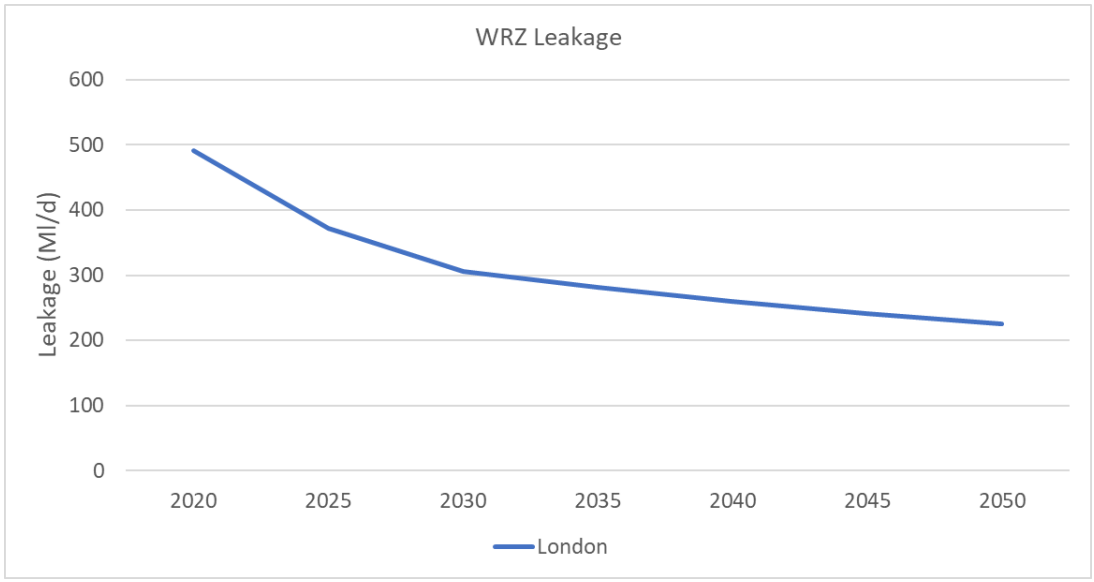

Figure 11 - 7: London WRZ Leakage

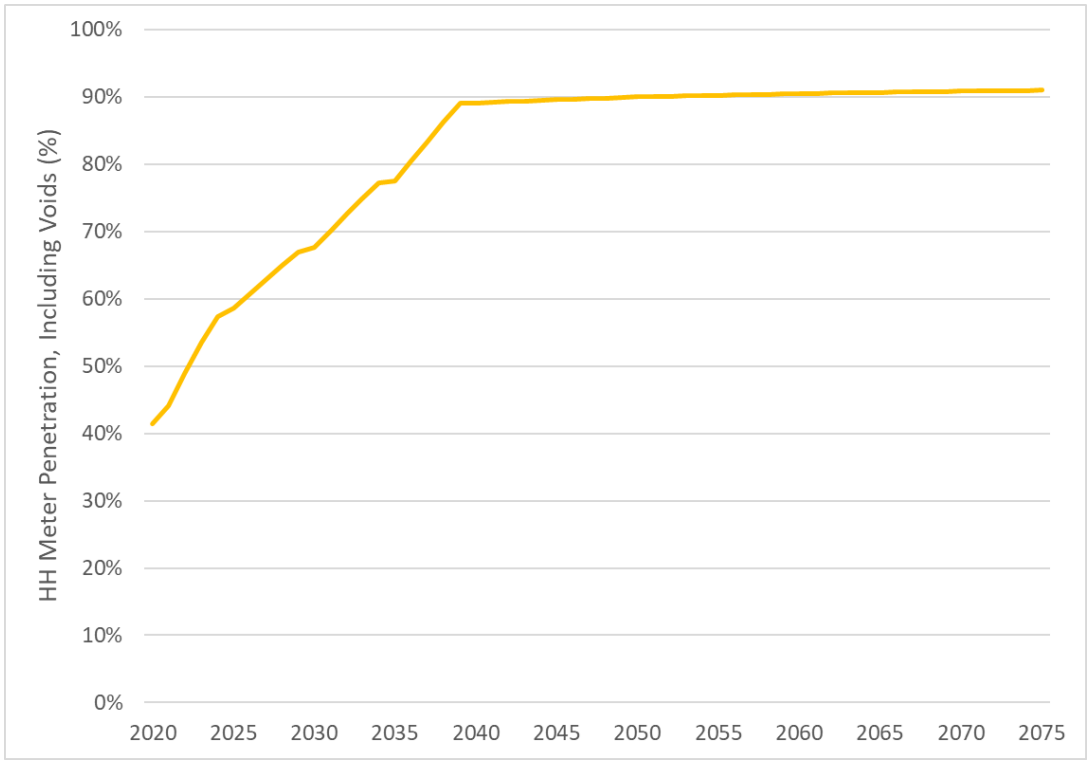

Figure 11 - 8: London WRZ Meter Penetration

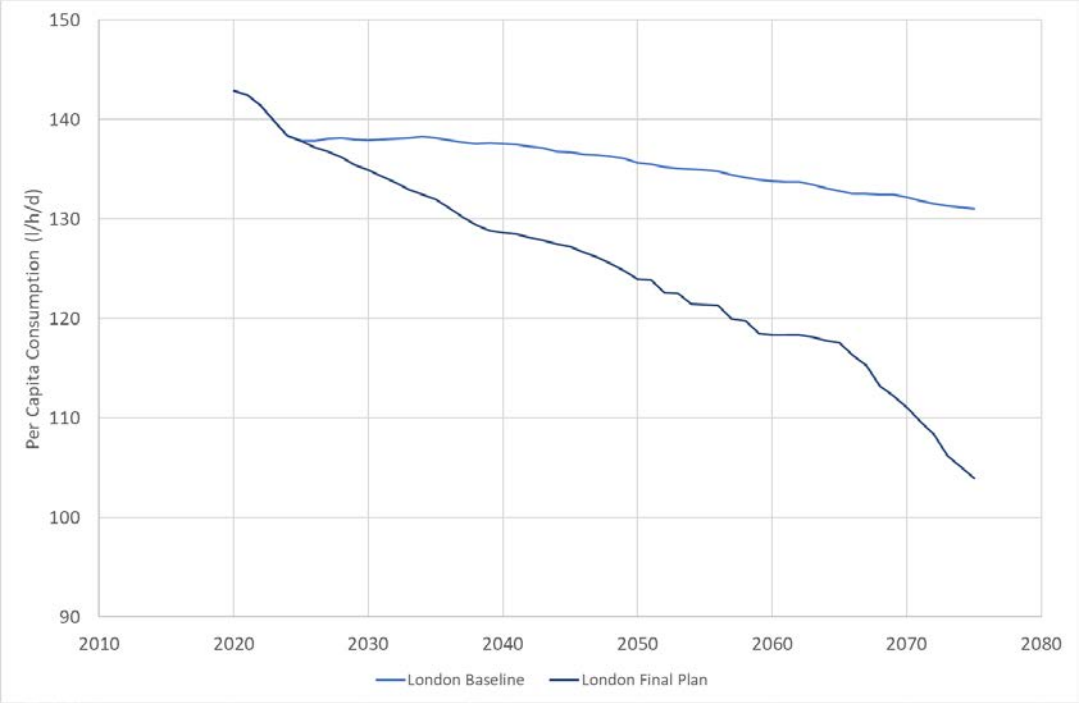

Figure 11 - 9: London WRZ PCC

Short-term – 2025-2030

11.87 We will continue our PMP, with 165,000 new internal household meters being installed in AMP8, finishing our main household PMP campaign, achieving a total meter penetration of 68% 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 324,000 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.

11.88 We will reduce leakage by 67 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.

11.89 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.

11.90 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.

11.91 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 over 100 Ml/d of benefit to our supply-demand balance.

Medium-term – 2030-2045

11.92 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 90% (including voids) by 2045.

11.93 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.

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

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

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

Long-term – 2045-2075

11.97 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.

11.98 In the longer term, our demand management programme relies 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.

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

Supply enhancement

11.100 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11 - 7. 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.

11.101 When operating as a conjunctive, integrated system, water supplied from SESRO and the STT cannot be distinguished (with abstractions from STT feeding into SESRO when both options are constructed), particularly when considering the transfer of resources involving Southern Water and Affinity Water. As such, water supplied to London from these options is referred to as coming from West-Thames sources in the Tables and discussion that follow.

Short-Term (2025-2030)

11.102 Through AMP8 there is no 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. 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.

11.103 In AMP8 our preferred plan shows that we could be able to pause the licence trade that is currently in place with RWE, associated with Didcot Power Station. The progress that we have

made with leakage reduction and metering means that we will be in a position of supply-demand surplus without this trade. Due to the low cost of this option and risk that demand management efforts in AMP7 and AMP8 may not be as successful as we anticipate, we are looking to continue this licence trade through AMP8 as a risk mitigation option (see later section on risks and uncertainties).

11.104 While no new schemes will be used, AMP8 will, however, be a time of great importance in working towards delivering schemes for the future. We will need to undertake planning, development, and construction of the Teddington DRA water recycling scheme, will need to progress through the consenting and design of SESRO, and will need to undertake a significant amount of work to ensure that the Addington Groundwater and Southfleet and Greenhithe Groundwater schemes will be available for use early in AMP9.

Medium-Term (2030-2045)

11.105 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 main option selected to provide this new resource is the Teddington DRA water recycling scheme, with further resource also needed from the reinstatement of the Didcot licence trade and two groundwater schemes.

11.106 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 option development process. Our preferred plan assumes that we are able to meet the ambitious timescale of delivering the option by 2031. In order to mitigate the risk of late delivery of this scheme we have been in discussion with the Environment Agency regarding the feasibility of a temporary amendment of the Lower Thames Operating Agreement (LTOA) which would allow us to abstract more water from the River Thames under drought conditions and so enhance our resilience to drought events, but which would pose some environmental risks if a drought were to occur. If the Teddington DRA cannot be delivered by 2031, a different option to amending the LTOA would be to delay our move to 1 in 200-year resilience by a year or two. This presents a trade-off between drought resilience and the environment.

11.107 We do not have very many large options which we could build by the early 2030s, and so our decision regarding which supply-side scheme to opt for was between different water recycling options, primarily the Beckton reuse and Teddington DRA options. The key factors in our decision between different recycling options were the feasible delivery timescales and costs, as there were limited differences between the best value criteria appraisals between the two options. In the WRSE emerging plan the Beckton reuse option was the option selected in the early 2030s, based on an assessment that the scheme was more deliverable by 2031.

11.108 Having looked at this further, the timescale for delivering the Beckton reuse option is not materially shorter, but the Beckton reuse option would be two to three times more expensive than the Teddington DRA option. The Teddington DRA scheme does not involve recycled water being used for supply, but is instead used to replace river water taken from the environment. The Beckton reuse scheme involves water being put into the River Lee upstream of our abstraction points, meaning that this water would be abstracted alongside river water. The Beckton reuse scheme is therefore more expensive because costly and energy-intensive additional water treatment is needed.

11.109 Our draft WRMP includes a 75 Ml/d Teddington DRA scheme. This was the largest Teddington DRA variant that we believed to be environmentally acceptable at the time we needed to feed the outcomes from our option screening into our investment programme appraisal, having previously found that significantly larger (300 Ml/d) scheme variants would not be environmentally acceptable.

11.110 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).

11.111 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. 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, the future demand scenario that we encounter, and the success of demand management efforts in different parts of the region. In our preferred programme pathway, in which there is extensive further need, we would begin the planning and construction process for the SST as described previously, beginning around 2040.

Long-term (beyond 2045)

11.112 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, which would be augmented by water from the SST in our preferred programme pathway, and other more severe future pathways.

11.113 In some future situations, as highlighted in Table 11 - 7, we need to develop desalination schemes, further reuse schemes, or new groundwater options in the long term. Decisions regarding which options to adopt would not need to be made until the 2040s, and so our plan can adapt in the future.

11.114 The plan for London demonstrates our effective adaptive planning. The London WRZ has a considerable need for new water resources in almost all future scenarios. In less challenging futures we will be able rely on the Teddington DRA and SESRO schemes to provide sufficient resource for the London WRZ in the medium and long term, with Affinity Water and Southern Water having limited need for water from these sources. This would mean that London would be able to make use of low-cost water provided by the low-opex Teddington DRA and SESRO schemes. In more challenging scenarios our plan can adapt, with water provided to other parts of the region where it is needed, but with additional resource being brought into the region through the STT meaning that London's supplies can expand at the same time as other companies'. The most expensive reuse and desalination plants only appear in the most severe future scenarios, far into the future. Numerous groundwater schemes may need to be constructed in the 2050s and 2060s under some future scenarios.

Option	Max DO	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
SESRO, STT, and Oxford Canal – as per West-Thames Option Table										
Water from combination of West-Thames Options	N/A	2040	2040	2040	2040	2040	2040	2040	2040	-
Teddington DRA	67	2031	2031	2031	2031	2031	2031	2031	2031	2031
Beckton Desalination, 150 Ml/d	133	2050	-	-	-	-	-	-	-	-
Crossness Desalination, 50 Ml/d	44	-	-	-	-	-	-	2061	-	-
Deephams Reuse, 46.5 Ml/d	42	2061	-	-	2061	-	-	-	-	-
Addington Groundwater	3	2032	2032	2032	2032	2032	2032	2032	2032	2032
London Confined Chalk	2	2048	-	-	-	-	-	2051	-	-
Recommissioning Merton GW Source	2	2062	-	-	2062	-	-	2052	-	-
Southfleet & Greenhithe GW Source	9	2031	2031	2031	2031	2031	2031	2031	2031	2031
Streatham MAR	5	2055	-	-	-	-	-	2051	-	-
Thames Valley MAR	3	2065	-	-	-	-	-	2053	-	-
Kidbrooke MAR	8	2054	-	-	-	-	-	-	-	-
Merton MAR	6	2064	-	-	-	-	-	2054	-	-
Horton Kirby MAR	5	2045	-	-	2050	-	-	2050	-	-
Licence Trade with RWE, Didcot Power Station*	23	2031	2031	2031	2031	2031	2031	2031	2031	2031
Import from Cheam (SES) to Merton	15	-	-	-	2050	-	-	2050	-	-

Table 11 - 7: Options used in London WRZ

* The modelled output from the WRSE Regional Plan indicates that we could pause our licence trade with RWE and maintain supply-demand surplus. However, we are looking to extend this agreement to offset the risk associated with demand management.

Utilisation in the preferred pathway.

11.115 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 - 8.

Short-term (2025-2030)

11.116 In the short-term, the London WRZ uses existing supplies, providing a 1 in 100-year level of resilience. During this period, we will export water to Affinity Water, offsetting risks associated with the construction of HS2.

Medium-term (2030-2045)

11.117 In the early 2030s, we will begin using the Teddington DRA scheme. In 2031 (not seen in Table 11 - 8) our use of Teddington DRA is in excess of 50 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, giving a surplus and offering a higher level of service to our customers during this period. 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)

11.118 As we continue through the planning period, additional water would be supplied from the combined SESRO-STT hub in the west of the Thames catchment. In 2060, assuming that licence reductions are made on the River Lee, we would begin to use the Deephams reuse scheme, a scheme which is low-cost, but which the Environment Agency could not permit without increased flow in the River Lee. In the long-term we may also import a small amount of water from Sutton and East Surrey.

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Water from West-Thames Options, Incl. Conjunctive Benefit from T2AT	0	0	111	99	174	191	273	257	234	225
Teddington DRA	0	19	65	66	67	67	67	27	27	57
Deephams Reuse, 46.5 Ml/d	0	0	0	0	0	0	0	42	42	12
Addington Groundwater	0	3	3	3	3	3	3	3	3	3
Recommission Merton GW Source	0	0	0	0	0	0	0	2	2	2
Southfleet & Greenhithe GW Source	0	9	9	9	9	9	9	9	9	9
ASR Horton Kirby	0	0	0	0	5	5	5	5	0	0
Licence Trade RWE Didcot*	0	23	23	23	23	23	23	23	23	23
Import from Cheam (SES) to Merton	0	0	0	0	11	12	13	14	0	0
Exports to Affinity Water Zone 4	-14	-11	-2	-2	-2	-2	-2	-2	-2	-2

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
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 - 8: Option Utilisation in Preferred Programme, London WRZ

* The modelled output from the WRSE Regional Plan indicates that we could pause our licence trade with RWE and maintain supply-demand surplus. However, we are looking to extend this agreement to offset the risk associated with demand management.

Swindon and Oxfordshire (SWOX) WRZ

11.120 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 only 8 Ml/d to over 100 Ml/d.

11.121 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

11.122 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.

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

11.124 Table 11 - 9 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. The declining baseline PCC profile here points to the government-led water efficiency measures that we have incorporated into our baseline demand forecast, while the gap between the baseline and final plan PCC profiles shows the impact of measures that We can implement (broadly before 2045) and further measures which we have assumed that the government will bring in (broadly after 2045).

	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	0.33	0.38	0.00	0.00	0.00
Bulk metering CSL	0.56	0.06	0.03	0.00	0.00
Replacement metering CSL	3.28	0.95	0.00	0.00	0.00
Mains replacement	0.19	1.03	1.01	0.76	1.09
Leakage innovation	0.10	0.10	0.00	0.85	1.23
Metering innovation	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	5.45	2.52	1.05	1.61	2.32
AMP7 Carry-over metering	3.24				
Household metering	0.47	0.00	0.00	0.00	0.00
Non-household metering	0.12	0.25	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	0.03	0.00
Total usage reduction	7.52	3.69	2.55	0.03	0.00
Total benefit from DMP	12.97	6.21	3.59	1.64	2.32

	New & Replacement Meters				
SWX	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	1,007.89	1,129.65	878.79	0.00	0.00
Household Metering (New)	9,755.08	8,014.23	4,862.15	0.00	0.00
Household Metering (Upgrades)	167,804.60	65,333.36	6,239.09	0.00	0.00
Non-Household Metering (Upgrades)	8,657.37	8,277.78	0.00	0.00	0.00

Table 11 - 9: SWOX WRZ Demand Management Programme Breakdown

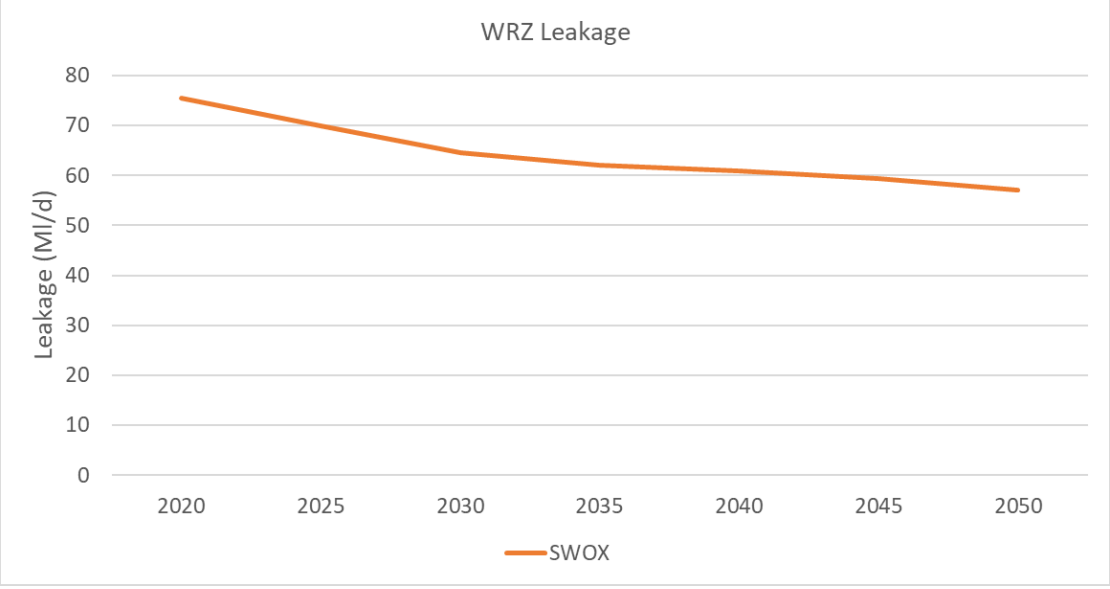

Figure 11 - 10: SWOX WRZ Final Plan Leakage

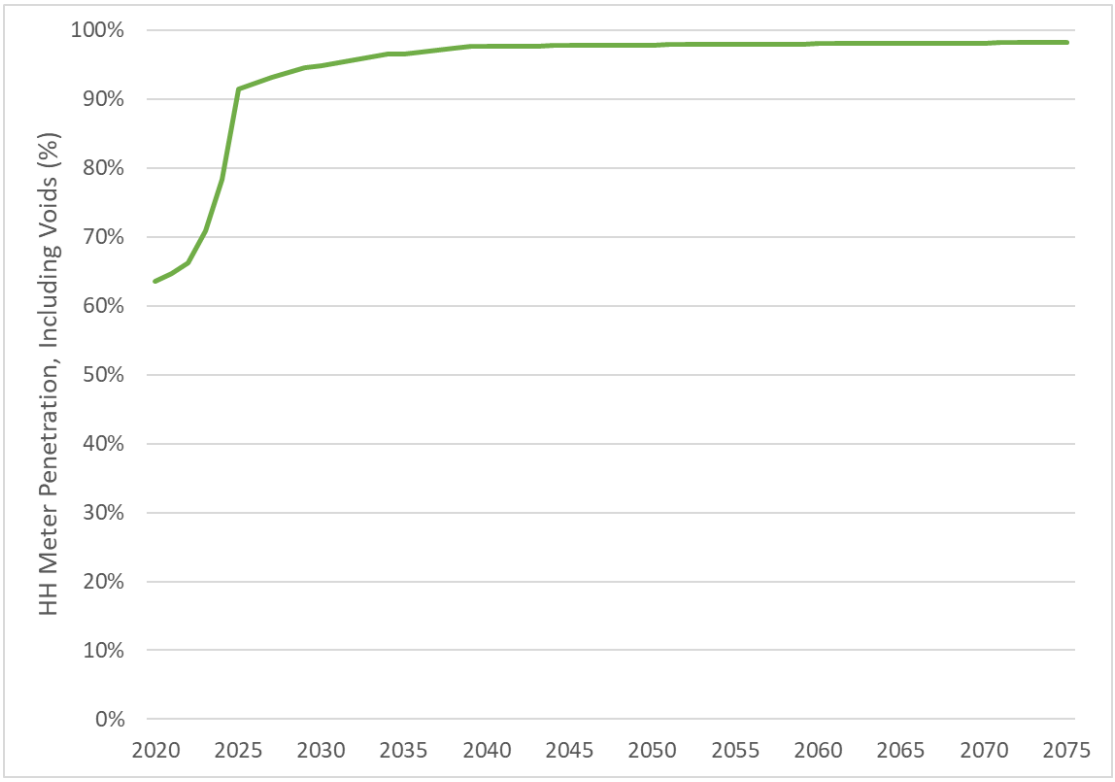

Figure 11 - 11: SWOX WRZ Final Plan Meter Penetration

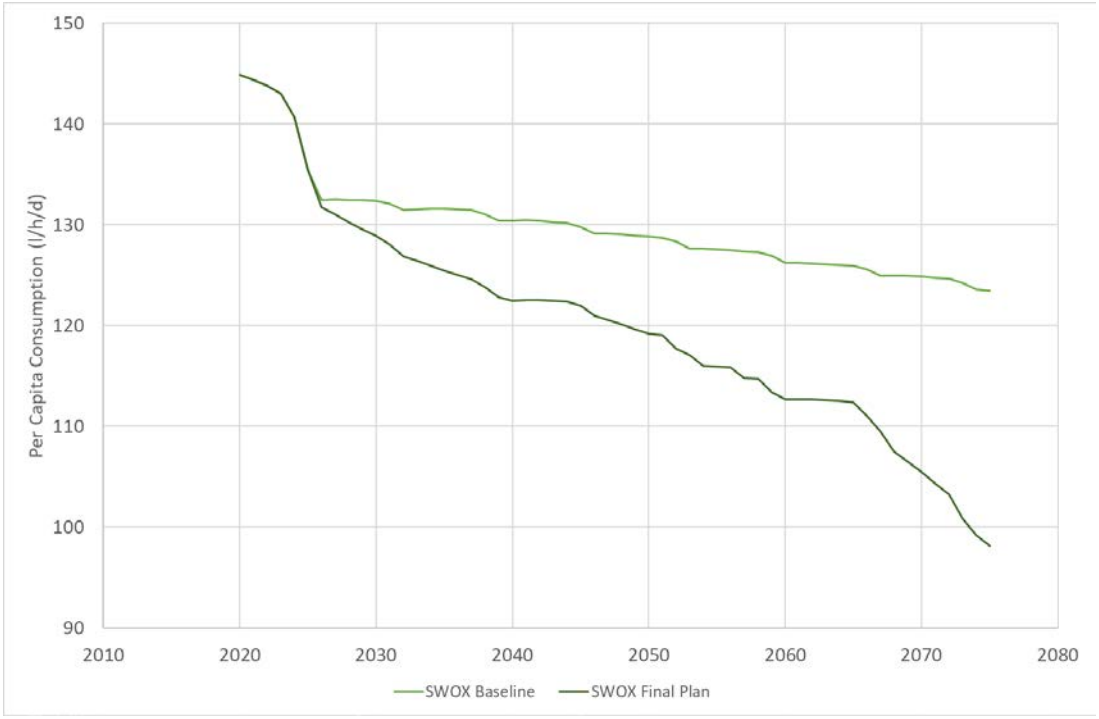

Figure 11 - 12: SWOX WRZ PCC

Short-term – 2025-2030

11.125 We will continue our PMP, with around 10,000 new household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 95% 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.

11.126 We will reduce leakage by 5.45 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.

11.127 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.

11.128 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

11.129 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 98% (including voids) by 2045.

11.130 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.

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

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

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

Long-term – 2040-2075

11.134 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.

11.135 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.

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

Supply enhancement

11.137 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11 - 10.

11.138 This table shows that there is a significant amount of new resources needed in the SWOX WRZ in High Environmental Destination scenarios (1, 4, 7) or in scenarios where an OxCam population forecast is used (scenarios 1 to 3), but little in other scenarios.

Short-term (2025-2030)

11.139 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 an upgrade to our Woods Farm groundwater source, in order to ensure that its enhanced yield will be available in 2031.

Medium Term (2030-2045)

11.140 In the period 2030 to 2039, no additional sources of water will be needed assuming that our demand management actions result in the outcomes that we anticipate.

11.141 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. If the OxCam growth corridor is to be put in place, or if our demand management has not been successful, then we will need to construct treatment and network assets in the SWOX WRZ to allow for use of water from SESRO from 2040 onwards. We may decide that a transfer from the Henley WRZ, making use of sources that are already available, would be sufficient in a more moderate scenario, or in an extreme scenario we may need both of these sources for the SWOX WRZ.

Long-Term (Beyond 2045)

11.142 The long-term investments required in the SWOX WRZ are dependent on the impacts that climate change has, and the licence reductions that are identified as being necessary. In severe future scenarios, we would need around 50-60 Ml/d of water to be imported to the SWOX zone from 2050 onwards, with the potential that some of this water could be transferred on to the SWA WRZ. In extreme future scenarios we could need several other new groundwater sources and an import from Wessex Water, in addition to water from SESRO, STT, and imports from other WRZs. In more moderate scenarios, the investments that would have been made in the 2040s would be sufficient to secure supplies in the SWOX for the future.

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	2042	2049	-	-	2050	-	-
Moulsford GW Source	2	2045	-	-	2040	-	-	2050	-	-
Woods Farm GW Source	2	2031	2031	2031	2031	2031	2031	2031	2031	2031
Removal of constraints at Britwell GW Source	1	2046	-	-	2042	-	-	2060	-	-
Import from Wessex Water	3	2048	-	-	2045	-	-	-	-	-

Option	Max DO Benefit (DYAA)	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
Import from Henley	5	2045	-	-	2040	2040	2042	-	-	-
Import from Kennet Valley	7	2050	-	-	-	-	-	-	-	-
Import from SWA	2	2026	2026	2026	2026	2026	2026	2026	2026	2026
Gatehampton Drought Permit	4	2031	2031	2031	2031	2031	2031	2031	2031	2031
Oxford Canal, Duke's Cut	12	-	-	-	-	2050	-	-	-	-

Table 11 - 10: Options Used in SWOX WRZ

Utilisation in the preferred pathway

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

Short-term (2025 to 2030)

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

Medium-term (2030 to 2045)

11.145 From 2031 onwards, we would temporarily make use of the Gatehampton Drought permit, and would use water from enhanced yields at an existing groundwater source to move to a 1 in 200-year level of resilience. In 2040 we would then make use of another new groundwater source and enhanced yields at an existing source, and would rely on an import from the Henley WRZ.

Long-term (Beyond 2045)

11.146 In the long-term, we would make use of water from the SESRO and STT combined hub. In this scenario, the most efficient way for us to supply the SWOX and SWA sources would be to construct treatment and build a pipeline which would transfer water to the SWOX and SWA WRZs.

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	0.0	0.0	59.4	57.2	55.6	54.2	46.3	35.4
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	0.2	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Removal of constraints at Britwell GW Source	0.0	0.0	0.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Import from Wessex Water	0.0	0.0	0.0	0.5	2.9	2.9	0.2	2.9	0.2	0.2

Option	Option Utilisation by Year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Import from Henley	0.0	0.0	3.0	5.0	2.3	2.4	2.5	2.4	2.8	3.1
Import from SWA	1.1	1.1	1.9	1.9	1.1	1.1	1.1	1.1	1.1	1.1
Gatehampton Drought Permit	0.0	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Export to SWA	0.0	0.0	0.0	0.0	-21.1	-18.7	-17.6	-18.3	-14.2	-10.1

Table 11 - 11: Preferred Programme Option Utilisation in SWOX WRZ

Slough, Wycombe and Aylesbury (SWA) WRZ

11.147 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 some scenarios, but not all. By 2050 the range of supply-demand balances that we have considered ranges from a 10 Ml/d surplus to a 60 Ml/d deficit.

11.148 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

11.149 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.

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

11.151 Table 11 - 12 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. The declining baseline PCC profile here points to the government-led water efficiency measures that we have incorporated into our baseline demand forecast, while the gap between the baseline and final plan PCC profiles shows the impact of measures that we can implement (broadly before 2045) and further measures which we have assumed that the government will bring in (broadly after 2045).

	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	0.11	0.15	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	0.10	0.75	0.64	0.55
Leakage innovation	0.10	0.00	0.00	0.20	0.42
Metering innovation	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	2.75	0.95	0.83	0.84	0.97
AMP7 Carry-over metering	1.76				
Household metering	0.55	0.00	0.00	0.00	0.00
Non-household metering	0.04	0.09	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	0.07	0.00
Total usage reduction	4.28	1.66	1.53	0.07	0.00
Total benefit from DMP	7.02	2.61	2.36	0.92	0.97

	New & Replacement Meters				
SWA	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	2,377.61	2,699.07	2,265.36	0.00	0.00
Household Metering (New)	11,012.75	15,378.56	10,215.71	0.00	0.00
Household Metering (Upgrades)	78,974.78	39,904.21	3,290.59	0.00	0.00
Non-Household Metering (Upgrades)	2,875.45	3,269.26	0.00	0.00	0.00

Table 11 - 12: SWA WRZ Demand Management Programme Breakdown

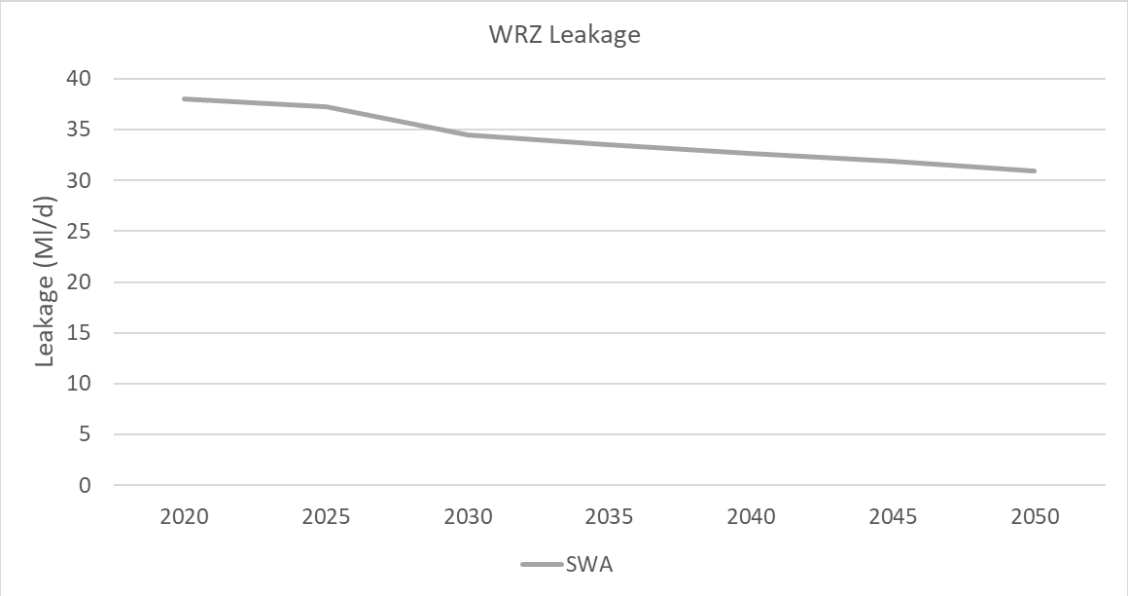

Figure 11 - 13: SWA WRZ Final Plan Leakage

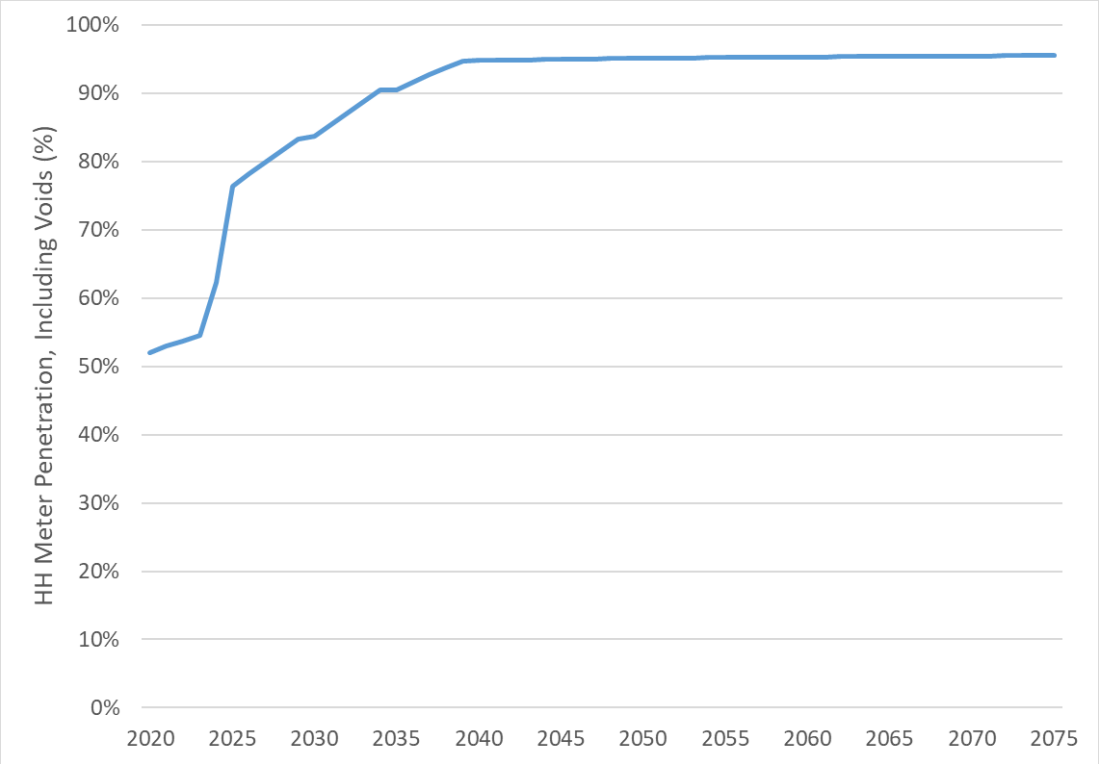

Figure 11 - 14: SWA WRZ Final Plan Meter Penetration

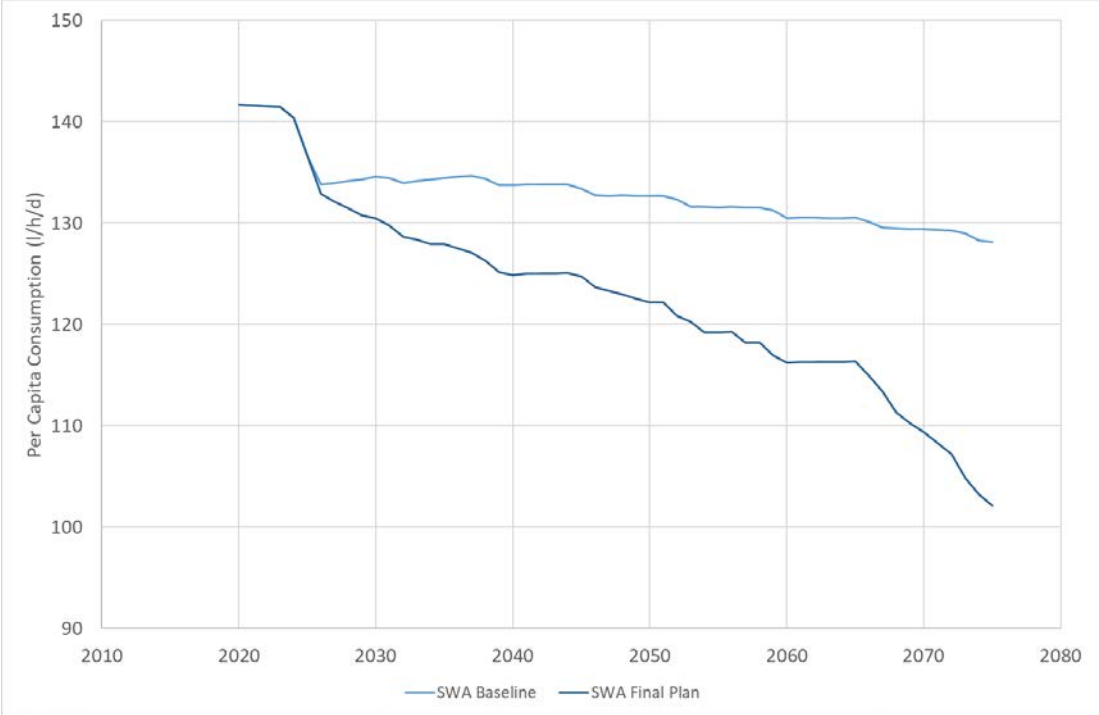

Figure 11 - 15: SWA WRZ PCC

Short-term – 2025-2030

11.152 We will continue our PMP, with 11,000 household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 84% by the end of AMP8. We will also undertake a significant upgrade programme including installation of nearly 79,000 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.

11.153 We will reduce leakage by 2.75 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.

11.154 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.

11.155 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

11.156 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 95% (including voids) by 2045.

11.157 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.

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

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

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

Long-term – 2045-2075

11.161 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.

11.162 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.

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

Supply enhancement

11.164 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11 - 13. Our plan shows that, assuming that demand management interventions are successful, no new sources of water would be needed in the SWA WRZ until 2048 at the earliest. This means that we can wait until at least 2035 to determine the supply enhancements needed in the SWA WRZ.

11.165 Future enhancements required would depend on the total volume of need across the SWA and SWOX WRZs. In some scenarios it would be more efficient to transfer water from the combined SESRO-STT hub across SWOX into SWA, and in others it would be more efficient to build a new treatment works in the SWA WRZ to abstract water released from SESRO and STT.

11.166 The utilisation of options in pathway 4 is shown in Table 11 - 14. This shows that in this scenario, around 20 Ml/d would be needed to be imported into the SWA WRZ to accommodate licence reductions being made at other sources.

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	N/A	2048	-	-	-	-	-	2050	-	-
Water from West-Thames Sources, imported via SWOX	48	-	-	-	2050	-	-	-	-	-
Groundwater - Datchet	2	2055	-	-	2051	-	-	-	-	-

Table 11 - 13: 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	21.1	18.7	17.6	18.3	14.2	10.1
Groundwater - Datchet	0.0	0.0	0.0	0.0	0.0	1.6	1.6	1.6	1.6	1.6
Export to SWOX	-1.1	-1.1	-1.9	-1.9	-1.1	-1.1	-1.1	-1.1	-1.1	-1.1

Table 11 - 14: Preferred programme option utilisation in SWA WRZ

Kennet Valley WRZ

11.167 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 7 Ml/d to 44 Ml/d.

11.168 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

11.169 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.

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

11.171 Table 11 - 15 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. The declining baseline PCC profile here points to the government-led water efficiency measures that we have incorporated into our baseline demand forecast, while the gap between the baseline and final plan PCC profiles shows the impact of measures that We can implement (broadly before 2045) and further measures which we have assumed that the government will bring in (broadly after 2045).

	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	0.10	0.16	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	0.07	0.37	0.24	0.18	0.28
Leakage innovation	0.11	0.05	0.09	0.18	0.76
Metering innovation	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	2.12	1.11	0.52	0.37	1.04
AMP7 Carry-over metering	1.88				
Household metering	0.25	0.00	0.00	0.00	0.00
Non-household metering	0.04	0.12	0.00	0.00	0.00
Household water efficiency	0.96	0.29	0.00	0.00	0.00
Non-household water efficiency	0.20	0.00	0.00	0.00	0.00
Metering innovation	0.04	0.27	0.17	0.00	0.00
Innovative tariffs	0.11	0.65	0.90	0.24	0.00
Total usage reduction	3.48	1.33	1.07	0.24	0.00
Total benefit from DMP	5.59	2.44	1.59	0.61	1.04

	New & Replacement Meters				
KVZ	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	1,105.98	1,248.92	1,016.73	0.00	0.00
Household Metering (New)	5,158.62	5,039.77	3,351.85	0.00	0.00
Household Metering (Upgrades)	44,434.77	17,572.28	2,174.21	0.00	0.00
Non-Household Metering (Upgrades)	3,003.88	3,507.40	0.00	0.00	0.00

Table 11 - 15: Kennet Valley WRZ Demand Management Programme Breakdown

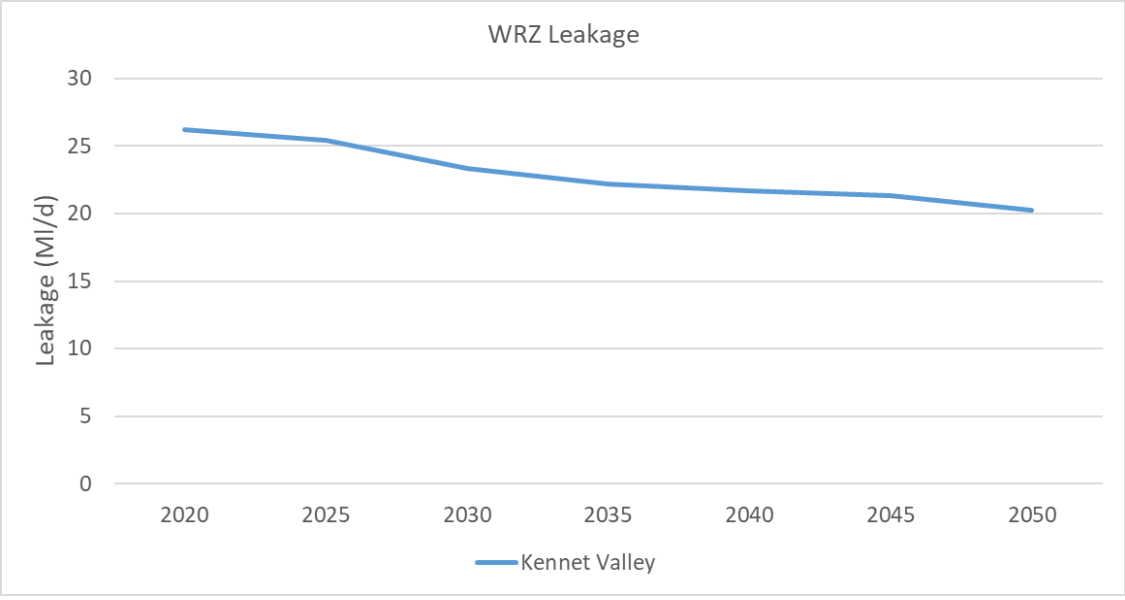

Figure 11 - 16: Kennet Valley Final Plan Leakage

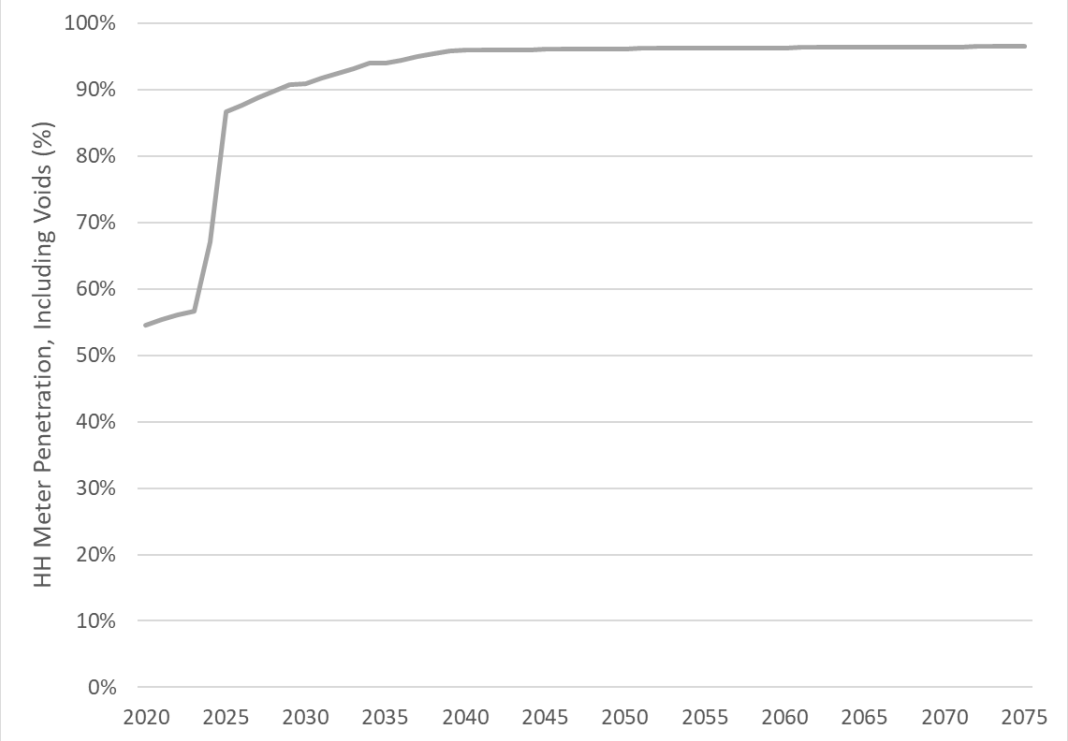

Figure 11 - 17: Kennet Valley Final Plan Meter Penetration

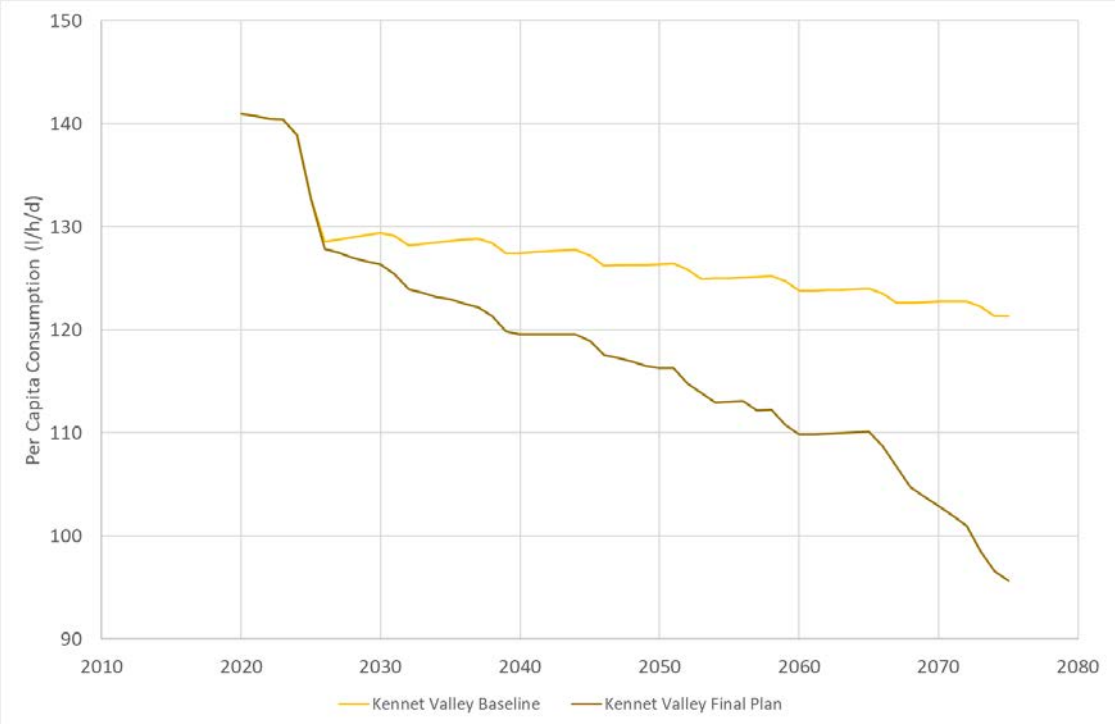

Figure 11 - 18: Kennet Valley WRZ PCC

Short-term – 2025-2030

11.172 We will continue our PMP, with over 5,000 new household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 91% by the end of AMP8. We will also undertake a significant upgrade programme, replacing over 44,000 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.

11.173 We will reduce leakage by 2.12 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.

11.174 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.

11.175 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

11.176 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 96% (including voids) by 2045.

11.177 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.

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

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

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

Long-term – 2045-2075

11.181 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.

11.182 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.

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

Supply enhancement

11.184 The new resources required under different pathways are detailed in Table 11 - 16.

11.185 This table shows that new resources would not be needed until 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 2040. The main reason for new resources being needed in 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.

11.186 If demand is high in the 2030s, we would need to construct a tunnel from the River Thames to support yields at this Reading source, which is currently supplied using flows in the River Kennet, in order that it could be used from 2040 onwards. If demand is lower, we can delay making this decision until the 2040s.

11.187 In several future scenarios we would look to recommission the Mortimer groundwater source, available for use in the mid-2040s.

11.188 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.

11.189 Table 11 - 17 shows the utilisation of options in pathway four, our preferred programme. This shows that the T2ST spur would be used in the period 2040 to 2050. The Mortimer GW source would also become available from the mid-2040s onwards, and would be used from this point on. The pipeline would remain available for resilience after 2050, but water from the Thames would become the main new source of water in the Kennet Valley zone from 2050 onwards.

Option	Max DO (DYAA)	Year Option is First Utilised in each Pathway								
		1	2	3	4	5	6	7	8	9
Water from West-Thames Sources, Transferred to Fobney WTW	N/A	2040	2042	2042	2050	-	-	2050	-	-
Transfer from T2ST Spur	10	-	-	-	2040	-		2040	-	-
Recommission Mortimer GW Source	5	2045	-	-	2042	2042	2042	-	-	-
Playhatch Drought Permit	4	2040	2040	2038	2038	2039	2040	2031	2031	2031

Table 11 - 16: Options used in Kennet Valley WRZ

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Water from West-Thames Sources, Transferred to Fobney WTW	0.0	0.0	0.0	0.0	18.8	18.0	16.9	17.2	14.5	11.7
Transfer from T2ST Spur	0.0	0.0	9.4	8.9	0.0	0.0	0.0	0.0	0.0	0.0
Recommissio n Mortimer GW Source	0.0	0.0	0.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5

Option	Option Utilisation by year (Ml/d)									
	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075
Playhatch Drought Permit	0.0	0.0	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 11 - 17: Preferred programme option utilisation in Kennet Valley WRZ

Guildford WRZ

11.190 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 20 Ml/d surplus to a 15 Ml/d deficit.

11.191 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

11.192 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.

11.193 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 in many future scenarios.

11.194 Table 11 - 18 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. The declining baseline PCC profile here points to the government-led water efficiency measures that we have incorporated into our baseline demand forecast, while the gap between the baseline and final plan PCC profiles shows the impact of measures that We can implement (broadly before 2045) and further measures which we have assumed that the government will bring in (broadly after 2045).

	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	0.03	0.06	0.00	0.00	0.00
Bulk metering CSL	0.23	0.15	0.12	0.00	0.00
Replacement metering CSL	0.19	0.13	0.00	0.00	0.00
Mains replacement	0.03	0.46	0.33	0.37	0.30
Leakage innovation	0.01	0.04	0.10	0.47	0.30
Metering innovation	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	0.75	0.97	0.85	0.85	0.60
AMP7 Carry-over metering	0.66				
Household metering	0.06	0.00	0.00	0.00	0.00
Non-household metering	0.01	0.03	0.00	0.00	0.00
Household water efficiency	0.21	0.14	0.00	0.00	0.00
Non-household water efficiency	1.20	0.00	0.00	0.00	0.00
Metering innovation	0.02	0.04	0.02	0.00	0.00
Innovative tariffs	0.05	0.31	0.62	0.01	0.00
Total usage reduction	2.20	0.52	0.64	0.01	0.00
Total benefit from DMP	2.96	1.49	1.50	0.86	0.60

	New & Replacement Meters				
GUI	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	3,455.41	3,935.44	3,364.54	0.00	0.00
Household Metering (New)	1,138.91	516.58	374.28	0.00	0.00
Household Metering (Upgrades)	9,798.28	8,954.55	852.81	0.00	0.00
Non-Household Metering (Upgrades)	894.39	1,511.08	0.00	0.00	0.00

Table 11 - 18: Guildford WRZ Demand Management Programme Breakdown

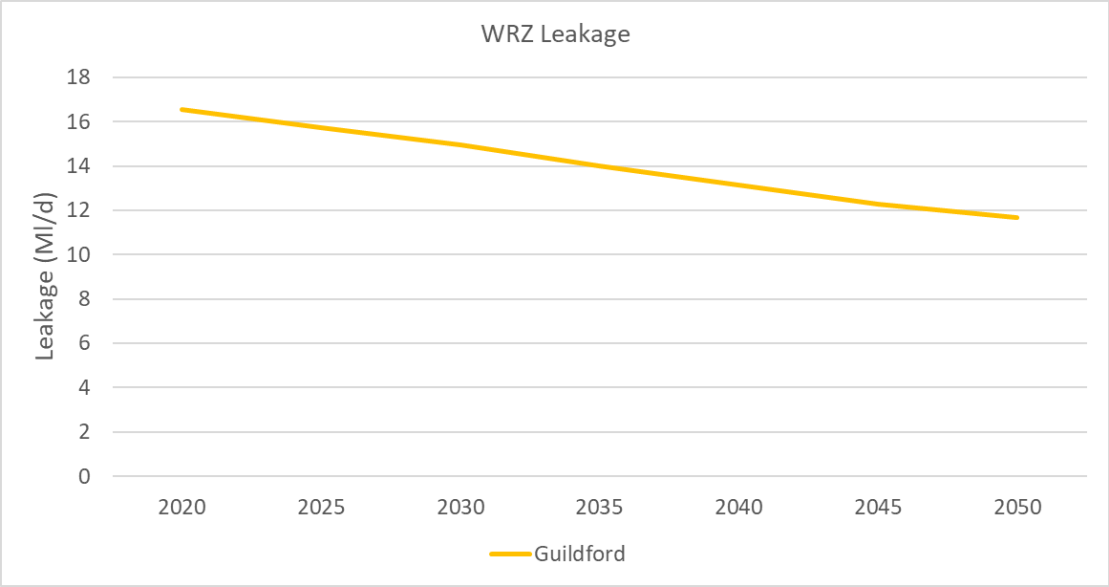

Figure 11 - 19: Guildford WRZ Final Plan Leakage

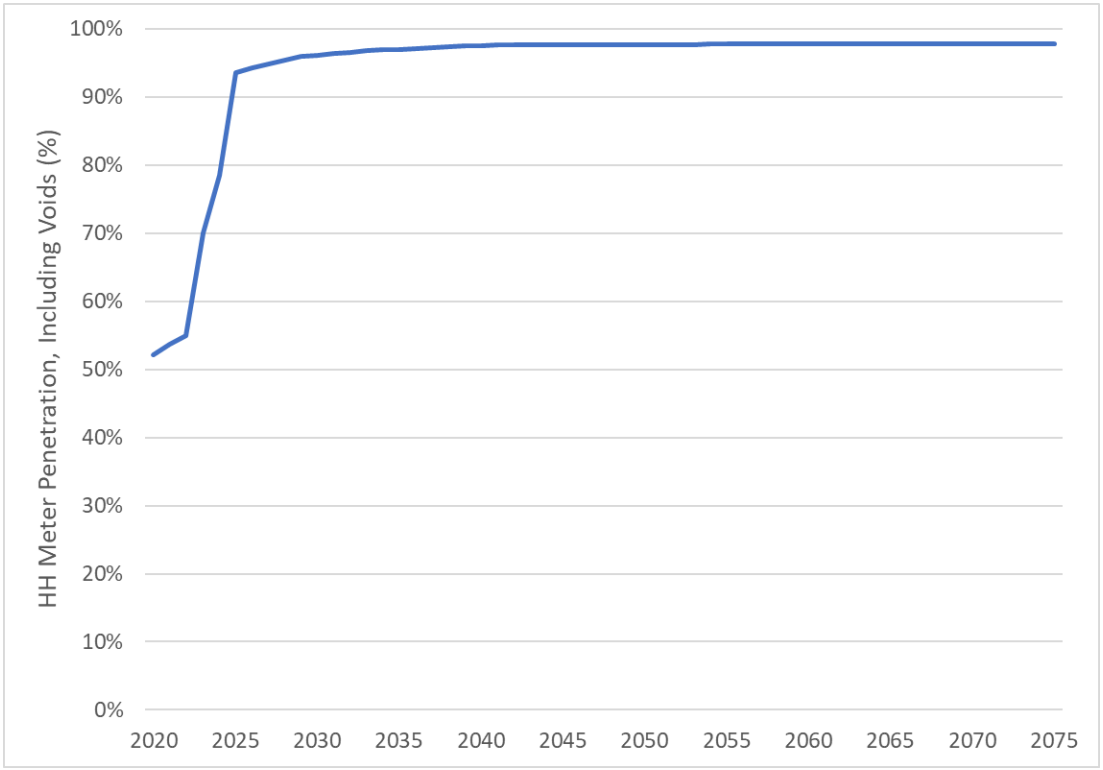

Figure 11 - 20: Guildford WRZ Final Plan Meter Penetration

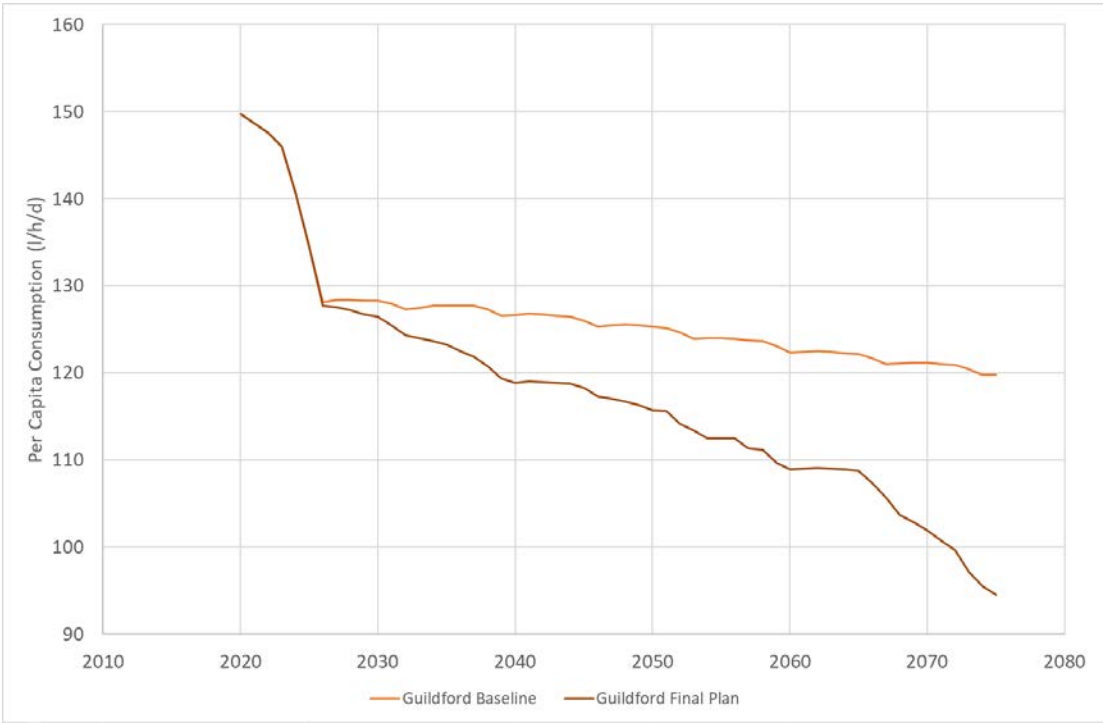

Figure 11 - 21: Guildford WRZ PCC

Short-term – 2025-2030

11.195 We will continue our PMP, with over 1,000 new household meters being installed in AMP8, finishing our household PMP campaign, achieving a total meter penetration of 96% by the end of AMP8. We will also undertake a significant upgrade programme, replacing nearly 10,000 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.

11.196 We will reduce leakage by 0.75 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.

11.197 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.

11.198 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.

11.199 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

11.200 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 98% (including voids) by 2045.

11.201 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.

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

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

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

Long-term – 2045-2075

11.205 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.

11.206 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.

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

Supply enhancement

11.208 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11 - 19. 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, imports from either South East Water or SES 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 - 20.

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	-	-	-	-	-
Import from SES at Reigate	5	-	-	-	-	-	-	2050	-	-
Shalford Drought Permit	5	-	-	-	-	-	-	2031	2031	2031

Table 11 - 19: 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	6.21	5.65	5.05	5.13	3.78	2.44

Table 11 - 20: Preferred programme option utilisation in Guildford WRZ

Henley WRZ

11.209 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 3 Ml/d deficit.

11.210 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

11.211 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.

11.212 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.

11.213 Table 11 - 21 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. The declining baseline PCC profile here points to the government-led water efficiency measures that we have incorporated into our baseline demand forecast, while the gap between the baseline and final plan PCC profiles shows the impact of measures that We can implement (broadly before 2045) and further measures which we have assumed that the government will bring in (broadly after 2045).

	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	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	0.00	0.01	0.06	0.00	0.08
Leakage innovation	0.00	0.00	0.00	0.00	0.00
Metering innovation	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	0.16	0.05	0.07	0.00	0.08
AMP7 Carry-over metering	0.22				
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	0.40	0.17	0.01	0.00	0.00
Total benefit from DMP	0.57	0.22	0.08	0.00	0.08

	New & Replacement Meters				
HEN	AMP8	AMP9	AMP10	AMP11	AMP12
Bulk Metering	172.00	195.28	163.97	0.00	0.00
Household Metering (New)	480.32	417.02	274.36	0.00	0.00
Household Metering (Upgrades)	7,060.58	2,813.80	246.77	0.00	0.00
Non-Household Metering (Upgrades)	0.00	0.00	0.00	0.00	0.00

Table 11 - 21: Henley WRZ Demand Management Programme Breakdown

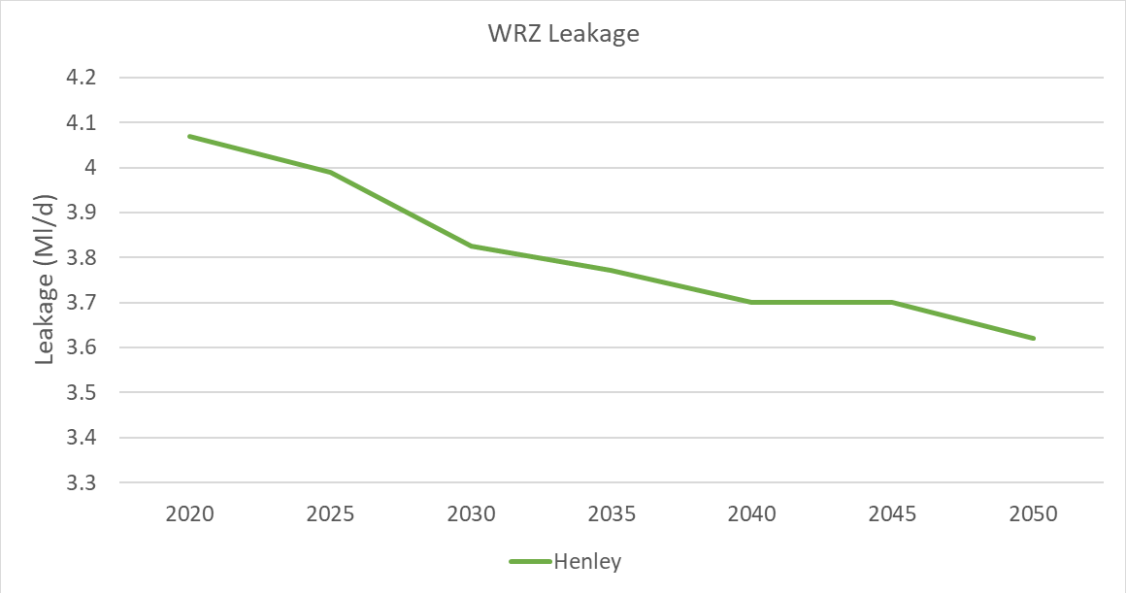

Figure 11 - 22: Henley WRZ Final Plan Leakage

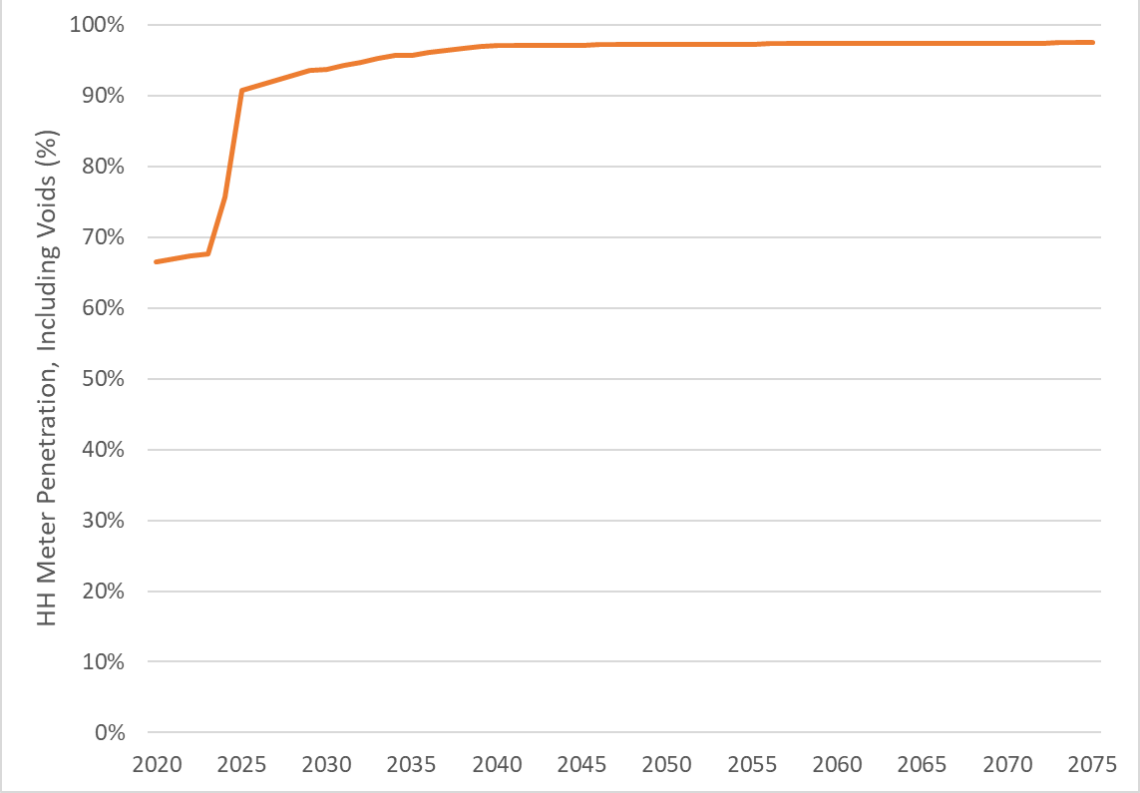

Figure 11 - 23: Henley WRZ Final Plan Meter Penetration

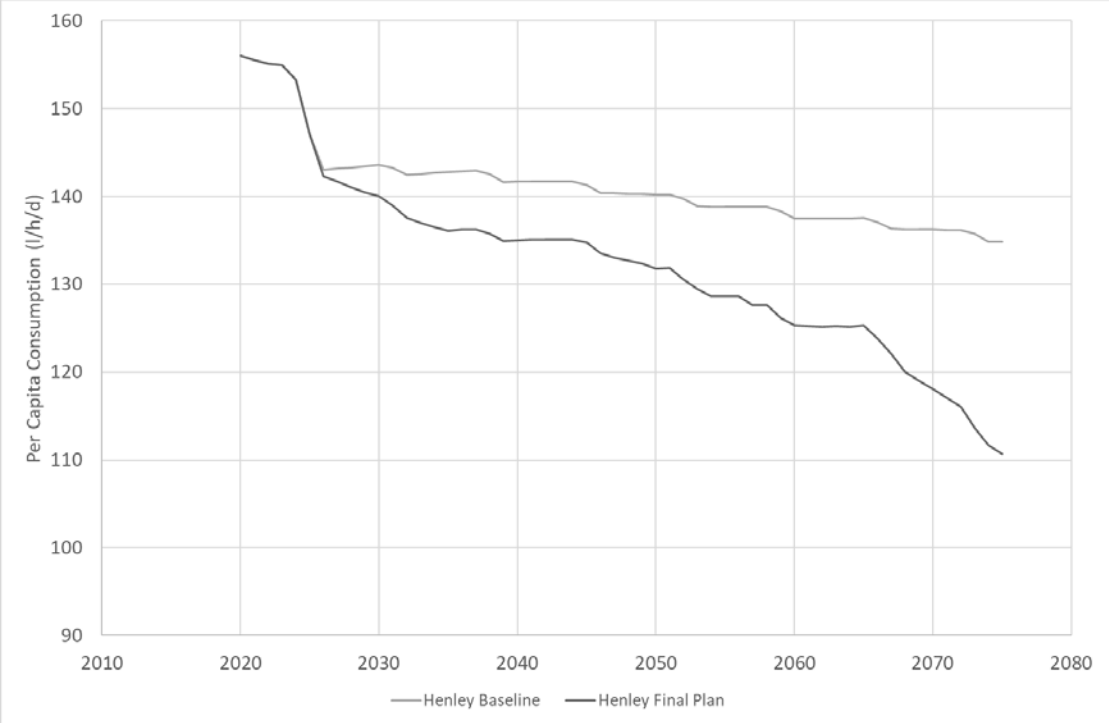

Figure 11 - 24: Henley WRZ PCC

Short-term – 2025-2030

11.214 We will continue our PMP, with 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 over 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.

11.215 We will reduce leakage by 0.16 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.

11.216 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.

11.217 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

11.218 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.

11.219 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.

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

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

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

Long-term – 2045-2075

11.223 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.

11.224 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.

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

Supply enhancement

11.226 The new resources required under different scenarios of future supply-demand balance are detailed in Table 11 - 22. This shows that supply-side investment will only be needed in extremely high scenarios of future population growth and in a scenario in which a large volume of future licence reductions is required in the zone.

11.227 We will need to monitor our progress in reducing demand in the Henley WRZ, and will need to make a decision on whether or not to progress an import to the zone in the 2040s.

11.228 In many future scenarios, water from existing sources in Henley WRZ would be exported to other WRZs. We will need to monitor progress in reducing demand to ensure that the Henley WRZ will remain in surplus should water from these transfers be required in other zones. Table 11 - 23 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
Import from Kennet Valley	2	2050	-	-	-	-	-	-	-	-
Harpsden/Sheeplands Drought Permit	6	-	-	-	-	-	-	2031	2031	2031

Table 11 - 22: 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	-3.04	-5	-2.31	-2.39	-2.48	-2.43	-2.79	-3.14

Table 11 - 23: Preferred programme option utilisation in Henley WRZ

Plan Assessment

11.229 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

11.230 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

11.231 As discussed throughout this section, we need to decide which options to invest in for our medium-term security of supply, in order to build towards 1 in 200-year and 1 in 500-year levels of resilience. The large decisions that this involves are:

- Question: Whether we should proceed with the Teddington DRA scheme or a different effluent reuse scheme, or defer achieving 1:200 drought resilience in the early 2030s?

  Answer: We should deliver Teddington DRA as soon as possible, with Beckton re-use as a backup

- Question: Whether we should proceed with SESRO or the STT, or alter the date we reach 1 in 500 drought resilience?

  Answer: We should proceed with SESRO for delivery in 2040, with STT as a backup (and in anticipation it will be required in 2050 – decisions on which will need to be made in a later iteration of the WRMP)

- Question: Which size of strategic option to proceed with?

  Answer: A SESRO of at least 100Mm^3 is required. Whether the 100 or 150Mm^3 size is chosen is close and is a key topic for this consultation

11.232 The investment decisions set out in our preferred plan provide a resilient, efficient solution to medium-term regional planning issues. The key outcome we will need to be aware of in the short to medium term is whether the OxCam growth corridor will be progressing in full, as we will need to progress the development of infrastructure to enable water from SESRO to be used in the SWOX should this be the case. We will also need 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. 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

11.233 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. The licence reductions identified as being necessary will be strongly influenced by the development and implementation of government policy and legislation in this area. 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. The key decisions to be made at this time will be whether to progress with the construction of further water resource schemes, such as the SST, through the late-2030s and 2040s.

Environmental assessment

11.234 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, using a GIS-based approach with results validated by experts in each area.

11.235 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) of our BVP, as well as programmes from pathway 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.

11.236 Our environmental assessments mean that 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 the Environment Act 2021, subject to further investigations being carried out when more detailed design of options is undertaken.

11.237 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 dWRMP24 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.

11.238 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.

11.239 We have identified reasonable alternative programmes through our programme appraisal, detailed in Section 10 of our dWRMP24. 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.

11.240 Throughout the process of environmental assessment of our options and plans we have undertaken extensive pre-consultation with our regulators and stakeholders, primarily Natural England and the Environment Agency. We are grateful for the advice and guidance received from our regulators in helping us to identify the right level of detail for us to undertake assessments.

11.241 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

11.242 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.

11.243 A small number of options within the plan intersect the same area of biodiversity action plan priority habitat, with construction periods at the same time or fairly close together. We will seek to reduce any habitat loss through further option development, as well as best practice construction techniques (such as species relocation) as we finalise our plan.

11.244 There may be temporary cumulative impacts on landscape and visual amenity for temporally overlapping construction activities related to three options, all of which are within 500m of an AONB but require minimal above ground infrastructure. We will look at reducing these impacts by altering construction timings and implementing best practice construction measures.

11.245 There is also potential for cumulative effects resulting from construction of SESRO, aspects of STT and the Abingdon to Farmoor Pipeline on a Scheduled monument. Embedded construction mitigation is expected to prioritise minimising these effects through consideration of the siting of temporary and permanent works.

11.246 The plan provides substantial positive cumulative effects on reducing vulnerability to climate change risks and hazards and on delivering reliable and resilient water supplies, providing a long term benefit for communities in the region.

HRA

11.247 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.

11.248 Consideration of the combined impacts of options in our preferred plan has resulted in a finding of no significant adverse effects on Habitats sites. There is the potential for low and localised in-combination impacts on the Cothill Fen SAC during the construction of two pipelines (Abingdon to Farmoor raw water transfer and Abingdon to SWOX/SWA treated water transfer) which would take water from SESRO to SWOX and SWA.

11.249 Further details of the assessments undertaken are available in Appendix C. Further options development work appropriate to the planned date of delivery for these options will ensure that they comply with all relevant environmental legislation prior to progressing to application stage. Where feasible, we will progress this as part of finalising our WRMP24.

WFD

11.250 Of the options selected in the plan, 22 required WFD Level 2 assessments. The findings indicate that there are precautionary WFD compliance risks associated primarily with the operation of

additional/new abstractions and new or ceased discharges (see summaries provided in Appendix D).

11.251 For groundwater bodies, deterioration risks were primarily associated with changes to quantitative surface water dependent status elements or GWDTE dependent status elements, as a result of new or increased groundwater abstractions, or construction of below ground works.

11.252 We will consult with the Environment Agency to ensure that further studies and investigations are scoped and undertaken as necessary to further confirm potential impacts to WFD waterbody status for these options. Where feasible, we will progress this as part of finalising our WRMP24.

11.253 Consideration of the cumulative impacts of options within our plan has shown that 21 water bodies would be impacted by more than one option in our preferred plan. Of these 21 water bodies, our assessment shows that there is a potential risk of deterioration of four water bodies due to cumulative impacts. We will consider this further and will conduct more detailed investigations to assess these impacts as we progress further in our planning.

11.254 Consideration of the impacts of our plan alongside other plans and programmes has identified that, of the 21 water bodies impacted by more than one option in our preferred plan, 5 are also impacted by one or more other planning projects. The cumulative effects assessment indicated that none of these waterbodies are at risk of further deterioration due to the combination of options and planning projects. Further information on the planning projects would be required to further quantify the cumulative effects on these water bodies; we will consider this further as we finalise our plan.

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

Natural Capital and Biodiversity Net Gain

11.256 Regarding Biodiversity Net Gain, the plan offers great opportunity to achieve landscape scale net gain with schemes such as SESRO, but overall there is a need to build further gain into the plan to achieve the mandatory minimum 10% increase for options requiring planning permission. We will need to achieve an additional gain of 1819.28 units to meet this target across the best value plan. Mitigation and enhancement opportunities have been suggested within Appendix AA, and will be working with WRSE to develop a strategy to practically achieve the required net gain, which will be presented as part of the final plan.

11.257 Our natural capital assessments have concluded that a small area of high value, irreplaceable habitats may be lost as part of the plan – we will be working with our regulators to develop an appropriate mitigation strategy as we progress through the planning stages for the options.

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

Invasive Non-Native Species

11.259 The Environment Agency's SRO Aquatic INNS Risk Assessment Tool (SAI-RAT) was used to assess the options selected in the plan. These assessments were carried out assuming an absence of mitigation.

11.260 The main risk associated with the two non-SRO options in the plan identified as presenting an INNS risk (both scored as Medium) is the transfer of raw water between currently unconnected locations – which could create a new pathway for INNS to be transferred and introduced, including risks associated with pipe bursts. Further details on the assessments are available in Appendix BB.

11.261 Across the strategic resource options selected in the plan, two components of each of the London Recycling, STT and SESRO SROs were scored as a Medium INNS risk in the absence of mitigation. Mitigation measures have been considered within the Gate 2 work for the SROs and the findings of the Gate 2 INNS risk assessments will continue to inform future design iterations, including design mitigation and appropriate biosecurity measures.

11.262 We will use the SAI-RAT tool to update the INNS assessments as further design information becomes available. Operational INNS risks may be mitigated through design or biosecurity measures. An evaluation of potential measures will be undertaken as options are progressed and the WRMP is finalised.

Costs and Carbon emissions

11.263 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 dWRMP24. As with our environmental assessments, cost and carbon assessments are undertaken at a level of detail commensurate with option salience and maturity.

11.264 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.

11.265 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.

11.266 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.

11.267 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 - 24, with the investment required shown in Table 11 - 25. 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.

	AMP8	AMP9	AMP10	AMP11	AMP12
Cumulative Bill Impact, per year (£)	14	37	65	80	100

Table 11 - 24: 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)	1100	2100	2650	2300	3350
Opex (£m)	90	120	130	150	220

Table 11 - 25: 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

11.268 The cost of all our options were provided to the WRSE at the start of 2022. Since then we have made updates to them to take account of new information received from our AMP7 delivery. The most important of these is with our mains rehabilitation costs, which after assessment against our AMP7 Conditional Allowance mains rehabilitation programme has been seen to increase. The impact of this has been shown by the WRSE to have no impact on the timing or size of the strategic resource options, such as Teddington DRA, SESRO, or the STT.

11.269 Table 11 - 26 shows the profile of carbon emissions from options that we would feature in our plan across the planning period. Some of the options in our plan would be shared, and so these figures are an over-estimate of the embodied carbon associated with the Thames Water component of the WRSE plan. Table 11 - 27 shows the embodied carbon emissions associated with different supply-side 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 2030 onwards, but STT from 2050 onwards). In order to compare the carbon emissions of options in a like-for-like way, please refer to our WRMP tables. 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 in our net zero pathway; our journey towards net-zero will support the delivery of national net-zero targets. In further developing options, we will investigate where the use of low-carbon materials or construction techniques may be feasible.

	AMP8	AMP9	AMP10	AMP11	AMP12	Total AMP8-12
Capital Emissions (tCO2e)	236,081	342,279	383,910	94,837	301,240	1,358,346
Operational Emissions (tCO2e)	18,013	53,670	76,510	35,955	47,213	231,361
Total Emissions (tCO2e)	254,094	395,949	460,419	130,791	348,454	1,589,707

Table 11 - 26: Embodied Emissions from Options in Thames Water Plan

Scheme	Capital Carbon	Operational Carbon	Total Emissions (tonnes CO2e)	Scheme Yield / Capacity	Year Selected
Addington Groundwater Source	3050	183	3233	3	2032
Deephams Reuse	26871	44341	71212	42	2061
DO Enhancement at Datchet Groundwater Source	1448	95	1544	2	2055
Enhancement of DO at Woods Farm Groundwater Source	1874	530	2404	2	2031
Guildford Demand Management Programme	8,887	2,079	10966	7	2026
Henley Demand Management Programme	1,678	812	2490	0.5	2026
Kennet Valley Demand Management Programme	14,274	5,878	20152	10	2026
Lockwood to King George V Reservoir Tunnel	50932	398	51330	-	2031
London Demand Management Programme	354,558	88,294	442852	271	2026
London Ring Main Extension	57774	0	57774	-	2040
MAR Horton Kirby	4652	41468	46120	5	2050
Merton Groundwater Source Recommissioning	5936	216	6152	2	2062
Mortimer Groundwater Sources Recommissioning	1864	5442	7306	5	2042
New Groundwater Source at Moulsford	2036	233	2269	2	2040
New Treatment Works at Kempton	110067	341440	451507	250	2040
New Treatment Works to Treat Water from SESRO for SWOX and SWA	31431	54139	85570	48	2049
Pipe to take water from SESRO to Farmoor	13266	570	13836	24	2050

Scheme	Capital Carbon	Operational Carbon	Total Emissions (tonnes CO2e)	Scheme Yield / Capacity	Year Selected
Removal of constraints on DO at Britwell Groundwater Source	1968	198	2165	1	2042
SESRO 100 Mm3 Variant	132415	699	133114	185	2040
Southfleet & Greenhithe Groundwater Source	8489	4660	13150	9	2031
Spur from T2ST to Kennet Valley	1190	688	1878	10	2040
STT Support from Minworth	-	18974	18974	70	2060
STT Support from Netheridge	-	1654	1654	24	2050
STT Support from Vyrnwy	102065	124691	226756	60	2053
STT Unsupported Transfer	221827	95787	317615	134	2050
SWA Demand Management Programme	24,376	11,169	35545	13	2026
SWOX Demand Management Programme	44,813	19,574	64388	23	2026
Teddington DRA	93997	89051	183049	67	2031
Transfer from Henley to SWOX	4125	518	4643	5	2040
Transfer from South East Water to Guildford	7027	76	7104	10	2050
Transfer from Wessex Water to SWOX	4511	34	4545	3	2045
Transfer of Water from SESRO to SWA	47426	761	48187	48	2050
Tunnel from Thames to KV Treatment Works	10266	130	10396	40	2050
Grand Total	1,395,096	954,782	2,349,878		

Table 11 - 27: Embodied Emissions from Supply-Side Schemes in the Preferred Programme.

Please note that, for shared options (SESRO and STT), the carbon emissions in the table above reflect an estimation of Thames Water's share in the use of that option. As such, 41% of the emissions from SESRO and 74% of the emissions from STT are included in the table above.

Risks and uncertainties

11.270 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

11.271 Our plan incorporates over 120 Ml/d of demand reduction during AMP8. No new sources of supply are planned during this period, nor could any large new sources of supply be constructed and commissioned in such a short timescale. In the longer term, our plan involves 300 Ml/d of company-led demand reduction up to the year 2050, incorporating over 170 Ml/d of leakage

reduction and over 120 Ml/d of household demand reduction. In addition to this company-led activity, we have assumed that around 160 Ml/d of demand reduction will be brought about by societal change and government-led intervention (around 130 Ml/d of which we have assumed to be within our baseline demand forecast).

11.272 This volume of demand reduction 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 demand reduction programme on available evidence and reasonable assumptions, there is nonetheless a 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.

11.273 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.

11.274 We have less direct control over household and NHH demand for water. While metering, water efficiency campaigns, and tariffs can encourage people to use less water, we cannot directly reduce our customers' demand. Having 10 million customers (forecast to become 12 million by 2050), each 1 l/h/d of additional average customer use translates to 10 Ml/d of additional water resources needed.

11.275 During AMP6 and AMP7 we have shown that significant levels of leakage reduction are achievable, but we are nonetheless aware of the risk to our supply-demand balance position in AMP8. We are likely to 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.

11.276 In the longer term, while the levels of demand management required present some risk to our plan, we have considered severe future scenarios of supply-demand deficit across the WRSE region, and have shown that we would be able to achieve supply-demand balance under extreme scenarios. As such, in the long-term, we will be able to adapt our plan should demand management activity be less effective than we anticipate. The long-term risk that we face is that if customer's demand for water does not reduce over the long term, we will need to invest in many more, potentially expensive sources of water. If we were to assume that demand management actions would be less effective over the long term, we would be very likely to prefer to invest in a 150Mm^3 SESRO scheme now, but we would need to make this decision imminently.

Risk: Capability of Thames Gateway Desalination Plant

11.1 The Thames Gateway desalination plant has faced a number of outage issues during recent years and has been unavailable throughout 2022 due to a planned maintenance upgrade. We have sought to address concerns over the reliability in this plan and how it is now reflected in our water resources planning. Section 4 identifies current and future investments to improve the reliability of the plant to mitigate the risk that the plant may not in future be able to produce as much water as we assume in our planning.

11.2 Section 4 further describes the planning assumptions. During the early part of the planning period, 50 Ml/d DO capability has been assumed from this plant. This results in a 19.2 Ml/d reduction in WAFU, when compared to the 100 Ml/d capability assumed in baseline DO modelling, as a result of the interaction between DO and outage allowance. The plan shows a surplus during the early part of the planning period (to 2029/30), whether the supply capability of the desalination plant is 50 Ml/d or 100 Ml/d.

11.3 In section 10 a sensitivity test was included to show the impact on the plan if the WAFU delivered by the plant were to be reduced from the baseline position over the long term. It demonstrated that whilst there would be some impact these changes would not be material regarding the large supply schemes being selected.

11.4 Progress on Gateway has been incorporated in the company's monitoring plan (see next sub-section). Updates will cover; maintenance programmes, overall progress on planned investment and plant performance. In the short-term progress in restoring the site's capability to 50 Ml/d (27 Ml/d WAFU contribution) by February 2023 will be reported and this will be taken into account in our final WRMP24.

Risk: Obtaining planning consent

11.5 The regional supply-demand balance position means that either the SESRO or STT scheme is very likely to be needed by the year 2040. The SESRO scheme has a lead time of approximately 15 years, and the STT scheme has a lead time of approximately 10 years, meaning that action is required now to ensure security of supply for the future. Both of these schemes would be constructed in areas where residents have a great deal of concern for their local environment, and both schemes would receive significant scrutiny during the consenting process.

11.6 If the SESRO scheme, our preferred option for delivering 1 in 500-year resilience by 2040, or the STT scheme were to be denied planning consent, our regional water supplies would carry a major risk, with little ability to respond. As such, it is critical that our WRMP24 is robust and properly evidenced, such that our preferred scheme can be promoted through the planning process.

Risk: WRZ integrity under severe environmental destination scenarios

11.7 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 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.

11.8 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

11.9 We are aware of potential changes to the cost and benefits of the strategic resource options as work continues. We have also seen changes to our mains rehabilitation costs due to increasing

inflationary effects in recent months. A further review of the WRSE regional plan is due in the first half of 2023. These potential changes may have an impact on this updated WRSE regional plan and therefore our revised draft WRMP, although this is unlikely to have a major effect the selection of strategic resource options.

Uncertainty: Acceleration and changes in policy ambitions.

11.10 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.

11.11 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

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

Uncertainty: West Berkshire Groundwater Scheme

11.13 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.

11.14 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.

11.15 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.

11.16 We have not explicitly considered a future scenario in which the WBGWS is not available, but consider that the range of supply-demand balance scenarios is sufficient to cover a range of future supply-demand balance conditions that could plausibly be experienced by Thames Water and across the WRSE region.

Monitoring Plan

11.17 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.

11.18 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 quarterly Water Resources Forum, which we will run jointly with both WRSE and Affinity Water where appropriate, and the associated technical 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.

11.19 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.

11.20 Full details of the outputs and monitoring plan which will be reported are given in Table 11 - 28. This includes:

- Tracking the water balance (SDB) and supply (WAFU) and demand (DI) for material changes to the forecast
- Reviewing population and property growth for material changes to the forecast
- Tracking progress with the demand management programme (reduction in PCC, meter installations and leakage reduction); and reporting progress on industry workstreams, coordinated through Water UK and Waterwise, to facilitate mandatory water labelling on water using products, changes to fitting standards and building regulations
- Progress updates on SRO development
- Investigations carried out under the Water Industry National Environmental Programme (WINEP), which will begin to make clear which of the reductions we need to make from our Environmental Destination scenarios
- Collaborative investigation into the continued feasibility of the WBGWS
- Ongoing progress on the question of drought resilience and levels of service
- Tracking the progress of plans to improve the capability and reliability of the Thames Gateway desalination plant.

Assessment Area	Monitoring Activity	Metric	Purpose and relationship with decision point
Water balance Summary	SDB	Ml/d	Actual vs predicted – Confirm if movement is within Headroom expectations, and confirm that SDB is maintained
	DI		
	WAFU		
Growth	Population	000s	Actual vs predicted and updates to projections
	Properties		
Demand Management	Leakage	Ml/d	Actual vs predicted – assumptions and impact assessment
	Metering	Activity	

Assessment Area	Monitoring Activity	Metric	Purpose and relationship with decision point
	PCC	l/hd/d	Understanding government-led policy development
Strategic option studies	Teddington DRA	Progress update	Progression towards DCO and readiness for construction during late 2020s (Ted DRA) and early 2030s (SESRO).
	SESRO (incl. T2AT, T2ST)		
	STT		We anticipate the need to continue studies of these options should the preferred options fail, or ahead of decisions in WRMP29
	Re-use / Desalination		
Regional Need	WRSE	Update	Regional modelling updates for WRMP29
Environmental need	Water Industry National Environment Programme (WINEP)	Update	Progress with current investigations / delivery Likelihood and magnitude of further sustainability reductions to reach Environmental Destination West Berkshire Groundwater Scheme
Resilience required	Regulators	Design drought	Update return period and DO
Desalination Plant Progress	Site capability and reliability	Ml/d and Update	Understand progress made in improving the site's capability and reliability Determine appropriate DO and outage allowance contributions for WRMP29

Table 11 - 28: Monitoring Plan Components

11.21 The expected timetable for upcoming regulatory milestones is as follows:

- Statement of Response and revised draft WRMP24 — May 2023
- WRMP24 submission to Secretary of State — Late Spring 2023
- Commencement of pre-application work re DCO for SESRO — Nov 2022
- SRO Gate 3 activities — Nov 2022 – Jan 2025
- Final Draft WRSE Regional Plan — September 2023
- Teddington DRA Planning Application — Q2 2024
- Hearing/Inquiry WRMP24 — Autumn 2024
- Secretary of State approval of WRMP24 (SRO needs case) — March 2025
- Pre-application work for SESRO DCO — Jan 2025 – Sept 2026
- Planning Consent for Teddington DRA — Q2 2025

- Statutory consultation on SESRO DCO Aug-Oct 2025
- Application for SESRO DCO October 2026

11.22 As highlighted in our WRMP19, given that our WRMP24 sets out the need for the SESRO option to be available before 2040, it is vital the promotion of WRMP24 proceeds in parallel with the promotion of a DCO for the SESRO. Specifically, we will need to progress investigations, activities and assessments related to the DCO process for the SESRO (and which are unrelated to the need for the SESRO) in parallel to the WRMP process, as part of the gated Ofwat SRO process.

11.23 We have included Figure 11 - 25, which we included in our WRMP19. Our current planning is following the most challenging future we considered at the time.

11.24 In the longer term, we will monitor population growth and the success of leakage and demand reduction efforts to assess the future demand scenario that we are likely to encounter. In addition, we will use insight gained from investigations carried out as part of the WINEP to determine those licence reductions which are likely to be required in the future, and will monitor and continue to use the latest science into the impact of climate change on extreme drought to determine the likely future pathway that we are taking, and so the actions that our adaptive plan would suggest that we should take. We have not, however, presented a monitoring plan extending beyond AMP8 due to the inherently adaptive approach of producing a WRMP every five years. While we could set out a monitoring plan for the period beyond 2030, it would be superseded by new forecasts producing for WRMP29.

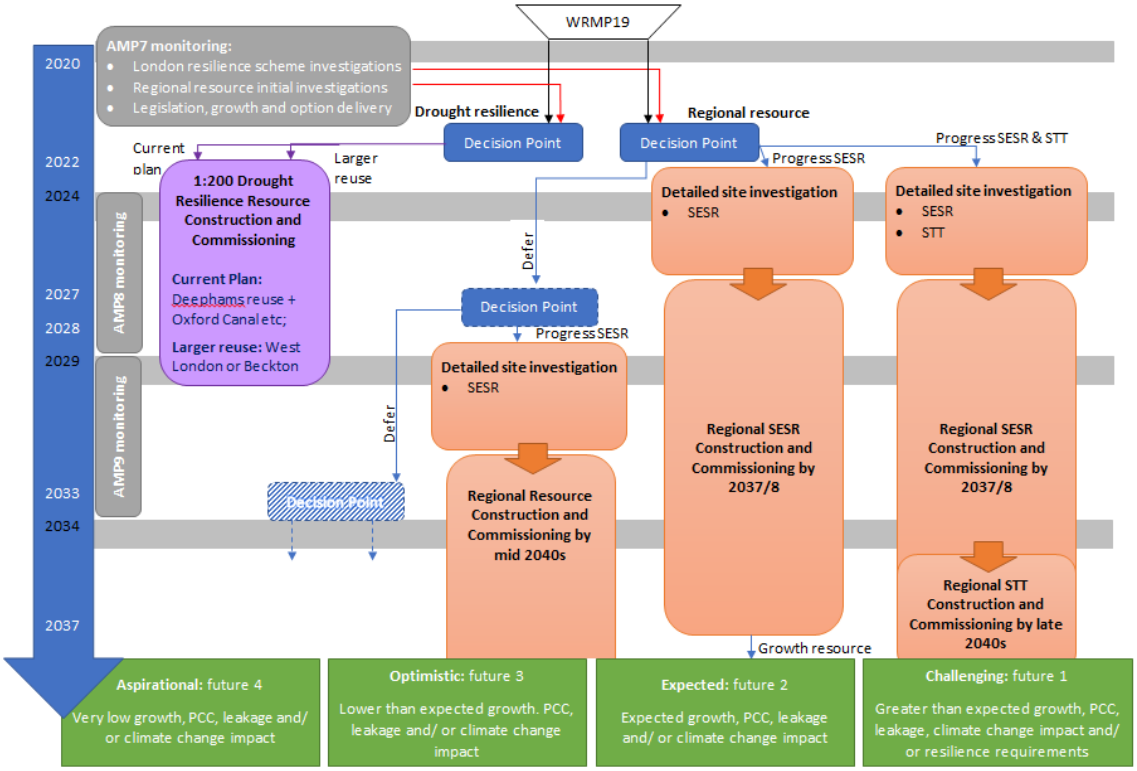

Figure 11 - 25: Figure from WRMP19 – Decision Points

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

11.25 In this section we have presented our preferred, BVP, and preferred programme. We now summarise the key parts of our plan and justify the decisions that we have made.

Demand Management

11.26 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 without any further intervention up to the year 2030.

11.27 Our 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 are based on evidence of achievable reduction and include a reasonable allowance for demand reductions from future innovations.

11.28 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.

11.29 We have developed our household demand reduction programme on the basis of reductions which can be evidenced, with reasonable assumptions around interventions which are untested in the UK. This 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. Our household demand reduction programme will contribute to the national aim of reducing PCC to 110 l/h/d by 2050, but we do not think that we could evidence a programme of reduction which we could be confident would see our customers reduce their consumption to 110 l/h/d, and we predict our programme of interventions will result in a PCC of 123 l/h/d by 2050 (in a dry year).

11.30 Throughout the period during which we will be making interventions to reduce demand, we will also need the help of government. Water efficiency labelling of appliances, the introduction of minimum water efficiency standards on appliances, and changes to building regulations will all be needed to ensure a secure supply of water in the future.

11.31 We consider that the demand management programme that we have set out strikes the right balance between prudence and ambition. If we were to derive, and rely on, a more ambitious programme than we have set out, we consider that the risk of under-delivery of that programme would be too high, and would pose a significant risk to the security of supply for our customers, with inevitable consequential detrimental impact on the environment.

Teddington DRA

11.32 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.

11.33 The Teddington DRA scheme is the best value option for us to move to 1 in 200-year resilience by the early 2030s, being an option which is deliverable in a short timescale, would deliver a sufficient volume of water to improve our London WRZ's drought resilience, and which is inexpensive compared to other available options.

11.34 Our plan involves proceeding with obtaining consent for and constructing the Teddington DRA scheme as soon as possible.

SESRO and Severn-Thames Transfer

11.35 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.

11.36 From this analysis, we have established that we should start obtaining consent for either the STT or SESRO as soon as possible, in order that one of the schemes could be used by 2040, and that the best value solution is to build SESRO as soon as possible, such 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 begin making licence reductions where these are identified as being ecologically effective. We do not think that we should consider the possibility of building neither the STT nor SESRO, due to the risk that would be placed on customers' supplies if we were to defer the decision until WRMP29. There would inevitably be consequential detrimental impacts on the environment as well.

11.37 We consider that the best value solution to the adaptive planning problem that we face is to construct the SESRO option to be ready for use from 2040 onwards. This involves beginning the consenting process as soon as possible. Our decision to promote construction of SESRO ahead 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.

11.38 The SESRO option, and later the STT and SESRO options acting together, 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 in severe future scenarios.

11.39 The volume of new resources required by 2040 under a variety of future scenarios means that we would need to construct a SESRO of at least 100 Mm^3, as smaller SESROs would mean that we would need to construct other supply options at the same time, resulting in increased costs. We could reasonably promote construction of any SESRO with a volume of 100Mm^3 or more, as there relatively marginal differences between outcomes associated with plans involving SESRO schemes of different volumes. However, we consider that a 100Mm^3 SESRO scheme provides the best value solution to the regional problem, with plans involving a 100Mm^3 SESRO scheme resulting in relatively better environmental performance, giving a greater opportunity for landscaping of the scheme, and providing a better balance of near-term and long-term investment given our current view of risk. Plans involving a 150Mm^3 SESRO option result in improved performance considering resilience metrics and would afford us a greater degree of protection if

the future is worse than we currently predict, or if demand management actions do not result in the benefits that we think they will. All SESRO schemes provide a resilient source of water with low operating costs that can facilitate inter-regional trades, and so provide the ideal base of an adaptive plan for an uncertain future.

11.40 In the longer term, we would take different investment decisions depending on the outcome of investigations to determine abstraction licence reductions which are needed to ensure the protection and improvement of the environment, and depending on the impacts that climate change has on our drought risk. Our preferred programme, which sets out options required under a 'High' future scenario of licence reductions, includes the development and construction of the STT for use from 2050 onwards, with the scheme likely to initially be used in a largely 'unsupported' form, with phased introduction of 'support' sources. Used in this way, the STT provides a modular, adaptable source of water, whereby water from support sources can be introduced as and when necessary, rather than being relied upon to provide a large 'baseload' source under which conditions the high operating costs and emissions make the scheme less favourable. In this scenario, SESRO and the STT would form a regional hub, providing a high level of resilience and operating as a conjunctive system.

11.41 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