Revised Draft Regional Plan
Water Resources South East

August 2023

Revised Draft Regional Plan – Water Resources South East	
Last updated	4 September 2023
Version	Draft V1.1
History of Changes made to this version	Correction of percentages in para 1.18 and Figure 16.9
Author	Adams Hendry Consulting Ltd
Approved by	Sarah Green, Lee Dance, WRSE Companies
WRSE Director Approval	Meyrick Gough

Email: contact@wrse.org.uk

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Executive Summary

1. Executive Summary

1.1. This document is Water Resources in the South East's (WRSE) revised draft regional plan for the South East of England. It is an updated version of the draft regional plan that was published for consultation in November 2022.

WRSE and the regional plan

1.2. WRSE is an alliance of the six water companies which cover the South East of England - Affinity Water, Portsmouth Water, SES Water, Southern Water, South East Water and Thames Water. WRSE is one of five regional groups across England, each of which is producing a strategic water resources plan.

1.3. The primary objective of water resources planning is to ensure that there are always enough supplies available to meet anticipated demands, under various weather conditions, but in particular in dry and very dry conditions.

1.4. The regional adaptive plan assesses the future need for water and identifies the set of options that present the best value to customers, society and the environment to secure long-term resilience. In doing this we take account of the likely effects of many individual factors, including climate change, population growth and changing environmental policy and legislation. The plan shows a core set of schemes and an adaptive set of schemes which would be developed under different future situations. Whichever path we look at investment is required.

1.5. Our regional plan looks ahead to 2075 and addresses the water resources planning challenges that we face. Our plan seeks to:

- Ensure there is enough water for a growing population and to support economic growth
- Improve the environment by leaving more water in the region's rivers, streams and underground sources
- Increase the region's resilience to severe drought and other extreme shocks and stresses
- Address the impacts of climate change on demand for water and how much is available.

1.6. As well as the regional plan, our six member companies are preparing their own individual Water Resources Management Plans (WRMPs), which set out the detailed proposals for each company's supply area.

1.7. There is a clear statutory and regulatory process that must be followed for preparing these plans, with approval to publish final WRMPs given by the Government. Regional plans are not yet statutory, however WRSE has followed the guidance and approach set out by the Environment Agency in preparing its regional plan.

1.8. To date, WRSE has published a series of consultation documents and other material, including method statements for how it would prepare the regional plan, together with an emerging draft and then draft regional plan for a period of public consultation.

1.9. Over 1,150 responses were received on the emerging regional plan and over 900 on the draft regional plan. WRSE has assessed the comments included in the consultation responses in detail and taken the issues raised into account in preparing and then updating its proposals.

1.10. This document, the revised draft regional plan, identifies WRSE's assessment of the need for additional water over the planning period to 2075, and the demand management and water resources options it has selected in its best value plan. The proposals in this revised draft plan have changed in response to comments on the draft plan, and updated data and information over the period since the draft plan was published.

Our region and the need for water

1.11. The South East region covers the area from the New Forest in Hampshire to the Isle of Thanet in Kent, up to Saffron Walden in Essex and across to Banbury in Oxfordshire – including London and other major towns and cities, and everywhere in between. It is home to 30% of the UK population and is worth £627 billion per year to the UK economy (30% of the total). The region

has 32 river catchments within it, and large areas are designated as protected landscapes or internationally or nationally significant wildlife and ecological habitats, including chalk streams.

1.12. The South East faces some of the most significant challenges to water resources in the future. Most of the region is already classified as water stressed and its population is set to grow, with major growth corridors planned in some areas. The impact of climate change will be felt acutely in the region, bringing changes to the amount and pattern of rainfall which are likely to, in turn, change the types of droughts we face in the future. The future is uncertain, and our plan is designed to be adaptive, enabling us to accommodate a range of different futures and uncertainties, enabling us to ensure that water supplies are resilient to different scales of challenges we may face in the future.

1.13. In 2020 the Environment Agency's National Framework for Water Resources looked at the pressures on public water supply nationally, regionally and over time. It provided a preliminary indication of the challenges we could face in providing water supplies in the future, in terms of public and non-public water supply need.

1.14. Of all the regions, the National Framework identified that the South East faces the greatest pressures on public water supplies. If surplus water can be made available, we will still need to develop significant new options to supply more water, as well as achieving ambitious efficiency and leakage reductions.

1.15. WRSE has undertaken its own detailed modelling for the regional plan, using existing sources of data and information as well as commissioning new research and forecasts. WRSE has undertaken thousands of model runs to enable it to quantify a wider range of future challenges and scenarios, and to identify the scale of need for water resources that will result. From this modelling we have selected a basis for our adaptive planning that covers all but the most extreme high and low ranges of need.

1.16. Our forecasts take account of how existing sources of water will be affected in future droughts, through climate change, as a result of population growth, and the need to leave more water in the environment to protect valuable habitats such as chalk streams. We need to plan to ensure supplies to customers are protected in an extreme drought (a 1 in 500 year drought).

1.17. We forecast that in a 1 in 500 year drought, without any of the proposals in the regional plan, there will be a deficit of between approximately 1,200 and 2,700 million litres of water a day (Ml/d) under the least and most challenging futures selected in our regional plan. By 2075 this deficit could worsen to between 1,200 and 3,000 Ml/d under the least and most challenging futures.

1.18. Our forecasts also enable us to quantify what is driving the need for additional water in the future. By 2075, we forecast that:

- 48% of the need for additional water is as the result of the need to improve the environment, through abstraction reduction;
- 8% results from the challenges of climate change;
- 29% results from population growth and non-household growth; and
- 15% from making water supplies resilient to more extreme drought events.

1.19. The scale of the deficits we have forecast is very significant, and requires significant action and investment on the part of our member companies, the Government and customers to ensure that water supplies will be protected into the future, whilst at the same time ensuring greater protection for the environment. This is the outcome that our regional plan seeks to achieve.

1.20. Having forecast how much additional water is needed in the future, WRSE assessed in detail the potential water resources options available to it. The options include measures to reduce demand and tackle leakage, as well as the development of new resources including reservoirs, pipeline and canal transfers, water recycling and desalination. Feasible options were made available for selection within the regional plan modelling.

1.21. WRSE modelled a series of alternative strategies, to test which options were selected by the model under different adaptive pathways or 'scenarios'. This

enabled WRSE to test the robustness of the regional plan to be able to adapt to different futures, and to determine the best value plan.

Our regional plan proposals

Demand management measures

1.22. The majority of the total water needed in the first 15-years of the planning period will come from reducing how much is used and what is wasted through leakage. This action plays an important role in securing water supplies across the planning period. By 2050, achieving the level of demand reduction identified in our plan will continue to provide over half the additional water we will need to address the shortfall in water supplies.

1.23. Our revised draft regional plan proposes to reduce leakage by 20% by 2027; by 30% by 2032; and by 50% by 2050. Every customer will also need to lower their water use to help meet national targets of 9% by 2027; by 14% by 2032; and by 20% by 2038 – so that by 2050 we all use only an average of 110 litres of water per person, per day. This is a greater level of reductions than were proposed in the earlier draft regional plan.

1.24. The levels of leakage and usage reductions in the plan are ambitious but our analysis shows this increased level of activity, beyond what was committed to by some companies in their previous WRMPs, is required if more significant reductions to abstractions are needed to protect the environment in the long-term. Delivering them will rely on new approaches and technologies that are yet to be tried and tested, as well as changes to customer behaviour and government policy.

1.25. Progress with these measures will need to be monitored closely, as if it is not achieved, we risk not having enough water to supply the people of the region and we could need to develop alternative water sources instead. Alternatively, we could develop more new sources of water earlier in the planning period to reduce our reliance on demand management measures.

New resource developments

1.26. Although demand management makes a significant contribution, a large number of new resources development are also required to meet the scale of water need over the planning period. This includes options to import water into the South East region, as well as major new transfers between our member companies and the areas that they supply. New reservoirs, water recycling schemes and desalination plants, as well as groundwater and below ground storage will also be required.

1.27. By 2035, our regional plan proposes to:

- Complete the construction of 1 new reservoir in Hampshire (Havant Thicket) and start to build 1 new reservoir in Oxfordshire (SESRO) and 1 in Kent (Broad Oak).
- Develop an inter-regional water transfer scheme using the Grand Union Canal to transfer water from the Midlands to the South East
- Develop 6 water recycling schemes in London, Kent, West Sussex, Hampshire and the Isle of Wight
- Develop 6 groundwater schemes across the region so we can store extra water in these vital sources.

1.28. The basket of options selected in the revised draft regional plan is different from that set out in the earlier draft regional plan, following updated modelling for this plan. WRSE is proposing a larger reservoir in Oxfordshire than in the draft regional plan, as this represents the best overall solution for the region when compared against alternative plans.

1.29. A number of other options are selected at different dates or sizes than in the draft regional plan, some as a result of our member companies changing delivery dates for the schemes, and others as the model determined that they were not needed until later in the plan as a result of the increased demand management measures now selected. However, the Grand Union Canal transfer has been brought forward as a single phase large scale transfer in the revised draft plan as the modelling determined it was required sooner to enable abstraction reductions to be delivered in that part of the region.

1.30. The Severn Thames Transfer is no longer selected as an option in the modelling, however the regions and companies involved with the option have committed to continue to investigate it as it represents a key strategic

alternative solution should monitoring determine that additional resources are required.

1.31. Between 2035 and 2075, our regional plan also proposes to:

- Complete the construction of the new reservoirs in Oxfordshire and Kent, and construct new reservoirs in West Sussex and East Sussex
- Build 6 desalination plants in Kent and West Sussex
- Develop 11 groundwater schemes across the region so we can store extra water in these vital sources.
- Develop 3 more water recycling schemes in Kent, West Sussex and East Sussex
- Develop new transfers from new strategic sources of water (such as reservoirs) to move more water around the South East

1.32. This is a lesser scale of new resources development than proposed in the earlier draft regional plan, again as a consequence of the increased demand management measures now selected in the revised draft regional plan. Over the longer term the regional plan identifies the need for significant investment in water recycling and desalination options, including a large number of options in Kent and Sussex, which will require investigation and assessment to overcome environmental challenges.

1.33. WRSE has calculated that the cost of the plan could be £19.3billion by 2075. Funding for the delivery of the proposals in the regional plan would be sought by our member companies through their five yearly Business Plans. The necessary investment is ultimately secured through customer bills.

1.34. WRSE has assessed the regional plan proposals in a series of environmental assessments which are to be published alongside the regional plan. This includes necessary Habitats Regulations, Water Framework Directive, Biodiversity Net Gain and Strategic Environmental Assessments.

1.35. The regional plan proposals that WRSE has selected demonstrably deliver best value for the region, performing better when assessed against a series of best value metrics than a plan which is selected based on cost alone.

Finalising our plan

1.36. The revised draft regional plan is being published for information, and not for a further period of public consultation. The publication of the revised draft regional plan is to support the ongoing and separate statutory processes being undertaken by WRSE's member companies to prepare their WRMPs.

1.37. Affinity Water, Portsmouth Water, SES Water, South East Water and Thames Water have submitted their revised draft WRMPs and their Statement of Responses to the Government and will now wait for it to indicate whether they can finalise their plans, whether further changes need to be made, or whether a hearing or inquiry into the WRMP is required before finalisation. The five companies expect to hear from the Government before the end of 2023.

1.38. The sixth company, Southern Water, has published its Statement of Response on its website and submitted its revised draft WRMP to regulators. Southern Water will publish its revised draft WRMP when given permission to undertake further consultation by the Secretary of State. It will then prepare a further Statement of Response document and may need to further update its revised draft WRMP before submitting it to the Government.

1.39. WRSE will wait to learn the Government's feedback on the individual company revised draft WRMPs before finalising the regional plan. This will enable it to ensure that the regional plan and company WRMPs are aligned on completion of this cycle of planning. WRSE is also working closely with the other regional water resources groups to ensure alignment between regional plans.

1.40. Where individual company WRMPs are not yet finalised when our final plan is published, we will ensure our plan clearly identifies how it can and will adapt to any changes to remaining WRMPs as they are finalised themselves. WRSE currently anticipates that the earliest the final regional plan will be published is early to mid-2024.

Our regional planning process

2. Introduction to WRSE and regional planning

2.1. This document is Water Resources in the South East's (WRSE) revised draft regional plan for the South East of England. It is an updated version of the draft regional plan that was published for consultation in November 2022.

WRSE and regional planning

2.2. In 2020, the Environment Agency published the first National Framework for Water Resources[1] to transform how we plan future water supplies. It requires water companies and other large water users to collaborate across boundaries, and, through regional water groups, develop plans that consider their region's water needs. These plans should then fit together to provide a joined up national solution.

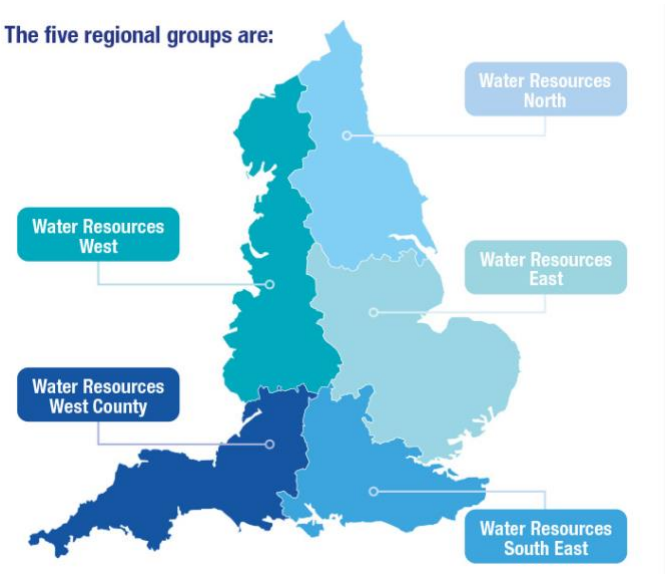
2.3. WRSE is one of five regional groups which together includes all the water companies operating in England (see Figure 2.1), and other major water users. Each regional group is producing a strategic water resources plan. This assesses the future need for water and identifies the set of options that present the best value to customers, society and the environment to secure long-term resilience.

2.4. WRSE is an alliance of the six water companies which cover the South East of England - Affinity Water, Portsmouth Water, SES Water, Southern Water, South East Water and Thames Water (see Figure 2.2). Production of a regional water resources plan for the South East is our central activity.

2.5. WRSE was established in the late 1990s and since then has been developing regional strategies that companies have referenced in the development of their own statutory Water Resource Management Plans (WRMP). Our last strategy, From Source to Tap[2], set out scenarios and corresponding strategies to tackle future challenges in South East England.

2.6. Water resources planning is the process we follow to ensure that there is a secure and reliable supply of water to meet the anticipated demands of customers. In doing this we take account of the likely effects of many individual factors, including climate change, population growth and changing environmental policy and legislation.

Figure 2.1: Map showing regional water groups

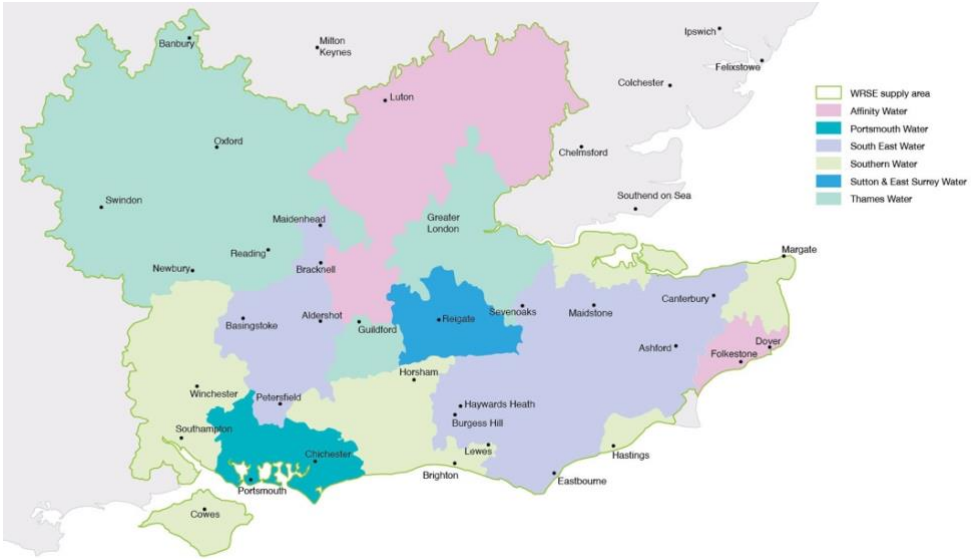


2.7. We achieve this by looking ahead to assess what the balance between available water supply and future customer demand might be, under normal, dry or very dry years.

[1] https://www.gov.uk/Government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources

[2] https://www.wrse.org.uk/media/ruymzrt0/from_source_to_tap.pdf

Figure 2.2: Plan showing WRSE area and our member water companies



2.8. In normal or wet years, there is generally plenty of water to supply customer demand and for the environment. Average or higher than average rainfall gives rise to correspondingly average or high river flows and groundwater levels, with plenty of water available for abstraction from rivers or groundwater. Customer demand also tends to be lower.

2.9. By contrast, in a dry year the water environment is under stress and the availability of resources to supply customer demand can be significantly reduced as river flows and groundwater levels tend to be much lower. Customer demand for water also tends to be higher, particularly in summer months. In these dry years, the spare water resource capacity is reduced and the risk that we may have a shortfall of water to supply demand increases.

2.10. The primary objective of water resources planning is to ensure that there are always enough supplies available to meet anticipated demands, under various weather conditions, but in particular in dry and very dry conditions. We assess supply and demand under both annual average and critical period scenarios, and for different drought conditions.

2.11. Our regional plan for South East England looks ahead to 2075 and addresses the planning challenges that we face.

Our Regional Plan journey

2.12. WRSE's work on this regional plan formally commenced in September 2019 when the six member companies agreed to prepare a regional plan, ahead of the preparation of their individual WRMPs as required by the National Framework. The development of a regional plan for the South East region requires detailed and complex technical work.

2.13. Some of this work builds on that undertaken by our member companies for previous WRMPs, however in many cases WRSE has developed and implemented new methods and datasets as part of this regional plan.

2.14. Preparation of the regional plan is a multi-stage process undertaken over several years. Figures 2.3 and 2.4 provides a high level overview of the approach we have taken, illustrating the body of work completed to date, and the stages of work that are yet to come. Further details on these stages are provided throughout this document. WRSE's document library on the WRSE website provides all published reports.

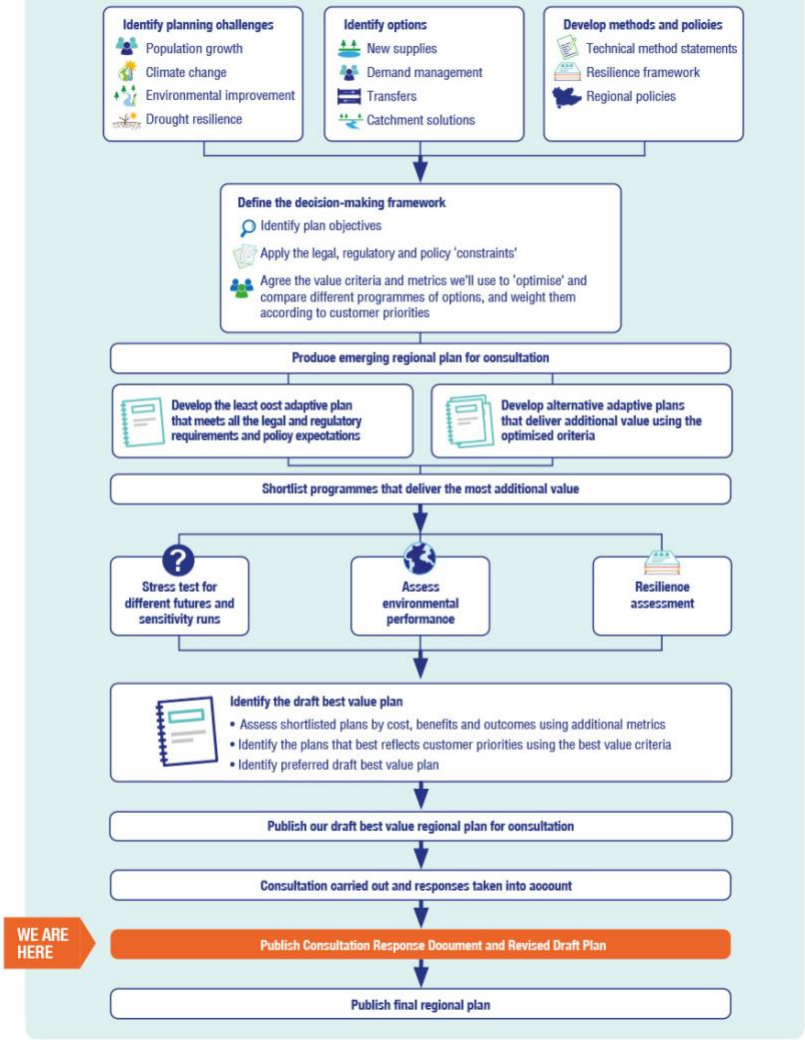
Engagement

2.15. We have engaged extensively through the preparation of the regional plan, with regulators, stakeholders, our customers and members of the public. This has included consulting with stakeholders on the future water resource requirements, key policies underpinning our plan, the draft method statements that explain the approaches we are using to prepare the plan, and the demand management and new resources development options available for selection.

2.16. We have also engaged with customers to identify and understand their priorities and preferences, both through widespread customer research and focus groups. This is particularly important given that the investment

required to implement the regional plan proposals will include that funded through customer bills.

Figure 2.3: Regional planning process overview



Consultation on the Emerging Regional Plan (Jan 2022)

2.17. In January 2022, we published our emerging water resources regional plan for a period of public consultation. The emerging regional plan presented a cost-efficient plan, with the best value planning not completed at that point.

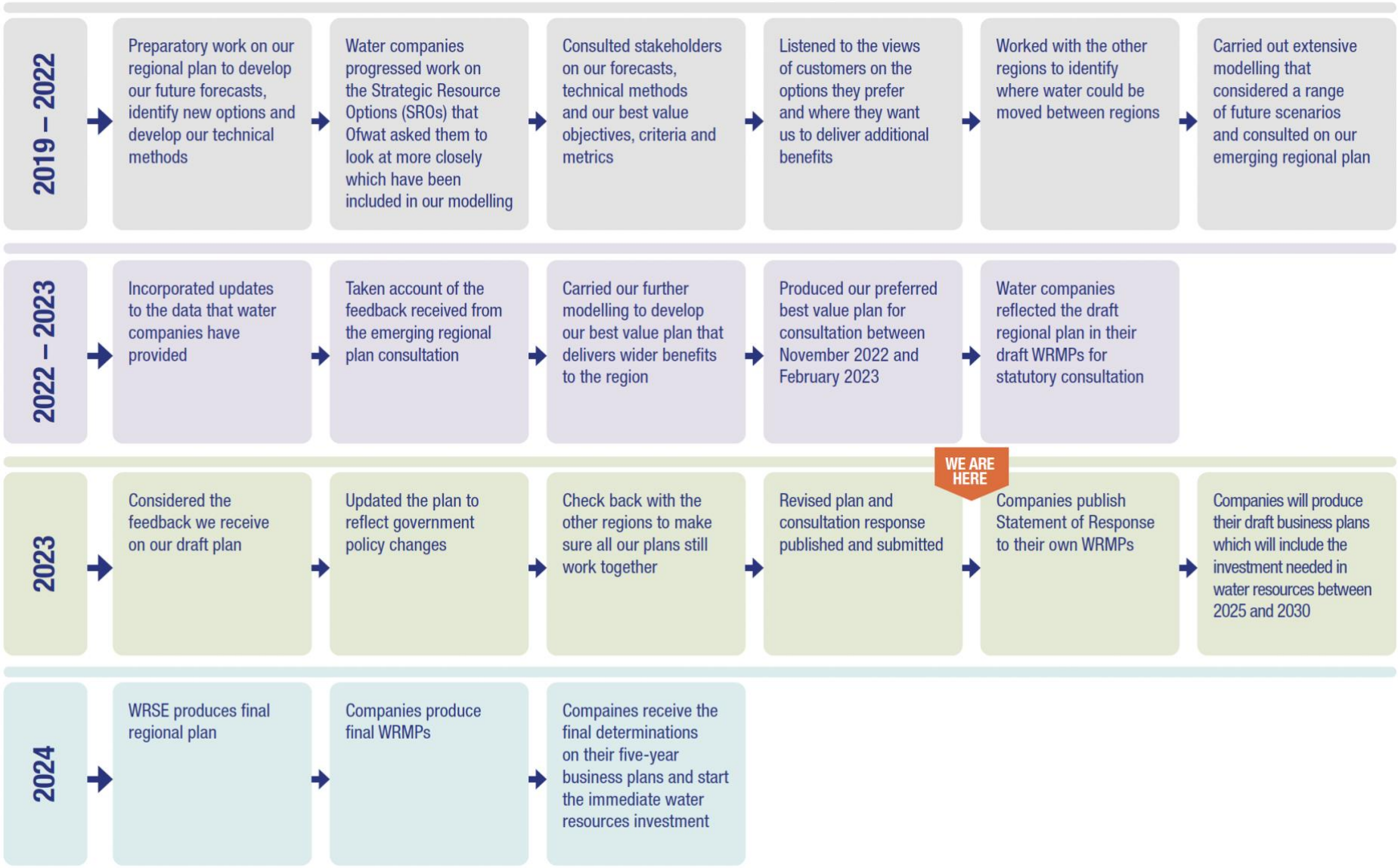
2.18. Consultation on the emerging regional plan took place between January and March 2022. Over 1,150 responses were received to the consultation from a range of stakeholders, and these were reviewed and taken into account by WRSE as it prepared its draft regional plan. WRSE published an emerging regional plan Consultation Response Document in May 2022, to summarise the comments received and its response to them.

Consultation on the Draft Regional Plan (Nov 2022)

2.19. In November 2022, we published our draft regional plan for a period of public consultation, following the completion of our best value planning processes. The best value plan identified the detailed demand management and new water resources developments required to be delivered in response to the significant scale of water resources challenges the South East is facing. The draft regional plan explained how the proposals in the plan are capable of being adaptive to a wide range of futures, with new investment in the early part of the plan period capable of adapting to any potential futures that may arise.

2.20. Consultation on the draft regional plan took place between November 2022 and February 2023. Over 900 responses to the consultation were received, from a wide range of organisations and individual stakeholders. The majority of the responses were focused on individual new resource developments proposed in the draft regional plan, including new reservoir proposals, water recycling proposals, water transfer proposals and desalination proposals. WRSE has considered all of the responses received as part of preparing this document, the revised draft regional plan. Alongside the consultation on our draft regional plan, WRSE and our member companies also commissioned additional customer research on the proposals in the draft regional plan. This research has provided further insight into how our customers view and value the proposals in the regional plan (see Appendix 4 to this document for further information).

Figure 2.4 – Our regional plan journey



2.21. WRSE published its draft regional plan Consultation Response Document on its website in August 2023, alongside the publication of this revised draft regional plan. The Consultation Response Document summarised the comments received on the draft regional plan, and provided WRSE's response to them, and how the regional plan has changed in response.

The revised draft regional plan

2.22. This revised draft regional plan builds on our emerging plan and draft plan consultations and the feedback we received on them.

2.23. Since the consultation on the draft regional plan we have addressed the feedback we received and made a number of changes to our approach, as summarised in Table 2.1 below.

Table 2.1: Changes since our draft regional plan

Topic	Key changes made to the plan
Whole Plan	Document restructured and detail amended to reflect consultation feedback.
Population and Demand Forecast	Updated population and growth forecasts, and household and non-household demand forecasts, including covid impacts on demand, as set out in Section 4 of this document.
Environmental Forecast and Environmental Ambition[3]	Updated environmental profiles from member companies, reflecting continued engagement with regulators and stakeholders, as set out in Section 4 of this document.
Best value planning and decision making	Clearer explanation of best value planning and decision making processes, as set out in Sections 8 and 17 of this document.
Demand Management Options	Updated demand management options within the plan, and commitment to meet the Government's Environmental Improvement Plan targets, including interim targets. This brings forward demand management measures earlier in the plan period, as set out in Section 11 of this document.
Drought options	Updated list of available drought options and environmental assessments of drought options incorporated into the regional plan, with updated list of drought options selected as set out in Section 15 of this document.
Water resources options	Updated scheme information, cost, best value metrics and delivery dates incorporated into the investment modelling. Updated best value plan selected and presented in the revised draft regional plan, including changes to water resources options selected, timing and deployable outputs, as set out in Sections 9 to 17 of this document.
Catchment management options	Additional catchment management options included compared to draft regional plan, as set out in Section 14 of this document.
Environmental assessments	Environmental assessments updated to reflect updated scheme information, feedback from environmental regulators, and additional assessment work undertaken since draft regional plan, as set out in Section 16 of this document.
Southern Water scheme delivery	Sensitivity testing of scheme delivery for the Hampshire Water Transfer and Water Recycling

[3] 'Environmental ambition' is the phrase we use to describe the Environmental Destination set by the National Framework for Water Resources

Topic	Key changes made to the plan
	Project delivery date, and confirmation this change (if agreed) does not affect the wider regional plan, as set out in Sections 12 and 17 of this document.

2.24. This revised draft regional plan incorporates the above changes, and presents an updated best value plan, with changes to the demand management and new water resources development selected in the plan.

Throughout this revised draft regional plan we provide a number of summary boxes to highlight differences from the draft regional plan. These seek to summarise and signpost the changes we have made to the plan.

2.25. The revised draft regional plan is being published for information, and not for a further period of public consultation. The publication of the revised draft regional plan is to support the ongoing and separate statutory processes being undertaken by WRSE's member companies to prepare their individual Water Resources Management Plans (WRMPs).

2.26. Following consultation on draft WRMPs in late 2022 and early 2023, the companies have themselves prepared Statements of Response, identifying the comments received on their draft plans and how the WRMPs have changed as a result. Those Statements of Response and revised drafts of the WRMPs have also now been published by five of the six companies. Details are on their respective websites. The sixth, Southern Water, has published its Statement of Response on is website and submitted its revised draft WRMP to regulators. Southern Water will publish its revised draft WRMP when given permission by the Secretary of State to undertake further consultation.

2.27. WRSE expects to finalise its regional plan in early to mid 2024 (see Section 18 of this document for more information).

Our governance structure and assurance

Governance structure

2.28. WRSE has developed a structure and governance that allows for greater access for a wide set of stakeholders to influence the process, decision-making and delivery of solutions so that our plan is truly collaborative. It provides for strong links with other regional groups and greater use of markets and competition.

2.29. Our work is governed by a Strategic Leadership Team (SLT) comprising our member water company and regulatory members. This is advised by our Executive Team (supported by an Oversight Group (OSG), Programme Management Board (PMB) and Engagement and Communications Board (ECB)) and by our Stakeholder Advisory Board which is itself supported by a multi-sector group, environmental advisory group, and customer challenge group.

Assurance

2.30. We recognise the importance of ensuring that we have followed robust processes in developing this plan. In July 2020 we published and consulted on a series of method statements[4] to provide confidence and assurance to our member water companies, regulators and stakeholders that:

- our methodologies are suitable, good practice and compliant with all relevant guidelines and regulatory direction;
- we have followed the methodologies we have set out and consulted on; and;
- all data inputs to the regional planning process have been uniform and correct.

2.31. The method statements were subsequently updated and re-published on our website to reflect the consultation comments, and also updates to regulatory guidance. We continue to keep the method statements under

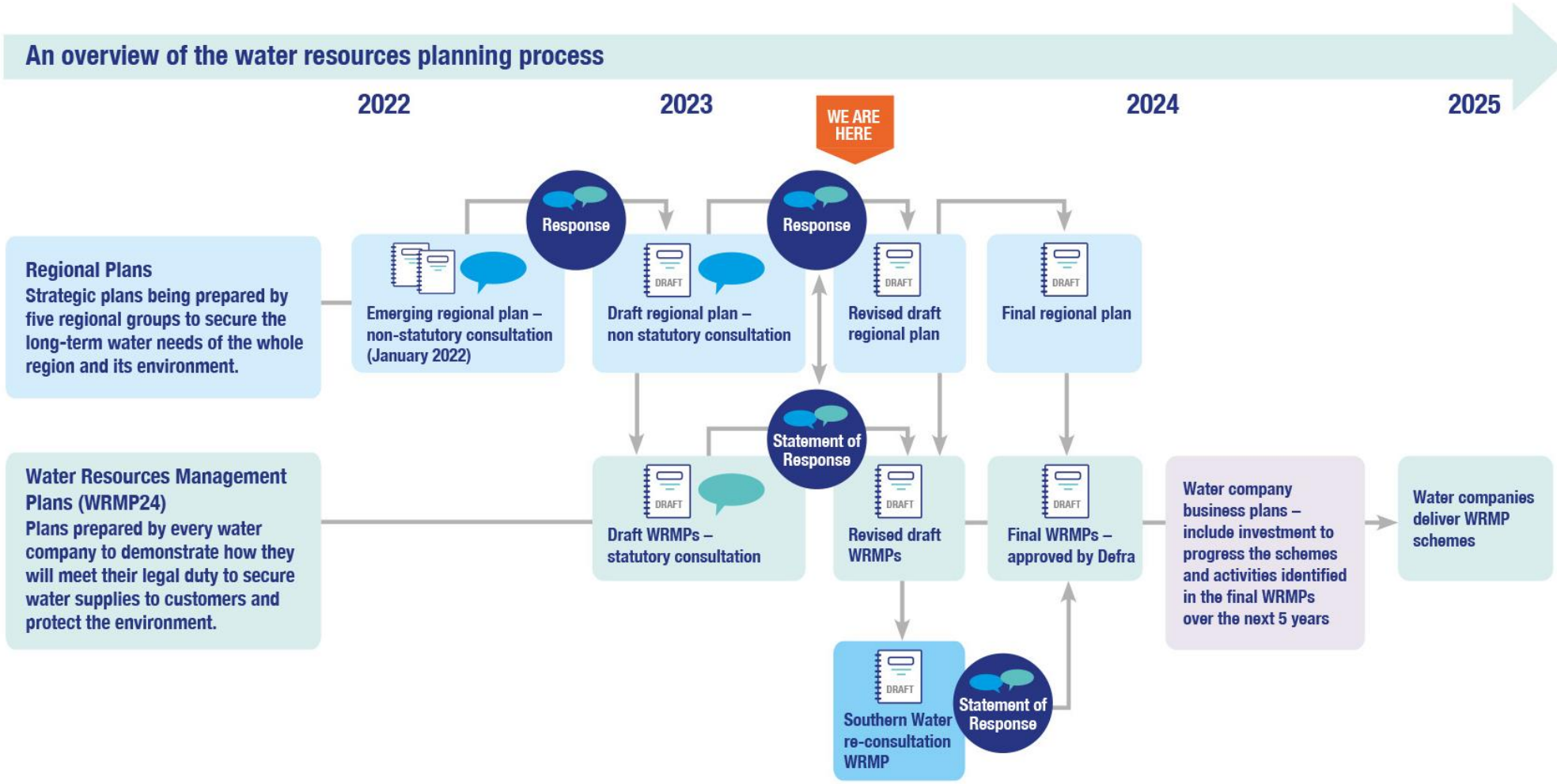
review and have published updated documents when our methodologies have needed to change.

2.32. WRSE receives data and information from its member companies and both it and its member companies commission their own research and modelling. A quality assurance programme has been adopted to scrutinise all data and processes, with external audit findings presented to the WRSE SLT for review and sign-off as the regional plan progresses. Our member companies have assured the input data for the regional plan, and WRSE has undertaken process assurance checks to ensure consistency with method statements.

2.33. WRSE has published a separate method statement setting out the assurance work that has been undertaken on the regional plan. This can be found in our WRSE Document Library.

2.34. The WRSE investment model is a mathematical optimisation model, which has been collaboratively developed by a number of suppliers. It is a complex problem solving tool to support the development of the regional plan. We commissioned an assurance review of the investment model to confirm the robustness of the work undertaken. This confirmed that the investment model operates in the way it was originally intended, without bias, and that the model is fit for purpose. We have published the Investment Model External Review report in the WRSE document library on our website.

Figure 2.5: Regional plan relationship with the WRMP and our member company business plan processes



Links with other plans and processes

2.35. Our regional plan has a close relationship with our member company's Water Resource Management Plan (WRMP) and business plan processes as shown in Figure 2.5. It should be noted that the timing for the finalisation of the regional plan and company WRMPs in Figure 2.5 is dependent on whether the Secretary of State determines that further information or potentially a hearing or inquiry is required before individual WRMPs are finalised. Further plans and strategies, and regulatory processes also have a relationship with the regional plan as summarised below.

Water Resource Management Plans

2.36. Water companies have a statutory duty to develop and maintain an efficient and economical water supply system[5] and ensure arrangements are in place to achieve this. They prepare, publish and maintain a WRMP which sets out how this obligation is achieved. The Water Resources Planning Guideline[6] (WRPG) sets out the requirements to be followed in producing their WRMPs. WRMPs are statutory and current legislation sets out the process for consultation and subsequent statement of response. A WRMP should reflect the regional plan unless there is clear justification for not doing so, and each WRMP must explain how it has reflected the regional plan and why the preferred programme has been selected.

2.37. In developing this regional plan, we have worked collaboratively with our six member companies to develop technical processes and procedures that apply both to the regional plan and the companies' own WRMPs. Our revised draft regional plan informs the revised draft company WRMPs, as shown in Figure 2.5. The timetable for our respective technical work and consultation has been developed to allow this to happen. This marks a significant change in approach. In previous water planning cycles, WRSE modelled different strategies based on data and solutions provided by the water companies and presented a series of scenarios rather than a preferred regional solution.

2.38. The new approach that has been adopted means that we have identified the water need across the whole region based on common standards and policies and modelled optimal regional solutions. Following consultation on draft plans and production of revised draft plans, we will publish our final regional plan alongside the companies' final WRMPs.

Company Business Plans

2.39. Company Business Plans are prepared on a 5-year cycle to identify the investment decisions that each individual company will take, including those derived from WRMPs, Drought Plans and Drainage and Wastewater Management Plans (DWMPs).

Strategic Resource Options and RAPID

2.40. Strategic Resource Options (SROs) are strategic schemes that have the potential to provide solutions to water needs for regions and between regions across England. There are a number of strategic resource options (SROs), which are currently being investigated in more detail to better understand the amount of water they can provide, the earliest date the water will be available, the area(s) that would benefit and to identify and address any issues that could stop or delay them from being built.

2.41. Ofwat has made up to £469m available to a range of water companies to progress SROs. This work is being led by the relevant water companies and overseen by RAPID – the Regulators' Alliance for Progressing Infrastructure Development – which is made up of a team of experts from the Environment Agency, Ofwat and the Drinking Water Inspectorate. RAPID's aim is to ensure that any necessary strategic resource options are "construction ready" for the 2025-2030 period.

2.42. Delivery of SROs is subject to a formal gated process governed by RAPID (see The RAPID gated process - Ofwat). The purpose of this is to ensure that at each gate the solutions merit continued investigation and development, and that companies progress SROS in a cost efficient way.

[5] https://www.legislation.gov.uk/ukpga/1991/56/part/III

[6] https://www.gov.uk/Government/publications/water-resources-planning-guideline/water-resources-planning-guideline

2.43. At the end of each gate, if an option is no longer considered to merit further investigation, then investigation of that option ceases through the RAPID process. We have been able to reflect RAPID's consideration of SROs in our regional plan. SROs have been included as options available for selection as part of our option appraisal process, utilising information submitted through the RAPID process.

Company Drought Plans and Drainage and Wastewater Management Plans

2.44. The regional plan is also informed by individual company drought plans as these identify options available for use by companies in a drought. These statutory plans are prepared on a 5 year cycle to describe the steps our water companies will take to maintain adequate supplies of water to customers and to protect the environment in the event of a drought.

2.45. Water and sewage companies (in the South East this is Thames Water and Southern Water) have also been developing the first iteration of long-term Drainage and Wastewater Management Plans (DWMPs). Our regional plan is being prepared in tandem with the DWMPs and we are investigating the longer-term potential for solutions to be identified across the water and wastewater sectors that achieve wider benefits.

Regional reconciliation

2.46. WRSE is one of five regions preparing their own regional plan. Given the key role which sharing resources across regional boundaries plays in water resources planning there has been a high degree of regional collaboration. For WRSE, key interfaces are with West Country, East and West regions, although there has been close collaboration across all regions. We explain more about regional reconciliation in Section 6 of this document.

WRSE's vision and policy objectives

2.47. Our regional plan for South East England looks ahead to 2075 and addresses the water resources planning challenges that we face. Our plan seeks to:

- Ensure there is enough water for a growing population and to support economic growth
- Improve the environment by leaving more water in the region's rivers, streams and underground sources
- Increase the region's resilience to severe drought and other extreme shocks and stresses
- Address the impacts of climate change on demand for water and how much is available.

2.48. Improving how we manage water resources in England is a critical part of achieving the Government's ambition to leave the environment in a better state than when they found it, and improve the nation's resilience to drought. This ambition is shared by WRSE and our member water companies.

2.49. The South East faces some of the most significant challenges to water resources in the future. Most of the region is already classified as water stressed and its population is set to grow, with major growth corridors planned in some areas.

2.50. The impact of climate change will be felt acutely in the region, bringing changes to the amount and pattern of rainfall which are likely to, in turn, change the types of droughts we face in the future. Consequently, this will reduce how much water is available for us all to use. Furthermore, the region is home to some of the nation's most sensitive habitats including internationally renowned chalk streams, some of which are currently relied upon by our member water companies and other abstractors to provide the water needed. Our plan will enable the South East to move to a position of more sustainable abstractions to benefit the environment.

2.51. The future is uncertain, and our plan will need to be adaptive, enabling us to accommodate a range of different futures and uncertainties. We have engaged with customers and stakeholders across the region to understand their priorities and preferences to formulate our regional plan.

Our policies

2.52. Our regional plan is informed by policies that we have developed in consultation with water industry regulators, customers and stakeholders.

We set out and consulted on our policies in August 2020[7] and responded to the consultation in October 2020[8]. Key concepts that have shaped our plan are set out below.

Policy based on best value

2.53. We are adopting a best value approach for our regional plan. In the context of water resources planning, this means seeking solutions that are cost efficient and secure supplies for customers, but also increase the overall benefit to customers, the wider environment and society as a whole.

2.54. This means that the water resource programme that is chosen for the regional plan may not be the cheapest, but delivers additional value as defined through the best value criteria.

Saving water

2.55. Saving water and using water more efficiently is a matter of huge importance to deliver environmental improvements and resilience. As water availability becomes increasingly stretched by pressures from climate change, population growth and rising demand, the more we can do to reduce water demands the more sustainable our future will be.

2.56. Personal water use ranges from an average of 127 to 155 litres per person per day in the South East and the majority of customers in the region have already been switched, or are due to be switched, to metered charges over the next five years – a key water company activity to reduce demand.

2.57. While water saving interventions may not always be the lowest cost solutions to secure reliable supplies, they are high on the agenda in terms of long-term sustainability, and companies have a legal duty to promote the efficient use of water. Our ambition is therefore to reduce water use and leakage across all sectors.

Leakage

2.58. While nationally leakage has fallen by 40 per cent since 1997[9], a fifth of all drinking water is still lost through leaks in water pipes. WRSE and our member water companies are committed to reducing leakage by 50 per cent of the levels seen in 2017/18 by 2050. Beyond that, from 2050 to 2075, the level of leakage reduction will be based on an assessment of options to determine which offer the best value. Leakage will still continue to reduce, although the scale of change may not be as great as in the period to 2050.

2.59. Our member water companies have different levels of leakage and their leakage rates have changed at varying rates over the past few years. We have therefore explored what would be involved in delivering the 50 per cent reduction across our member companies – the cost, how it could be delivered, and any additional benefits and risks of not being able to meet the target. Beyond 2050, we have discussed with our customers and stakeholders whether reducing leakage further, or providing new resource schemes or water efficiency will offer better value in the future.

2.60. Funding for leakage will need to be agreed through successive five year water company business plans and WRMP cycles. As this may require significant long-term investment to replace water mains, this policy will need to be regularly reviewed and will require on-going engagement.

Personal water use

2.61. Our plan will set out a path to reduce per capita consumption (PCC) based on evidence, best value, local circumstances and engagement with customers and stakeholders. We have assessed different PCC targets and dates for achieving them, to see what effect this has on our proposals in the plan, including a range of demand management scenarios, with and without government interventions, to demonstrate and better understand the range of reductions that we may see in our region.

[7] https://www.wrse.org.uk/media/navh0vze/wrse-policies-consultation-document-04082020.pdf

[8] https://www.wrse.org.uk/media/lnjnyemc/wrse-response-to-policies-consultation_051020.pdf

[9] https://www.ofwat.gov.uk/households/supply-and-standards/leakage
/

2.62. The Government has introduced a national target for PCC of 110 litres per person per day by 2050 (in a dry year). We have incorporated this into our revised draft regional plan, and the Government's Environmental Improvement Plan[10] requirements for interim targets to be met before this date, however achieving these is reliant upon government interventions that are not yet part of government legislation.

2.63. Our member companies have already achieved important reductions through metering and changes to customer behaviour, with further reductions in PCC expected from smart metering and water efficiency measures. Achieving the Government's national target will require decisive action by the Government, going beyond current policy decisions and announcements and including labelling of white goods and building regulations. There are risks in relying on government policy decisions that have not yet been made, and we explore these risks further in Section 17 of the plan and explain our monitoring approach in Section 19 of the plan.

The environment and future resilience policy positions

2.64. We face an environment and climate crisis in the South East and share the ambition of customers, interested groups, regulators and the Government to protect and improve the environment in our region. Part of this is to reduce abstraction of water from rivers and groundwater where this causes unacceptable harm to vulnerable environments, particularly during droughts, with a particular focus on internationally and nationally significant and rare chalk streams. We and our member companies are working with catchment partnerships and other stakeholders to derive integrated catchment plans that can be delivered by multiple parties.

2.65. While many actions have already been identified, the National Framework for Water Resources[11] suggests significantly more changes are needed in the future and we believe it's in the best interests of customers and the environment to start planning for these now. We want to make a step change in protecting both customer supplies and the environment from future shocks and stresses, as outlined in our policy positions below on the environment, resilience, levels of service, drought orders and permits and supporting private water supplies during drought.

Environmental ambition

2.66. Environmental ambition has never been as important as it is now. We're pursuing our strategic and technical work, as well as our engagement with customers and stakeholders, to understand how we can play our part to identify and deliver a progressive level of environmental protection, enhancement and adaptation for our region. We'll continue to work with regulators and the Government to discuss how to make this a practical reality, including the best way to secure funding.

2.67. Our approach in the plan is to move beyond the traditional approach of limiting environmental needs based on the requirements set out by the Environment Agency in WINEP (Water Industry National Environment Programme). Until now, this has limited WRMPs to consider only these mandatory actions in the next 5 years designed to improve the health of the water environment. Instead, we are planning for the longer term, adopting the National Framework expectations and modelling the implications of these, and other environmental scenarios for both existing sources of water and future options.

2.68. The WRPG requires that we properly consider environment and society in our decision-making. This means that we must demonstrate overall positive environmental benefit from our plan. We need to ensure that regional plan proposals will have less impact on the environment than any environmental challenges we are trying to solve. The guidelines also specifically require us to consider biodiversity net gain through the plan as a whole and individual options, and to undertake natural capital assessments.

2.69. We have been and will continue to work with the Government and regulators to make sure they support the ambitions of our customers and stakeholders to create a sustainable environment, so we're confident

[10] *Environmental Improvement Plan (2023)*

[11] *https://www.gov.uk/Government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources*

funding can be secured through water company business plans and potentially other sectors.

Resilience

2.70. All water supply systems are designed to deal with a certain level of drought before they need to rely on drought measures, or in some circumstances more extreme drought restrictions such as rationing water. Since privatisation the level of resilience of the system has on the whole been improving, but more needs to be done and we need to offer a greater level of protection to both the environment, by not using drought permits as frequently, and customers. This means designing the system to be able to cope with more severe droughts in the future than it has seen in the past.

2.71. The industry has worked hard on understanding how future droughts of different severities and durations can impact the water supply systems in the South East and from this work we understand how much of a shortfall in supplies could occur if a more extreme drought were to occur in the region. We have used this knowledge in helping to derive the regional plan.

2.72. In line with Government expectations and guidance we therefore intend to increase resilience of the region's water resources to drought so the need for emergency drought restrictions, such as rota cuts or standpipes, reduces. The WRPG requires companies, and therefore the region, to move the design of the regional systems to be able to cope with a 1:500 year drought, without the need for water rationing by no later than 2040, unless it can be shown that more cost-effective solutions can be achieved by delaying achieving this standard until 2045 or 2050. This marks a change in the current design standard for the system and planning to a more severe drought typically reduces the availability of water from existing and future sources to a greater or lesser extent. We have planned on this basis, and explain our assessment of the results, and sensitivity around these dates in Section 17 of the plan.

2.73. Other aspects of resilience supported by customers and stakeholders have been explored as set out in our resilience framework published in June 2020[12]. This aligns with the National Infrastructure Commission's resilience document – Anticipate, React, Recover published in May 2020[13]. Through our plan we have developed a wider understanding of the vulnerability of water in the region and how a joined-up approach to resilience planning can offer better value for everyone.

Levels of service

2.74. Through this plan, our member water companies have worked towards a common service level for all customers in the South East for temporary use bans (TUBs) and also looked at the potential for non-essential use bans (NEUBs) in the longer term. Water companies include the use of TUBs (formerly hosepipe bans) and NEUBs (the next step of restrictions which also extend to businesses) as part of their water resource planning. This balances the need to invest significant amounts in water sources, which otherwise would not be needed very often, but would drive up customers' bills.

2.75. Currently these planned frequencies range across our member companies from once in every 10 years on average to less than once in every 20 years for TUBs; and once in every 20 years on average to less than once in every 80 years for NEUBs.

Drought permits and orders

2.76. Our member companies have a range of drought permits and orders they can call upon to secure supplies for customers during droughts by taking actions such as temporarily increasing abstractions, lowering minimum flow limits or bringing new abstractions online. These permits and orders are set out in the statutory drought plans and have been subject to a separate consultation process. The Environment Agency made clear in its National Framework these could be used to deliver increased resilience, but not at the cost of the environment.

[12] https://www.wrse.org.uk/media/pqvnpbpl/wrse-resilience-framework-technical-report-consultation-document.pdf

[13] https://nic.org.uk/app/uploads//Anticipate-React-Recover-28-May-2020.pdf

2.77. However, given the very sensitive nature of the environment in the South East, particularly vulnerable chalk streams, and given customers' and stakeholders' concern for the environment, we haven't planned to include permits and orders unless the Environment Agency is satisfied that they pass suitable sustainability tests. We recognise that drought orders and permits may still be required, as tactical options in the interim, where more sustainable, strategic options may take several years to deliver. Keeping some permits and orders in reserve allows us to further avoid the use of extreme restrictions like rota cuts and standpipes, something customers have repeatedly said they would find unacceptable.

2.78. Our plan aligns with the approach to drought permits and orders set out in the Environment Agency's National Framework and the WRPG. Whilst these have a role to play in improving levels of service and drought resilience to 1:500 years, our plan only proposes to use these where they would not unnecessarily harm the environment.

Private water supplies during drought

2.79. Our plan supports some private water supplies where public health or the welfare of animals could be at risk in a severe drought. During a severe drought, private water supplies which support agriculture, animal farming and private homes can become unreliable or unavailable. Technical work we have undertaken in preparing our regional plan is showing that between 2-3% of private water supplies could become unreliable under 1:500 drought scenarios. Water companies may, and often do, step in to share supplies under public health and animal welfare legislation, so they do not place additional pressure on resources and the environment at a time when they are already severely stretched.

Pathway to net zero carbon

2.80. The UK became the first major world economy to set a target for achieving net zero on greenhouse gas emissions into law – committing to net zero operating emissions by 2050. As one of the more energy-intensive sectors in the UK, the water industry has set itself a stretching target to achieve net zero operational carbon by 2030. The November 2020 Water UK Net Zero 2030 Routemap[14] set out the actions that water companies will need to take to achieve net zero by 2030.

2.81. WRSE is aligning with the English water company commitment to reach net zero operating carbon emissions at a sector level by 2030, ahead of the Government's aspirations for 2050. Beyond 2030, we will look to align with approaches for embodied and operational carbon, following national best practice and industry guidance as it develops. The regional plan carbon assessment helps identify where key sources of emissions are within the programme to help support our member companies to engage stakeholders involved in scheme delivery to collaborate on emissions reductions. WRSE's work also incorporates the best practice guidance developed by the sector research body, UKWIR, as it focuses on how the sector can remove more carbon than it emits by 2050[15].

Ethical buying, social equity and public value

2.82. WRSE is preparing one of five regional plans being developed in England and Wales to secure resilient water resources for the future. As expectation grows for increased collaboration to create a strategic network across water company boundaries, it's important to consider how these are evaluated in our regional plan. We believe water transfers or shared infrastructure with other regions should meet the same principles and standards which form the basis of our plan. Our regional plan therefore includes social and public value in our approach.

2.83. By ethical buying we mean applying the same standards to others as we do to ourselves. In order to meet the policies outlined in this document, we apply the same standards to options and interventions which are reliant on other regional plans. In particular, this includes our positions on resilience and environmental ambition. For example, we wouldn't want to degrade the environment in another region just to provide water to the South East. The regulators have also set out their expectations when sharing water between

[14] https://www.water.org.uk/routemap2030/

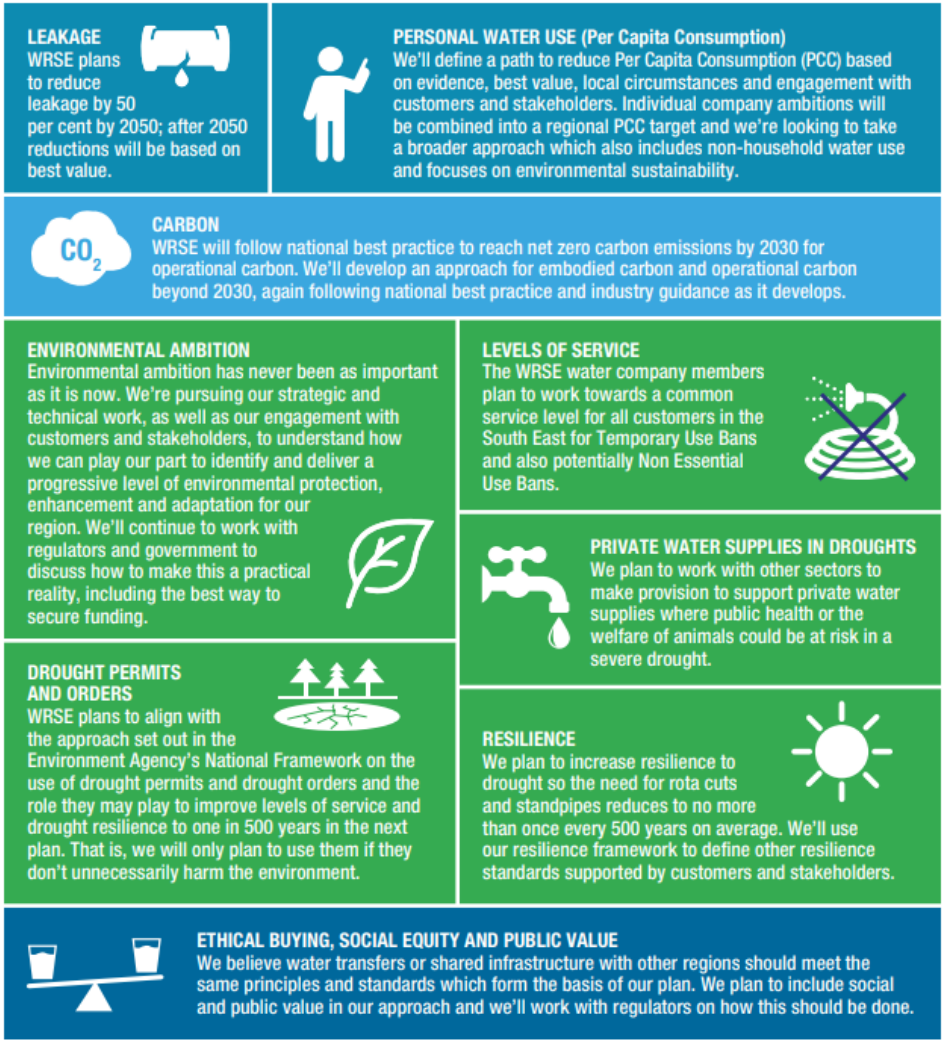
[15] https://ukwir.org/quantifying-and-reducing-direct-greenhouse-gas-emissions-from-waste-and-water-treatment-processes-1

regions to ensure habitats and customers in a region aren't compromised in order to provide water to the South East.

Summary

2.84. We have summarised our policy expectations in Figure 2.6 below.

Figure 2.6: WRSE policy expectations



3. Context for our regional planning

Updates have been made to the legal and policy context for the regional plan, reflecting publications since the draft regional plan.

Introduction

3.1. This section highlights some of the key factors that have shaped the development of our plan.

Legal and regulatory expectations

3.2. The Water Resources Planning Guideline[16] (WRPG) sets out the requirements for companies to follow in producing their statutory WRMPs. This guideline was updated in March 2023. The regional plan is currently a non-statutory plan. Both the WRPG and National Framework state that consultation should be undertaken on regional plans. Through measures outlined in Part 5 of the Environment Act 2021[17] it is anticipated that in the future there may be a statutory requirement for regional plans.

3.3. WRSE has ensured that the regional plan has been developed collaboratively with engagement and consultation opportunities throughout the development of the plan. The regional plan has adopted WRPG methods in order that WRMPs can directly reflect the regional plan outcomes. The publication of the emerging and draft regional plans, and now the revised draft regional plan, have been important steps in this process.

Preparing for a Drier Future

3.4. The National Infrastructure Commission (NIC) set out England's water infrastructure need in their 'Preparing for a Drier Future' publication in April 2018[18]. It highlighted that the water supply system is already strained and that the pressure from climate change, an increasing population and need to protect the environment will only rise over coming decades. The report stresses the limitations of the current water resource planning system and calls for a twin-track approach combining demand management (including leakage reduction) with long term investment in supply infrastructure.

3.5. To achieve this, the NIC sets out a number of measures, including halving leakage by 2050 and allowing compulsory metering beyond water stressed areas by the 2030s. One of the biggest challenges introduced by the report was the design of supply systems to be resilient to a 1:500 year drought. This gave rise to the subsequent change in the planning standards that we see today in the WRPG. It also highlighted the need for a strengthened regional approach to water resource planning which led to the National Framework for Water Resources.

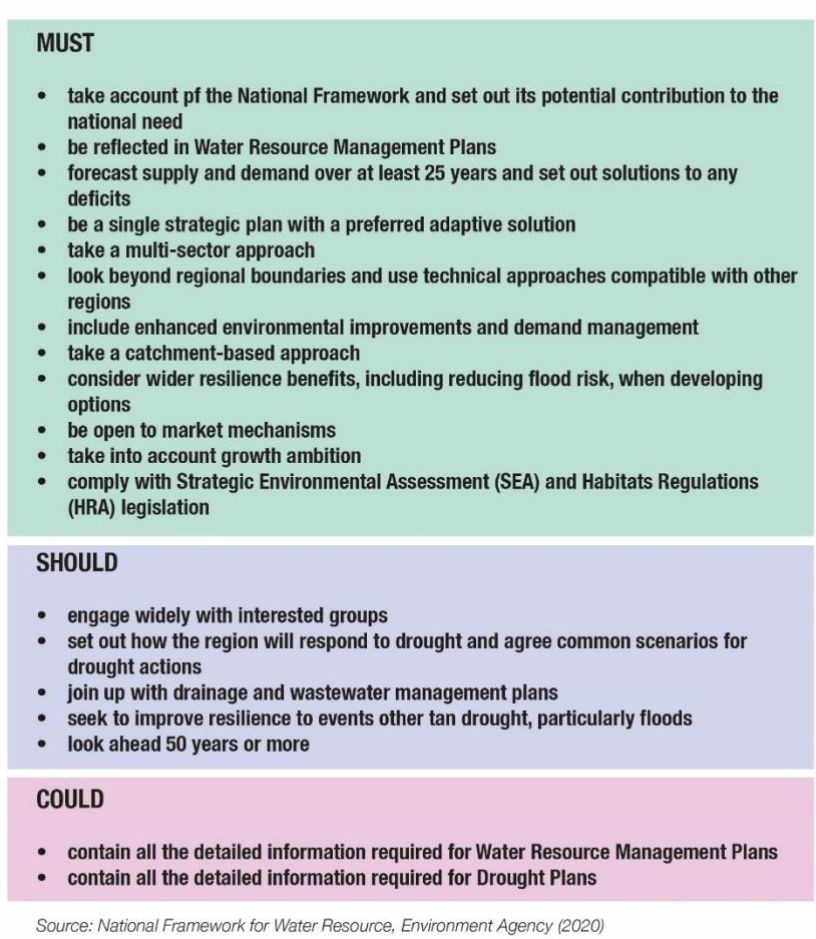
National Framework for Water Resources

3.6. The National Framework for Water Resources[19] (March 2020) set out the basis for regional water resource planning and the information a regional plan should include. The intention is that regional plans will deliver a step change in resilience and environmental protection by putting aside company boundaries and considering the needs of the whole region. Figure 3.1 sets out regional plan expectations from the National Framework.

3.7. The Framework recognises that the changes set out are ambitious and it will be necessary to manage uncertainty and risks associated with this. It promotes an adaptive planning approach with the need to carefully track progress of factors such as water demand, population, climate change and environmental improvements, and identify clear decision points where alternative approaches may need to be brought in. These decision points are to make sure there is enough time for alternative approaches to be adopted should demand reductions not follow the expected track.

[16] https://www.gov.uk/Government/publications/water-resources-planning-guideline/water-resources-planning-guideline
[17] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[18] https://nic.org.uk/app/uploads/NIC-Preparing-for-a-Drier-Future-26-April-2018.pdf
[19] Https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/872759/National_Framework_for_water_resources_main_report.pdf

Figure 3.1: What regional plans must, should and could include



Source: National Framework for Water Resource, Environment Agency (2020)

3.8. The Framework also highlights the shared goal of the Government, regulators and regional groups to improve the environment and address unsustainable abstraction of water. Whilst company WRMPs already account for replacing a significant amount of water from unsustainable sources, in particular the unique and highly valued chalk streams, the Framework indicates that eventual reductions in abstraction may be even higher. The Framework calls for a shared 'environmental destination' (which we term environmental ambition in our plan) with agreed steps for getting there covering short, medium and long-term changes, recognising that developing alternative supplies of water takes time and will need significant changes to how water is managed.

3.9. In addition, the Framework presents a picture of England's future water needs by 2050, taking account of the water needs of the environment and all water using sectors including:

- Public water supplies provided by water companies
- Agriculture
- Power generation
- Industry

3.10. The Framework sets out the pressures each region will face, the options they have available and the key areas that need to be addressed to secure future supplies. For regional plans, the National Framework provides strategic direction for their production, highlighting that they should:

- **Build resilience to drought** – Plans should be based on achieving a level of drought resilience so that emergency drought order restrictions, such as rota cuts and standpipes, are expected to be implemented no more than once in 500 years on average.
- **Reduce water demand** – Regional plans should reflect ambitious water demand savings that the Government has committed to.
- **Increase water supply and move water to where it is needed** – Regional plans should identify a diverse portfolio of supply and demand options, including significant supply side infrastructure by 2050.
- **Work across sectors –** In developing the regional plan, regional groups should work with non-mains supply business sectors to seek innovative, cross-sector solutions.

- **Enhance the environment –** Regional plans should be proactive in enhancing the environment and increasing environmental ambition.
- **Manage uncertainty** – Regional plans should set out ambitious reductions in demand and leakage, however the risk that these may not be met needs to be carefully managed. An adaptive planning approach should be followed that tracks demand and sensitive drivers of water need, including population, climate change and the need for environmental improvements.

3.11. The Framework also encourages regional planning groups to work together, seeking common approaches and methods, and sharing data and information to promote intra-regional transfers where appropriate.

A Green Future: Our 25 Year Plan to Improve the Environment

3.12. In 2018, the Government published its 25-year plan for the environment[20] which committed to achieving clean and plentiful water by improving at least three quarters of our waters to as close to their natural state as soon as is practicable. Abstraction of water can impact on the health of river and groundwater sources. If too much water is abstracted, less is available as a habitat for wildlife and pollutants will be more concentrated.

3.13. Based on the 25 Year Environment Plan, the WRPG requires us to use a natural capital approach as part of our decision-making process. Natural capital is defined in the 25 Year Environment Plan as 'the elements of nature that either directly or indirectly provide value to people'. The Government's 25 Year Environment Plan also places great importance on enhancing biodiversity.

Environment Act

3.14. The Environment Act, which achieved Royal Assent in November 2021, aims to protect and enhance the environment through regulating improvement of air and water quality, tackling waste, increasing recycling and improving the natural environment. The Act provides for legally binding targets to be set for the following core areas: waste and recycling, clean air, nature, and water, with the hope that these changes will assist in the transitioning to a more circular economy.

3.15. The Act includes a strengthened biodiversity duty which includes Local Nature Recovery Strategies to support a Nature Recovery Network and the provision for a legal requirement to provide biodiversity net gain for certain types of development. The WRPG encourages us to go beyond what might be required by the Environment Act to provide an ambitious level of measurable biodiversity net gain.

Environmental Improvement Plan (EIP)

3.16. The Government published the EIP in January 2023 (after the draft regional plan). The EIP is the Government's first revision of the 25 Year Environment Plan, building on its vision with more detailed plans for working with landowners, communities and businesses to deliver the Government's goals for improving the environment. This includes a target to restore 75% of terrestrial and freshwater protected sites to favourable condition by 2042.

3.17. Importantly, the EIP includes specific interim targets towards the Government's goals, providing a means of tracking and monitoring progress, including a number of relevance to the regional plan. The Environment Act 2021 includes a water demand target to reduce the use of public water supply in England per head of population by 20% from the 2019/20 baseline reporting year figures, by 2037/38. The EIP and the Plan for Water elaborate on this, setting out that this will require:

- household consumption to fall to 122 litres per head per day (l/p/d)
- non household consumption to fall by 9% from 2019/20 levels
- total leakage to be reduced by 37% from 2017/18 levels.

3.18. This is part of the trajectory to achieving 110 litres per person per day for household water use, a 50% reduction in leakage and a 15% reduction in

[20] https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

non-household water use by 2050. This is the first time non-household targets have been set.

Agriculture Act

3.19. The Government's Agriculture Act 2020 sets out how farmers and land managers in England will be rewarded in the future with public money for "public goods" – such as better air and water quality, thriving wildlife, soil health, or measures to reduce flooding and tackle the effects of climate change, under the Environmental Land Management scheme. These incentives will provide a vehicle for achieving the goals of the Government's 25 Year Environment Plan and commitment to reach net zero emissions by 2050.

Water Industry National Environment Programme (WINEP)

3.20. WINEP is the programme of work water companies in England are required to do by the Environment Agency and Natural England to meet their obligations from environmental legislation and UK government policy. The WINEP is the most important and substantial programme of environmental investment in England. For 2020 to 2025 it consists of £5.2 billion of asset improvements, investigations, monitoring and catchment interventions to improve the natural environment.

3.21. Whilst WINEP provides the actions required in the short-term to be compliant with environmental legislation, the process has not to date lent itself to considering a more collective longer-term approach, as the approach doesn't account for potential landscape changes or the impact climate change might have on the availability of water in the future. The consideration of levels of environmental ambition through regional planning now addresses this.

3.22. In July 2021, Defra and the Environment Agency consulted on a review of WINEP[21] which included consideration of how the programme could allow for more flexibility to deliver better environmental outcomes, for example, enabling greater use of nature and catchment based solutions, shifting focus of investment away from the 5-yearly cycle and an option development process that promotes more innovation and company collaboration.

Water Framework Directive

3.23. We need to take account of the requirements of the Water Framework Directive and the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, including the environmental objectives in the River Basin Management Plans (RBMPs). The WRPG obliges us to consider solutions that promote the requirements of the Directive and look to work in partnership with others. An early policy introduced through the planning framework is to cap existing licences to historic abstraction levels. This policy looks to address deterioration of catchments, from a volumetric or flow perspective by not allowing abstractions to continue to grow as the need for water increases. This policy approach was included in our draft regional plan and has been updated and included in our revised draft regional plan. We are encouraged to review solutions that have been identified in RBMPs and identify where these may require partnership working with others in the catchment to achieve the solution.

3.24. The WRPG also requires us to look towards targeted and cost-effective implementation of restoration measures required at the catchment scale, with water companies either working alone or in partnership with other organisations. Outcomes from such measures can be uncertain, so we need to consider this in our planning and monitoring.

Strategic Environmental Assessment and Habitats Regulations

3.25. The Strategic Environmental Assessment (SEA) Directive (2001/42/EC) and associated regulations (retained as UK law following Brexit) require an assessment of the likely significant environmental effects of certain categories of plans and programmes. Although the regional plan is not currently a statutory plan, we are undertaking an assessment of our regional plan to identify where it may give rise to likely significant effects on the

[21] https://www.gov.uk/Government/consultations/review-of-the-water-industry-national-environment-programme-winep

environment. The companies will also undertake an SEA of their statutory WRMPs.

3.26. In developing our plan, we have also considered the requirements of the Conservation of Habitats and Species Regulations 2017. Although not currently a statutory requirement for the regional plan, we are undertaking an assessment of the effects of our plan or project alone, or in combination with, other plans or projects, for example, the effects of supply options on Habitats sites. The companies will undertake HRA of their WRMPs, where there are likely significant effects on Habitats sites.

3.27. More information on our environmental assessments is in Section 16 of this document.

Long Term Planning for the quality of drinking water supplies

3.28. In July 2022 the Drinking Water Inspectorate published updated guidance for water companies to inform their preparation of business plans for the next periodic review process (PR24). The guidance does not launch new obligations or requirements on companies, but brings together existing and imminent legislative changes into a single set of water quality guidance to inform long term planning.

Future policy changes and challenges

3.29. Policy changes can occur rapidly over time and have the potential to affect our future planning. Our approach in response has been to work closely with our environmental regulators (Defra, Environment Agency and Natural England) and to incorporate not only current policy requirements but also known future policy challenges into our regional planning work. This enables us to develop a resilient and adaptive plan that can cope with future policy challenges that are expected or may be likely to emerge over time.

3.30. These future policy challenges mean that the future that we are planning for is uncertain at this time, and the scale of our response will need to adapt as the challenges and policy responses to them become clearer. We explain in Section 19 of this document how we are planning to monitor and manage these uncertainties and retain adaptivity and flexibility within our regional plan.

Geographical and environmental context

3.31. The South East region is home to 30% of the UK population and is worth £627 billion per year[22] to the UK economy (30% of the total). It covers the area from the New Forest in Hampshire to the Isle of Thanet in Kent, up to Saffron Walden in Essex and across to Banbury in Oxfordshire – and everywhere in between.

3.32. The area covers 26,400 square kilometres, 32 river catchments, 121 planning authorities and nine Local Enterprise Partnerships. It is culturally rich and diverse, with a mix of major cities (including London), seaside towns and rural hamlets. It has a highly valued and protected natural environment.

Population/Demand Centres

3.33. With 30% of the UK population, the region contains 5 cities and towns above 200,000 population – London (8.9 million population), as well as Southampton, Portsmouth, Brighton and Reading, and many other larger cities and towns. As well as having large resident populations, many locations include significant employment and their working day populations exceed those resident in the area as a result of in-commuting. These are key demand centres for water resources. The region also includes popular tourist destinations and resorts, leading to significant seasonal variations in water resources demand.

River basin catchments

3.34. The WRSE area comprises two river basin districts – Thames and South East, that incorporate a number of catchments as shown on Figure 3.1.

3.35. The **Thames river basin district** covers over 16,200km^2. It encompasses all of Greater London and extends from north Oxfordshire southwards to Surrey and from Gloucester in the west to the Thames Estuary and Kent in the east.

[22] https://www.wrse.org.uk/media/ruymzrt0/from_source_to_tap.pdf

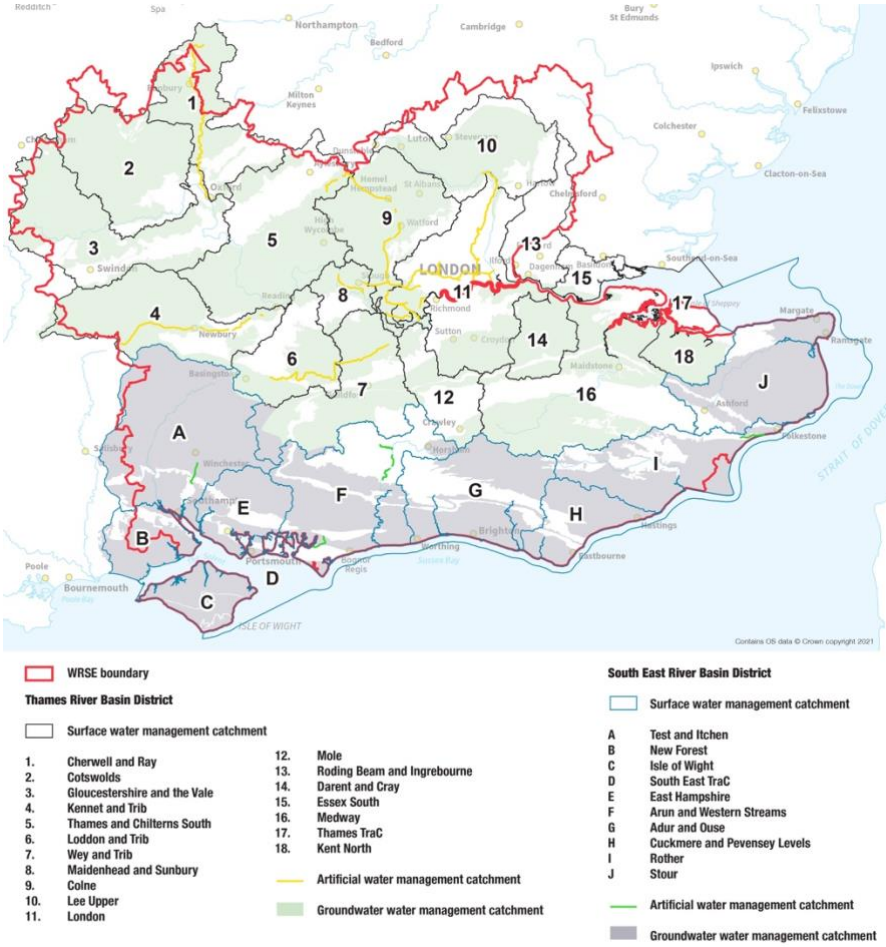
In total over 15 million people live in the Thames district with many entering daily to work or visit. In addition to Greater London, other urban centres in the river basin district include Luton, Reading and Guildford.

3.36. The characteristics of the Thames river basin district are set out in the River Basin Management Plan[23]. The Thames river basin district has a rich diversity of wildlife and habitats, supporting many species of global and national importance from chalk streams and rivers and salt marshes. The catchments that make up the river basin district include many interconnected rivers, lakes, groundwater, estuarine and coastal waters. These range from chalk streams and aquifers to tidal and coastal marshes. Around 17% of the river basin district is urbanised and the rural land is mainly arable, grassland and woodland.

3.37. The **South East river basin district** covers over 10,200km^2 and extends from Hampshire in the west to Kent in the east. It includes East and West Sussex, the Isle of Wight and parts of Wiltshire and Surrey. In total over 3.5 million people live and work here which is densely populated and includes the major urban centres of Southampton, Portsmouth, Brighton and Hove.

3.38. The characteristics of the South East river basin district are set out in the river basin management plan[24]. The South East river basin district has a rich diversity of wildlife and habitats, supporting many species of global and national importance. These include migratory salmon rivers, native white clawed crayfish, and estuaries and coastal waters important for shellfish, wintering wildfowl, breeding gulls and terns. The catchments that make up the river basin district include many interconnected rivers, lakes, groundwater, estuarine and coastal waters. These range from chalk streams of the Test and Itchen catchments to the modified rivers of the Rother catchment. Around 65% of the river basin district is used for farming, including livestock, arable and horticultural businesses. Important sectors contributing to the economy of the district include technology, manufacturing, tourism, financial services and construction.

Figure 3.1: River Basin Districts and Catchments within the WRSE area



[23] https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/718342/Thames_RBD_Part_1_river_basin_management_plan.pdf

[24] https://www.gov.uk/Government/publications/south-east-river-basin-district-river-basin-management-plan

Current status of catchments in the South East

3.39. There are 531 waterbodies covering 29 catchments within the South East region. The health of each of these waterbodies is assessed using six indicators, these are:

- fish
- other animals such as invertebrates
- plant communities
- the clarity of water
- the condition of the river channel and flow of water
- safety of the water for recreational contact.

3.40. When you consolidate the assessments of the six individual criteria for all water bodies across the 29 catchments in the South East, the overall assessment is that 32.6% are in a good status and the remaining 67.4% are below good.

Regional rainfall

3.41. The South East region is dependent on rainfall to provide water supplies for customers, whether through groundwater sources, river abstractions or reservoir or below ground storage. The South East region is in serious water stress. This means that current or future household demand for water is a high proportion of the effective rainfall available which is, or is likely to be, available to meet that demand. In the Environment Agency's latest assessment, all our member companies are in serious water stress.

3.42. Under normal conditions, average rainfall across South East England is 64mm per month compared with 81mm per month across England and Wales. When rainfall levels are lower, such was the case through 2022, the formal announcement of a drought, and temporary restrictions on water use are necessary responses. The region is likely to continue to be at risk of needing water restrictions over the short to medium term, however, over the longer term, delivering our plan will mean our environment is more resilient, our supplies are more reliable and our relationship with water will be different in the years to come.

Landscape and biodiversity

3.43. Whilst in parts densely populated, the South East region contains large areas of internationally and nationally important landscapes and habitats. These provide key space for the enjoyment and understanding of our natural environment, and for the protection and enhancement of designated landscapes, habitats and species.

National Parks and Areas of Outstanding Natural Beauty

3.44. The South East region has two National Parks – South Downs and New Forest – and eight Areas of Outstanding Natural Beauty (AONB) – Chichester Harbour, Chilterns, Cotswolds, High Weald, Isle of Wight, Kent Downs, North Wessex Downs, and Surrey Hills – see Figure 3.2. Together these nationally important landscapes cover extensive parts of our region, and contain many other environmentally designated landscape, heritage and nature conservation features within them.

Figure 3.2: National Parks and AONB within the WRSE area

National and International Designated Nature Conservation Sites

3.45. The South East region has a rich network of European and nationally designated nature conservation sites, protecting coastal, estuary, river, woodland, heath and other key habitats and species that are dependent on them. Figure 3.3 shows the distribution of International and National nature conservation sites and the numbers of individual designations are in Table 3.1. Taken together, these designations protect a significant area of land within our region.

Figure 3.3: International and National Designated Sites in the WRSE area

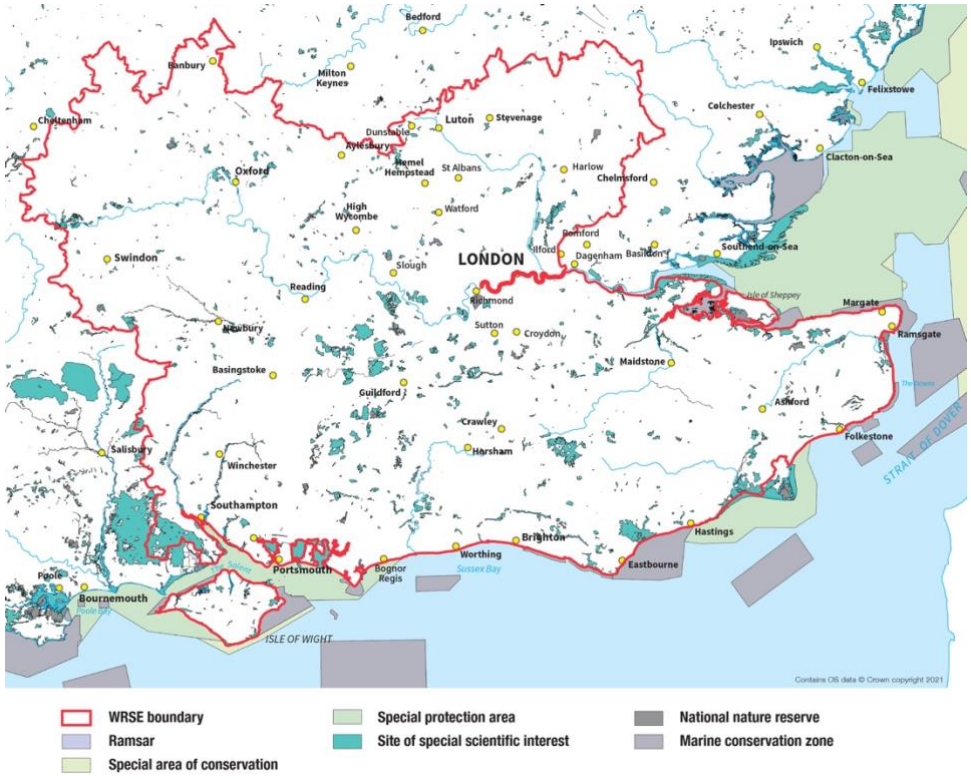


Table 3.1 Ecological Sites in the South East Region

Designated Site	Total Number
Special Areas of Conservation (SAC)	298
Special Protection Areas (SPA)	196
Ramsar sites	126
Sites of Special Scientific Interest (SSSI)	1,661
National Nature Reserves (NNR)	86
Local Nature Reserves (LNR)	480
Marine Protected Areas (MPA)	1
Marine Conservation Zones (MCZ)	14

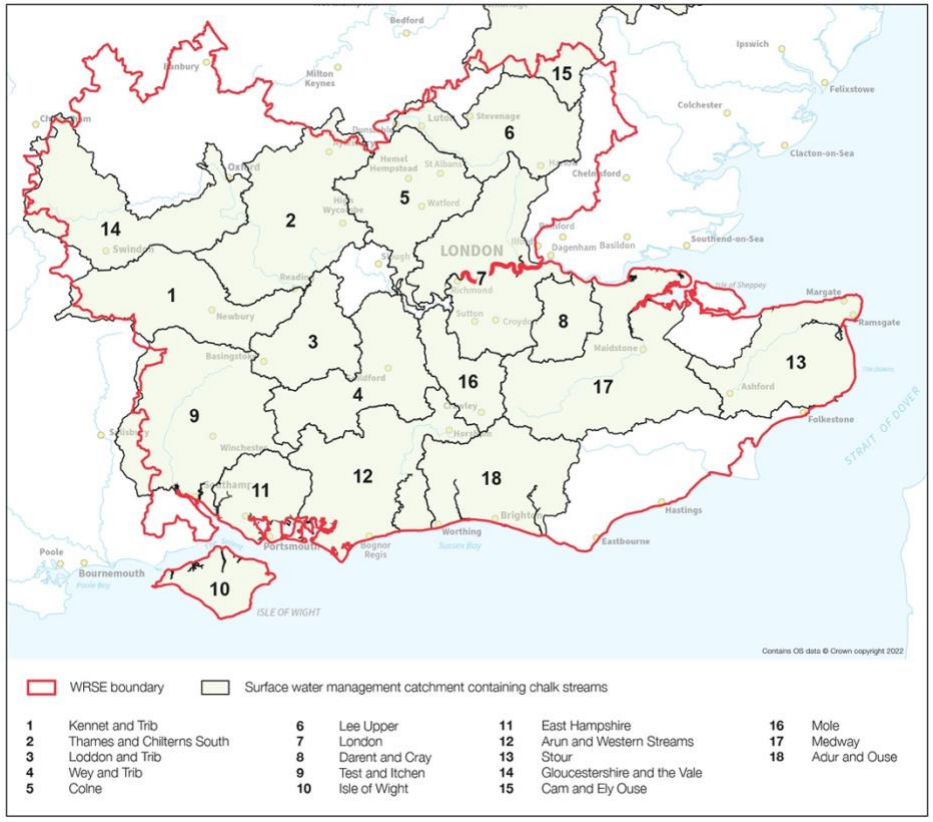
Chalk stream catchments

3.46. The chalk stream catchments in the South East are a rare and precious natural resource. The catchments including chalk streams are shown on Figure 3.4. Although they provide internationally and nationally important habitats for key species, they have historically also provided significant sources of groundwater and surface water for public water supply, agriculture and other uses.

3.47. Over recent decades, concerns about the impacts of abstraction and discharges on chalk stream catchments has increased, leading to significant changes to abstraction licences and discharge consents by the Environment Agency through the Habitats Regulations Review of Consents, and Restoring Sustainable Abstraction Programmes. Further reductions in abstractions are planned within some chalk stream catchments, and this is a significant driver of proposals in our regional plan. This responds to the challenges being raised about impacts of abstractions on chalk stream catchments, including

through the Chalk Streams First Initiative in the Chilterns, the CaBA Chalk Stream Restoration Strategy[25] and other initiatives in the South East.

Figure 3.4: Catchment areas that include chalk streams



Our current water supplies

3.48. Our member companies in the South East region abstract, treat and distribute on average over a third of the water supplied across England. The region has some unique characteristics:

- Six water companies supply water to 8.2 million homes and 2 million businesses
- More than half the region's water – and up to 100% in some water resource zones – comes from underground sources. These rely on there being enough winter rainfall to fill them up ready to meet the higher demand for water in the spring and summer
- Normal demand for water is currently 6 billion litres per day
- Around 60% of homes have a water meter
- Around 135 million litres per day is also used by other sectors in the South East, not supplied via public water supply companies, taken directly from rivers and underground sources by the power sector, farming sector, and paper production industry.

3.49. Through working closely with customers and investing in their infrastructure, our member companies currently put less water into supply than they did in 2000, despite a population that has increased significantly over that time (see Figure 3.5). This has been achieved in a number of ways.

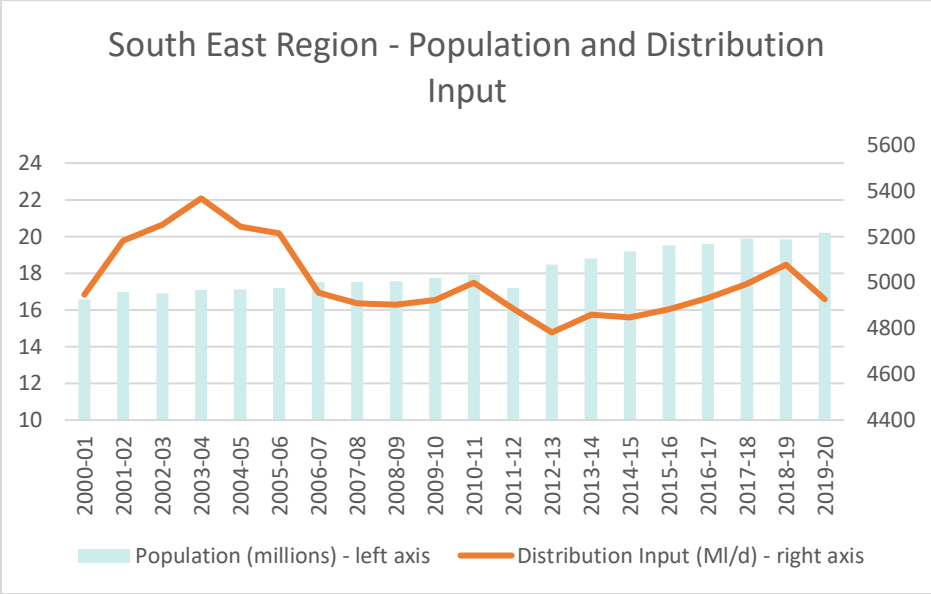
3.50. Household demand (per head) for water has decreased over time, driven by changes in lifestyle and the development of more efficient devices such as washing machines and dishwashers. Alongside this, our member water companies have implemented large scale leakage reduction campaigns, together with water efficiency programmes to increase customers' awareness of water as a precious resource. Many companies have also implemented meter installation programmes, some achieving significant proportions of metered customers. Monitoring has demonstrated that

[25] https://catchmentbasedapproach.org/wp-content/uploads/2021/10/CaBA-CSRG-Strategy-MAIN-REPORT-FINAL-12.10.21-Low-Res.pdf

metered customers, paying for the volume of water they use, have lower consumption than non-metered households.

3.51. Alongside this, our member water companies have invested heavily in improving the resilience of their water supply networks, including through sharing water with neighbouring water companies. The data in figure 3.5 is to 2019/20. More recent data is not considered likely to change the long term trends, although companies have experienced shorter term changes as a result of the Covid pandemic.

Figure 3.5: Regional population and distribution input (2000-2020)



3.52. As set out in the Water UK 'Leakage Routemap to 2050'[26], the water sector in England and Wales has been managing leakage levels against specific targets since 1997. This followed a severe drought starting in 1995, which left reservoir levels very low. Mandatory leakage targets were introduced following an emergency leakage summit in May 1997; and leakage targets of one form or another have been in place since. Suppliers in England and Wales have reduced their water sector leakage by 40% from 1996 to 2020.

[26] https://www.water.org.uk/publication/a-leakage-routemap-to-2050/

4. The challenge we face

A number of the forecasts have been updated since the draft regional plan was published, including population and housing growth forecasts, and demand forecasts including non-household demand. Updated figures are presented throughout this section, including updated forecasts of the levels of deficits we will face in the future as a result of these changes.

The National Framework for Water Resources

4.1. In 2020 The National Framework for Water Resources[27] looked at the pressures on public water supply nationally, regionally and over time. These included climate change, population growth and the need to increase drought resilience. It provided a preliminary indication of the challenges we could face in providing water supplies in the future, in terms of public and non-public water supply need.

4.2. Of all the regions, the National Framework identified that the South East faces the greatest pressures on public water supplies. If surplus water can be made available, we will still need to develop options to supply more water, equivalent to all new water resource options and transfers currently selected in company WRMPs, as well as achieving ambitious efficiency reductions. If surplus water cannot be accessed, demand will need to be reduced or further resources developed.

4.3. The Framework highlights that we must track the progress on demand management as if savings are less than expected, a large shortfall may reduce resilience, limit progress on environmental improvements and lead to more frequent use of drought measures. We have summarised the National Framework's assessment of the South East region's needs in Appendix 2 to this document.

How the National Framework has informed this regional plan

4.4. The amount of water needed in the future for public water supply (water provided by water companies) is being driven by four main challenges which will mean either less water is available for us to use or more water is needed. They are:

- **Drought resilience** – more water needs to be made available so our supplies last longer during severe drought events, those that occur once in every 500 years, so emergency measures are less likely to be needed.
- **Population growth** – an increase in population means more water is needed to supply customers and businesses
- **Climate change** – will reduce how much water is available from our water sources and when it is available, droughts will also become more common
- **Environmental protection and improvement** – we need to leave more water in the environment, reducing how much water we can take from some of our existing sources

4.5. As a result of more detailed work we have undertaken (explained in the following sections), our own forecasts differ from those in the National Framework, and we have assessed the scale of the challenges we face as being even greater than anticipated in the National Framework. As a result, we have included additional scenarios to consider possible lower impact environmental ambitions as well as those in the National Framework.

4.6. Given the scale and complexity of the challenges we are facing in the South East, we have designed a regional planning process that is capable of modelling and assessing many different potential futures, to help us to select a resilient and adaptive best value regional plan. The future is uncertain, and we will need to adapt and adjust our proposals over the coming years and decades as part of monitoring and review. However, the regional plan process is specifically designed to facilitate this adaption and change, whilst ensuring that demand management and new resource developments to be

[27] Https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/872759/National_Framework_for_water_resources_main_report.pdf

implemented in the short term remain as robust choices and decisions whatever future may evolve.

How we calculate how much water we need

4.7. This part of our regional plan explains how we calculate forecasts for how much water we will need in the South East for the period from 2025 to 2075. We need to assess how much water will be needed in the future, so we can decide which demand management and new resources development options are required as part of our regional plan.

4.8. We start by forecasting the future demand for water under different planning scenarios. We then identify the supplies already available to meet the demand under each scenario, taking account of risks and uncertainties associated with various components of the supply and demand forecasts. By comparing how much water we have available with how much water we will require in the future, this tells us what our future water resource needs will be. We complete this for 9 different scenarios in the future, each giving a range of needs. We complete this analysis for all 37 water resource zones in the South East of England for every year of the plan.

4.9. Where future demand exceeds future supply, we have a supply-demand deficit that needs to be closed by selecting options that will either reduce demand or increase supply. We are required to prepare a plan that evaluates which options in combination provide best value and ensure no supply demand deficits occur.

Planning scenarios

4.10. The WRPG states that a WRMP must consider the worst-case dry year combination of supply and demand forecasts for each water resource zone, together with the uncertainties incorporated in target headroom. Drought resilience must also be included, to provide resilience to 1:500-year extreme drought by 2039/40. WRSE has looked at these requirements and agree that we need to meet these standards as quickly as we can, recognising the pressures on household bills at the moment. We have updated the analysis we undertook at the draft plan stage and we still conclude that meeting this standard of resilience by 2040 represents the best timing. The updated analysis (set out in Section 17 of the plan) shows that moving the design standard back to 2045 or 2050 does not delay the need for key strategic schemes to be constructed, it merely delays their utilisation as a number of these schemes are required to also deliver the level of environmental ambition set out in the regional plan. Therefore in reality, if the infrastructure was built, then it would be utilised fully to protect customers and the environment, regardless of whether drought resilience was achieved in 2045 or 2050.

4.11. To ensure that that the scheme choices are not just based on the extreme drought, but are balanced against other types of planning scenarios, we have enabled the investment modelling to undertake an analysis for four different planning states across the nine future planning forecasts. These different planning states encompass normal years, dry years and droughts across the region. Forecasts and uncertainty profiles were imported for each of four deterministic planning scenarios:

- Normal year (1:2 year) annual average (NYAA)
- Dry year (1:100 year) annual average
- Dry year (1:500 year) annual average (DYAA)
- Dry year (1:500 year) critical period (DYCP)

4.12. Therefore the investment model seeks to find solutions that work across the 37 water resource zones, on an annual basis for the four different planning scenarios in that year, and for each of our adaptive plan pathways (see Section 6 for an explanation of our adaptive plan). Our adaptive plan has 9 different branches, and as a result, some 1,332 forecast requirements per year must be resolved for the plan to be valid. This means the model needs to identify solutions so that no deficits occur in any water resource zones in any year of the planning period under each of the four planning scenarios.

Our demand forecast

4.13. Our methods for forecasting the future demand for water from a growing population are set out in our Demand Forecast Method Statement available in our WRSE Library.

4.14. We forecast the future demand for water – from households, businesses, industry and other sectors – across the WRSE region and across a range of different scenarios which account for external influences like climate change. Demand forecasting is a well-established process that follows regulatory guidance and industry best practice, with components that, when combined, give us an estimate of the demand that we will need to meet in the future. These components are:

- Household demand - this is calculated from population and property forecasts combined with per capita consumption (PCC) and per household consumption (PHC) forecasts
- Non-household demand - this is based on a range of factors, including population and properties growth, climate and economic data
- Leakage – this includes both distribution network losses (made up of losses from large water mains, service reservoirs, and smaller distribution mains) and customer -side leaks on supply pipes
- Minor components – including operational usage by water companies and unbilled usage by organisations such as the fire brigade.

4.15. Each company in the region completed their demand forecast for the regional plan on a consistent basis.

Household demand

4.16. Household demand is calculated from population and property forecasts combined with per capita consumption (PCC) and per household consumption (PHC) forecasts.

Population and property forecasts

4.17. The WRPG emphasises the importance of using Local Authority Local Plans as evidence in deriving a growth forecast and specifies that the forecast must not constrain planned growth by local councils and strategic housing developments. Where an alternative source of data is used, for example beyond the planning period of the Local Plan, or where a Local Plan has not been published, the evidence used should be clearly set out and any assumptions clearly described. We followed this requirement but also considered additional projections to ensure we have included the most likely range of household demand growth up to the end of the century.

4.18. For the draft regional plan WRSE commissioned Edge Analytics to develop both population and property forecasts for all the WRZs in the region. They used the latest available Local Plan and Office for National Statistics (ONS) trend-based data, as well as other sources including those from the Greater London Authority (GLA). More detail on their methods is available in the report: Population & Property Forecasts - Methodology and Outcomes[28]. Edge Analytics' work also included a forecast for the Oxford-Cambridge (OxCam) area to assess the potential impact of this significant proposed housing plan within our housing growth scenarios.

4.19. For the draft regional plan WRSE and Edge Analytics produced forecasts for a wide range of scenarios, by using a combination of trend, housing-led (incorporating housing need, housing requirements and actual planned scenarios) and employment-led forecasts, to account for considerable uncertainty in the projections. Forecasts were produced under 19 main scenarios up to 2050 with three further projections (Principal, High and Low) for each scenario up to 2075. There were therefore 57 projections for each WRZ. From the 57 projections, the minimum and maximum increase in total population at the WRSE level by 2050 were 2.1% and 26.3% respectively, with an average increase all projections of 17.2%.

4.20. Seeking to adopt the same growth forecast and additional growth scenarios across the region was not possible as different factors are driving differences in the upper and lower forecasts in different WRZs and it is important to take these local differences into account.

4.21. The Housing Plan based projections were developed using two approaches: a 'top-down' approach and a 'bottom-up' approach. The 'top-down' forecasts allocate growth based on location of existing housing stock, i.e. growth continues in locations where houses have already been built. The 'bottom-

[28] https://www.wrse.org.uk/media/isrfvms0/wrse_file_1346_wrse-population-property-forecast-methodology-draft-report.pdf

up' housing plan forecasts take account of areas or sites where housing is identified for delivery in the future, not just where it currently exists. We adopted 'bottom-up' figures for the housing plan values as they represent a more realistic view of the locations of new growth and allocate growth to WRZs more accurately.

4.22. Population growth, particularly household population growth, is likely to be the main driver behind future demand in most WRZs. The rate of growth for new properties primarily impacts household occupancy which also has an impact on PCC, since average PCC typically decreases with an increase in average occupancy. Each company has also accounted for hidden and transient populations. However, at WRZ level, there is considerable variation. There is also a wide variation on which growth forecast produces the upper and lower boundaries of the range, with two scenarios producing the minimum forecast and five different scenarios providing the maximum forecast across the WRZs.

4.23. The WRPG requires WRSE to base its baseline growth forecast on plan-based growth assumptions. Based on data and recommendations from Edge Analytics, we selected to use the Housing Plan Principal (P) scenario as the baseline growth forecast for the draft regional plan. It is hard, however, to predict exactly when, where and at what rate housing and population growth will happen, so we looked at a number of different scenarios to help us develop our household demand forecast. Within our modelling for the draft regional plan we therefore considered alternative forecast scenarios to account for the differences in the upper and lower forecasts between WRZs, as explained in the Edge Analytics report[29]. This allowed us to model and test higher and lower scenarios. Figure 4.1 below is an illustration of the forecasts for the draft regional plan.

Figure 4.1: Draft regional plan population growth forecasts

4.24. Following publication of the draft regional plan, WRSE commissioned Edge Analytics to update the forecasts utilising the most recent available ONS population and household data, and updated housing growth information from local planning authorities. The same five population and growth scenarios have been used for the regional plan, but with the updated data and forecasts within them.

4.25. The main drivers of the differences between the draft regional plan and revised draft regional plan forecasts are different base years and changes to the housing growth evidence informing the Housing-Need and Housing-Plan scenarios. Other methodological/data changes have also had an impact on the forecast outcomes but to a lesser extent.

4.26. The latest forecasts for the revised draft regional plan used the ONS 2021 mid-year population estimates (underpinned by 2021 Census data), whereas

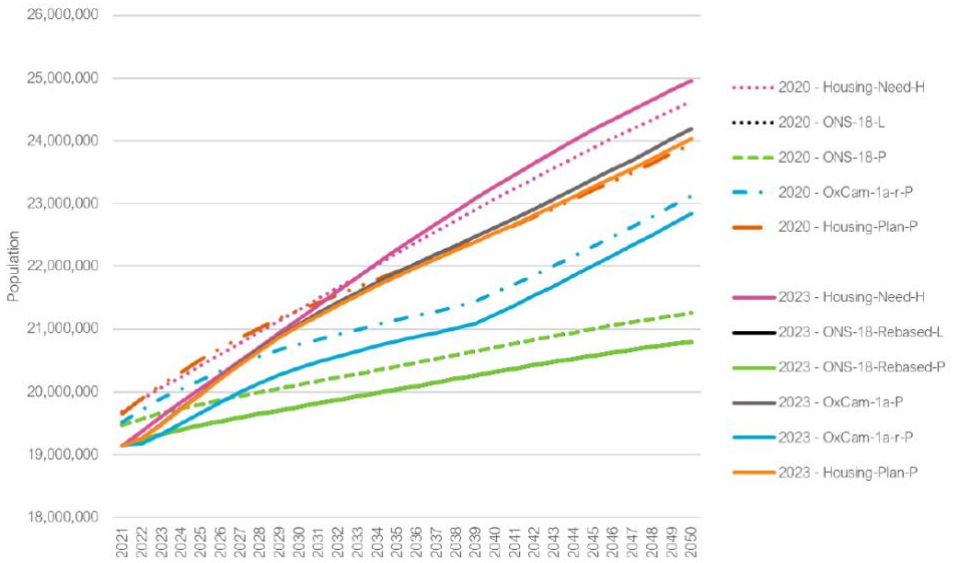
[29] https://www.wrse.org.uk/media/lvmlkv3a/vicus-methodology-final-31-07-2020.pdf

the draft plan forecasts were based on 2018 estimates. The updated forecasts update both the total population (described below) and the underlying structure of the population (its age and sex) when compared to the 2018 forecasts.

4.27. In relation to housing growth, Edge Analytics devised its 'Housing Need' and 'Housing Plan' forecasts on information from local planning authorities. For the revised draft plan these forecasts use information updated in Jan-Feb 2023, whereas the draft plan forecasts were based on information updated in early 2020.

4.28. Figure 4.2 below summarises the effect of the updated population forecasts, with the dotted lines being the 2020 forecasts used as the basis for the draft regional plan, and the solid lines being the updated 2023 forecasts for the revised draft regional plan. A summary of Edge Analytics updated forecast information is available in the WRSE document library.

Figure 4.2: Comparison of draft regional plan and revised draft plan forecasts



4.29. Table 4.1 below then provides a comparison between the 2020 forecasts (used for the draft regional plan) and the 2023 forecasts used for the revised draft regional plan. Note that the 2023 forecasts added an extra forecast which was an adjusted Ox Cam (Oxford Cambridge growth corridor) forecast.

Table 4.1: Comparison between draft plan and revised draft plan forecasts

2020 Scenarios	Population		Population Change	Population Change %	Dwellings p.a.	Population		Population Change	Population Change %	Dwellings p.a.
	2021	2050				2021	2100			
Housing-Need-H	19,692,433	24,628,751	4,936,318	25.1%	99,131	19,692,433	29,805,795	10,113,361	51.4%	75,819
Housing-Plan-P	19,648,395	23,945,684	4,297,290	21.9%	89,688	19,648,395	27,011,856	7,363,461	37.5%	58,558
ONS-18-L	19,473,684	21,251,483	1,777,798	9.1%	51,770	19,473,684	22,074,570	2,600,886	13.4%	29,409
ONS-18-P	19,473,684	21,251,483	1,777,798	9.1%	51,770	19,473,684	24,031,005	4,557,320	23.4%	42,021
OxCam-1a-r-P	19,514,665	23,117,138	3,602,473	18.5%	91,761	19,514,665	26,092,542	6,577,877	33.7%	59,484

2023 Scenarios	Population		Population Change	Population Change %	Dwellings p.a.	Population		Population Change	Population Change %	Dwellings p.a.
	2021	2050				2021	2100			
Housing-Need-H	19,136,248	24,959,131	5,822,883	30.4%	105,433	19,136,248	29,243,867	10,107,619	52.8%	69,438
Housing-Plan-P	19,136,298	24,028,276	4,891,978	25.6%	91,840	19,136,298	25,884,596	6,748,298	35.3%	49,432
ONS-18-Rebased-L	19,136,248	20,799,731	1,663,482	8.7%	46,074	19,136,248	20,231,861	1,095,613	5.7%	17,364
ONS-18-Rebased-P	19,136,248	20,799,731	1,663,482	8.7%	46,074	19,136,248	22,442,699	3,306,451	17.3%	30,832
OxCam-1a-P	19,136,248	24,193,687	5,057,439	26.4%	94,542	19,136,248	26,060,611	6,924,363	36.2%	50,562
OxCam-1a-r-P	19,136,248	22,842,472	3,706,224	19.4%	94,469	19,136,248	24,629,081	5,492,833	28.7%	50,533

4.30. The resulting forecasts for the principal scenarios used in the revised draft regional plan, showing projected total change and percentage change for the periods to 2050 and 2100 are in Table 4.2 below.

Table 4.2: Revised draft plan forecast population change (000s) from 2021 base

Scenario	2050	2050	2100	2100
	Change	Change %	Change	Change %
H Need	5823	30.4%	10108	52.8%
H Plan	4892	25.6%	6748	35.3%
ONS 18 L	1663	8.7%	1096	5.7%
ONS 18 P	1663	8.7%	3306	17.3%
OxCam	3706	19.4%	5493	28.7%

Per Capita/Household Consumption (PCC/PHC)

4.31. The second component of household demand is the level of consumption measured on either a per person (capita) or a per household basis. Our method has been aligned with the approach taken on growth, and is based on a bottom-up method consistent with the WRPG that is appropriate to each company - depending on factors such as data availability and metering penetration. Through our plan we have sought to align our member companies' policies, assumptions, assurance and framework for calculating PCC/PHC in order to have a broadly consistent method which is a step change from our previous regional plans.

4.32. Calculation of household demand is based on unconstrained demand (i.e. with no restrictions on water use such has temporary use bans) in a dry year. Restrictions are included in the options appraisal as drought options. This ensures there is no double counting of the benefit of measures in reducing demand. We also calculate demand in a 'normal year' for each WRZ.

4.33. Whilst our member companies have made commitments on reducing PCC in the long term, for the purposes of the baseline forecast only those measures which are in the current period (2020 to 2025), and therefore funded in the Price Review 2019 process, are included. This is consistent with the WRPG. All other potential reductions in PCC are included in the options appraisal assessment - as a range of demand management strategies - so that the selection of demand and supply-side options is based on the model outputs.

4.34. One key area which affects demand management is the extent to which external interventions outside of the control of our member companies, including changes in government policy, will influence household consumption. This is important as if assumed reductions in consumption are not achieved, this could lead to an increased need for new resources. For example, studies have shown that consumption from white goods would significantly reduce if mandatory water labelling was introduced, and leakage from toilets, which is estimated to occur in around 5% of toilets, could also be minimised if a combination of amendments to current building regulations and practices were introduced. Therefore, whilst some limited interventions are included in our baseline, more ambitious/uncertain levels are in our demand management strategies, including those relying on government interventions.

Resulting forecast change in population and household demand

4.35. The WRPG requires us to use local plan data as the basis of our growth forecast – this is at the higher end of the range of growth scenarios we have produced to date. However, all scenarios are considered within our plan to ensure we can adapt depending on the level of growth that actually occurs. Given the uncertainty in the forecasts, we have considered how population growth could influence the amount of additional water we would need to input into our supplies across a range of scenarios. The additional water we could need is set out in Table 4.3. From 2025 to 2035, when there is greater certainty as to the likely housing growth, and consistent with the WRPG, our modelling for the regional plan is based on the Housing Plan Principal (P) scenario. From 2035 to 2075, where there is increasing uncertainty, we have considered a range of growth scenarios.

Table 4.3: Change in demand as a result of population growth from 2025

Year >>>		2040		2050		2060		2075	
Scenario	Planning Scenario	Change (Ml/d)	Change (%)	Change (Ml/d)	Change (%)	Change (Ml/d)	Change (%)	Change (Ml/d)	Change (%)
Maximum	DYAA	483.2	14.8%	689.3	21.1%	785.2	24.0%	905.8	27.7%
	DYCP	553.4	14.7%	798.7	21.2%	923.9	24.5%	1086.8	28.8%
	NYAA	466.6	15.0%	665.0	21.4%	756.7	24.3%	871.9	28.0%
H_Plan	DYAA	393.4	12.1%	566.2	17.4%	595.0	18.2%	612.5	18.8%
	DYCP	451.2	12.0%	658.2	17.5%	707.8	18.8%	751.9	20.0%
	NYAA	381.4	12.3%	547.9	17.6%	574.7	18.5%	590.4	19.0%
Oxcam1a	DYAA	404.7	12.4%	586.8	18.0%	615.6	18.9%	632.6	19.4%
	DYCP	463.5	12.3%	680.6	18.1%	730.2	19.4%	774.0	20.5%
	NYAA	392.2	12.6%	568.0	18.3%	594.7	19.1%	610.0	19.6%
ONS18	DYAA	154.8	4.8%	193.3	6.0%	219.2	6.8%	241.6	7.5%
	DYCP	185.0	5.0%	240.9	6.5%	285.3	7.7%	333.5	9.0%
	NYAA	150.1	4.9%	186.9	6.1%	211.1	6.9%	231.6	7.6%
Minimum	DYAA	145.5	4.5%	175.0	5.5%	137.4	4.3%	66.3	2.1%
	DYCP	172.4	4.7%	216.3	5.8%	189.6	5.1%	130.9	3.5%
	NYAA	141.2	4.6%	169.2	5.5%	132.0	4.3%	62.2	2.0%

Non household demand

Non-household demand from public water supply

4.36. Non-household demand is influenced by a range of factors which need to be assessed and modelled to produce a robust forecast that also accounts for a reasonable uncertainty range. Like household demand, the non-household demand forecast is based on unconstrained demand in a dry year.

4.37. WRSE commissioned Artesia (WRSE Document Library) to carry out a region-wide assessment of non-household and non- public water supply demand, to maximise alignment between our member companies' forecasts. The aim of the report was to produce a central (baseline) forecast for each WRZ, alongside an upper and lower forecast to account for uncertainty, using a methodology consistent across the companies as well as adhering to the WRPG. The work involved the segmentation of non-household properties into five sectors grouped in terms of the main factor(s) that drives growth:

- Agriculture and other weather-dependant industries
- Non-service industries (excluding Agriculture)
- Service industries – population driven
- Service industries – economy driven
- Unclassified

4.38. For each of the sectors a different forecasting approach is required which takes into account the main explanatory factors that influence demand in that sector. These include climate, population growth (as used in the household demand forecast), employment and Gross Value Added (GVA). A different approach is taken for the forecasts from 2025-2050, which can be correlated to available data, and post- 2050 when a population or trend based approach is needed.

4.39. Artesia's data was incorporated into the draft regional plan, and Artesia was then asked to develop updated forecasts for our member companies for them to consider incorporating in their WRMPs.

4.40. Table 4.4 shows the demand forecast by sector that has been incorporated into the revised draft regional plan.

Table 4.4: Public non-household demand forecast by sector

Sector	Updated consumption (Ml/day)
Agriculture	39.7
Non-service industries (excl. Agriculture)	71.1
Service industries (population driven)	231.3
Service industries (economy driven)	280.3
Unclassified	198.6

Non-household demand from non-public water supply

4.41. As set out in Section 2, the National Framework for Water requires us for the first time to consider the future needs of sectors that have their own water supplies through our regional plan. Details of our approach is set out in our multi-sector method statement available in the WRSE Library.

4.42. To develop a regional assessment of the future water requirements we have sought to understand how much water is required for the public water supply system and the other sectors over the planning period, and how much water will be available from the environment to support these requirements. The difference between the requirements and the availability provides an indication of the scale of the challenge in the future.

4.43. To support our work, WRSE established a multi-sector stakeholder group. This comprises representatives from industries which have a licence, or an equivalent legal permission, to abstract water from the environment in order to support their manufacturing or specific activity requirements. Just like the water industry, these sectors abstract water from the environment in the South East of England. The National Framework set out the volumes of water that are currently abstracted through a number, but not all, of these abstractions. It has been assumed that the current abstraction rates that have been reported through the abstraction returns represent the current requirements of the industries. However, these abstractions do not represent all the abstractions in a catchment. Industries such as trickle

irrigators and navigation authorities, such as the Canal and River Trust also abstract water from the environment; they are not currently included in the National Framework Assessment report. Therefore, the volumes of water reported in the National Framework underestimate the amount of water, outside public water supply, that is currently abstracted each day and how much extra water may be needed in the future.

4.44. Building on the work undertaken for the National Framework, we have worked with the key sectors and updated forecasts to understand the range of potential future requirements for each sector in the region. We also received input from Energy UK. It provided a range of scenarios on behalf of the power sector for their future water needs, which included future government policy which could see a transition from gas generation and storage.

4.45. The current water requirement of the other sectors is based on abstraction returns and the voluntary returns of those who are currently exempt. Some of these abstractors exempt from licensing will be brought under the abstraction licence regime in the future, this includes sectors and organisations such as the Canal and River Trust and trickle irrigation users.

4.46. The anticipated growth rates of these sectors have been aligned, where possible, with the assumptions underpinning the non-household growth forecast methodology used by water companies. Where non-public water supply (non-PWS) forecasts do not exist then additional expert advice has been sought through the WRSE multi-sector group to improve forecasts. This has included a review of the NFU integrated water management strategy document[30] and the potential power sector freshwater consumption report prepared by Energy UK included as Appendix A to the multi-sector method statement.

4.47. The non-PWS assessment prepared by Artesia for WRSE looked at multi-sector demands out to 2050. Through work with the stakeholder advisory and multi-sector groups WRSE extended these demands linearly out to 2075. Further adjustments were made to incorporate increased demands for the power sector to match their licensed abstraction volumes, and to include a specific paper production demand.

4.48. It was envisaged that increased non-PWS demands could be met in three potential ways:

- Using existing licence headroom to meet any increases in non-PWS demands;
- Using existing licence headroom combined with the new multi-sector options to meet specific increases in future non-PWS demands (e.g. multi-sector demand management, increased farm storage, non PWS recycled water schemes etc.);
- Accommodate any specific increases in non-PWS demands within a revised PWS solution i.e. creating a multi-sector option from a PWS option.

4.49. The majority of the proposed future growth for non-PWS can be met within their current abstraction licence bounds in a normal year, therefore falling within the first option listed above. There are, however, a number of point sources which have been identified which are likely to have increased demands in the future which cannot be met with existing abstraction headroom.

4.50. Where new multi-sector options have been identified to meet these increased demands, options have been included in the WRSE investment modelling. Some non-PWS point demands, however, do not currently have a way to be met in future.

4.51. In these cases, the increases in non-PWS demand have been included in the WRSE investment model sensitivity runs to understand what PWS options would be required to meet the additional non-PWS demand. We will be continuing to work with the multi-sector group to identify if it is possible to resolve this demand using new multi-sector options, or by amending existing PWS options, i.e. the second or third options in the list above.

[30] https://www.nfuonline.com/media/03dpvggn/integrated-water-management.pdf

4.52. As set out above, forecasting demand from the non-public water supply sector is considerably more challenging given the lack of data. Whilst the impact on overall demand is relatively small, at a current level of around 150 million litres per day in comparison to an overall demand of up to 6 billion litres per day in the public water supply (PWS) sector, our member companies are working together with the Environment Agency and other stakeholders to better understand the locations and volumes associated with non-public consumptive abstraction of water, and in particular any future changes to permitted direct abstraction. We are also working to identify if abstractors are more likely to use public supplies in future, for example due to climate change.

4.53. By 2025, the start of our planning period, we expect other sectors to be using 164 million litres per day, the largest component of which is for agricultural and horticultural use (see Figure 4.3 below).

4.54. Through this work we have identified that nearly 100 million litres per day of additional water could be needed by 2075, primarily by the power and paper industries, and agriculture and horticulture users. The forecast is projecting demand under average condition. Our analysis has also shown that other sectors have little spare capacity to cope with drought conditions. Table 4.5 below shows projected demand in the future if we follow a linear trend through to 2075.

4.55. Whilst it has been identified that the majority of non-PWS demand can be met through existing licences, this is under normal year conditions. We have therefore also explored the impact of droughts on non-PWS demands, with sensitivity testing of how demand could change in a 1:100 year scenario and under an extreme drought scenario i.e. a 1:500 year event.

Figure 4.3: Non-public water supply forecast

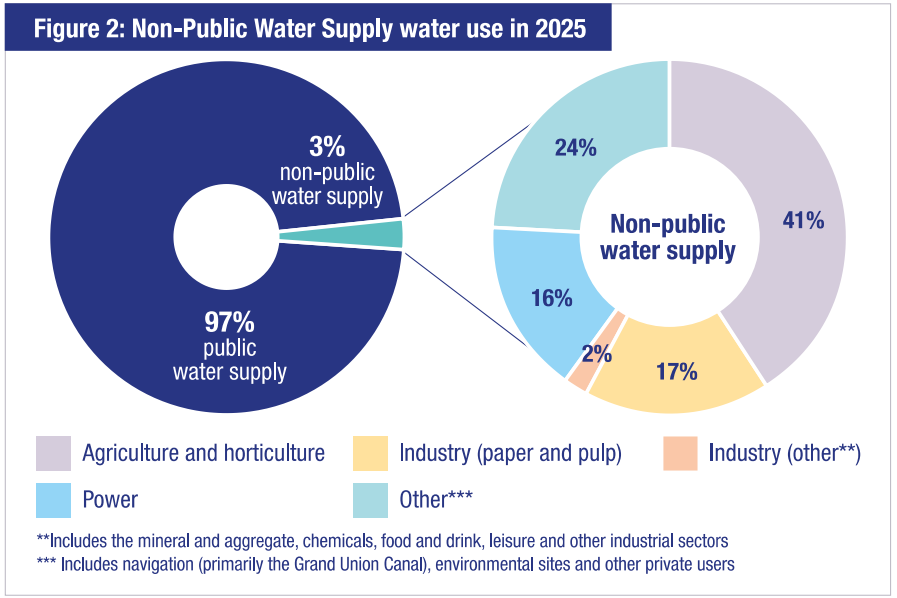


Table 4.5 The future needs of other sectors in the South East using a linear trend forecast (Ml/day)

Sector	2025	2030	2040	2050	2070
Agriculture (non-spray irrigation)	16.16	16.28	16.52	16.77	17.26
Spray irrigation	29.07	31.01	34.95	38.89	46.74
Horticulture including trickle irrigation	32.01	33.73	38.04	42.35	50.63
Chemicals	1.81	1.87	2.00	2.13	2.39
Food and drink	0.70	0.72	0.78	0.84	0.95
Minerals and extraction	1.79	1.77	1.72	1.67	1.58
Navigation	0.01	0.01	0.01	0.01	0.01
Paper and Pulp	33.02	53.67	54.96	56.26	58.85
Power	4.00	11.70	24.20	38.20	38.20
Other	45.75	51.65	51.44	51.24	50.83
Total	**164.31**	**202.40**	**2224.63**	**248.35**	**267.43**

4.56. The sensitivity testing has shown that there is no spare non-PWS capacity under an extreme drought scenario, and there would therefore likely be increased demands under these conditions. This is likely to have impacts on public water supply, particularly in the early years of the regional plan (up to 2040).

4.57. Further work is required to understand the multi-sector demands under different drought scenarios in collaboration with the multi-sector stakeholder group and regulators, particularly to understand the impacts of proposed licence capping on non-PWS sources.

Leakage and other components of the demand forecast

4.58. In line with the WPRG, WRSE has taken the same approach with forecasting baseline leakage as with PCC/PHC in that only those measures in the current Business Plan up to 2025 are included in the baseline forecast, with leakage remaining consistent thereafter, regardless of any increase in customer connections. It is assumed that planned reductions in leakage in the 2020-2025 period are achieved.

4.59. Ofwat introduced a consistent leakage methodology requiring all water companies to broadly align in their methods. This methodology was used in the 2020-2025 Business Planning period. Therefore it was not considered necessary to carry out a further joint assessment of leakage across the region.

4.60. Managing leakage is an important part of a water resources strategy. A low level of leakage is desirable for its environment benefit and because it defers the need to invest in new resources which would otherwise be needed to meet increases in demand over time. It also demonstrates water companies' commitment to customers to reduce losses over time.

4.61. Other minor components of the demand forecast include water taken unbilled and distribution system operational use including process water for treatment works. Water companies demand forecasts include allowances for these components.

Our supply forecast

4.62. We prepare a supply forecast to calculate the baseline level of water resources we predict will be available in the future to meet demand. These are calculated for each water resource zone (WRZ) for each planning scenario, and for each year throughout the fifty year planning period before the addition of any new schemes. This forecast is composed of several elements:

- Baseline deployable outputs
- The impacts of climate change on the water available in the environment
- Bulk imports and exports between our member companies and from other water companies or businesses into our region
- Potential reductions in the amount of water we use in order to protect the environment
- Process losses due to water used during treatment, and a risk based allowance for outage at water supply works.

Baseline deployable outputs

4.63. Deployable Output (DO) is the amount of water that water companies can take from river and groundwater sources accounting for any constraints on the maximum amount of water than can be taken from a source on a sustainable basis. These constraints vary and can include:

- Source characteristics (e.g. hydrological or hydrogeological yield)
- Physical and infrastructure constraints (e.g. aquifer properties, pump capacity, distribution networks)
- Raw water quality and treatment constraints
- Licence and other regulatory constraints on water abstraction
- Demand constraints and levels of service

4.64. It is often useful to describe DO in terms of the return period of weather conditions such as 1:2 (normal year), 1:10 (dry year), 1:200 or 1:500 (severe drought) etc. Return periods provide an estimate of the average probability

of a given drought event and the associated water resource yield we can expect in a drought of that severity.

4.65. Average DO (ADO) is the level of demand that the system can theoretically support under a design drought condition when measured as an average across the year whereas Peak DO (PDO) is used for the volume that can be abstracted during a period of peak demand which typically lasts for 2-3 weeks in the summer. ADO and PDO vary with the return period i.e. ADO in a normal year would be different from the ADO in a dry year. Sometimes we also use Minimum DO (MDO) which is the volume of water available from a source during the period of minimum resource availability (typically the autumn).

Drought resilience

4.66. During drought events water companies plan an escalating level of restriction on water use, which can be used to conserve water as a natural resource at times of drought – they are aimed at conserving supplies for as long as possible through prioritising water use, encouraging efficient use of water in homes/businesses and protecting the environment. These restrictions range from level 1 (media campaigns to encourage efficient use of water) and level 2 (Temporary use ban orders [hose pipe bans]) through to level 4 severe water use restrictions.

4.67. Level 4 restrictions are a last resort when all other alternatives have been exhausted, they involve physically constraining the supply of water through rota cuts and standpipes on the street. These restrictions are considered unacceptable by stakeholders, except in the most extreme circumstances, and customer surveys have consistently shown that customers are not prepared to accept these measures. The impacts of level 4 restriction would have material impacts on society, public health, and the economy to an extent not seen in modern times in the UK.

4.68. The National Infrastructure Commissions (NIC) report 'Preparing for a drier future' (2018)[31] recommended that the current level of resilience to severe drought (level 4, rota cuts and standpipes) should be increased from the current level of a 1 in 4 to a 1 in 17 chance of these measures being used by 2050 (the 1 in 17 equates to a nominal return period of 1:500). The NIC also set out a cost benefit case which showed that a £21bn investment to increase resilience would offset a £40bn cost of continuing to be relying on emergency options over the next 25 years. This is reflected in the National Framework which recommends that all regional plans should plan for 1:500 extreme drought resilience by 2039/40.

4.69. For water resources the planned return period for droughts, under previous planning guidance, has been to plan for the worst on record – this generally equated to ~1:100 year drought events due to the length of hydrological records that are available. A 1:100 return period equates to a 1% chance of the event occurring in a given year, which in turn equates to a 1 in 4 chance of happening sometime in the next 25 years. The shift to a 1:500 level of drought resilience equates to an annual chance of approximately 0.2%, or 5% chance of these measures being used over a 25 year period.

4.70. Our March 2020 document setting out preliminary water resource requirements for the South East was based on planning for a severe drought once in every 500 years and, as a result, boosting the level of resilience of our water supplies. While some stakeholders considered this was unnecessary, there was broader consensus to support this move and since then it has been included as a requirement in the Government's National Infrastructure Strategy[32] and in the WRPG.

4.71. Since our March 2020 document we have carried out detailed work to understand the impact that more severe droughts will have on our water resources. We are considering a range of different rainfall scenarios which include droughts of different durations and intensities so that we understand how much water would be available from our sources under different drought conditions.

4.72. The use of 'stochastic' climate datasets is growing within water resources planning, driven by a need to consider the impact of droughts that have not

[31] https://nic.org.uk/app/uploads/NIC-Preparing-for-a-Drier-Future-26-April-2018.pdf

[32] https://www.gov.uk/Government/publications/national-infrastructure-strategy

happened in the past. Historically, water resources planning has been carried out based on assessing supply capability considering only droughts that have happened in the past. This use of the historical record gives climate datasets that water companies, regulators, and stakeholders can be reasonably confident in (being based on weather that has happened) but does not allow for a thorough exploration of impacts of droughts that could happen in the future.

4.73. Reasonably reliable historical records for rainfall and potential evapotranspiration (PET), which are two of the most important inputs to hydrological models, are generally no more than around 100 years long, and so for companies to confidently assess their supply capability under '1 in 500 year' drought requires a significant amount of statistical analysis of climatic drivers and historical records.

4.74. The use of the term 'stochastic' regarding climate datasets references the nature of rainfall and the way that these datasets are derived. Rainfall cannot be predicted based solely on climatological indicators and rainfall volumes are instead climate-driven, but partially random (i.e. it would not have been possible at the beginning of 1976 to determine how much rain would have fallen that year, or when). The climate datasets are derived using relationships between output variables (temperature, rainfall) and climate indicators (e.g. North Atlantic Oscillation, Sea Surface Temperature), along with 'random chance', to generate datasets which are statistically consistent with the historical baseline, but which represent different versions of what 'could' have happened.

4.75. The generation of stochastic climate datasets involves a significant amount of complex analysis involving climate science and statistics. For the regional planning process the climate datasets represent a total of 19,200 years of modelled data. This allows us to plan on the basis of not only what we have experienced in the past, but also what we are likely to experience in the future. This is the first time that we have used a consistent data set within the South East of England which utilises a method and approach which has been rolled out to those companies in England. This data set also provides a consistent assessment of the deployable output of a number of options across the South East of England including the key Strategic Resource Options.

4.76. The amount of water we need in the future to provide this increased level of resilience is greater than our original projection because we are considering what a wider range of more severe droughts could mean. The way in which Drought Orders and Drought Permits are used within the plan, to help achieve a higher level of resilience to drought, has been subject to considerable feedback. Some stakeholders are keen to see these tools used to avoid increased investment in new resources while others want their use to be avoided altogether to help protect the environment. Our position is to rely as little as possible on Drought Orders and Drought Permits, particularly in sensitive areas. We have worked with the Environment Agency to review all tools that are currently available to water companies so that we understand the range of environmental risks. We will only include Drought Orders and Drought Permits in our plan which are agreed with the Environment Agency.

4.77. As part of our assessment of alternative water resource programmes we have tested alternative scenarios comparing the cost impact of using or not using Drought Orders and Drought Permits, and the time periods over which they can be relied on in drought conditions.

4.78. Our assessment has told us that we will need to produce a further 406 million litres per day more water to make our supplies more resilient to severe droughts by 2040.

Climate Change

4.79. The process we have followed to calculate the impact climate change could have on the amount of water that is available in the future is set out in our Climate Change – Supply Side Method Statement available in the WRSE Document Library.

4.80. We need to ensure that we include an appropriate allowance for the impact that climate change will have on supply capabilities in the period up to 2075.

4.81. For WRMP19, water companies carried out the most comprehensive supply-side climate change assessment ever undertaken by the UK water industry. However, since these analyses have been conducted, the underlying data that was used has been updated, with the 'UKCP09' climate change projections being replaced with 'UKCP18' projections. Data from UKCP18[33] provides the most up to date climate change projections available for the UK, using the best climate models from the UK and around the world, and provides several datasets which can be used by the water industry to determine the range of outcomes that climate change may result in.

4.82. Since WRMP19, the Environment Agency released new guidance associated with assessment of supply-side climate change impacts to incorporate guidance on using UKCP18 projections and on how to account for climate change impacts when considering '1 in 500-year' drought.

4.83. Our assessment tells us that climate change is expected to make droughts more serious and common in the future. This is because we are likely to see lower rainfall levels during hotter, drier summers so less water will be available in the sources we rely upon for our supplies. The extent of future climate change is as yet unknown and dependent on human actions now and in the future. Even if we were to know the level of future emissions, the impact that this would have on our supplies is still uncertain. As such we have included 28 climate change scenarios in our planning (see Climate Change – Supply Side Method Statement for more details).

4.84. As with population growth, given the uncertainty in the forecasts, we have considered how climate change could impact our supplies across a range of adaptive pathways. The additional water we could need is set out in Table 4.6, across a range of median, upper quartile (Scenario 6) and lower quartile (Scenario 7) climate change scenarios.

Table 4.6 Changes to supplies resulting from climate change scenarios (from 2025)

Climate Change Scenario		Year >>> Planning Scenario	2040 change (Ml/d)	2050 change (Ml/d)	2060 change (Ml/d)	2075 change (Ml/d)
6	High	DYAA	- 82.08	- 123.32	- 164.57	- 226.41
		DYCP	- 65.37	- 105.15	- 144.87	- 204.52
7	Low	DYAA	7.33	19.96	2.62	- 23.43
		DYCP	50.06	33.36	16.73	- 8.28
Median	Medium	DYAA	- 14.05	- 41.69	- 69.32	- 110.77
		DYCP	- 5.52	- 33.32	- 61.08	- 102.77

Bulk imports and exports

4.85. The bulk imports and exports component reflects transfers of water in and out of a WRZ. This can reflect both within company inter zonal transfers as well as exports and imports to other neighbouring water companies or other formal transfers.

4.86. There are many existing bulk transfer agreements between our member companies, and with companies in other regions. Existing inter-zonal transfer pipelines and existing inter-zonal bulk transfer agreements within the region are included as options after 2026, to enable existing transfer agreement inclusion to be included in the modelling. Bulk transfer agreements with neighbouring water companies are included as options in our investment modelling.

Abstraction reduction to protect the environment

Our approach

4.87. This new approach to defining environmental ambition for regional planning was first set out in the National Framework for Water. Our approach has sought to integrate existing, well-established process, with other indicators

[33] https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/download-data

to provide a better longer-term view of the potential requirements of the environment.

4.88. Assessment of the waterbodies across our region shows that 67.4% have below good status. Our past approach to protecting the environment has been focused on what improvements are required in the next 5 to 15 years to deliver the improvements set out in the WINEP. WINEP is a programme of both investigation and delivery projects, governed by the Environment Agency and implemented by the water companies. Typically, this programme investigates potential issues which might then feed into the next round of water company business plans.

4.89. The WINEP provides the actions required in the short-term to be compliant with environmental legislation. The process does not currently lend itself to considering a more collective longer-term approach as the approach doesn't account for potential landscape changes or the impact climate change might have on the availability of water in the future. For this reason, there is a need to use other approaches.

4.90. We have therefore developed an environmental ambition method to establish a series of alternative 'futures' which can be used to derive an adaptive regional plan and hence identify a series of pathways towards these different outcomes. The draft plan has assessed different scenarios that anticipate future levels of environmental protection, all including greater levels of protection than current levels, which will help to move towards planning for proactive protection rather than retrospective remediation.

4.91. As illustrated in Figure 4.4 below, our approach to defining environmental ambition has evolved as we have developed our plan. The work commenced with the Environment Agency's work associated with the National Framework, which established the potential licence reductions required by 2050 to meet the Environmental Flow Indicators (EFI) (these seek to ensure that a good ecological status is achieved or maintained). Detailed assessments were undertaken to identify the effect on supplies arising from the four scenarios, Business as usual (BAU), Enhance, Adapt and Combine. An additional scenario, BAU+, was developed for the South East to take uneconomic water bodies into account. Building on this, our member companies developed two additional scenarios, Central and Alternative.

4.92. We analysed the impact of all these scenarios on the supply-demand balance of our region's water resource zones by establishing the potential changes to deployable output to feed into the investment model.

4.93. We used this work to inform the environmental scenarios in our emerging regional plan (January 2022), where four of the scenarios were used to explore the range of challenges associated with the different future levels of environmental ambition: BAU+, Enhance, Central and Alternative.

4.94. Alongside and subsequent to the emerging regional plan consultation, we then undertook a mapping exercise to ensure consistency of approaches between our member companies, and derived consistent High, Medium and Low scenarios to utilise as the basis for decision making for the draft regional plan. All the environmental ambition scenarios in the draft regional plan took the proposed licence capping reductions into account.

4.95. The revised draft regional plan continues to use the High, Medium and Low scenarios. Since the draft regional plan WRSE has received updated environmental profiles from member companies, reflecting continued engagement with regulators and stakeholders.

4.96. The WRPG identifies that the BAU+ scenario is the minimum to be considered by our member companies in their WRMPs and this therefore has been used as the reference scenario for the regional plan. The WRSE High environmental ambition scenario best aligns with the BAU+ environmental ambition, whilst also incorporating licence capping, as shown in Figure 4.5.

Figure 4.4: The development of our approach to environmental ambition

Business as usual (BAU): The same percentage of natural flows for the environment that currently applies continues for the future. Uneconomic waterbodies, where reducing abstraction would imply a significant investment, were initially discarded. However, an additional scenario (**BAU+**) including them has been subsequently incorporated.

Enhance: A greater environmental protection for protected areas and Sites of Special Scientific Interest (SSSI) rivers and wetlands, principal salmon and chalk rivers is achieved by applying the most restrictive Abstraction Sensitivity Band (ASB).

Adapt: Same ASB as BAU but a recovery to a lower standard in some heavily modified waterbodies is assumed.

Combine: Balances a greater environmental protection for protected areas, SSSI rivers and wetlands and principal salmon and chalk rivers with a view that good status (as defined under the Water Framework Directive) cannot be achieved everywhere in a shifting climate. Hence, adopts the Enhance ASB with a lower recovery to the EFI in some heavily modified waterbodies.

Based on their knowledge of the catchments, with regards the potential ecological benefit of sustainability reductions and their affordability assumptions, companies developed two further scenarios to complement the existing five scenarios: **Central** and **Alternative**. These environmental ambition forecasts were developed in liaison with local EA teams.

In addition, companies applied the licence reductions estimated for the EA scenarios to obtain the DO impact for some of their groundwater sources.

Four of the seven defined scenarios were used in the WRSE investment modelling for the emerging regional plan, to represent the range of potential future environmental ambitions: **BAU+**, **Enhance**, **Central** and **Alternative**.

Due to the variation between relative reductions in the scenarios applied by the companies, a mapping exercise was undertaken to map **Enhance**, **Central** and **Alternative** across to consistent **High**, **Medium** and **Low** scenarios for each Water Resource Zone (WRZ).

BAU+ is the minimum environmental ambition scenario required to be considered by companies in their WRMPs, as stated in the Water Resource Planning Guidance (WRPG). This therefore has been used as a reference scenario for the Draft Regional Plan.

The **High** environmental ambition scenario best aligns with the **BAU+** environmental ambition.

All environmental ambition scenarios in the draft regional plan take the proposed licence capping reductions into account.

Non-PWS impacts have not been included in these assessments.

The Revised Draft Regional Plan has used the same scenarios as the Draft Regional Plan; **High**, **Medium** and **Low**.

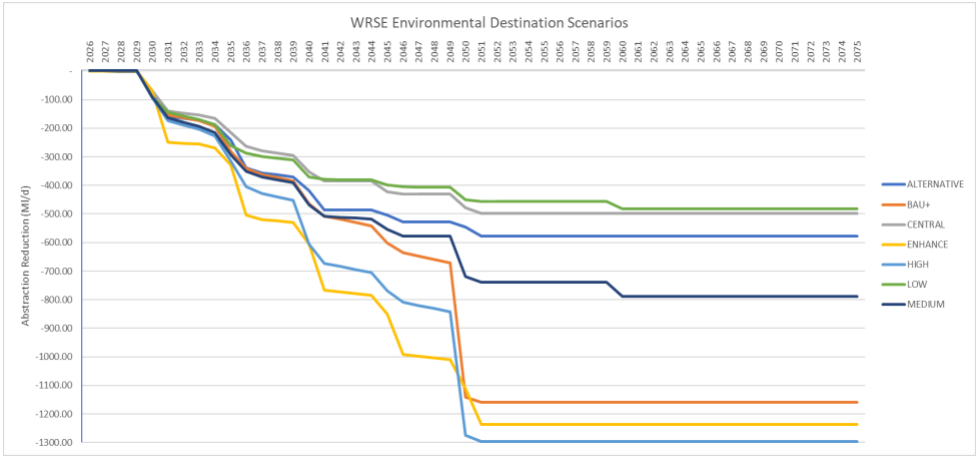
BAU+ is the minimum environmental ambition scenario required to be considered by companies in their WRMPs, as stated in the Water Resource Planning Guidance (WRPG). This therefore has been used as a reference scenario for the Revised Draft Regional Plan.

The **High** environmental ambition scenario best aligns with the **BAU+** environmental ambition.

All environmental ambition scenarios in the revised draft regional plan take the proposed licence capping reductions into account.

Non-PWS impacts have not been included in these assessments.

Figure 4.5: Comparison of scenario impacts on Deployable Output



4.97. Tables 4.7. and 4.8 present the modelled reductions in deployable output (DO) for public water supply licences and abstractions to fulfil the objectives of the high environmental ambition scenario.

4.98. At a regional level it can be seen in Table 4.7 that the reductions in DO resulting from achieving the High environmental ambition scenario would be an approximately 600Ml/d reduction by 2040, and 1,275Ml/d by 2050.

Table 4.7: Available residual deployable output (Ml/d) following application of the High Environmental Ambition Scenario

Company	2025-26	2029-30	2034-35	2039-40	2044-45	2049-50
Affinity	870	849	794	732	673	579
Portsmouth	203	203	163	136	108	80
SES	191	191	185	179	173	167
South East	615	569	528	493	465	435
Southern	516	516	451	360	309	286
Thames	3090	3065	3046	2978	2987	2661
WRSE	**5485**	**5392**	**5168**	**4878**	**4715**	**4210**

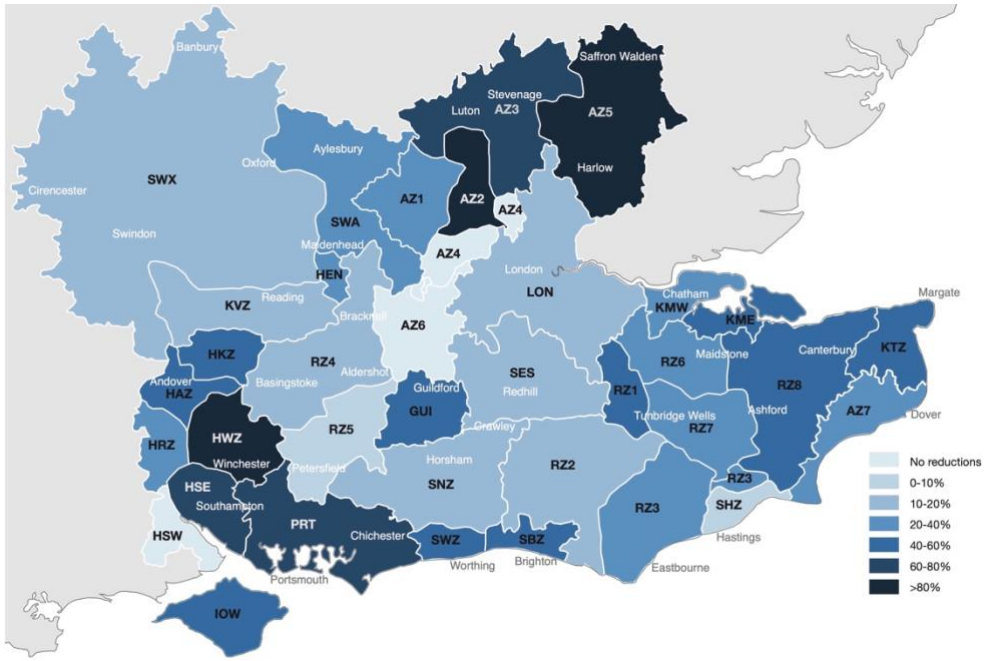
Table 4.8 Percentage change in DO from High Environmental Ambition

Company	2029-30	2034-35	2039-40	2044-45	2049-50
Affinity	2.44%	8.71%	15.81%	22.62%	33.42%
Portsmouth	0.00%	19.53%	33.12%	46.71%	60.31%
SES	0.00%	3.07%	6.14%	9.21%	12.28%
South East	7.57%	14.17%	19.97%	24.47%	29.25%
Southern	0.00%	12.69%	30.22%	40.10%	44.54%
Thames	0.60%	1.20%	3.40%	3.14%	13.70%
WRSE	**1.66%**	**5.76%**	**11.04%**	**14.02%**	**23.24%**

4.99. At a company level, the largest percentage reductions are forecast for Portsmouth Water and Southern Water, at over 60% and 44% reductions by 2050 respectively. Thames Water is forecast an approximately 14% reduction, but this equates to the largest volume of reduction (429Ml/d). The reductions are not uniform across our member companies, and differ significantly by WRZ, as shown in Figure 4.5.

4.100. The challenges arising from the DO reduction at WRZ level are explored in more detail in individual company draft WRMPs.

Figure 4.5: Map showing percentage reduction in deployable output in 2050 compared to 2025 in the High environmental ambition scenario



Process losses and outage

4.101. When companies treat water, there are some limited process and operational losses. This is accounted for in the supply forecast. Process losses here refer to the volume of water that is recycled back into the environment between the point of abstraction from the environment and where treated water enters the distribution network due to water treatment processes. Typically, groundwater sources have a simpler treatment process (in some cases only disinfection is required) than surface water sources and so process losses in groundwater dominated WRZs will tend to be smaller. For the regional plan, each company provided process loss calculations.

4.102. Outage refers to the planning allowance made for the temporary loss of DO from a source. This risk-based assessment of outage is included in the supply forecast to cover against the risk that not all of the potentially available supplies might be available at any given time. Outages can be both unplanned and planned. Unplanned outages can occur for a variety of reasons, such as mechanical failures or water quality issues. These can be either full outage, where an entire source is unable to produce water, or partial outage, where a site can produce water but not at the maximum DO. Planned outages occur where we need to take a source out of supply so we can undertake maintenance or improvement works.

4.103. To calculate outage for the regional plan, a consistent approach was adopted by our member companies for 2025-26 onwards as set out in our Outage Method Statement[34]. The approach looked at historical outage patterns and uses statistical models to forecast a future risk-based outage allowance at the 95th percentile. This means that if the calculated outage allowance was 10Ml/d then 95% of the time outage volumes would be expected to actually be less than or equal to that total.

Taking account of uncertainty

4.104. All forecasts carry a degree of uncertainty. The water sector deals with a percentage of this uncertainty through a planning factor called headroom. Uncertainty in future forecasts can arise in two key areas: accuracy of the components and the uncertainty arising from the range of potential future forecasts. For example, how accurate is the housing plan forecast really going to be.

4.105. There is an industry accepted methodology (UKWIR: An improved methodology for assessing headroom[35]), which sets out this approach and how this is calculated. For the purposes of the regional plan, we have

[34] https://www.wrse.org.uk/media/mpcljldq/method-statement-outage-aug-2021.pdf

[35] https://ukwir.org/water-research-reports-publications-viewer/6d4e9115-305b-4708-8544-14c4a7c9181a

developed a consistent approach to determining headroom that has been adopted across our member companies.

4.106. The traditional approach to headroom is to identify the uncertainty in the supply demand components and include an allowance of this uncertainty onto the demand forecasts. This has been required because companies used to only use a single forecast of the future which they knew was uncertain but for planning purposes the single forecast approach was simpler and easier to discuss. The uncertainty associated with these forecasts were catered for in headroom which was then added to the demand forecast.

4.107. The adaptive planning approach we are using for the regional plan (see Section 6 of this document) has meant that we have needed to develop an alternative approach to target headroom. The components used in our headroom profiles, based on the UKWIR guidance, are set out in Table 4.7. The adaptive planning approach already takes account of some of the uncertainty arising from a range of forecasts as it branches. To avoid double counting risks, we have removed any components used to define a branch (environmental ambition, growth, etc) from our headroom assessment.

4.108. Our full target headroom assessment was mainly focused on the beginning (root) part of our adaptive plan before it branches. After the root section the adaptive plan branches on environmental ambition and growth forecasts but leaves climate change as a central or median estimate. Therefore, an Environmental Ambition and Growth (EAG) target headroom profile was generated that dropped components associated with those components, such as vulnerable licences and demand forecast variations.

4.109. In the final set of branches in the adaptive plan the environmental, growth and climate change components are explored. Therefore, a third target headroom profile, Environmental Ambition, Growth and Climate Change (EAGC) was generated that excluded uncertainty of impact of climate change on source yields from the headroom component. The three headroom profiles included in Table 4.7 were combined to generate a combined headroom profile, referred to as the hybrid headroom profile. Target headroom profiles were generated at a WRZ level for both the DYAA and DYCP.

Table 4.9: Components to be used in the headroom profiles

Component	Component description	Full target Headroom profile	Environmental Ambition and Growth target headroom profile (EAG)	Environmental Ambition, Growth, and Climate Changes target headroom profile (EAGC)
S1	Vulnerable surface water licences	✗	✗	✗
S2	Vulnerable groundwater licences	✗	✗	✗
S3	Time limited licences	✗	✗	✗
S4	Bulk imports	✓	✓	✓
S5	Gradual pollution of sources causing a reduction in abstraction	✓	✓	✓
S6	Accuracy of supply-side data / overall source yield	✓	✓	✓
S7	Not used	✗	✗	✗
S8	Uncertainty of impact of climate change on source yields	✓	✓	✗
S9	Uncertain output from new resource developments	✓	✓	✓
D1	Accuracy of sub-component data	✓	✓	✓
D2	Demand forecast variation	✓	✗	✗
D3	Uncertainty of climate change on demand	✓	✓	✓
D4	Uncertain outcome from demand management measures	✓	✓	✓

5. Identifying the range of deficits in the South East region

The forecast deficits have been updated following updated population and growth, environment and other forecasts for the revised draft regional plan.

5.1 Previous sections of this document have set out the range of information informing the preparation of the baseline supply-demand balance of the regional plan. This includes information on a wide range of factors affecting future supplies and resource demands, including population growth, climate change and environmental policies and aspirations.

5.2 Through combining our demand forecasts and supply forecasts we are able to calculate how these will balance in the future, and how much water we need as a result. We produce supply demand balance plots at individual WRZ level, which can be aggregated at company and regional level. These plots identify how the scale of supply demand balance challenges change, according to the scale of future challenges we are facing.

5.3 The forecasts either result in a surplus or a deficit, and it is common in water resources planning for individual WRZs to start in a small surplus and then to move into a deficit as the planning period progresses. In some WRZs, however, they are forecast to start the planning period in a deficit and for this to worsen through the planning period. These WRZs are unable to balance demand and supply of water under our planning scenarios without demand management interventions or water resource developments.

5.4 The forecasts we produce cover the different planning scenarios required under the WRPG – Normal Year Annual Average (NYAA), Dry Year Annual Average (DYAA), Dry year Critical Period (DYCP), and for different drought conditions - 1:100 year, and importantly for the regional plan given the need to increase resilience to more severe droughts, the 1:500 year drought. Plots can be provided at WRZ, company and regional level.

5.5 When selecting schemes to solve for the future challenges, all four planning scenarios are used to ensure that the solutions selected can meet the anticipated deficits across all the scenarios to provide more efficient solutions. The four planning scenarios also provide utilisation profiles across the full planning challenge rather than a utilisation profile focused on the severe drought only.

5.6 From the information we have gathered, we have utilised:

- 5 different population growth scenarios (maximum, Hplan, OxCam, ONS18 and minimum)
- 29 climate change scenarios (28 different scenarios plus the median), and
- 4 different environmental ambition scenarios (BAU+, high, medium and low)

5.7 To ensure that the full range of potential future challenges is planned for, we have combined the population growth, climate change and environmental scenarios together in differing combinations. This results in a total of 580 different potential future water requirements, covering the full range of challenges that we face. Whilst these 580 futures are formed from different combinations of the individual scenarios, these individual combinations can give very similar results to other futures.

5.8 We plot each of these 580 futures under each of our four planning scenarios to demonstrate how, without any proposals we may make in the regional plan, the forecast deficits in available supplies change over time, under each of the potential futures. The range between the forecasts is significant.

5.9 We have provided forecast summaries in Figures 5.1 to 5.4 at the regional level for each of these planning scenarios. These highlight that the South East region is facing significant reductions in the supply demand balance because of the potential futures we face. The plots show how the reductions change for each of the NYAA, 1:100 DYAA, 1:500 DYCP and 1:500 DYAA planning scenarios. These are the forecast deficits which the investment model is then asked to solve and derive the optimum solution for (see Section 6 of this document for more details).

Figure 5.1: Normal Year Annual Average (NYAA) plot of potential futures

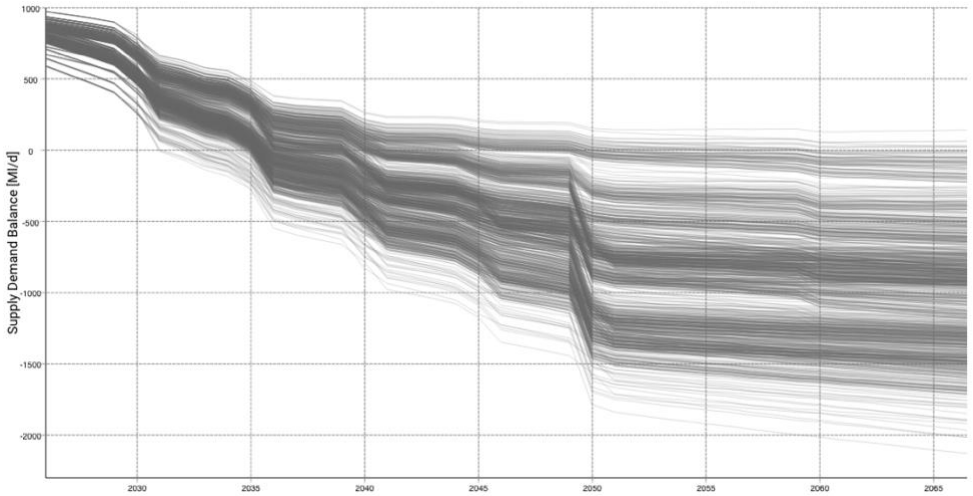


Figure 5.2: 1:100 Dry Year Annual Average (DYAA) plot of potential futures

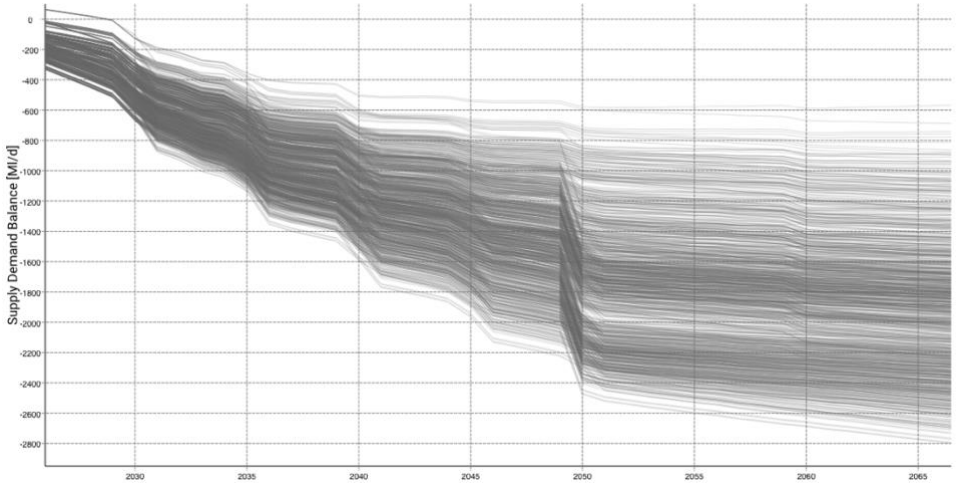


Figure 5.3: 1:500 Dry Year Critical Period (DYCP) plot of potential futures

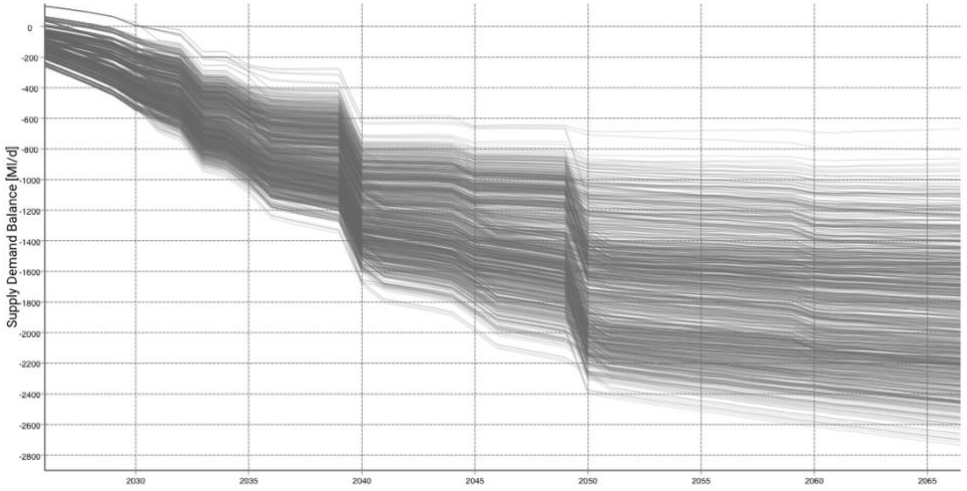
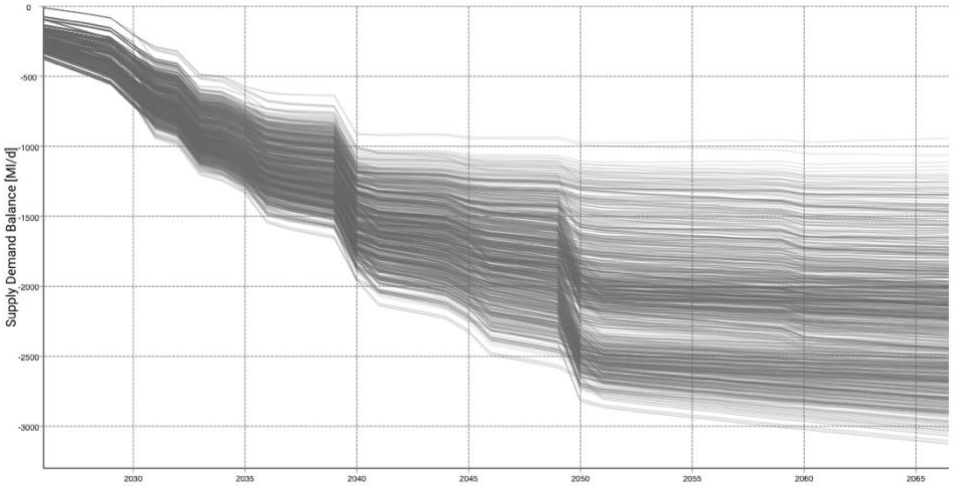


Figure 5.4 1:500 Dry Year Annual Average (DYAA) plot of potential futures



5.10 We do not know how these different scenarios may combine in the future, and there is therefore considerable uncertainty and a wide range of potential future challenges that we need to plan for. We will continue to monitor and update these scenarios over future iterations of the regional plan, but we need to plan now for the full range of potential futures we face. This will enable us to ensure that we maintain sufficiently resilient public water supplies for customers and multi-sector users, in an environmentally acceptable and responsible way.

5.11 The plots show in graphical format the wide range of potential impacts on the supply demand balance under the 580 potential futures. Each of the plots, although different, is consistent in what it shows – as in the early part of the planning period the lines are relatively closely grouped, as there is less variability in the forecasts in the short term. However, by the middle of the planning period the spread between the lines increases, as the range of potential futures, and the corresponding impacts on the supply demand balance increases. By the end of the planning period the range between the most challenging and least challenging future is very significant, amounting to thousands of megalitres a day difference between the forecast futures.

5.12 It is therefore not only the magnitude of the individual potential future challenges, but also the range between them and how this could change over time, which drives investment choices in the regional plan. These combinations of discrete forecasts describe the overall supply demand balances the region potentially faces in the future. Whilst each pathway is described by a combination of discrete forecasts, many of the pathways are remarkably similar in terms of their deficits either at specific times or trend in the future. What this means is that whilst a single pathway or branch has been selected, there are several other combinations of forecasts that could produce a similar supply demand balance to the one described in the plan.

5.13 It should be noted that the environmental ambition scenarios not only describe the outcome associated with a particular scenario, but each scenario has an associated implementation profile. For the revised draft regional plan we updated the scenarios for the implementation of environmental ambition in liaison with environmental regulators. The scenarios will still take place over a number of years, but some of the updated profiles accelerate the implementation programme to try and reduce abstractions quicker. All the environmental ambition profiles build in licence capping within the first 10 years of the plan and agreed reductions to sources.

5.14 The following section of this document explains how we have selected our regional plan, including our selection of individual pathways as part of our adaptive planning approach. This includes an explanation of how we have undertaken investment model runs using various iterations of branches and trees, to determine what we consider to be the most appropriate to select as the basis for the regional plan. These have been tested and assessed by our member companies, and with the environmental regulators, which is particularly relevant given the degree of influence that the selected level of environmental ambition has on the regional plan.

5.15 This testing and review process has been undertaken on an iterative basis, enabling the impacts on investment model option selection to be understood at each stage of the process. From this work, we have been able to assess the scale of supply demand balance deficits arising from some of the more challenging climate change, population growth and environmental ambition scenarios. For the more extreme scenarios, this includes testing the extent to which there are sufficient options available to overcome supply demand deficits, and/or whether some options considered to be potentially environmentally damaging and initially screened out need to be selected, in order to meet the scale of deficit forecast.

5.16 Our best value planning approach was consulted on and its application is explained in detail in our Best Value Planning Method Statement, available in our document library. Under our best value planning approach, we have identified four objectives for our regional plan to achieve, building on consultation and engagement on best value. This means our regional plan is not least cost, but it will deliver more to customers, the environment and society.

5.17 To make sure our plan is resilient to future shocks and stresses, both the ones we can forecast and those we can't, our plan is being developed and tested against a new resilience framework, which we consulted on, as part of

the best value plan. This allows us to appraise choices for our plan in terms of the resilience of both water supplies and the natural environment. The resilience framework is in our document library and is discussed in Section 6.

6. How we have prepared our plan

This section of the plan has been redrafted, bringing together a number of previously separate sections to more clearly explain the approach to the preparation of the regional plan.

Approaches we have used

6.1 In this section we explain how we have used the problem characterisation assessment and decision-making tools to develop our plan, including our: adaptive planning; and best value planning approaches, which includes our resilience framework; and the regional reconciliation which helps align our plans with the other four regional groups in England.

6.2 These tools, processes and approaches ensures that the adaptive plan is compliant with the Water Resource Management Planning Guidance and reports the investment strategy which meets government expectations.

Problem characterisation

6.3 Water resources planning uses a risk-based planning approach. The tools you develop and methods you employ to identify an overall best value solution should be commensurate with the risks in your planning area. In order to establish the level of risk, we have taken the base data we have gathered and carried out an assessment known as problem characterisation.

6.4 Problem characterisation enables us to examine the severity of any potential planning problems and the potential complexity of solution to those problems at WRZ-level. By combining these elements, we can establish an overall High, Medium, Low risk level for each zone, and go on to consider which tools are fit for purpose to meet those risks. Critically we can also understand if a simple risk allowance (headroom) would be sufficient to cope the potential uncertainty or whether an adaptive planning approach would be a better planning approach.

6.5 Our assessment work, for characterising the risk in the South East, is set out in our Problem Characterisation Report, available in our Document Library. There are a range of risks and potential levels of impact on future supplies identified for each of the individual water resource zones (WRZ). We consider that taken together at a regional scale, the overall risk for the South East of England to be high.

6.6 The UKWIR Decision Making Process guidance describes decision-making tools and supporting methods available from the simple to the complex, cost-based to full multi-metric, system simulated adaptive planning. With WRSE assessing its level of risk as high, UKWIR Guidance recommends that we consider the use of extended or complex risk-based techniques to enable a thorough analysis of the planning problem. The decision support tools we have developed are specifically designed to respond to this, as summarised below.

Adaptive planning

6.7 Water resource plans have traditionally always considered a range of potential futures, but the published WRMPs identified a single forecast future which formed the basis for identifying the proposals necessary to balance customer demand and available supplies. This 'central forecast' included 'headroom' (an allowance for uncertainty and risk) and was used as the basis for the whole of the plan period (normally a 25 year period).

6.8 The range of potential futures and challenges that we face is significant, and this requires a different approach. We have chosen to develop an adaptive plan as a result, which means the options that are ultimately chosen will be the ones that best meet a wide range of possible futures. This adaptive planning approach is promoted by the National Framework and the WRPG.

6.9 An adaptive plan approach acknowledges that there are large uncertainties when forecasting future conditions (supply, demand and environmental policy in this case), and takes these into account when identifying the best value solution. The 'plan' therefore includes four elements:

- A preferred set of *pathways* that show how we invest and build in response to changing conditions.

- The short term *actions* that we need to start now, and the longer term *investments* in each pathway
- Any *preparatory actions* we need to take now and going forward to allow us to keep the longer term options open
- A *monitoring plan* that identifies how we will track the situation and what will 'trigger' us to take one pathway over another

6.10 At their broadest context adaptive plans show how a programme of investment would change if key policy uncertainties were resolved and forecasted growth rates and climate change occurred in the future. The various pathways or situations are influenced by exogenous factors and policy decisions. Typically, exogenous factors have smoother forecasts whereas policy decisions lead to step changes in forecasts.

6.11 Adaptive plans consist of a number of different situations which are combined into an adaptive situation tree whose branches highlight where these trigger points are and indicate where and how a plan might deviate from one path to another path. The South East regional plan combines 9 different situations to create the regional situational tree. The overall cost efficiency of the branches would be influenced by the initial choices made in the plan. For the South East adaptive plan it sets out what investments are required in the short term to allow the investment strategies to adapt to the different future scenarios.

Best value planning

6.12 The scale and complexity of water resources planning for the South East supports the use of advanced decision-making methods to ensure that a robust solution is reached. When preparing its plans, WRSE constructs two types - plans which just consider costs, referred to as the least cost plan, and plans which consider costs and other metrics, referred to as the best value plan.

6.13 An adaptive plan that is best value, in the context of water resources planning, is one that considers a range of factors (not exclusively financial cost). As a minimum any plan must still meet the legislative and regulatory requirements (including securing a supply of wholesome drinking water for customers) and other policy expectations in an efficient, affordable and deliverable way. A best value plan seeks a solution that not only secures supplies for customers, but also increases the overall benefit to customers, the wider environment and society as a whole. The metrics that are used to define best value were set out in our consultation document in July 2021. These metrics were then set and used in our emerging plan; draft regional plan and this revised draft regional plan.

6.14 Our best value planning approach is explained in detail in our Best Value Planning Method Statement on our website. Under our best value planning approach, we have identified four objectives for our regional plan to achieve, building on consultation and engagement on best value. This means our regional plan is not least cost, but it will deliver more to customers, the environment and society. Our best value objectives for the regional plan to meet are:

- Deliver a secure and wholesome supply of water to customers and other sectors
- Deliver environmental improvement and social benefit
- Increase the resilience of the region's water systems
- Deliverable at a cost that is acceptable to customers

6.15 Beneath each of these objectives are a number of criteria that we use to measure how our plan performs and to help us identify the 'best value' plan for the region. Some of these criteria are constraints within our plan so the plan must deliver them. This includes meeting the supply-demand balance, contributing to the Environmental Improvement Plan interim targets, reducing leakage by 50% by 2050, achieving levels of abstraction reduction and increasing resilience to a one in 500-year drought event. The remaining criteria are used to help compare how different water resource programmes perform so we can identify the one that delivers 'best value' to the region.

6.16 These criteria were chosen following consultation with stakeholders and we've asked customers which they consider to be the most important. This will help us take forward a regional plan that best meets their priorities. Each objective is represented by a set of value criteria which, in turn, will have an associated metric that measures the additional value it delivers. We use the criteria and metrics to assess the different water resource programmes that

are produced through our investment modelling. We'll also use them to compare the shortlisted best value programmes and explain the differences between them and the additional value each delivers.

6.17 Each programme comprises a series of options and will be a different version of what the plan could look like. Some of the value criteria identified are things that we 'must do', including the legal and regulatory requirements that our regional plan must meet to support our member companies' WRMPs. Others are topics or policy areas (things we "should-do") where there is a strong policy expectation that they will be achieved and/or the individual member companies have already made commitments regarding their incorporation. These value criteria are described as constraints. For example, the secure and wholesome supply of drinking water to customers is an absolute requirement on companies; as is the demonstration of how all the water resource programmes we produce meet these requirements.

6.18 There are other criteria we use to generate different programmes which deliver additional value. We use these criteria and metrics to help us identify where value is added so we can differentiate between programmes. These are described as optimised criteria and we use them to shortlist the water resource programmes that offer 'best value' and achieve our objectives.

6.19 Once we have used these criteria to shortlist our 'best value' water resource programmes we use the metrics to help compare the different programmes. These metrics combined with the consultation responses and customer survey work help us identify any 'trade offs' in how different (optimised) value criteria are measured and weighted that need to be made before ultimately identifying the preferred water resource programme that will form the basis of our regional plan.

6.20 We have not appraised and selected individual options in isolation. We have appraised a series of programmes, each comprising options that we consider, by combination, meet our objectives, value criteria and deliver additional value. There are a number of potential best value programmes that could be adopted, each delivering alternative levels of value against different best value criteria. There is no single understanding of what is "best" but trade-offs will be made between different levels of value across the objectives. Figure 6.1 below, sets out the value criteria and the metrics that represent each objective.

6.21 Most of the optimised metrics used in best value appraisal are calculated using information that is evaluated at option-level. The Investment model takes the option-level information and combines it to make programme level assessments. Combining option-level information to make a programme-level assessment can be as simple as adding option-level values together. In other cases, further calculations are made e.g. the cost metrics, where each of the schemes have to be scheduled over the planning period and costs discounted over time.

Figure 6.1 Best Value criteria and metrics

Deliver a secure and wholesome supply of water to customers and other sectors to 2100

Value criteria	Definition	How we'll measure it (metric)	Criteria type	Data source	Method statement / document
Meet the supply demand balance	All the water resource programmes that we consider for the regional plan must meet the supply demand balance so there is no water shortfall in any of the water companies' supply areas over the planning period. This is a legal requirement.	Public Water Supply - supply demand balance profile (Ml/day)	Constraint	Final supply demand balance for public water supply	Regional planning tables
	The regional plan is also looking to address the future needs of other sectors. We've worked with representatives of sectors that rely heavily on water in our region to understand how much additional water they need the regional plan to deliver to meet their future needs.	Provides additional water needed by other sectors (Ml/day)	Constraint	Non-public water supply demand forecast	Multi-sector
Leakage	The South East water companies have committed to reducing leakage by 50% by 2050. All the water resource programmes that we consider for the regional plan will achieve this target.	50% reduction in leakage by each company by 2050 from 2017/18 baseline (%)	Constraint	SE water companies Annual Review 2017/18	Options appraisal
	There are options that would reduce leakage further over the planning period. We will develop programmes that include leakage reduction beyond 50% and use this criterion to assess and compare the performance of the shortlisted programmes.	% leakage reduction above 50%	Optimised	Option level assessment	Options appraisal
Water into supply	All the water resource programmes we consider will include options to reduce water use. At present there is no formal target for water consumption that we can include in our plan so we will develop programmes that include different levels of consumption reduction and use this criterion to assess and compare the performance of shortlisted programmes. Defra is considering a metric or target to encourage a reduction in the amount of water used. We'll revisit this if it is set to make it a constraint within the plan. In that event, anything beyond that target will be used to demonstrate performance of the shortlisted programmes.	Distribution Input (DI) per property (litres per day)	Optimised	Option level assessment	Options appraisal
Customer preference	We have conducted research into customer priorities and preferences for different option types. This produces a score, and we will use this criterion to assess and compare the performance of shortlisted programmes. In addition to using this criterion to assess best value, we will engage with customers to help us consider the application of weightings to the different criteria and identify the preferred programme.	Customer preference for option type (score)	Optimised	Customer research	Customer engagement

Deliver environmental improvement and social benefit

Value criteria	Definition	How we'll measure it (metric)	Criteria type	Data source	Method statement / document
Strategic Environmental Assessment (SEA)*	Regional plans are non-statutory but we will apply the SEA criteria. The SEA informs the decision-making process through the identification and assessment of the effect a plan or programme will have on the environment. We will use the SEA to calculate the individual scheme scores. This does not replace the SEA process.	Programme benefit (score max) Programme disbenefit (score min)	Optimised	Option level assessment	Environmental assessment
Natural capital	Natural capital can be defined as the elements of nature that directly and indirectly produce value or benefits to people (now or in the future). There is no statutory target to increase natural capital, but it is an aspiration of the UK Government's 25-year Environment Plan. We will calculate the increase in natural capital that the different water resource programmes deliver and use this criterion to assess and compare the performance of different programmes.	Enhancement of Natural Capital Value (£m)	Optimised	Option level assessment	Environmental assessment
Abstraction reduction	Reducing abstraction from sensitive water sources is one element of how the regional plan will deliver environmental improvement. We will use our investment model and technical environmental work to optimise this, considering affordability, the expected benefits that will be derived and the timing of delivery.	Reduction in the volume of water abstracted at identified sites (Ml/day) and by when (date)	Constraint	Environment Agency scenarios and water company scenarios	Environmental ambition
Biodiversity	Improving biodiversity is required under a range of different legislation and policy and assessing the biodiversity net gain of our water resource programmes is a requirement of the Water Resources Planning Guideline. It is also an SEA objective. We will develop a net gain score** for each of our different water resource programmes and use this criterion to assess and compare the performance of different programmes.	Net gain score (%)	Optimised	Option level assessment	Environmental assessment
Carbon	The water industry has committed to achieving net zero operational carbon emissions by 2030. There is also an objective to reduce embodied and operational carbon emissions as part of the SEA. We will show how different water resource programmes seek to balance the additional carbon created through a combination of minimising emissions by considering alternative construction techniques and/or materials and by carbon offsetting schemes. The cost of this is included in the total programme cost but we will also use the cost of carbon offsetting to assess and compare the performance of different programmes.	Cost of carbon offsetting (£m)	Optimised	Option level assessment	Environmental assessment

*The Strategic Environmental Assessment (SEA) is a separate part of the programme appraisal process and includes a number of objectives and metrics. We consulted on the scope of our SEA and its objectives in August 2020. In addition to looking at the overall benefits and disbenefits we will also be undertaking further checks on the in-combination effects of different options working in conjunction with each other both from an environmental perspective and the ability to deliver the options within each programme.

**We will agree an appropriate method of calculating biodiversity net gain through discussions with regulators.

Increase the resilience of the region's water systems

Our multi-sector, regional resilience plan will plan for a wider range of shocks, stresses and events beyond drought and will assess the resilience of the region's main water systems:

- The public water supply system run by water companies
- The non-public water supply system that provides the water to other sectors
- The environmental water system.

We have developed a Resilience Framework*** so we can show how the resilience of each system is changed by the different water resource programmes. There are three components of our resilience assessment – reliability, adaptability and evolvability – which each have a set of associated metrics. We will produce a score based on the amalgamated metrics for each of these components and use this a criterion to assess and compare the performance of different water resource programmes.

Value criteria	Definition	How we'll measure it (metric)	Criteria type	Data source	Method statement / document
Drought resilience	Water companies currently plan for a severe drought to occur once in every 200-years. The National Infrastructure Strategy[3] set a requirement for this to increase to once in every 500-years, increasing the level of resilience, this has been endorsed by HM Treasury. All the water resource programmes we produce will achieve this level of resilience. We will use the Best Value planning approach to identify the optimum time we can achieve this increased level of resilience.	Achieve 1 in 500-year drought resilience (date achieved)	Constraint	This is included as a requirement in the National Infrastructure Strategy	
Resilience assessment Reliability	Reliability is the ability to withstand short term shocks without actively changing the performance of the system.	Programme reliability score	Optimised	Resilience assessment	Resilience Framework
Resilience assessment Adaptability	Adaptability is the ability to make a short-term change in performance of the system to accommodate the impact of a shock and recover.	Programme adaptability score	Optimised	Resilience assessment	Resilience Framework
Resilience assessment Evolvability	Evolvability is the ability to modify the system function to cope with long term trends.	Programme evolvability score	Optimised	Resilience assessment	Resilience Framework

***We consulted on the Resilience Framework in June 2020. It sets out a method for assessing resilience across the three main water systems – public water supply, non-public water supply and the environment. We have responded to feedback and developed it further through engagement with stakeholders. You can view the final Resilience Framework Method Statement here.

[3]National Infrastructure Strategy, November 2020

Deliverable at a cost that is acceptable to customers

Value criteria	Definition	How we'll measure it (metric)	Criteria type	Data source	Method statement / document
Programme cost	This represents the total cost of delivering all the options in the water resource programme. It uses the standard HM Treasury rate to calculate the total programme cost. We will use this criterion to assess and compare the performance of the different water resource programmes.	Net Present Value (£m) using the Social Time Preference Rate (STPR)	Optimised	Option level assessment	Option appraisal
Inter-generational equity	This criterion also looks at the total cost of the programme but calculates it using a lower HM Treasury rate that spreads the cost of the programme over the planning period delivering best value for both present and future generations. We will use this criterion to assess and compare the performance.	Net Present Value (£m) using the Long Term Discount Rate (LTDR)	Optimised	Option level assessment	Option appraisal

Resilience framework

6.22 To make sure our plan is resilient to future shocks and stresses, both the ones we can forecast and those we can't, our plan is being developed and tested against a new resilience framework as part of the best value plan. This allows us to appraise choices for our plan in terms of the resilience of both water supplies and the natural environment.

6.23 We have utilised our resilience framework in three ways:

- A baseline assessment of the resilience of our public water supply system (on our website).
- Score and identify the benefits of various options that either increase the supply of water or reduce demand for it.
- Assess the resilience of alternative water resource programmes as part of our 'best value' assessment to identify our preferred plan.

6.24 Our resilience framework approach allows us to incorporate the concept of 'resilience' into our regional planning process. This framework helps us to move from a focus on securing public water services and managing the risk

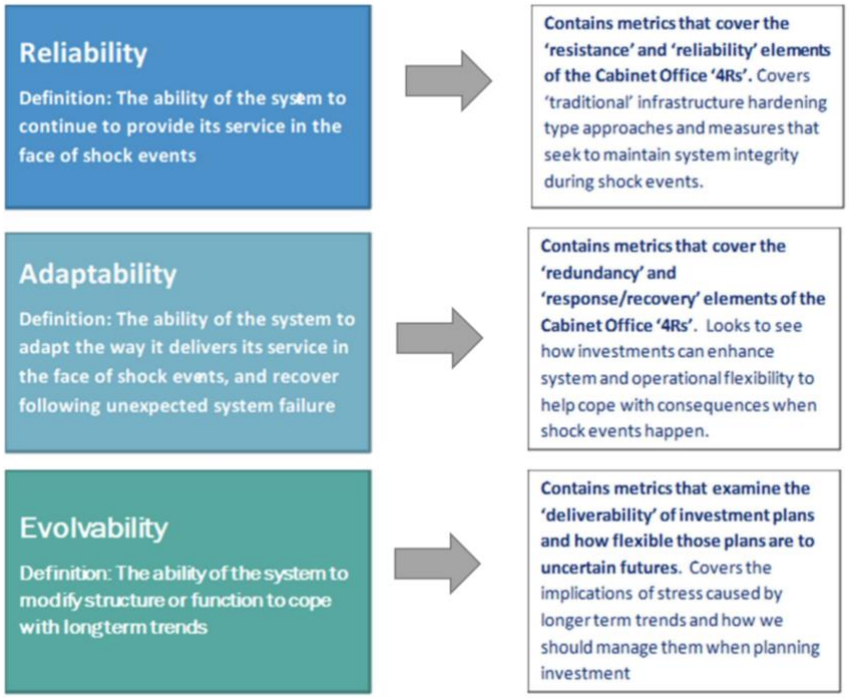
of droughts, to securing water resilience across a series of connected water systems. It is described in detail in our Resilience Framework Method Statement, available in the WRSE Document Library.

6.25 We recognise that the water resource systems across the South East of England are complex, multi-sector and interlinked, and that risks associated with drought events cannot be viewed in isolation if we are able to meet the challenges and identify the opportunities that exist within the domain of water resources within our region. We also understand that we must plan to invest in improvements to our water resource system so we can build resilience against the uncertainty of future shocks and stresses to those systems.

6.26 Our framework allows us to evaluate and quantify resilience so that we can incorporate the concept into our wider best value planning of water resources for the South East. This is an important step towards a wider, more integrated understanding of water resources planning.

6.27 Our resilience framework is based on the three key attributes of reliability, adaptability, and evolvability. These describe how our systems can cope both in the face of 'shock' events (transient events such as droughts or pandemics that can act to disrupt the function of the system) and future 'stresses' (trends that affect the functioning of the system). This method incorporates the required 'resilience in the round'[36] approach recommended by Ofwat, and the 4R's recommended by the Cabinet Office[37] to understand the resilience of existing systems, and extends this to include an assessment of how resilient our investment plans themselves are to future uncertainties. A summary of the three attributes and how they relate to the best practice recommended by the Cabinet Office and Ofwat is provided in Figure 6.2.

Figure 6.2: Summary of resilience attributes and how these relate to the Cabinet Office and Ofwat guidance



6.28 As well as the three resilience attributes, there are two further key approaches that inform our resilience framework.

- A Systems Approach – We identified three primary systems of interest – the public water supply system, the water environment system and the non-public water supply system. We assessed these systems to understand how they interact with each other and how they interact with the wider South East regional socio-economic system (i.e. those

[36] https://www.ofwat.gov.uk/wp-content/uploads/2017/09/Resilience-in-the-Round-report.pdf

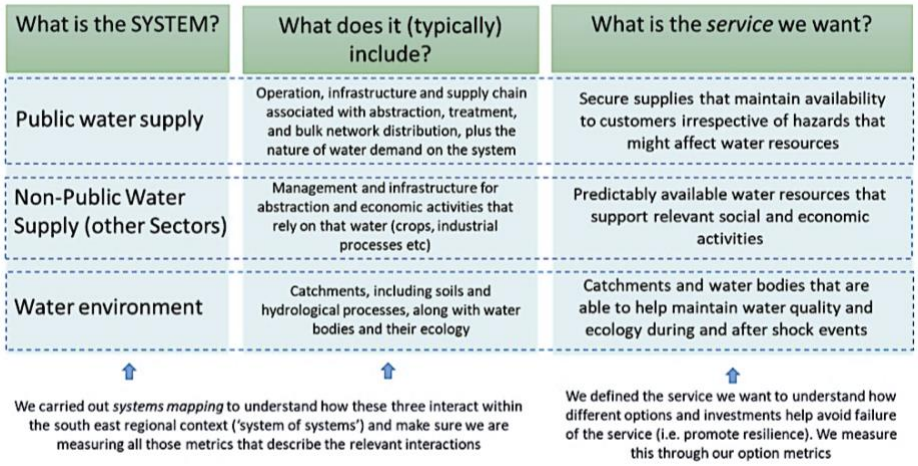
[37] https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/61342/natural-hazards-infrastructure.pdf

wider activities that rely upon a secure and sustainable supply of water) and used this to inform our scoring metrics

- Scoring metrics – The three core attributes (reliability, adaptability and evolvability) are not specific enough to allow us to measure them directly so we developed metrics to evaluate the existing systems and investment plans.

6.29 Through system mapping we were able to identify resilient attributes for each system as set out in Figure 6.3.

Figure 6.3: Primary water resource systems and the resilient service we want to achieve



6.30 The framework means we can score resilience in a consistent and comparable way and consider the overall resilience of water resource programmes as part of our best value decision-making process.

Regional reconciliation

6.31 WRSE is one of five regions preparing their own regional plan. Given the key role which sharing resources across regional boundaries plays in water resources planning there has been a high degree of regional collaboration. For WRSE, key interfaces are with West Country, East and West regions, although there has been close collaboration across all regions.

6.32 A key aspect of the regional collaboration has been to share information on available options and on the outputs of the individual regional modelling work. This focuses on existing and potential inter-regional transfers, to ensure transfers align in individual plans in terms of volumes and dates.

6.33 We have presented our investment model run outputs to the other regions as part of the reconciliation process, to test and verify the extent to which potential transfers into the South East from other regions are expected to be available under the planning scenarios. The expectation at the outset of this process was that regional imports could potentially play a key role in meeting some of the scale of challenges that the South East region is facing.

6.34 The regional reconciliation process enables the regions to test this against consistent planning scenarios, including what effect achieving higher levels of resilience (1:500), population growth and climate change, and differing levels of environmental ambition, has on future availability of water to transfer to and from other regions. Under the more challenging futures, rather than having plentiful supplies of water to potentially transfer to the South East, other regions are themselves facing significant water resource deficits. The greater the challenge the regions plan for, the lower the potential future inter-regional transfers that results.

6.35 We have undertaken a number of iterations of our investment modelling as we have worked through the regional reconciliation process. The resulting outputs, in the form of our emerging, draft and revised draft regional plans are based on the most likely availability of resources from other regions at this point in time. A regional reconciliation report is published alongside the regional plans from each region at each stage of the process, to set out the work undertaken and outcomes achieved. These are published on the WRSE website.

The steps we have taken to prepare our regional plan

6.36 In this section we explain the tools we have used and steps we have taken to select our regional plan as follows:

- how we have used **our investment model** to develop the best value and alternative plans through scenario and sensitivity testing
- how we defined the **adaptive plan situation tree** and **selected pathways**
- how we used the selected pathways to identify the range and scale of **supply demand balance challenges** that the region could face under various scenarios, depending on future climate change, population growth and environmental ambition.

Our investment modelling

6.37 We have undertaken thousands of investment model runs to develop the best value and alternative adaptive plans for the South East, including sensitivity and stress testing of our proposals, and concluded that:

- There are an immediate set of schemes required to meet the short and medium term challenges in the region. These must be developed and in place within the first ten years of the plan.
- The move to a greater level of resilience and protecting the environment at key catchments within the region will require another set of strategic solutions to be put in place. These solutions and the connectivity they put in place by 2040 will allow the region to better adapt to the future as well as deliver environmental protection.
- The final stages of the plan set out what additional solutions will need to be put in place or commenced to meet the future environmental requirements, climate change and population growth.

6.38 The investment modelling developed by WRSE uses 'net present value' optimisation to identify the lowest cost solution across the region to the supply and demand challenge that it faces. It incorporates the 'must do' items identified by the Water Resources Planning Guideline and sets them as conditions that the model must meet (i.e. supply must be greater than (or equal to) demand given the level of environmental ambition and drought resilience that is required for that scenario, and leakage reduction must be at least 50% by 2050).

6.39 Whilst for the emerging plan only those factors that could be given a monetary cost were considered, for the draft and revised draft regional plans we have used best value metrics within the investment model, and been able to optimise against those metrics. All plans therefore have an associated set of BVP metric scores.

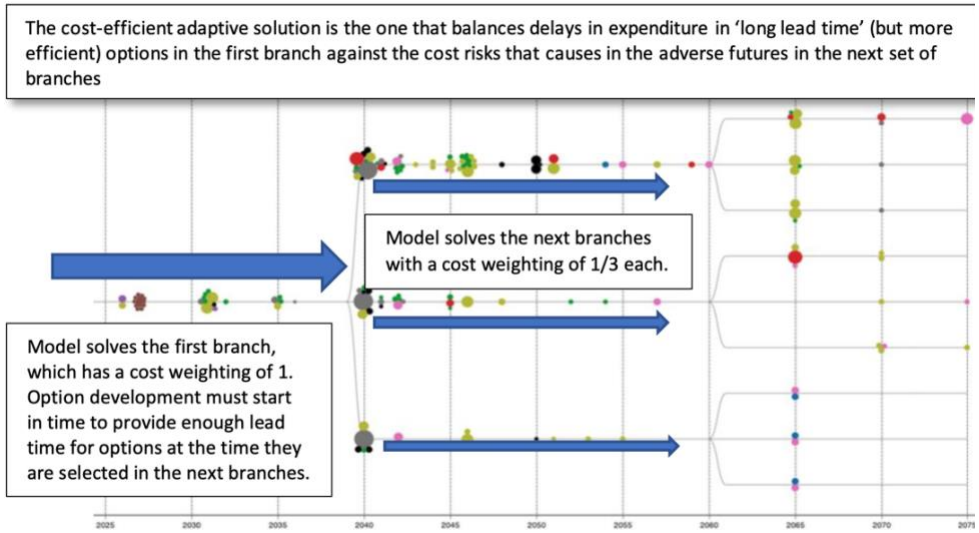
6.40 The model manages future uncertainties through the use of the 'adaptive pathway trees. The investment model works by simultaneously solving all branches of the tree (each of which represent a different set of future conditions).

6.41 For each branch it seeks to minimise the cost associated with meeting the need on that branch, whilst ensuring that sufficient intervention activity is carried out prior to the 'break point' to allow future branches to be solved. The lowest cost plan is the one that does this for the lowest total expected programme expenditure, discounting future costs in line with Government guidance to give a net present cost. The best value plan is selected from model runs which seek to optimise performance against a series of best value metrics. Except for the first branch, which is common to all futures, all other futures are considered equally likely and the costs weighted accordingly. The adaptive pathway branches have been selected so that they are similarly likely given what we know about future risks at this point. These key concepts are illustrated in Figure 6.4.

6.42 Further explanation of the investment modelling approach is detailed in our Investment Model Summary report, published in 2019.

6.43 The runs presented in this regional plan reflect the configurations of supply system operations and infrastructure that may be required to share schemes on a regional basis as they were understood at the time. Where ongoing studies indicate that there are uncertainties in this configuration that have the potential to affect the choice and timing of cost-efficient scheme selection, then the implications of this are explained in the plan.

Figure 6.4: Illustration of investment modelling approach



The adaptive plan

6.44 Within this section we set out how we have characterised the vast range of challenges in the South East using an adaptive situation tree. This situation tree was used by our investment model to derive a series of investment plans to meet the needs of the region taking uncertainty into account.

6.45 An adaptive plan acknowledges that there are large uncertainties when forecasting future conditions (supply, demand and environmental policy in this case), and takes these into account when identifying the 'best value' solution. The 'plan' therefore includes 4 elements:

- A set of pathways that show how we invest and build in response to changing conditions.
- The short term actions that we need to start now, and the longer term investments in each pathway
- Any preparatory actions we need to take now to allow us to keep the longer term options open
- A monitoring plan that identifies how we will track the situation and what will 'trigger' us to take one pathway over another

6.46 Our adaptive planning approach isn't just looking for the quickest fixes or 'smallest' schemes that can be built quickly in response to immediate needs, but is considering the optimum set of solutions over the longer term, and across many different potential futures. Short term decision making can often result in regret if futures turn out to be more challenging than expected. Similarly, taking an overly risk adverse position from the start can result in investment and developments that can become unnecessary or utilised much less over the longer term. The basis of the adaptive planning is to look at the wide range of future uncertainty, described through the supply demand balances, and determine what are the best schedule and schemes that can meet and adapt for future uncertainty in which the initial part of the plan is the core scheme.

6.47 There are several ways to create an adaptive plan. WRSE used the investment model to undertake a mathematical optimisation of the best combination of schemes to solve the future challenges across the planning horizon based on a branched pathway. This approach uses advanced techniques to show how a programme of investments would change if key uncertainties were resolved in the future, taking into account the development time required for different options. This is how we create a water resources plan at a water resource zone level.

6.48 To undertake an optimisation the investment model needs information about how much water we'll need, how much will be available in different scenarios and what options are available. To ensure we also solve the local issues across the region we create a number of smaller areas which we calculate the supply demand balances for. These are referred to as Water Resources Zones (WRZs), which our member companies also use to develop their plans.

6.49 The various pathways or situations which define how much water is required are derived using a discrete combination of forecasts. The situations are influenced by exogenous factors and policy decisions. Typically, exogenous factors have smoother forecast whereas policy decisions lead to step

changes in forecasts. Adaptive plans highlight where and how a plan might deviate from one path to another path, setting trigger point to identify where different decisions may be taken.

6.50 Our fully adaptive plan looks across all the branches and derives a set of programmes that efficiently adapt to the uncertainties. Our model applies a technique known as 'progressive hedging' to determine those options which need to be developed in the short term in order to provide the necessary platform to adapt to different pathways in the future.

6.51 The plan aims to avoid locking the region into more costly strategies by maintaining flexibility. This works in two ways – if we plan for too much investment early on then we could be locked into a strategy with more water than we need for less adverse futures, however if there is under-investment, then we could be locked into a highly reactive strategy which might not meet future demands, could be less efficient for the future and would transfer the cost of future reactive investment to future generations.

6.52 To maintain flexibility, we need to pick an initial strategy and then have branch points that balance the timings of investment decisions:

- Branching too soon – could lead to a lack of long-term planning; longer term strategies can always be pushed back, so they never end up being started. Rapid, costly, and potentially less environmentally acceptable initiatives could be needed if the future is more adverse.
- Branching too late – we lose the opportunity to scale back or take advantage of more optimistic circumstances; and we could be locked into preparing for more adverse futures than we need to plan for.

6.53 When determining when to branch we can take two perspectives:

- Branching once acceptable levels of risk are exceeded. We identify our starting strategy, but acknowledge that we need multiple different strategies open to us at the point where uncertainty in the future exceeds the uncertainties we have allowed for.
- Branching at a 'natural break point'. In this context this would tend to be at the point when we have a substantially more definitive answer to our key uncertainties than we currently have. At that point it is 'natural' for us to review/change strategies.

6.54 The factors that WRSE have used are growth; levels of environmental ambition; and climate change. We plan WRMPs in 5-year cycles, so branch points will occur at the start/end of an Asset Management Plan (AMP) period. We have also developed the monitoring plan around these factors.

6.55 For the regional plan, we can distil the theoretical branch points into two options:

- Risk based trigger: When do the future uncertainties caused by environmental, climate and growth factors exceed the target headroom?
- Policy decision-based trigger: When can a decision regarding the final environmental ambition be made?

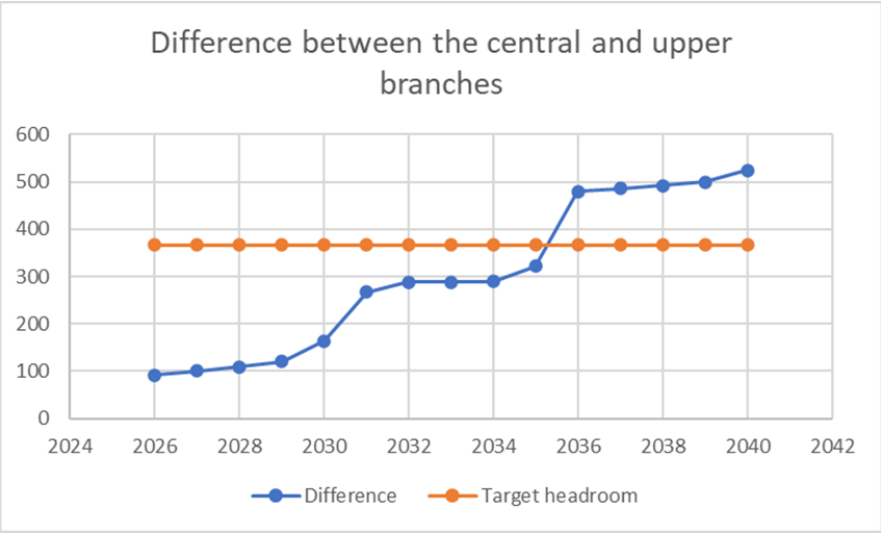
Risk based trigger

6.56 The graph in Figure 6.5 shows an illustration of differences (in Ml/d) between the upper forecast and the central forecast for the draft regional plan compared to the target headroom for the core part of the plan. This helps to indicate when the risk-based trigger is breached and when it would be appropriate to branch. Given the policy choices this initial trigger accommodates changes in growth.

6.57 As the illustration shows, the difference between the two forecasts exceeds the target headroom allowance just after 2035, which suggests that a branch point should be set at this point.

6.58 The decision point for the monitoring plan would therefore be set at 2030; the beginning of AMP period. This would allow a five-year review period to be undertaken to determine which growth and climate change scenarios the plan is tracking against. The branch point would then be set at 2035, which represents the starting position for the AMP. To summarise, we monitor all of the time; we branch in 2035 and the decision point to start the process to report a different pathway or revise a plan is taken in 2030.

Figure 6.5: Illustration of the difference (Ml/d) between forecasts based on the draft regional plan



Policy based trigger

6.59 WRSE has two different policy decision-based triggers:

- Timing decision trigger (1:200; 1:500); and
- Policy timing and magnitude decision point

6.60 We used a series of runs to determine the best time to introduce the 1:200 year and 1:500 year drought resilience policies. Whilst the timing of when we should mover to this standard is within company control, it can also be heavily influenced by the Government. Currently the BVP is based on achieving this by 2040. Therefore, we have assessed the effect of alternative plans to demonstrate how they would change if we achieved this level of resilience slightly earlier or later than 2040.

6.61 Environmental ambition is the largest uncertainty that we are facing. Uncertainties must be investigated before the final policy positions regarding environmental ambition are known. The time required for these investigations to be undertaken and to conclude the outcomes with the regulators will be key to deciding when a decision on environmental ambition policies could be made.

6.62 There appear to be two obvious times for a decision on environmental ambition: 2035 and 2040. The logic for this is shown in the two diagrams in Figures 6.6 and 6.7 below, which demonstrate that the delivery of environmental ambition cannot be concluded until the final determination / WINEP sign off. With a branch point placed at 2040 (Figure 6.6) our member companies and the regulators complete investigations and agree on the final environmental ambition over the next two AMPs (2025-2035). The conclusions of these decisions feed in to the WRMP (34) and business plans for AMP10. Please note that abstraction reductions will occur during 2025 to 2040; it is just the final set of reductions that are subject to these decisions. If a branch point is placed at 2035 (Figure 6.7) our member companies and the regulators complete investigations over the next AMP (2025-2030) and the conclusions feed in to the next WRMP and business plans resulting in the branch point starting in 2035.

6.63 The policy position for environmental ambition has been developed with the Environment Agency and other stakeholders over the past three years. During this time the environmental destination profiles have been discussed with the Environment Agency. The profiles have been adjusted to take account of the Water Framework Directive (WFD) no-deterioration policy and known commitments. Following consultation on the proposals in the draft regional plan, profiles have been further reviewed to see if delivery can be brought forward. However, there is still uncertainty on what the final environmental ambition will be for each individual source and this is unlikely to be resolved until the proposed WINEP and other investigations are completed over the next five years.

Figure 6.6: 2040 decision on environmental ambition

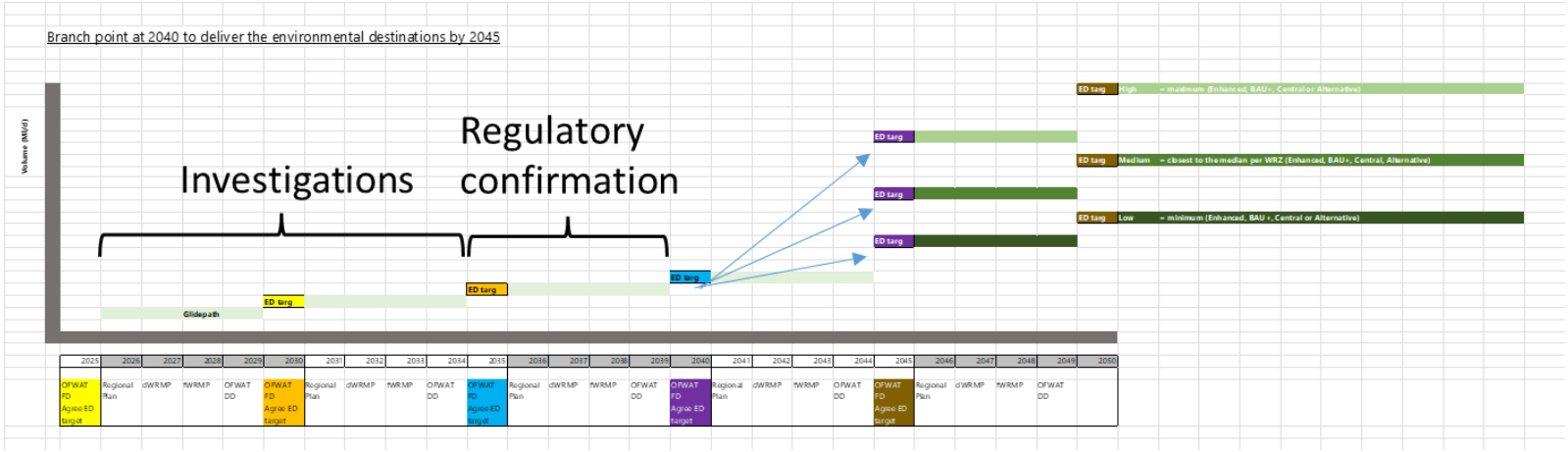
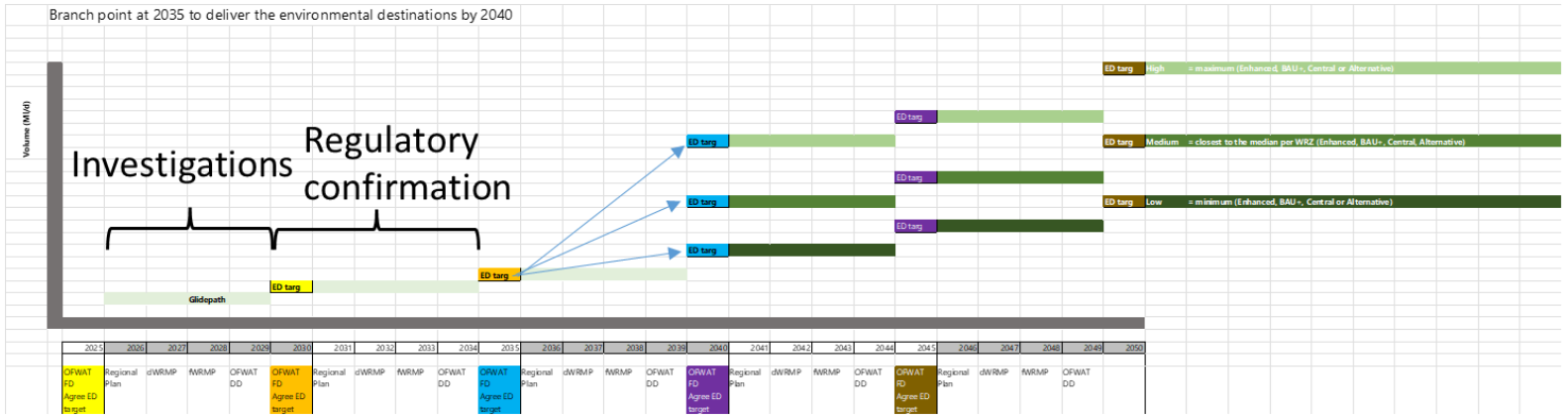


Figure 6.7: 2035 decision on environmental ambition



6.64 In the emerging plan the situation tree was as shown in Figure 6.8. For the draft regional plan, the tree configuration was changed as shown in Figure 6.9. We have retained this situation tree for the revised draft regional plan.

Figure 6.8: Emerging regional plan (Jan 2022) situation tree

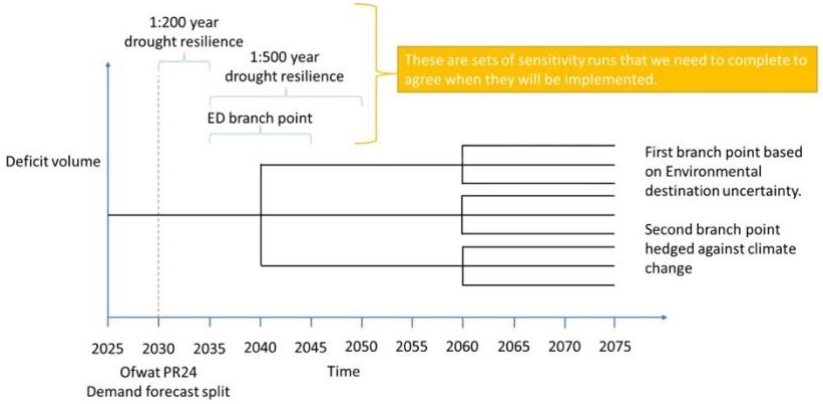
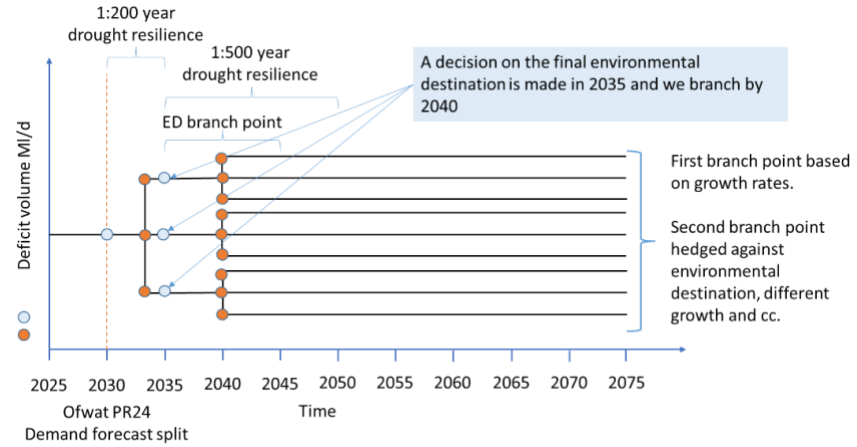


Figure 6.9: Draft and revised draft regional plan situation tree



6.65 The changes meant that the plan branches on different growth scenarios by 2035 and different environmental ambition profiles by 2040. By the time we reach 2040 the plan will accommodate 9 different potential pathways. It also means that the schemes selected at the beginning of the plan are chosen as they are the least regret options to develop the plan from in the subsequent branches.

Defining the situation tree

6.66 In this section we set out how we defined the situation tree that was used to develop the regional adaptive plan.

6.67 There are many possible combinations and permutations of the discrete forecasts resulting in a wide range of potential supply demand deficits across the South East region at a company water resource zone level, as shown in Figures 5.1 to 5.4. These are forecasts rather than predictions. These forecasts set out the range of possible futures and the purpose of the regional plan is to set out those schemes which need to be investigated, promoted and developed to adapt to these potential futures. Where a scheme is selected across different branches, it shows that the scheme can demonstrate benefit/value in a range of different potential futures. This makes the decision to invest in that option a low regret decision, and the scheme a lower regret option because it has a greater prospect of still responding (and having benefit/value) despite the uncertainty around which future will actually arise.

6.68 In order to build an adaptive plan, it is necessary to characterise the range of forecast supply demand balances using a set of pathways or situations that are representative of the range of challenges. For the regional plan we defined nine potential pathways covering the key forecasts including an upper and lower forecast deficit.

6.69 Defining these situations, we could either use percentiles through all of the potential supply demand balances or discrete combinations of forecasts. The latter approach is easier to demonstrate compliance with WRPG. For this regional plan we have selected the approach of using combinations of discrete forecasts to characterise the range of potential supply demand

balances which will be used to define the various situations. This provides regulators and stakeholders with an easier way of determining what each situation represents.

6.70 Whilst this approach of combining a growth forecast with a climate change impact and an environmental ambition and then comparing this with the supply forecast helps understanding what causes that level of deficit there are a number of other combinations of discrete forecasts that can also produce similar levels of deficits. Therefore, the solutions being presented in the regional plan should be considered as not just answering the specific combination of discrete factors but a more general point that this level of deficit in the region is best solved using this combination of solutions.

6.71 For each situation we must define a specific growth forecast; a supply forecast; an environmental ambition and a climate change impact forecast. The combination of these forecasts set out how much water is required for each of the four planning states over the planning period for each water resource zone.

6.72 The approach we adopted in the emerging regional plan attracted support and criticism in terms of the branch points and the use of certain growth forecasts as set out in our emerging plan consultation response document. In the previous section we set out how we changed the situation tree and the timing of the branches in response to comments. To address other concerns, we also changed some of the combinations of discrete forecasts used to define the situation tree in the emerging plan.

6.73 For the draft regional plan we settled on using the following forecasts to define the future supply demand balance situations:

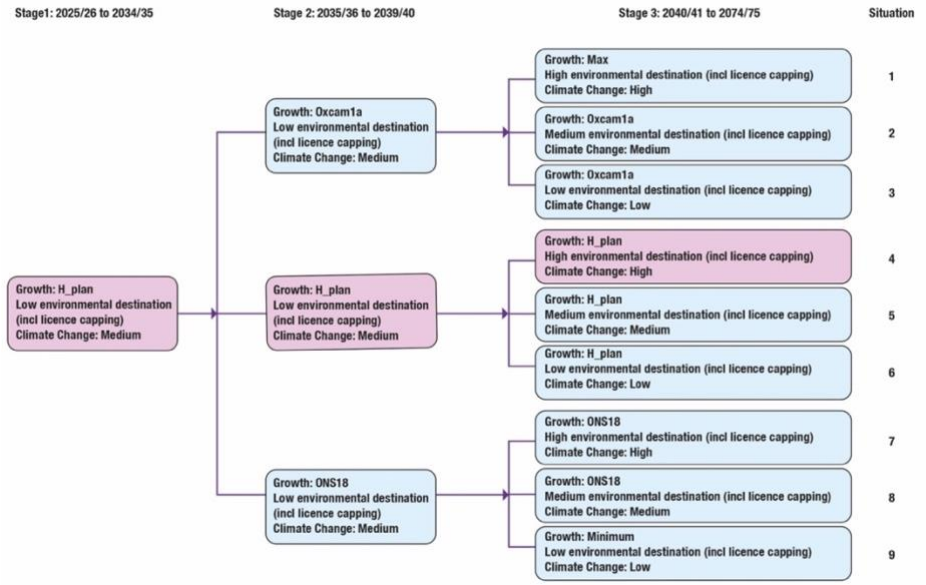
- Growth: We have considered five growth scenarios, as set out earlier in the plan, which are used across the nine adaptive plan branches. These are: housing plan as defined by the local authorities; housing plan taking into account the potential growth in the Oxford Cambridge (OxCam) growth corridor; the Office for National Statistics (ONS) 2018 central forecast for the South East region; ONS 2018 low growth forecast (minimum growth) for the South East and a housing max forecast which is defined initially by the housing plan forecasts from the local authorities but in the later years by the housing need number of the local authorities. These estimates have been updated following the consultation on the draft regional plan.
- Environmental ambition: We have three scenarios of high, medium, and low. The method for deriving these forecasts is set out in our environmental ambition method statement [WRSE Document Library} but essentially uses a combination of locally derived (through the Environment Agency and our member companies) environmental ambition forecasts based on reducing abstractions at key sources to leave more water in the environment in the future. Since the emerging and draft plans we have also included further reductions for licence capping, as set out in our environmental ambition method statement, and reprofiling the delivery of the environmental ambition by 2050, accelerating delivery where we can.
- Climate change: We have simulated the impact that climate change could have on future supplies using the UKCP18 regional datasets. In total we have simulated 28 different climate change futures. From these we have selected three scenarios (as set out in our climate change method statement (WRSE Document Library) which represent an average impact, upper impact and lower impact measured at a regional level.
- Supply forecast: This has been derived from the regional simulation model, groundwater models and company estimates using the spatially coherent stochastic weather sequences for the region (as set out in our supply forecast method statements; regional simulation model, stochastic datasets, groundwater, hydrology, deployable output, climate change and outage – available in our WRSE Document Library). For the preferred LCP and BVP we have used the supply forecast sequences that move to a 1:500 year drought sequence by 2040. We have also explored later dates for achieving the 1:500 year drought resilience stand which are described in subsequent sections. This model has been used to determine the deployable outputs.

6.74 We selected these forecasts for the following reasons:

- The selection of the housing plan and the housing plan plus OxCam are the two forecasts explicitly set out in the WRPG. For any WRMP and by implication any regional plan to be compliant it must consider these growth scenarios. The purpose of building a resource plan around this growth rate is simply to ensure that the water resource infrastructure is there to support housing growth.
- The ONS 18 central forecast was selected as it was referred to in consultation responses to the emerging plan and also in the Ofwat long term strategy methodology. This forecast is lower than the housing plan forecasts.
- The maximum and minimum growth forecasts serve as stress tests in the adaptive regional plan to ensure that this wide range of uncertainty is considered when selecting the schemes in the next 5 years.

6.75 The combination of these forecasts resulted in the situation tree for the draft and revised draft regional plans shown in figure 6.10 below.

Figure 6.10: Situation tree for the draft and revised draft regional plans



6.76 Consultation on the emerging and draft regional plans provided comments both in support and opposed to the range of forecasts used as the basis for the adaptive plan branches. As explained in Section 4 of this document, we have updated the base data in the population and growth forecasts to use the most up to date information available – this responds directly to comments on the draft plan. We have also updated our environmental ambition forecasts in liaison between our member companies and the Environment Agency since the draft plan. In this way, whilst the structure of the situation tree for the revised draft regional plan has not changed since the draft regional plan, the data in the forecasts underpinning it has.

6.77 This situation tree is applied to every WRZ against four different supply forecasts; Normal year, dry year, 1:500 year drought; and a supply forecast during the summer of a 1:500 year drought. Therefore, for every one of the 37 WRSE WRZs we set out four sets of situation trees covering nine potential supply demand forecasts. This equates to 1,332 forecasts per year of the plan and over the 50 years of the plan (2025 to 2075) represents 66,600 forecasts that we need to develop a solution for.

6.78 The wide range of forecasts for the different situations were shown earlier in this document (in Figures 5.1 to 5.4). Figures 6.11 to 6.14 below repeat those earlier graphs, but with coloured lines added to them to identify the forecasts relating to our nine adaptive pathways, showing how our adaptive pathways reflect the range of forecasts we have developed.

Figure 6.11: Normal Year Annual Average (NYAA) plot of potential futures

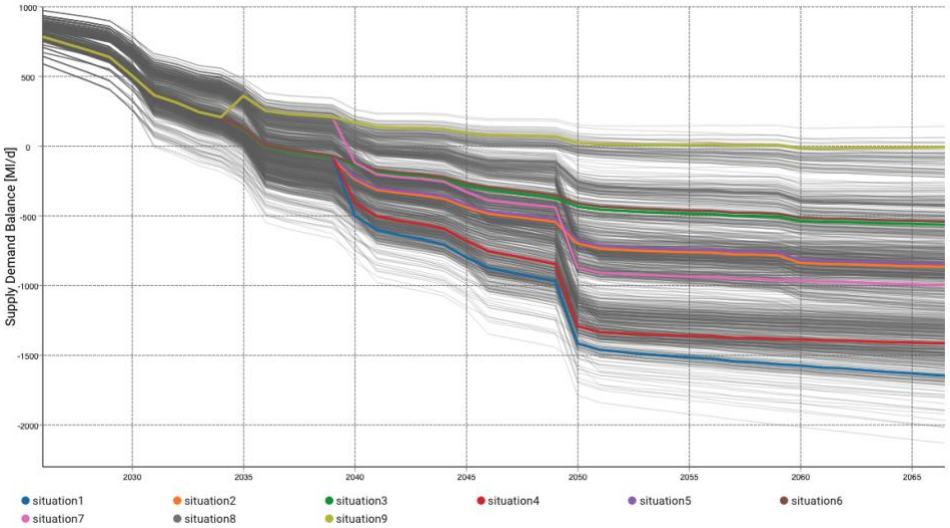


Figure 6.12: 1:100 Dry Year Annual Average (DYAA) plot of potential futures

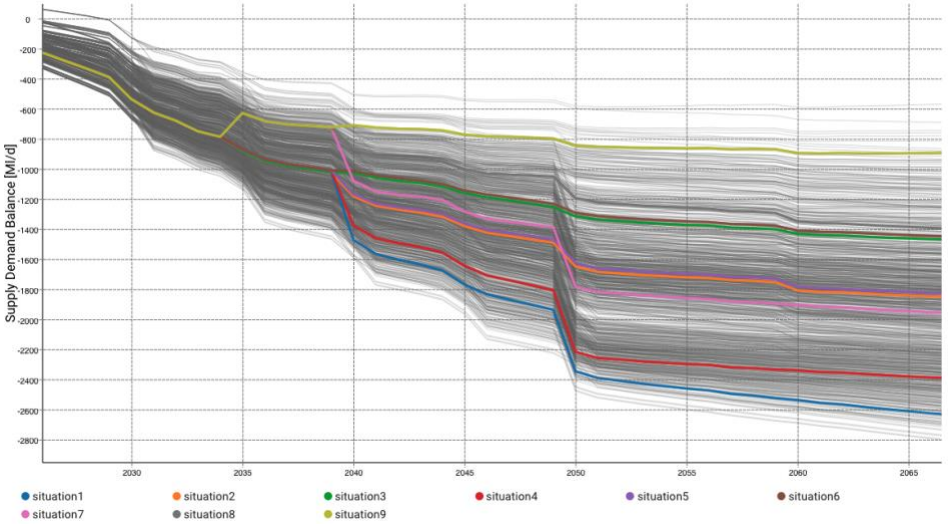


Figure 6.13: 1:500 Dry Year Critical Period (DYCP) plot of potential futures

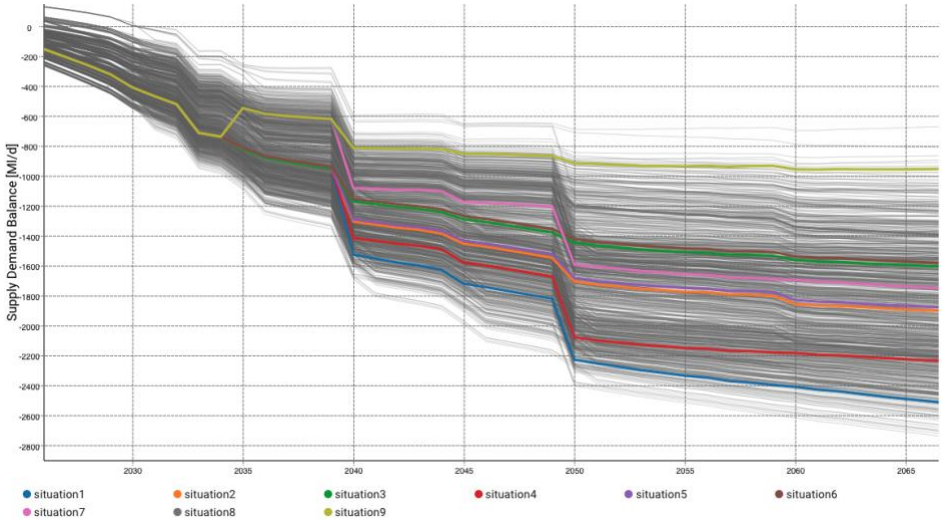
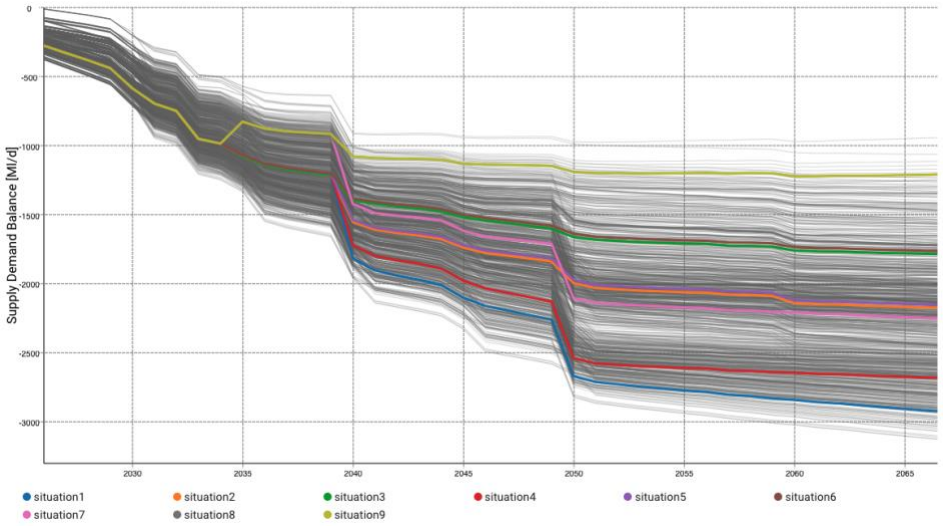


Figure 6.14: 1:500 Dry Year Annual Average (DYAA) plot of potential futures



6.79 The structure of the situation tree means that the adaptive plan can be broken down into several key parts, as set out in the diagram in Figure 6.15. This figure shows a timeline of specific investments (represented as dots on the adaptive plan). Each dot is colour coded to the type of investment it represents. The size of the dot represents the volumetric size of the proposed scheme. For illustrative purposes the plots focus on the key infrastructure required and those dots which would represent transfers; temporary use bans; non-essential use bans; leakage reductions and water efficiency campaigns having been turned off (if they were shown it would be very difficult to identify what infrastructure developments were proposed).

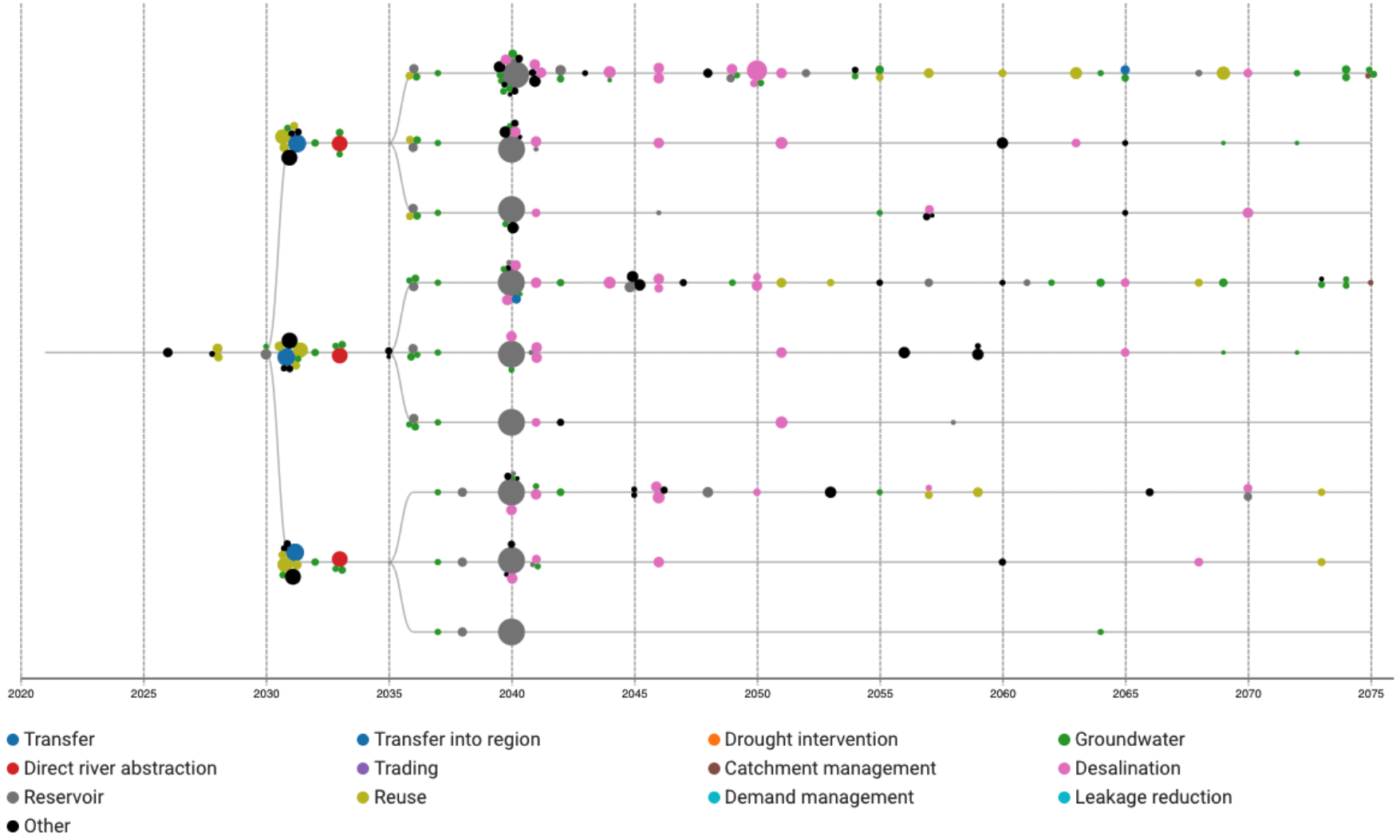
6.80 The core part of the plan refers to non-branching part of the tree, i.e. up to 2035. In this part of the plan we:

- Set out the schemes, studies and investigations that are required to be delivered in the next AMP.
- Identify schemes that are common across all plans and are focused on the business plan requirements.
- Highlight which strategic decisions will be required to adapt to drought resilience, building on the initial set of schemes, being delivered for the South East.
- Focus on the demand management strategies, key resource schemes, etc.
- Show when the next decision points are and the fact that permission for several key future schemes will be required.

6.81 The timeframe from 2035 to 2050 is driven by alternative plans for environmental ambition and increased drought resilience. The decision point for these pathways occurs in 2035 following the investigations undertaken in the core plan phase. Following the decision point in 2035, the Government will then set out the final environmental ambitions and from this point the region will then know which schemes are required to be delivered to meet the final expectations having already put the building blocks in place.

6.82 Beyond 2050 the plan sets out a range of potential future strategies. It is this part of the plan which we could describe what might happen if longer term trends prevail. This part of the regional plan is subject to significant change and influence from innovation, new government policies and future societal change.

Figure 6.15: Explanation of the adaptive plan approach



Note: Transfers omitted from this diagram, for clarity

The supply demand balance resulting from the selected pathways

6.83 We have used a range of discrete forecasts to create a situation tree which enables us to identify the range and scale of supply demand balance challenges that the region could face under each of the planning scenarios, depending on future climate change, population growth and environmental ambition.

Normal Year Annual Average (NYAA)

6.84 The normal year planning scenario represents an event which should occur, on average, every other year. This is used to ensure that the solutions selected in the regional plan can contribute to the challenges the region faces in a normal year as well as the more severe droughts. This scenario also indicates how much a solution would be utilised under these more extreme droughts.

6.85 As can be seen from Figure 6.16 and Table 6.1, under NYAA the region starts in a surplus of approximately 785Ml/d but is forecast to be in deficit by 2040 (in all but situations 8 and 9), with deficits forecast to increase significantly through the planning period.

Figure 6.16: NYAA Supply demand balance plot for South East (NYAA)

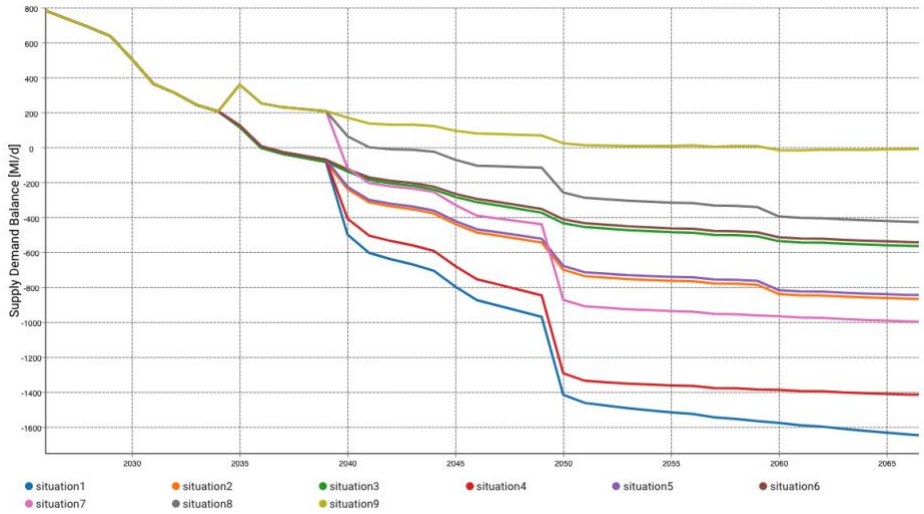


Table 6.1: Supply demand balance (Ml/d) for South East (NYAA)

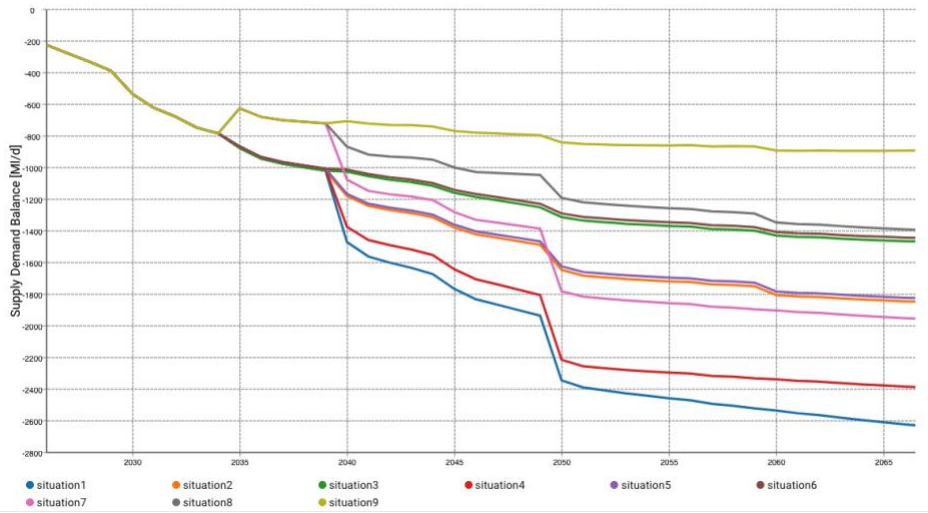
	2026	2030	2035	2040	2050	2060	2075
Sit 1*	784.94	506.87	118.48	−497.55	−1,413.99	−1,574.22	−1,738.32
Sit 2	784.94	506.87	118.48	−236.47	−698.00	−837.52	−908.26
Sit 3	784.94	506.87	118.48	−136.75	−431.73	−534.67	−606.72
Sit 4	784.94	506.87	127.58	−406.00	−1,290.62	−1,386.12	−1,451.26
Sit 5	784.94	506.87	127.58	−223.45	−675.80	−815.36	−886.52
Sit 6	784.94	506.87	127.58	−123.72	−409.53	−512.51	−584.98
Sit 7	784.94	506.87	360.71	−116.77	−871.24	−964.19	−1,034.10
Sit 8	784.94	506.87	360.71	65.78	−256.42	−393.43	−469.37
Sit 9	784.94	506.87	360.71	172.23	25.34	−13.93	−1.42

*Sit = situation

Dry Year Annual Average (DYAA) 1:100

6.86 The dry year annual average planning scenario represents an event which would be experienced once in a hundred years and is similar to some of the historic droughts experienced. The root and branches are derived from the same combination of discrete forecasts that are used across all of the planning scenarios. Figure 6.17 shows the range of planning challenges we would expect.

Figure 6.17: Supply demand balance plot for South East (DYAA 1:100)



6.87 Table 6.2 summarises the potential deficits that could occur across the South East given the discrete combinations of growth, climate change and environmental ambition. These challenges are more severe than the normal year planning challenge but not as severe as the 1:500 year planning challenges. Under this scenario the region is in deficit at the start of the planning period, and this deficit increases significantly as the planning period progresses.

Table 6.2: Supply demand balance (Ml/d) for South East (DYAA 1:100)

	2026	2030	2035	2040	2050	2060	2075
Sit 1*	−224.45	−533.75	−875.44	−1,470.52	−2,344.30	−2,534.67	−2,753.68
Sit 2	−224.45	−533.75	−875.44	−1,179.35	−1,646.11	−1,805.05	−1,908.78
Sit 3	−224.45	−533.75	−875.44	−1,025.45	−1,312.23	−1,428.72	−1,520.28
Sit 4	−224.45	−533.75	−865.95	−1,373.58	−2,214.09	−2,337.60	−2,454.04
Sit 5	−224.45	−533.75	−865.95	−1,165.78	−1,623.22	−1,782.19	−1,886.39
Sit 6	−224.45	−533.75	−865.95	−1,011.88	−1,289.34	−1,405.86	−1,497.89
Sit 7	−224.45	−533.75	−625.59	−1,075.38	−1,781.35	−1,901.89	−2,023.22
Sit 8	−224.45	−533.75	−625.59	−867.59	−1,190.48	−1,346.48	−1,455.57
Sit 9	−224.45	−533.75	−625.59	−706.74	−840.58	−890.99	−894.90

Dry Year Critical Period (DYCP) 1:500

6.88 The 1:500 year planning scenarios represent the new drought resilience standards across the region. There are two 1:500 year planning scenarios that we look at, the annual average scenario and the peak summer demand scenarios. These droughts provide a far greater challenge that the normal year planning scenarios.

6.89 2040 is the date we have set for meeting the 1:500 requirement (we mostly meet 1:200 drought requirements until this date). This provides sufficient time to develop strategic resources to meet the drought resilience provision and is in line with the preferred timescales for this Government policy, as set out in the WRPG. We have explored alternative dates to achieve this drought resilience standard. Each alternative adaptive is set out to allow customers, stakeholders, and regulators to make a comment.

6.90 As can be seen from the plot in Figure 6.18, and in Table 6.3, under 1:500 DYCP the region starts with a small deficit at the start of the planning period, with the deficits increasing significantly. We would normally expect to see greater deficits in the critical peak time than in the annual average condition. The reasons why this is not the case comes down to how the environmental ambition scenarios typically have a far bigger impact on the annual average figures, as they curb the total amount of water abstracted over the year rather than the amount of water that is abstracted to meet summer peak demand for water. If the abstraction scenarios change and are deemed to affect the peak summer abstraction as much as the annual abstraction, then the deficits would increase across the region.

Figure 6.18: Supply demand balance plot for South East (DYCP 1:500)

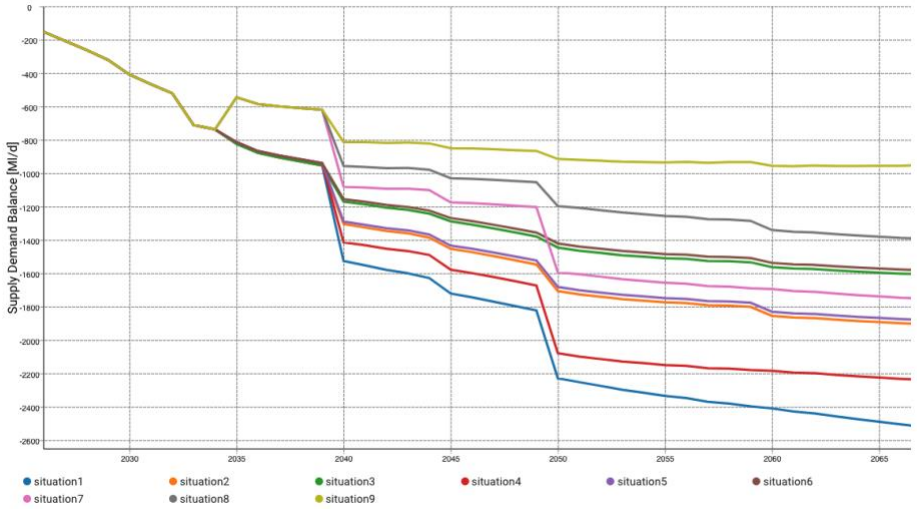


Table 6.3: Supply demand balance (Ml/d) for South East (DYCP 1:500)

	2026	2030	2035	2040	2050	2060	2075
Sit 1*	−150.86	−406.89	−821.60	−1,523.94	−2,225.86	−2,406.84	−2,648.77
Sit 2	−150.86	−406.89	−821.60	−1,302.44	−1,703.59	−1,852.64	−1,966.17
Sit 3	−150.86	−406.89	−821.60	−1,168.20	−1,443.00	−1,559.91	−1,662.74
Sit 4	−150.86	−406.89	−811.22	−1,412.23	−2,075.99	−2,181.57	−2,305.42
Sit 5	−150.86	−406.89	−811.22	−1,287.60	−1,678.74	−1,827.70	−1,941.62
Sit 6	−150.86	−406.89	−811.22	−1,153.36	−1,418.15	−1,534.97	−1,638.18
Sit 7	−150.86	−406.89	−543.59	−1,079.64	−1,591.90	−1,692.29	−1,820.16
Sit 8	−150.86	−406.89	−543.59	−955.02	−1,194.64	−1,338.42	−1,456.36
Sit 9	−150.86	−406.89	−543.59	−811.31	−912.53	−953.45	−954.57

Dry Year Annual Average (DYAA) 1:500

6.91 The 1:500 year DYAA planning challenge is the most severe in the region and is a key driver for future interventions in the South East. In this planning scenario we would see the full extent of the abstraction restrictions impact on the sources and the future availability of sources.

6.92 2040 is the date we have set for meeting the 1:500 requirement (we mostly meet 1:200 drought requirements until this date). As can be seen from the plot in Figure 6.19, and in Table 6.4, the region starts the planning period with a significant deficit under this scenario, and this significantly worsens across the planning period under all situations. Not only are the magnitude of the challenges significant, so is the range that the regional plan must be able to adapt to, ensuring that the options selected in the core branch are able to put in place schemes that work well across the range of future challenges.

Figure 6.19: Supply demand balance plot for South East (DYAA 1:500)

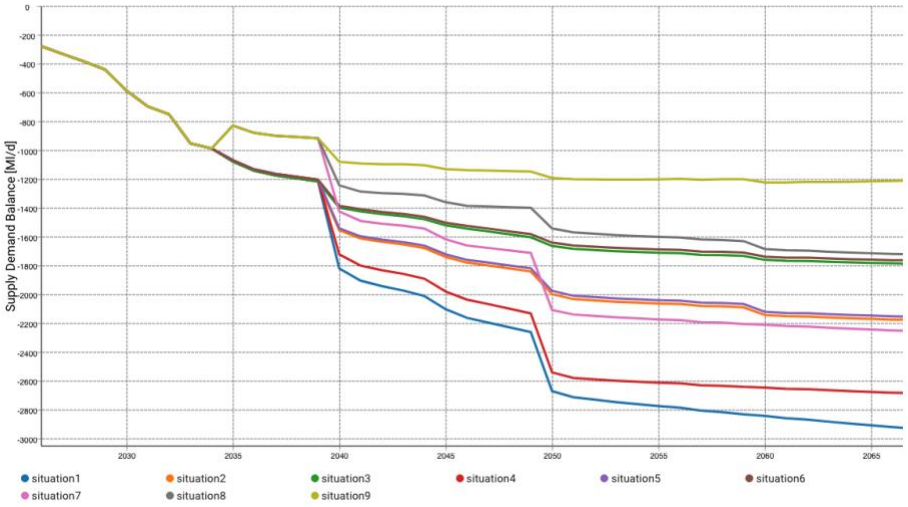


Table 6.4: Supply demand balance (Ml/d) for South East (DYAA 1:500)

	2026	2030	2035	2040	2050	2060	2075
Sit 1*	−276.24	−584.35	−1,076.47	−1,817.66	−2,668.77	−2,840.85	−3,037.25
Sit 2	−276.24	−584.35	−1,076.47	−1,552.54	−1,995.83	−2,141.16	−2,223.28
Sit 3	−276.24	−584.35	−1,076.47	−1,396.41	−1,661.31	−1,758.47	−1,823.86
Sit 4	−276.24	−584.35	−1,066.98	−1,720.72	−2,538.56	−2,643.78	−2,737.60
Sit 5	−276.24	−584.35	−1,066.98	−1,538.98	−1,972.94	−2,118.31	−2,200.89
Sit 6	−276.24	−584.35	−1,066.98	−1,382.84	−1,638.42	−1,735.62	−1,801.47
Sit 7	−276.24	−584.35	−826.62	−1,422.53	−2,105.82	−2,208.06	−2,306.79
Sit 8	−276.24	−584.35	−826.62	−1,240.79	−1,540.20	−1,682.59	−1,770.07
Sit 9	−276.24	−584.35	−826.62	−1,077.70	−1,189.67	−1,220.75	−1,198.48

6.93 There was significant challenge in consultation responses on the draft regional plan, to the levels of population and household growth, and environmental ambition forecasts used as the basis for the regional plan investment modelling. WRSE has updated the base population and housing data underpinning the forecasts since the draft regional plan, and updated its environmental ambition forecasts.

6.94 As can be seen from the tables and graphs above, there is a wide range of alternative future scenarios that have been derived for assessment, reflecting the complexity and scale of the future challenges facing the South East. Providing such a wide range of potential futures is important given the long term nature of the regional plan, coupled with the ability through the adaptive planning approach of monitoring and reviewing actual performance over time as part of the 5 year planning cycles, and adapting plans where necessary as a result. The consequences of not planning ahead are huge for society, the economy and the environment.

6.95 Whilst WRSE is required to report a reported pathway for regulatory purposes, the regional plan has nine adaptive plan pathways which are considered to be equally likely. The regional plan is capable of adapting to each of the pathways and respond to future decisions to be taken on growth, environmental ambition and climate change.

6.96 Situations 1 to 3 are based on the Oxford-Cambridge growth corridor (OxCam), with variations around future climate change and environmental ambitions. These scenarios are referred to in the Water Resource Planning Guidance (WRPG). Situation 1 includes a high growth based on the housing need as defined by the local authorities.

6.97 Situations 4 to 6 are based on the local housing plan growth forecasts combined with different sustainability reductions and climate change scenarios. Situation 4 has been used as the reported pathway / preferred plan, selected as Situation 4 meets the WRPG growth forecast requirements, incorporates environmental ambition, and takes account of potential climate change impacts. WRSE reviewed the potential pathways with regulators and WRSE's Strategic Leadership Team approved Situation 4 as being the most appropriate reported pathway for the plan.

6.98 Situations 7 to 9 are based on the Office of National Statistics population growth forecasts and, like the other situations explore the impact of different sustainability reductions and climate change scenarios. Situation 9 considers an extremely low growth scenario base on an Office for National Statistics forecast.

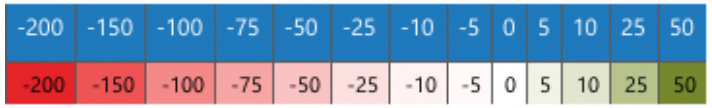
6.99 Each of the 9 pathways in the adaptive plan is formed from a combination of decisions, based on achieving different policy requirements and future forecast scenarios. Whilst the plan focuses on the 9 pathways, each is very similar to a number of other policy choice combinations. The adaptive plan we have selected covers the vast majority of the range of potential futures that have been modelled, with only a very small percentage higher or lower than the adaptive plan pathways.

6.100 We have explained in Section 12 of our draft regional plan Consultation Response document (in WRSE document Library) how respondents to consultation challenged our assessments of the 'need' for additional water , and are advocating WRSE should adopt the lowest of all the potential futures. However, these low levels of need do not comply with the WRPG, and are outside the range of potential futures that Ofwat requires companies to plan for in the LTDS. As a consequence, the risks of adopting the lowest of all the potential futures are significant.

Geographical variation in supply demand balance

6.101 The final part of this section focuses on the regional differences in the scale of the challenges being faced under the adaptive plan branches. As previously described, there are significant regional differences both in the baseline supply demand balances within individual WRZ, and in the effect of the growth, environmental ambition and other forecasts we have made.

6.102 Figures 6.20 to 6.23 provide a geographical representation of the DYAA 1:500 supply demand balances across the South East, by individual water resource zones. This highlights that the challenges differ between WRZs and between our member companies, and increase over time through the planning period, but not on a consistent basis. The key for the figures is as follows – with the numbers being supply demand balance surplus or deficits, in Ml/d.



6.103 Given the scale of forecast supply demand deficits in the South East, doing nothing is not an option. We need to identify, assess and select appropriate demand management and new resource development options to meet the forecast future deficits. The next section explains how these options have been identified and assessed.

Figure 6.20: 2026 Supply Demand Balance by WRZ (DYAA 1:500)

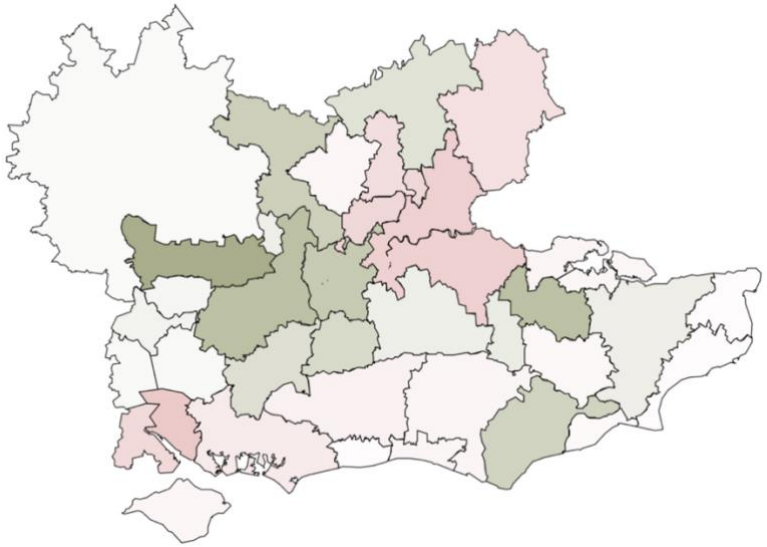


Figure 6.21: 2040 Supply Demand Balance by WRZ (DYAA 1:500)

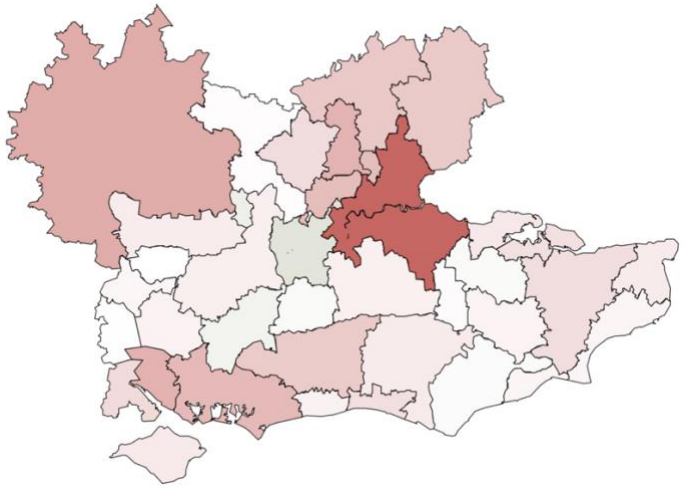


Figure 6.23: 2060 Supply Demand Balance by WRZ (DYAA 1:500)

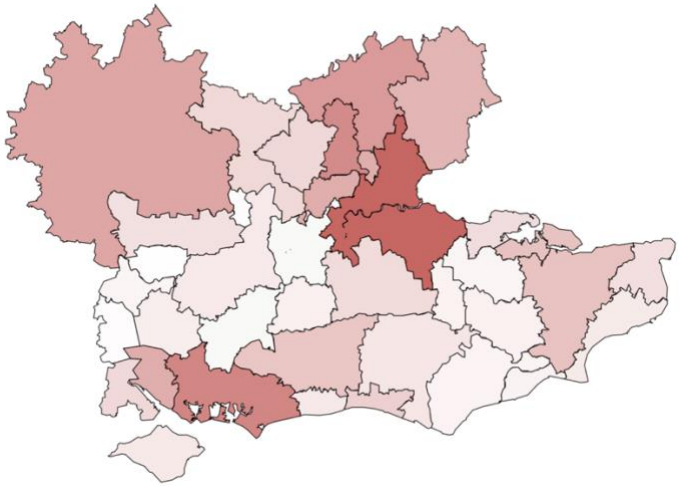
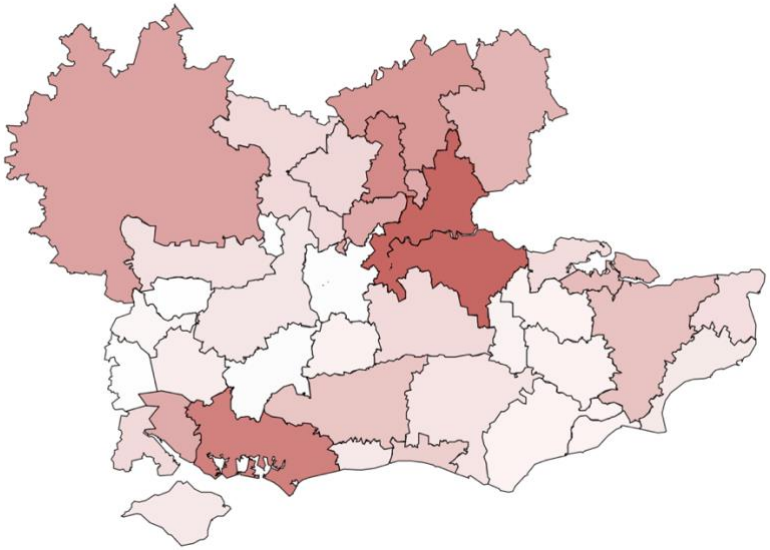


Figure 6.24: 2075 Supply Demand Balance by WRZ (DYAA 1:500)



7. Available water resource options

There are minor updates to this section compared to the draft plan, reflecting information updates provided by our member companies on option feasibility, cost, delivery timescales and best value metrics.

7.1 Having assessed the scale of water resources deficits that the South East region as a whole is facing over the planning period, both in aggregate and in individual WRZ under our four planning scenarios, we then turn to the options available to meet those deficits.

7.2 Water companies and some third parties submitted options to WRSE to consider in the regional plan. We have carried out an appraisal of the water resource options that could be used to address future deficits in water supplies. This has included existing options and new options which have been identified through our engagement process. In total, more than 4,000 options have been appraised as part of the process of developing our regional plan. Whilst these are primarily public water supply (PWS) options, these also included non-public water supply options.

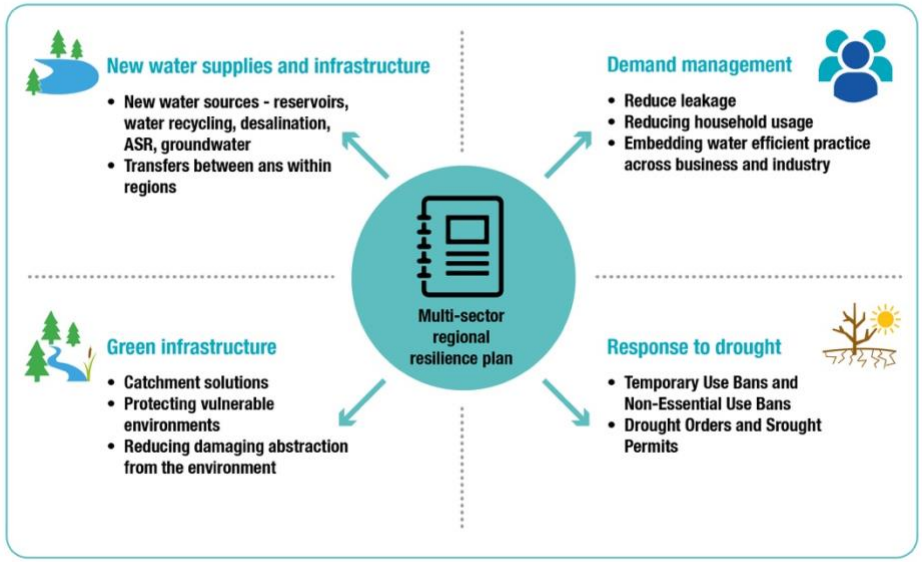
7.3 Working with us, our member water companies identified and provided data for regional supply, demand and transfer options not included in the baseline, whether existing, under construction or new. Options can be stand-alone or made up of:

- Option elements (resource, conveyance)
- Option phases (modular increases in resource DO)
- Option stages (planning, development, construction and operation).

7.4 Options were categorised into four categories as shown in Figure 7.1 comprising: new water resources infrastructure, demand management, green infrastructure and response to drought.

7.5 Details of how we undertook our options appraisal are set out in our Options Appraisal Method Statement and the outcomes of the process in our Options Appraisal Summary Report, both available in the WRSE document library.

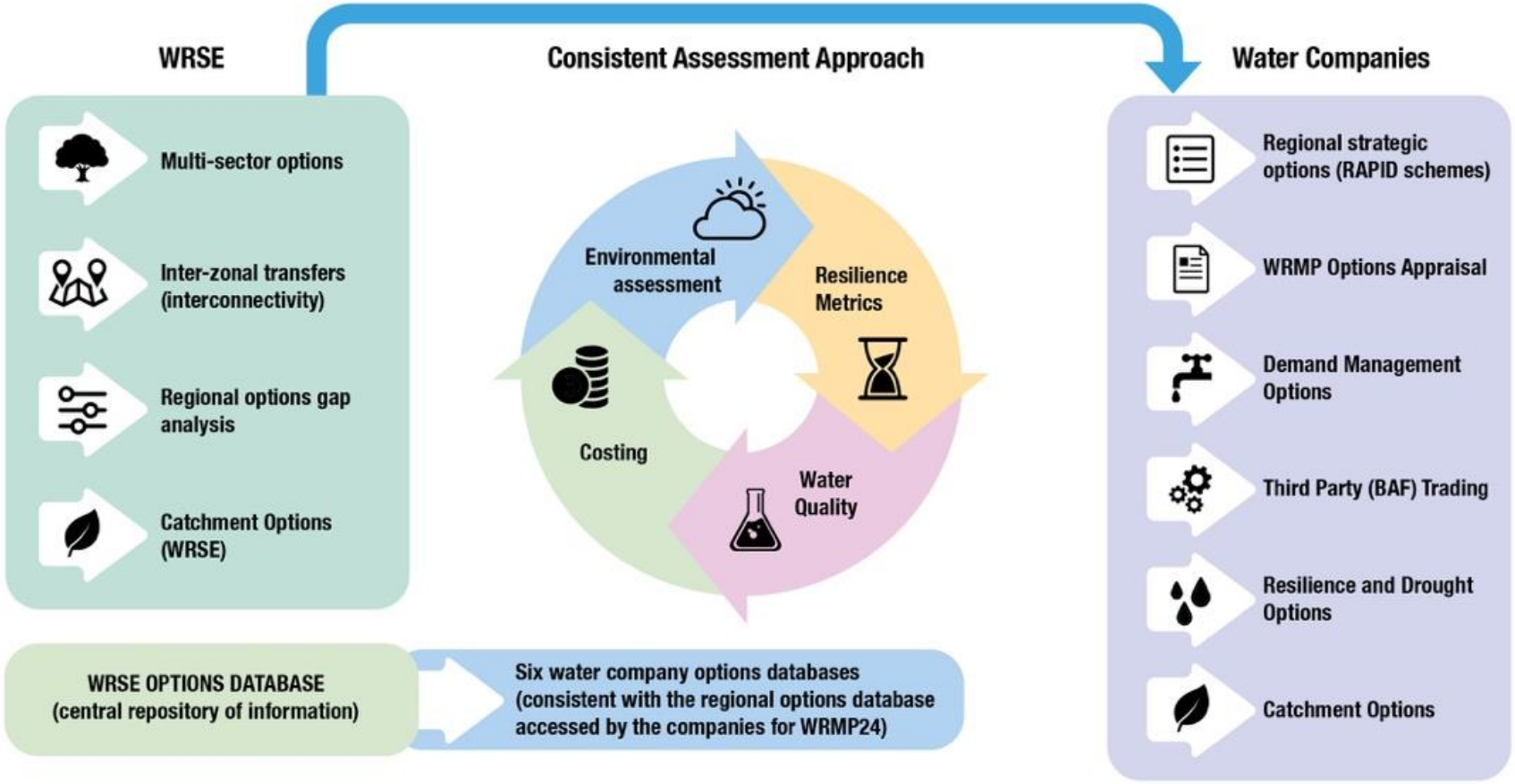
Figure 7.1: WRSE categorisation of options



Options appraisal process

7.6 We developed an options appraisal process that is integrated with our member water companies' WRMPs and wider programme requirements for environmental, resilience and water quality assessments as shown in Figure 7.2. The options appraisal approach undertaken by WRSE and our member companies promotes integration between the regional and water company WRMP options appraisals, allowing both to actively inform the other.

Figure 7.2: Integrated options appraisal methodology



7.7 A key component of the methodology has also been the work that three of our member companies are progressing with RAPID. This work includes the development activities for a number of strategic water resource options (SROs) identified by Ofwat in its PR19 Final Determination, and also the findings of a strategic options gap analysis conducted by Ofwat. A schematic of all the SRO schemes can be found here and the gate one and two submissions and decisions on the schemes here.

7.8 Figure 7.3 provides a detailed overview of our options appraisal process. From the preliminary identification of options by our member companies, WRSE and third parties, the water companies (and for some options WRSE) screened options to identify feasible options. Option information on feasible options was developed to feed into the investment modelling. Where options were rejected, the reason for rejection was included by our member companies in the rejection registers for their WRMPs.

The options we have considered

7.9 As part of its work, WRSE and the water companies have identified and assessed a wide range of potential options as set out below.

7.10 Demand management (DM) options include:

- Leakage reduction (distribution network and customer supply pipes)
- Water efficiency (behaviour change and physical interventions at household level), and
- Metering (universal and smart)

7.11 To promote alignment of demand management strategies between our member companies we have developed up to four demand management strategies using the updated growth forecast information. Each of the strategies looked at meeting the various government targets using known technological solutions and potentially new innovative solutions. Companies prepared their strategies and submitted these different demand management strategies to WRSE for consideration in the regional plan. Options have also been included for different scenarios of government led policy interventions to promote efficient water use.

7.12 New water supplies and infrastructure options include:

- Imports of water into the South East region
- Raw water transfers within the region
- Water recycling
- Desalination
- Reservoirs
- Managed aquifer recharge
- Groundwater
- Integrated catchment and nature based solutions

7.13 Drought options we have considered include:

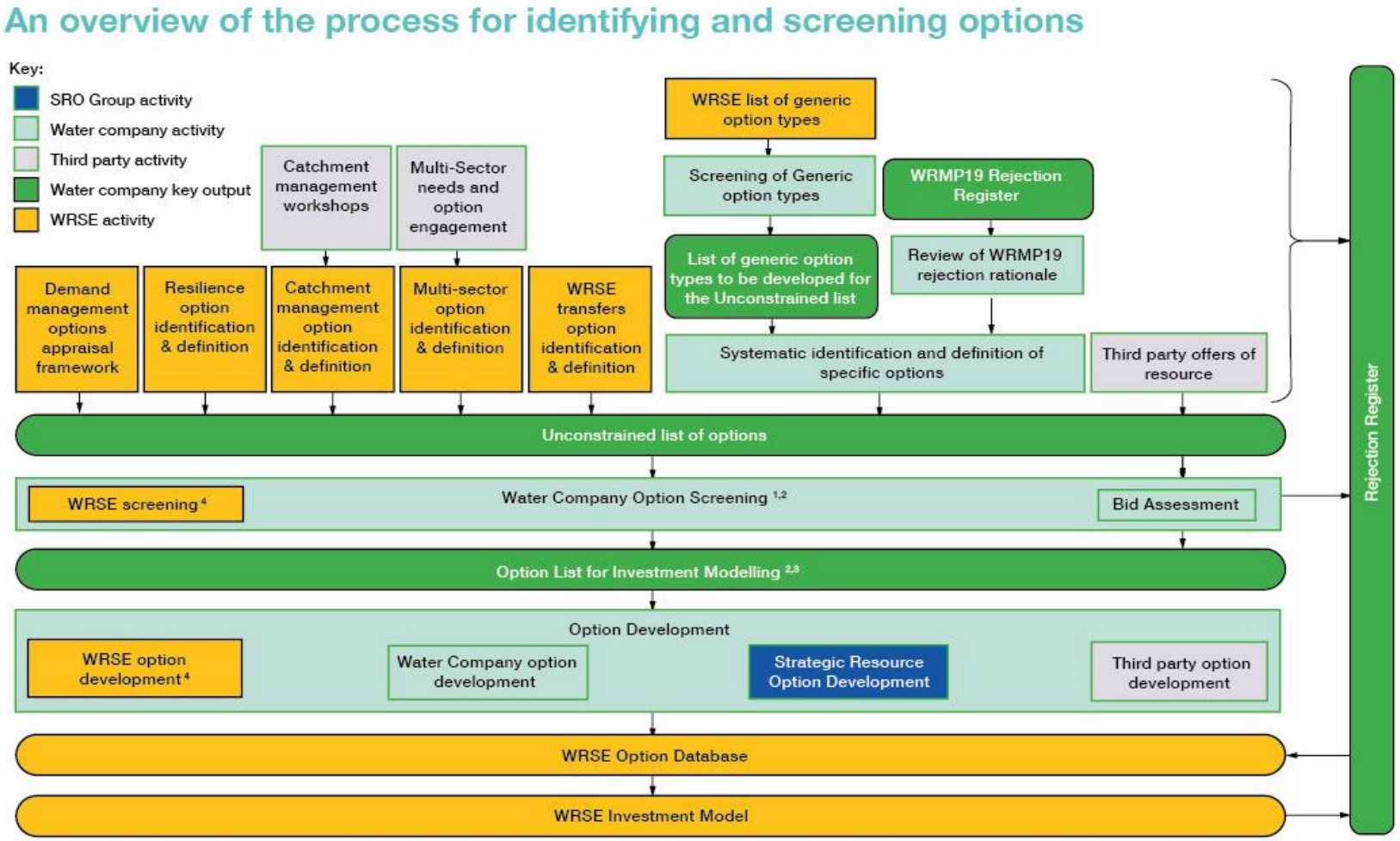
- Temporary Use Bans (TUBs)
- Non-Essential Use Bans (NEUBs)
- Drought orders and permits where agreed with the Environment Agency

7.14 Through working with other sectors, we also identified and assessed potential options for supply to agricultural, power, industrial and other water users. Our member water companies also sought offers of resources for public water supplies from third parties.

7.15 We did not apply a minimum size threshold to filter the supply options because even smaller local options can be important to meet demands when aggregated, though schemes of less than 1Ml/d are usually not meaningful at regional scale. Both larger and smaller options are therefore equally available for selection as part of the investment modelling. It is therefore not the case that the regional plan is promoting or seeking to select a single set of large solutions to meet the challenges being faced.

7.16 WRSE published an Options Summary Report providing more information on feasible options available for selection in our draft regional plan regional investment modelling in the WRSE Library.

Figure 7.3: Process for identifying and screening options



Note 1: Screening processes will vary between companies and may include a one or two stage approach, company specific feedback has been provided of option screening
Note 2: The Option List for Investment Modelling may be the full Feasible List of options, or a Constrained Feasible List, where this has been agreed with stakeholders (including EA), provided that care is taken when constraining the Feasible List to ensure options that could benefit other companies are not rejected at this stage.
Note 3: Demand management options are represented as stategies comprising baskets of consumption and leakage reduction options combined by Water Companies to achieve different levels of total demand reduction
Note 4: WRSE option identification, screening and development activities focused upon catchment management, multi-sector and strategic transfer options

Our assessment of the options

7.17 The Options Summary Report explains in more detail how options were assessed and incorporated into the investment modelling for the draft regional plan.

7.18 For the draft regional plan, the total number of options generated through our technical work, and included on the unconstrained options list was over 3,290. The feasible list of options for investment modelling for the regional plan was 1,757. There was a total of 1,533 options on the rejection register.

7.19 A total of 639 feasible options were excluded from the draft regional plan investment modelling for a number of reasons, including adverse impacts identified through environmental assessments (including in relation to water quality and drinking water quality) or uncertainty/deliverability issues. Whilst these options remain technically feasible, in some cases these options, in the early stage of development, gave rise to significant uncertainties and require further investigation by our member companies to confirm option feasibility. These options have been excluded as part of the programme appraisal process with WRSE's programme management board (PMB) and through water company discussions with regulators. Some of the options, however, have been available to use in investment model sensitivity runs, to help with wider discussions on these particular schemes.

7.20 There are a number of schemes which our member companies are progressing through feasibility and consenting processes, for implementation during AMP7 and AMP8.

7.21 Subsequent to the publication of the draft regional plan, companies provided further updates on the availability, cost and timing of options. The companies have also broken their demand management options down into a greater level of detail including leakage, mains replacement programmes, water efficiency and metering, This included a number of changes from Southern Water, including the exclusion of a desalination option in Sussex that had been selected in the draft regional plan (but was no longer considered feasible by Southern Water), and less significant updates from other companies. We provide more information on this in Appendix 3 to this document.

Feasible Options Appraisal

7.22 In total, 4,379 options were available for selection by the revised draft regional plan investment model, some of which can be developed in a range of different sizes depending on how much water is needed. This is a significant increase from the 1,118 options available for the draft regional plan, as a consequence of the greater number of individual demand management options.

7.23 In the Environment Improvement Plan (EIP) Defra set out a series of future water efficiency commitments it expected water companies to meet. We have tested scenarios on how quickly these will be implemented across the South East, as explained in Section 17 of the plan.

7.24 We have developed a database to compile information on options which is linked to our investment model. To appraise and assess options the following information was collated.

Cost

7.25 To facilitate whole life costing in the model, the following was required for each option:

- **Capital expenditure (capex)** – this includes initial capital costs to plan, develop and construct an option;
- **Optimism bias** – this has been utilised to adjust the capex estimates for options to account for risk and uncertainty and therefore was applied to feasible options to ensure a consistent approach to the costs;
- **Operating expenditure (opex)** – operating costs are provided, broken down into fixed costs for costs that do not vary with utilisation and variable costs for opex (e.g. power and chemicals) that do vary with utilisation. A minimum flow can also be added where an option needs to be maintained at a minimum level of utilisation (e.g. where a sweetening flow is required). An opex saving can also be included where an option results in savings to existing operating costs.

Carbon

7.26 Estimates of carbon emissions have been prepared for each option, including:

- **Capital carbon –** includes initial carbon emissions associated with construction and for asset replacements.
- **Operational carbon excluding from electricity** – incorporates fixed operational carbon for emissions that do not vary with utilisation and variable carbon for emissions (e.g. from chemicals) that do vary with utilisation.
- **Emissions from electricity –** estimated power requirement and the grid emissions factors for each year in the planning period. Where a minimum flow is included for an option then this is used for calculating the minimum level of operational emissions and emissions from electricity.

Resilience metrics

7.27 Our resilience framework was used to score and identify the resilience benefits of the feasible options. The scoring utilises both quantitative and semi-qualitative methods, with generic scores generated for each option type to create a 'norm' against which bespoke scores for each option were created. These scores have not been used for selecting the least cost assessment but have been applied for the draft best value plan.

Environmental metrics

7.28 To support the options appraisal WRSE and its six member companies undertook an environmental assessment of the regional plan feasible options which included the following processes.

Strategic Environmental Assessment (SEA)

7.29 Each option was assessed using SEA objectives and assessment criteria to determine positive and negative construction and operational effects. For the purposes of the investment modelling the SEA results were translated into numerical values. The SEA metrics consisted of a positive score and a negative score which was assessed both pre and post mitigation measures being included. The SEA metrics included the results of the Habitat Regulations Assessment (HRA), Water Framework Directive (WFD) assessment and Invasive Non-Native Species (INNS) risk assessments.

Habitat Regulations Assessment (HRA) Test of Likely Significance

7.30 The WRPG requires that regional plans and their component options should be subject to HRA Screening (Test of Likely Significance) and where likely significant effects (LSE) are identified, further Appropriate Assessment should then take place. A likely effect would be considered significant if it could undermine integrity and/or the conservation objectives and/or qualifying features of a Habitat site. Each option was screened for LSE prior to any mitigation being included. The HRA Test of Likely Significance outcomes were included as part of the SEA and contributed to the development of the SEA metrics.

Water Framework Directive (WFD)

7.31 A WFD level 1 assessment undertaken for the regional plan included identification of affected waterbodies, identification of possible impacts, application of embedded mitigation measures and the calculation of a screening score. The results of the WFD level 1 assessments were incorporated into the SEA and associated SEA metrics.

Natural Capital Accounting (NCA) and Biodiversity Net Gain (BNG)

7.32 Using Defra's Enabling a Natural Capital Approach (ENCA)[38] the assessment for the regional plan included the valuation of natural capital assets and ecosystem services within the footprint of each option and their zone of influence.

7.33 The assessment methodology used the most relevant qualitative, quantitative and/or monetary valuation approaches for the NCA. The

[38] https://www.gov.uk/guidance/enabling-a-natural-capital-approach-enca

assessment of an option's impact on the natural capital metrics (or ecosystem services) was undertaken in a sequential manner with an initial qualitative assessment, followed by a quantitative analysis, and finally a monetised assessment if enough confidence existed in the values. The Natural Capital metric constituted a single discrete monetised value reported in £/year generated by combining the outputs of each of the six monetised natural capital metrics to provide a single cost / benefit figure.

7.34 A biodiversity baseline was developed from spatial data sets of habitat inventories and assessed in line with the DEFRA BNG metric 3.0 which was used to calculate BNG change through land use of each option. As this assessment was carried out using only open-source data, a precautionary approach was applied, presuming that where not specifically known, habitats were assigned the maximum habitat score to ensure a consistent approach. The BNG metric consisted of a single score for each option being the difference between the BNG units after the implementation of the option, less the BNG baseline units uplifted by 10%.

Invasive Non-Native Species Assessment (INNS)

7.35 An Invasive Non-Native Species (INNS) risk assessment was undertaken for each option based on option type and included into the SEA and associated SEA metrics.

Our environmental metrics

7.36 To fully integrate environmental considerations into the options decision-making process, the results of the environmental assessments were translated into four environmental metrics which were included in the investment modelling:

- SEA positive
- SEA negative
- Natural Capital value (£/year)
- Difference between BNG units after intervention and the target of baseline +10%

Customer preference metric

7.37 We carried out research with more than 2,500 domestic and business customers from across the region to help us understand which options they prefer to supply their water. We've scored each option type based on the feedback from customers and used this within our investment model to help us identify the water resource programme in our regional plan. More information on our customer research is set out in Appendix 4 to this document.

Options Summary Report

7.38 WRSE published an Options Summary Report alongside the draft regional plan. The report includes summary lists of the options considered as part of the draft regional plan preparation comprising:

- Feasible options list
- Potentially technically feasible but excluded from optimisation in the investment model options list
- Rejected options list

7.39 A copy of the draft regional plan Options Summary Report is available in the WRSE Document Library. This will be updated for the final regional plan, and will include final numbers and types of options available for the investment modelling.

8. How WRSE selected its regional plan proposals

This section of the plan has been redrafted to provide a clearer description of WRSE's decision making approach in selecting the least cost and best value regional plan. An explanation of the decisions WRSE has taken, following this approach, are then presented in detail in Section 17 of the plan.

WRSE investment modelling approach

8.1 The WRSE model determines the most cost efficient and best value set of options that can solve the challenges across 9 different futures using an adaptive planning approach. It does this through two stages, these are set out in our investment modelling proof of concept report which was published in 2019 and consulted on as part of our method statements. We have also had this approach reviewed and audited by an independent expert, which has been published in the WRSE Library.

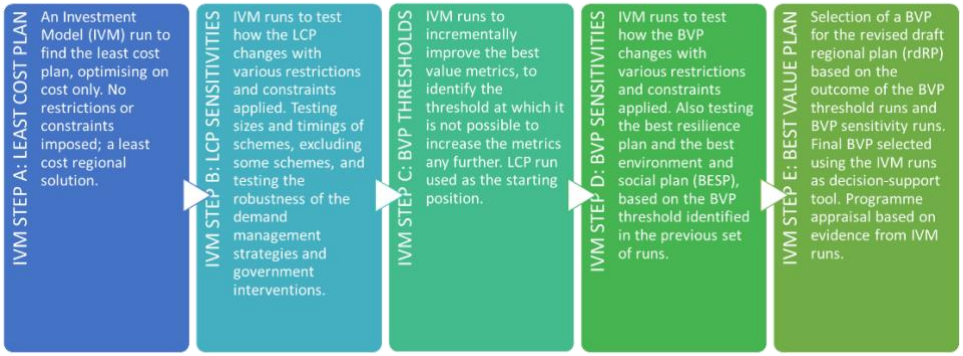
8.2 In the first stage of the WRSE investment model it treats each of the 9 future scenarios, in the adaptive plan tree, as discrete supply demand problems to solve and finds the schedule of solutions to ensure there are no deficits in a cost efficient way.

8.3 In the second stage, the WRSE investment model looks at these potential solutions across the individual pathways and determines the optimal selection and scheduling of these options, using a progressive hedging technique. This approach identifies the least regret set of options at the beginning of the plan which can then be used as a core set of options to adapt from for any of the 9 potential futures. Least regret means options which are adaptable to any of the potential futures modelled and included in the adaptive plan.

8.4 The WRSE Investment Model (IVM) is used to derive adaptive investment strategies for the region and companies. The output from each model run is a set of cost and best value metric information. These outputs along with other outputs such as network connectivity diagrams characterise the performance of a plan.

8.5 In order to derive a best value plan WRSE uses a five step process as set out in Figure 8.1 below.

Figure 8.1: Investment modelling steps towards best value plan



8.6 **STEP A**: The least cost plan (LCP) is derived using the investment model (IVM). All schemes are available for the model to choose from, i.e., there are no pre-selected or "forced in" schemes, so the IVM is free to select feasible options when available within the planning period.

8.7 **STEP B**: Having derived the least cost plan a series of sensitivity tests are then undertaken to see what happens to the plan if key schemes are excluded or delayed. These LCP sensitivity runs provide useful additional information to determine how critical certain schemes are to the plan and also whether there are any alternatives to them. Some of these tests also explore different combinations of the size of certain schemes. These tests are also used to see what happens if a policy compliance date moves forward or backwards e.g. how would the investment plan change if the extreme drought resilience compliance date moved back to 2050.

8.8 **STEP C**: Successive model iterations to produce a different set of costs and overall average score of the best value plan metrics for subsequent use in investigating the extent to which best value performance can be improved.

8.9 **STEP D**: The next stage in the process is to consider if the overall best value plan (BVP) metrics could be improved. The investment model is used to derive these plans by imposing thresholds for each of the metrics that it must meet to derive a plan. Each new plan still has to meet the policy conditions and must not have any future supply demand deficits. If they do contain deficits they are reviewed but they cannot be considered as a viable plan. The thresholds that are set are based on improving the thresholds obtained from the least cost plan run. When the threshold limits cannot be met the model run is infeasible. Successful BVP runs typically cost slightly more than the LCP but have improved BVP scores.

8.10 **STEP E**: Those BVP runs which are feasible are reviewed to understand what additional schemes have been added to the LCP to improve the overall score of the programme. Typically, catchment management schemes get included in the plan and although they do not always provide any deployable output benefits, they do provide some limited improvements in Natural Capital, SEA benefits and bio-diversity net gain.

8.11 In some BVP model runs, schemes are added to the last year of the programme but are never used as part of the regional plan solution. For example, the model run may select a treatment works to be built, but not actually use it. Where this occurs these runs are not considered to be viable plans as they include schemes which are not utilised but incur an expense.

8.12 The BVP sensitivity testing phase of deriving the regional plan therefore looks at a range of solutions that improve the BVP scores and test these against other BVP runs which explore different availability of options.

8.13 The following sections of the plan explain what WRSE's regional plan proposals are. In Section 17 of the plan we explain our decision making that selected those proposals, following the approach set out above, including sensitivity testing.

Our regional plan proposals

9. Summary of our regional plan proposals

This section of the plan has been redrafted, and the summary information on the plan updated to reflect the revised draft regional plan proposals. Greater explanation is also provided of the role of key schemes in increasing the resilience of water resources in the South East.

Context

9.1. Previous sections of our regional plan identified how much additional water is needed in the future to meet or exceed legal and regulatory requirements and policy expectations that water companies must meet. This includes:

- Increasing the resilience of the region's water supplies to reduce the risk of emergency restrictions such as standpipes to no more than once every 500-years, on average by 2040
- Leaving more water in the environment to deliver long-term environmental improvements
- Reducing leakage by at least 50% by 2050 from 2017/18 levels, and meeting the Government's interim targets in the EIP
- Meeting the national target to reduce household water use to 110 litres per person per day in a dry year by 2050, and meeting the Government's interim targets in the EIP
- Accommodating growth and responding to the challenges of climate change

9.2. The South East of England will run out of water unless demand is reduced and additional resource schemes are developed. This shortfall could occur as early as 2030 in an extreme drought (this includes taking account of benefits from drought permits, Temporary Use Bans and Non-essential Use bans) or as late as 2050 under average climatic conditions. The times will vary at a water resource zone level but by 2075 this deficit could vary from 1,000 Ml/d to as much as 3,000 Ml/d without demand management and water resources options being implemented.

9.3. Leakage reduction, demand management measures and drought orders/permits are core to our overall strategy. They will deliver 76.4% of the overall solution in the first five years of the plan and remain at over 55% of the solution by the end of the planning period. However, these measures alone are not sufficient, and significant additional new water resources will be required to be planned and delivered.

9.4. All the regions have considered how much water they can offer other regions. Where there are opportunities, WRSE has incorporated the opportunities as options in our regional plan. However, as observed at the draft plan stage the amount of water available from outside the South East is much lower than had previously been anticipated (at emerging plan stage), given challenges other regions are facing to secure water supplies for their own customers. Therefore, whilst the investment model has considered options from other regions, the South East is heavily dependent on solutions being delivered within the region through saving water, delivery of new water resources schemes, as well as a network of new water transfers between our member companies and the WRZs they supply.

9.5. We have considered a wide range of potential new water resource options as part of the preparation of our plan. We have assessed the schemes against a range of best value metrics, including financial, environmental and customer preferences. We have undertaken thousands of investment model runs as part of the preparation and testing of our regional plan. The schemes in the regional plan are consistently selected across a wide range of different plans, policy scenarios and sensitivity tests which indicates a stable solution for the South East region given the wide range of challenges and uncertainties it faces in the future.

9.6. The plan that we have selected is the plan that delivers the highest overall best value metric scores when compared with the alternative plans we have considered (as explained in Section 17 of the plan). It is also the plan with the highest customer preference metrics. This is not the only plan capable of meeting the challenges that we face. The combination or timing of schemes within the respective plans can vary when weighted in favour of individual metrics, but the plan that we have selected represents what we consider to

be the most appropriate and optimum best value regional solution across all best value metrics.

9.7. The WRPG requires us to present a best value plan and also a least cost plan and a best environmental and societal plan. We present information on these in Section 17 of this document. Our best value plan delivers additional value over and above that which would be delivered through our least cost plan. The best value plan is better for the environment and increases the resilience of our water supplies when compared to the least cost plan. It achieves greater resilience and overall value when compared to the best environmental and societal plan.

9.8. We have presented an explanation of how we have tested key decisions underpinning our plan in Section 17 of this document, explaining how we considered alternative policy decisions, tested the inclusion and exclusion of options, and considered cost and timing sensitivity of options. This testing is an important part of ensuring that the plan is robust. Our wide-reaching discussions around the plans are an equally important part of our appraisal, providing a more general sense check of technical outputs to reaffirm the plan as appropriate, based on collective opinion as well as metric scores.

9.9. The regulatory guidance water companies must follow requires them to identify a pathway on which to base the first 25 years of their WRMP. We have therefore identified a 'reported' pathway compliant with the Water Resources Planning Guideline (WRPG) produced by the Environment Agency. This requires water companies to plan for growth in line with local authority housing plans. It reflects the expectations of our regulators for a level of abstraction reduction that will deliver the required environmental improvement expected in the future, based on analysis carried out to date. It will also achieve the 1 in 500-year level of drought resilience by 2040 and deliver significant leakage reduction and water efficiency. Our reported pathway (situation or pathway 4) is not the most likely or expected pathway, and our plan is genuinely adaptive. Identifying this reported pathway allows the regional plan to fulfil the WRPG requirement.

Regional plan at a glance

9.10. The plans and detailed information presented in the subsequent sections show the regional plan proposals for different time periods within our overall planning period to 2075. Our graphics and text explain how the selection of schemes would vary under different future situations.

Our proposals for 2025 to 2035

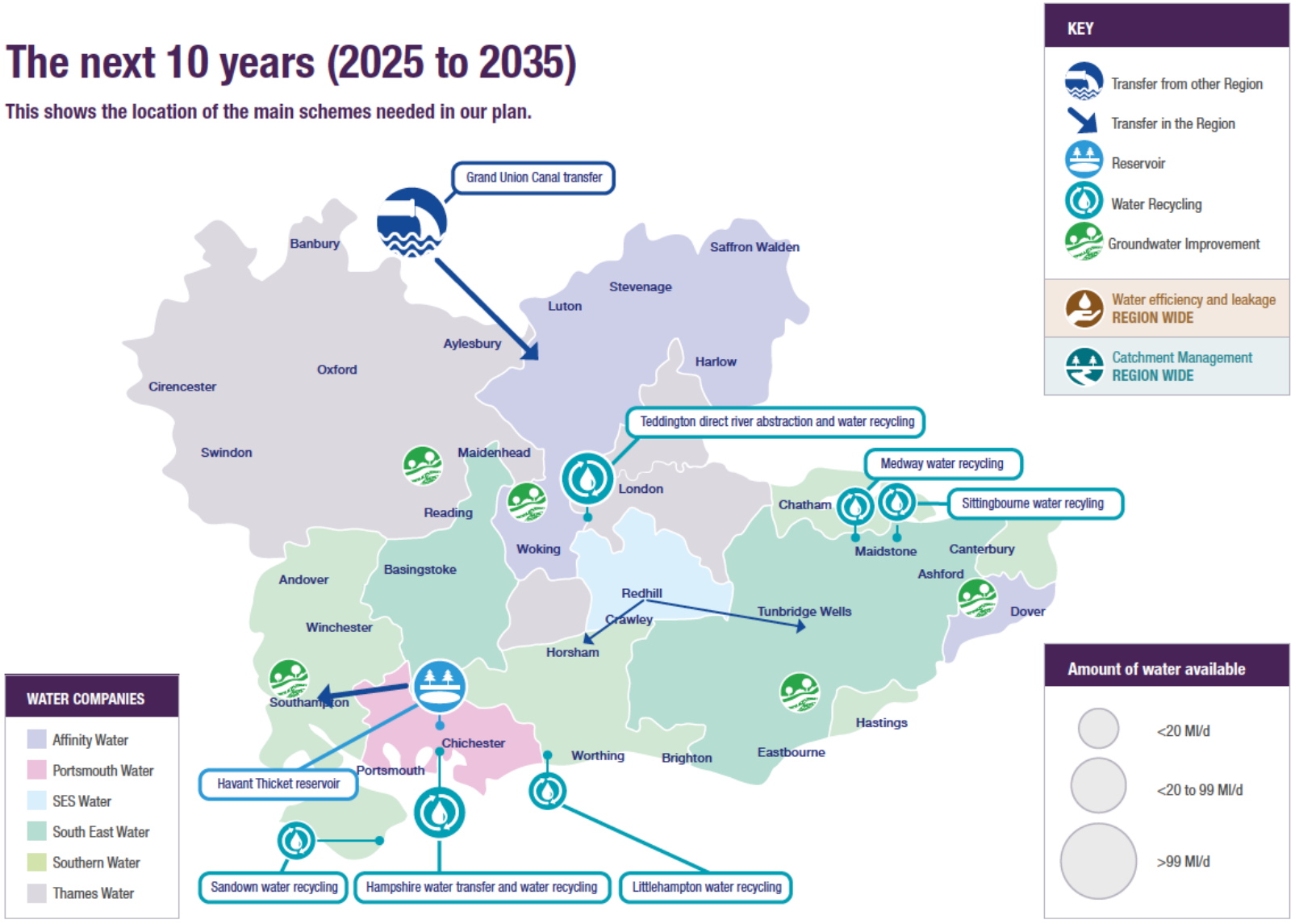
9.11. Figure 9.1 below summarises the location of key supply schemes identified in the revised draft regional plan in the period 2025 to 2035. The options selected in the first part of our plan are least regret options, required under any of the future challenges we face, and will enable us to adapt to any of the future pathways beyond 2035. This means that the investment needed in the first ten years of our plan has been tested against a range of different futures, so we know it is required. This includes

- options needing to be planned, constructed and delivered or commenced in this period; and
- preparatory work, such as securing planning and other consents, for longer terms options

9.12. These 'least regret' options must be progressed urgently, so we are ready to meet the challenges we face. Least regret does not mean these solutions will be easy to implement or won't potentially be disruptive while they're being delivered. They are solutions that are needed if we are to have secure and resilient water supplies in the future alongside an improved environment. Least regret options needing to be progressed in the early part of the planning period are those that the water companies must progress (through investigation, consenting and implementation) as they are critical solutions required, irrespective of which future pathway is selected in 2030.

9.13. It should be noted that schemes selected and funded for development in this regional plan in the next five years will be included into the baseline of the next plan, in accordance with the current WRPG. These early options in the regional plan will be taken forward into subsequent plans as 'baseline' schemes, in the same way that other schemes are included in the baseline of

Figure 9.1: Our proposals for 2025 to 2035 – location of key schemes



this regional plan. The need for these proposals would not be re-considered as part of those plans.

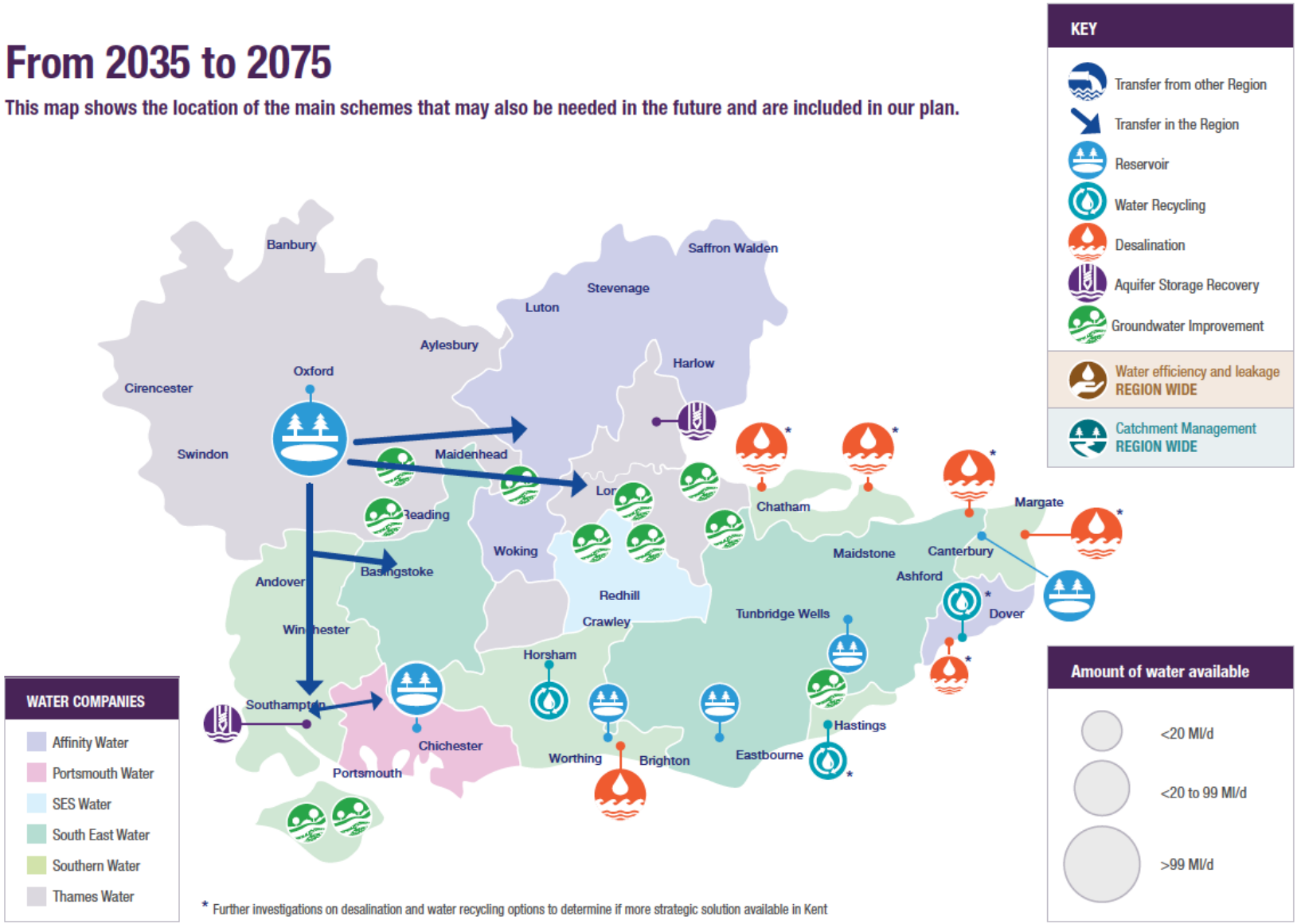
Our proposals for 2035 to 2075

9.14. The majority of the options selected for development in our regional plan are selected in the period to 2040 and 2050, in which we will achieve increased drought resilience (by 2040) and our environmental ambition (by 2050).

9.15. From 2035 onwards a greater number and capacity of options is required under the more challenging futures. Particularly over the longer term, these increasingly rely on water recycling, desalination and other infrastructure options. Under less challenging futures, the scale of new resource developments we will need to implement over the longer term will be less. Much will depend on the future scenario we face.

9.16. Figure 9.2 below summarises the location of key schemes identified in the revised draft regional plan in the period 2035 to 2075.

Figure 9.2: Our proposals for 2035 to 2075 – location of key schemes



How our regional plan proposals make water resources more resilient in the South East

9.17. The water resources challenges that the South East region is facing are significant, requiring substantial investment in demand management and new water resource developments over the plan period. As the diagrams above illustrate, there are a significant number of least regret options proposed to be delivered before 2035, and in the early part of the 2035 to 2075 period, for which technical and environmental assessment work needs to be completed and consents secured so that they can be implemented.

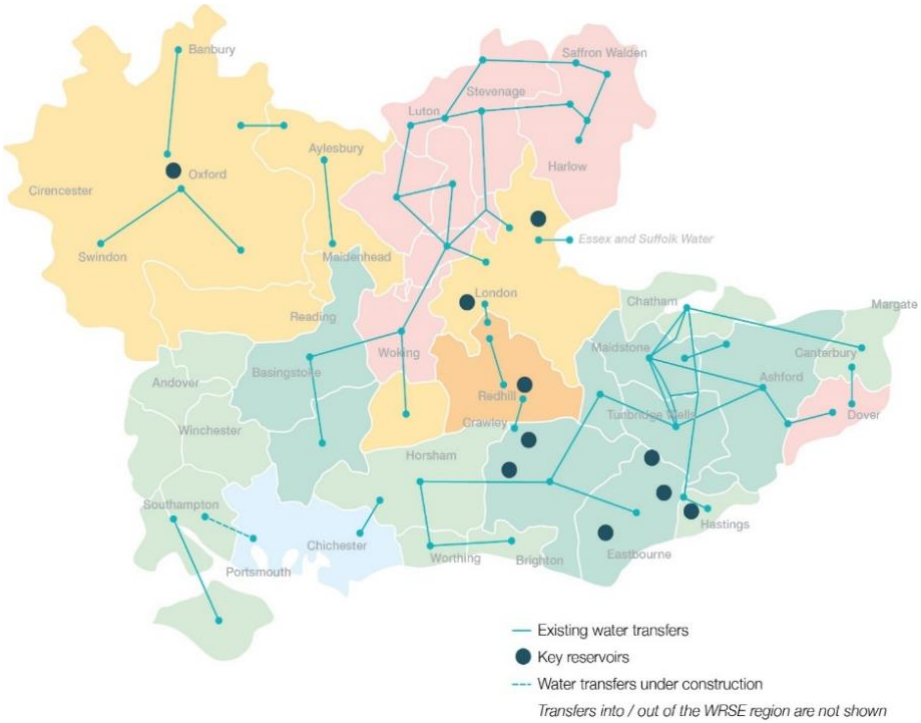
9.18. As these options are consented and implemented, and as later options are also brought forward and developed, the way in which water resources are shared between regions and companies, and delivered to customers within the region will fundamentally change, with increased connectivity and sharing of resources.

9.19. There are a number of critical regional schemes as part of this solution, and this section of the plan explains how water resources in the South East will be made more resilient as a result of the proposals within the regional plan.

9.20. The South East of England is comprised of 37 water resource zones with limited connectivity between companies and their water resource zones, as shown in Figure 9.3.

9.21. Transfers within the region at the start of the planning period are characterised as by either historical agreements tied to reservoir developments or new time limited agreements between companies following resources being freed up through demand management activities such as metering, leakage reductions and water efficiency programs which help customers reduce their consumption and save water.

Figure 9.3: Water resource zone connectivity in the South East



9.22. The configuration of the water resource zones in the South East could be considered as six sub-regional zones: as shown in Figure 9.4 below:

- Upper Thames
- Lower Thames
- West
- Central
- South
- East

Figure 9.4: Sub-Regional Zones

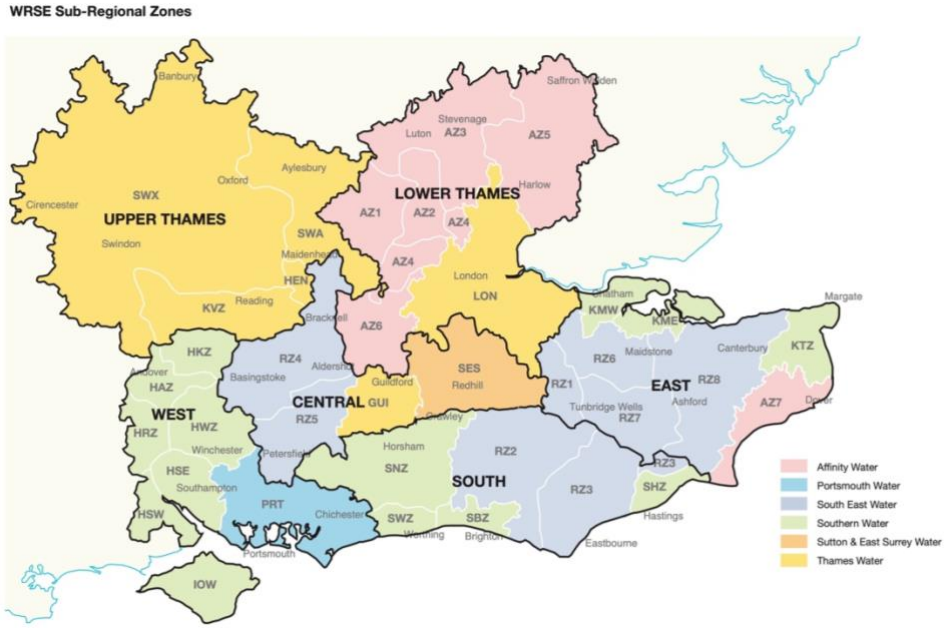
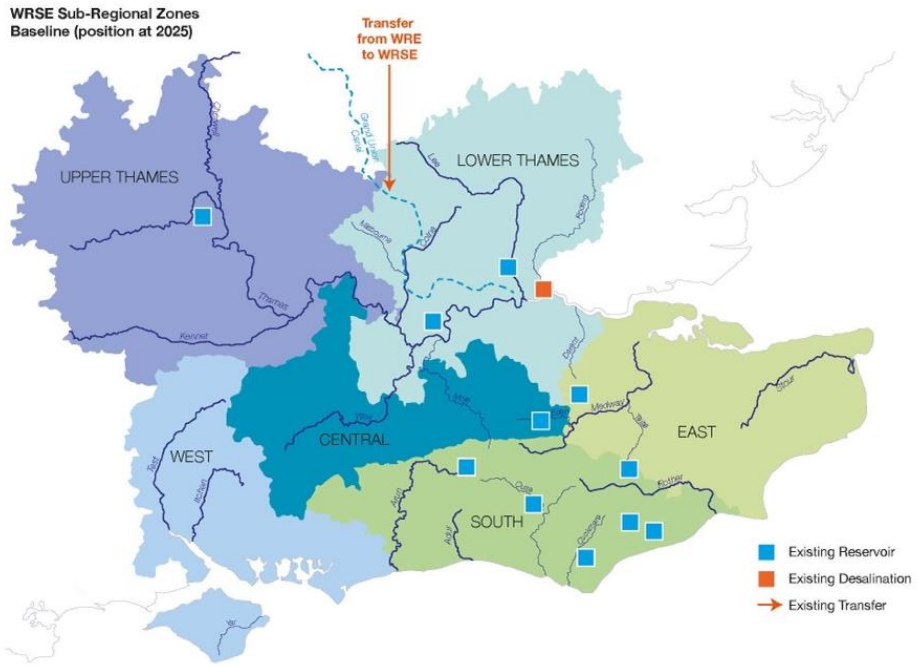


Figure 9.5: Position at 2025



9.23. In the emerging regional plan, the draft regional plan and the revised draft regional plan, increased connectivity remains a key feature following the principles of the existing transfers of sharing resources across the region as and when they are developed either through becoming more efficient with the water we have and or developing new sources of water.

9.24. The first map in Figure 9.5 below shows the baseline position at 2025, identifying the existing reservoirs and desalination plant, and import of water to the region at the start of the planning period.

9.25. We then characterise the development of the regional network through two snapshots in time: 2035 and 2050, with a narrative provided to explain how changes will occur as schemes are developed.

Position at 2035

9.26. The immediate challenges the region faces arise from current commitments. Following an abstraction licence inquiry in 2018 Southern Water has accepted licence reductions at key sources in Hampshire to protect the chalk river environments. Until solutions are in place, Southern Water is relying on drought permits and orders to provide a solution. Portsmouth Water are increasing the bulk supplies to Southern Water as well as developing a reservoir to provide further transfers to Southern Water as part of a series of measures to provide a medium-term solution for them.

9.27. Affinity Water has to deliver sustainability reductions across a number of their zones to protect the Environment and Thames Water have a commitment to improve the resilience of their supply systems to be able to cope with a 1:200 year drought by the 2030's.

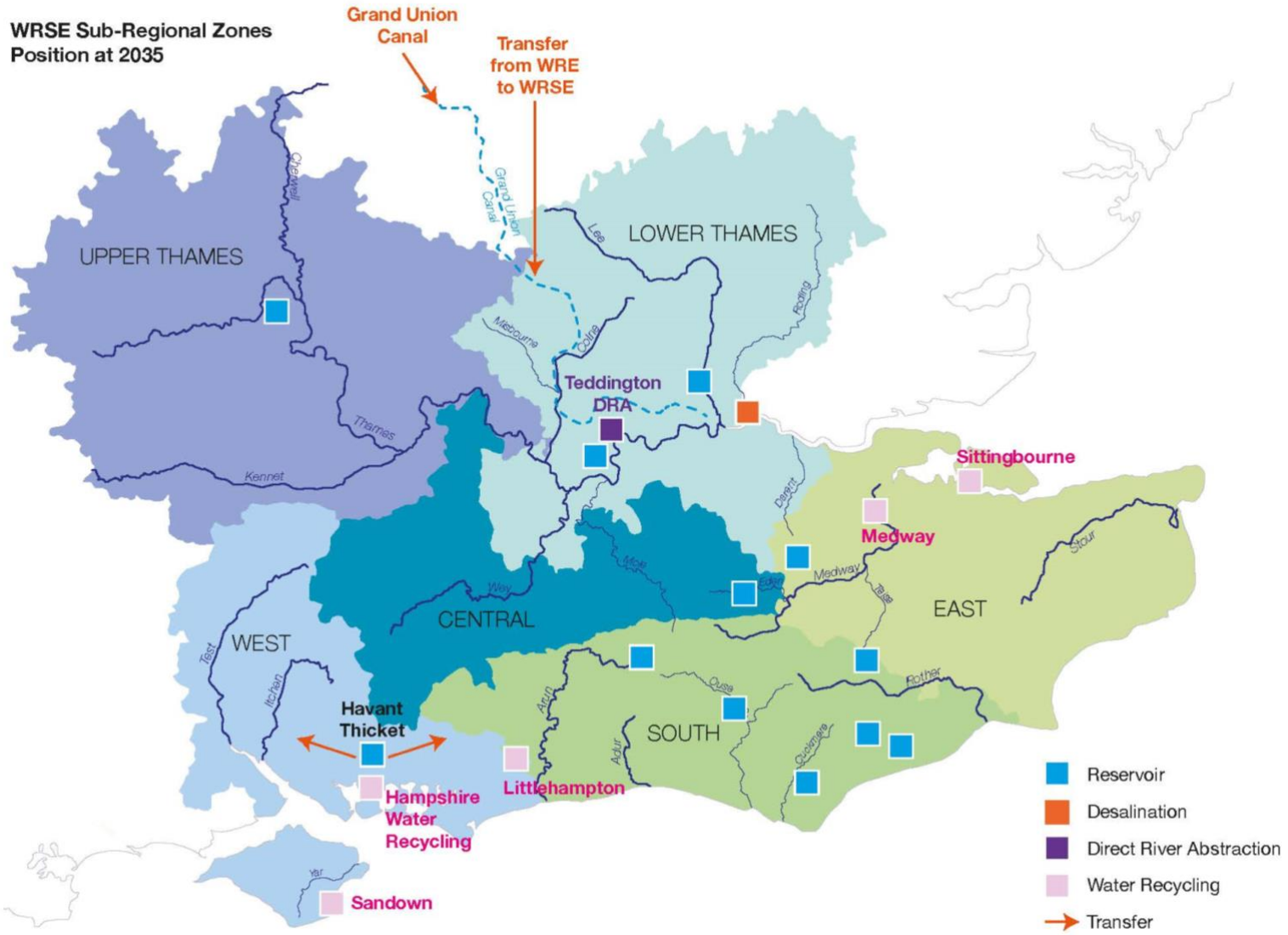
9.28. Our regional plan proposals selected by 2035 are set out in Figure 9.6 below.

9.29. The solutions within the plan are heavily dependent on saving water, sharing more water between companies and delivering some key strategic options. The Lower Thames sub-regional zone develops two key sources of water while the West sub-regional zone develops a reservoir and a recycling scheme. These schemes allow Affinity Water to take a reduced supply from Grafham reservoir for a short period of time in order to free resources at this reservoir for Anglian Water to provide additional support for Cambridge Water. This so-called 'virtual reverse trade' frees up 27 Ml/d of water to Cambridge Water.

9.30. SES Water will provide additional bulk supplies to Southern Water and South East Water and this will improve the connectivity in the East sub-regional zone. The new transfers provided are in addition to the existing set of transfers and help balance out resource availability across the zones.

9.31. Therefore, by 2035, the initial schemes respond to the immediate deficits arising from previous commitments on WINEP, environmental reductions and population growth.

Figure 9.6: Position at 2035



Position at 2050

9.32. The second tranche of new schemes are required to come online between 2035 and 2040 to deal with sustainability reductions, population growth, climate change and improving resilience across the region. The final tranche of investments help meet the sustainability reductions by 2050.

9.33. Figure 9.7 below shows how these developments operate across the region as the sub-regional zones become further connected by 2050. Key strategic resources are shared and distributed across the region where possible, leading to a number of significant changes to the regional water resources position.

9.34. The SESRO reservoir proposal would support up to five companies in the South East under different drought events. SES Water would be the only company that does not benefit from the SESRO reservoir proposal. This key strategic resource will provide water to the Upper Thames, Lower Thames, the West and Central sub-regional zones. The three core companies receiving water from the SESRO reservoir proposal are Thames Water, Southern Water and Affinity Water. However, South East Water would also receive additional supplies in their zone in the Central sub-regional zone during hot dry summers. By providing water to Southern Water, the SESRO reservoir proposal is also able to indirectly support Portsmouth Water as the company becomes a net importer of water over the planning period of 50 years.

9.35. Initially, the Havant Thicket reservoir along with the Hampshire Water Transfer and Water Recycling Project, provides key water resources to Hampshire. However, once the Thames to Southern Transfer proposal is developed, water from Havant Thicket reservoir and the Hampshire Water Transfer and Water Recycling Project are then used to support transfers to Southern Water in the South sub-regional area. This re-allocation of resources is part of an efficient use of water across the region.

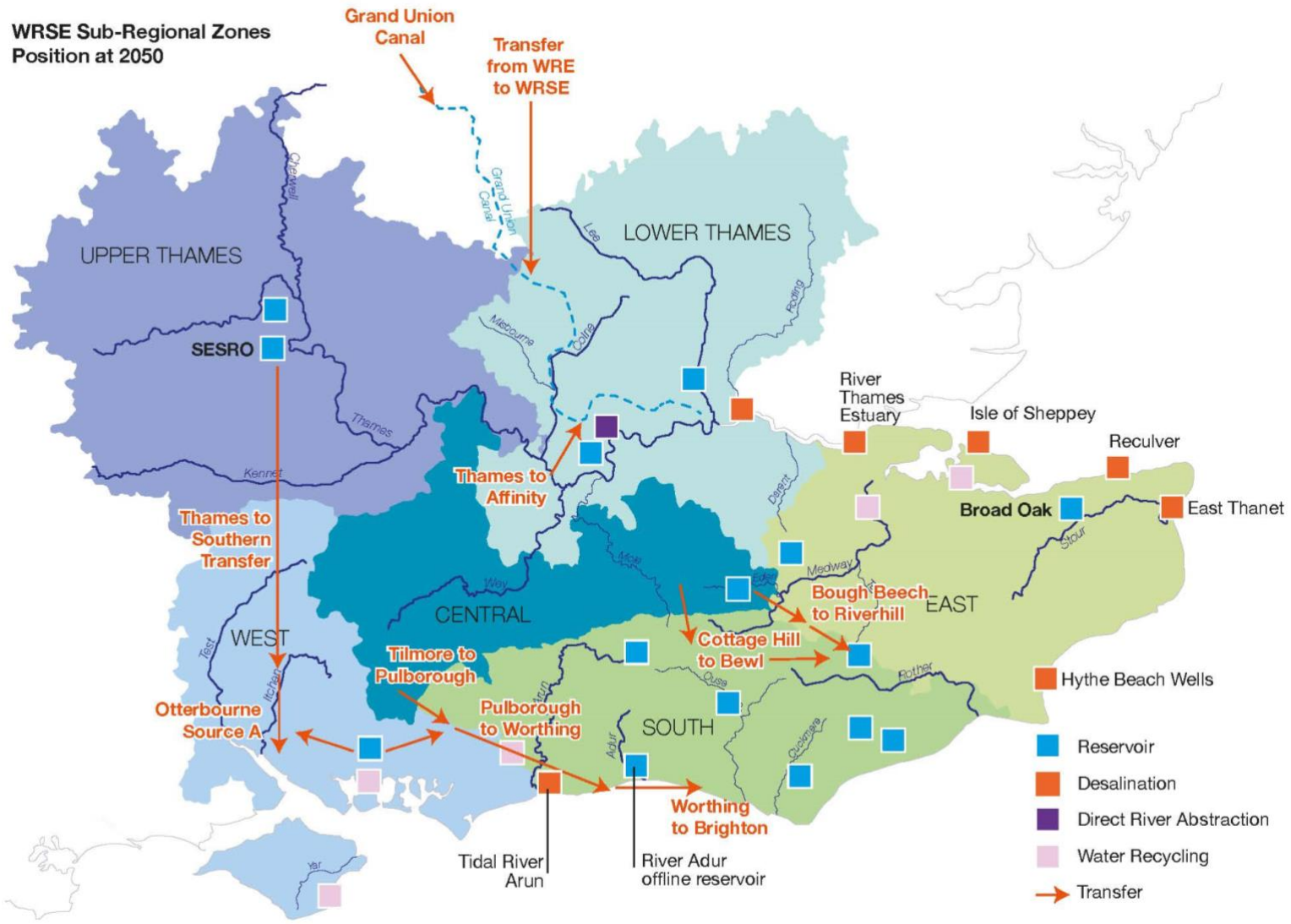
9.36. SES Water, located in the Central sub-regional zone, continue to support Southern Water with transfers, but also goes on to develop transfers to South East Water in the South sub-regional zone. These transfers from the West and Central sub regional zones enable companies to meet their future sustainability reductions, housing growth commitments and the anticipated climate change impacts.

9.37. Further development of the water transfer network in the Kent and Hastings area, in the East sub-regional zone, enables South East Water, Southern Water and Affinity Water to share water from new recycling schemes, the Broad Oak reservoir proposal and a number of proposed desalination proposals across this area. This improved connectivity will also help companies meet peak summer demands and support future housing growth.

9.38. As time progresses and the challenges in the South East materialise it is vital that resources are shared across the region in order to provide cost efficient solutions to protect the environment and customers; support growth; tackle climate change and implement government policy.

9.39. The development of strategic network across the South East zones and its sub regional areas is a key part of the infrastructure development and facilitates moving water to those zones and areas that require it during different droughts and at different times of the year. This will require more flexible operating arrangements between the companies in the South East allowing companies to temporarily trade water on an annual basis rather than a fixed contractual volume of water.

Figure 9.7: Position at 2050



10. Our regional plan proposals in detail

This section of the plan has been updated to reflect the proposals selected in the revised draft regional plan proposals.

Context

10.1 Whilst section 9 of this document set out a summary of the regional plan proposals, this section and Sections 11 to 15 that follow provide a more detailed explanation of the proposals selected in the regional plan. This starts with a regional overview diagram, and then an overview of the types of options selected in the different parts of the plan period, the numbers of options selected, and the amount of water that the options will deliver.

Regional overview diagram

10.2 The regional overview diagram in Figure 10.1 below shows the options selected as part of our best value investment modelling. Options are identified in different time periods within the planning period from 2025/26 to 2074/75.

10.3 **The timing shown for the option is the date when the investment modelling first utilises the option**. For many options, especially larger infrastructure schemes, decisions will need to be taken well in advance of these dates (up to 15 years in some cases) to enable necessary assessment, consenting and construction work to take place. This means financial costs will be incurred by the companies promoting the options ahead of the date when they are first utilised. The options may be completed ahead of their first utilisation – potentially in the Asset Management Plan (AMP) period before, and this plan presents the regional best value plan proposals.

10.4 **The new resource options only appear once in each branch of the diagram** – in the period that they are first selected in the investment modelling. The model then utilises them again in that branch through the rest of the period to 2075 – so they continue to be available for use. Where an option appears in more than one branch, but in different periods, this means the model selects them earlier or later, depending on the scale of challenge it is seeking to solve (more options earlier, to meet more challenging futures).

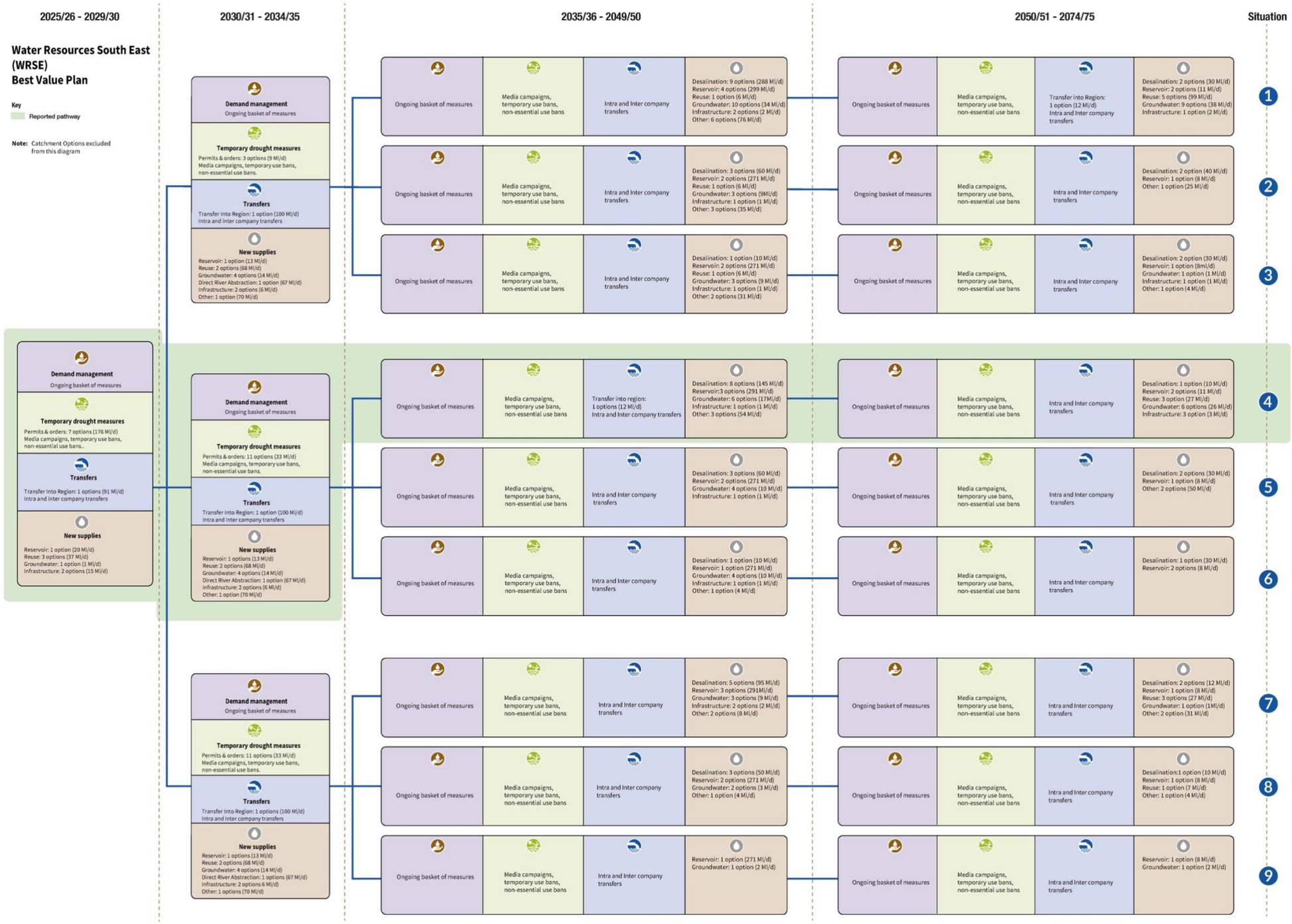
10.5 **Any figures shown in the diagram (in Ml/d) for an option are the maximum capacity** under the 1:500 Dry Year Annual Average (DYAA) scenario – what is currently termed an extreme drought. This is a total capacity figure and not a representation of how much the option would actually be utilised. The investment model optimises its selection across all of the different design scenarios.

10.6 It is important to note that **the options may have different utilisations under different design scenarios** – e.g., Normal conditions, 1;100 DYAA, 1:500 Dry Year Critical Period (DYCP) and 1:500 DYAA figure. The regional plan focuses mainly on the 1:500 DYAA figures, as this is the drought resilience scenario that we are planning to achieve.

10.7 **Utilisation may vary across the planning period** - this does not mean that the maximum capacity would be immediately implemented when the scheme is first utilised, as it may vary over the duration of the planning period. For some options the utilisation gradually increases over time as the scale of the supply demand deficit that the modelling is seeking to solve increases. Other options may only need to be utilised for a period of time within the overall planning period, however the investment modelling seeks to optimise the overall selection of options as part of the best value plan.

10.8 Alongside the preparation of the best value regional plan, our six member companies are preparing their individual WRMPs, which present each company's detailed proposals for their own supply areas. The detailed selection and timing of options will be set out by our member companies in their WRMPs. National guidance makes clear that a WRMP should reflect the regional plan unless there is clear justification for not doing so. It is for the WRMP to explain how it has reflected the regional plan and why the preferred programme has been selected. We have prepared company level overview diagrams to show the options selected at a company level in the regional plan. These are enclosed at Appendix 5 to this document for context.

Figure 10.1: WRSE regional plan options selected under 1:500 DYAA in each model pathway



Overview of types of options selected

10.9 Another way of illustrating the mix of proposals in our plan, and how this changes over time and under different potential futures is to explore the numbers of the different types of options that are selected under each of the model pathways (situations) for the 1:500 DYAA scenario (our core planning scenario).

10.10 Table 10.1 below provides a summary at the regional level, highlighting for each of the 9 situations, data at 5 different time slices:

- 2025/26 – the first year of the planning period
- 2029/30
- 2034/35
- 2049/50
- 2074/75 – the end of the planning period

10.11 The columns in the table show how the mix and utilisation of options changes, under the following headings:

- Number of options – the total number of options utilised across the option types in each time slice.
- Resource (%) – the percentage utilisation compared to the utilisation of all new options
- Option utilisation (Ml/d) – the actual utilisation of the options as per the option types in the various time slices tabulated.
- .

10.12 Consistent with the regional plan overview diagram, the table shows both the increasing numbers of options required under the more challenging futures, and how there is an increasing selection of options including water recycling and desalination over the longer term, in the absence of other potential options to meet the larger supply demand deficits being faced.

10.13 Following on from this table, the subsequent sections of this document describe the proposals in the regional plan in more detail, in a series of sections covering our proposals for:

- Water efficiency and leakage reduction (Section 11)
- New sources of water (Section 12)
- Water transfers around the region (Section 13)
- Catchment management and nature-based solutions (Section 14)
- Drought Orders and Drought Permits (Section 15)

10.14 Section 16 of this document then outlines the cost, carbon and environmental assessments of the plan and the options elected within it.

10.15 Section 17 of this document then explains WRSE's decision making and consideration of alternative plans that we have evaluated.

Table 10.1: Types of options selected in 1:500 DYAA regional plan

Situation 1	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	0	0	0	70	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.6
Demand management	469	469	469	469	469	4%	25%	29%	34%	33%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	1	9	11	0%	0%	1%	10%	10%	0.0	0.0	4.0	261.0	318.5
Drought demand management	74	92	92	92	92	37%	17%	11%	9%	8%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	11	13	13	13	22%	8%	6%	0%	0%	143.1	94.4	112.3	0.0	0.0
Into region pipelines	8	10	10	10	11	12%	10%	8%	6%	6%	137.6	175.8	214.4	237.0	251.8
Leakage	208	208	208	208	208	3%	11%	10%	10%	11%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	12	16	25	0%	1%	2%	2%	3%	0.0	7.7	22.4	43.6	87.2
Other	8	13	17	21	24	22%	19%	15%	13%	12%	0.0	133.3	260.6	301.8	313.1
Reservoir	0	5	6	6	11	0%	6%	5%	4%	7%	0.0	32.3	97.9	110.7	208.2
Recycle and reuse	0	2	4	6	8	0%	2%	13%	11%	11%	0.0	20.0	137.9	274.1	342.0

Situation 2	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	0	1	1	2	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Demand management	469	469	469	469	469	4%	25%	29%	39%	38%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	1	3	5	0%	0%	1%	2%	4%	0.0	0.0	4.0	47.6	85.7
Drought demand management	74	92	94	94	94	37%	17%	11%	10%	10%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	11	20	20	20	22%	8%	7%	0%	0%	143.1	94.4	128.9	0.0	0.0
Into region pipelines	8	10	10	11	11	12%	10%	8%	7%	6%	137.6	175.8	143.2	178.0	175.7
Leakage	208	208	208	208	208	3%	11%	10%	12%	12%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	8	8	11	0%	1%	1%	1%	1%	0.0	7.7	4.2	18.4	23.4
Other	8	13	17	17	19	22%	19%	15%	13%	14%	0.0	133.3	153.8	214.6	240.2
Reservoir	0	5	6	6	6	0%	6%	5%	4%	4%	0.0	32.3	58.0	109.3	110.0
Recycle and reuse	0	2	3	4	5	0%	2%	13%	12%	11%	0.0	20.0	115.9	159.7	177.2

Situation 3	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	0	1	2	3	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Demand management	469	469	469	469	469	4%	25%	29%	40%	39%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	0	1	3	0%	0%	0%	0%	1%	0.0	0.0	0.0	5.4	24.6
Drought demand management	74	92	94	94	94	37%	17%	11%	11%	10%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	11	20	20	20	22%	8%	7%	0%	0%	143.1	94.4	115.2	0.0	0.0
Into region pipelines	8	10	10	10	10	12%	10%	8%	7%	7%	137.6	175.8	117.3	170.0	193.0
Leakage	208	208	208	208	208	3%	11%	10%	12%	13%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	8	8	10	0%	1%	1%	1%	1%	0.0	7.7	4.2	8.1	9.6
Other	8	13	16	16	19	22%	19%	15%	13%	13%	0.0	133.3	101.7	180.4	207.1
Reservoir	0	5	6	6	6	0%	6%	5%	4%	4%	0.0	32.3	32.2	76.8	84.9
Recycle and reuse	0	2	3	4	5	0%	2%	13%	12%	12%	0.0	20.0	100.6	100.8	100.8

Situation 4	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	0	0	0	71	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.6
Demand management	469	469	469	469	469	4%	24%	29%	37%	36%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	2	8	9	0%	0%	2%	5%	5%	0.0	0.0	8.1	126.9	154.7
Drought demand management	74	94	94	94	94	37%	17%	11%	10%	9%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	19	20	20	20	22%	9%	7%	0%	0%	143.1	108.4	121.4	0.0	0.0
Into region pipelines	8	10	11	11	11	12%	10%	8%	7%	7%	137.6	180.0	226.4	216.1	250.0
Leakage	208	208	208	208	208	3%	11%	10%	11%	12%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	11	12	18	0%	1%	1%	1%	2%	0.0	6.9	12.8	29.7	57.9
Other	8	14	16	19	24	22%	19%	14%	13%	13%	0.0	128.8	212.9	292.8	295.9
Reservoir	0	5	5	5	8	0%	6%	5%	4%	5%	0.0	31.7	55.0	105.0	132.1
Recycle and reuse	0	2	4	5	7	0%	2%	13%	12%	11%	0.0	20.0	124.8	323.3	333.9

Situation 5	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	0	1	1	1	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Demand management	469	469	469	469	469	4%	24%	29%	39%	38%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	1	3	5	0%	0%	1%	2%	3%	0.0	0.0	4.0	51.3	90.0
Drought demand management	74	94	94	94	94	37%	17%	11%	10%	10%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	19	20	20	20	22%	9%	7%	0%	0%	143.1	108.4	118.3	0.0	0.0
Into region pipelines	8	10	10	11	11	12%	10%	8%	7%	6%	137.6	180.0	175.2	245.5	176.7
Leakage	208	208	208	208	208	3%	11%	10%	12%	12%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	9	9	12	0%	1%	1%	1%	1%	0.0	6.9	10.4	23.1	24.7
Other	8	14	15	15	18	22%	19%	14%	12%	13%	0.0	128.8	128.5	189.6	240.5
Reservoir	0	5	5	5	5	0%	6%	5%	4%	4%	0.0	31.7	46.3	95.1	105.0
Recycle and reuse	0	2	3	4	5	0%	2%	13%	12%	11%	0.0	20.0	100.6	51.6	172.5

Situation 6	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	0	1	2	3	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Demand management	469	469	469	469	469	4%	24%	30%	40%	40%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	0	1	2	0%	0%	0%	0%	2%	0.0	0.0	0.0	9.4	32.4
Drought demand management	74	94	94	94	94	37%	17%	12%	11%	10%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	19	20	20	20	22%	9%	7%	0%	0%	143.1	108.4	103.9	0.0	0.0
Into region pipelines	8	10	10	10	10	12%	10%	8%	7%	7%	137.6	180.0	151.9	197.5	215.8
Leakage	208	208	208	208	208	3%	11%	10%	12%	13%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	9	10	10	0%	1%	1%	1%	1%	0.0	6.9	9.2	11.5	13.3
Other	8	14	15	16	17	22%	19%	14%	13%	12%	0.0	128.8	73.6	155.6	185.6
Reservoir	0	5	5	5	5	0%	6%	5%	4%	4%	0.0	31.7	31.0	56.8	64.2
Recycle and reuse	0	2	3	3	5	0%	2%	14%	12%	12%	0.0	20.0	66.6	50.6	50.8

Situation 7	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	1	1	1	1	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Demand management	469	469	469	469	469	4%	25%	30%	38%	38%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	1	5	7	0%	0%	1%	4%	4%	0.0	0.0	4.0	75.7	101.4
Drought demand management	74	94	94	94	94	37%	17%	12%	10%	10%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	19	19	19	19	22%	9%	7%	0%	0%	143.1	97.5	120.6	0.0	0.0
Into region pipelines	8	10	10	11	11	12%	10%	8%	7%	6%	137.6	135.6	177.8	226.5	184.4
Leakage	208	208	208	208	208	3%	11%	10%	12%	12%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	7	9	10	0%	1%	1%	1%	1%	0.0	0.0	4.7	19.0	20.2
Other	8	13	14	17	20	22%	19%	14%	12%	13%	0.0	85.7	146.8	195.5	220.5
Reservoir	0	5	5	5	8	0%	6%	5%	4%	5%	0.0	28.8	40.5	101.4	130.4
Recycle and reuse	0	2	4	5	6	0%	2%	13%	12%	12%	0.0	20.0	67.4	121.3	187.7

Situation 8	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	1	1	2	3	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Demand management	469	469	469	469	469	4%	25%	30%	40%	40%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	1	3	4	0%	0%	1%	2%	2%	0.0	0.0	4.0	26.7	60.0
Drought demand management	74	94	94	94	94	37%	17%	12%	11%	10%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	19	19	19	19	22%	9%	7%	0%	0%	143.1	97.5	115.4	0.0	0.0
Into region pipelines	8	10	10	11	11	12%	10%	8%	7%	7%	137.6	135.6	134.3	188.4	193.5
Leakage	208	208	208	208	208	3%	11%	10%	12%	13%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	6	8	8	0%	1%	1%	1%	1%	0.0	0.0	2.7	10.9	10.9
Other	8	13	14	14	16	22%	19%	14%	12%	12%	0.0	85.7	90.1	189.6	193.6
Reservoir	0	5	5	5	6	0%	6%	5%	4%	4%	0.0	28.8	29.8	71.9	89.3
Recycle and reuse	0	2	3	4	5	0%	2%	13%	12%	12%	0.0	20.0	49.3	50.8	50.8

Situation 9	Number of options					Resource %					Utilisation Ml/d				
Category	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75	2025/26	2034/35	2039/40	2049/50	2074/75
Catchment management	0	1	2	3	3	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Demand management	469	469	469	469	469	4%	25%	30%	40%	41%	33.1	404.1	667.2	1014.8	1054.9
Desalination	0	0	0	0	0	0%	0%	0%	0%	0%	0.0	0.0	0.0	0.0	0.0
Drought demand management	74	94	94	94	94	37%	17%	12%	11%	10%	287.9	275.3	260.1	271.4	271.9
Drought Interventions	8	19	19	19	19	22%	9%	7%	0%	0%	143.1	97.5	94.6	0.0	0.0
Into region pipelines	8	10	10	10	10	12%	10%	8%	7%	7%	137.6	135.6	119.7	158.2	155.7
Leakage	208	208	208	208	208	3%	11%	10%	12%	13%	24.3	181.6	233.7	309.0	339.9
New storage underground	0	5	6	7	8	0%	1%	1%	1%	1%	0.0	0.0	0.0	6.6	8.1
Other	8	13	13	13	14	22%	19%	14%	12%	12%	0.0	85.7	46.3	119.7	121.2
Reservoir	0	5	5	5	5	0%	6%	5%	4%	4%	0.0	28.8	26.1	45.4	52.1
Recycle and reuse	0	2	3	3	4	0%	2%	14%	12%	12%	0.0	20.0	45.5	44.0	50.4

11. Water efficiency and leakage reduction

This section of the plan has been updated to reflect the proposals selected in the revised draft regional plan proposals.

Understanding the region's water use today

11.1 Water companies measure how much water they put into supply each day using a measure called distribution input (DI). Over the last 20 years, DI has fallen by 21 million litres per day despite the region's population growing by 3.6 million, so there has been no net increase in the amount of water being taken from the environment. This is primarily due to the reduction in leakage, coupled with water efficiency activity and metering, which companies have successfully delivered since privatisation.

11.2 Household customers in the South East use, on average, 145 litres per person per day, which is higher than any other region. Around 18% of water supplied is used by businesses. The region is warmer and drier than most other areas of the country with varying demographics, housing stock and metering levels, all of which have an impact on how much water people use.

11.3 The roll out of water meters across large parts of the region means that water companies have a better understanding of their customers' water use and are helping people make savings. Meters also help to detect leaks on customers' pipes, which makes up around a quarter of the water lost each day through leakage.

What our regional plan proposes

11.4 Reducing water use is as an essential part of tackling the climate and environmental emergency we are facing both nationally and internationally. It will help mitigate the impact of climate change by helping people use water more efficiently, particularly as the population grows, while at the same time cutting the carbon emissions produced by abstracting, treating, moving, and heating water.

11.5 Reducing demand for water is a priority for the regional plan. It is vital in the first decade of the plan while new water sources are developed, and the level of long-term environmental improvement through abstraction reduction is determined.

11.6 The regional plan promotes the need, between 2025 and 2040, for very significant investment across the South East to reduce how much water is used and wasted to meet the Government targets for leakage reduction and water efficiency, including interim targets in the Government's Environmental Improvement Plan. Temporary measures that reduce discretionary water use during droughts are also included in the plan. In addition, it identifies the need for the Government to introduce new policies that will deliver long-term reductions in water use across society. This does not include the leakage reductions water companies have already committed to between 2020 and 2025.

11.7 The majority of the total water needed in the first 15-years of the planning period is expected to come from reducing how much is used and what is wasted through leakage. This action is required under all the adaptive planning pathways and plays an important role in securing water supplies across the planning period.

11.8 Achieving and maintaining this lower and more sustainable level of water use across society is a key component of the long-term solution in all the alternative pathways. By 2050, achieving the level of demand reduction identified in our plan will continue to provide over half the additional water we will need to address the shortfall in water supplies.

11.9 The levels of leakage and usage reductions in this plan are ambitious but our analysis shows this increased level of activity, beyond what was committed to by some companies in their previous WRMPs, is required if more significant reductions to abstractions are needed to protect the environment in the long-term. Delivering them will rely on new approaches and technologies that are yet to be tried and tested, as well as changes to customer behaviour and government policy.

11.10 Progress against the plan will need to be monitored closely, as if it is not achieved, we risk not having enough water to supply the people of the region and we could need to develop alternative water sources instead. Alternatively, we could develop more new sources of water earlier in the planning period to reduce our reliance on demand management measures.

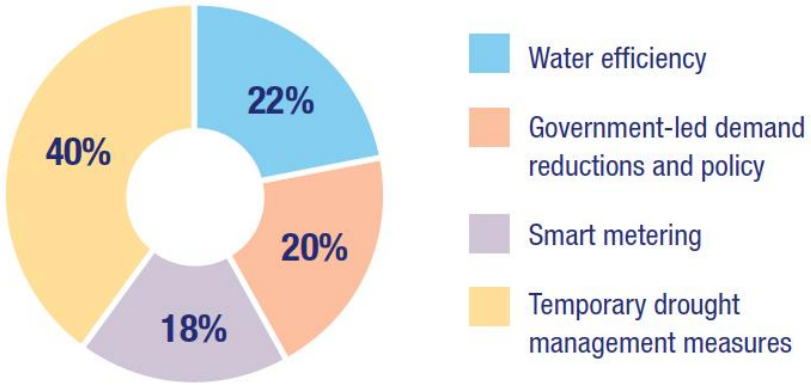
How we will deliver reductions in demand for water

11.11 The regional plan sets out how much total demand must reduce across the region and in each water company area, but it gives our member companies the flexibility to deliver leakage and water efficiency programmes that best meet the needs of their customers, address the specific challenges of their local areas, and use new technologies as they develop.

11.12 Our six member companies have prepared a range of demand management strategies that include leakage reduction and water efficiency activities such as smart metering, tariffs and behaviour change.

11.13 Our collective action across these areas seeks to achieve the proportional split in demand reduction across the region by 2050 (for our reported pathway) as shown in Figure 11.1.

Figure 11.1 Contribution of demand management schemes



Leakage reduction

11.14 The regional plan will deliver the ambition of halving leakage levels across the region by 2050, a commitment made in 2019. It will build on the reductions planned to be achieved between 2020 and 2025 in current WRMP and business plans, and specifically achieve the Government's Environmental Improvement Plan interim targets to reduce leakage by 20% by 31 March 2027 and 30% by 31 March 2032 (based on the 2019 leakage position).

11.15 In total, leakage will be reduced by 556 million litres of water per day by 2050, of which 310 million is delivered through this regional plan. This will see our six member companies reduce leakage in the South East by 50% from 2017/18 levels by 2050. Activities to reduce leakage could include the following:

- Installing sensors in water pipes that use smart technology to detect smaller and less visible leaks, so they can be found and fixed more quickly
- Replacing old water mains so there are fewer leaks and bursts and fewer interruptions to service
- Managing the pressure inside water pipes so less water is lost through leakage
- Working with customers to identify and repair leaks on their own water pipes.

11.16 Halving leakage by 2050 is a major challenge, but the water industry is committed to delivering it and is developing a roadmap that sets out how it will get there. This includes working to develop innovative solutions to reduce leakage as alternatives to large scale and costly mains replacement programmes.

11.17 The proposals in our revised draft regional plan will achieve a 64% reduction in leakage at a regional level. At a company level the figures range from 61% to 67% as illustrated in Table 11.1 below. The percentage leakage reduction is a total figure, based on the volume of water lost through leakage (in Ml/d). The 2017/18 and 2050 leakage figures in comparison are litres per property per day, and so are affected over time by the increasing number of

household properties (the growth in properties reduces the average leakage per property).

Table 11.1: WRSE and company leakage reduction by 2050

Company	Total Leakage (% reduction)	2017/18 Leakage (l/property/d)	2050 leakage (l/property/d)
Affinity Water	63%	121	44
Portsmouth Water	62%	101	38
SES Water	67%	89	29
South East Water	62%	103	40
Southern Water	61%	90	35
Thames Water	64%	176	63
WRSE	**64%**	**140**	**51**

11.18 The differences between the company figures result from different approaches to leakage reduction and different scales of challenges being faced. Further details of the leakage reduction measures being proposed by our six member companies are set out in their draft WRMPs.

11.19 In the longer-term, reducing leakage beyond 50% will become increasingly difficult and less cost efficient. Our regional plan promotes an ongoing reduction in leakage beyond 2050 but at a slower rate because of uncertainties around how this will be done, how much it will cost and its value for money. We explore the uncertainties around achieving targets, and how the adaptive regional plan would need to respond in Section 17 of this document, and set out our monitoring proposals in Section 19.

11.20 As the regional plan is monitored and reviewed into the future, we will continue to balance leakage reduction and uncertainty, particularly as technological advancements are made, and we better understand the costs.

Water company water efficiency activity

11.21 The regional plan identifies the need for water companies to do more to help their customers use water more efficiently at home and work. This could include:

- Rolling out meters, including smart devices, to more customers to help them understand and reduce their water use. This includes a universal metering programme in Portsmouth Water's area
- Targeting activity and communications to customers about water use
- Delivering more in-home water saving visits and fitting products to help save water
- Running public information campaigns to promote water efficiency
- Testing how different tariffs can encourage water efficient behaviour
- Helping customers and business to reduce wastage from poor plumbing.

11.22 The Government has promoted a national ambition for per capita consumption (PCC) to fall to 110 litres per person by day (l/h/d) by 2050. The Government's Environmental Improvement Plan, published since the draft regional plan, set interim targets to be achieved which include a reduction in per capita consumption by 20% from the 2019 to 2020 baseline reporting figures by 31 March 2038, with interim targets of 9% by 31 March 2027 and 14% by 31 March 2032.

11.23 WRSE has updated its PCC commitments in the revised draft regional plan to meet the Government's targets and ambition, achieving the 110 l/h/d in a dry year by 2050 and the Environmental Improvement Plan interim targets.

11.24 As illustrated in Table 11.2 below, the proposals are to achieve 108 l/h/d in a dry year at a regional level by 2050. At a company level the regional plan will achieve between 102 l/h/d and 109 l/h/d.

11.25 Achieving this higher level of water efficiency however, requires WRSE to rely on a higher assumed level of government interventions, 'Government led C+', compared to 'Government led B', which was the basis for the draft regional plan. Further details on this are set out in the section below, and in Section 17 of the plan.

Table 11.2: WRSE and company PCC reduction by 2050

Company	*2019/20 PCC* *(l/person/d)*	2025/26 NYAA PCC (l/person/d)	2025/26 DYAA PCC (l/person/d)	2050 DYAA PCC (l/person/d)
Affinity Water	*152.8*	132.6	144.2	109.3
Portsmouth Water	*149.9*	155.5	161.6	102.0
SES Water	*143.3*	135.0	146.6	104.3
South East Water	*143.1*	134.0	139.7	108.5
Southern Water	*126.5*	126.8	138.0	105.9
Thames Water	*144.9*	136.9	141.0	108.4
WRSE	***144.1***	**135.1**	**142.0**	**107.9**

11.26 The variation across the region is due to several factors such as housing types, levels of affluence, household size and other personal choices that influence how water is used. Mean water use is around 100 l/h/d, however the average is 145 l/h/d due to a moderate proportion of households being higher water users. Some of these use high levels of water for medical reasons, some due to leaks in their supply pipes, leaking toilets and fittings and other customers choose to use the levels that they want or can afford to pay for. Smart metering and targeted research of the high users, both of which are planned proposals in the early years of the regional plan will help understand their water usage patterns more.

11.27 Further details of water efficiency measures being proposed by our six member companies are set out in their draft WRMPs.

Water efficient government policies

11.28 Achieving the levels of water efficiency required by the Government requires significant water company investment and customer behavioural change. WRSE and our member companies are developing and implementing strategies to achieve the planned savings, but the scale of the change required should not be under-estimated. Whilst action by the water companies in terms of educational and promotional activity, as well as water efficiency programmes, fittings and water audits, a significant step change in customer behaviour will be needed to ensure the company and WRSE strategies are effective and sustained. Even with this, the full level of water savings can only be achieved with government policy interventions (such as water labelling, building regulations changes and other measures) as well, not all of which have been funded or committed to.

11.29 The draft regional plan set out WRSE and our member companies' plans for significant investment in water efficiency to reduce domestic and non-household demand, supported by government interventions. These would enable at a regional level for PCC to be reduced to 115 l/h/d (normal year), based on an assumed level of government interventions known as 'Government led B'.

11.30 WRSE modelled and tested various different levels of government interventions as part of the preparation of the draft regional plan. The differences between the profiles are the timings of when the three levels of government interventions are adopted. The low intervention includes water labelling of all water using products, which has already been committed to by the Government. The medium intervention includes water labelling and then also includes minimum standards for all water using products. The high intervention includes water labelling, minimum standards, and new building regulations. 'Government led B', the basis for the draft regional plan, relies on low until 2040, medium from 2060, and high from 2080 (interim between 2040 to 2060 to 2080).

11.31 Since the draft regional plan, the updates to the WRPG and the publication of the Government's Environmental Improvement Plan with its interim targets changes mark a significant shift in policy with important implications for companies, who now become increasingly reliant on government-led

demand management interventions to make the demand management savings required to meet this target.

11.32 Currently, the Government has committed to deliver policies that could help to reduce household PCC but has not announced a timetable to do so. The lack of clarity over the Government's commitments and timescales adds significant risk to the revised draft plan, as the total demand savings across the region associated with government policies is more than 400 Ml/d over the planning period. WRSE has therefore also modelled different timescales for different combinations of the Government low, medium and high interventions to review potential risks and impacts to the regional plan.

11.33 Following investigation and assessment of the options, and following the Government's publication of the Environmental Improvement Plan with its interim targets to be met, WRSE has adopted a reliance on a higher assumed level of Government interventions, 'Government led C+', compared to 'Government led B', which was the basis for the draft regional plan.

11.34 The change in the level of reliance on Government-led interventions between the plans is shown in Table 11.3 below. Both the draft regional plan and revised draft regional plan use the high Government-led interventions scenario, but the delivery times are accelerated for the revised draft regional plan – assuming the full savings will be achieved by 2050, compared to 2095 in the draft regional plan.

Table 11.3: Comparison of draft and revised draft plan Government Interventions

Plan	Low (Water labelling)	Medium (Water labelling + minimum standards)	High (Full Government support)	Regional PCC in 2050 (l/p/d)
Draft regional plan BVP (Gov-led B)	6 l/p/d impact	Additional 6 l/p/d impact (total impact 12 l/p/d)	Additional 12 l/p/d (total impact 24 l/p/d)	115
	Implemented from 2025, with savings achieved by 2040	Implemented from 2060, with savings achieved by 2075	Implemented from 2080, with savings achieved by 2095	
Revised draft regional plan BVP (Gov-led C+)	6 l/p/d impact	Additional 6 l/p/d impact (total impact 12 l/p/d)	Additional 12 l/p/d (total impact 24 l/p/d)	108
	Implemented from 2025, with savings achieved by 2040	Implemented from 2030, with savings achieved by 2045	Implemented from 2035, with savings achieved by 2050	

11.35 The range of Government Intervention scenarios we have modelled and assessed represent different combinations and rates of achieving the Government Interventions. The full range of scenarios is as set out in Figure 11.2 below. Each scenario uses a combination of:

- Low = water labelling
- Med = water labelling + minimum standards
- High = water labelling + minimum standards + building regs

11.36 The low, medium and high profiles are taken up across different timeframes across the different scenarios, for example, in 'Government-led A' scenario low is adopted from 2025, medium from 2060, with full medium benefits realised by 2075. This is illustrated in the colour gradients showing the transition between when the scenarios start and when the full benefits are realised.

Figure 11.2 Timeframes for Government Intervention scenarios modelled

Government Interventions	2025	2030	2035	2040	2045	2050	2055	2060	2065	2070	2075	2080	2085	2090	2095	2100
Gov-led A	LOW	LOW	LOW	LOW	LOW	LOW	LOW	MED	MED	MED	MED	MED	MED	MED	MED	MED
Gov-led B	LOW	LOW	LOW	LOW	LOW	LOW	LOW	MED	MED	MED	MED	HIGH	HIGH	HIGH	HIGH	HIGH
Gov-led C	LOW	LOW	LOW	LOW	LOW	MED	MED	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Gov-led C+	LOW	MED	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Gov-led C++	LOW	MED	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Gov-led D	LOW	LOW	LOW	MED	MED	MED	MED	MED	MED	MED	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Gov-led E	LOW	LOW	MED	MED	MED	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Gov-led F	NONE	LOW	LOW	MED	MED	MED	MED	MED	MED	MED	MED	MED	MED	MED	MED	MED
Gov-led G	NONE	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH	HIGH
Gov-led H	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW	LOW

11.37 With the incorporation of the interim targets from the Environmental Improvement Plan and the commitment to dry year 110 l/p/d in the revised draft regional plan, demand management will play an even more significant role in the regional plan. There are significant under-performance and under-delivery risks attached to securing the levels of water efficiency required, not least as they are not within the control of a single party, requiring collective and co-ordinated action by WRSE and the water companies, consumer groups, the Government, local authorities, and ultimately by household and non-household customers. Section 17 of this document explores these risks and sensitivities in more detail.

11.38 We will continue to support the Government as it develops its roadmap for water efficiency. This action by the Government will be an important part of how society invests in its future environment and protects it for future generations. It will also share the cost of delivering sustained reductions in water use beyond just water company customers.

11.39 Sectors that rely heavily on water are facing the same long-term pressures on their supplies. We have established a group that brings together representatives from the sectors that use the most water within the region to work more collaboratively to secure supplies. The group has identified examples of how other users are innovating to reduce their water use and manage water more efficiently such as harvesting rainwater from the roofs of glasshouses and storing the water in new on-site reservoirs.

Reduce water use during droughts

11.40 When droughts occur, water companies take emergency action to reduce the demand for water as part of their Drought Plans. This includes introducing Temporary Use Bans (TUBs) on domestic customers and Drought Orders for Non-Essential Use Bans (NEUBs) on business customers, both of which temporarily restrict certain discretionary water-using activities, to help preserve water supplies. For example, washing cars and watering gardens with a hosepipe.

11.41 The regional plan continues to rely on temporary restrictions on customers' water use during droughts. Temporary use bans or 'hosepipe bans' on households and non-essential use bans on businesses will continue to be needed in line with the levels of service our six member companies have committed to in their drought plans. We comment more on these in Section 15 of this document.

11.42 The reduction in water use that results from these temporary solutions contributes nearly 250 million litres of water per day in the revised draft regional plan during periods when demand for water is at its highest.

Sensitivity testing

11.43 Section 17 of this document explains the alternative policy approaches to Government interventions that we have evaluated, including modelling different assumed levels of Government interventions and the water savings associated with them.

11.44 We explore the uncertainties around achieving targets, and how the adaptive regional plan would need to respond in Section 17 of this document, and set out our monitoring proposals in Section 19.

12. New sources of water

This section of the plan has been updated to reflect the proposals selected in the revised draft regional plan.

Context for new sources of water

12.1 Whilst demand management measures will contribute a significant proportion of our future water resources needs, we also need to plan for and deliver a significant scale and capacity of new resource developments to meet the future challenges we face.

12.2 Our regional plan includes a number of schemes that are required, and which are of least regret, and a number of other potential schemes that could provide new water supplies for the future. This is based on our assessment of the feasible options which have been included in our regional investment modelling to identify the most cost-efficient, adaptive solution.

12.3 In the following pages we provide a summary of the schemes that feature in the reported pathway of our draft best value plan. Some of the schemes identified are already being progressed by our member companies and other water companies, including as Strategic Resource Options (SROs) through the gated process governed by the Regulators' Alliance for Progressing Infrastructure Development (RAPID). As explained in earlier sections of this document, the RAPID process involves a more detailed assessment of SROs led through a separate governance process to regional planning and WRMPs, with data and information shared between them.

12.4 Alongside our reported pathway, we also highlight some of the schemes that could be needed in the higher and lower pathways presented in this consultation.

12.5 Some key schemes are described in the following sections to give examples of the locations and types of schemes in our regional plan. At the end of this section, we provide a table (Table 12.1) that identifies the main options selected in our regional plan.

12.6 Full details of the schemes being proposed by our six member companies are set out in their draft WRMPs.

12.7 Section 17 of this document evaluates the proposals in this regional plan in more detail, including testing alternative plans that we have evaluated, and different combinations and timings of options selected in those plan

12.8 We have grouped the options by option type:

- Transfers between regions
- Reservoirs
- Water recycling
- Enhancing groundwater and aquifer use
- Desalination
- Multi-sector options

New sources of water identified in our revised draft regional plan

Transfers between regions

12.9 As part of the planning for our regional plan we have carried out a process of reconciliation with the other regional groups to identify opportunities to share water between regions and provide a more joined up national solution to the country's future water needs.

12.10 This has shown that there are two potentially viable transfers from the Water Resources West region into the South East using the existing river and canal network. Other regions have indicated through a regional reconciliation process that they are unlikely to be able to provide additional water, beyond what is required to meet their region's needs. These schemes have therefore been discounted at this stage.

Options selected for utilisation by 2035:

Scheme description	First utilised	Water available
Grand Union Canal (GUC) transfer	2031*	100 Ml/d

** Affinity Water is proposing in its WRMP to deliver this scheme by 2032*

Grand Union Canal

12.11 The Grand Union Canal (GUC) transfer proposal provides a transfer of water between Severn Trent and Affinity Water, so crosses between the Water Resources West and WRSE regions. The GUC runs from Birmingham to London and could be enhanced and used to transfer water that is produced through a new water recycling scheme at Minworth near Birmingham.

12.12 In the draft regional plan, a first 50Ml/d phase of the GUC proposal was selected for delivery in the early 2030s in all future scenarios. A second 50Ml/d phase was required by 2040 in our reported pathway and the high pathway.

12.13 The GUC transfer proposal is a key part of the regional solution, enabling Affinity Water to meet abstraction reduction commitments in the 2025-2035 period, allowing for earlier delivery of further environmental ambition in its supply area compared to a plan without the GUC transfer proposal. The GUC transfer proposal also enables Affinity Water to reduce the import from Grafham, benefiting the WRE region.

12.14 The revised draft regional plan selects the GUC transfer proposal as a single 100Ml/d phase as this helps provide additional resilience to Affinity Water in order to meet existing WINEP commitments, and also to enable a new reverse transfer between Affinity Water and Anglian Water, which will ultimately help to support Cambridge Water. Whilst selecting GUC at 100 Ml/d increases the costs of the plan, it is an important step in the development of a robust and resilient regional plan. Bringing forward a 100Ml/d transfer earlier in the planning period also accords with the consultation responses which supported the earlier delivery of the full 100Ml/d scheme.

Export to Anglian Water

12.15 Since the draft regional plan, following a request from Water Resources East through the regional reconciliation process, WRSE has included an additional virtual transfer out of the region within the revised draft regional plan. The new transfer of 27Ml/d is facilitated by Affinity Water reducing its existing take from Grafham reservoir by 27 Ml/d. This water is then used by Anglian Water to transfer water to Cambridge Water.

Severn Thames Transfer

12.16 The Severn Thames Transfer (STT) is a transfer of water from the North West and the Midlands, via the River Severn to the South East. The River Severn would transfer water to Gloucestershire and from there it would be pumped into the River Thames via a new pipeline or the restored Cotswold Canals. The capacity of this option, utilising water available in the River Severn and from a number of other potential sources was up to 500 Ml/d, and the initial phase of STT was selected in the draft regional plan in 2050.

12.17 Updated investment modelling for the revised draft regional plan does not select STT as an option as part of the regional plan under any of the adaptive planning pathways. However, through the regional reconciliation process WRSE has agreed with adjoining regions that the STT proposal should continue to be progressed as it may be required under future adaptive plans. Further information on this is provided in Section 17 of the plan.

Reservoirs

12.18 Reservoirs store water when it is available, typically pumping water from a river or spring when water levels are high (usually during the winter) when it would otherwise flow out to the marine environment. The water is then stored until it is needed, when levels of available water in the natural environment are low.

12.19 Building additional reservoir storage will help us to adapt to climate change, capturing more excess water during intense rainfall periods. Water supplies

in reservoirs could also be supplemented by other sources such as water recycling schemes. The water will be stored until it is needed before being treated and supplied to customers.

12.20 There are a limited number of locations across the South East where reservoirs can be built due to water availability, geology, and social and environmental factors, and we have considered all of these in the development of our plan. The regional plan has identified the need for both new reservoir schemes and schemes that will increase the size of the region's existing reservoirs.

Options selected for utilisation by 2035:

Scheme description	First utilised	Water available
Havant Thicket reservoir in Hampshire	2030	21 Ml/d

Options selected for utilisation by 2050:

Description	First utilised	Water available
Broad Oak reservoir near Canterbury	2036*	22 Ml/d
South East Strategic Reservoir Option (SESRO) near Abingdon, Oxfordshire	2040	271 Ml/d
River Adur Offline reservoir in West Sussex (this option was named as Blackstone reservoir in the draft regional plan)	2045	19.5 Ml/d

** South East Water is proposing in its WRMP to deliver this scheme earlier*

Options selected for utilisation after 2050:

Scheme description	First utilised	Water available
New Arlington Reservoir in Sussex	2057	8.6Ml/d
Raising Bewl Reservoir in Kent by 0.4m	2061	3Ml/d

Havant Thicket reservoir

12.21 Havant Thicket reservoir is a WRMP19 scheme which has planning permission and its construction is underway. It will be able to provide an average of 21 Ml/d initially, and then more if combined with recycled wastewater from the Hampshire Water Transfer and Water Recycling proposal providing additional water (see water recycling section). It will provide a strategic solution to drought resilience in the Hampshire area by addressing the water supply shortfall from changes in abstraction licences.

Broad Oak Reservoir

12.22 Both the draft regional plan and our revised draft regional plan include the development of a (5,126 Ml capacity) reservoir at Broad Oak, near Canterbury, in Kent with an intake on the Great Stour, yielding a maximum of 22Ml/d. Broad Oak reservoir is selected in the revised draft regional plan in the reported and most other pathways by 2036. Preparatory work for this scheme is already underway, with South East Water identifying in its WRMP the potential to deliver the scheme in 2033, and provide earlier increased resilience, public amenity value and wider benefits to the environment, customers and communities in East Kent.

12.23 The scheme would allow groundwater and surface water sources to be operated conjunctively to maximise benefits to the wider environment, i.e., resting chalk sources when groundwater levels are low, and by capturing flood flow and storing in the reservoir so that it can be used during summer/dry periods. The inclusion of the Broad Oak Reservoir is a longstanding option for which South East Water own the necessary land and

have completed extensive work over a number of years to carefully develop and assess the impact and potential benefits of a new reservoir.

South East Strategic Reservoir Option (SESRO)

12.24 Our regional plan identifies the South East Strategic Reservoir Option (SESRO) near Abingdon, Oxfordshire as a key solution needed to meet the region's additional water requirements by 2040. Water would be pumped from the River Thames during periods of high flow, stored in the reservoir and released back into the river during low flows for abstraction downstream, or treated on site before transfer to supply customers across Oxfordshire, Berkshire and Hampshire.

12.25 The draft regional plan identified that the SESRO reservoir proposal was a key part of the regional solution, selected under all 9 of the adaptive planning pathways for delivery by 2040, with the 100 million cubic metres (Mm^3) SESRO reservoir proposal option selected in the draft regional plan.

12.26 Four size variants of the SESRO reservoir proposal are available for selection in the WRSE investment modelling, 75, 100, 125 and 150 Mm^3 (as well as options that develop the reservoir in phases). The assessment undertaken for the draft regional plan showed that balancing of the benefits and disbenefits of the options revealed that the decision was close between the 100 Mm^3 and 150 Mm^3 options, with the two size variants each having different benefits and trade-offs with other schemes selected across the region, particularly desalination and recycling options. The draft regional plan selected the SESRO reservoir proposal at 100 Mm^3 as it performed better against some of the best value criteria WRSE assessed, particularly those that provide additional benefits to the environment and society. The larger 150 Mm^3 reservoir performed better against the resilience criteria and biodiversity net gain metrics, but overall had a slightly lower score against the best value metrics compared to the 100 Mm^3 reservoir.

12.27 The investment modelling for the revised draft plan identified that the SESRO reservoir proposals remains a core part of the least cost plan. WRSE's analysis of investment model runs shows that the principle of a regional plan with SESRO still provides more resilient and better value plans overall compared to plans which exclude the reservoir. To test this we completed model runs with SESRO included or excluded from the plan, at different potential option sizes, as explained in more detail in Section 17 of this document.

12.28 The best value plan investment modelling confirmed that, as for the draft regional plan, plans with the SESRO reservoir proposal as a core scheme are cheaper and achieve better overall best value plan (BVP) metric scores. However, the modelling of different size options for the SESRO reservoir proposal for the revised draft plan has produced different outcomes than the draft regional plan.

12.29 In the draft regional plan the 100 Mm^3 and 150 Mm^3 size SESRO reservoir proposals were extremely close in metric scores, but the 100 Mm^3 reservoir came out as slightly better value. However, for the revised draft regional plan the modelling outputs demonstrate that a plan with the SESRO reservoir proposal at 150 Mm^3 provides better overall BVP scores than the 100 Mm^3 and 125Mm^3 options. The plan with the SESRO reservoir proposal at 150 Mm^3 outperforms the plans with other size variants in the resilience and SEA benefit scores. This indicates that the plan with the 150 Mm^3 SESRO reservoir proposal is more resilient and better able to adapt and evolve to future challenges compared to the plans with smaller SESRO reservoir proposals. The difference between the plans remains close, however the overall cumulative metric scores leads WRSE to conclude that a regional plan with the SESRO reservoir proposal at 150 Mm^3 offers better value than the plans with the other smaller sizes of the SESRO reservoir proposal.

12.30 In all cases, the SESRO reservoir proposal is fully utilised by 2050 which indicates that the reservoir would be fully utilised early on in the planning period and no later than ten years after it is brought online (this is ten years into an asset life of 250 years). The larger SESRO reservoir proposal is able to support more water resources zones with the delivery of their sustainability reductions, and would provide water to five of the six companies in the South East, adding additional flexibility across the network.

12.31 Through the modelling work WRSE is able to demonstrate that the larger SESRO reservoir proposals (125 Mm^3 and 150 Mm^3) are able to support more

water resource zones through a critical extreme dry year. The larger reservoir (150 Mm^3) is able to support the implementation of sustainability reductions quicker than the smaller size reservoir options. This will allow companies to accelerate reductions and protect vital habitats across the South East in a more flexible way. It is also provides greater resilience capability to the operational loss of an existing raw water storage reservoir for planned or unplanned maintenance.

12.32 The larger reservoir is also better at dealing with potential underperformance of any of the demand management reductions schemes (Government or company) and provides time for the region to develop alternative solutions should key policies fail to be delivered. Selection of the larger reservoir also helps off-set the need for larger scale desalination and water recycling plants in London in different future scenarios (as could be required with smaller SESRO reservoir proposals).

12.33 Based on the outcomes from modelling and the consideration of available options and plans, WRSE has determined that the best value plan investment model run with the SESRO reservoir proposal at 150Mm^3 is the preferred basis for the revised draft regional plan. Best value plan investment modelling for the different size options of the SESRO reservoir proposal can produce viable solutions to the scale of the regional challenge being faced, however the plan with the SESRO reservoir proposal at 150 Mm^3 produces better average best value plan metric scores, and is more resilient to dealing with known potential future risks, including the increased reliance on demand management and Government Interventions in the revised draft regional plan.

12.34 WRSE considers that the larger reservoir option is the most appropriate proposal to be included within the revised draft regional plan. The principle of this strategy is to develop the SESRO reservoir proposal to the largest size possible at the site, which is currently 150 Mm^3. If further detailed design and site investigations reduce this capability, or if the Secretary of State determines otherwise in relation to the WRMP or the determination of a DCO application, then WRSE considers that the scheme should still be developed based on this principle.

12.35 Detailed technical assessments and studies of the SESRO reservoir proposal are currently underway through the RAPID gated process, and applications for consent for the reservoir will need to be proceeded with by the middle of the current decade because it will take 15 years to plan, build and fill with water.

River Adur Offline reservoir

12.36 This reservoir (named as Blackstone reservoir in the draft regional plan) could provide up to 20 Ml/d and would store water from the River Adur that would then be supplied to Brighton and parts of West Sussex.

Longer term reservoir options

12.37 Over the longer term, beyond 2050, in our reported pathway there is a need to develop a new reservoir at Arlington in Sussex, and to increase the storage capacity of the existing Bewl reservoir in Kent.

Water recycling

12.38 Water recycling is where highly treated wastewater is returned to the environment and used to supplement our natural water supplies. It is used extensively in other parts of the world, such as California and Singapore. It typically involves moving a coastal or estuarine treated wastewater release point higher up in the catchment. The water, which would undergo an extra stage of enhanced treatment, would be released at a point where it can support additional water abstraction.

12.39 Consideration needs to be given to the environmental impact on the watercourse or waterbody that receives the additional treated water so that it does not affect its ecology. In some areas, using an environmental buffer such as a reservoir or lake to store the treated water – mixed with river or spring water – instead of releasing it directly into the environment, provides a more suitable alternative and our plan includes these options.

12.40 Our regional plan has identified that water recycling will need to form an important part of the solution, with variations in the schemes needed depending on the future scenarios we face. The modelling undertaken for

our regional plan indicates that recycling will be needed in the early years of the plan to achieve the higher level of drought resilience required by 2040 and the environmental ambitions associated with reducing abstraction.

Options selected for utilisation by 2035:

Scheme description	First utilised	Water available
Sandown water recycling scheme to support abstraction from the River Yar on the Isle of Wight	2028	8.5 Ml/d
Littlehampton water recycling scheme to support abstraction from the River Rother in West Sussex	2030	15 Ml/d
Water recycling scheme to supplement abstraction from the River Medway in Kent	2031	14 Ml/d
Hampshire Water Transfer and Water Recycling Project to supplement water supplies in Havant Thicket reservoir in Hampshire	2031*	60 Ml/d
Recycled wastewater from the paper production process to enable a trade of an existing licence for public water supply in Kent	2031	7.5 Ml/d
Teddington direct river abstraction supported by water recycling at Mogden in London	2033	67 Ml/d[39]

** Southern Water is proposing in its WRMP to deliver this scheme later, by 2035*

Options selected for utilisation after 2050:

Description	First utilised	Water available
Hastings water recycling scheme to supplement supplies in Darwell reservoir, East Sussex	2051	15.3Ml/d
Hythe water recycling scheme in Kent	2053	5 Ml/d

12.41 Six water recycling schemes are identified in the regional plan for completion by 2035. They are needed in all alternative pathways. Water companies are already progressing these schemes. They will provide a resilient supply of water to replace existing water sources and are in areas where extra water is needed.

Sandown and Littlehampton

12.42 Sandown and Littlehampton are two WRMP19 schemes that Southern Water are currently progressing through investigations and preparation of applications for necessary consents. Southern Water notified WRSE in 2023 that delivery of the Littlehampton scheme will be later than in the draft regional plan. The two schemes are required before 2030.

Hampshire Water Transfer and Water Recycling Project

12.43 A scheme that uses highly treated wastewater to supplement the water stored in the new Havant Thicket reservoir has been identified in our regional plan. Treated wastewater from the Budds Farm wastewater treatment works would receive additional treatment at a new recycling facility in Havant before being pumped to the reservoir where it would be stored to supplement the spring water supply. The water would then be further treated at a water supply works before being supplied to people in the local area or transferred through new pipelines to supply other areas in both Hampshire and West Sussex. The scheme could deliver up to 60Ml/d.

[39] *67 Ml/d is the DO benefit of the 75 Ml/d scheme*

Southern Water consulted on this scheme during Summer 2022 as part of its preparation for applications for consent. It is proposing to deliver this scheme later, by 2035, in its revised draft WRMP.

Teddington Direct River Abstraction

12.44 The Teddington Direct River Abstraction would use highly treated wastewater from Mogden Wastewater Treatment Works to compensate flows taken from a new abstraction on the River Thames, upstream of Teddington Weir. This could deliver up to 75 Ml/d of water (67Ml/d deployable output) that could be used to supplement the supplies in the Lee Valley reservoirs.

Water recycling in Kent

12.45 Two water recycling schemes are selected before 2035 in our reported pathway in Kent. The first would provide a supply of up to 7.5Ml/d of highly treated industrial process water to an industrial user and the other would treat and transfer highly recycled water from Aylesford to supplement abstraction from the River Medway.

Options beyond 2035

12.46 Two options are selected in the regional plan reported pathway, one in East Sussex to supplement supplies in Darwell reservoir, and the other at Hythe in Kent. As part of the preparation of the next cycle of regional plans and WRMPs, WRSE will work with our member companies to reconsider desalination and water recycling options in sub-regional areas such as Kent, including generating and assessing potential sub-regional solutions, where multiple individual solutions are currently selected in the regional plan. The Kent area needs a regional solution which incorporates additional storage, supported by water recycling and desalination options, notwithstanding that environmental regulators have expressed concerns about potential environmental impacts from some individual options.

12.47 Water recycling forms an essential part of our regional plan over the longer term. If water recycling schemes cannot be progressed, then desalination plants or more storage options will need to be built instead. However, there are a limited number of potential locations for new storage in South East England and they typically take longer to plan and build.

Enhancing groundwater and aquifer use

12.48 Much of the region's water supplies come from groundwater which is stored within the underground aquifers across the South East. They provide a direct supply of water and are the source of the region's many chalk rivers and streams. Our plan will deliver a net reduction in abstraction from our existing sources but also looks to improve how we store water underground, without impacting on the environment.

12.49 Groundwater abstraction improvement schemes involve making changes to existing groundwater storage, where it is sustainable to do so, to make more water available. Groundwater storage schemes can involve using other sources of water to recharge the existing groundwater source known as Managed Aquifer Recharge (MAR). Alternatively, where groundwater conditions are suitable they can create a new area of storage underground so more can be stored. Water can then be pumped back to the surface and treated when needed.

Options selected for utilisation by 2035:

Scheme description	First utilised	Water available
Five groundwater improvement schemes, including recommissioning former sources, comprising:	Between 2026 and 2035	Between 0.6 Ml/d and 5 Ml/d per scheme
Romsey Groundwater		
Tappington South		
Groundwater: recommission Gravesend source		
Egham LGS		
Groundwater development – Moulsford groundwater source		

Options selected for utilisation by 2050:

Description	First utilised	Water available
Seven groundwater schemes to improve or recommission existing groundwater sources, or managed recharge comprising:	Between 2035 and 2050	Between 1.5 Ml/d and 5.5 Ml/d per scheme
Outwood Lane borehole – licence increase		
Groundwater licence trade – Halling		
Groundwater development – Recommission Mortimer disused source		
Rye groundwater reconfiguration		
Groundwater: Newchurch LGS		
Groundwater: Eastern Yar replacement borehole		
Managed Aquifer Recharge scheme using water from the River Test to supplement groundwater supplies		

Options selected for utilisation after 2050:

Description	First utilised	Water available
Six groundwater schemes to improve or recommission existing groundwater sources, or managed recharge, comprising:	Between 2050 and 2075	Between 1.6 Ml/d and 8.8 Ml/d per scheme
Groundwater development – Woods Farm existing source increase DO		
Groundwater development – Datchet existing source increase DO		
Groundwater development - Addington		
Groundwater development – Southfleet and Greenhithe		
Aquifer Storage and Recovery scheme at Epping		
Groundwater development – Water Lane borehole		

Groundwater schemes

12.50 Groundwater abstraction improvement schemes are promoted in areas where the current arrangements are limiting how much water can be abstracted. They are typically cheaper to develop and make the best use of water already available. However, it is important that any developments to groundwater sources and the amount of water taken from them does not damage the environment, particularly where they feed chalk rivers and streams.

12.51 Our revised draft regional plan identifies five schemes before 2035 that could improve the way groundwater sources are currently configured so they can be used more efficiently and produce more water. They range from producing 0.6 to 5 Ml/d of additional water to the region. A further seven groundwater schemes are identified before 2050, and six more by 2075. Groundwater schemes are needed in all the alternative pathways, although the more challenging pathways require more to be delivered.

Managed Aquifer Recharge and Aquifer Storage and Recovery

12.52 Aquifers are underground layers of rock which naturally store water. These schemes involve injecting additional fresh water from other parts of the aquifer, or from rivers, into a confined area within the aquifer. It can then be stored and pumped back to the surface and treated when needed. There are several examples of existing Managed Aquifer Recharge schemes in the

South East including Thames Water's North London Artificial Recharge Scheme and SES Water's North Croydon peak management scheme.

12.53 There are a limited number of locations in the South East where this is possible because of the geology of the region, and the technology used is still being developed. Thames Water is already planning an Aquifer Storage and Recovery scheme in its area and the regional plan has identified two schemes in Hampshire and the outskirts of London where this could be used to provide additional storage. These schemes will require further technical investigation by water companies.

Desalination

12.54 Desalination turns seawater and brackish water into drinking water by removing the salt, providing a reliable source of water, including during droughts. There is one existing large desalination plant in London, and it is a technology that is used extensively in other parts of the world such as the Middle East, where there is a shortfall in available water throughout the whole of the year. Desalination plants can often be expanded to treat more water if needed in the future.

12.55 Producing drinking water in this way uses a lot of energy and the salt that is removed must be safely disposed of to avoid damaging the environment. Our research shows that customers have concerns about desalination plants, and they are seen as an option of last resort if alternative sources of water are not available. Desalination technology is anticipated to continue to advance over the life of our regional plan and environmental and energy use concerns may be capable of being reduced or mitigated over time.

Options selected for utilisation by 2035:

Scheme description	First utilised	Water available
No options selected by 2035		

Options selected for utilisation by 2050:

Description	First utilised	Water available
River Thames estuary desalination in Kent (phase 1)	2040	20 Ml/d
River Thames estuary desalination in Kent (phase 2)	2040	20 Ml/d
East Thanet coast desalination (phase 1)	2041	20 Ml/d
Reculver desalination of brackish water	2044	30 Ml/d
Isle of Sheppey desalination (phase 1)	2046	20 Ml/d
Tidal River Arun desalination (phase 1)	2046	10Ml/d
Tidal River Arun desalination (phase 2)	2050	20Ml/d
Hythe beach desalination	2050	5 Ml/d

Options selected for utilisation after 2050:

Scheme description	First utilised	Water available
Isle of Sheppey desalination (phase 2)	2065	10 Ml/d

Sussex Coast desalination scheme

12.56 The draft regional plan selected a desalination plant on the Sussex Coast early in the planning period. This was a WRMP19 scheme being promoted by

Southern Water. Southern Water notified WRSE in 2023 that the option was no longer feasible and it is no longer available for selection by the regional plan investment modelling.

Desalination schemes beyond 2035

12.57 There are a number of desalination plants selected in the regional plan after 2040 in coastal and estuarine locations across Kent and East Sussex. They feature in the reported pathway and the higher pathway with some variations in the timing. More desalination schemes are needed in the higher pathways.

12.58 The need for desalination plants in these areas is primarily driven by the long-term need to protect and improve the freshwater environment. Therefore, the decision on the location and level of future abstraction reductions will determine what additional resources will be needed.

12.59 The WRSE investment modelling indicates that desalination is the least preferred option on a cost-efficient economic basis. We recognise that desalination is not a preferred option for many customers and stakeholders due to its cost and environmental impact. It tends to be identified as the preferred option where the need in an area is so high that there are no other local sources of water to meet it, or where the alternative is a long-distance transfer to move water from another part of the region, which typically have high economic and carbon costs associated with them.

12.60 The options selected in the regional plan rely on the successful completion of technical and environmental investigations, and the consenting of options, resolving outstanding environmental impact concerns, technology and energy issues over the first ten years of the plan, so that they can be constructed and operational thereafter.

12.61 The Kent area needs a regional solution which incorporates additional storage, supported by water recycling and desalination options, notwithstanding that environmental regulators have expressed concerns about potential environmental impacts from some individual options. As part of the preparation of the next cycle of regional plans and WRMPs, WRSE will work with our member companies to further consider desalination and water recycling options in sub-regional areas such as Kent, including generating and assessing potential sub-regional solutions, where multiple individual solutions are currently selected in the regional plan.

Multi-sector options

12.62 We have included a number of multi-sector options in our regional plan which would involve water companies working with other sectors on shared solutions that provide multiple benefits. There are also options, that if modified, could provide water for other sectors.

12.63 Our analysis shows that the additional requirements of the power and agricultural sectors can be met within their existing licence headroom, development of local storage solutions and becoming more efficient with how water is used. However, this is assuming that the existing licence remains unchanged. If their licences are capped, in a similar way to public water supply licence capping being implemented by regulators, then they could require additional water from the regional plan. We will continue to work with the agricultural, horticultural, and power sectors, over the winter to look at alternative future strategies should licence headroom reduce, alongside environmental and economic regulators.

12.64 In addition to power and agriculture, we also looked at the needs of other industry within our region, and how the future needs of the paper industry could be met. Our assessment shows that there is currently capacity across all the licences that are held by paper producers in Kent to meet anticipated growth in the sector's demand for water. The regional plan includes a scheme that recycles the wastewater from the paper production process to enable a licence trade that would provide an extra 7.5 million litres per day for public water supply. This could be increased to provide a further 12.5 million litres of water per day for use by paper producers. Furthermore, there is potential opportunity for similar recycling schemes to be developed at other sites. We will continue to work with the paper industry to explore these options further.

12.65 As well as industry needs, we have also considered wider sector water needs in our region. There are two wetland areas which have been identified by

Natural England, which would require additional water during a drought. We will continue to work with environmental organisations on a solution, which could involve using recycled water to support the wetland areas.

12.66 We will continue to work with multi-sector stakeholders, particularly through the WRSE Stakeholder Advisory Board, to understand the non-public water supply water needs, and potential multi-sector solutions to meet these needs.

Other options

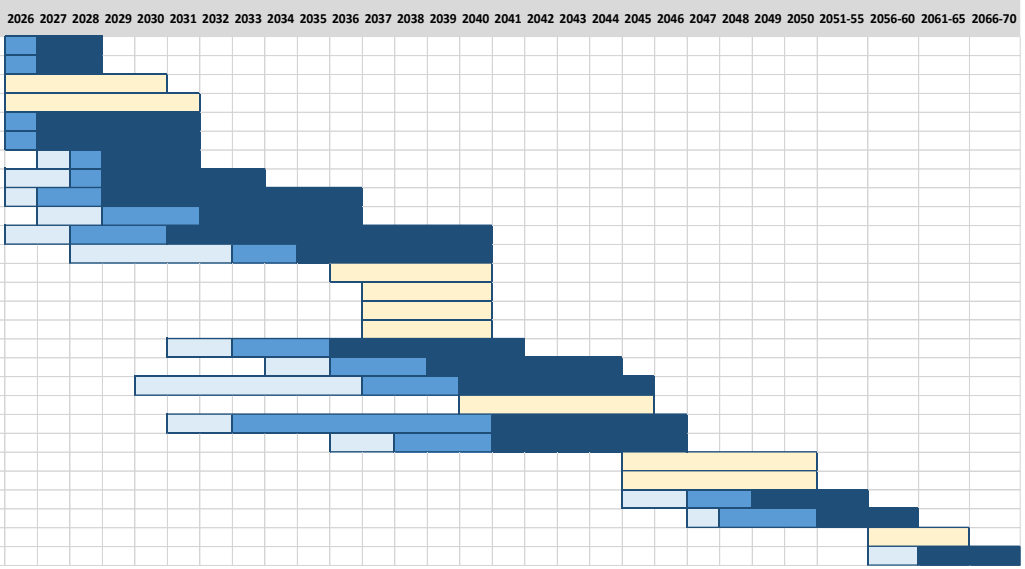
12.67 The revised draft regional plan investment modelling has also selected a number of water treatment capacity upgrades and other infrastructure schemes which are required as part of the overall regional solution. In many cases, these schemes provide treatment capacity in conjunction with water transfer schemes or other options selected in the plan.

Summary of the main new sources of water identified in our regional plan

12.68 Table 12.1 identifies the main new resource options selected by the investment modelling in our regional plan for the South East region in the 1:500 DYAA scenario, that will provide water over the planning period. The table shows the broad timetable for the planning and construction phases of these main schemes and when the water will become available.

Table 12.1: Main new resource options to provide water over the planning period

Option Name (SEMD)	Category	Year (first utilised)
Recycling: Sandown WwTW (8.1Ml/d)	Reclaimed water, water re-use, effluent re-use	2028
Recycling: Littlehampton WwTW (15Ml/d)	Reclaimed water, water re-use, effluent re-use	2028
Havant Thicket Reservoir (Approved Scheme)	New reservoir	2030
GUC option 3 100 Ml/d LB	Bulk transfers into region (raw)	2031
Recycling: Medway WwTW (12.8Ml/d)	Reclaimed water, water re-use, effluent re-use	2031
Recycling: Recharge of Havant Thicket reservoir from Budds Farm and new WRP (60Ml/d	Reclaimed water, water re-use, effluent re-use	2031
Recycling: Sittingbourne industrial water recycling (7.5Mld)	Reclaimed water, water re-use, effluent re-use	2031
Teddington Direct River Abstraction (Indirect Water Recycling) 75 MLD - Construction	Direct river abstraction	2033
Broad Oak Reservoir	New reservoir	2036
Test MAR	Artificial Storage and Recovery wells (or Aquifer Storage and Recovery (ASR)	2036
New Reservoir - SESRO 150Mm3 - Construction	New reservoir	2040
Culham (120) - potable - Construction	Increase water treatment works (WTW) capacity	2040
Western Rother licence and storage programme	New reservoir	2040
Desalination: River Thames estuary (20Ml/d)	Desalination	2040
Desalination: River Thames estuary (20Ml/d) Phase 2	Desalination	2040
Oxford Canal - Duke's Cut (SWOX) - Construction	Bulk transfers into region (raw)	2040
Desalination: East Thanet coast & transfer (20Ml/d)	Desalination	2041
Desalination at Reculver (30Ml/d Option)	Desalination	2044
Storage: River Adur offline Reservoir	New reservoir	2045
Lower Thames Reservoir Transfer 2a 100 Ml/d	Bulk transfers within region (raw)	2045
Desalination: Isle of Sheppey (20Ml/d)	Desalination	2046
Desalination: Tidal River Arun (10Ml/d)	Desalination	2046
Hythe Beach Wells RO Desal (brackish water)	Desalination	2050
Desalination: Tidal River Arun (20Ml/d) Phase 2	Desalination	2050
Recycling: Hastings WTW conjunctive use with Darwell reservoir (15.3Ml/d)	Reclaimed water, water re-use, effluent re-use	2051
New Arlington Reservoir	New reservoir	2057
Desalination: Isle of Sheppey (10Ml/d) Phase 2	Desalination	2065
Recycling: Horsham WTW conjuctive use with Arun Reservoir, Pulborough (6.8Ml/d)	Reclaimed water, water re-use, effluent re-use	2068



Key:

Planning	
Development	
Construction	
Whole Scheme	

13. Water transfers around the region

This section of the plan has been updated to reflect the proposals selected in the revised draft regional plan proposals.

Transfers in the region today

13.1 Our six member companies already share some of the region's water supplies through pipelines that link their supply areas. Currently, up to 115Ml/d can be moved between our member companies.

13.2 There are also pipelines that link the companies' water resource zones (WRZs) which enable them to move water around their own supply areas, and imports into the region from companies outside of the WRSE area. The total volume of transfers in the region in 2026 at the start of the regional plan is approximately 400Ml/d.

What our regional plan proposes

13.3 The regional plan has identified new transfers to increase how much water can be moved around the region. As new sources of water are developed, they will be shared between companies helping to increase the resilience of the region's water supplies.

13.4 Alongside the options needed to make more water available to transfer (covered in the previous section), the regional plan has identified new transfers to move water around the South East more easily by 2060, depending on the future scenario we face.

13.5 This will see more transfers between different parts of our six member companies' supply areas and between different water companies, increasing the connectivity of the region. These transfers don't produce any extra water, but they do move water from areas where more is available to those where there is less; and they will help make supplies to homes and businesses more resilient as water companies will have more sources to rely upon.

13.6 As part of this network, the regional plan identifies that some new strategic transfers are required, all of which are being investigated through the RAPID gated process, to enable water produced by the major schemes to be transferred other areas. These include:

- **1. Havant Thicket to Southampton** - A pipeline that would move up to 90Ml/d of water from Havant Thicket reservoir, in conjunction with the Havant water recycling scheme, to deliver the required quantity of water supply to Southern Water's customers in the Hampshire area.
- **2. Thames to Affinity Transfer -** A transfer that could move up to 100Ml/d of water from the River Thames to Affinity Water's supply area. With the larger (100Ml/d) size of the GUC transfer selected, the transfer between Thames and Affinity only needs to be 50 Ml/d as long as all of the demand management measures deliver the anticipated savings. Water could be supplied from a range of sources, including SESRO or through water recycling. Water is most likely to be transferred to a water treatment works in Iver, but water could be transferred to North Mymms if the Thames-Lee Tunnel is used and water is transferred from North East London
- **3. Thames to Southern Transfer** – A transfer that would enable up to 120Ml/d of water from SESRO to be treated in a new water treatment works and then transferred by pipeline to supply Southern Water's customers in Hampshire.

13.7 By 2075, an additional 1100 million litres of water per day will be able to be moved through the enhanced regional water network compared to the start of the plan in 2026.

Diagrams to explain our water transfer proposals

13.8 The plots in this section illustrate how water moves into and around the region, and how this will change under the proposals in our regional plan. The hexagons in the plots are the individual water resource zones (WRZs) in

the South East region, and WRZ outside of the region that provide a transfer of water either into or out of the region.

13.9 Each of the plots shows transfers at a particular point in time, under our 1:500 DYAA planning scenario. The thicker the lines between the WRZ, the larger the transfer. The plots demonstrate how increased connectivity within the region, and from other regions, will significantly increase the flow of water that is transferred over time. All of the plots represent the position under our reported pathway – situation 4.

13.10 A key for the WRZ abbreviations used in the plots is in the table below:

WRZ	Water Company	Zone Name
AZ1	Affinity Water	Misbourne
AZ2	Affinity Water	Colne
AZ3	Affinity Water	Lee
AZ4	Affinity Water	Pinn
AZ5	Affinity Water	Stort
AZ6	Affinity Water	Wey
AZ7	Affinity Water	Dour
PRT	Portsmouth Water	Portsmouth
SES	SES Water	SES
RZ1	South East Water	Tunbridge Wells
RZ2	South East Water	Haywards Heath
RZ3	South East Water	Eastbourne
RZ4	South East Water	Bracknell
RZ5	South East Water	Farnham
RZ6	South East Water	Maidstone
RZ7	South East Water	Cranbrook
RZ8	South East Water	Ashford
HAZ	Southern Water	Hampshire Andover
HKZ	Southern Water	Hampshire Kingsclere
HRZ	Southern Water	Hampshire Rural
HSE	Southern Water	Hampshire Southampton East
HSW	Southern Water	Hampshire Southampton West
HWZ	Southern Water	Hampshire Winchester
IOW	Southern Water	Isle of Wight
KME	Southern Water	Kent Medway East
KMW	Southern Water	Kent Medway West
KTZ	Southern Water	Kent Thanet
SBZ	Southern Water	Sussex Brighton
SHZ	Southern Water	Sussex Hasting
SNZ	Southern Water	Sussex North
SWZ	Southern Water	Sussex Worthing
GUI	Thames Water	Guildford
HEN	Thames Water	Henley
KVZ	Thames Water	Kennet Valley
LON	Thames Water	London
SWA	Thames Water	Slough, Wycombe and Aylesbury
SWX	Thames Water	Swindon and Oxfordshire

13.11 In addition, a number of zones have been included for investment modelling purposes only, which represent transfer and distribution constraints in the WRSE network, shown in grey on the hexagons plot. A list of the abbreviations for these zone names is in the table below:

WRSE Zone	Zone Name
HON	Honor Oak Junction
HTE	Havant Thicket Exchange
KGV	King George V Junction
OTT	Otterbourne Junction
PWE	Portsmouth Water East
RA4	Raw AZ4 Junction
STR	Strategic Thames Resource
STT	Severn Thames Junction

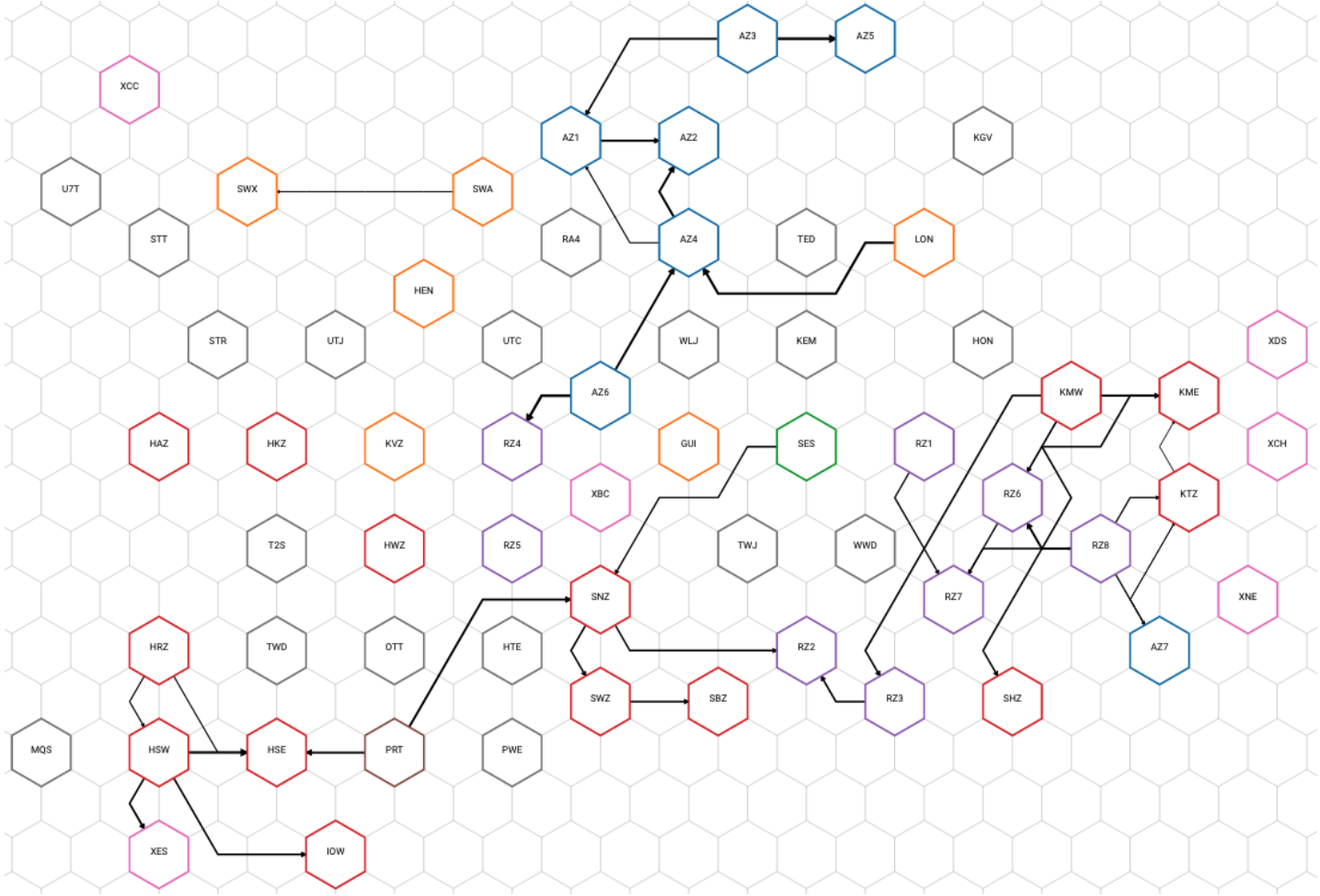
T2S	Thames to Southern Junction
TWD	Testwood Junction
TWJ	Thames-Weirwood Junction
UTC	Upper Thames Constrained
UTJ	Upper Thames Junction
WLJ	West London Junction
WWD	Weirwood Junction

13.12 The pink hexagon zones which begin with the letter “X” refer to specific investment modelling zones created to facilitate the third party and non-public water supply options.

Existing Network (2026)

13.13 Figure 13.2 identifies the existing transfers at the start of our regional planning period.

Figure 13.2: Transfers in 2026 at start of the plan period

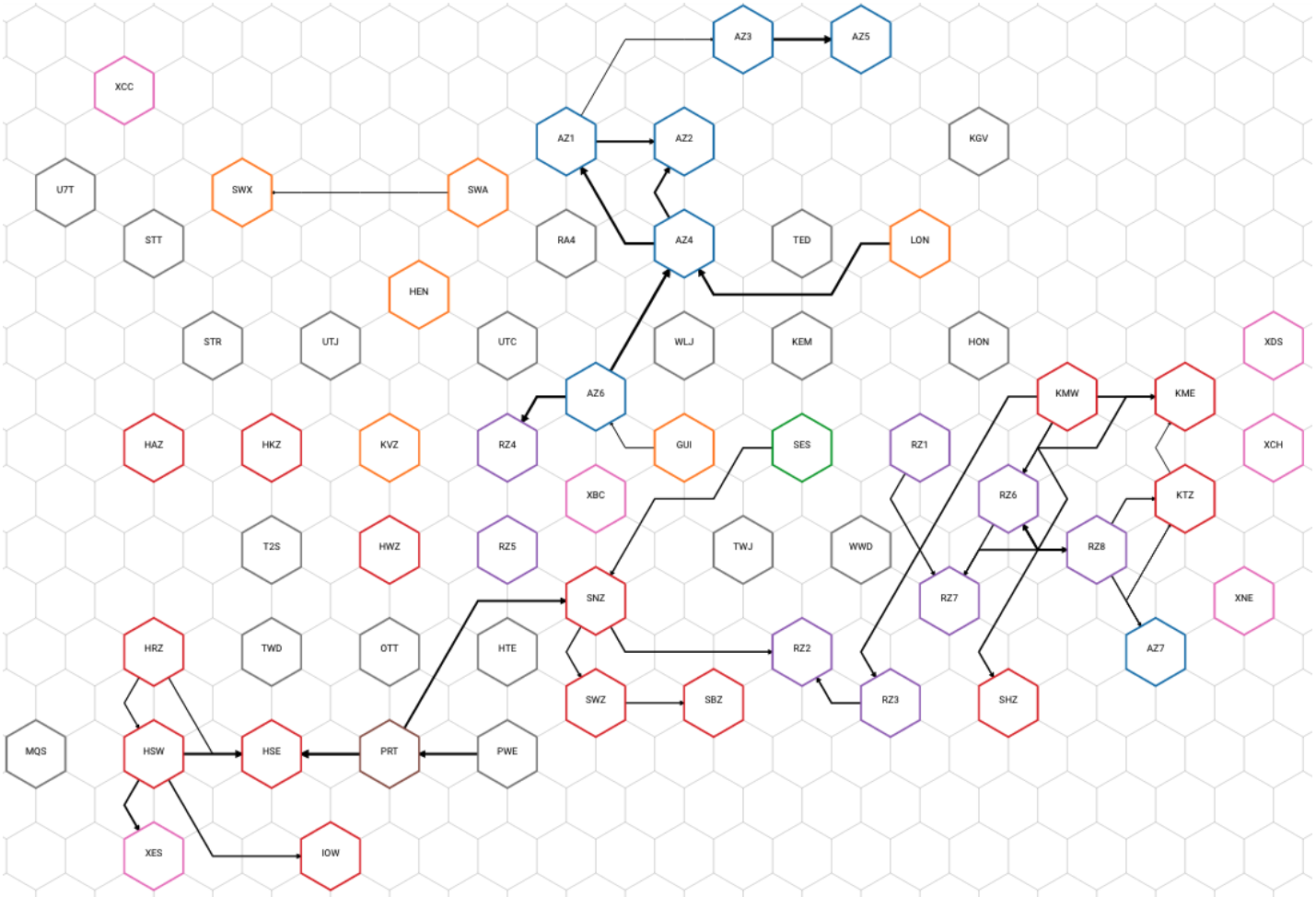


Network at 2029/30

13.14 Figure 13.3 identifies the transfers at the end of 2029/30.

13.15 By the end of 2029/30 we start to see increased transfers of water through the network, principally through existing transfer capabilities.

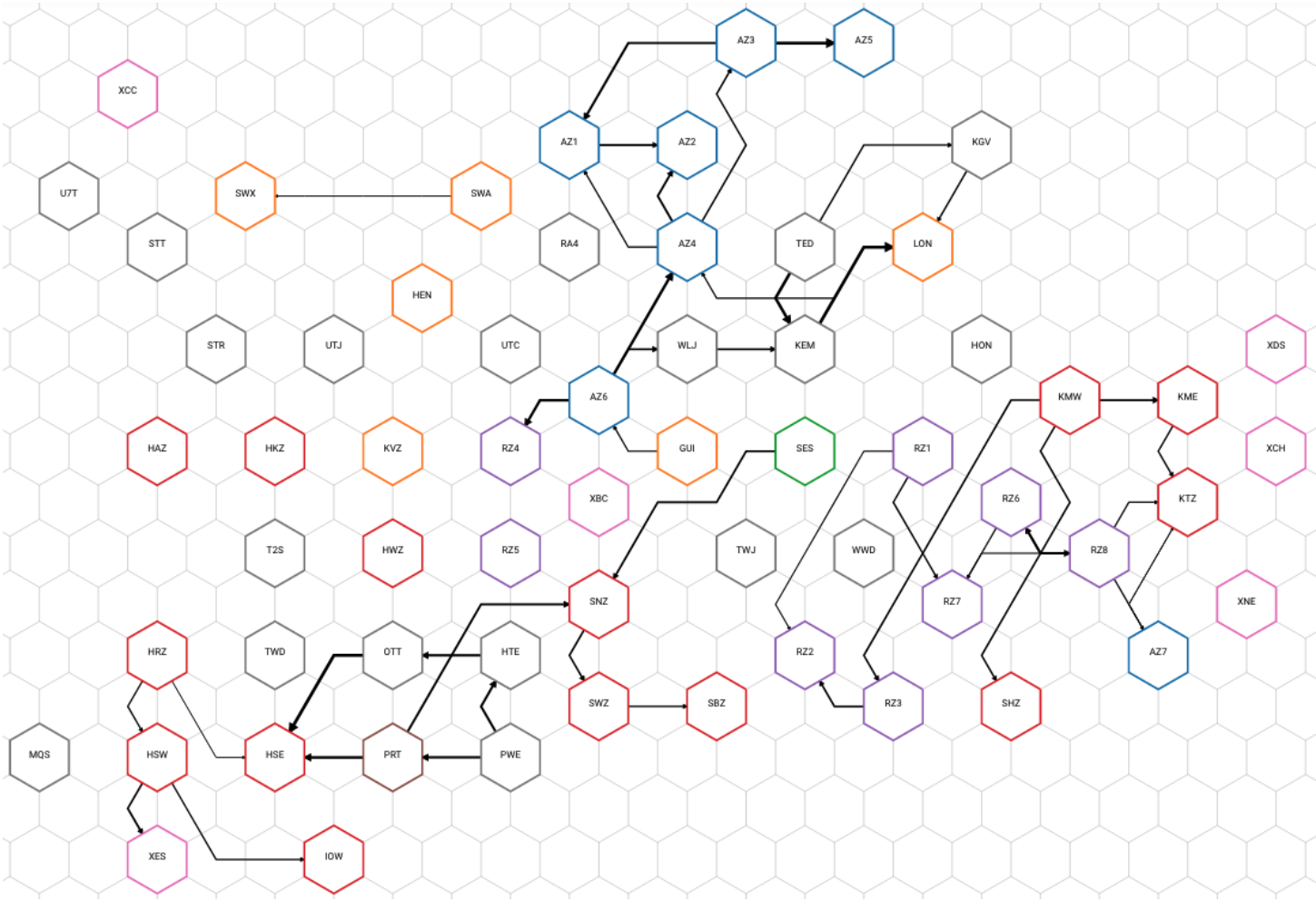
Figure 13.3: Transfers at end of 2029/30



Network at 2034/35

13.16 Figure 13.4 identifies the transfers at the end of 2034/35.

Figure 13.4: Transfers at end of 2034/35



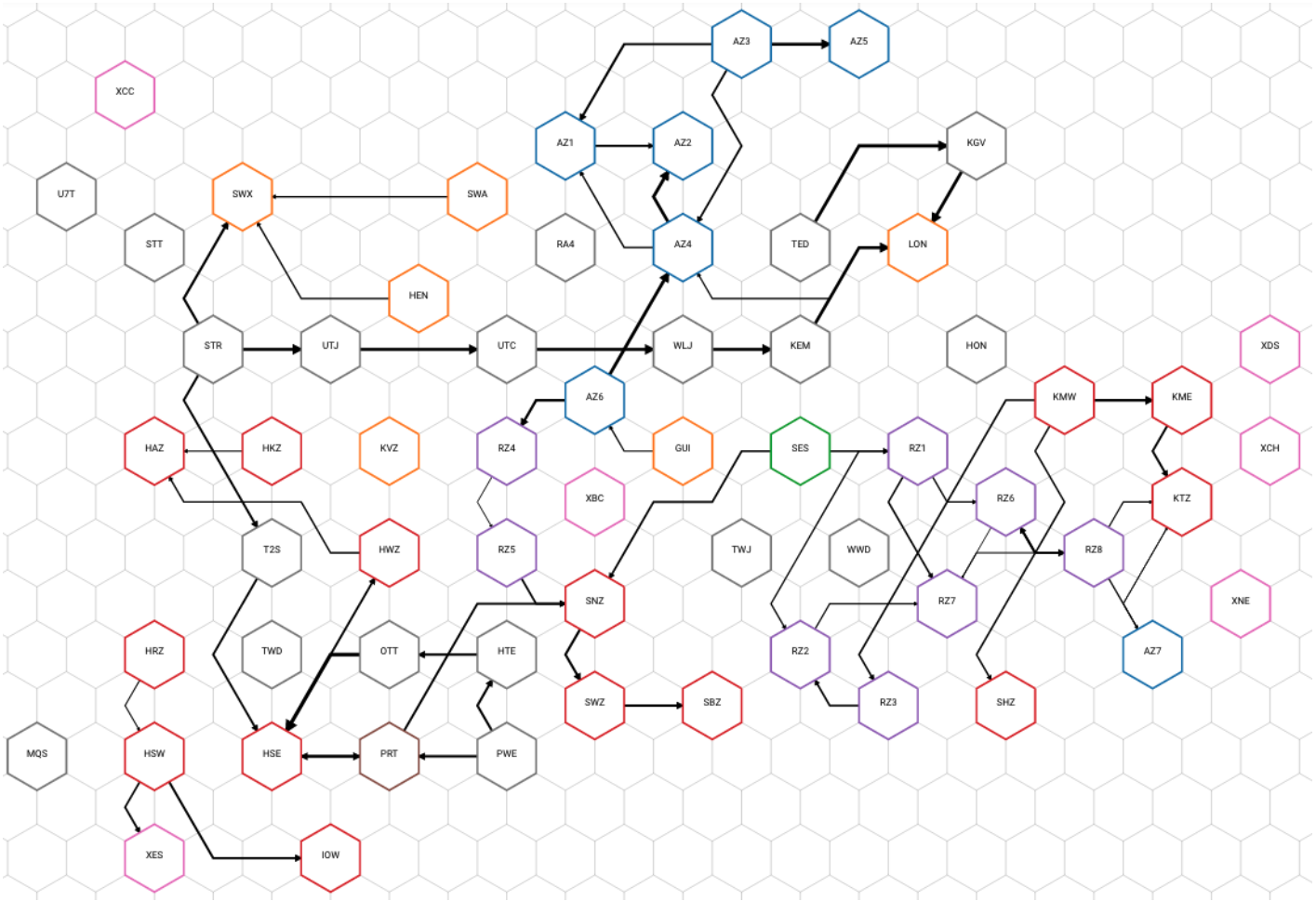
13.17 By the end of 2034/35 the increasing connectivity across the network is becoming more pronounced, but a number of the strategic transfers have not yet been developed. The key changes by this date are:

- Additional transfers from Havant Thicket reservoir to Portsmouth Water and Southern Water.
- Additional water transferred by Thames Water from Teddington.

Network at 2039/40

13.18 Figure 13.5 identifies the transfers at the end of 2039/40.

Figure 13.5: Transfers at end of 2039/40



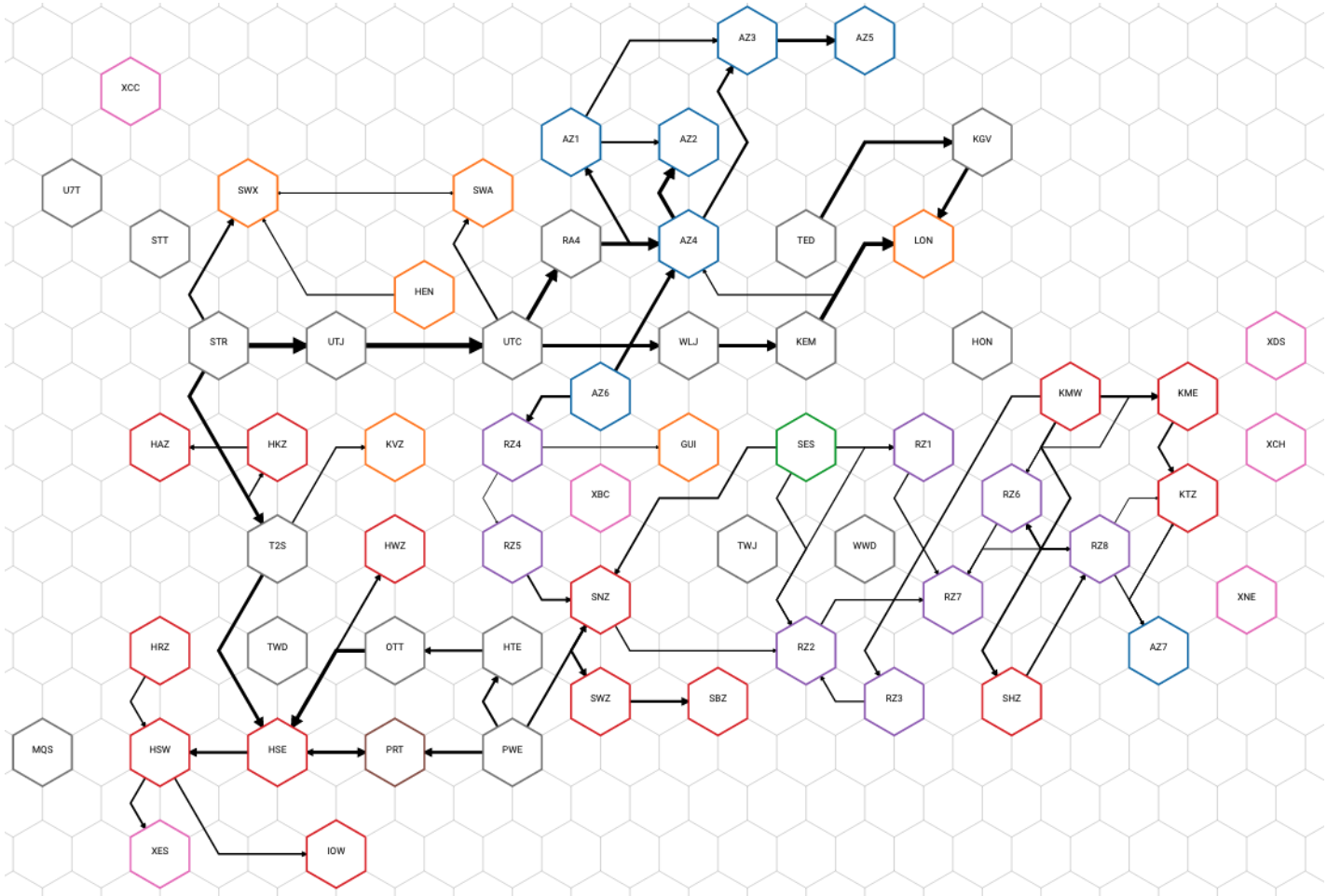
13.19 By the end of 2039/40 SESRO has been developed, facilitating a number of strategic transfers across the network. The key changes by this date are:

- Transfers from Thames Water to Affinity Water and Southern Water, relating to SESRO.
- Additional connectivity between Southern Water zones.
- Additional connectivity between SES Water and Southern Water.
- Additional connectivity between SES Water and South East Water.

Network at 2049/50

13.20 Figure 13.6 identifies the transfers at the end of 2049/50.

Figure 13.6: Transfers at end of 2049/50



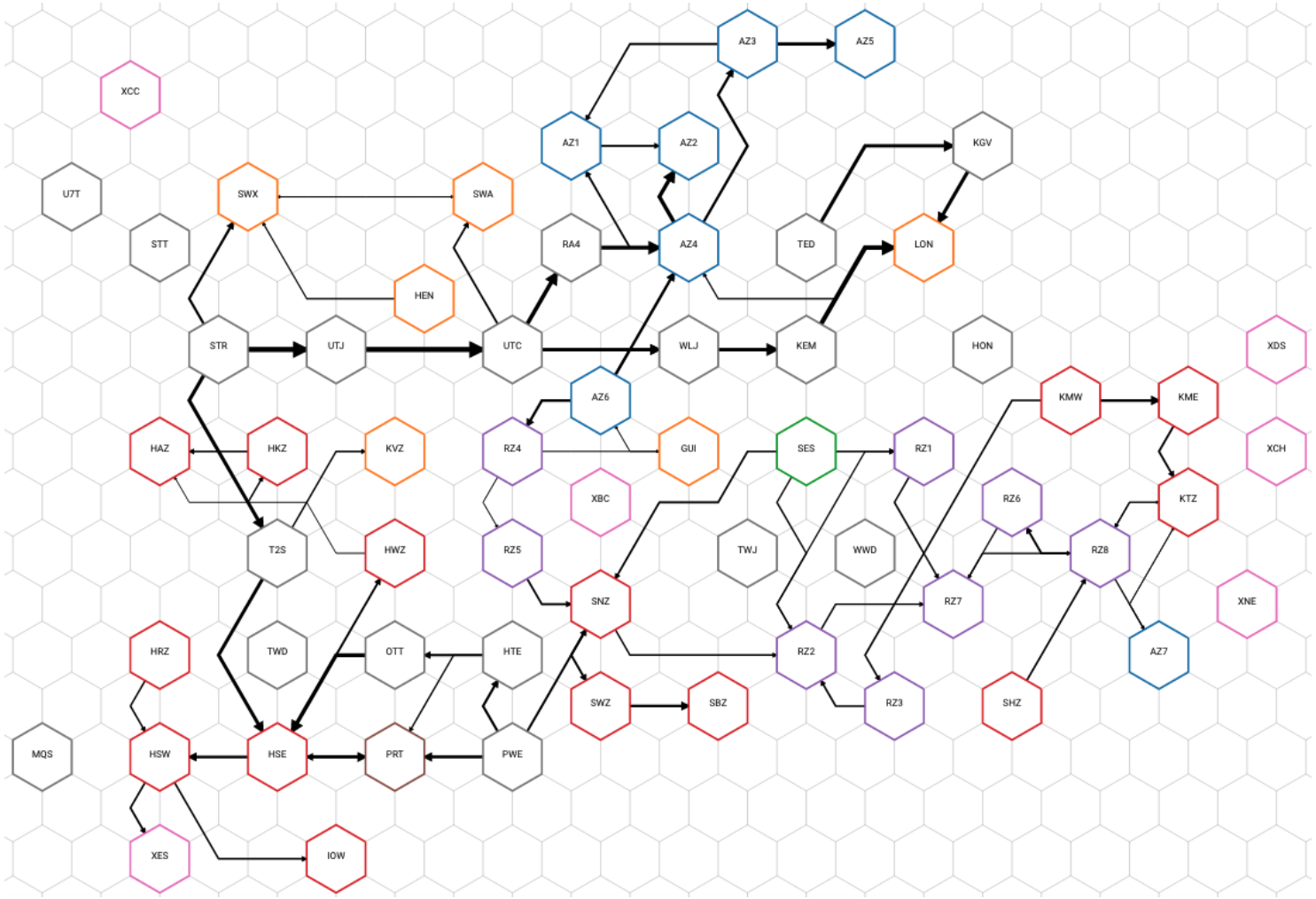
13.21 By the end of 2049/50 the scale of transfers has increased. The key changes by this date are:

- Further transfers sourced from SESRO, including to Kennet Valley
- Additional connectivity between SES Water and Thames Water.
- Additional connectivity between South East Water and Southern Water.
- Additional connectivity between South East Water and Thames Water.

Network at 2059/60

13.22 Figure 13.7 identifies the transfers at the end of 2059/60.

Figure 13.7: Transfers at end of 2059/60



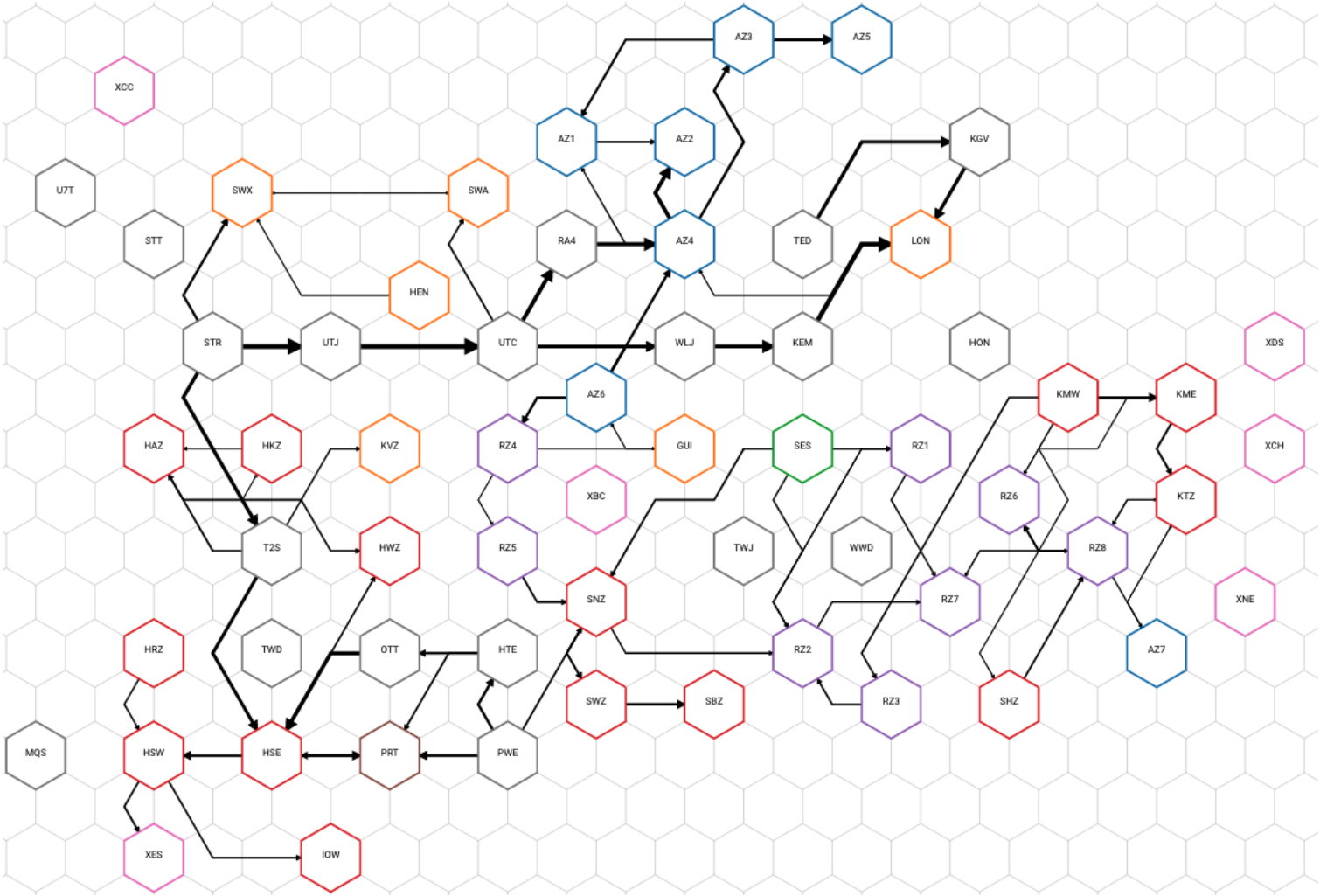
13.23 By the end of 2059/60 the regional transfer network proposed in our regional plan is fully developed. There are no key changes by this date compared to the network in 2049/50, but there are some increased volumes of water being transferred.

Network at 2074/75 – end of the planning period

13.24 Figure 13.8 identifies the transfers at the end of the planning period in 2074/75.

13.25 By the end of 2074/75 the transfer network across the region is stable, and there are no significant changes compared to the network in 2059/60.

Figure 13.8: Transfers at end of 2074/75



13.26 Table 13.1 below shows how the total volumes of water (in Ml/d) being transferred around the region change over time, highlighting the contribution of some of the larger transfers into the region, and larger transfers between companies.

Table 13.1: Changes in regional transfers over time

Regional Transfers (Ml/d)	2026	2035	2050	2075
Existing	(Ml/d)	(Ml/d)	(Ml/d)	(Ml/d)
Within Company	167	273	514	485
Between WRSE Companies	92	62	64	51
Refinery Supply	10	10	10	10
Baseline				
Imported from Grafham	91	64	77	77
Havant Thicket Consented Transfer	0	20	20	20
New				
Non SRO transfers	37	93	379	398
Thames to Southern Transfer	(0)	(0)	(68)	(74)
Southern Water Hampshire SRO transfer	0	21	21	21
SESRO SRO	0	0	247	247
Thames to Affinity Transfer	(0)	(0)	(100)	(100)
Grand Union Canal	0	80	69	100
Thames Water	0	54	139	159
TOTAL (Ml/d)	397	677	1540	1568

13.27 The SRO schemes help to move water around the region, but if all the volumes of these were tabulated and summed, the volumes would be duplicated. For example, STT and SESRO bring new water into the region, and this is transferred on through T2ST and T2AT, so by adding the totals of all these schemes, the volumes would be double counted. Therefore, only new sources of water are shown in the table, and any potentially duplicated volumes are shown in brackets and not included in the totals.

14. Catchment management and nature-based solutions

This section of the plan has been updated to reflect the proposals selected in the revised draft regional plan proposals. There are a greater number of catchment options selected in the revised draft regional plan, compared to the draft regional plan.

Context for catchment solution planning

14.1 Our six member companies abstract water from 28 river catchments across the South East region along with other users who have their own licences to abstract the water they need. Improving these catchments is a priority for the regional plan to ensure the ongoing quality and quantity of our water supplies, and to deliver wider environmental benefits that help achieve the targets set in the Government's 25-year plan for the environment. They will help make the environment more resilient and better able to adapt to climate change.

14.2 Catchment schemes and nature-based solutions could play an important role in securing resilient and sustainable water supplies for the future. The environmental forecasts we have produced show that by 2050, we may need to leave 1.1 billion litres of water in the environment that we currently use to supply our customers. This will require our member companies to significantly reduce how much water they abstract from certain sources and replace that water with new sources.

14.3 Exploration of a more integrated approach that combines the use of catchment and nature-based solutions with more moderate levels of abstraction reduction could be undertaken. This may deliver better outcomes for our rivers at a more efficient cost and deliver wider environmental benefits such as improving water quality and reducing flood risk.

14.4 It is important that we build our understanding and evidence-base over the next 10 years to help inform the decisions that will need to be taken in the future about the level of abstraction reduction that is required. This will ensure we continue to abstract water in a sustainable way and help strike the right balance between environmental improvement and cost to customers.

What our regional plan proposes

14.5 Working with stakeholders, we identified more than 200 potential catchment and nature-based schemes across 20 catchments in South East England, which were included in our emerging regional plan.

14.6 The nature-based schemes in our regional plan include the following activities:

- River restoration
- Nutrient and sediment reduction
- Integrated catchment management
- Working with farmers to improve land management practices
- Water retention measures such as natural flood management and wetland creation
- The creation and management of terrestrial habitats
- Sustainable Drainage Systems (SuDS) schemes.

14.7 Some of these options will help catchments to function more naturally, and to allow groundwater catchments to function so that rainwater stays on the land longer and replenishes groundwater stocks (which in turn support the flows in rivers). We also want to work with other land and water users to reduce their water demand and reduce the impact of their own activities on raw water quality (which will mean that water is easier to treat, using less chemicals, carbon, waste) and provide a long-term biodiversity benefit.

14.8 For the draft regional plan, the regulatory guidance in the WRPG that applied at that time meant that only schemes that resulted in a direct increase in our region's supplies were able to be included in the plan. This resulted in only one catchment scheme, on the River Itchen and River Test in Hampshire

being selected. Other catchment schemes could not be included within the draft plan as a specific deployable output benefit could not be assigned to them. This issue was highlighted in the draft regional plan, and the relative lack of catchment options was criticised in some consultation response.

14.9 The guidance in the WRPG has subsequently changed since the draft regional plan was published, and catchment schemes can now be included within regional plans and statutory WRMPs even if there is no deployable output benefit, as long as they improve best value metrics. As part of WRSE's investment modelling for the revised regional plan, the inclusion of catchment management schemes increased the best value metrics for the plan and as a result 67 catchment management schemes are now included within the regional plan, across numerous catchments, as set out in Table 14.1 below.

Table 14.1: Catchment management schemes selected

Catchment Scheme	Company
Scale Up - Biddenden Beult - Headwater Wetland Option	MUS
Biddenden Beult - Headwater Wetland Option	MUS
Portfolio 1 (Standard): Arun and Western Streams	PRT
Portfolio 1 (Standard): East Hampshire	PRT
Portfolio 1 (Standard): Darent and Cray	SES
Portfolio 1 (Standard): London	SES
Portfolio 1 (Standard): Medway	SES
Portfolio 1 (Standard): Mole	SES
Portfolio 1 (Standard): Darent and Cray	SEW
Portfolio 1 (Standard): Medway	SEW
Portfolio 1 (Standard): Adur and Ouse	SEW
Portfolio 1 (Standard): Arun and Western Streams	SEW
Portfolio 1 (Standard): Cuckmere and Pevensey Levels	SEW
Portfolio 1 (Standard): Medway	SEW
Portfolio 1 (Standard): Rother	SEW
Portfolio 1 (Standard): Adur and Ouse	SEW
Portfolio 1 (Standard): Cuckmere and Pevensey Levels	SEW
Portfolio 1 (Standard): Medway	SEW
Portfolio 1 (Standard): Rother	SEW
Portfolio 1 (Standard): Loddon and tributaries	SEW
Portfolio 1 (Standard): Maidenhead and Sunbury	SEW
Portfolio 1 (Standard): Test and Itchen	SEW
Portfolio 1 (Standard): Wey and tributaries	SEW
Portfolio 1 (Standard): Arun and Western Streams	SEW
Portfolio 1 (Standard): East Hampshire	SEW
Portfolio 1 (Standard): Loddon and tributaries	SEW
Portfolio 1 (Standard): Test and Itchen	SEW
Portfolio 1 (Standard): Wey and tributaries	SEW
Portfolio 1 (Standard): Darent and Cray	SEW
Portfolio 1 (Standard): Medway	SEW
Portfolio 1 (Standard): Medway	SEW
Portfolio 1 (Standard): Rother	SEW
Portfolio 1 (Standard): North Kent	SEW
Portfolio 1 (Standard): Medway	SEW
Portfolio 1 (Standard): Rother	SEW
Portfolio 1 (Standard): Stour	SEW
Portfolio 1 (Standard): Kennet and tributaries	SWS
Portfolio 1 (Standard): New Forest	SWS
Portfolio 1 (Standard): North Kent	SWS

Portfolio 1 (Standard): Medway	SWS
Portfolio 1 (Standard): Medway	SWS
Portfolio 1 (Standard): Stour	SWS
Portfolio 1 (Standard): Adur and Ouse	SWS
Portfolio 1 (Standard): Cuckmere and Pevensey Levels	SWS
Portfolio 1 (Standard): Rother	SWS
Portfolio 1 (Standard): Adur and Ouse	SWS
Portfolio 1 (Standard): Arun and Western Streams	SWS
Portfolio 1 (Standard): Adur and Ouse	SWS
Portfolio 1 (Standard): Arun and Western Streams	SWS
Portfolio 1 (Standard): Mole	TWU
Portfolio 1 (Standard): Wey and tributaries	TWU
Portfolio 1 (Standard): Loddon and tributaries	TWU
Portfolio 1 (Standard): Maidenhead and Sunbury	TWU
Portfolio 1 (Standard): Thames and South Chilterns	TWU
Portfolio 1 (Standard): Kennet and tributaries	TWU
Portfolio 1 (Standard): Loddon and tributaries	TWU
Portfolio 1 (Standard): Thames and South Chilterns	TWU
Portfolio 1 (Standard): Colne	TWU
Portfolio 1 (Standard): Darent and Cray	TWU
Portfolio 1 (Standard): London	TWU
Portfolio 1 (Standard): Maidenhead and Sunbury	TWU
Portfolio 1 (Standard): Medway	TWU
Portfolio 1 (Standard): Mole	TWU
Portfolio 1 (Standard): Roding, Beam and Ingrebourne	TWU
Portfolio 1 (Standard): Cherwell and Ray	TWU
Portfolio 1 (Standard): Colne	TWU
Portfolio 1 (Standard): Maidenhead and Sunbury	TWU
Portfolio 1 (Standard): Thames and South Chilterns	TWU
Portfolio 1 (Standard): Cherwell and Ray	TWU
Portfolio 1 (Standard): Cotswolds	TWU
Portfolio 1 (Standard): Gloucestershire and the Vale	TWU
Portfolio 1 (Standard): Kennet and tributaries	TWU
Portfolio 1 (Standard): Thames and South Chilterns	TWU

14.10 Amongst the 67 schemes there are multiple schemes within some catchments, including by different companies. The incorporation of additional catchment options in this way accords with the strong support expressed in the draft regional plan responses.

14.11 These are not the only catchment management and nature based solutions which will be implemented across the region, as others are funded and delivered through wider programmes of work, separate from the regional plan and WRMP processes. Our six member companies are also considering a wide range of catchment options which are being driven by other plans they produce such as Drainage and Wastewater Management Plans (DWMPs), the Water Industry National Environment Programme (WINEP) and drinking water quality plans. The companies will identify the schemes to be included in their five-year business plans to secure funding from Ofwat.

14.12 These schemes could deliver multiple benefits, including helping to provide resilient water resources. Developing a better understanding of the benefits these schemes can deliver and improve the way we measure their impact will be important to help inform their use in future regional plans and WRMPs.

14.13 Delivery of catchment and nature-based schemes will require our member companies to work in partnership with other agencies. There is also the potential for alternative funding to be accessed through Environmental Land Management Schemes to help deliver wider environmental benefits.

14.14 WRSE will continue to work with environmental stakeholders and regulators to understand the potential impacts and benefits of catchment and nature-based solutions in our region.

15. Drought Orders and Permits

This section of the plan has been updated to reflect the proposals selected in the revised draft regional plan proposals.

Context for Drought Permits and Drought Orders

15.1 During droughts, water companies can apply for temporary drought orders and drought permits on certain water sources that allow them to temporarily abstract more water, or abstract at a different time of year, to help them supply customers if the drought becomes more severe.

What our regional plan proposes

15.2 Our six member companies and the Environment Agency reviewed the impact of the 78 drought permits and orders available to them and excluded 53 from the regional plan investment modelling because of the potential impact they would have on the environment. This was undertaken through the Drought Plan process, separate to the regional planning process. The remaining 25 drought permits and orders are available for selection in the investment model.

15.3 In the revised draft regional plan the investment model selects 18 of these drought permits and orders to be used as options in the early years of the plan until the region reaches 1 in 500-year drought resilience in 2040. The most significant of the drought permits and orders in the regional plan are those in the Test and Itchen catchments in Hampshire, where Southern Water has already reduced its abstractions during a drought by more than 180 million litres per day. There are options being developed to replace this water but, in the meantime, they will need to be used should a drought occur.

15.4 After 2040, drought orders and drought permits will only be used in our plan if we experience a drought more serious than a 1:500 year event with monitoring and mitigation measures agreed with the Environment Agency and Natural England to help protect the environment. They have not been included as options after 2041 in our regional plan, as the increased drought resilience that will have been achieved means that we will not need to rely on them.

Data and information

15.5 The impact of the increased drought resilience proposed in the regional plan is that the chance of experiencing the impacts of droughts by the public is reduced. The events will still occur but the consequences on the public water supply system reduces.

15.6 Table 15.1 below shows an analysis, based on the draft regional plan proposals, of how the chances of experiencing certain events reduces over the duration of the plan. The figures in the table represent the chances of experiencing a particular event during the course of the proposed plan compared with the current chance.

Table 15.1: Chance of experiencing drought event change under best value plan

Drought intervention	Current	Draft best value plan
Temporary use ban (TUB)	99.48%	97.04%
Non-essential use ban (NEUB)	63.58%	48.88%
Environmental drought order / permit	46.68%	18.23%

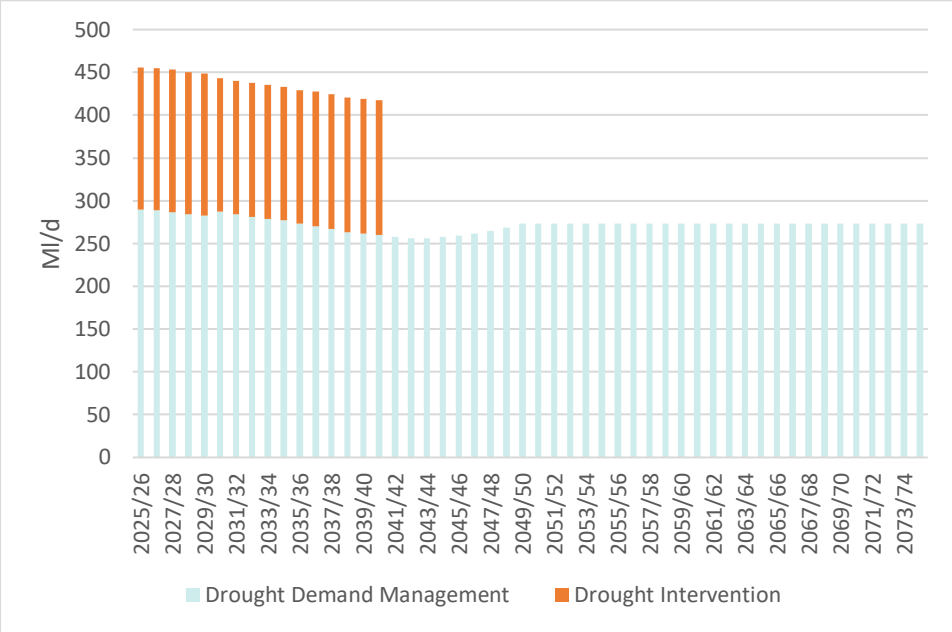
15.7 The figures are indicative. The reductions in the chance of experiencing certain events occur once the 1:500 year drought resilience standard has been met and although we have modelled the policy to not use drought orders and permits after we have achieved this standard, there remains a chance, albeit much reduced, that an event more severe than a 1:500 year drought occurs and triggers the use of drought permits and drought orders. Table 15.2 below identifies the drought permits and drought orders selected in the investment modelling between 2025 and 2040 in the 1:500 DYAA scenario. They would not all be required under other planning scenarios. They are not available for selection beyond 2041.

Table 15.2: Drought permits and orders selected in the regional plan 1:500 DYAA (Ml/d)

Drought Permit or Order	Company	DO (Ml/d)
Drought Permit: Source S	Portsmouth Water	3.4
Hackbridge Drought Permit	SES Water	4.0
Kenley and Purley Drought Permit	SES Water	2.1
Outwood Lane drought permit	SES Water	2.0
River Eden May drought permit	SES Water	0.3
River Eden Summer drought permit	SES Water	1.4
Lower Itchen Drought Order	Southern Water	38.0
Test Drought Permit/Order	Southern Water	80.0
River Medway Drought Permit/Order	Southern Water	17.0
Pulborough Drought Permit/Order	Southern Water	23.0
Weir Wood Reservoir Drought Order	Southern Water	2.1
North Arundel Drought Permit/Order	Southern Water	2.5
Candover Drought Order	Southern Water	4.9
Calbourne Drought Permit/Order	Southern Water	1.5
Gatehampton Drought Permit	Thames Water	3.5
Playhatch Drought Permit	Thames Water	4.1
Sheeplands/Harpsden Drought Permit	Thames Water	5.6
Shalford Drought Permit	Thames Water	5.0
Total		**200.4**

15.8 Figure 15.1 shows the contribution that the drought permits and drought orders (drought interventions) would make in the context of the Temporary Use Bans (TUBs) and Non Essential use Bans (NEUBs) (Drought Demand Management) that would also be applied as part of our member companies' responses to drought.

Figure 15.1: Water resources benefit (Ml/d) from drought interventions and demand management measures.



16. Evaluation of our proposals

This section of the plan has been updated to reflect the updated assessments of the proposals selected in the revised draft regional plan proposals.

The effect of our proposals on the supply demand balance

16.1 Section 6 of this document identified the supply demand balance (SDB) deficits which the South East region faces, based on the situation tree selected as the basis for the adaptive pathway for the revised draft regional plan.

16.2 The figures provided a geographical representation of the DYAA 1:500 supply demand balances across the South East, by individual water resource zones. This highlights that the challenges differ between WRZs and between companies, and increase over time through the planning period, but not on a consistent basis.

16.3 This section repeats the figures from Section 6, but each with an additional figure that identifies the supply demand balance effect of our regional plan proposals being in place. It can clearly be seen that with the regional plan proposals in place the forecast significant deficits are met and overcome.

16.4 The key for the figures is as follows – with the numbers being supply demand balance surplus or deficits, in Ml/d.

-200	-150	-100	-75	-50	-25	-10	-5	0	5	10	25	50
-200	-150	-100	-75	-50	-25	-10	-5	0	5	10	25	50

Figure 16.1: 2026 SDB by WRZ (DYAA 1:500) – WITHOUT regional plan

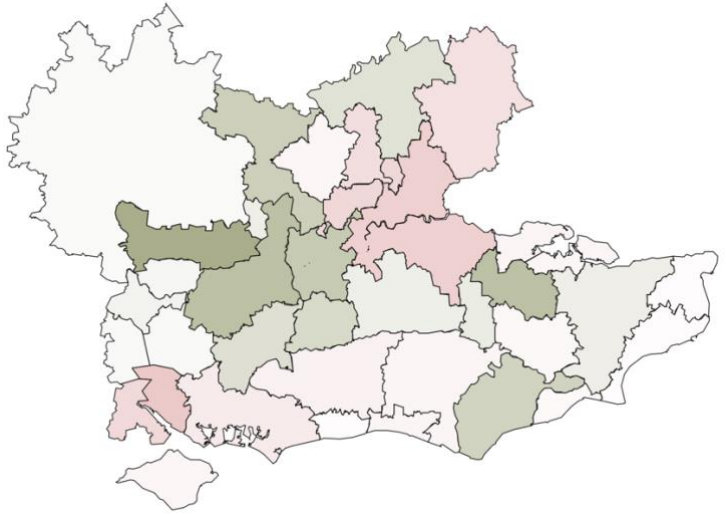


Figure 16.2: 2026 SDB by WRZ (DYAA 1:500) – WITH regional plan

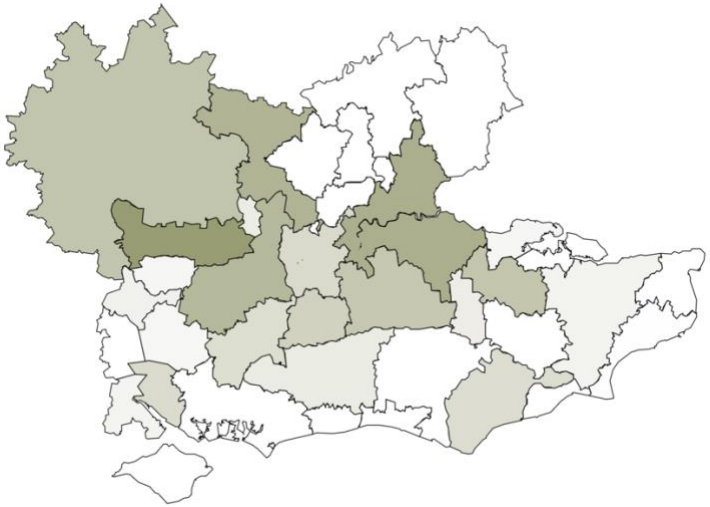


Figure 16.3: 2040 SDB by WRZ (DYAA 1:500) WITHOUT regional Plan

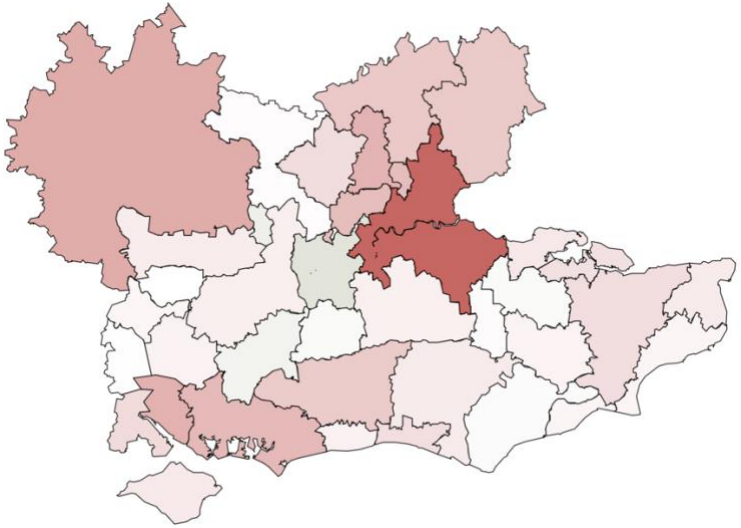


Figure 16.4: 2040 SDB by WRZ (DYAA 1:500) WITH regional Plan

Figure 16.5: 2060 SDB by WRZ (DYAA 1:500) WITHOUT regional Plan

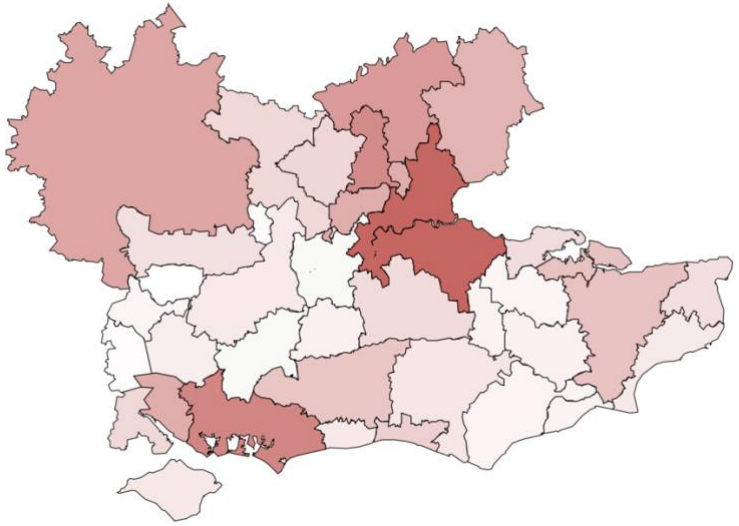


Figure 16.6: 2060 SDB by WRZ (DYAA 1:500) WITH regional Plan

Figure 16.7: 2075 SDB by WRZ (DYAA 1:500) WITHOUT regional Plan

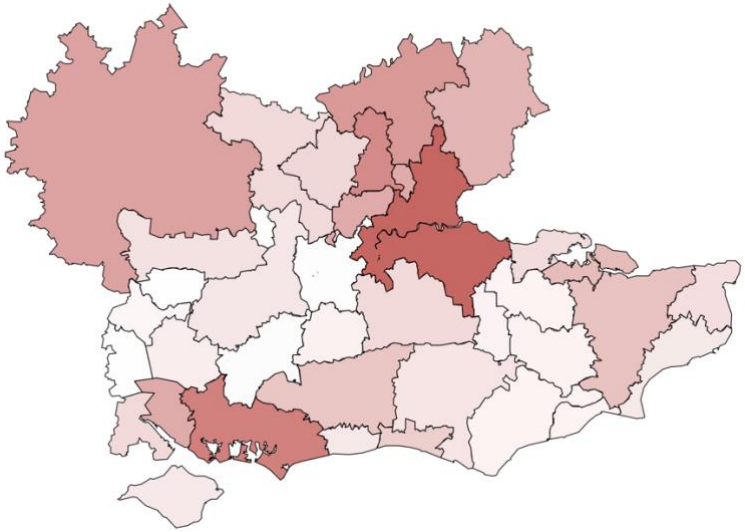


Figure 16.8: 2075 SDB by WRZ (DYAA 1:500) WITH regional Plan

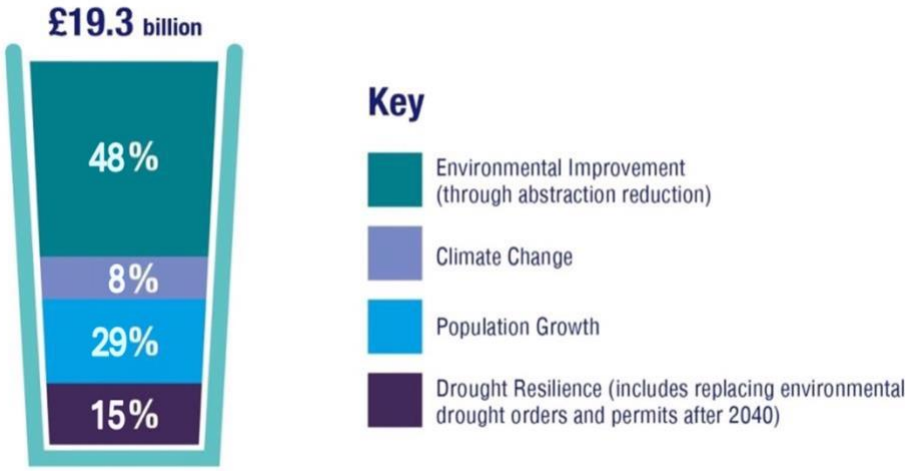
Cost and Carbon

How much will it cost?

16.5 The cost of our revised draft best value plan for the reported pathway is £19.3 billion between 2025 and 2075. The £19.3 billion includes the cost to build and operate new infrastructure and transfers, and to deliver leakage reduction and water efficiency activities. These figures are Net Present Value (NPV).

16.6 Just over half of the investment needed is being driven by the need to protect and improve the environment, as shown in Figure 16.9.

Figure 16.9: Factors that are driving the investment in the revised draft regional plan



16.7 The range of potential costs associated with the full adaptive plan pathways (covering more or less challenging pathways) from 2025 to 2075 is between £17.9 billion and £22.7 billion.

16.8 The figures are expressed as totex (total expenditure), which combines the operational, capital and carbon costs of these options. The totex will be spread across the planning period.

16.9 Investment in water resources is largely funded through customer water bills. Delivery of the proposals in our regional plan will require an increase in bills. The actual bill increases will be different, depending on which water company provides your water, their current bill and the level of investment they need to make in other areas of their service.

16.10 The indicative bill impacts for each company will be reported in their draft WRMPs. The company dWRMPs may also include options and costs which have not been included in the regional plan – for example network enhancements and transfers within company water resource zones.

16.11 Bill increases over the 2025 to 2030 period will be set through the water company business plan process, which will see draft business plans submitted to Ofwat in 2023, before being finalised in 2024.

16.12 We have undertaken various sensitivity runs to assess the cost implications of the policy choice and decisions that we have made as part of the regional plan preparation. The result of these model runs are set out in Section 17 of this document. We have also explored the cost sensitivity of the options selected in the regional plan, including testing whether option cost increases would make a material difference to the selection of options in the regional plan.

Carbon

16.13 Building and running new infrastructure, whether for new resources, or to manage demand, will create carbon emissions.

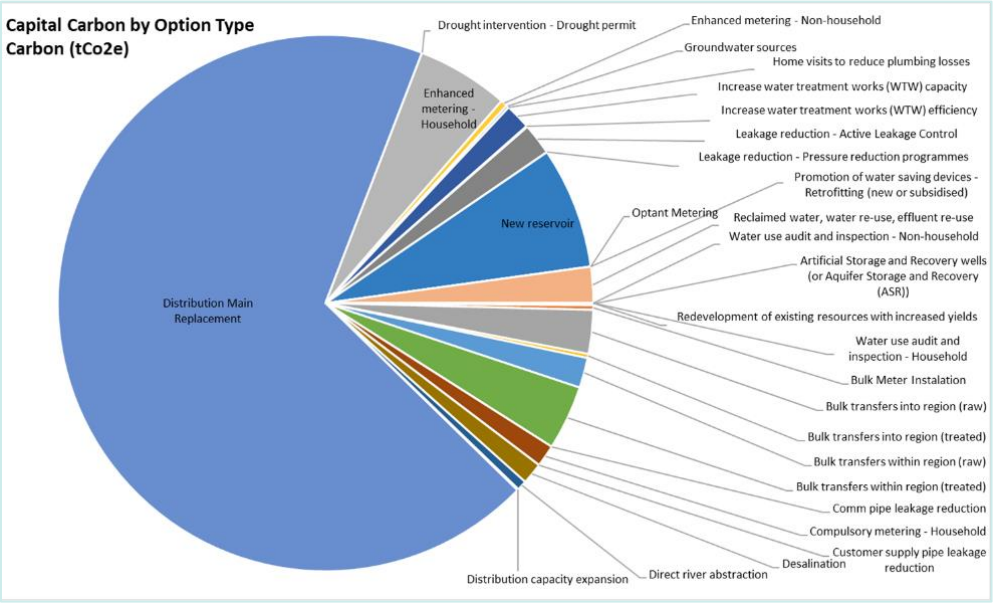
16.14 In the development of this plan, we have considered the carbon cost of the schemes. This includes the carbon emissions created through the construction process (capital carbon) and the emissions produced through their ongoing operation (operational carbon). This has taken account of the carbon reductions that will come as a result of the decarbonisation of the electricity network in our modelling.

Capital carbon

16.15 Capital carbon emissions have been estimated for the regional plan. This includes the emissions generated on site from construction activities (such as excavators working on site or HGVs transporting materials), as well as the embodied emissions in the construction materials brought to site (such as the emissions generated when producing concrete, which is then used on site).

16.16 The breakdown of the capital carbon is shown in Figure 16.10 below.

Figure 16.10 Regional plan capital carbon by option type for the reported pathway



16.17 Most of the capital carbon in the plan is from the distribution mains replacement program which help companies meet their regulatory targets by 2038 and 2050. As most of these schemes will not be built until several years from now, time is available to work with the supply chain (e.g. steel and concrete manufacturers) to find new lower carbon solutions to construction. The All Company Working Group (ACWG), made up of the water companies with Strategic Resource Options (SROs), have engaged with the supply chain to estimate just how much progress with reducing emissions might occur over the next 60 years. This engagement has produced emission reduction estimates for most facets of construction, ranging from the types of construction equipment moving around on site, to the type of steel that might be used in future pipelines. Three different scenarios have been produced, a worst case, middle case and best case scenario; to allow for the industry moving slower or faster than expected.

16.18 An example to illustrate this approach is for pipelines. For many large pipelines conveying vast quantities of drinking water around the region, 70% of the capital carbon emissions are attributed to producing the pipeline material itself[40]. In the middle case (a moderate level of ambition), estimates by the ACWG indicate that 7% of carbon could be reduced in the manufacture of ductile iron pipes in the next 15 years, increasing to 39% in 15 to 35 years. Physically this would mean manufacturers of iron deploying stove flue or top gas recycling in most blast furnace-basic oxygen furnace sites, which is a transition the water companies can help promote by requiring contractors to use lower carbon materials thereby generating demand for these new materials.

16.19 Concrete is another building material with a large carbon footprint. Many of the assets needed in the SROs include concrete, either to build above ground tanks, foundations for buildings, or underground structures. Building on the work of the Low Carbon Concrete Routemap[41], the ACWG estimates that by optimising current practice in manufacturing and using supplementary cementitious materials, 20% of carbon emissions generated when building tanks could be eliminated if built within the next 15 years.

16.20 The output of this work from the ACWG is that SRO types, for example a pipeline, or a water treatment works, now have carbon reduction estimates calculated assuming certain progress is made in the supply chain over the

[40] *For a ductile iron pipeline, which is a common material at this pipe size.*

[41] *https://www.ice.org.uk/media/q12jkljj/low-carbon-concrete-routemap.pdf*

next 10, 30 or 60 years. These percentages can then be applied to the list of resource options contained within a given plan, accounting for how far into the future they will be delivered, which then provides WRSE with an initial estimate of the carbon emissions that can be avoided if engagement with the supply chain occurs.

16.21 The ACWG carbon consistency work has been documented, and the report is saved on the WRSE website in the document library.

Operational carbon

16.22 Water resources options are provided to WRSE by our six member companies and by cross-company teams developing SROs. As part of this process, each water company and SRO prepares their own cost and carbon emissions estimate for each resource option. There is currently no sector wide standard for completing the carbon assessments, but the approach is improving all the time. As a minimum, operational carbon is closely accounted for. For operational electricity (e.g. Scope 2), this is relatively straightforward to calculate and Government published datasets (by BEIS), provide consistency in estimating the carbon emissions arising from electricity consumed. This component will largely be decarbonised as the UK electrical grid transitions to more renewable generation, however the water companies are still striving to promote efficiency and reduce electrical consumption to help make that transition easier.

16.23 Operational emissions also encompass direct emissions from plant and operations (e.g. Scope 1), which for most schemes relates to the fuel consumed on site for operational activities or fugitive emissions which may arise on site due to processes (mostly during wastewater treatment). While these Scope 1 emissions are more difficult to estimate, water companies have made an estimate of them. These emissions sit directly within the control of water companies, and mitigation activities are planned (such as switching to electric maintenance vehicles).

16.24 The last component accounted for within operational emissions is consumption of chemicals (such as chlorine for disinfecting drinking water). These fall into Scope 3 emissions, as using chemicals on site does not emit carbon, but for every litre of chemical consumed there is an embodied carbon footprint. Estimating the embodied emissions of these purchased chemicals (Scope 3) is difficult, as suppliers can change and transportation distances from supplier to site can vary. Nevertheless, water companies have estimated embodied carbon from chemical consumption.

16.25 Within the chemicals production sector in the UK, decarbonisation is not expected to happen rapidly. For water companies, this means exploring opportunities for switching chemicals used to lower embodied carbon chemicals, finding efficiencies, or working with the supply chain to reduce emissions.

Estimated carbon emissions

16.26 The estimated carbon emissions for the reported pathway of the revised draft regional plan are shown in Table 16.1, covering the period from 2021 to 2075. The table shows the carbon estimates before and after applying the “middle case” and “best case” mitigation factors for capital carbon.

16.27 It can be seen that total carbon emissions over the period are estimated at 9.4 MtCO2e (metric tonnes of carbon dioxide equivalent), which might be reduced by approximately 28% by the middle case capital carbon mitigation scenario, or 33% under the best case capital carbon mitigation scenario. The same data is presented in an annual profile in Figure 16.10.

16.28 In interpreting the data, it is important to note that there is uncertainty around the carbon estimates. A particular area of weakness that is acknowledged is around estimation of carbon emissions associated with demand management interventions (particularly metering and leakage reduction activities, including mains renewals). Due to gaps in some carbon data for demand management options the demand management emissions estimate is based upon high level analysis of carbon intensities for demand management interventions, but further work is planned to refine this for the final regional plan.

Table 16.1: Estimate of emissions from 2021 to 2075 (DYAA, reported pathway)

Estimated carbon emissions	Without capital carbon mitigations		With middle case capital carbon mitigations			With best case capital carbon mitigations		
Category	**'000 tCO2e**	**% of total**	**'000 tCO2e**	**% of total**	**% Mitigation**	**'000 tCO2e**	**% of total**	**% Mitigation**
Capital Carbon	6,349	67%	3,707	55%	42%	3,220	51%	49%
Replacement Carbon	357	4%	346	5%	3%	343	5%	4%
Operational Carbon - Electricity related	123	1%	123	2%	0%	123	2%	0%
Operational Carbon - Non-power related	2,610	28%	2,610	38%	0%	2,610	41%	0%
Total Carbon	**9,438**	**100**	**6,785**	**100**	**28%**	**6,295**	**100**	**33%**

16.29 Currently investigations around potential for mitigating emissions have focused upon certain key categories of capital carbon. However, there is potential to identify significant further mitigation potential from considering future operational carbon mitigation (particularly chemicals), other types of capital carbon assets not yet considered for mitigation, and demand management carbon.

16.30 Further supply chain engagement is needed as other manufacturing and construction sectors respond to climate legislation and begin to implement decarbonisation activities within their own supply chains. Through collaboration, the aim is to accelerate this process to help maximise decarbonisation potential in the timeframes relevant to the WRSE plan.

Residual emissions and offsetting

16.31 After applying carbon reductions, there is still a significant quantity of residual emissions left, estimated at over 6 MtCO2e. Whilst this quantity of residual emissions is very uncertain, it provides our member companies with an idea of scale when planning further work to drive emissions reductions and for potential sequestration or carbon offsetting activities.

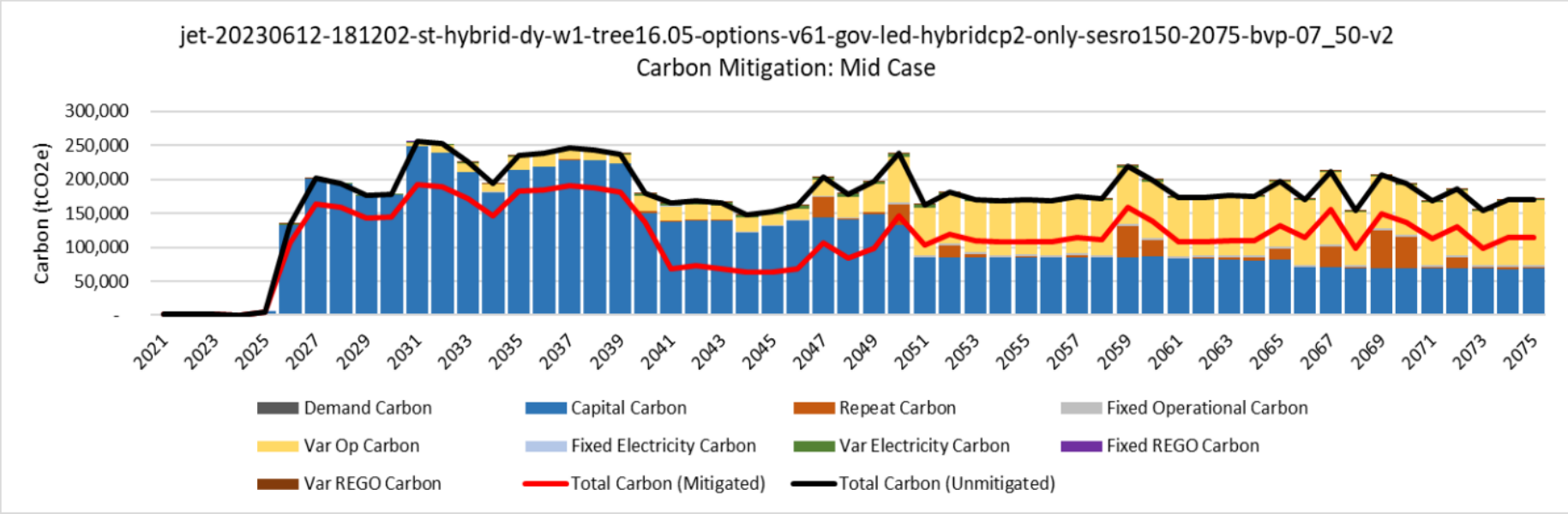
16.32 Indicative regional carbon sequestration activities and challenges are described below, and WRSE will continue to work with its member companies to look at the reduction of carbon emissions across the region.

16.33 Sequestering carbon through land use changes (e.g. such as planting trees), requires very large areas for the level of emissions generated during construction. Applying this requirement on a scheme-by-scheme basis would require significantly larger areas of land, to accommodate both the planned infrastructure and the planted space to sequester the equivalent amount of carbon.

16.34 Related to ecological considerations, planning land use changes (e.g. vegetated spaces) with only a carbon purpose in mind, might yield sub-optimal or even negative results from a biodiversity and ecological perspective. For example, to sequester the most carbon in the least amount of land, one might propose planting a single crop that is known to sequester carbon best. While this would fulfil the carbon requirements best, from an ecological perspective, encouraging biodiversity by planting different flora and promoting a diverse habitat, would be far better despite the reduced carbon sequestration that might occur. Such an approach would also contribute to achieving the Biodiversity Net Gain (BNG) requirements that will need to be provided associated with delivery of resource options.

16.35 In addition to the carbon and ecological considerations, there are also potential synergies with water resources, from interventions that slow run off and store water in the environment either in surface water bodies such as wetlands, or through increasing groundwater recharge. Such interventions also have the potential benefit of slowing flows through rivers and mitigating flooding risks.

Figure 16.10 Regional plan carbon emissions with and without capital carbon mitigation for the reported pathway



Notes: The reductions noted above have been estimated based on the reductions calculated in the ACWG report. This report estimated savings for asset types that provide a large part of the capital carbon emissions for a 'typical' reservoir project, pipeline project, and for a treatment plant project. The potential reductions for each asset type have then been applied to all the resource options within the best value plan. Not all asset types were considered in the ACWG report and for those asset types not considered, for example tunnels, no reduction has been assumed. For other components that had a similar but not identical description, estimates have been assumed that are in line with similar reductions estimated by the ACWG report. The Total Carbon (Mitigated) line shown does not include the additional mitigation potential from use of renewable generation for additional power requirements.

16.36 Whist progress has been made on identifying catchment management interventions as part of the regional plan, further work is needed to assess the potential carbon sequestration and BNG benefits of these interventions. These are important drivers that help build the case for implementation of catchment management schemes, which then have the potential to also deliver other tangible, but more difficult to quantify, water resources and flood risk management benefits.

16.37 Further development of these regional catchment management schemes then has the potential to provide options for mitigating residual carbon emissions whilst also delivering other environmental and societal benefits.

Assessment of environmental effects and benefits

Assessment of environmental effects

16.38 To determine the environmental effects of the options in our regional plan and alternative plans, the following staged assessment process was undertaken:

- Options-level assessment (including Strategic Environmental Assessment (SEA), Habitats Regulations Assessment (HRA), Water Framework Directive (WFD), Natural Capital Assessment (NCA), Biodiversity net gain (BNG), and Invasive Non-Native Species (INNS) assessments)
- Programme Appraisal – including cumulative and in-combination effects for SEA, HRA, WFD, NCA and BNG.

16.39 Summaries of the environmental assessments undertaken will be published alongside this regional plan. The following documents will be published and available for review in the WRSE Document Library:

- Strategic Environmental Assessment Summary Report
- Strategic Environmental Assessment Environmental Report
- Habitats Regulation Assessment
- Natural Capital and Biodiversity Net Gain
- Water Framework Directive Assessment

16.40 The overall findings are captured within the SEA Environmental Report. The findings are reported for two periods, firstly options selected by 2050 and separately those selected post 2050 (and up until 2075). The majority of the proposals in the plan are for the period pre-2050.

16.41 The assessments undertaken reflect the strategic nature of the regional plan. It should be noted that there are separate and more detailed environmental assessments of our member company WRMPs that are published alongside those WRMPs, and available on the company websites. Further and more detailed assessments, including (where appropriate) Environmental Impact Assessments ,will also be undertaken of individual schemes as part of future applications for planning and other consents.

16.42 For the SROs, there are also separate detailed environmental assessments undertaken and submitted to RAPID as part of the Gate 2 submissions. Copies of these separate assessments are on our relevant member company websites, and on the RAPID website.

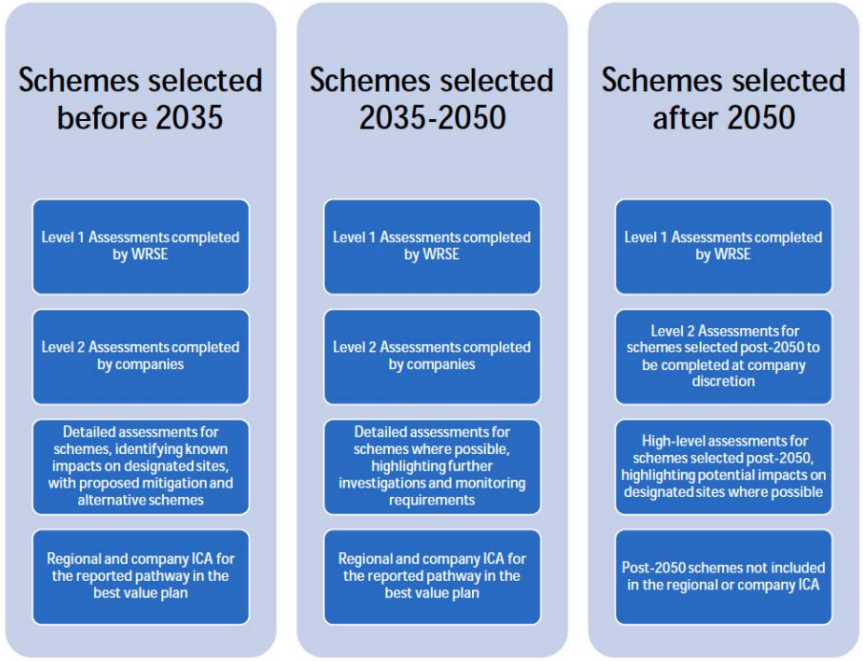
16.43 Since the publication of the draft regional plan, WRSE and our member companies have continued to progress the environmental assessments of the options in the regional plan and individual WRMPs. This has included ensuring that the assessments take account of updated information submitted on Strategic Resource Options (SROs) as part of the RAPID gated process, including updated environmental, carbon and biodiversity net gain assessments. WRSE and the companies have also reviewed and updated the assessments in light of comments received on the draft regional plan.

16.44 The environmental assessment reports undertaken for the draft regional plan have been further updated for the revised draft regional plan, taking account of updated environmental and scheme information, and to consider and respond to comments submitted on the draft regional plan, including from the environmental regulators and other organisations and individuals.

16.45 WRSE and our member companies have engaged with our environmental regulators over the details of the environmental assessments undertaken, and the comments received as part of the draft regional plan consultation. This included comments on the approach to assessments and the details of

the assessment outcomes on individual options. WRSE and our member companies have developed a tiered approach for the environmental assessments of the regional plan and the options selected within it, through engagement with the Environment Agency and Natural England. This approach ensures that appropriately detailed environmental assessments are completed for the plan, with a greater level of detail focused on the plan and options within it in the periods 2025 to 2035, and 2035 to 2050, than for the longer term options in the 2050 to 2075 period, as illustrated in Figure 16.11 below.

Figure 16.11: Summary of assessment approach for updated assessments



16.46 Updated environmental reports will be published alongside the revised draft regional plan. Where options with a potential for adverse environmental effects are selected in the plan, this is identified in the environmental reports, along with details of appropriate mitigation or compensatory measures that may be required to be considered through subsequent and more detailed work as part of applications for planning and other consents.

16.47 For those options later in the planning period, a description of environmental risks relating to the options is set out in the environmental reports, and additional work to further investigate them will be undertaken through subsequent regional plan and WRMP 5 yearly plan making cycles.

16.48 For some longer term options, potential alternatives to these options may need to be identified and considered as alternatives through subsequent plan cycles should environmental risks and impacts not be capable of being overcome.

Summary of environmental assessments of revised draft regional plan proposals pre-2050 for the reported pathway

16.49 Environmental and social considerations have influenced the development of the revised draft regional plan through integration of the environmental assessment process within the investment modelling and decision-making.

16.50 The 'high' environmental destination, consumption reduction options, change in level of service to enhance water available for use (WAFU) and leakage reduction will lead to more water being kept within the natural environment, supporting improvement for water quality and biodiversity, and resilience of the natural environment to drought conditions as identified in the WFD and SEA assessments. These types of options also have benefits for climate, carbon and resource use by reducing the need for new supply side options.

16.51 Where new supply side options are required, the revised draft regional plan makes a commitment to achieving environmental net gain through delivery of BNG and provision of ecosystem services associated with habitat creation and enhancement such as new woodland sequestrating carbon and reducing run-off rates. The revised draft regional plan is committed to achieving a minimum BNG of 10% and for certain options this will be higher due to Local Planning Authority (LPA) requirements. BNG delivery will be a collaborative

process between the six member water companies and will be delivered at a company level due to the localised delivery requirements for BNG.

16.52 The SEA also identified positive cumulative effects for the SEA objective on delivering reliable and resilient water supply to customers through delivery of new water supply option, increased capacity and improving transfers across the region. The SEA cumulative effects assessment identified cumulative negative effects for SEA objectives on soil due to cumulative loss of agricultural land, carbon due to construction and operational carbon emission across the plan, and resource use due to the cumulative effects of materials and resource use and waste production across the plan.

16.53 The SEA in-combination effects assessment identified several options with the potential for interactions with the same sensitive receptors. This was largely due to construction effects such as disturbance from noise, air and light pollution from different options where the construction periods overlapped. These sensitive receptors included Local Nature Reserves, Sites of Special Scientific Interest (SSSI), heritage assets and community assets. However, it is likely that with implementation of best practice construction techniques and a Construction Transport Management Plan, in-combination effects can be minimised.

16.54 The revised draft regional plan includes several desalination options along the Kent Coast which is heavily designated. There are potential for in-combination effects from brine discharge affecting salinity and temperature within marine Habitats Sites. The options are selected post 2035 allowing time for further investigation of effects. The next WRSE Regional Plan (2029) will consider selection of these options further in terms of modelling salinity and temperature effects and potential alternative options.

16.55 A small number of selected options have the potential for in-combination effects, as identified by the HRA, WFD and INNS assessments for the revised draft regional plan and the water company revised draft WRMPs. This is largely due to uncertainty around effects and further studies have been recommended to confirm effects. For several options it is anticipated that the further studies together with tailored mitigation will mitigate in-combination effects. Other options are selected post 2035, allowing time for future investigations to be incorporated into the next Regional Plan.

16.56 A number of natural capital stocks are likely to be temporarily and permanently impacted by the revised draft regional plan. Construction impacts are likely to include the release of CO_2 due to habitat clearance, loss of natural hazard management, loss of air pollutant removal, a reduction in food production services and a reduction in water purification. However, the revised draft regional plan presents an opportunity to improve the existing habitats through post-construction remediation and replacement of low value habitats with higher value habitats. The plan crosses several Natural England Habitat Network Enhancement Zones and is therefore suitable for the planting of new high value habitats.

Assessment of environmental benefits relating to environmental ambition (environmental improvements from abstraction reduction)

16.57 Earlier sections of this document explained in detail how the regional plan has followed the approach of the National Framework and WRPG in identifying an appropriate level of environmental ambition for the regional plan. Improving the environment of South East England is a priority for the regional plan. It will help to deliver the Government's ambition to achieve clean and plentiful water by improving at least three-quarters of our waters to as close to their natural state as is practicable. Abstraction, the process of taking water from the environment, is one of many things that can have an impact on the health of our waters. It can affect river flows, wetlands and ecology.

16.58 Our regional plan proposals will enable significant reductions in levels of abstraction reduction to be achieved, through licence changes, delivering flow benefits in catchments and overall environmental improvement across the South East region.

16.59 We have identified the abstraction reductions that are necessary to achieve the high levels of environmental ambition that we are planning for (in terms of Ml/d reductions in abstraction). However, the flow benefits that will

accrue from them and wider environmental benefits of achieving these reductions, need more detailed investigation and assessment.

16.60 Analysis of the 'health' of the 531 waterbodies in the 29 catchments within the South East region showed that 32.6% of waterbodies are currently in 'good' status and that the remaining 67.4% are below good (being either classified as moderate poor or bad status). This is an aggregate condition status, incorporating the six individual components – Fish, Clarity, Invertebrates, Flow, Plants and Safety.

16.61 Reductions in abstraction facilitated by the proposals in the regional plan will impact or benefit some of the six individual components more than others. We have not tried to assess each of the impacts that abstraction reduction will have on each of the water bodies for each of the criteria. However, we have illustrated what the overall benefit to the South East could be if all of water bodies were at 'good' ecological status.

16.62 In 2012 the Environment Agency updated their National Water Environment Benefit Survey (NWEBS) values. These can be used to assess the monetary benefit of improving the water courses in the South East from their current state to good. There are values per km, and for each of the six health components. Revising the NWEBS values to 2020 prices took into account national average population growth (by household numbers) and GDP deflators to better reflect the values NWEBS have in present day (2020) prices.

16.63 Taking these values and applying them to the current status, lengths of the water courses and the duration of the regional plan, the resultant benefits are assessed to be between £2.3bn and £3.4bn, as explained in table 16.2 below. This indicates that achieving a good status across the region brings significant benefits. It is recognised that these benefits do not occur from abstraction reductions alone; other actions will be required by industries and people who work and/or operate within a catchment.

16.64 The risk adjusted benefits assume that 30% of the measures put in place will not fully succeed in the catchment and therefore some of the water bodies for a specific health indicator do not reach 'good' status.

16.65 The scale of environmental benefits that can be achieved through achieving 'good' ecological status is relevant to the consideration of the cost of the regional plan proposals. The cost to the plan as a whole, when including environmental ambition, is significant and one of the largest cost drivers that we have. On face value the increased cost does not balance out with the benefits. A significant part of the regional environmental ambition may become a legal requirement (to ensure that WFD status does not deteriorate) subject to any necessary cost benefit consideration of the licence changes required as part of sustainability reductions, or other legal mechanism that may be used.

16.66 If the BAU+ scenario, which has been locally verified by the EA, is taken as a conservative view of the future legal requirements then the difference between this BAU+ scenario and the high environmental ambition scenario is within this overall benefit range.

16.67 There are clearly a lot of assumptions relating to these environmental benefit figures. WRSE will continue to work through these assumptions with our member water companies, our advisory board and will review and update the environmental ambition assessment as required.

Table 16.2: Benefits of achieving good ecological status in South East

Catchments	Sum of Benefits (£m)	Sum of Risk adjusted benefits (£m)
Adur and Ouse	£ 129	£ 90
Arun and Western Streams	£ 178	£ 125
Cam and Ely Ouse (including South Level)	£ 6	£ 4
Cherwell	£ 52	£ 36
Colne	£ 344	£ 241
Combined Essex	£ 8	£ 6
Cotswolds	£ 92	£ 65
Cuckmere and Pevensey Levels	£ 51	£ 36
Darent	£ 85	£ 60
East Hampshire	£ 30	£ 21
Isle of Wight	£ 26	£ 18
Kennet and Pang	£ 55	£ 38
Loddon	£ 90	£ 63
London	£ 638	£ 446
Maidenhead to Sunbury	£ 156	£ 109
Medway	£ 355	£ 248
Mole	£ 195	£ 136
New Forest	£ 1	£ 1
North Kent	£ 9	£ 6
Roding, Beam and Ingrebourne	£ 15	£ 11
Rother	£ 113	£ 79
Severn Vale	£ 102	£ 71
Stour	£ 101	£ 71
Test and Itchen	£ 42	£ 29
Thame and South Chilterns	£ 146	£ 102
Upper and Bedford Ouse	£ 2	£ 1
Upper Lee	£ 187	£ 131
Warwickshire Avon	£ 2	£ 1
Wey	£ 190	£ 133
Grand Total	**£ 3,399**	**£ 2,379**

17. WRSE's revised draft regional plan decision making

Section 8 of the plan set out a description of WRSE's decision making approach in selecting the least cost and best value regional plan. This section provides an explanation of the decisions WRSE has taken, following this approach. This is a newly drafted section of the plan, drawing together information from different parts of the draft regional plan and adding further explanation.

Context

17.1 There have been a number of changes made to the regional plan between the draft regional plan, consulted on in November 2022, and this revised draft regional plan. Many of these changes have been due to updates to regulatory guidance and policy documents which have impacted the scale of the challenge the regional plan has to solve, and in response to consultation comments on the draft regional plan. The decisions made by WRSE in the process of updating the regional plan have been outlined in this section.

17.2 This section of the plan also sets out the key changes which have been made to the regional plan, outlining the outputs of the WRSE investment model, the resulting schemes selected in the least cost plan and best value plan for the revised draft regional plan, and the impacts of known risks on the selection of strategic resources (SROs) within the regional plan.

17.3 The section will cover:

- Policy changes
- Data changes
- Decision making for the revised draft regional plan
    - Best value plan and least cost plan
    - Known risks
    - Mitigation of the risks using SESRO and STT
    - Draft regional plan consultation
- Sensitivity testing
    - Achieving policy expectations
    - Core scheme selection
    - Scheme selection, costs and timing
- Best value plan comparison

17.4 The draft regional plan was published for consultation in November 2022, and selected the following Strategic Resource Options (SROs) in order to meet the regional challenges:

Table 17.1: Strategic Resource Options selected in the draft regional plan

Timeframe	Strategic schemes selected (draft regional plan BVP reported pathway)	Policy Challenges
2025-2039	Havant Thicket reservoir	Current commitments, WINEP, licence capping
	Hampshire Water Transfer and Water Recycling Project	
	Grand Union Canal transfer (Phase 1 - 50Ml/d)	
	Teddington Direct River Abstraction (DRA)	
2040-2049	South East Strategic Reservoir Option (SESRO) (100Mm^3)	1:500 Drought resilience
	Grand Union Canal transfer (Phase 2 - 50Ml/d)	
2050-2075	Severn Thames Transfer (STT)	Environmental ambition

17.5 The analysis in this section of the plan focuses on these key strategic schemes to demonstrate how they have been impacted by the changes made to the regional plan between the draft and revised draft publications.

Policy changes

17.6 Since the draft regional plan was published for consultation in November 2022, a number of key regulatory guidance documents have been published, including the final WRPG in March 2023, which companies are required to follow for their statutory WRMPs, and the Government's Environmental Improvement Plan (EIP), which was published at the end of January 2023. These new, revised or updated documents have changed the policies the regional plan and WRMPs are required to meet – particularly in relation to water efficiency and PCC targets.

17.7 The draft regional plan sought to meet a regional average PCC target of 110 litres per person per day (l/p/d) by 2050 in a normal year. This approach allowed companies to balance PCC reductions across different types of houses; age groups; demographics, etc. However, the Ofwat price review 2024 (PR24) methodology and updated WRPG both state that each individual company needs to meet a PCC target of 110 l/p/d by 2050 in a dry year. This is also reinforced in the EIP, which also introduced a set of interim PCC targets.

17.8 At the draft plan stage, WRRSE indicated what would happen to the regional plan if there was a higher PCC target imposed on companies through a government water efficiency scenario referred to as Government C. The move to these new targets has two important consequences for the revised draft regional plan:

- Firstly, if the PCC target is met, then the projected deficit between the demand and the supply of water in 2050 under pathway 4 reduces from approximately 1,370 Ml/d (if only leakage targets and non-household consumption targets are met) to approximately 950 Ml/d (if leakage targets, PCC targets and non-household targets are met). This means that there would be less new strategic resource required over the planning period.
- Secondly, this new target marks a significant shift in policy with important implications for companies, who now become increasingly reliant on Government-led demand management interventions to make the demand management savings required to meet this target.

17.9 The baseline regional PCC at the start of the plan in a dry year is approximately 140 l/p/d. Currently, the Government has committed in the EIP to deliver policies that could help to reduce household PCC but has not announced a timetable to do so. This is a change to the position at the draft plan stage in which there was no legislative commitment to deliver interventions beyond water labelling. As a result, WRSE has considered a range of different government intervention scenarios based on implementing three different Government water efficiency policies at different times. The Government policies modelled are:

- Low – water labelling of all water using products by 2024 (already committed to by Government). Total savings of 6 l/p/d.
- Medium – water labelling plus minimum standards for all water using products. Total savings of 12 l/p/d.
- High – full Government support – water labelling, minimum standards and new building regulations for new homes and retrofits. Total savings of 24 l/p/d.

17.10 Since the draft regional plan publication, all the water companies have updated their demand forecasts, demand management schemes and leakage reduction programmes. Combining these programmes with the Government C+ profile will allow companies to meet the 110 l/p/d PCC target by 2050 in a dry year, as required in the WRPG.

17.11 Whilst the commitment of the Government to deliver these water efficiency polices is welcomed there is still uncertainty when the policies, other than water labelling, will be delivered. The lack of clarity over the Government's timescales adds risk to the revised draft plan, as the total demand savings across the region associated with the assumed Government policies is more than 400 Ml/d. WRSE has therefore investigated a range of different timescales for the three water efficiency policy interventions to review potential risks and impacts to the regional plan as part of the regional plan process.

17.12 The change in the level of reliance on Government-led interventions between the draft regional plan and revised draft regional plan is shown in Table 17.2 below. The best value plan in both the draft regional plan and revised draft regional plan use the high Government-led interventions scenario, but the delivery times are accelerated for the revised draft regional plan – assuming the full savings will be achieved by 2050, compared to 2095 in the draft regional plan. The Gov-led H scenario does not go beyond the low Government-led interventions scenario.

Table 17.2: Comparison of levels of reliance on Government Interventions

Plan	Low (Water labelling)	Medium (Water labelling + minimum standards)	High (Full Government support)	Regional PCC in 2050 (l/p/d)
Draft regional plan BVP (Gov-led B)	6 l/p/d impact	Additional 6 l/p/d impact (total impact 12 l/p/d)	Additional 12 l/p/d (total impact 24 l/p/d)	115
	Implemented from 2025, with savings achieved by 2040	Implemented from 2060, with savings achieved by 2075	Implemented from 2080, with savings achieved by 2095	
Revised draft regional plan BVP (Gov-led C+)	6 l/p/d impact	Additional 6 l/p/d impact (total impact 12 l/p/d)	Additional 12 l/p/d (total impact 24 l/p/d)	108
	Implemented from 2025, with savings achieved by 2040	Implemented from 2030, with savings achieved by 2045	Implemented from 2035, with savings achieved by 2050	
Revised draft regional plan Alternative (Gov-led H)	6 l/p/d impact	-	-	119
	Implemented from 2025, with savings achieved by 2040			

17.13 The revised draft plan has not proposed any other policy changes as a result of the consultation. Therefore, the revised draft plan continues to meet the following policies, which remain a core part of the revised draft regional plan:

- Improve the overall drought resilience standard of 1:500 year by 2040 across the South East at the same time (see later section for explanation);
- Continue to use the least environmentally damaging drought orders and permits to solve deficits in the plan where possible. However, the use of these options would stop no later than locally agreed timescales or 2042, whichever is earlier.
- Continue to use Temporary Use Bans (TUBs) and Non-Essential Use Bans (NEUBs) throughout the plan to solve potential future deficits.

Data changes

17.14 In response to the consultation feedback and new information becoming available we have updated the following elements in the revised draft plan:

- Population growth forecasts.
- Delivery profiles of the environmental ambition profiles.
- Addition of a reverse water trade of 27 Ml/d from Affinity Water to Anglian Water.
- Scheme costs, mainly to align with the RAPID Gate 2 submissions for SROs and pre-Gate 3 costs for Southern Water SROs.
- Demand management and leakage options have been updated due to the higher level of activity required to meet the revised targets.
- Scheme delivery dates.
- The exclusion by Southern Water of the Sussex Coastal desalination plant option in its Worthing Water resource zone.
- The inclusion of an additional groundwater scheme in Southern Water's Brighton zone.

17.15 There have been material changes to several delivery dates for key Southern Water schemes that were selected in the first 15 years of the regional plan. The schemes impacted by these delays are Hampshire Water Transfer and Water Recycling Project (moving from 2030 to 2035), Littlehampton water recycling (moving from 2027 to 2030) and Havant Thicket reservoir (moving to 2031).

17.16 The delayed delivery of these schemes causes a deficit in the supply demand balances for Southern Water in their Hampshire water resources zones. This deficit cannot be resolved by the available feasible options in the investment modelling. The deficit could be met by extending the existing drought orders and permits on the Rivers Test and Itchen, which Southern Water are exploring together with other alternatives in conjunction and discussion with regulators as part of the WRMP process. Whilst Southern Water continue to explore the implications of the revised delivery dates with the regulators, the regional plan has undertaken a comprehensive set of model runs looking at what happens to the regional plan if the original delivery dates or revised delivery dates were met.

17.17 Moving the delivery dates back and extending the use of drought orders and permits provides a solution for the short-term deficits and does not change any of the other schemes in the plan. Any mitigation measures or alternative schemes that Southern Water are considering as an alternative to extending the use of drought orders and permits should provide an equivalent volume of water over the short term (2025 to 2035). Therefore, the delays to the Southern Water schemes will not impact on other companies, as any other companies cannot currently support Southern Water with the short-term deficits, and Southern Water's alternatives will need to meet the equivalent volume of water to the drought orders and permits.

17.18 Currently in the WRSE tables, the original delivery dates for these schemes are used. This is because Southern Water and the regulators are still discussing the alternatives and the mitigation and monitoring measures required.

Revised draft regional plan decision making using the investment model as a decision support tool

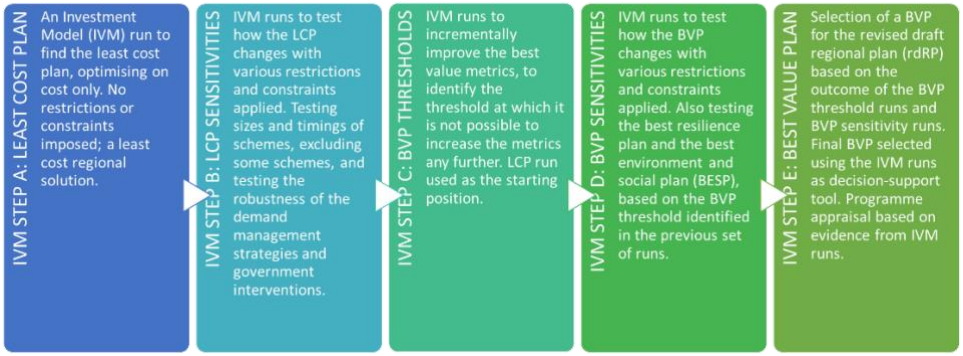
17.19 The WRSE investment modelling determines the most cost efficient and best value set of options that can solve the challenges across nine different futures using an adaptive planning approach. It does this through two stages.

- In the first stage, the investment modelling treats each of the nine future scenarios in the adaptive plan tree as discrete supply demand problems to solve and finds the schedule of solutions to ensure there are no deficits in the most cost-efficient way.
- In the second stage, the investment modelling looks at the potential solutions across the individual pathways and determines the optimal selection and scheduling of these options, using a progressive hedging technique (i.e. which solutions at the beginning of the plan provide the most cost efficient or best value set of solutions when considering the wide range of potential futures). These initial schemes are the least regret set of options at the beginning of the plan which can then be used as a core set of options to adapt from for any of the nine potential futures.

17.20 The investment modelling is used to derive adaptive investment strategies for the region and companies. The outputs from each model run include costs and best value metric information, as well as network connectivity diagrams which characterise the performance of a plan.

17.21 In order to derive a best value plan WRSE uses a five-step process, as set out in Figure 17.1.

Figure 17.1: Investment modelling steps towards best value plan



17.22 The WRPG asks for a "preferred programme", and a "preferred pathway" within the preferred adaptive programme. For WRSE, our preferred programme is the best value plan, and within this, we have selected the "reported pathway" which meets the required criteria set out in the WRPG. For the draft regional plan and for the revised draft regional plan the reported pathway is Situation / Pathway 4 of our adaptive plan.

Least cost plan

17.23 The least cost plan is the starting point for the regional plan. It sets out the set of schemes which provide a cost-efficient solution to the regulatory and government targets in the most cost-efficient way across the entire range of challenges and situations in the regional adaptive plan.

17.24 At the emerging plan and draft plan stages we set out the plan that best meets the policy and regulator requirements, and the revised draft plan does the same. The investment requirements within the plan are primarily driven by Government and regulatory requirements. The increased need for water arising from population growth is offset by the companies' demand management and leakage reduction programmes.

17.25 The least cost plan provides a good understanding of the mix of schemes required to meet the challenges set out in the adaptive plan. It also provides a baseline position for the best value metrics. From the least cost plan we are able to test and understand what would happen to the regional plan under different circumstances, for example if certain schemes were excluded, if the assumed government savings weren't achieved, if the companies demand management programmes deliver the anticipated activities but those activities don't result in the anticipated savings, and what additional schemes are added to the plan through the best value plan process.

17.26 The least cost plan for our revised draft regional plan selects the following SROs in Situation 4, the reported pathway:

Table 17.3: Strategic Resource Options selected in the least cost plan

Timeframe	Strategic schemes selected (revised draft regional plan LCP reported pathway)	Policy Challenges
2025-2039	Havant Thicket reservoir	Current commitments, WINEP, licence capping
	Hampshire Water Transfer and Water Recycling Project	
	Grand Union Canal transfer (Phase 1 - 50Ml/d)	
	Teddington Direct River Abstraction (DRA)	
2040-2049	South East Strategic Reservoir Option (SESRO) (150Mm^3)	1:500 Drought resilience
2050-2075	No Strategic Schemes selected	Environmental ambition

17.27 The schemes selected are very similar to those in the draft plan, which we consulted on, and the revised draft best value regional plan in the initial 15 years. Demand management schemes, Havant Thicket reservoir, Hampshire Water Transfer and Water Recycling Project, Grand Union Canal (GUC) transfer; Teddington Direct River Abstraction (DRA) and SESRO all provide key core solutions to the future challenges in the South East.

17.28 When the least cost plan is compared to the draft least cost plan, there are differences at 2050 and beyond. The additional demand management savings, from meeting the new PCC targets in 2050, negate the need for a substantial second set of SROs in the 2050s. The schemes that were prevalent in the draft plan in 2050 have been replaced by much smaller schemes. This change also allows schemes that are selected earlier in the plan to be sized slightly differently as the combination of slightly different schemes provides a more cost-effective solution given the regulatory targets and ambition that companies are planning for.

17.29 Investment model runs have been undertaken to identify a candidate plan, and then further runs undertaken in accordance with our programme appraisal process to test that plan and understand what would happen to the selection of schemes if different circumstances were to occur.

17.30 For example, the programme appraisal of the least cost plan model runs identified that if Affinity Water develop the GUC transfer proposal at 100Ml/d rather than 50 Ml/d (as is selected in the revised draft regional plan least cost plan), it can help provide additional resilience in order to meet existing WINEP commitments, enable the reverse transfer between Affinity Water and Anglian Water, which will ultimately help to support Cambridge Water, and ensure deficits in their zones do not occur if Government fail to implement their demand management savings in a timely manner. Selecting the GUC transfer proposal at 100 Ml/d increases the costs of the plan, but is an important step in the development of a robust and resilient regional plan.

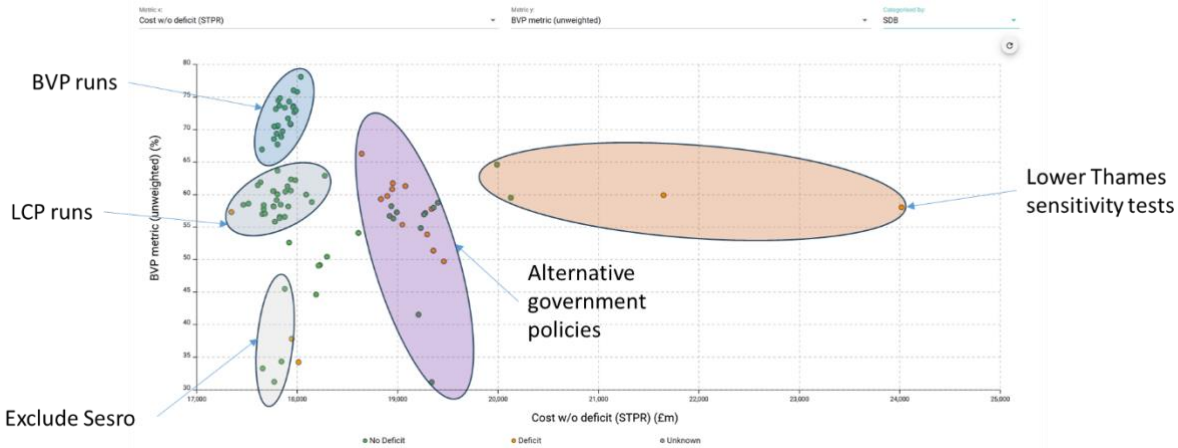
17.31 In conjunction with the GUC transfer proposal at 100 Ml/d, we have also explored the different available sizes of other schemes, including the SESRO reservoir proposal. The scatter plot in Figure 17.2 below shows the range of different tests that we have completed throughout the revised draft regional plan programme appraisal process.

17.32 The axes on the plot show cost versus the average best value plan metric score. The plot demonstrates the impacts that certain policy changes have

on the regional plan. Each dot represents a 9-branch adaptive plan; the outputs from an investment model run. As the points on the plot move to the right, the costs of the plans increase. As the points on the plot move up the y-axis, the average BVP metric scores of the plans increase. Therefore, points which are in the upper left quadrant of the graph represent better value plans compared to those in the lower right quadrant of the plot.

17.33 The key areas tested through the process were the impacts of Government demand management savings, the success of company demand management savings, the impact on the lower Thames from flood alleviation schemes, and the exclusion of key solutions such as Teddington DRA and SESRO. The testing also included looking at the delayed delivery dates for the Southern Water schemes; fixing the size of certain schemes to see how well the resultant plans performed and also explored how we could improve the value of the plan by increasing certain metrics.

Figure 17.2: Scatter plot showing the sensitivity runs undertaken for the least cost plans and best value plans



17.34 The sensitivity testing, inclusive of the Government savings (Gov-led C+) sensitivities, still confirms that a regional plan with the SESRO reservoir included as part of the solution provides a more cost efficient and better value plan, as defined by the BVP metrics, compared with plans which exclude the reservoir. This is clearly shown in the plot above and described in an earlier section of the regional plan.

17.35 The least cost plans and sensitivity runs provide a baseline position to improve from for the best value plan.

Best value plan

17.36 Least cost plan model runs have been used as the baseline from which to test performance against the best value plan metrics to find candidate best value plans for the revised draft plan. When we move from least cost plan to best value plan, there is very little difference in the selection of the SROs in the reported pathway, as shown in Table 17.4 below. This is because the metrics perform well in the least cost plan, so when we ask the investment modelling to find a solution which improves their performance, there is not much improvement which can be found.

Table 17.4: Strategic Resource Options selected in the best value plan

Timeframe	Strategic schemes selected (revised draft regional plan BVP reported pathway)	Policy Challenges
2025-2039	Havant Thicket reservoir	Current commitments, WINEP, licence capping
	Hampshire Water Transfer and Water Recycling Project	
	Grand Union Canal transfer (100Ml/d)	
	Teddington Direct River Abstraction (DRA)	
2040-2049	South East Strategic Reservoir Option (SESRO) (150Mm^3)	1:500 Drought resilience
2050-2075	No Strategic Schemes selected	Environmental ambition

17.37 A comparison of the schemes in situation 4 of the least cost plan and best value plan are shown in the tables below. Table 17.5 shows that the improved value in the best value plan mostly comes from the exclusion of 34 schemes in the least cost plan and the inclusion of 89 additional schemes. The remaining 802 schemes selected in the least cost plan are also present in the best value plan, either at the same time (majority of cases) or at slightly different times.

Table 17.5: Summary of options selected in the least cost plan compared to the best value plan

Summary of option comparison:	Count
Options selected only in the Best Value Plan:	89
Options selected only in the Least cost Plan:	34
Options selected in both models at the same time:	602
Options selected in both models at different time:	200

17.38 The 89 unique schemes selected in the best value plan which were not selected in the least cost plan are shown per option type in Table 17.6 below:

Table 17.6: Breakdown per option type of the 89 unique options selected in the best value plan which were not selected in the least cost plan

Row Labels	Count of Name
Bulk transfers into region (raw)	1
Bulk transfers within region (raw)	1
Bulk transfers within region (treated)	3
Catchment management schemes - Integrated catchment management	67
Desalination	3
Distribution capacity expansion	3
Increase water treatment works (WTW) capacity	1
Increase water treatment works (WTW) efficiency	2
New reservoir	3
Potential Transfer Resource (Treated)	1
Reclaimed water, water re-use, effluent re-use	4
Grand Total	**89**

17.39 The main difference between the least cost plan and the best value plan is that the best value plan selects significantly more catchment management schemes, albeit that they are introduced at the end of the planning horizon. These schemes should be further investigated by companies, in collaboration with landowners and environmental organisations, to see if they could add additional value to the plan.

17.40 The key difference in the selection of SROs between the least cost plan and best value plan is the size of the GUC transfer scheme, which was 50 Ml/d in the least cost plan and is 100 Ml/d in the best value plan. The overall size of the GUC transfer scheme in the draft regional plan was also 100 Ml/d, however it was split into 2 phases. In the revised draft regional plan best value plan, the GUC transfer scheme is 100Ml/d but selected in a single phase.

17.41 The best value plan process for the revised draft regional plan has confirmed that, as for the draft regional plan, regional plans which select SESRO are cheaper and achieve better overall scores against the best value plan metrics. For the draft regional plan, plans with the 100 Mm^3 and 150 Mm^3 size variants were extremely close in terms of their performance against best value metrics, however the plan with the 100 Mm^3 reservoir was considered

to be slightly better value. For the revised draft regional plan, it has been demonstrated that the plan with the SESRO at 150 Mm^3 provides better overall best value plan scores compared to plans with the 100 Mm^3 and 125Mm^3 size variants.

17.42 The plan with the 150 Mm^3 SESRO size variant outperforms plans with other size variants of SESRO for the resilience and SEA benefit metric scores. This indicates that the plan with the 150 Mm^3 SESRO reservoir proposal is more resilient and better able to adapt and evolve to future challenges compared to plans with a smaller SESRO reservoir selected.

17.43 Whilst the individual metric differences are still relatively small, the overall cumulative impact of the metric scores leads us to a regional plan with the SESRO reservoir proposal at 150 Mm^3, as it offers better value than the plans with the other smaller sizes of the SESRO reservoir proposal. In addition, plans with the larger SESRO size variant can support more water resources zones with the delivery of their sustainability reductions, provide water to five of the six companies in the South East, add additional flexibility across the network, continue to support the delivery of sustainability reductions across a number of water resource zones, and help to off-set the need for larger scale desalination and water recycling schemes in London in different future scenarios.

17.44 The larger SESRO size variant is also more adaptable to manage risks relating to underperformance of the demand management strategies, including the Government interventions, and provides time for the region to develop alternative solutions should key policies fail to be delivered.

17.45 The cost difference between the least cost plan and the best value plan is approximately £203m.This is equivalent to the cost difference that was observed between the least cost plan and the best value plan at the draft plan stage in November 2022.

Known risks in the revised draft regional plan

17.46 There are a number of known risks for the revised draft regional plan which could impact the size of strategic schemes selected in the plan. In order to understand these impacts, WRSE has undertaken significant sensitivity testing in the investment modelling.

Demand management:

17.47 If Government under-deliver against the anticipated demand management interventions, then companies would have to develop further solutions to meet their supply duties in the future. This is also the case if companies do not to see the expected savings from implementing their planned demand management strategies.

Thames Water schemes:

17.48 There are a number of scheme-related risks for Thames Water, which have been tested in the investment modelling to understand implications for the selection of strategic schemes in the regional plan.

17.49 The Environment Agency have asked Thames Water to investigate the impacts of the West Berkshire Groundwater Scheme (WBGWS) being taken offline in 2060 – a potential loss of 60Ml/d for Thames Water. The Environment Agency have also asked Thames Water to test earlier dates for the potential loss of the scheme – in 2040 and 2050.

17.50 In recent drought situations, notably the 2022 drought, levels in the Lower Thames reservoirs have fallen more quickly than is predicted in hydrological modelling, due to constraints on abstraction. This implies a potential risk to London's Deployable Output (DO). The Environment Agency's River Thames Flood Alleviation Scheme (RTS) would exacerbate these issues and could lead to a potential loss of 86 Ml/d (1 cumec), if it is constructed, from 2030 onwards (i.e. the date it is currently planned for).

17.51 A number of the existing raw water storage reservoirs and associated infrastructure in the Thames Valley and Lee Valley is ageing (some is over 100 years old). Availability of all the existing storage reservoirs are critical for Thames Water to be able to maintain supplies during droughts, and there is a growing risk of assets being out of service for an elongated period of time due to both planned and unplanned maintenance.

Potential scheme exclusions:

17.52 WRSE has reviewed the risks around particular schemes being excluded, should they be deemed infeasible in the future.

17.53 WRSE has tested the following schemes being excluded, and reviewed the impacts to the plans and which schemes are selected as alternatives: SESRO, STT transfer (both the full scheme and the Minworth support element only), Teddington DRA, Beckton Desalination and the Hampshire Water Transfer and Water Recycling proposal.

Benefits of a plan with the 150 Mm³ SESRO size variant to mitigate against these risks

Demand management:

17.54 The delivery of government demand management interventions has been tested in the investment modelling through different scenarios. The revised draft regional plan best value plan uses the Gov-led C+ profile, which supports all six water companies to meet the PCC target of 110 l/p/d by 2050, but WRSE has also tested a scenario for under-delivery by Government, i.e. what happens if Government go no further than the current commitment of water labelling. This is modelled in the Gov-H scenario. The Government-led demand savings in Gov-led C+ provide over 400 Ml/d of water towards the future baseline deficits.

17.55 If Government do not implement the assumed water efficiency policies, then the companies would have to develop further solutions to meet their supply duties in the future. This additional cost would increase the cost of the plan by approximately £2bn, but the core schemes at the beginning of the plan remain the same. Additional schemes selected include the STT transfer proposal, desalination options and water recycling schemes. The scale of these additional interventions depends on the size of the SESRO reservoir proposal selected; the larger reservoir size variant offsets the need for approximately 100 Ml/d of additional capacity, which is equivalent to an SRO-type scheme.

17.56 Under the Gov-led H scenario, solutions with the SESRO reservoir proposal at 100 Mm³ or 150 Mm³ provide marginally more cost-effective solutions compared to the 125 Mm³ size variant. The plan with SESRO at 150 Mm³ provides better best value plan scores compared to plans with smaller SESRO size variants.

17.57 In all three Gov-led H runs with the SESRO reservoir proposal at 100 Mm³, 125 Mm³ and 150 Mm³, the STT transfer proposal must be developed to support the regional plan. In the solution with SESRO at 150 Mm³ the regional plan does not rely on the STT Minworth proposal for support – in the solutions with SESRO at 100 Mm³ and 125 Mm³ the reliance on Minworth for the STT transfer proposal is required. The ability for Minworth to provide output to support both the GUC transfer proposal and the STT transfer proposal without having a detrimental impact on the low flows in the River Trent remains a significant uncertainty (an issue raised in regulators comments on the draft regional plan). Therefore, the SESRO reservoir proposal at 150Mm³ would provide additional resilience to mitigate this risk.

17.58 The plan with SESRO at 100 Mm³ solution provides very little time between the Government implementing a policy change and having to start the construction of the STT transfer proposal, albeit just for the transfer and support options, whereas plans with SESRO at 125 Mm³ and 150 Mm³ both provide a clear window before the STT transfer proposal needs to be developed. This is beneficial as it enables companies more time for developing schemes before they are required.

17.59 The SESRO reservoir proposal is shared primarily between three companies: Thames Water, Affinity Water and Southern Water. However, South East Water receive a supply via the Thames to Southern Transfer (T2ST) SRO during peak summer demands and Portsmouth Water receive a supply of water from Southern Water via the T2ST in an average year. Under the Gov-led H scenario, SESRO 150 Mm³ could also be used to support Portsmouth Water via a further transfer from Southern Water, although this would only be required towards the end of the planning period.

17.60 Thames Water would receive water from SESRO into its SWOX, SWA, Kennet Valley and London water resource zones. The volume of water which each company requires from SESRO will vary on an annual basis, and depending on whether it is an average year, a dry spell or an extreme drought scenario. This annual variation in the allocation of resources will require a very flexible contractual supply contract which will allow trading between the parties.

Thames Water schemes:

17.61 The interconnectivity in the South East has not significantly changed from the draft regional plan. Water is allocated to different demand areas from the SESRO reservoir proposal depending on the size variant selected in the plan. Smaller size variants of SESRO typically do not allocate water to London during an extreme drought. Instead, London is supported by the selection of an additional desalination or water recycling scheme. This introduces a risk to Thames Water in later years of the plan, particularly if the Thames Water scheme risks identified above materialise – i.e. the West Berkshire Groundwater Scheme is taken offline, the River Thames Flood Alleviation Scheme impacts the available water, or the raw water storage reservoirs are taken offline for maintenance.

17.62 Plans with the larger sizes of the SESRO reservoir proposal, 125 Mm^3 or 150 Mm^3, are capable of supporting London throughout an extreme drought from 2040 onwards. The additional capacity from a larger reservoir could also allow Thames Water to accelerate their sustainability reductions in various chalk streams, and potentially accommodate an earlier loss of the West Berkshire Groundwater Scheme in 2040 or 2050.

Potential scheme exclusions:

17.63 The exclusion of additional schemes adds to the costs of the plan as more solutions are required. The excluded schemes include:

- SESRO reservoir proposal
- STT transfer proposal (both the full scheme and the Minworth support element only)
- Teddington DRA transfer proposal
- Beckton desalination proposal
- Hampshire Water Transfer and Water Recycling proposal

17.64 The additional solutions required for the smaller SESRO size variants mean that London is reliant on additional SRO schemes such as the STT transfer proposal and/or Beckton desalination proposal.

The Severn Thames Transfer proposal

17.65 The Severn Thames Transfer (STT) proposal represents a strategic resource option that facilitates the transfer of water from the River Severn to the River Thames. This would be supported by several sources of water[42] from United Utilities and Severn Trent.

17.66 During the development of the draft regional plans and draft WRMPs, the STT proposal was selected as part of the WRSE regional solution, in conjunction with other schemes, in 2050. This was also reflected in WRW's plans.

17.67 Whilst the STT transfer proposal featured in both regions' draft preferred plans, a series of sensitivity tests at the time showed that the STT transfer proposal could be selected as early as 2039, if SESRO could not be developed, or if not at all the government water efficiency policies resulted in a lower demand forecast due to increased water efficiency.

17.68 In March 2023 the regional reconciliation process began its third round. At this time, none of the regions had finalised a preferred revised draft regional plan. Therefore, sensitivity runs were undertaken to explore what might happen under certain scenarios. This scenario modelling used the updated STT transfer proposal data, however some of the other available information and data regarding STT in the WRSE model was based on the draft plan.

17.69 The scenario testing approach confirmed that if the WRSE companies met the 110 l/h/d PCC target by 2050 then the STT transfer proposal was not

[42] *The North West Transfer enabling use of Vyrnwy Reservoir, and recycling water from Minworth and Netheridge.*

selected in the reported pathway (preferred plan). Sensitivity tests also confirmed the need for the STT transfer proposal in scenarios without SESRO or with government water efficiency interventions not reducing demand to the levels anticipated. Therefore, the need for the STT transfer proposal inclusion in an adaptive plan was confirmed. Given that the revised draft plan was still under development for WRSE, but we knew that the revised regional plan would seek to achieve the 110 l/h/d PCC guidance target, the more likely scenario was that the STT transfer proposal would not be required in the preferred plan for WRSE or WRW. This was the agreed outcome of reconciliation for inclusion in the revised draft WRMPs, which includes adaptive pathways to deal with potential changes.

17.70 Although water companies are working towards mitigating known risks through their plans, they are also influenced by factors outside of their control. It is therefore reasonable to plan on the basis that there is a likelihood of these risks occurring. The adaptive pathways recognise different potential outcomes. In either case, there is a need to progress development of the STT transfer proposal system[43] in the next 5 years so it can be delivered by 2039 if required.

17.71 As the regional plans continue to be developed the risks associated with the promotion of certain schemes or delivering the water efficiency targets, set out in the Environment Improvement Plan, remain. Both WRSE and WRW have developed a series of adaptive regional plans to help offset some of this risk.

17.72 The adaptive regional plans consider three scenarios:

- benign scenario in which schemes and assumed savings from water demand reduction measures are delivered (this is aligned to the reported pathway/preferred plan)
- a short term adverse scenario in which preferred supply options aren't delivered and the STT transfer proposal is then required to be developed and operational by 2039/40; and
- a long term adverse scenario in which the projected demand management savings do not materialise and additional water from the STT transfer proposal is required by 2050.

17.73 Through this approach both regions monitor the delivery of the schemes and benefits of their plans to understand if their plans are still on track or whether they need to adapt to one of the scenarios above.

17.74 For the regional plans to remain flexible and adaptive it is critical that key schemes are progressed in a timely manner. In the case of the STT transfer proposal and the potential for it to play a part in the short term adverse scenario this would require development of the scheme to continue over the next AMP period (2025 to 2030) and through the next Gate in the RAPID gated process to provide confidence that the scheme could be utilised when required. Proposed milestones are under development and in discussion with RAPID to be reflected in future Gate submissions.

17.75 Therefore, both regions and relevant companies are promoting the continued development of the STT transfer proposal system in their WRMPs, regional plans and business plans to provide confidence to regulators and the Secretary of State that their plans are robust and can adapt to meet their statutory duties in the future. Wording to explain this approach is being included within relevant regional plans and company WRMPs, to demonstrate alignment of the companies and regions on this need to solve national water resources risks identified in the National Framework.

Draft regional plan consultation responses

17.76 WRSE published and consulted on the draft regional plan in November 2022. WRSE has carefully considered the consultation responses received, and the feedback has informed ongoing work to revise and update the regional plan. This work has resulted in a revised draft regional plan being prepared and published alongside the draft regional plan Consultation Response Document.

[43] *STT System includes the STT and the sources that feed water to the STT, namely Severn Trent Sources (Netheridge), Minworth and the North West Transfer. Changes to the flow regime in the Severn catchment due to releases, interactions with the Severn Regulation Scheme, a bypass pipeline for the Afon Vyrnwy and system operation are within the scope of the STT project.*

17.77 In its draft regional plan consultation response, the Environment Agency (EA) made a number of recommendations for WRSE to consider in order to ensure the regional plan is robust. This included: reviewing long-term demand management ambition and mitigation for uncertainty in delivery of short-term demand reductions; revisiting the justification for the size of the SESRO reservoir proposal; taking account of any benefits of earlier delivery of environmental ambition and public water supply resilience that may be provided by a larger SESRO reservoir proposal and ensuring that the final regional plan is best value for the region (summary of recommendations in Section 2, p 6-7 of the EA's response to the WRSE draft regional plan).

17.78 To meet these recommendations, WRSE has undertaken further investment modelling, and undertaken more sensitivity tests to ensure the outcomes of the programme appraisal are well understood and well evidenced. This includes reviewing the investment modelling runs with the various sizes of the SESRO reservoir proposal and understanding the performance of plans with different sizes of the SESRO reservoir proposal with respect to cost and best value metrics.

17.79 In the draft regional plan consultation, WRSE received comments from stakeholders regarding the environmental impacts of the different sizes of the SESRO reservoir proposal, commenting that the larger reservoir would have more negative environmental impacts compared to a smaller reservoir.

17.80 WRSE has undertaken environmental assessments to support companies' statutory WRMP requirements for environmental assessments, as set out in our method statements, and detailed in the environmental report for the draft regional plan. There are four summary environmental metrics which companies submit for each option, which are used in the best value planning programme appraisal. These are the Strategic Environmental Assessment (SEA) Benefit, SEA Disbenefit, Biodiversity Net Gain (BNG) and Natural Capital metrics. Table 17.7 below shows the detail, components and units of these different metrics.

Table 17.7: Best value plan environmental metrics

BVP Environmental Metric	Detail / Components
SEA Benefit	Metric is summary of 14 sub-metrics, with a total score between 0 and 99. SEA benefit metric scores are provided pre- and post-mitigation. The post-mitigation scores have been used in the BVP programme appraisal. The 14 sub-metrics are: air; biodiversity, flora and fauna; carbon; climatic factors; flood risk; historic environment; landscape; material assets; minimise waste; population and human health; soil; tourism and recreation; water resource; water supplies.
SEA Disbenefit	Metric is summary of 14 sub-metrics, with a total score between -99 and 0. SEA disbenefit metric scores are provided pre- and post-mitigation. The post-mitigation scores have been used in the BVP programme appraisal. The 14 sub-metrics are: air; biodiversity, flora and fauna; carbon; climatic factors; flood risk; historic environment; landscape; material assets; minimise waste; population and human health; soil; tourism and recreation; water resource; water supplies.
Biodiversity Net Gain	Metric is the number biodiversity net gain (BNG) units from an option, between -10,000 and 10,000.
Natural Capital	Metric is a summary of six sub-metrics, with the unit of cost per year (£/year). The six sub-metrics are: air pollutant removal; carbon storage; food production; natural hazard management; recreation and amenity value; water purification.

Summary of WRSE decision making

17.81 Based on the outcomes from investment modelling and the decision-making undertaken, WRSE has determined that the best value plan model run with the SESRO reservoir proposal at 150Mm^3 is the preferred programme for the revised draft regional plan.

17.82 Best value plan model runs with the three different size variants of the SESRO reservoir proposal all produce viable solutions to the regional challenge, however the best value plan with the SESRO reservoir proposal at 150 Mm^3 produces better average best value plan metric scores, and is more resilient to dealing with known potential future risks. In all cases, the SESRO reservoir proposal is fully utilised by 2050 which indicates that the reservoir

would be fully utilised early on in the planning period and no later than ten years after it is brought online (this is ten years into an asset life of 250 years).

17.83 Through the modelling work WRSE has shown that the larger SESRO reservoir proposal size variants (125 Mm^3 and 150 Mm^3) are able to support more water resource zones in a critical extreme dry year. The larger reservoir (150 Mm^3) is able to support the implementation of sustainability reductions quicker than the smaller size variants. This will allow companies to accelerate reductions and protect vital habitats across the South East in a more flexible way. It is also provides greater resilience capability to the operational loss of an existing raw water storage reservoir for planned or unplanned maintenance.

17.84 In all three plans, the GUC transfer proposal remains selected at 100 Ml/d which is critical for Affinity Water to provide a robust plan to minimise the additional demand for water from other companies should Government fail to deliver against their commitments, or if one or more of the other risks materialise. If none of the risks materialise then the need for companies to depend on drought orders and permits in the future reduces, as will the need to rely on TUBs and NEUBs. It will also provide an opportunity to deliver some environmental ambitions slightly earlier for some key catchments.

17.85 The principle of this strategy is to develop the SESRO reservoir proposal to the largest size possible at the site, which is currently 150 Mm^3. If further detailed designs and sites investigations reduce this capability, then the scheme should still be developed based on this principle.

17.86 WRSE considers that the additional work undertaken between the draft regional plan and revised draft regional plan addresses regulator and stakeholder comments regarding the decision making around the size of the SESRO reservoir proposal, and that the environmental assessments undertaken demonstrate that the environmental impacts of the different size variants of the reservoir have been appropriately incorporated into the best value planning process.

17.87 The investment modelling undertaken for the revised draft regional plan has demonstrated that the SESRO reservoir proposal at 150Mm^3 is selected in the reported pathway for both the least cost plan and the best value plan.

17.88 The larger reservoir has also been demonstrated to be the most resilient size variant to manage known future risks, particularly risks from under-delivery of Government demand management interventions and uncertainty around the continued availability of existing schemes. This review of resilience aligns with EA expectations set out in their consultation response to the draft regional plan and WRMPs.

Sensitivity Testing

Achieving policy expectations

17.89 As part of the investment modelling for the draft regional plan and revised draft regional plan WRSE has explored many different combinations of policies, and timings for achieving key objectives including drought resilience. The conclusion of this work was our decision to base the revised draft regional plan on:

- Achieving the 1:500 year drought resilience by 2039/40
- Government water efficiency policy C+ (meeting Government ambition for leakage and water efficiency, including Environmental Improvement Plan interim targets)
- The inclusion of TUBs and NEUBs, which is in line with company drought plans
- The inclusion of less environmentally damaging drought permits up until the time we achieve the resilience standard of 1:500 year

17.90 Taking account of consultation feedback, and the potential for key policy decisions around drought resilience and PCC to influence cost and scheme selection in the regional plan, we have considered the sensitivity of the plan to the following policies:

- **The year in which we achieve the 1:500 year drought resilience**. These runs consider whether changing this date changes the plan, and have

been undertaken due to a specific request from regulators. These sensitivity runs also consider the use of drought orders and permits. In the emerging regional plan, we included a policy that when the 1:500 year drought resilience standard is reached, the use of these drought orders and permits would stop in the following year. Whilst this approach was broadly supported, regulators and stakeholders wanted to understand how this cessation policy impacted the plans. We have undertaken a number of investment model runs to show the impact.

- **Per Capita Consumption (PCC)** - Each of our six member companies have put forward a number of potential demand reduction policies, at each WRZ, to meet leakage targets and reduce PCC. To complement these strategies, we have developed a series of Government-led interventions which complete the companies' strategies to try to meet the national PCC ambition of 110 l/p/d by 2050. Individual company ambitions have been combined with one of the Defra demand management policies into a regional PCC outcome which supports the broader ambition of the Government. Sensitivity runs around this PCC outcome have been undertaken.

17.91 By assessing the results of these sensitivity runs we can explore the impacts of the different policies and timings on the regional plan, including best value metric scores, the cost of the plan, and key schemes selected. These results are explored in the sections below.

Testing when we achieve the 1 in 500 year drought resilience:

17.92 The Water Resources Planning Guideline sets out the Government expectation that water supply systems should become more resilient in the future. This has a number of components:

- The aim should be to achieve the 1 in 500 year resilience in the financial year starting in 2039, or before
- Optimum timing for achieving this, considering the costs and benefits of alternative approaches, should be explored
- Some flexibility in the timescales for achieving a resilience of 1 in 500 year is possible, where costs are exceptionally high locally in comparison to benefits
- Where more flexibility is considered appropriate, meeting a 1 in 500 year by 2050 scenario should be presented
- Whilst in the short term, the increased use of drought management options can be considered, these should not be relied on in the medium to longer term

17.93 The companies used simulation models to determine the deployable output of their systems under different drought events including the 1:500 year drought. This analysis was also used to determine the output from resource options. Based on this information WRSE explored the impacts on the regional plan moving all of the companies to this 1:500 year drought resilience standard at the same time.

17.94 The supply forecast profiles reflected the company's current drought resilience standard, any agreed future improvements (Thames Water moving to a 1:200 year standard by 2032) and then moving to the 1:500 year standard by 2040.

17.95 When testing different timings for the resilience standard we moved the 1:500 year standard to a later date of 2045 or 2050 instead of 2040, and also tested an earlier date of 2035. These were not the only changes to the supply forecast, as we also had to account for climate change. Therefore, the supply forecast used in the investment model reflects a composite of current resilience standards, climate change impacts; and a step transition to the 1:500 year drought resilience standard.

17.96 At the draft plan stage WRSE tested achieving this level of resilience in 2035; 2040; 2045 and 2050. Meeting the standard earlier requires more infrastructure to be developed in order to meet the shortfall so there are increased pressures on customer bills in the short term. Delaying improving the resilience of the system increases the likelihood of customers and industry being impacted by these severe droughts. At the draft regional plan, we set out that achieving this standard by 2040 in line with government expectations. By achieving this standard by 2040 customers and the environment should see less reliance on drought permits and orders after the first 15 years of the plan, such that the likelihood of being impacted by certain events reduces as set out in Table 17.8 below:

Table 17.8: Comparison of cost of achieving drought resilience

Drought intervention	Current	BVP
Temporary use ban (TUB)	99.48%	97.04%
Non-essential use ban (NEUB)	63.58%	48.88%
Environmental drought order / permit	46.68%	18.23%
Extreme drought & drought plan interventions	9.53%	2.96%

17.97 We have updated the analysis we undertook at the draft plan stage, and we still conclude that meeting this standard of resilience by 2040 represents the best timing.

17.98 The updated analysis shows that moving the design standard back to 2045 or 2050 does not delay the need for key strategic schemes to be constructed, it merely delays their full utilisation as a number of these schemes are required to deliver environmental protection. Therefore, the trigger for the infrastructure being developed to is either or both to protect customers and the environment and moving the resilience standard back to 2045 or 2050 does not negate the environmental need.

17.99 The sensitivity run where the resilience standard was brought forwards to 2035 has similar schemes selected compared to the run with the 2040 resilience date, but was more costly as the schemes were accelerated.

17.100 The cost of the plans achieving the different levels of resilience are as follows:

- 1:500 yr. by 2035 situation 4: £19,871m
- Least Cost Plan situation 4: £19,052m
- Best Value Plan situation 4: £19,255m
- 1:500 yr. by 2045 situation 4: £19,322m
- 1:500 yr. by 2050 situation 4: £19,293m

17.101 It can be seen from the model runs that delaying the resilience standard increases the overall cost of the plan as additional schemes have to be brought online. The differences between situation 4 in the least cost plan and the best value plan and the delayed drought resilience plans is GUC and the timing of some schemes. In the least cost plan, GUC is 50 Ml/d but in the best value plan and delayed resilience plans the GUC transfer proposal is selected at 100 Ml/d across all 9 branches. This in itself will cause an increase in the costs. The other minor costs differences are due to different timing of schemes which are accelerated by 2 years. The conclusion of this analysis is that achieving the drought resilience by 2040, in line with the WRPG, is more cost effective than delaying achieving this standard.

17.102 To be clear, Temporary Use Bans (TUBs) and Non- Essential Use Bans (NEUBs) will still be required in the future, but the need for more drought permits to abstract more water from the environment during droughts or water rationing during the next 50 years will be significantly reduced.

Testing different levels of PCC:

17.103 The second key policy area that we have tested sensitivity around is how the combination of Government interventions and actions by the water companies could drive the PCC down within the region, supporting the Government's ambition of achieving 110 l/p/d in a dry year across all five regions in England by 2050.

17.104 WRSE has considered a range of possible policies and the timing of their introductions. The policies are designed to introduce water labelling; standards for water fittings; building regulation standards and further Government campaigns to promote water efficiency. We grouped these activities into three levels of interventions by the Government, resulting in either a low, medium, or high level of water efficiency reductions at a per person or capita level. These three levels of interventions were then applied over the planning period in different ways to generate a series of "Government Intervention" profiles, which have been labelled Government Intervention A through to Government Intervention H. In addition to these demand management strategies, we also considered an additional two scenarios: low only (based on Government only adopting water labelling) and no Government scenarios (based on no Government interventions being adopted).

17.105 For each of the Government intervention policies we used our investment model to generate a cost-efficient strategy to meet the future deficits in the region. This provided an objective understanding of the impact these policies could have on investment plans, but it also highlighted the risk that arises if these objectives are not fully achieved by Government intervention. This is as the benefit from some of the policies are greater than the output from one or more strategic resource options, i.e. there is a risk of reliance on Government to implement these interventions to create demand savings, as any shortfall in supply would have to be met by one or more large water company schemes.

17.106 For the emerging and draft regional plan we discussed the potential use of several different Government intervention strategies with regulators and Defra and at the time, "Hybrid scenario B" was selected as it represented a scenario that had the lowest risk of overestimating the savings that would be delivered through Government interventions. The phased introduction of the low, medium and high policies would give successive Governments time to introduce these policies, but at a rate which balances the risks of public water supply and their statutory duties against progressive improvement in water efficiency delivered throughout 10 or more Government terms.

17.107 Since the draft plan, a new Water Resources Planning Guideline and the Government's Environmental Improvement Plan have been published. These documents set out a higher expectation to save and conserve water over the planning period of the regional plan. The new targets include interim expectations for companies in 2038 as well as 2050.

17.108 In light of the new targets, we have updated the government profiles, in particular the government C profile, and companies have updated their demand management and leakage options for the revised regional plan. Following these updates, we have tested the impact these different policies to understand the impact they have on investment strategies and in particular to understand if they meet the Government's ambition of achieving PCC and leakage targets by 2038 and 2050, especially the 110 l/p/d in a dry year for all across all six companies in the South East of England by 2050.

17.109 Whilst many of these policies have remained the same, we have explored varying the timings of implementing the high, medium and low strategies set out in the Government C profile. This variation coupled with the updated demand management and leakage strategies allows the companies to meet the EIP aspirations set out by the Government.

17.110 Table 17.9 below sets out the different Government interventions that have been modelled; summarising the impact each of the policies have on the cost of the plan and the savings they could generate by 2050. It also sets out if the plans that were generated had any deficits in them and what their best value plan score was. Plans which contain deficits are not compliant with guidance and the average cost of the plans are not as optimal, but they are still indicative.

Table 17.9: Costs and savings associated with Government interventions

Government policy	Did the plan contain deficits?	Cost (£'m)		Savings Ml/d)			BVP score
		Average cost	Situation 4 cost	2030	2040	2050	
Government A scenario	*Deficit*	£19,355	£22,388	44	141	150	58.61
Government B scenario	*Deficit*	£19,355	£22,388	44	141	150	58.61
Government C+ interventions	*No deficit*	£17,666	£19,052	45	315	569	64.86
Government D scenario	*Deficit*	£19,046	£21,577	44	141	250	62.24
Government E scenario	*Deficit*	£18,642	£20,552	44	188	300	68.51
Government F scenario	*Deficit*	£19,294	£21,574	-	94	250	59.09
Government G scenario	*Deficit*	£18,951	£20,706	-	94	350	63.9
Government H scenario – with increased transfer	*No deficit*	£18,940	£21,687	44	141	150	63.45

17.111 It is also worth noting that the cost of implementing the government policies is assumed to be carried by the Government and through the other supply chains that will deliver them. For example, more water efficient washing machines will be reflected in the price of the good rather than on the water bill.

17.112 There are several key points to note in the table above. Government scenario C+ not only produced the cheapest overall plan but also it did not contain any deficits. This plan delivered the most savings by 2050 and relied on the implementation of all the Government policies (water labelling, water

fittings, water efficient new homes, and promotional campaigns) by 2035. The combination of these government interventions and the company's leakage and demand management strategies meant that the companies could meet the PCC and leakage targets in 2050. None of the other government interventions combined with the company strategies could meet the proposed EIP targets.

17.113 Government Interventions A, B, D, E, F and G all had deficits. In our scenario testing Government H also had a deficit but this was resolved with an increased transfer from Thames to Southern and then on to Portsmouth Water. To achieve this the pipeline capacity of the Thames to Southern Transfer would have to be increased from 120 Ml/d to approximately 160 Ml/d.

17.114 We have completed several additional investment models runs investigating how the plan would adapt if the only Government intervention that was delivered was water labelling. This Government H profile details what Defra have commitment to deliver before 2025. Several sensitivity tests were completed to ensure that the revised regional plan could adapt for such a scenario which is prudent given that this is the only time bound commitment that Defra and Government have made. In each of these sensitivity tests the preferred regional plan could adapt, albeit that the additional infrastructure required would increase the costs of the plan by around £1.5bn to £2bn.

17.115 Based on our analysis, Government intervention policy C+ is now the best policy for the regional plan as it allows the EIP targets to be met whilst delivering the most cost efficient plan that meets the government guidance and targets. cheapest remains the selected policy for the draft regional plan.

Core schemes selected in investment model runs for the regional plan

17.116 WRSE has published three regional plans to date: an emerging plan for consultation, a draft plan for consultation and the revised draft plan. Each of these plans have been derived through an investment model run which determines investment strategies that adapt to meet the future challenges the South East of England faces. All the plans feature demand management and leakage reduction schemes as part of their core strategy in order to meet regulatory and Government expectations.

17.117 WRSE has undertaken numerous investment model runs to understand and test how well different plans perform, as defined by the best value plan metrics, or what happens if certain schemes are not allowed to be developed. We have also explored what happens if schemes are delayed or cost more than expected. These scenarios and sensitivity tests help us determine which schemes are core to the regional plan.

17.118 During the development of the emerging regional plan, we completed 41 investment model runs to help inform the selection of the emerging plan. These sensitivity tests and runs provided good insight into the selection and use of key schemes, and showed how the water from these schemes could be shared across the region. We described this in our emerging regional plan documentation.

17.119 There were several key points that came from this early modelling work. Schemes in the regional plan were shared across the region leading to more connectivity between water resource zones and companies. Some external transfers into the region provided solutions which were always selected across all the adaptive planning branches, such as the GUC transfer proposal. Other transfers into the region, such as the STT transfer proposal, formed part of an adaptive strategy to help meet future challenges, and were selected in many investment model runs, but not many of the adaptive plan branches.

17.120 At the emerging plan stage schemes such as the SESRO reservoir proposal, STT transfer proposal through a piped connection, Broad Oak reservoir; the River Adur Offline Reservoir, Beckton water recycling and the Hampshire Water Transfer and Water Recycling Project were selected.

17.121 Following the consultation on the emerging plan, we changed the adaptive plan tree by bringing forward the branch points to align with key triggers. We also updated scheme information and costs to reflect the continued options appraisal work and SRO development through RAPID's Gated process. To help derive the draft regional plan we undertook and completed

a further 129 investment model runs, each run containing 9 situations. Many of these runs solved the future range of supply demand balances that the region faces. When we excluded key options or transfers, we found some deficits would occur.

17.122 All this information helped understand the robustness of the draft regional plan and again which schemes were selected in the majority of runs and across the majority of solutions or which were the adaptive solutions to help build on a core set of schemes. We published these runs at the time of the draft plan consultation and described the preferred regional plan and the reported pathway.

17.123 WRSE has now reviewed the consultation feedback and customer feedback from the draft regional plan consultation. We have updated the population forecasts, scheme information and costs, demand forecasts, revised the environmental destination profiles and updated demand management options to meet Defra's Environmental Improvement Plan national commitments. This sets a new baseline for the region, and WRSE has completed a further 150 investment model runs to inform the selection of the revised draft regional plan.

17.124 When selecting plans, the performance of individual plans are appraised through review of the best value plan metrics to understand which schemes get selected as part of an adaptive strategy or part of a core strategy. WRSE has focussed on the following schemes in our analysis, as they have attracted the most regulator and stakeholder interest during the consultations:

- SESRO reservoir proposal (SESRO)
- STT transfer through a piped connection (STT-Pipeline)
- STT through the canal (STT-Canal)
- Grand Union Canal transfer (GUC)
- Teddington direct river abstraction proposal (Teddington DRA)
- Broad Oak reservoir proposal
- Blackstone reservoir proposal
- Beckton desalination proposal
- Beckton water recycling proposal
- Deephams water recycling proposal
- Hampshire Water Transfer and Water Recycling Project

17.125 Figure 17.3 below shows a summary of the analysis undertaken, showing key investment model runs completed for the draft and revised draft regional plans. The scatter plot shows the percentage of runs a scheme was selected in and the percentage of situations it was selected in.

17.126 Schemes in the upper right-hand corner of the graph are schemes which are selected across most of the runs and situations. Those in the lower left-hand corner are schemes which are selected in a few runs and a few situations. The upper left-hand corner represents schemes which are selected in a few runs but across most situations. The lower right-hand corner represents schemes which are selected in most runs but only a few of the situations. The plot could be viewed as having core schemes in the upper right quadrant, adaptive schemes in the lower right quadrant, alternative schemes in the upper left quadrant, and backup adaptive schemes in the lower left quadrant. It should be noted that the scatter plot displays the results for key runs in the draft plan and the revised draft plan.

17.127 We have broken this analysis down further, by repeating the analysis for runs in which schemes weren't excluded or forced in for scenario testing. Other sensitivity runs were included, e.g. schemes being delayed. The scatter plot in Figure 17.4 shows the result of this analysis.

Figure 17.3: Scatter plot showing the percentage of time schemes were selected in different model runs and situations (draft and revised draft regional plans)

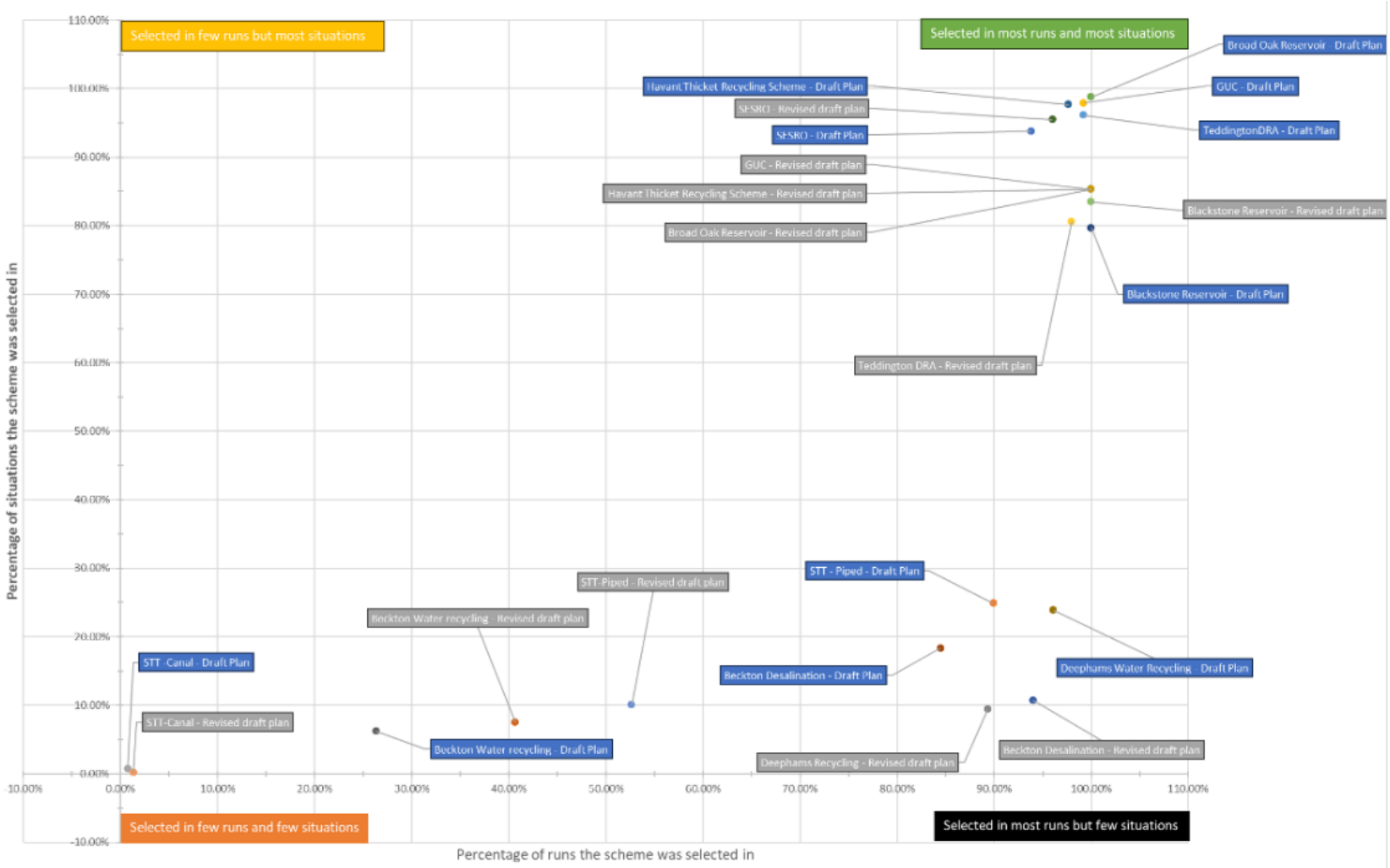
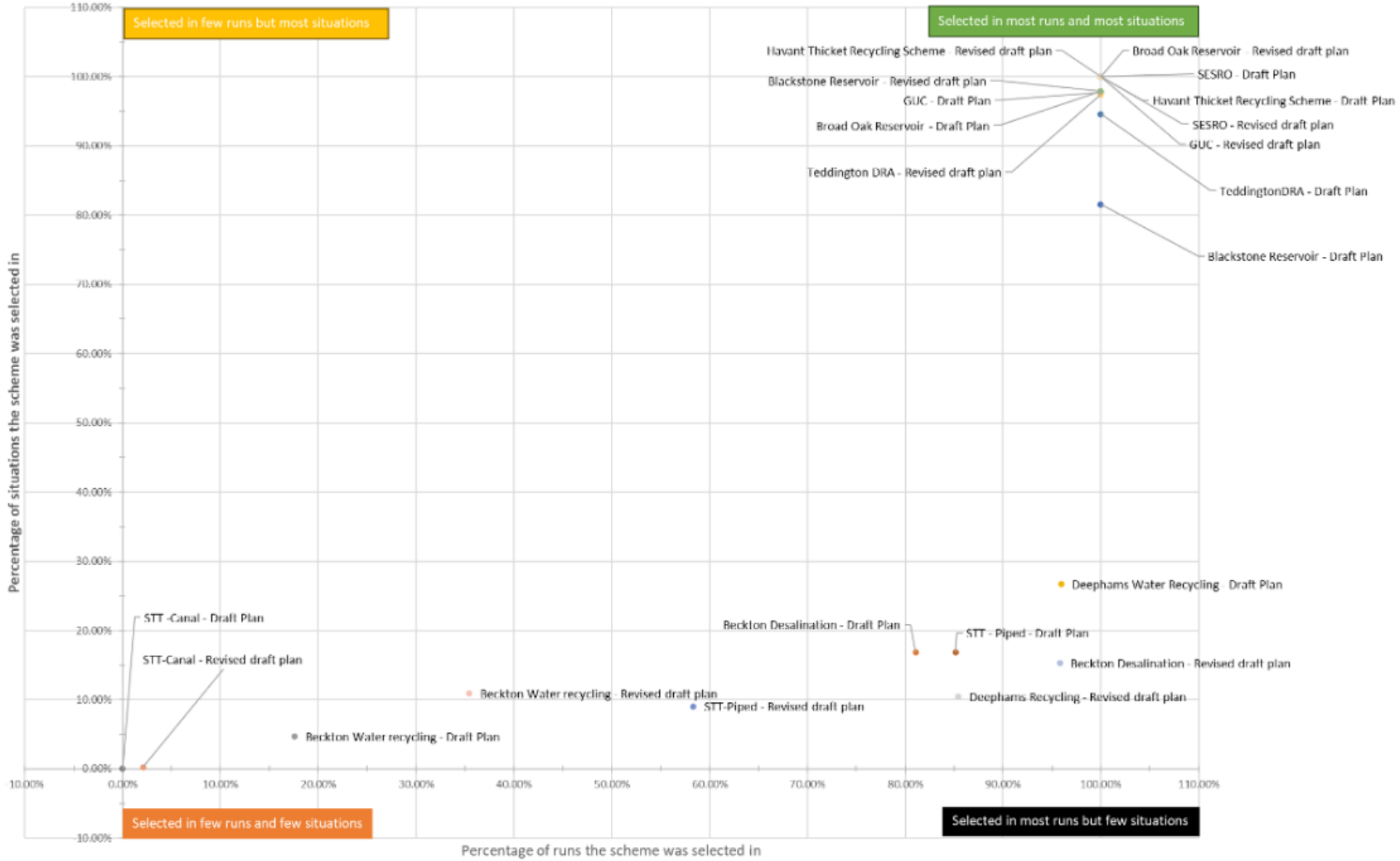


Figure 17.4: Scatter plot showing the percentage of time schemes were selected in investment model runs and situations (draft and revised draft plans) where schemes weren't part of a sensitivity test



17.128 The distinction between the core schemes (upper right quadrant) and the adaptive schemes (lower right quadrant) become more defined. The following schemes remain as core schemes to the plan: the Broad Oak reservoir proposal; Hampshire Water Transfer and Water Recycling Project; the River Adur Offline reservoir proposal; the Teddington DRA proposal; the GUC transfer proposal, and the SESRO reservoir proposal.

17.129 The adaptive schemes (lower right quadrant) are the Deephams water recycling proposal, the Beckton desalination proposal, and the STT Pipeline transfer variation. From an investment modelling perspective, the selection of these schemes are less favoured either due to cost and or the performance of the BVP metrics, and they are not generally selected in investment model runs unless specific sensitivities are being tested.

17.130 This analysis clearly indicates that there are a core set of schemes, which in addition to the demand management and leakage reduction schemes, are selected in the majority of the runs and feature in most of the situations within the runs. This demonstrates that these schemes are core to the regional adaptive plans and set a good foundation from which to adapt from in the future.

17.131 We have included a summary of the scheme selection in the revised draft regional plan investment modelling in Appendix 7 to this plan.

Testing sensitivity around scheme selection, timing and cost

17.132 The comparative assessments we have undertaken enable consideration of the effects that different policy choices and decisions have on the schemes selected by the investment model. We can evaluate if the selection of schemes is influenced by the policy choices and decisions that we take, or whether schemes are consistently selected by the investment model irrespective of the policy choices and decisions we have taken.

Schemes selected under different drought resilience scenarios:

17.133 WRSE has undertaken analysis to determine how the investment model selection of key schemes changes between the different drought resilience scenarios, i.e. achieving 1:500 year drought resilience by 2035, 2040 (as proposed in our best value plan), 2045 or 2050. The analysis demonstrates that adoption of different drought scenarios does not influence the selection of most of the main options that the investment model selects for the plan, with key strategic reservoir, water recycling and water transfer schemes consistently selected.

17.134 The scenario in which achieving the drought resilience was delayed until 2050 had the greatest effect on scheme selection, however, this scenario (and the delay to achieving drought resilience) conflicts with current Government expectations for achieving drought resilience by 2040, and would delay decisions beyond the current branch points in our adaptive plan.

17.135 The investment modelling undertaken for the revised draft regional plan, and comparison of its results does not change the conclusions reached at the draft plan stage.

Schemes selected under different PCC scenarios:

17.136 On a similar basis, for the draft plan WRSE assessed how the investment model selection of some of the key schemes changed with different Government intervention scenarios. The analysis showed that, generally, additional schemes are selected in scenarios with lower savings from Government water efficiency policies.

17.137 The investment modelling undertaken for the revised draft regional plan, and comparison of its results does not change the conclusions reached at the draft plan stage.

Schemes selected under other investment model optimisation:

17.138 Our least cost plan and best environmental and societal plan are investment model runs where the model is required to optimise selection based on certain criteria. WRSE is required to present these two plans as part of its regional plan to comply with WRPG.

17.139 In addition, WRSE has used the investment model to consider the effects of optimising the regional plan based on other criteria and metrics.

17.140 If the investment model is required to optimise on resilience, natural capital or biodiversity net gain scores, then the model typically selects additional schemes as part of the plan which provide additional capacity, but at an additional cost compared to our best value plan. However, the additional capacity is not required to meet the supply demand challenges that the region is facing, and so this additional investment is otherwise unnecessary.

17.141 If the investment model is required to optimise resilience and environmental metrics at the same time, then there is an inherent trade-off between them, as the model is seeking to optimise resilience (through incorporation of additional capacity) at the same time as seeking to optimise environmental metrics (which are adversely affected by the additional capacity). Our best value plan is considered to perform well against all the best value metrics, and provide a good balance.

17.142 Optimising between carbon and best value plan scores also involves inherent tensions, as optimising on carbon tends to have lower overall best value metric scores. Again, our best value plan provides a good balance between these metrics.

Testing the implications of ruling in or ruling out main schemes:

17.143 We have used investment model runs to explore what the effect on the regional plan would be if key schemes were ruled out, or excluded, and also what effect ruling in schemes which the investment model is not currently selecting would have. This enables comparison of the best value metric performance and costs of alternative potential solutions, providing confidence on the robustness of the best value plan.

17.144 Our assessment concluded that there was a clear consistency between the investment model selection of the main schemes in the plan. The investment model consistently selected these schemes across different model runs. Only if individual core schemes were ruled out (or excluded) from selection was the model then forced to select alternative and additional options, at additional cost and with lower best value metric scores. This again gives confidence in the selection of core schemes within our best value plan.

Testing the sensitivity of the cost and timing of main schemes:

17.145 In addition to the sensitivity testing outlined above, consideration has been given to the costs and timings of schemes selected in the investment model. To assess this, a number of sensitivity runs have been undertaken to explore the effects of increasing the costs of options in the plan, and of delaying the delivery dates of key schemes.

17.146 The investment model consistently selected the main schemes notwithstanding increased costs, or delays to the timing of the schemes, giving confidence that the investment model runs that have been adopted as the basis for the best value plan are robust.

Best value plan comparison

Overview

17.147 This section provides a summary comparison of the best value plan with the least cost plan and the best environmental and societal plan. The data in the tables are based on the reported pathway, which is situation 4 in the adaptive plan. These two alternative plans are specifically required in the guidance in the Water Resources Planning Guideline.

17.148 The least cost plan is the plan which the WRSE investment modelling determines is the least overall cost. The investment model was run to select a least cost plan by only using the cost information to optimise the solution and does not optimise on the best value metrics.

17.149 The best environmental and societal plan is the plan which the WRSE investment modelling determined has the highest metric score when optimised on the environmental and customer preference metrics. It therefore does not try to improve the resilience metric scores in the plans.

Comparison of the three plans

17.150 Tables 17.10 and 17.11 below show how these plans compare against each other in terms of costs and metrics. There is very little difference between

these three plans, both in terms of costs, metrics and strategic scheme selection.

17.151 WRSE is separately publishing comparable summary information from the investment model for the best value plan, the least cost plan and the best environmental and societal plan. This includes tables showing the full set of best value metrics for all adaptive plan pathways within the plans, together with other key model run outputs. This information will be available in WRSE's Library.

17.152 Our best value plan delivers additional value over and above that which would be delivered through our least cost plan. The best value plan achieves greater resilience and overall best value when compared to the best environmental and societal plan.

Comparison of best value and least cost plans

17.153 Table 17.10 below provides comparative cost and best value metric information for the best value and least cost plans.

17.154 The table illustrates that for the reported pathway (Situation 4) whilst the best value plan has a higher cost than the least cost plan, the differential is low – approximately 1% higher cost.

17.155 A comparison of the best value metrics shows that whilst the least cost plan is typically cheaper overall and provides slightly better SEA benefits than the best value plan, it performs worse against all the other best value plan metrics.

Table 17.10: Best value plan and least cost plan comparison

Net Present Value (Cost) (£m)	Best Value Plan (BVP) value	Least Cost Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Cost w/ deficit (STPR)	19255	19052	−203.32	−1.06
Cost w/o deficit (STPR)	19255	19052	−203.32	−1.06
Cost w/ deficit (IGEQ)	28806	28508	−298.78	−1.04
Cost w/o deficit (IGEQ)	28806	28508	−298.78	−1.04
Cost w/ deficit (LTDR)	21121	20898	−222.18	−1.05
Cost w/o deficit (LTDR)	21121	20898	−222.18	−1.05

Environmental	Best Value Plan (BVP) value	Least Cost Plan value	Absolute Difference from BVP	Percentage Difference from BVP
SEA environmental benefit	67933	67149	−784.00	−1.15
SEA environmental disbenefit	97446	99769	2323	2.38
Natural capital	81015364	75242447	−5772917.40	−7.13
Bio-diversity net gain	−199,827	−204,324	−4497.00	−2.25

Social	Best Value Plan (BVP) value	Least Cost Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Customer preference	36555	33042	−3513.00	−9.61

Reliability	Best Value Plan (BVP) value	Least Cost Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Reliability	29	28	−0.94	−3.21
R1: Uncertainty of option supply/demand benefit	6	6	−0.26	−4.53
R3: Risk of service failure due to other physical hazards	7	7	−0.11	−1.63
R4: Availability of additional headroom	7	7	−0.05	−0.69
R5: Catchment/raw water quality risks (incl. climate change)	4	4	0.06	1.46
R6: Capacity of catchment services	0	0	−0.30	−97.40
R7: Risk of service failure to other exceptional events	5	5	−0.15	−2.82
R8: Soil health	0	0	−0.11	−99.84

Adaptability	Best Value Plan (BVP) value	Least Cost Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Adaptability	14	14	−0.19	−1.30
A3: Operational complexity and flexibility	7	7	−0.11	−1.59
A4: WRZ connectivity	8	8	0.01	0.17
A7: Customer relations support engagement with demand managemer	0	0	−0.09	−72.10

Evolvability	Best Value Plan (BVP) value	Least Cost Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Evolvability	20	19	−0.89	−4.54
E1: Scaleability and modularity of proposed changes	9	9	−0.10	−1.18
E2: Intervention lead times	4	4	−0.21	−5.00
E3: Reliance on external bodies to deliver changes	6	6	−0.13	−2.09
E5: Collaborative land management	0	0	−0.45	−98.12

Comparison of best value and best environmental and societal plans

17.156 Table 17.11 below provides comparative cost and best value metric information for the best value and best environmental and societal plans. The best environmental and societal plan uses the environmental metrics (SEA +'ve; SEA –'ve; natural capital; and biodiversity net gain) together with the customer preference metric when trying to improve the overall score of the plan. It does not optimise on the resilience metrics.

17.157 The table illustrates that for the reported pathway (situation 4) the best value plan has a lower cost than the best environmental and societal plan, although the differential is low at approximately 1% higher cost.

17.158 A comparison of the best value metrics shows that whilst the best environmental and societal plan scores better against the SEA benefit metric, the best value plan performs better against the adaptability, evolvability and resilience metrics, providing a more balanced overall plan.

Table 17.11: Best value plan and best environmental and societal plan comparison

Net Present Value (Cost) (£m)	Best Value Plan (BVP) value	Best Environmental and Social Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Cost w/ deficit (STPR)	19255	19383	128.42	0.67
Cost w/o deficit (STPR)	19255	19383	128.42	0.67
Cost w/ deficit (IGEQ)	28806	29165	358.6	1.24
Cost w/o deficit (IGEQ)	28806	29165	358.6	1.24
Cost w/ deficit (LTDR)	21121	21290	169.15	0.8
Cost w/o deficit (LTDR)	21121	21290	169.15	0.8

Environmental	Best Value Plan (BVP) value	Best Environmental and Social Plan value	Absolute Difference from BVP	Percentage Difference from BVP
SEA environmental benefit	67933	68530	597	0.88
SEA environmental disbenefit	97446	102686	5240	5.38
Natural capital	81015364	82655299	1639934.58	2.02
Bio-diversity net gain	−199,827	−172,101	27726	13.88

Social	Best Value Plan (BVP) value	Best Environmental and Social Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Customer preference	36555	36736	181	0.5

Reliability	Best Value Plan (BVP) value	Best Environmental and Social Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Reliability	29	27	−2.47	−8.46
R1: Uncertainty of option supply/demand benefit	6	5	−0.55	−9.45
R3: Risk of service failure due to other physical hazards	7	6	−0.62	−8.83
R4: Availability of additional headroom	7	7	−0.12	−1.77
R5: Catchment/raw water quality risks (incl. climate change)	4	4	−0.10	−2.59
R6: Capacity of catchment services	0	0	−0.30	−97.37
R7: Risk of service failure to other exceptional events	5	5	−0.67	−12.26
R8: Soil health	0	0	−0.11	−99.84

Adaptability	Best Value Plan (BVP) value	Best Environmental and Social Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Adaptability	14	14	−0.75	−5.20
A3: Operational complexity and flexibility	7	6	−0.66	−9.92
A4: WRZ connectivity	8	8	0.01	0.13
A7: Customer relations support engagement with demand managemer	0	0	−0.09	−72.10

Evolvability	Best Value Plan (BVP) value	Best Environmental and Social Plan value	Absolute Difference from BVP	Percentage Difference from BVP
Evolvability	20	19	−0.90	−4.59
E1: Scaleability and modularity of proposed changes	9	9	−0.01	−0.08
E2: Intervention lead times	4	4	−0.20	−4.84
E3: Reliance on external bodies to deliver changes	6	6	−0.24	−3.90
E5: Collaborative land management	0	0	−0.45	−98.12

Finalising the plan, monitoring and review

18. Finalising our regional plan

How we will finalise our regional plan

18.1. The revised draft regional plan is being published for information, and not for a further period of public consultation. The publication of the revised draft regional plan is to support the ongoing and separate statutory processes being undertaken by WRSE's member companies to prepare their individual Water Resources Management Plans (WRMPs).

18.2. Following consultation on draft WRMPs in late 2022 and early 2023, the companies have themselves prepared Statements of Response, identifying the comments received on their draft plans and how the WRMPs have changed as a result. Those Statements of Response and revised drafts of the WRMPs have also now been published by five of the six companies. Details are on their respective websites.

18.3. Affinity Water, Portsmouth Water, SES Water, South East Water and Thames Water have submitted their revised draft WRMPs and their Statement of Responses to Government and will now wait for the Government to indicate whether they can finalise their plans, whether further changes need to be made, or whether a hearing or inquiry into the WRMP is required before finalisation. The five companies expect to hear from the Government before the end of 2023.

18.4. The sixth company, Southern Water, has published its Statement of Response on its website and submitted its revised draft WRMP to regulators. Southern Water will publish its revised draft WRMP when given permission to undertake further consultation by the Secretary of State. It will then prepare a further Statement of Response document and may need to further update its revised draft WRMP before submitting it to Government.

18.5. WRSE will wait to learn the Government's feedback on the individual company revised draft WRMPs before finalising the regional plan. This will enable it to ensure that the regional plan and company WRMPs are aligned on completion of this cycle of planning. WRSE is also working closely with the other regional water resources groups to ensure alignment between regional plans.

18.6. Whilst the revised draft regional plan that has been published alongside this consultation response document represents the current regional plan proposals, whether the final regional plan will need to take account of further changes will not be known until all of the WRMPs for the companies are finalised.

18.7. Where individual company WRMPs are not yet finalised when our final plan is published, we will ensure our plan clearly identifies how it can and will adapt to any changes to remaining WRMPs as they are finalised themselves. WRSE currently anticipates that the earliest the final regional plan will be published is early to mid 2024.

18.8. WRSE will ensure that it regularly updates on progress on its website.

Materiality of Southern Water WRMP changes

18.9. As noted above, Southern Water is proposing to reconsult on changes to its WRMP. WRSE's investment modelling has identified that neither Southern Water nor any of the other water companies in WRSE have available options that can help to meet Southern Water's deficits over the period until the Hampshire Water Transfer and Water Recycling Project Option is delivered.

18.10. As a consequence, the potential implications of Southern Water's further targeted consultation and finalisation of the WRMP are limited to Southern Water, and no consequential impacts on other company WRMPs would result. A comparison of the results with and without the delay in Southern Water's schemes shows that there are no changes to other companies plans before 2050.

Reviews of the regional plan

18.11. WRSE will prepare a review of the regional plan on a five yearly cycle, timed to coincide with the preparation of the next cycle of water company WRMPs, due to be completed in 2029.

18.12. In advance of this, WRSE will ensure that it prepares and publishes an Annual Monitoring Report, building on the content of the company WRMP Annual Reviews (normally published in June of each year). This will enable WRSE to monitor data and trends in the implementation of the plan, policy and legislative changes, and other factors relevant to the plan.

18.13. Further information on monitoring and review of progress is set out in the following Section 19 of this document.

19. Monitoring and review of progress

This section of the plan has been updated to provide more information on WRSE's monitoring proposals and to better explain how the adaptive plan will respond to the monitoring information WRSE collects and publishes.

Context

19.1. WRSE and our six member companies will carefully monitor progress with the implementation of the regional plan, and the key population, environmental and climate data trends relevant to the scale and nature of the water resource challenges facing the South East region.

19.2. WRSE will ensure that it prepares and publishes an Annual Monitoring Report, building upon the content of the company WRMP Annual Reviews (normally published in June of each year).

19.3. WRSE will also ensure that it provides a regular update to its commentary on the factors that could change the regional plan, as summarised in table 18.1 below, and explained in more detail through the remainder of this section. These factors and issues will be monitored together with member companies as well as regulators, and will also take stakeholder and customer feedback into account where possible.

Table 18.1: Factors which could change the regional plan and key issues which will be monitored by WRSE

Factors which could change the regional plan	Key issues to be monitored and resolved where possible
Environmental ambition	WRSE has worked with the EA and Natural England to develop the existing environmental ambition profiles, and to incorporate licence capping. The profiles will need to be reviewed to ensure they meet policy expectations, particularly regarding licence capping and the results of ongoing WINEP and environmental investigations.
Quantifying environmental benefits	WRSE will continue to work with our member companies, regulators and catchment partners to better understand schemes and ecological benefits from environmental ambition.
Demand side options	TUBs and NEUBs have been included in the regional plan as one of the measures to meet the challenges ahead. The default regional position is that this will remain the case unless there is feedback to change this policy position. WRSE have tested several different Government water efficiency policies. Government Policy C+ brings the region to 110 l/p/d by 2050 in a dry year, but this puts a lot of onus on Government to deliver a significant component of the plan. This will require careful monitoring as the plan progresses to review Government commitments.
Supply side options	Uncertainties relating to supply side schemes will be monitored and resolved where possible. Key schemes to monitor include SESRO, GUC, Hampshire Water Transfer and Water Recycling, and Teddington DRA. Drought orders and permits continue to be selected in the regional plan until 2040, however WRSE will monitor regulatory positioning on the continued use of drought orders and permits and adjust our approach accordingly. WRSE has investigated accelerated cessation of the use of drought orders and permits (2035) as well as delayed cessation (2045 and 2050). WRSE will continue to work with the All Company Working Group (ACWG) and the National Advisory Unit (NAU) to look at emerging substances relating to reuse and water recycling schemes and compliance with the Water Framework Directive.
Carbon reduction	We will monitor the cost of carbon and mitigation options.

Future environmental policies	WRSE will continue to work with Government and regulators throughout the regional planning process to inform and support resolution of outstanding environmental policy uncertainties.
Regional reconciliation	There will need to be further regional reconciliation to ensure consistency is maintained between the regions in future.
Multi-sector options	WRSE will continue to engage with stakeholders and multi-sector groups to improve our understanding of non-public water supply demand forecasts, potential multi-sector options, and impacts on non-public water supply sources from droughts and licence capping.
Drought resilience	We have tested several different implementation timescales for 1:500 year drought resilience timing. Unless there is a strong consultation response or regulatory direction, the default WRSE position is 2040 for achieving 1:500 year drought resilience.

Factors influencing our regional plan

19.4. There remain a number of specific risks and uncertainties which could influence and affect the proposals in the regional plan. This section highlights what these risk and uncertainties are, how they could potentially affect the plan, and the monitoring proposals and action that WRSE is planning to take in response.

19.5. This section also sets out the longer-term monitoring beyond this regional plan that WRSE will undertake to enable it to update its forecasts in preparation for the next regional plan preparation.

Environmental ambition

19.6. WRSE supports the development of long-term planning scenarios for achieving environmental outcomes. Without understanding the potential scale and distribution of future changes to water available for abstraction, it limits the ability to plan strategically and risks poorer value decisions on investment, resilience and environmental outcomes in the plan.

19.7. These longer-term scenarios for sustainability reductions are, however, not based on the quality of empirical evidence needed for decision 'making' in isolation. The relatively low confidence in these longer-term scenarios means that they can only be used to inform planning decisions with caution. They should be used to help 'inform, support and provide context' for decisions.

19.8. The degree of variance in the scale of the environmental ambition challenge that we face is clear from the regional plans we have published. For the higher levels of environmental ambition to be achieved, it requires a significant number of existing sources to be switched off or reduced in scale and use, necessitating large numbers of new water resource options to be developed, in addition to the demand management and other baseline elements of the regional plan. The number and size of new schemes required increases with the level of environmental ambition.

19.9. The increased number of schemes needing to be selected leads to increased cost, as the cost of delivering sustainability reductions will generally increase, per unit volume, with higher levels of ambition. Simply put, in investment modelling, the more cost-effective options are utilised first and as more are required it becomes necessary to develop increasingly more expensive options. These tend often not only to be more expensive in terms of financial cost but also in terms of the environmental, carbon and social costs of these options.

19.10. For the highest levels of environmental ambition, we have not been able to solve the supply demand balance deficits by 2050 without allowing the model to select options that would have otherwise been excluded due to their level of environmental risk or environmental performance. We have allowed these to be selected later in the plan, from 2045 onwards, but this does not mean that the options would be developed. The regional plan will have been reviewed, in some cases multiple times, before the time when those schemes will need to be promoted for consenting. There may be technological advances, reductions in costs and environmental impacts, or new options identified before then which may ultimately be selected in a subsequent regional plan, and WRMPs.

19.11. What this does mean, however, is that there is undoubtedly a choice to be made, balancing the policy driven need to achieve environmental ambition on the one hand, with the increased cost and need to develop and use potentially environmentally damaging water resources options over the longer term as a result. The need for evidence of ecological benefits and decisions on the most appropriate level of environmental ambition are key uncertainties facing the regional plan.

WRSE action in response

19.12. We will continue to engage with our regulators and stakeholders and support the further consideration of these issues by our environmental and economic regulators ahead of their determination of the environmental ambition to be delivered through this and subsequent regional and company plans.

Quantifying environmental benefits

19.13. Whilst the water resource impact of environmental policies or ambitions may be clearly defined in terms of the Ml/d reduction in deployable output that could be required, there are difficulties in quantifying the benefits of sustainability reductions in economic terms. There is currently no commonly agreed framework across regulators, Government, companies and others. Furthermore, there is a lack of evidence that reductions will necessarily benefit the water environment.

19.14. This lack of evidence of the precise ecological benefits of making different volumes of abstraction reduction is problematic, as aside from achieving a specific environmental target, there is a lack of quantifiable benefits to be balanced against the water resources impacts and the economic and environmental costs of the new resources that are required to be delivered as a result.

19.15. There is a concern that focusing on the benefits of delivering sustainability reductions in isolation could lead to sub-optimal investment decisions.

19.16. We have prioritised achieving environmental ambition within chalk stream catchments in the regional plan and it is likely that the plan will enable tangible progress to be made with respect to recovering chalk streams. Our revised draft regional plan has selected a significant number of additional catchment management schemes compared to the draft regional plan. Despite this, we recognise that the progress may not meet the expectations of all stakeholders.

19.17. As our six member companies seek funding and approval for, and then implement and further develop their programmes of catchment management measures (including through catchment partnerships), we will review the deployable output benefits of more real-world schemes to inform the identification of more catchment management options for future regional plan preparation.

WRSE action in response

19.18. We will continue to work with our member companies, regulators and catchment partners to better understand schemes and ecological benefits. As a greater level of data and information becomes available we will incorporate this into our options appraisal and investment modelling for the next cycle of regional plans and WRMPs. This data and information will also inform company business plan submissions to Ofwat.

Demand Side Options

19.19. Demand management and leakage reductions are core to the regional plan. These schemes coupled with temporary use bans (TUBs) and non-essential use bans (NEUBs) provide the greatest contribution to the future challenges in the South East of England.

19.20. However, we have seen during the Covid-19 pandemic how quickly customer behaviour can change, with data indicating that household demand increased by around 10% while non-household demand fell by around 25% due to lockdowns and more people working at home.

19.21. The revised draft regional plan includes an increased level of demand reduction compared to the draft regional plan, including commitments relating to the Government's per capita consumption (PCC) reduction to 110 litres per person by day by 2050, and the interim targets in the

Environmental Improvement Plan. This is a particular challenge, requiring not only water company activity, but also reliance on Government interventions, including earlier interventions in the revised draft regional plan than in the draft regional plan as shown in Table 18.2 below.

Table 18.2: Comparison of draft and revised draft plan Government Interventions

Plan	Low (Water labelling)	Medium (Water labelling + minimum standards)	High (Full Government support)	Regional PCC in 2050 (l/p/d)
Draft regional plan BVP (Gov-led B)	6 l/p/d impact	Additional 6 l/p/d impact (total impact 12 l/p/d)	Additional 12 l/p/d (total impact 24 l/p/d)	115
	Implemented from 2025, with savings achieved by 2040	Implemented from 2060, with savings achieved by 2075	Implemented from 2080, with savings achieved by 2095	
Revised draft regional plan BVP (Gov-led C+)	6 l/p/d impact	Additional 6 l/p/d impact (total impact 12 l/p/d)	Additional 12 l/p/d (total impact 24 l/p/d)	108
	Implemented from 2025, with savings achieved by 2040	Implemented from 2030, with savings achieved by 2045	Implemented from 2035, with savings achieved by 2050	

19.22. WRSE's selection of Government-led C+ as the basis for the revised draft plan follows extensive assessment of the different intervention scenarios. It is not, however, without risk. Whilst the Government has committed to introducing mandatory water labelling by 2024, the impacts arising from this, and the commitment to other Government interventions is not yet clear.

WRSE action in response

19.23. WRSE will continue technical work and engagement with Government, regulators and our six member companies beyond the revised draft regional plan on these issues. This includes developing a consistent approach to managing this risk, particularly around delivery of demand reductions, and ensuring alternative options are investigated and capable of being brought forward if required. Moving forward, WRSE will also be seeking clearer guidance from Government on the profile of their introduction and Ml/d savings that would be derived from these interventions.

Supply Side Options

19.24. The regional plan includes a significant number of supply side options to respond to the scale of future challenges being faced.

19.25. As with any large and complex strategic plan, there are still uncertainties relating to these supply side options, many of which will be overcome and mitigated as more detailed work is undertaken through WRMPs, through the RAPID gated process for SROs, and as detailed feasibility and environmental assessments are completed ahead of and in support of applications for planning and other consents.

WRSE action in response

19.26. WRSE will consider updated data and information on the individual supply side options, which will be generated as a result of ongoing and more detailed assessment of the engineering, environmental, consenting and land risks relating to options through the RAPID gated process for SROs, and through further work at company level in relation to WRMP preparation. Companies may need to factor in commercial and regulatory aspects, including procurement and delivery mechanisms for their schemes, in the context of PR24.

Carbon reduction

19.27. English water companies have committed to reaching net zero operational carbon emissions by 2030. Many of the options in the regional plan will produce capital carbon while they are being built and operational carbon when they are used.

19.28. There is also the potential that the Government may increase the cost of carbon in construction projects to promote more environmentally friendly solutions. This has the potential to change the carbon assessments that we have undertaken, and could influence the selection of options in our regional plan.

WRSE action in response

19.29. The regional plan has been optimised for new carbon associated with the options, as part of the determination of the best value plan. This has highlighted the costs and benefits of carbon optimisation against other best value criteria to inform the best value decision making.

19.30. Even with carbon optimisation included in the option selection process, the regional plan does not achieve net zero; carbon is still emitted during construction (capital carbon), and new emissions are generated during the life of the assets (operational carbon). The additional carbon will need to be incorporated within Company net zero route maps and strategies, and mitigation and offsetting activities may be identified in business plans.

Future environmental policies

19.31. There are a series of emerging policy and regulatory risks that have the potential to impact on individual options available for selection as part of the WRSE modelling, and on the WRSE strategy as a whole.

19.32. WRSE, other regional groups (through the National Framework), companies (through the All Company Working Group) and individual SRO working groups are all working constructively and collaboratively with regulators to understand and engage on these risks and uncertainties.

19.33. The range of potential policy and regulatory risks and uncertainties are wide-ranging but through the gated process and consultations these risks are reducing over time.

WRSE action in response

19.34. WRSE will continue to work in collaboration with key partners, particularly regulators, beyond the revised draft regional plan as the regional plan is finalised, and beyond this, looking forward to the next regional plan.

19.35. Engagement and working with regulators is a key regional activity. Whilst some outstanding policy issues are within the gift of regulators, other policy decisions may benefit from the evidence which the regional planning approach can support – particularly the scale and timing of investment decisions which may be impacted by either policy decisions or policy uncertainty. We will continue to work with Government and regulators throughout the process to inform and support resolution of outstanding policy uncertainties.

Regional reconciliation

19.36. WRSE has engaged extensively with the other regions in preparing the regional plan. A key part of this work has been the regional reconciliation process, where the regions have shared their emerging proposals for consistency checks and assessments with the other regions.

19.37. The reconciliation process has demonstrated that with the higher levels of environmental ambition, there are fewer water resources available for sharing and transfer between the regions than had perhaps been anticipated at the outset of the regional planning process. Regions which had been thought to potentially be able to supply resources to the South East have been shown to have deficits of their own under the more challenging futures.

19.38. Although there is less water available to transfer into the region than originally anticipated, nevertheless, transfers into the region form a critical part of the regional plan and it is essential that WRSE and our six member companies have certainty on the availability of resources to transfer, and the cost and assessed impacts associated with them.

WRSE action in response

19.39. The other regional groups have consulted on their regional plans alongside consultation on their member water company WRMPs, as WRSE has done. The regional reconciliation report is saved on the WRSE website, in the WRSE document library.

19.40. WRSE will continue to liaise closely with other regional groups as the regional plans and individual WRMPs are finalised, to ensure consistency is maintained between the regions. We will also continue to work with the Environment Agency in the development of the next National Framework for Water Resources document, anticipated in early 2025.

Multi-sector options

19.41. The regional plan has taken account of the anticipated future water needs of other sectors. Further analysis is required, but at this stage the impacts on scheme/option decisions currently appears limited in extent.

19.42. Whilst WRSE has worked to integrate the needs of multiple sectors into our regional plan, there is significant further work which can be undertaken to improve our understanding of non-public water supply demands, vulnerabilities and options in future.

19.43. There is further work needed to understand the future demands of other sectors and fully embed them into the regional plan. This includes:

- Understanding the impact that the Environment Agency's licence capping policy will have on the other sectors' existing abstraction licences
- Understanding whether any reductions are needed to the licences of other sectors to achieve long-term environmental improvement
- Working with the other sectors to determine how resilient they will need their water supplies to be in the future under different planning scenarios so this can be built into the regional plan
- Considering a wider range of future scenarios for different sectors and how this could impact on their demand for water in the future.
- Continuing to identify and develop multi-sector options that can be included in future regional plans
- Working with regulators to establish how schemes that supply water to other sectors should be funded, that avoids water company customers cross subsiding investment by other sectors

19.44. Energy UK have provided WRSE with updated future power needs for the South East, which follows a consistent approach which has been used for all the regional groups. Further discussions are required with stakeholders and power and water regulators to understand potential commercial sensitivities and anti-competition laws to progress the development of multi-sector options in the South East.

19.45. NFU are working closely with Water Resources East (WRE) on a number of pilot schemes, given the agriculture demand in the East of England is much greater than elsewhere in the country. WRSE will continue to work with the NFU to look at the agricultural demands in the South East, and WRSE are supportive of NFU ambitions of the development of a national agricultural water framework.

WRSE action in response

19.46. WRSE has continued to work with customers and stakeholders. Whilst some developments have occurred like the agreement to produce a national farming study by the time of the next plan and the update of potential power industry requirements, these can be accommodated with the current licences issued to these abstractors.

19.47. We will continue to work with these sectors in the development of the next regional plan, but for now this is as far as we can take account of the other sectors in this regional plan. WRSE will also continue to work with stakeholder and multi-sector groups and regulators to specifically understand the impacts of proposed licence capping regulations on non-public water supply abstractions.

Drought resilience

19.48. WRSE has investigated a range of dates for achieving the 1:500 year drought resilience standard for the region. In line with the guidance, WRSE has concluded that achieving 1:500 drought resilience by 2040 provides the best overall solution for the region. This is consistent with the position in the draft regional plan.

19.49. The annual review mechanisms will ensure the region is able to keep track of any changes in Government drought resilience policy and compliance dates. If the date of compliance is brought forwards, then additional schemes will be required on top of those schemes highlighted in the regional plan in the first 15 years to meet the resulting deficits in the supply-demand balance.

19.50. If the date of policy compliance is moved back to 2045 or 2050, WRSE has demonstrated through sensitivity testing that the core strategic schemes

(GUC transfer proposal, Teddington DRA proposal, Hampshire Water Transfer and Water Recycling Project, and SESRO reservoir proposal) remain selected at the dates in the revised draft plan.

WRSE action in response

19.51. WRSE will continue to work with regulators and companies to review the date for the 1:500 drought resilience standard.

Our longer-term monitoring proposals

Long-term projections

19.52. As well as the level of environmental ambition that is to be achieved through the regional plan proposals, the other key determinants of the scale of water resources challenge the region faces are climate change and population growth.

19.53. For population growth, the longer-term forecasts are highly influenced by factors outside of the influence or control of WRSE, including global, national and regional economic conditions, international migration and others. WRSE has obtained updated forecasts for the revised draft regional plan, utilising the most up to date information available.

19.54. The regional plan has been based on the latest available climate change projections, and there remains a wide range of variability between the highest and lowest climate change scenarios that have been used. The uncertainty in the longer-term forecasts is a key factor influencing the scale and types of options being selected in the regional plan, particularly in the mid to latter parts of the planning period.

19.55. WRSE will ensure that it uses the most appropriate and up to date forecasts to inform its modelling and assessment work, commissioning its own research and forecasting when required. We will monitor actual data to determine the accuracy of forecasts it has used, to inform subsequent rounds of regional plan preparation. The next updated regional plan forecasts will be prepared as part of the next cycle of regional plan and WRMP preparation.

Water resources performance data

19.56. Each water company is required to submit data annually to Defra and the Environment Agency on key indicators relating to its water supply performance in an 'Annual Data Return'. This data, reported at Company and individual WRZ level, includes a series of metrics on supply, demand and customers, covering the security of supplies to customers, including water abstracted, outage, metered and unmetered PCC, and population and property data.

19.57. In addition, each company must prepare and submit a WRMP Annual Review annually, in which performance is reported, including progress towards the delivery of WRMP plans and proposals. This includes consideration of whether there may have been a material change in circumstances such that re-consultation on the WRMP is required.

19.58. The annual review mechanisms provide a consistent level of information for companies and their WRZs to feed into WRSE. Working closely with our six member companies, WRSE can then analyse this information, to identify and assess trends in performance on the key regional plan proposals. This enables WRSE to update its information to feed into the next regional plan.

19.59. The key areas of monitoring relevant to the next regional plan include the following.

- **Leakage reduction**: performance towards the leakage reduction targets, including company and WRZ level progress, any delays being experienced and potential barriers (and mitigation necessary) to achieving the high levels of leakage reduction set out within the regional plan.
- **Demand management**: progress with the implementation of the water efficiency and metering programmes that our member companies have committed to in the regional plan, and the reductions in water usage that have been achieved as a result, compared to that forecast.
- **Environmental benefits and outputs achieved**: including identifying and monitoring specific metrics for the level of environmental benefit that will be delivered in individual catchments as a result of the

environmental ambitions being planned for – so that benefits can be captured and quantified in the regional planning work, and we can consider outcomes-based approaches as well as policy driven measures.
- **Catchment management**: as our member companies implement and further develop their programmes of catchment management measures (including through catchment partnerships), to review the deployable output benefits of more real-world schemes to inform the identification of more catchment management options for future plan preparation.

19.60. We will also need to ensure we utilise the most update forecasts available. To help inform future regional plans we will:

- ensure we utilise the latest climate change and other long-term forecasts when published, as well as commissioning our own research and forecasts for population and household growth.
- continue to collaborate regionally and nationally in developing long range forecasting and modelling techniques to help us plan for and manage future uncertainties.
- work with the other regions to ensure consistency of approaches to regional plan preparation.

Monitoring the implementation of individual options

19.61. We will work closely with our six member companies to review progress with the implementation of the individual options identified within the regional plan and subsequent WRMP24s, including those larger SROs being progressed through the RAPID gated process.

19.62. Reviewing the progress of these schemes helps us to refine and adapt implementation programmes and risks relating to the longer-term options identified in the regional plan, and for new options that are identified as part of the preparation of the next regional plan.

19.63. It is important to note that WRSE does not have a role in securing the delivery of individual schemes, as this falls to individual companies or other scheme promoters. WRSE will provide information and technical support to our member companies as part of their work.

WRSE's Monitoring Plan

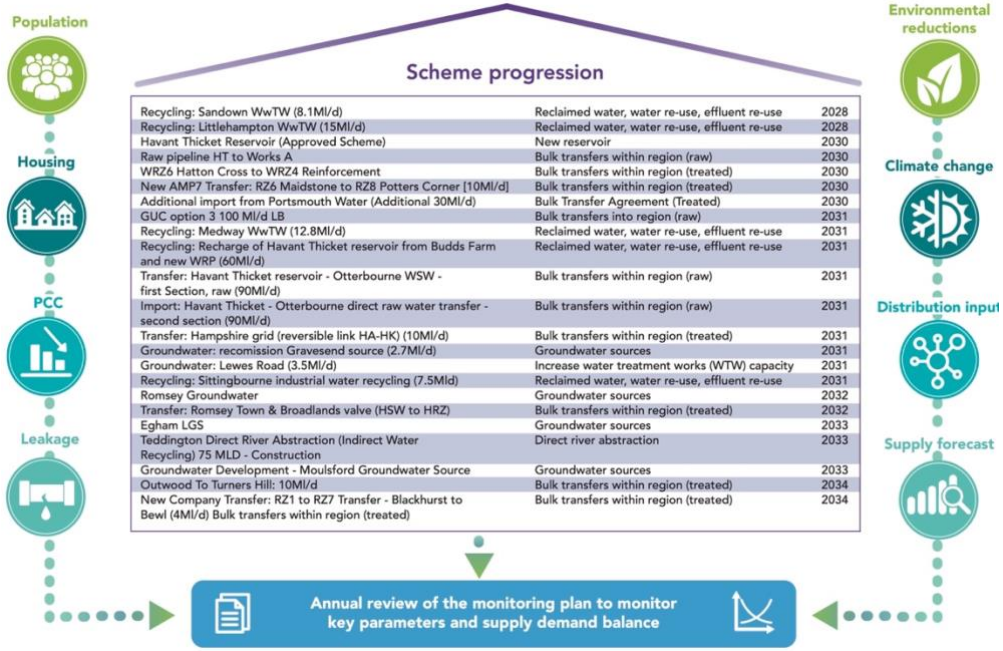
19.64. The regional adaptive plan takes account of changes in population and housing growths (in the demand forecasts); climate change; environmental reductions to abstraction licences and improving drought resilience.

19.65. To cope with these changes a range of schemes must be delivered in a timely manner to meet the anticipated forecasts for water. Therefore, the following sources of information will be used to help track and ensure that the annual performance of the system is within the anticipated range of challenges we have accommodated. Fig 19.1 below summarises the key sources of data that will be used for the regional plan.

19.66. The various sources of information for each of the sections are outlined below:

- Population growth has been reviewed and updated in 2023. We will review this again in in 2025 and 2027, using any new Census information and ONS data published. These updates will be compared with the forecasts in the regional plan at a water resource zone level.
- Housing growth numbers will be updated in 2025 and 2027. These forecasts will be collected from the local housing plans. These updates will be collected through inspection of the local housing plan growth forecasts. We will track how these forecasts compare with those in the regional plan and if they exceed the regional planning numbers. We will also be monitoring the Oxford Cambridge growth forecasts.
- Per Capita Consumption (PCC) numbers will be taken from the water company annual returns for each of their water resource zones, and will take into account any Government announcements that are made regarding water efficiency commitments from the Government's Environment Improvement Plan.
- Leakage reductions are a key component of the plan. We will track the outturn leakage numbers each year at each water resource zones to see how well the zones are tracking against their expected outturns.
- We will use the annual returns completed by companies to monitor and track against scheme delivery, environmental reductions and distribution input.

Figure 19.1: Sources of monitoring data



Recycling: Sandown WwTW (8.1Ml/d)	Reclaimed water, water re-use, effluent re-use	2028
Recycling: Littlehampton WwTW (15Ml/d)	Reclaimed water, water re-use, effluent re-use	2028
Havant Thicket Reservoir (Approved Scheme)	New reservoir	2030
Raw pipeline HT to Works A	Bulk transfers within region (raw)	2030
WRZ6 Hatton Cross to WRZ4 Reinforcement	Bulk transfers within region (treated)	2030
New AMP7 Transfer: RZ6 Maidstone to RZ8 Potters Corner [10Ml/d]	Bulk transfers within region (treated)	2030
Additional import from Portsmouth Water (Additional 30Ml/d)	Bulk Transfer Agreement (Treated)	2030
GUC option 3 100 Ml/d LB	Bulk transfers into region (raw)	2031
Recycling: Medway WwTW (12.8Ml/d)	Reclaimed water, water re-use, effluent re-use	2031
Recycling: Recharge of Havant Thicket reservoir from Budds Farm and new WRP (60Ml/d)	Reclaimed water, water re-use, effluent re-use	2031
Transfer: Havant Thicket reservoir - Otterbourne WSW - first Section, raw (90Ml/d)	Bulk transfers within region (raw)	2031
Import: Havant Thicket - Otterbourne direct raw water transfer - second section (90Ml/d)	Bulk transfers within region (raw)	2031
Transfer: Hampshire grid (reversible link HA-HK) (10Ml/d)	Bulk transfers within region (treated)	2031
Groundwater: recomission Gravesend source (2.7Ml/d)	Groundwater sources	2031
Groundwater: Lewes Road (3.5Ml/d)	Increase water treatment works (WTW) capacity	2031
Recycling: Sittingbourne industrial water recycling (7.5Mld)	Reclaimed water, water re-use, effluent re-use	2031
Romsey Groundwater	Groundwater sources	2032
Transfer: Romsey Town & Broadlands valve (HSW to HRZ)	Bulk transfers within region (treated)	2032
Egham LGS	Groundwater sources	2033
Teddington Direct River Abstraction (Indirect Water Recycling) 75 MLD - Construction	Direct river abstraction	2033
Groundwater Development - Moulsford Groundwater Source	Groundwater sources	2033
Outwood To Turners Hill: 10Ml/d	Bulk transfers within region (treated)	2034
New Company Transfer: RZ1 to RZ7 Transfer - Blackhurst to Bewl (4Ml/d) Bulk transfers within region (treated)	Bulk transfers within region (treated)	2034

- The climate change projections will be updated against the next UKCIP forecasts in order to compare with the range of forecasts we have included in the plan. We will also use the climate change committee annual reports to track how government is progressing with their commitments and how this might indicate which of the climate change projections might be more likely in the future.
- Supply forecasts will be updated in 2026 and reviewed in 2028. The supply forecast will be updated to take account of the reductions to existing abstraction licences; new schemes coming online and any new information on drought resilience standards. They will also take on board any updates to approaches for generating future droughts.

19.67. The above section outlines how we will monitor and track developments in the plan. For each element we will know if the forecasts or policy interventions by Government are on track, within bounds or exceeding forecasts.

19.68. For all the elements, it is important to bring them together to understand the combined impacts of each of these forecasts and whether this exceeds the anticipated range of supply demand balances within the plan.

19.69. Therefore, in the monitoring plan we will bring the information together to determine if the plan is still on track or trending to exceed the expected range. This will help us understand if the plan is still able to adapt to the changes or if further interventions would be required. Individual exceedances in some of the underlying data would be acceptable if the combined supply demand balance picture is still within limits.

19.70. Each annual review will provide us with another data point to compare with the regional plan and as time progresses, we will be able to determine which of the branches / supply demand forecasts are more likely and therefore which of the adaptive solutions would be required on top of the core schemes. These will be flagged in the annual review and taken on board when the next regional plan is developed.

19.71. WRSE will draft a monitoring plan document, for publication alongside the final regional plan. This will provide details of the monitoring approach outlined above, including WRSE's adaptive plan monitoring proposals.

APPENDICES

Appendix 1: Glossary and abbreviations

Acronym	Term	Definition
1:500	1:500 year level of drought resilience	Being resilient to a drought that would happen on average once every 500 years – or it has a 0.2% chance of happening every year
	Abstraction	Taking water from the environment (under license from the Environment Agency) for use in the public water supply or industry
	Adaptive Planning	Adaptive planning allows us to account for uncertainty, such as different impacts of population growth and climate change, which is useful when planning for the future. For each new plan, we monitor how previous ones have been implemented and incorporated new forecasts into modelling. We're then able to adapt future plans to meet different scenarios, based on this understanding.
ADO	Average Deployable Output	Annual average deployable output from a source
AMP	Asset Management Plan	Water company business plan (prepared on five yearly cycle)
AONB	Area of Outstanding Natural Beauty	Area of countryside in England, Wales and Northern Ireland, that has been designated for conservation due to its significant landscape value.
	Aquifer	A body of rock and/or sediment that holds groundwater
ASR	Aquifer Storage and Recovery	Injecting additional fresh water from other parts of an aquifer or from the rivers into a confined area within the aquifer. It can then be stored and pumped back to the surface and treated when needed
BVP	Best Value Plan	A best value plan is one that considers factors alongside economic cost and seeks to achieve an outcome that increases the overall benefit to customers, the wider environment and overall society. Regional plans should identify the best options to meet the challenges we face, delivering best value for the environment and society.
	Business Plan	Water companies develop and submit business plans every five years to Ofwat, the economic regulator. These plans set out the commitments companies make to their customers and how they will meet them.
CaBA	Catchment Based Approach	An initiative that works with Government, local authorities, water companies,

		businesses and more, to maximise the natural value of our environment.
	Catchment	The area from which precipitation (rainfall) and groundwater would naturally collect and contribute to the flow of a river
CCG	Customer Challenge Group	A group of independent stakeholders representing different customer groups and scrutinising water companies' business plan development
CCW	Consumer Council for Water	The consumer protection body for water customers in England and Wales
	Cost-efficient	A cost-efficient planning process assesses all options which meet both company and WRSE feasibility threshold against whole life delivery costs including the cost of carbon. The resulting plan therefore represents the lowest programme costs to deliver required policy outcomes and core strategic objectives. A cost-efficient plan does not include, in its selection processes, other benefits, additional value and/or wider objectives.
CSF	Chalk Streams First	Initiative promoting abstraction reduction for chalk streams in the Chilterns
Defra	Department of Environment, Food & Rural Affairs	UK Government department responsible for environmental matters – including water resources.
	Desalination	A process where seawater or brackish water is turned into drinking water by removing the salt, providing a reliable source of water including during droughts
	Demand management	Measures taken by water companies to support customers reduce the amount of water they use, and leakage
DO	Deployable output	The output of a source or bulk supply as constrained by licence (if applicable); pumping plant and/or well/aquifer properties; raw water mains and/or aqueducts; transfer and/or output main; treatment; water quality
DI	Distribution Input	The flow entering the water supply distribution network
	Draft Regional Plan	The draft WRSE regional plan published for consultation in November 2022.
DWMP	Drainage and Wastewater Management Plans	New statutory plans where wastewater companies take a company-wide approach to managing their wastewater and drainage assets
	Drought Permit	An authorisation granted by the Environment Agency under drought conditions, which allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis

	Drought Order	Powers granted by the Secretary of State during drought to modify abstraction/discharge arrangements on a temporary basis
DYAA	Dry year annual average	Represents a period of low rainfall and unrestricted demand and is used as the basis of a WRMP
DYCP	Dry year critical period	The period(s) during the year when water resource zone supply demand balances are at their lowest
ERP	Emerging Regional Plan	The document published by WRSE for consultation in January 2022
Environment Agency	Environment Agency	The regulator responsible for environmental protection and enhancement – part of the Defra family
	Environmental Ambition	Levels of environmental improvement due to sustainability reductions/abstraction reductions.
EIP	Environmental Improvement Plan	The Government's delivery plan for the environment, published in January 2023
	Groundwater	Water held underground in the soil or in voids in rock
GUC	Grand Union Canal	A canal stretching 137 miles from London to Birmingham with arms into Slough, Aylesbury, Leicester and Northampton
GVA	Gross Value Added	Output (at basic price) minus intermediate consumption (at purchaser price)
HRA	Habitat Regulations Assessment	Assessment to consider the likely significant effects on designated Habitats (European) sites
	Headwater	Permanently flowing tributaries feeding a river system
INNS	Invasive Non-Native Species	Any non-native animal or plant with the ability to spread, causing damage to the environment and the way we live
l/p/d l/h/d	Litres per person per day Litres per head per day	Water efficiency units used in the regional plan.
MDO	Minimum deployable output	Deployable output for the autumn period in a dry year when groundwater levels and river flows are at their lowest and sources are constrained to their minimum deployable outputs
Ml/d	Mega litres per day	Millions of litres per day. Unit of measurement for flow in a river or pipeline.

	Natural Capital	Our stock of natural resources, including, soils, air, water and all living organisms. Some natural capital assets provide "goods and services", often called ecosystem services.
	Nature-based solutions	Sustainably managing natural features and processes to deliver wider benefits for customers – such as catchment management or river restoration
NE	Natural England	The Government's adviser for the natural environment in England
NEP	National Environment Programme	A list of environment improvement schemes that ensure water companies meet European and national targets related to water. Also see WINEP.
	National Framework for Water Resources	An Environment Agency document that sets the strategic direction for long-term regional water resource planning
NIC	National Infrastructure Commission	An impartial, expert body commissioned by the Government to advise on infrastructure priorities and long-term challenges
	Net zero operational carbon emissions	The water sector, through Water UK, has pledged to achieve net zero carbon emissions from its operations by 2030
NEUB	Non Essential Use (Ban)	A drought order approved by the Secretary of State to restrict specific water uses by businesses
	Non-household	Use by businesses and public bodies such as schools and hospitals
NYAA	Normal Year Annual Average	This is the demand for water expected under normal conditions
Ofwat	Office of Water Services	The economic regulator of the water sector in England and Wales
	Outage	Temporary loss of deployable output
PCC	Per capita consumption	Amount of water a person typically uses every day
PDO	Peak deployable output	Deployable output for the period in which there is the highest demand
RAPID	Regulators' Alliance for Progressing Infrastructure Development	An organisation formed by Ofwat, Environment Agency and Drinking Water Inspectorate to help accelerate the development of new water infrastructure and design future regulatory frameworks
RBMP	River Basin Management Plan	Management tool within integrated water resources management containing descriptions of water resources within drainage basin and water allocation plans
	Regional groups	The five regional groups outlined in the water resources framework – Water Resources South East, West Country Water Resources, Water Resources East, Water

		Resources North and Water Resources West.
	Regional reconciliation	The process to understand how each region could support the others' developing plans
	Restoring Sustainable Abstraction	Environment Agency programme to identify abstractions that are unsustainable or potentially damaging and to restore sustainable abstraction
	River Restoration	The process of managing rivers to reinstate natural processes
SSSI	Sites of Special Scientific Interest	An area designation for conservation, usually due to particular interest to science due to the flora and fauna within it or important geological features
SRO	Strategic Resource Option	Large-scale infrastructure solutions for securing additional water
STPR	Social Time Preference Rate	A method used to put a present value on costs and benefits that occur at a later date
	Source	A named input to a water resource zone where water is abstracted from a well, spring or borehole, or from a river or reservoir
SEA	Strategic Environmental Assessment	Assessment of likely significant effects of certain plans and programmes
	Supply-demand balance	The difference between total water available for use (as supply) and forecast distribution input (as water demand) at any given point in time over the planning period/horizon
	Sustainability Reduction	Reductions in deployable output required to meet statutory and/or environmental requirements
TUB	Temporary Use Ban	Drought management measures imposed by water companies on customers – previously known as hosepipe ban
WAFU	Water available for use	Combined total of deployable output; future changes to deployable output from sustainability changes, climate change etc.; transfers and any future inputs from a third parties; short term losses of supply and outage; and operational use or loss of water
WFD	Water Framework Directive	Environmental Legislation relating to river basin management and committing all EU member states to achieving good quantitative status to all water bodies and retained as UK law following Brexit
WINEP	Water Industry National Environment Programme	A programme issued to water companies by the Environment Agency which outlines what regulators expect companies to include in future investment plans to meet environmental obligations

	Water recycling	A process where wastewater is treated above usual standards to be returned to the environment and then abstracted downstream to process for drinking water
WRMP	Water Resource Management Plan	A plan produced by each water company every five years that follows a statutory process and sets out how they will provide water over the long-term
WRPG	Water Resources Planning Guideline	Published Guidance for the preparation of WRMP and regional plans from the Environment Agency, Natural Resources Wales and Ofwat
WRSE	Water Resources in the South East	Partnership of water companies and regulators in South East England working together to make best use of available water resources
WRZ	Water Resource Zone	The largest possible zone in which all resources, including external transfers, can be shared and hence the zones in which all customers experience the same risk of supply failure from a resource shortfall
	Water UK	The trade association for water companies

Appendix 2: National Framework summary of future challenges

In 2020 the National Framework for Water Resources[44] looked at the pressures on public water supply nationally, regionally and over time. These included climate change, population growth and the need to increase drought resilience. It provided a preliminary indication of the challenges we could face in providing water supplies in the future. We have set out below what the National Framework told us and then how we went on to develop our own forecasts that differed from those set out in the National Framework.

Public water supply need

To understand public water supply needs the National Framework for Water Resources utilised the data provided by each water company on water availability in their 2019 WRMPs. This data was aggregated to a regional and national scale and adjusted so that it is comparable across companies. From this data the National Framework provides an understanding of future water needs and what is driving the change in these needs over time. It also provides a comparison of different ways of addressing the need, taking into account the approaches used in WRMPs and alternative scenarios, for example, that achieve more ambitious demand reductions.

The National Framework also includes an understanding of how much water is used by different sectors and subsectors outside the water industry now, and how that is likely to change in the future. The analysis assumed that actions in the latest round of WRMPs are implemented up to 2025. These include, on a national basis:

- Reducing leakage on average by 19%
- Reducing domestic water consumption on average from 138 l/h/d to 132 l/h/d
- Developing 145 Ml/d of new sources
- Significantly increase resilience to drought

From 2025 it assumes that nothing further is done to meet future water needs to 2050. This allows the Framework to understand the scale of additional capacity required to meet future needs during that period.

The National Framework seeks to account for the main pressures on public water supply – climate change, environmental protection, population and increasing drought resilience – but recognises that these have a range of potential impacts. To manage this complexity, their forecast was based on one plausible scenario, considered to represent a reasonable assessment of likely future pressures. This includes:

- Climate impacts taken from WRMPs
- The most ambitious environmental protection scenarios set out in WRMPs
- Increased drought resilience to a 1 in 500 year drought
- High population growth dataset that fits closely with the population data in WRMPs.

If no action is taken after 2025, the National Framework modelling suggests that England could need up to 3,435 Ml/d by 2050 to meet public water supply needs, with an additional 5,500 to 6,000 Ml/d needed between 2025 and 2100.

As shown in Figure App2.1, the need to increase resilience to drought and population growth are the main contributors to water need. Figure App2.2 shows how these drivers develop through the period to 2050. There is an assumption in the National Framework model that there is an immediate need to increase drought resilience, as climate change and population growth develop across the period. In terms of environmental protection, this is considered to develop up to 2035 but then level off. However, it is recognised that this is likely to under-represent the changes needed.

[44] https://www.gov.uk/Government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources

Figure App2.1: Estimate of how much each of the pressures on public water supply is contributing to the potential additional national water need by 2050

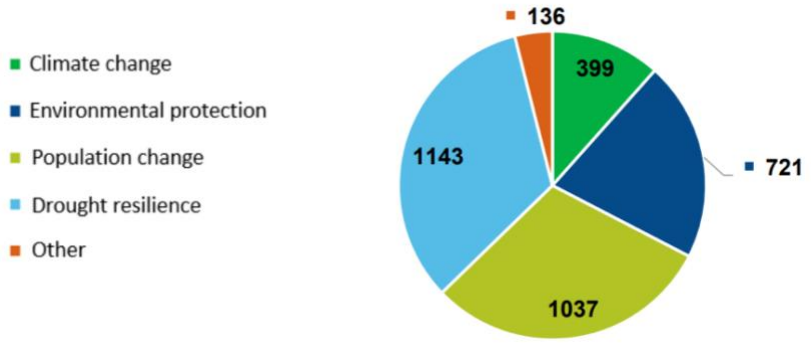
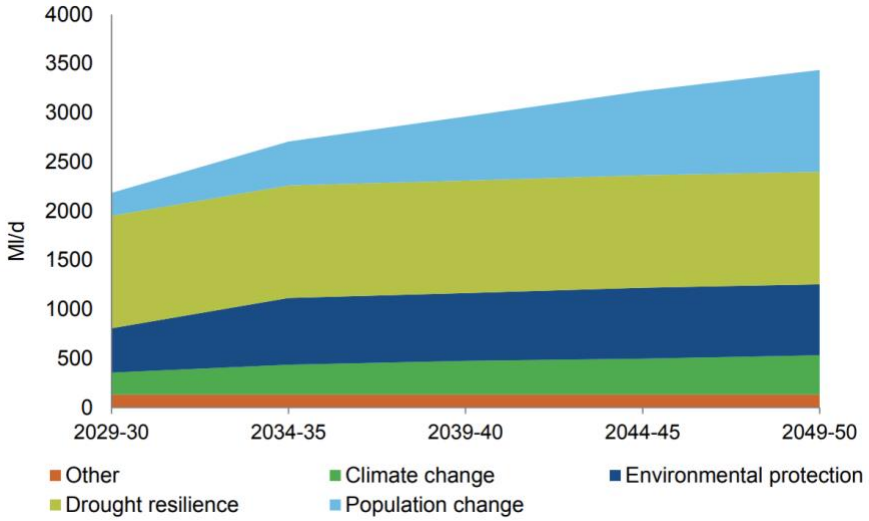
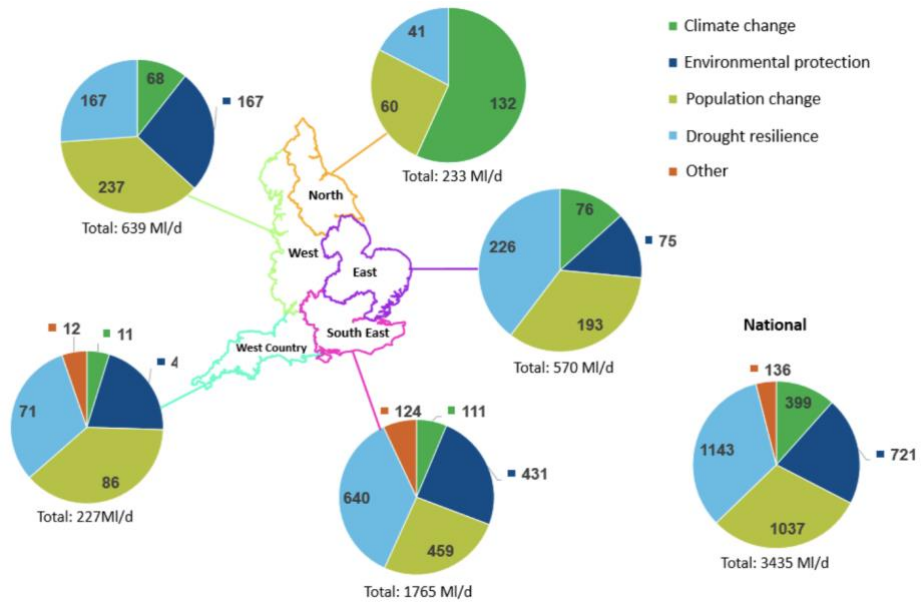


Figure App2.2: The cumulative development of the national additional water need over time in ML/d by driver. (Note this is for a 'do nothing' scenario and therefore excludes actions to meet these pressures.)



The regional picture of water need set out in the National Framework provides a stark picture of the pressure facing the South East as shown in Figure App2.3. It estimates that future need for water in the South East could be 1,765Ml/d by 2050, almost half of the water needed nationally. Over a third of this is driven by the need to increase public water supply resilience to droughts, with increased water consumption and protection of the environment also playing a significant part. Deteriorating water quality giving rise to reduced supplies is also another driver.

Figure App2.3: Future pressures on water resources nationally and by region in millions of litres per day (Ml/d) by 2050 assuming no further action is taken from 2025



The figures presented in the National Framework provide a starting point, and the Framework signposts the work that the Regional Groups need to do in order to fully understand public water supply needs.

Non-public water supply need

The National Framework highlights the necessity to also understand the pressure on water resources from other sectors that are not supplied through water companies. It stresses the need for regional groups to work with these sectors to develop a better understanding of their water needs and explore solutions to meet existing and future demand, as well as protecting the environment.

The National Framework shows how water is used across England and the sectors that are important for each region. This is shown in Figure App2.4, highlighting for the South East the predominant sectors are industry and agriculture.

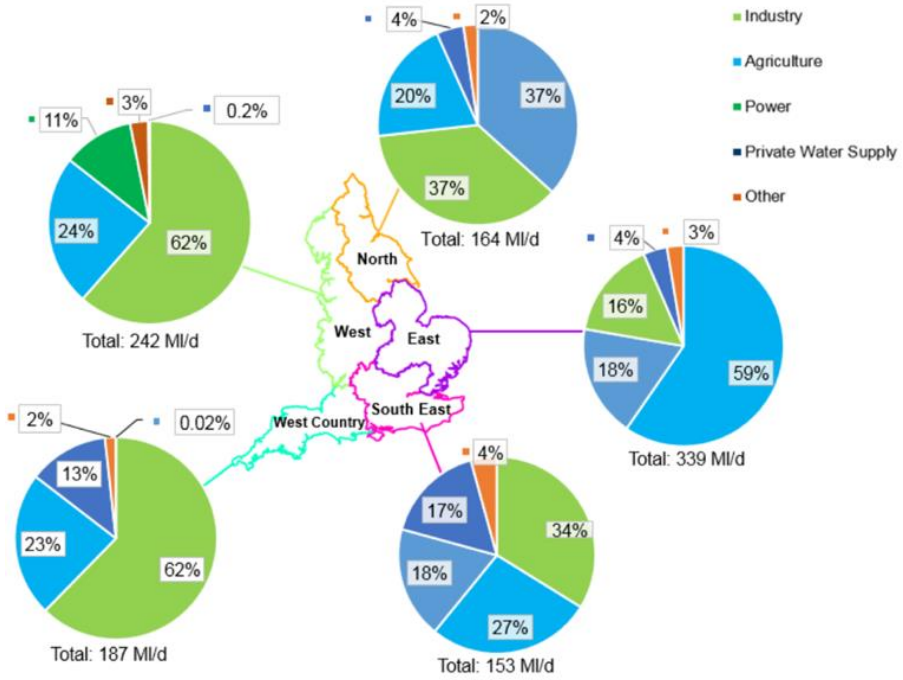
In comparison to the other regions, the South East has the lowest demand for consumptive water uses. However, our region includes significant trickle irrigation which has historically been exempt from licensing. This includes the rapidly developing soft fruit industry. The National Framework acknowledges that their work does not fully represent these important sectors as they do not feature in historic abstraction records.

The National Framework challenges us and the other regional groups to gain a better understanding of future demand for non-public water supply. There are sectors that rely on access to water and face many of the same issues as the water companies supplying public water.

The National Framework provides a preliminary assessment of how water demand may change in the future, examining drivers for, and uncertainties in, water demand outside of the water industry. This focuses on direct abstraction rather than water supplied by water companies. However, the assessment is limited as it does not represent new abstractions emerging in locations where it currently does not take place.

It is anticipated that estimates of non-public water use will increase in part as a result of some abstractions no longer being exempt from the licensing following regulations introduced by the Water Act 2003. This applies to navigation, minerals (likely to be non-consumptive use) and trickle irrigation.

Figure App2.4: Current consumptive water abstraction outside the water industry across the regional groups.



There are many factors that impact demand, including water availability, product market forces, economics, policy and regulation. The National Framework focused on seven key sectors, that in combination represent in excess of 60% of consumptive freshwater direct abstraction arising from outside the water industry.

The data from each sector was based on the sources set out in Table App2.1.

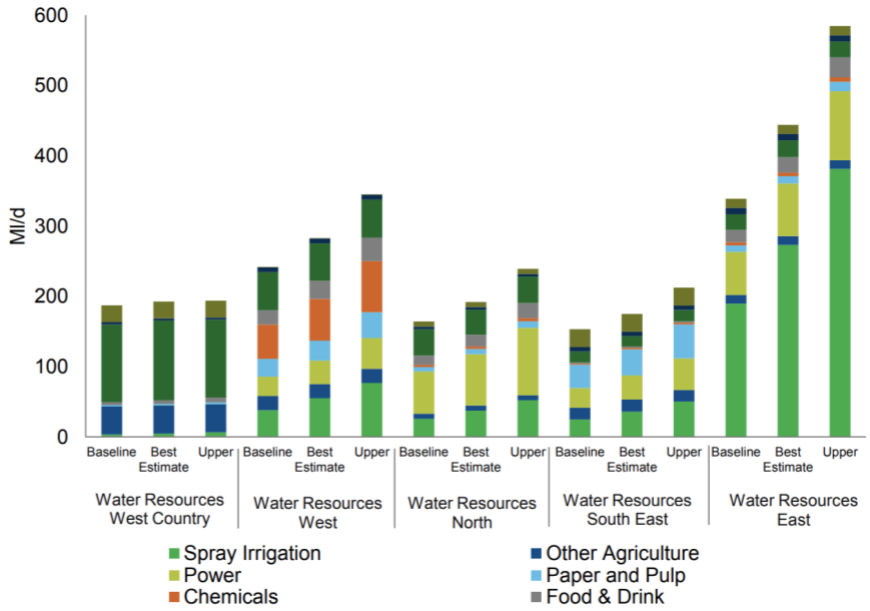
Table App2.1: Data sources for non-public water use

Sector	Data
• spray irrigation • electricity production • paper and pulp • chemicals • food and drink	Based on standard growth rates across England and not adjusted for different regions as limitation on future water use data
• livestock • protected edible crops and ornamental plants	Based on estimates of growth on projections of non-household water use, supplied by water companies in their water resources management plans, as an indicator of how direct abstraction could change.

Figure App2.5 shows the potential changes in water consumption for different scenarios. The National Framework recognises the limitations of this assessment, signposting the need for further work to fully assess future changes. Using best available information to form estimates, the assessment reflects the uncertainty of how the factors that influence demand may interact. As the figure shows, a best estimate and upper range scenario are considered.

The assessment shows that in all of the sectors examined, the potential increase in demand remains lower than the total volume currently licensed for abstraction nationally. This would appear to indicate that at a national scale these sectors have sufficient water. However, this does not necessarily mean that water is available where it is needed. The assessment does not account for certain abstractions exceeding licence quantities, nor does it consider potential environmental pressures that could be addressed through licence changes. It may not be possible for unused limits on licences to be utilised in the future.

Figure App2.5: Potential range of changes to non-public water supply use to 2050.



The National Framework recognises the challenges that planning for non-public water supply brings and highlights the need to be reviewed as regional plans progress. It anticipates that we will work with the business sectors that abstract directly and seek opportunities for collaboration.

Of all the regions, the South East faces the greatest pressures on public water supplies. If surplus water can be made available, we will still need to develop options to supply more water, equivalent to all new water resource options and transfers currently selected in company WRMPs, as well as achieving ambitious efficiency reductions. If surplus water cannot be accessed, demand will need to be reduced or further resources developed. The Framework highlights that we must track the progress on demand management as if savings are less than expected, a large shortfall may reduce resilience, limit progress on environmental improvements and lead to more frequent use of drought measures.

Appendix 3: Consideration of water resources options

Options Summary Report

WRSE published an Options Summary Report alongside the draft regional plan which included summary lists of the options considered as part of the draft regional plan preparation comprising:

- Feasible options list
- Technically feasible but excluded from optimisation in the investment model options list
- Rejected options list

A copy of the draft regional plan Options Summary Report is available in the WRSE Document Library.

A summary of that information was published as an appendix to the draft regional plan. That Appendix has not been updated for this revised draft regional plan. The options considered as part of the revised draft regional plan are largely the same as for the draft regional plan, with the changes as described below.

Demand Management

Demand management (DM) options assessed for our draft regional plan included:

- Leakage reduction (distribution network and customer supply pipes)
- Water efficiency (behaviour change and physical interventions at household level)
- Metering (conversion from fixed rate to metered tariff, smart metering)

Options assessed included metering, water efficiency and leakage reduction initiatives covering the company and customer-side measures. Changes in national policies, in the form of Government interventions, which would result in demand reductions were also considered.

Since the publication of the draft regional plan, WRSE and our member companies have re-assessed the demand management options available as part of the investment modelling and increased the amount of water saved through them and disaggregated them into smaller component parts. This has resulted in an increase in the total number of options available for selection, for the investment model, from 2,000 to 4,000.

How we treated AMP7 / AMP8 Schemes in the plan

The WRPG sets out the baseline water resources planning scenarios, and assumptions around which schemes should be included in the baseline. Schemes should be included as baseline if they meet one or more of the following conditions:

- The scheme has planning permission to go ahead;
- A funding allowance has been made by Ofwat in a business plan for the delivery of the scheme; or
- The scheme includes other necessary permissions such as abstraction licences or environmental permits.

The guidance on including previously funded schemes was new in the WRPG for the draft regional plan and WRSE reviewed schemes against this guidance and identified those which qualify. This was discussed with our member companies and regulators. A table was included in the draft regional plan to show the schemes which had been included in the WRSE Investment Model (IVM) as options which would be delivered in the next AMP. Within the list were the strategic schemes, the start date when the benefit from these schemes was expected, and whether the scheme had been included in the baseline in the IVM or not, for the draft regional plan.

The table (Table App3.1) has been updated for the revised draft regional plan, to reflect changes in the status of schemes for the AMP7/8 period that have been provided to WRSE by our member companies.

Table App3.1: Existing WRMP scheme status in investment model (update Aug 23)

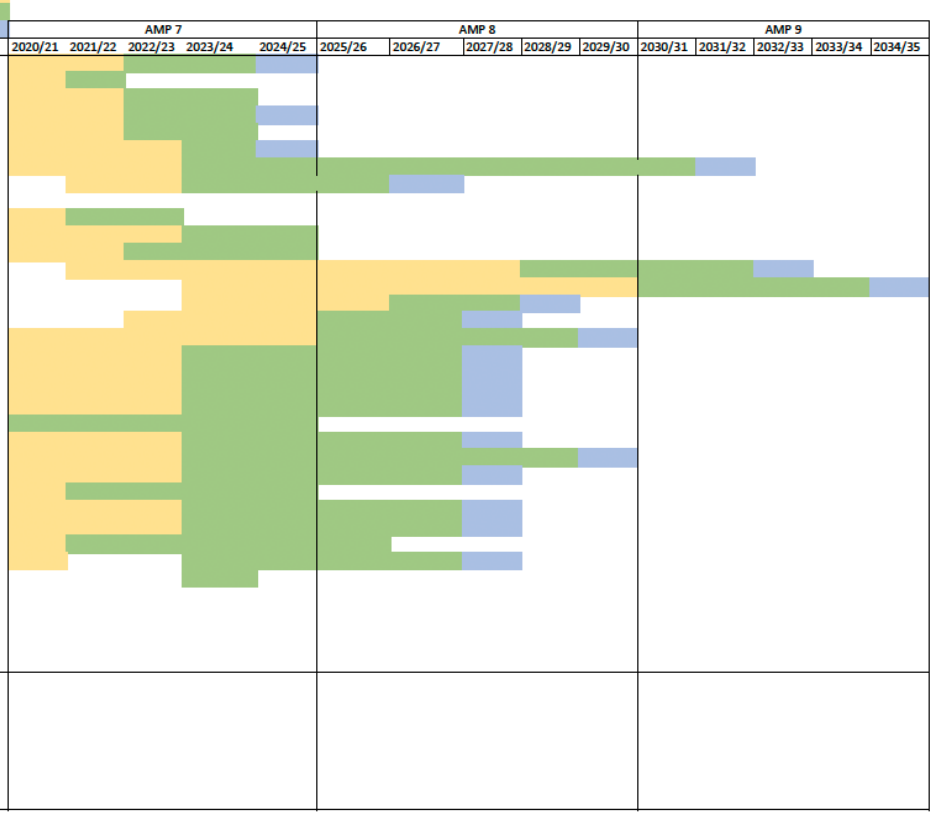
Key

Planning/Design Phase

Construction/Implementation Phase

Scheme benefit i.e. the scheme is on line and providing benefit from the 1st April that year.

Company	Strategic Schemes	Start date	Option in model baseline
AFF	WRZ6 to WRZ4 Company Transfer	2024-25	Yes
AFF	WRZ4 Network reinforcement	2022-23	Yes
AFF	WRZ4 Upgrades	2023-24	Yes
AFF	WRZ3 New Storage (CE)	2024-25	Yes
AFF	WRZ3 New Storage (PTN)	2023-24	Yes
PRT	Source C, H & O DO recovery schemes	2024-25	No - Included within baseline supply forecast
PRT	Havant Thicket reservoir	2031-32	Yes
PRT	Accelerated universal smart metering programme (requested)	2026/27	Yes
SES	No schemes		
SEW	Industrial groundwater source	2023-24	Yes
SEW	RZ6 Zonal Scheme	2024-25	Yes
SEW	Bewl-Darwell	2024-25	Yes
SEW	Broad Oak Reservoir	2032-33	No
SEW	Arlington Reservoir	2034-35	No
SEW	RZ7 to RZ2 Company Transfer	2028-29	Yes
SEW	RZ1 to RZ7 Company Transfer	2027-28	No
SWS	Additional import from PWC Source A (further 23Ml/d)	2029-30	Yes
SWS	Sandown WwTW Indirect Potable Reuse (8.5Ml/d)	2027-28	Yes
SWS	Hampshire Grid (HSW to HSE)	2027-28	Yes
SWS	Hampshire Grid (HSW to HSE)	2027-28	Yes
SWS	Southampton link main	2027-28	Yes
SWS	Romsey Town to Broadlands valve	2024-25	Yes
SWS	Newbury Groundwater	2027-28	Yes
SWS	Littlehampton Recycling (20Ml/d)	2029-30	Yes
SWS	Transfer to Rotherfield WSW & Rogate BH rehabilitation	2025-26	Yes
SWS	Scheme to bring Smock Alley back into service	2024-25	Yes
SWS	Winter transfer: Stage 2 - New main Shoreham/North Shoreham and Brighton A	2027-28	No
SWS	Recycling: Medway WwTW (18 Ml/d)	2027-28	Yes
SWS	SEW Kingston to SWS KT (near Canterbury)	2025-26	Yes
SWS	Utilise full existing transfer capacity KME - KTZ	2027-28	Yes
SWS	Sandwich licence variation	2023-24	Yes
THM	Managed Aquifer Recharge Horton Kirby ASR	2024-25	No - included within baseline supply forecast
THM	Groundwater development: Southfleet and Greenhithe		No - Option unlikely to be delivered
THM	New River Head		No - Option unlikely to be delivered
THM	Ladymead	2024-25	No - included within baseline supply forecast
THM	Deephams recycling	2030-31	Availability of option now delayed
Deleted Schemes			
PRT	PWC Source J Boreholes (DELETED)	~~2024-25~~	No
SWS	Additional import from PWC Source A (additional 9Ml/d) (DELETED)	~~2024-25~~	No
SWS	Bournemouth Water supply from Knapp Mill (DELETED)	~~2027-28~~	No
SWS	Fawley desalination (modular to 75Ml/d) (DELETED)	~~2027-28~~	No
SWS	Sussex Coastal Desalination (10Ml/d) (DELETED)	~~2027-28~~	No
SWS	Pulborough groundwater licence variation (DELETED)	~~2021-22~~	No
SWS	Sussex Coast - ASR (DELETED)	~~2027-28~~	No



The draft regional plan identified that a number of previous WRMP options had been rejected, and were listed in the rejection register in the WRMP tables published by each company. This was linked to work companies and WRSE had undertaken in reaching that decision.

The key schemes in this category at the time of the draft regional plan included the following, which were not included in the baseline into the IVM:

- Fawley desalination option which was rejected through the SRO investigation and gated process at gate 1.
- Pulborough groundwater scheme following environmental investigations
- The potential bulk supply from Bournemouth following environmental investigations on the river Avon
- The lower greensand aquifer and storage recovery scheme on the Sussex coast.

Since the publication of the draft regional plan, our member companies advised us of additional changes to the availability of schemes, and the updated table for the revised draft regional plan set out in Table App3.1 above therefore now also includes the following schemes that were not available for selection in the investment modelling for the revised draft regional plan:

- Portsmouth Water Source J boreholes – as this option was no longer considered feasible
- Additional import from Portsmouth Water Source J – this option was reliant on the Source J boreholes providing additional water to Portsmouth Water, and so in the absence of that option, this transfer was also no longer considered to be feasible.
- Sussex Coast Desalination Option – this was an option selected in the draft regional plan, however Southern Water confirmed to WRSE in 2023 that the option was no longer considered to be feasible.

Options from previous WRMPs such as Broad Oak and Arlington Reservoirs were not included in the baseline into the IVM for the draft or revised draft regional plans as there remained a choice whether these future schemes should go ahead or not. These decision points were in 2021/22 (draft plan) and 2023/24 (the final plan), respectively.

Havant Thicket Reservoir had received planning permission and is under construction and therefore in the draft regional plan the IVM assumed that it would be delivered by 2029. The delivery date for the revised draft regional plan assumes that delivery will be by 2030 based on updated information in 2023. WRSE has only made this assumption for the reservoir scheme. Potential associated schemes with the reservoir, such as the recharge of the reservoir through the Hampshire Water Transfer and Water Recycling Project remains an option within the IVM and have not been included as baseline. The original and delayed dates of these schemes have been explored through the investment model.

The Deephams recycling scheme remains an option for the IVM in the draft and revised draft regional plans, but the availability of this option is delayed to 2060, associated with the delivery of environmental improvements on the River Lee.

Schemes that are due to be completed in the current AMP period (AMP7) have been assumed to be completed before the start of the WRSE plan, and their benefits have been reflected in baseline company positions in the regional plan. All the other options in the IVM have not been included in baseline for the IVM.

Appendix 4: How customers and stakeholders have shaped our regional plan

Engagement with customers

Customer engagement has been a critical part of developing our regional plan. The regulatory framework sets out the requirement to ensure we engage with water company customers, and understand their views, priorities, and preferences. Details of how we have engaged with stakeholders is set out in our method statement[45].

It is crucial that as we engage with customers, we ensure there is a clear line of sight or 'golden thread' between our regional plan, company WRMP24s and PR24 business plans as they are developed.

We have worked collaboratively with our member companies through our Engagement and Communications Board (ECB) to ensure engagement activity is coordinated, inclusive and effective. In addition, when it has been appropriate, we have worked with other water companies across England to ensure both a collaborative and efficient approach to engagement. We have convened regular sessions with company Customer Challenge Group (CCG) representatives and the Consumer Council for Water (CCW) through a regional CCG (rCCG) to challenge and test the engagement approach and materials used.

We have used independent agencies to conduct the customer engagement, ensuring expert input and challenge as well as helping to shape innovative approaches.

The approach we have adopted is in accordance with the expectations set out in the National Framework which puts the onus on the regional groups 'to decide how and to what extent they engage with customers at the regional level', and the WRPG which requires our member companies to take account of customers' preferences and the costs and benefits for customers.

The key milestones and engagement points in the development of our plan to date are set out in Figure App4.1.

Engagement with stakeholders

Engagement with stakeholders is an important part of the development of our plan and water companies respective WRMPs. There is a diverse community with a stake in planning future water resources and our aim is to be open and transparent, sharing information in a timely way to raise awareness of the plan and to seek active participation to develop a multi-sector plan that identifies the solutions that may form part of water companies draft WRMPs. Details of how we have engaged with stakeholders is set out in our method statement[46].

Through our ECB we ensure communication and engagement activity is coordinated, inclusive and effective. The Environment Agency attends the ECB, contributing to the Board whilst retaining its independent role.

We designed our engagement programme to meet the expectations set out in the National Framework and the WRPG, and to support the development of our plan.

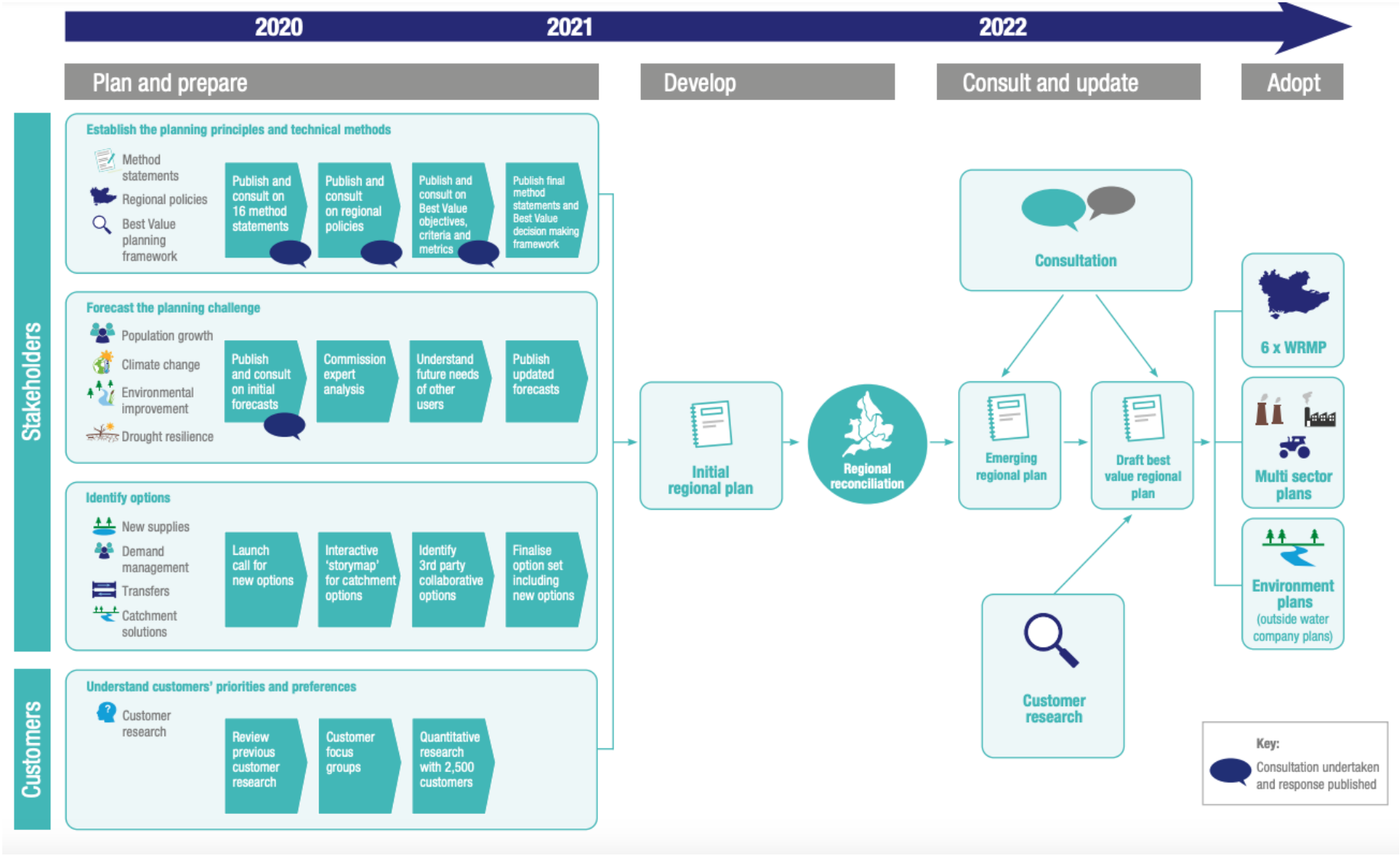
Through our engagement we have sought to:

- Develop a plan which provides a secure and sustainable water supply which meets the future needs for public water supply and other sectors, supports the well-being of society and economic growth.
- Agree the strategic challenges facing the region, e.g. climate change, population growth, protection and enhancement of the environment, as well as the foundation data and scenarios used to develop the planning forecasts.
- Inform the policies adopted in the plan – specifically around key areas such as environmental ambition, risk and resilience, and the use of drought orders and permits.

[45] https://www.wrse.org.uk/media/2ebdm352/method-statement-customer-engagement-september-2021.pdf

[46] https://www.wrse.org.uk/media/gyiiud1y/method-statement-stakeholder-engagement-sept-2021.pdf

Figure App4.1: Key engagement stages to date



- Build an understanding of, and agreement to, the technical methods, data and assumptions employed in the plan.
- Contribute to the solutions considered in the plan, including catchment, nature based and multi-sector solutions, as well as proposals for innovative solutions.
- Engage on the strategic resource options considered in the development of the plan.
- Consult on and agree the objectives, criteria and metrics that will be used to inform the development of the best value plan and build an understanding of, and agreement to, the decision-making process to help determine the preferred plan.
- Gain support for the overall plan, and where there are areas of challenge to understand the basis for the challenges and be able to clearly articulate and evidence the approach and decisions made by us and the six member companies.
- Ensure a clear and transparent approach for stakeholders, specifically in respect of the alignment of the regional plan with other regional plans, and also with other companies' WRMP24s and wider planning processes.

What options do customers prefer

Our work to date

As we develop our regional plan that provides "the best value to customers, society and the environment… to secure long-term resilience", we need to understand how we address both the challenges and opportunities for water resources.

This requires detailed insight into the preferences of customers across a range of issues, to ensure that the policies at the heart of water resource plans continue to deliver for customers and stakeholders alike.

Our six water companies (and in collaboration with Anglian Water, Severn Trent Water, South West Water and United Utilities through a collaborative programme coordinated by WRSE) have been reviewing a wide range of historical customer evidence, as well as conducting some new specific research with customers.

Outputs from Phase 1 of the process were as follows:

- Customer preference to inform long-term water resource planning – Synthesis of findings summary report, Eftec, March 2021[47]
- Customer preferences to inform long-term water resource planning – Part A Evidence review, Eftec, February 2021[48]
- Customer preferences to inform long-term water resource planning – Part B Deliberative Research, Eftec, February 2021[49]
- Customer preferences to inform long-term water resource planning – Part C Customer Survey, Eftec, March 2021[50]

We also reviewed and accounted for the customer views gathered as part of the Gate 1 submissions for the SRO schemes that form part of the range of options considered as part of our plan. These summary reports can be found on our Engagement HQ website here.

Phase 1 of our customer preference work involved three stages as follows:

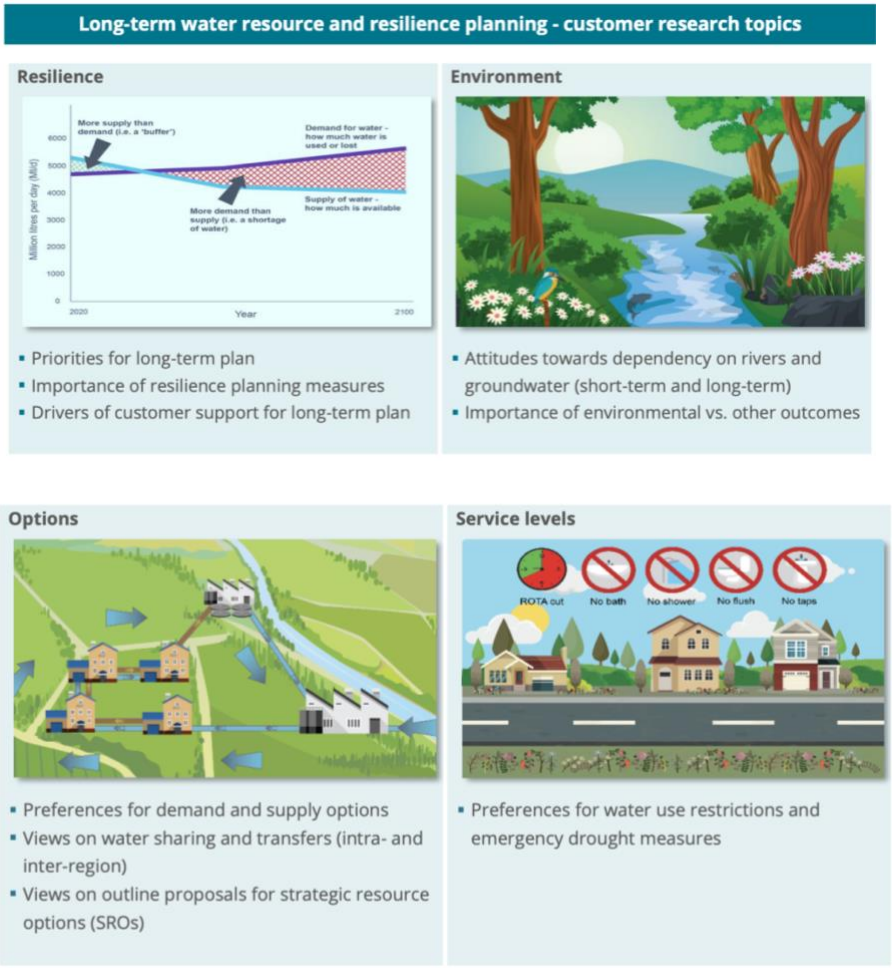
[47] https://wrse.uk.engagementhq.com/8774/widgets/24974/documents/11856
[48] https://wrse.uk.engagementhq.com/8774/widgets/24974/documents/11267
[49] https://wrse.uk.engagementhq.com/8774/widgets/24974/documents/11307
[50] https://wrse.uk.engagementhq.com/8774/widgets/24974/documents/11855

Part A: Evidence Review	Part B: Deliberative Research	Part C: Customer Survey
• Insights compiled from PR19, WRMP19 and recent customer research. • 120 documents submitted by the ten companies. • Consolidated view of the customer evidence structured around: (i) resilience outcomes; (ii) demand measures; (iii) supply side solutions; and (iv) the wider policy context.	• Conducted with household customers from all ten participating companies. • Implemented online between August 2020 and January 2021 with approximately 80 customers. • Range of discussion topics and exercises to understand views on: (i) water resources and the risk of emergency drought restrictions; (ii) resilience planning; (iii) supply and demand options; and (iv) sharing resources and strategic options.	• Representative online survey of customers in the WRSE region carried out in Autumn 2020 to measure preferences for: (i) demand and supply options; and (ii) alternative regional plan profiles. • Approximately 2,300 household customers and 350 non-household customers. • Results are a direct input to the WRSE regional plan investment model.

The mixed-method research approach provided a rich basis to draw on to understand customers' views and priorities. The intention has been to frame the evidence within the context of the long-term objectives for improving the resilience of the water system to drought and other disruptive events. Overall, this encompasses a broad range of topic areas which – typically – have previously been explored with customers in a piecemeal way. A summary of the customer research topics is set out in Figure App4.2.

We have also been working closely with the Consumer Council for Water and the chairs of our member water companies' Customer Challenge Groups (CCGs). We have also formed a regional CCG to share and enable challenge of our engagement approach and the materials we have been using.

Figure App4.2: Summary of customer preference topics



Source – Eftec, 2021

Key Findings from Phase 1

Customers are fully supportive of the coordinated and collaborative approach to developing the regional plan in the South East. There is a strong expectation that the plan will deliver beyond the minimum requirements for ensuring long-term security of supply, by reducing the dependency of the system on the environment, and building in additional capacity into the system to ensure against wider uncertainty and disruption (see Figure App4.3).

Underlying customers' views is a willingness to support plans and investments that will safeguard levels of service and the environment for future generations. Experience through 2020 of restrictions due to COVID-19 lockdowns have given customers a new appreciation of the disruption to day-to-day lives that are manageable. Whilst some limited aspects of extreme drought measures (rota-cuts/standpipes) may be felt tolerable, most restrictions on the use of water that would be in place are generally not acceptable to customers. Correspondingly, there is support for further reducing the risk of these measures being needed from the current level of a 40% chance during a customer's lifetime (corresponding to a 1 in 200 level of service).

Customers recognise that a pragmatic mix of options are required to achieve this. Leakage reduction, demand measures, and new supply sources are not seen as substitutes. Rather it is the timing and ordering of options that matters most to customers. First, companies must get their "own house in order" by reducing leakage and helping customers to save water. After this, the right supply options for customers are ones that are reliable, avoid environmental harm, and provide wider benefits including enhanced local amenity and recreation opportunities such as reservoirs. There is a role for water sharing and transfers if they are an absolute necessity, but in general the inherent preference is for self-sufficiency within an area rather than dependency on a transfer-in. Indeed, customers can be uncomfortable with transfers because there is a perception that these schemes will simply shift water availability problems around the country rather than dealing with them directly.

Figure App4.3: The shape of the best value plan for customers

The findings from the research provide a forming view on the key characteristics of the best value plan for customers. In effect, these represent customers' expectations or criteria for what an acceptable plan will feature and the aspects of candidate plan(s) that will likely be the focus of customers' attention.

Protect the environment

For customers, the environment is as equally – if not more - important as the other key outcomes that the plan can deliver. The plan is as much an opportunity to bring about an improved water environment through reducing the dependency of the water system on rivers and groundwater, as it is to safeguard water supplies over the long-term.

The key expectation for customers is that:

- The long-term plan to secure water supplies and improve resilience of the water system to drought and unexpected events are not at the expense of the environment; and
- Supply options that have a net positive environmental impact and deliver wider public value (e.g. recreation and amenity) will be preferred. Use of chemicals, high energy use, and other unmitigated impacts are key reasons why some options are less favoured.

Minimise risk in the system

For customers, a resilient plan is one that reduces future uncertainty by building capacity into the water system to deal with future disruption. Insurance associated with overbuilding infrastructure is not a key concern, with a typical view that it is "better to be safe than sorry".

The key expectation for customers is that:

- The long-term plan will place more weight on options that safeguard supplies and reduce risk of disruption with a high degree of certainty.

Acceptable balance of demand and supply options

For customers there is a very clear view on the balance of demand and supply options for the plan, and the order and timing in which they should be implemented.

The key expectation for customers is that:

- Ensuring the current system is efficient is the starting point. Practically this means reducing leaks and removing constraints in the water supply network;
- In the short-term efforts will be focused on being more efficient with the water that is currently supplied and helping customers use less water, along with actions that deliver wider benefits and public value, such as catchment management initiatives; and
- Over the longer-term new resource schemes will be the cornerstone of the plan because gains from leakage reduction can only go so far and significant reductions in demand cannot be relied upon. For supply options the driving preferences are certainty and avoiding significant environmental impacts (see above).

Affordable for all

For customers, there is typically a degree of insensitivity to fairly modest changes in bills for investments that will improve service levels and reduce the risk of future disruption. There is also a willingness to pay for investments now to safeguard water resources and the environment for future generations. At present, the main constraint in terms of customer support and the cost of the plan appears to be that bills are affordable for vulnerable or low-income households.

The key expectation for customers is that:

- The scale of any bill increase accounts for the needs of vulnerable and low-income households, helping to ensure their bills are affordable.

Source: Eftec, 2021

The level of importance placed by customers on protecting the environment is noteworthy. The strength of feeling observed in research conducted in 2020 has evolved since the PR19 and WRMP19 engagement by companies. This could be because of an increased appreciation of the local environment by customers due to COVID-19 restrictions – but such a conclusion would be anecdotal at this stage, rather than reliably evidenced. Moreover, whereas previous research had tended to look at the environment in a narrow way – related to abstraction and support for measures to reduce impacts – the approach to the research drew out this preference as cross-cutting the key principles for developing a long-term plan, support for water sharing and transfers, and preferred options.

Accordingly, the overall view is that water companies should not plan to harm the environment. Whilst levels of service are important, they are not seen as a greater priority than protecting the environment. There is little support for abstracting more water from the rivers and groundwater in normal circumstances – for both sensitive habitats and wider catchments – and use of drought orders and drought permits is seen as a last resort. Only in very extreme drought situations where rota cuts and standpipes are being considered could the environment be seen as a lower priority than people.

Based on the initial outline plans there is mostly a positive sentiment towards Strategic Resource Options (SROs), but it is evident that customer support is dependent on a range of assurances for customers. This includes demonstrating that such schemes are a necessity and that environmental impacts, energy use and cost are justified. Customers in "supplier" regions for transfers may also have concerns about impacts on their service levels, particularly due to switching of supply sources (e.g. reliability, water quality, taste and hardness), which will need to be addressed in order to ensure support across all affected customers.

Customers are fully supportive of the coordinated and collaborative approach to developing the regional plan in the South East. There is a strong expectation that the plan will deliver beyond the minimum requirements for ensuring long-term security of supply, by reducing the dependency of the system on the environment, and building in additional capacity into the system to ensure against wider uncertainty and disruption.

Customer research on the draft regional plan

WRSE and the water companies in the South East commissioned independent expert economics and engagement consultancy Eftec to design and implement a programme of focused household and non-household customer engagement around the proposals in the regional plan. Eftec's work sought to examine customer's preferences for the balance of the regional long-term water resources plan in terms of reducing demand for water, developing new schemes, and bill impact.

Approximately 1,700 household and non-household customers participated in an online survey that was carried out between March and May 2023. Eftec ensured that the respondent samples were representative of the South East of England and provided coverage of the six WRSE water companies.

Survey respondents completed a series of choice exercises to pick their preferred profiles for the regional plan, selecting:

- Preference over alternative plans without bill impact. This provided an "unconstrained" view of customer preferences based on the profile of each plan (i.e. the mix of schemes and impacts).
- Preference over alternative plans with (randomised) bill impact. This provided a "constrained" view on customer preferences reflecting trade-offs between higher/lower bill amounts and the profile of each plan.

The profiles of alternative plans shown to respondents were specified from WRSE's investment modelling outputs for the draft regional plan. The plans illustrated the alternative high-level choices and trade-offs for the balance of the regional plan based around sources of water (supply schemes, inter-region transfers and demand management) and selected bill impacts.

Key findings

A series of key findings were concluded following analysis of the customer preferences by Eftec.

Customers' overall preference is for a balanced regional plan. The three most-preferred plan profiles for both households and non-households were the Least Cost, Best Value and Gov C (the level of Government interventions used as the basis for the draft regional plan) plans. These all featured a mix of strategic resource schemes and higher levels of demand management ambition. Whilst differences in the strength of preference between the three plans were relatively modest – and varied according to level of bill impact – they were clearly preferred over alternative plans including the plan that excluded the SESRO reservoir proposal, and Gov H (no Government led demand management interventions) plans. In combination the level of support for these plans was around 70% - 75% of household and non-household samples. The Least Cost and Best Value plans in combination accounted for around half of customers' preferred plan responses.

Customers value the added resilience offered by the Best Value plan. There was an observed shift in household and non-household preferences at higher bill amounts, where the level of support for the Best Value plan tended to increase. The added dimension of the Best Value plan is the higher level of resilience to unexpected events and the results suggests that customers found this to represent better value for money over the alternative plan profiles at higher bill levels. At lower bill amounts it was also evident that these aspects of the regional plan stood out for the greater proportion of customers, given the comparatively low level of preference observed for the Excluding SESRO, which offered lower resilience to unexpected events.

Customers recognise the need to reduce demand and see this as an integral part of the regional plan. A consistent finding across all aspects of the analysis of customer preferences was the low level of preference for the Gov H plan (no Government led intervention for demand reduction). On this basis, the higher level of support for Least Cost and Best Value plans can be attributed in part to the inclusion and sooner introduction of water efficiency and product standards to support targets to reduce per capita consumption. Moreover, there was a comparable level of support for the highest level of demand management ambition through the Gov C plan at lower bill impact levels.

The tailing-off in the level of support at higher bill amounts for increased demand management ambition via the Gov C plan likely reflects the value for money perspective of customers. As the cost of a plan increases for customers, it became increasingly important for it to incorporate strategic resources that contribute to enhanced resilience – i.e. effectively paying for added "insurance" for security of future water supplies - and for there to be less reliance on reducing demand, which poses risks as there is an increasing level of uncertainty that the higher levels of water savings needed can be achieved.

Customers' preferences did vary across the region but in line with the profile of the alternative plans. The greatest level of support for the Best Value plan was observed from respondents in the Lower Thames area. The Least Cost plan stood out as having the strongest level of preference from respondents in the West, and this was by a sizeable margin even at higher bill impact amounts (approx. 50% share). In both cases, the support observed for these plans corresponds with the strategic resource options they include that would see water moved from the Upper Thames area to the Lower Thames and West areas.

In contrast, respondents in the Upper Thames had more mixed views. A preference for a greater emphasis on demand management (Gov C plan) was observed – compared to the other areas – and, particularly at higher bill amounts. Overall, though, the difference in the level of support between the Gov C and the Least Cost plan was marginal.

The Best Value and Least Cost plans either individually or in combination also tended to be most favoured in the Central, East and South areas. This is consistent with overall observed preference that customers tended to favour plans that offered a mix of solutions, over greater dependency on local level schemes and the highest level of demand management ambition.

Split views between the Least Cost and Best Value plans were in part attributable customer socio-economic and demographic characteristics. The Best Value plan tended to be supported more by younger respondents (24 or younger) and those in higher Social Economic Groups (SEGs), whilst the Least Cost plan was typically favoured by older respondents (55+) and lower SEGs. The distinctions in this regard, though, tended to reduce at higher bill impact amounts where support for the Best Value plan increased across all age groups and SEGs.

Conclusions

In aggregate no single plan stood out with a majority share of customer support. The balance of preference for these three plans varied according to aspects including bill impact, location, and customer characteristics. Nevertheless, the research findings in relation to the patterns of customer preferences are conclusive and Eftec considered that the following points could be drawn as conclusions with respect to the choices that remain for finalisation of the regional plan:

There is a greater level of customer support for a regional plan that incorporates large strategic schemes that can share water resources across multiple company areas. An alternative approach with more emphasis on “local” schemes (e.g. Excluding SESRO) received relatively limited support and was clearly preferred less by most customers.

In line with the greater level of support for a plan incorporating strategic schemes, the greater weight of customer preference was for self-sufficiency within the WRSE region. Large-scale transfers from outside of the region were not viewed as the primary solution. Indeed, the level of support observed for the Gov C plan indicates that a sizeable proportion of customers preferred demand reduction over reliance on large-scale transfers as the basis of “balanced” regional plan to secure water supplies.

The regional plan must be supported by Government led-measures to help bring down per capita consumption. The Gov H plan and limited level of demand management ambition was clearly the least supported plan overall by customers. At the opposite end of the scale, more customers tended to favour enhanced resilience over the very highest level of demand reduction, indicating that there is a limit to the level of ambition – and risk - that should be targeted in the regional plan. For a sizeable proportion of customers, the appropriate balance appears to be achieved by the Best Value plan (50% demand management measures).

WRSE has taken these conclusions into account in its decision making for the revised draft regional plan.

A copy of the Eftec report on the customer research outcomes is available in the WRSE Document library on its website.

Appendix 5: Company level diagrams

The diagrams in Figures App5.1 to App5.6 overleaf shows at a company level how the options selected under each of the branches in the regional plan change, depending on the scale of the challenges being faced.

The same context and commentary apply to these diagrams as is explained in Section 10 of this document for the regional overview. Including that:

- Given the number of options selected for some companies, options have been grouped together where necessary to keep the diagrams readable.
- The timing shown for the option is the date when the investment modelling first utilises the option
- The figures shown in the diagram (in Ml/d) for the option is the maximum capacity of the option in the 1:500 Dry Year Annual Average (DYAA) scenario.
- Options may have different utilisations under different design scenarios, and utilisation may vary across the planning period – for some options starting lower and increasing, or for others peaking at a point where the resource is most needed to meet supply demand balances.
- The new resource options only appear once in each branch of the diagram – the model then utilises them again in that branch through the rest of the period to 2075.
- Where a new resource option appears in more than one branch, but in different periods, this means the modelling selects them earlier or later, depending on the scale of challenge it is seeking to solve.
- It is for our six member company WRMPs to explain how they have reflected the regional plan and why the preferred programme has been selected.

The company level diagrams illustrate that some companies are facing larger challenges than others, with more options being selected by the investment model as a result.

Figure App5.1: Affinity Water – WRSE best value plan proposals

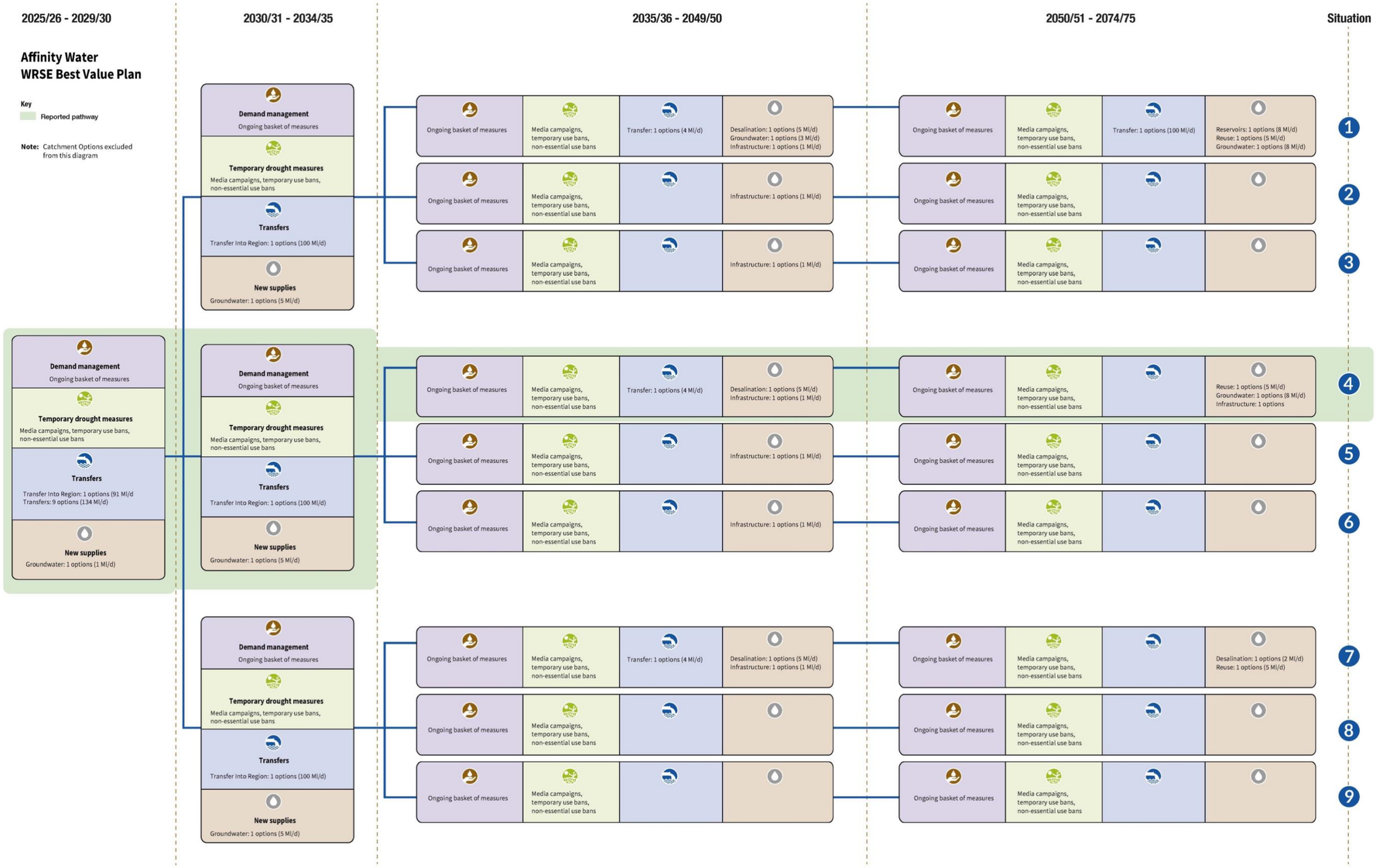


Figure App5.2: Portsmouth Water – WRSE best value plan proposals

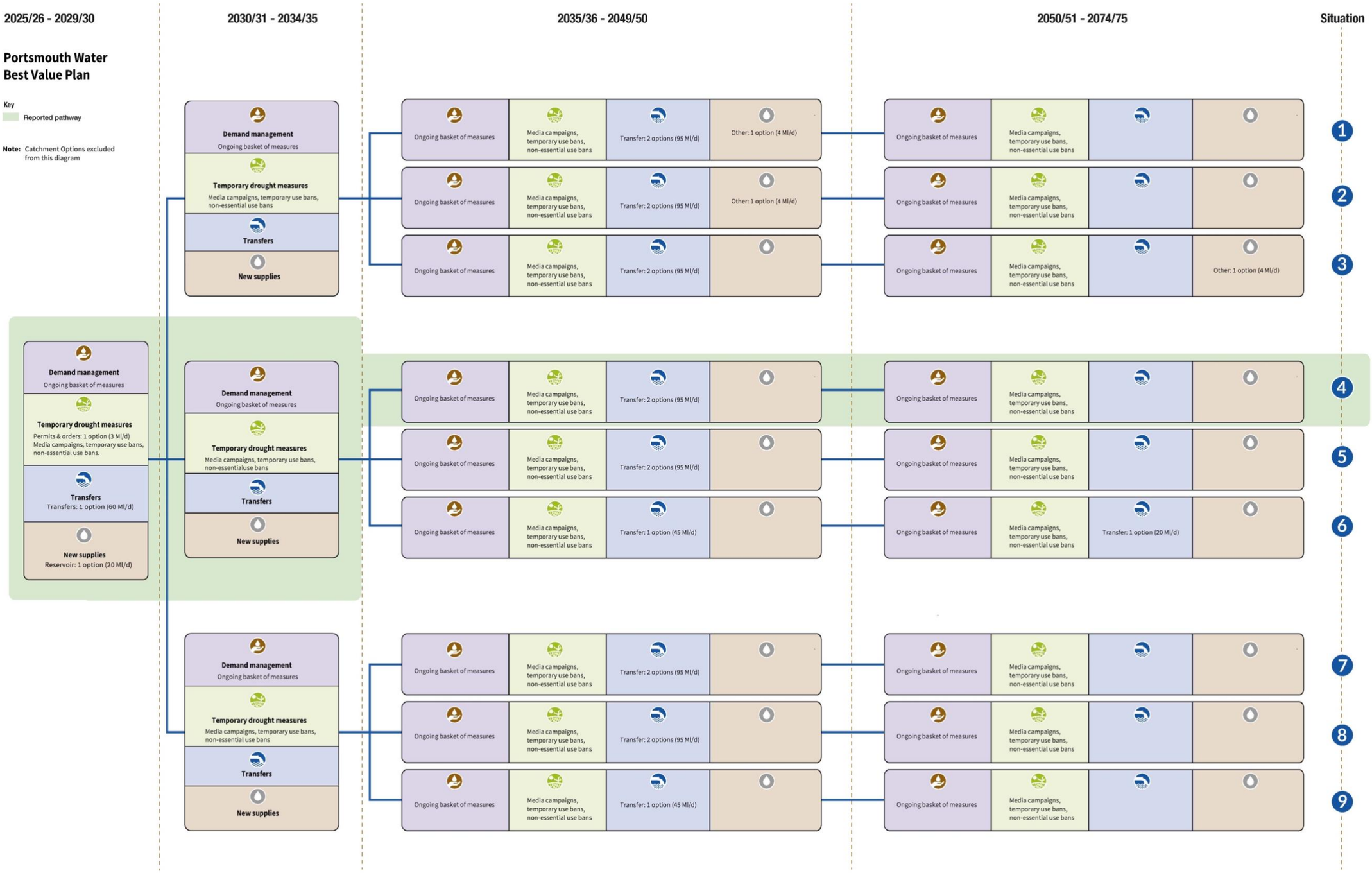


Figure App5.3: SES Water – WRSE best value plan proposals

Figure App5.4: South East Water – WRSE best value plan proposals

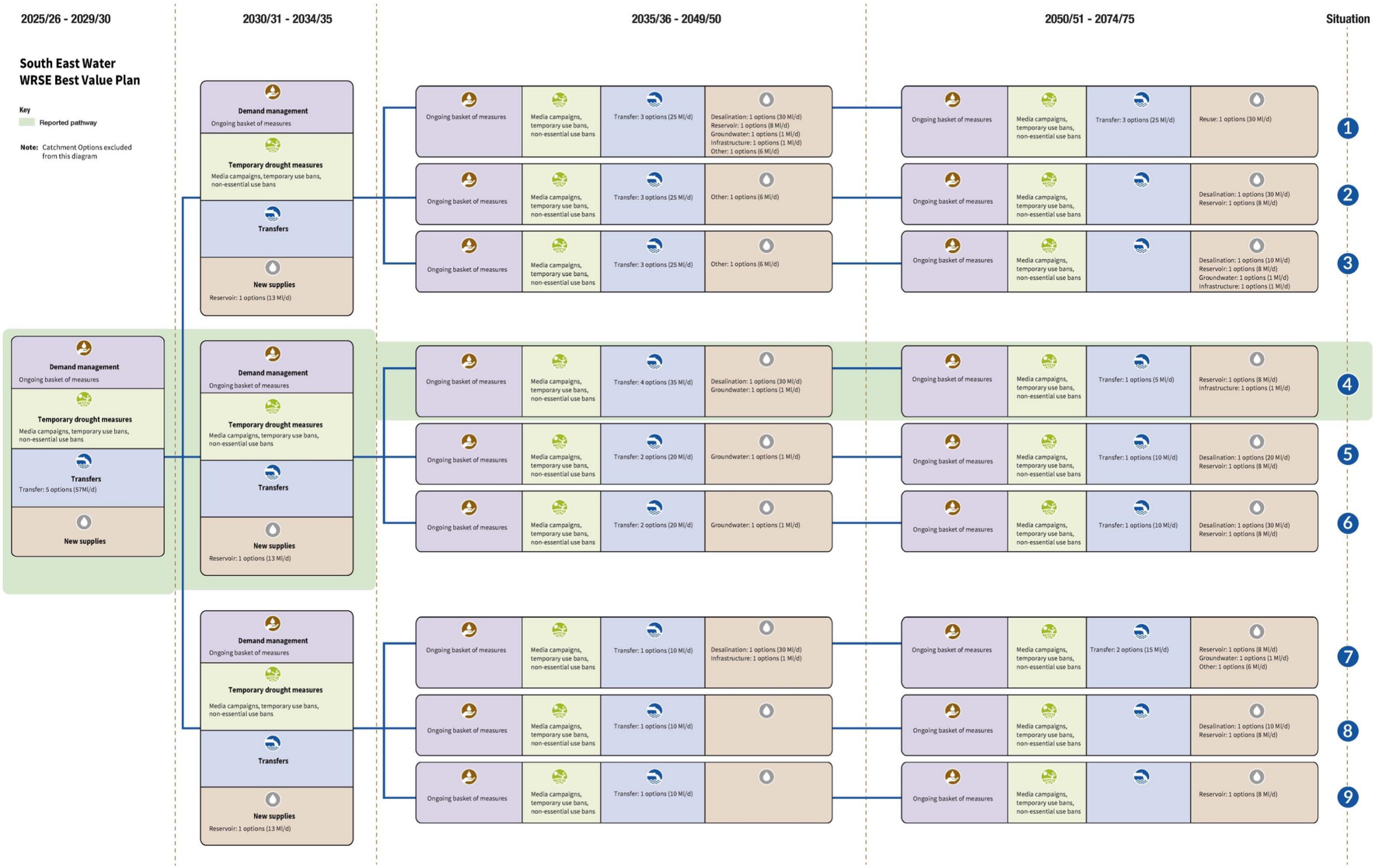


Figure App5.5: Southern Water – WRSE best value plan proposals

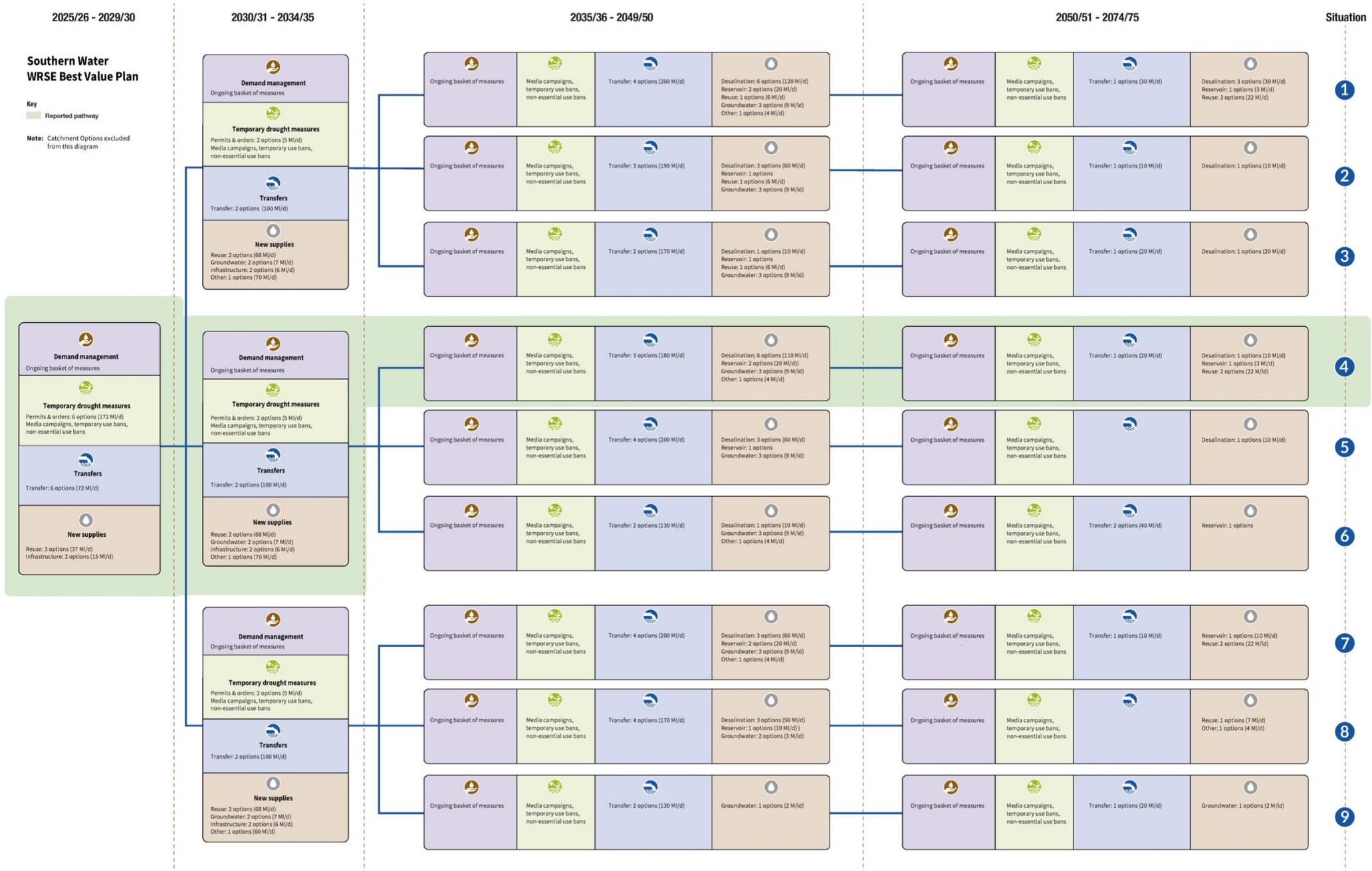
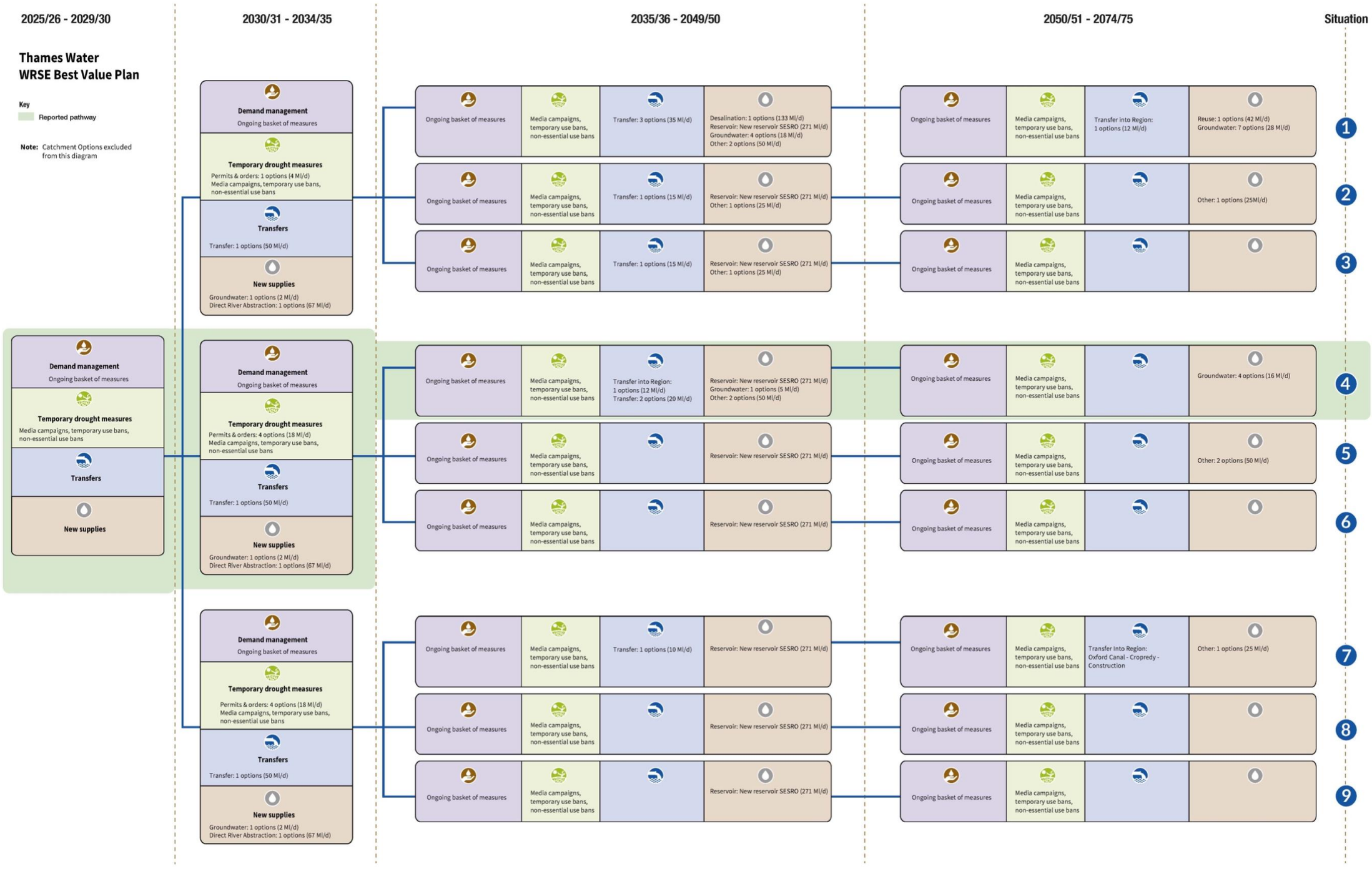


Figure App5.6: Thames Water – WRSE best value plan proposals



Appendix 6: Environmental Assessment

Context

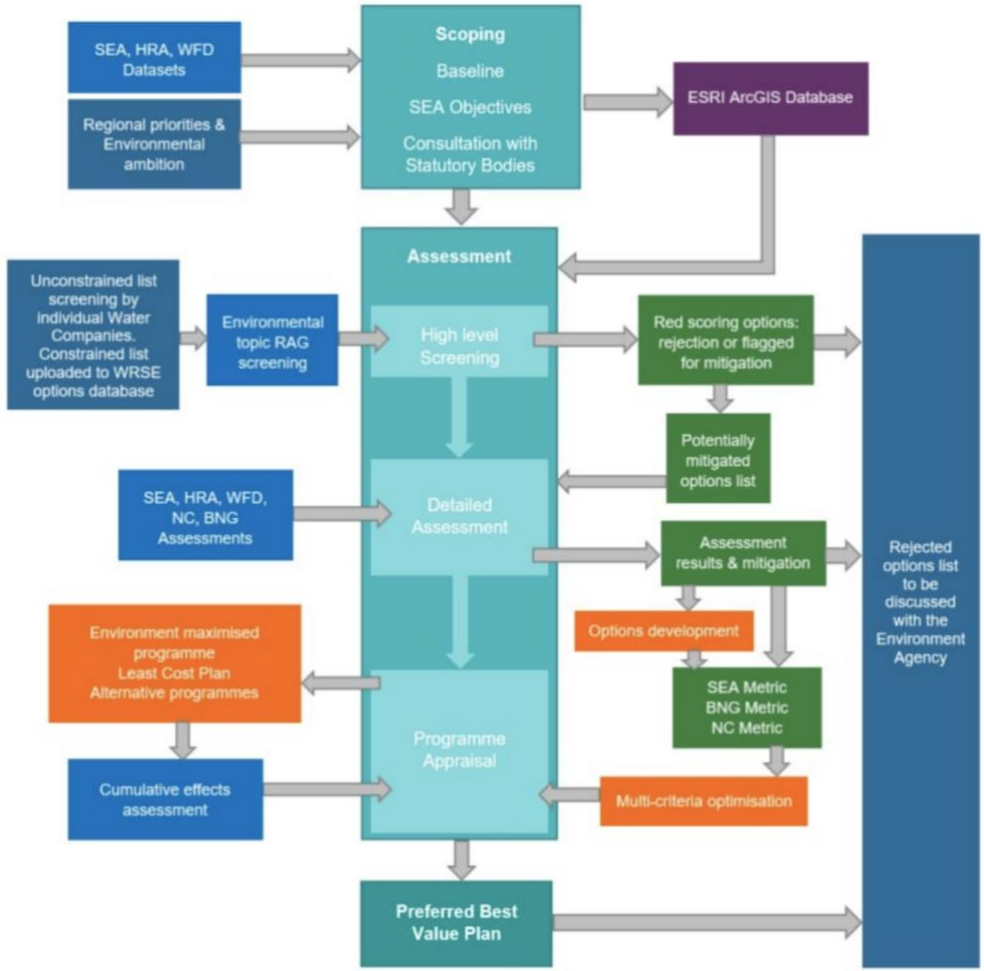
Prior to this regional plan, environmental evaluation has predominantly been undertaken through the Strategic Environmental Assessment (SEA) process both at the level of individual WRMPs and through a combined and cumulative assessment undertaken where necessary on the regional plan. In addition, Water Framework Directive (WFD) assessments and Habitats Regulation Assessments (HRA) have been undertaken by water companies, where necessary, as part of their options appraisal and selection processes for their plans and to ensure compliance with environmental legislation.

For the draft regional plan, we developed and implemented an expanded and integrated environmental process to provide a consistent framework for environmental assessments. These assessments informed the draft regional plan and fed into the assessments undertaken by our member companies for their WRMP24s. As set out in the Water Resources National Framework, this allows us to set out both environmental impacts and opportunities to maximise the wider social and environmental values. As part of this we are also incorporating environmental valuation techniques such as Biodiversity Net Gain (BNG), Natural Capital (NC) and ecosystem services assessment. An overview of the process is included in Figure App6.1.

Key outcomes from this process have been to develop an overarching set of SEA objectives, based on SEA Directive topics and key priorities for WRSE, and informed by a review of our member companies' SEA objectives. The main themes, messages and objectives from the policies, plans and programmes review are set out in Figure App6.2 and it is these that have fed into the development of our SEA objectives.

The two-stage approach first involved a high-level screening of the options provided by our member companies which has enabled us to flag those options with high environmental risk and where mitigation will be needed. The second stage has been a detailed assessment (undertaken by our member companies) to include assessments consistent with SEA, HRA, WFD, NC, INNS and BNG approaches, and the development of environmental metrics to feed into the options decision-making and programme appraisal processes. Engagement with our environmental regulators has been a key component of this process.

Figure App6.1: Environmental Assessment Approach

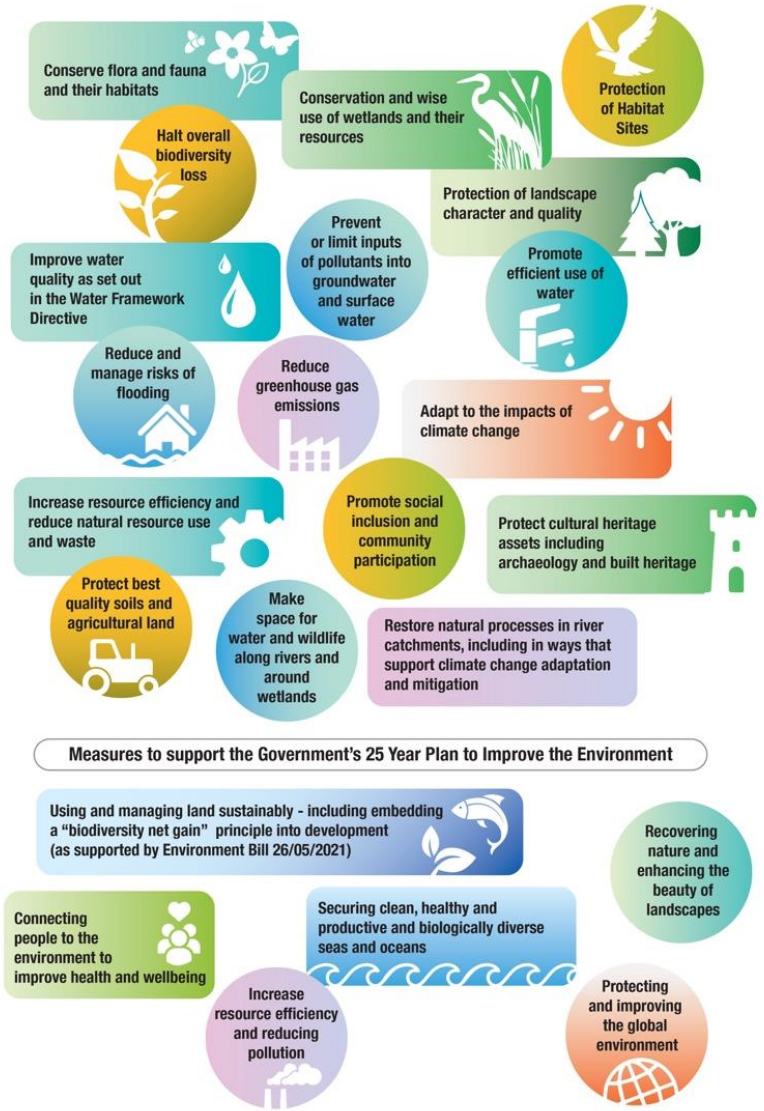


The SEA includes proposed mitigation, and a programme of monitoring of significant environmental effects of the plan's implementation with the purpose of identifying unforeseen adverse effects at an early stage and being able to undertake appropriate remedial action. In accordance with the SEA Regulations, monitoring arrangements may comprise or include arrangements established for other purposes. This is of particular relevance to water reuse schemes where water quality and quantity is a key component to the maintenance of healthy ecosystems.

We have undertaken the process of environmentally assessing our regional plan and applied environmental metrics in our options appraisal and selection process. In respect of the components that make up our environmental assessment:

- **SEA** works to inform the decision-making process through the identification and assessment of options and significant and cumulative effects a plan or programme may have on the environment.
- For **HRA**, the regional plan screens likely significant effects in the absence of mitigation of options to comply with legislation. Where options are deemed to have uncertain or likely effects, either individually or in combination, these have been subject to Appropriate Assessment, the next stage in the HRA process as part of the company WRMPs, with the results fed back up to the regional level.
- For **WFD**, a level 1 assessment informed WRSE's initial assessment of options, with options that were identified as having potential effects on WFD objectives of waterbodies subject to Level 2 WFD assessments as part of the company WRMPs, with the results fed back up to the regional plan.
- WRSE included **NCA** and **BNG** processes as part of the options appraisal for the regional plan.
- Options that have been identified as having high or moderate Invasive Non-Native Species (INNS) have also undergone further investigation as part of the company WRMPs, with the results fed back up to the regional plan.

Figure App6.2: Themes for assessment of the regional plan within the SEA.



How the environmental assessments have informed our regional plan

Environmental metrics

As part of the SEA and other assessments of the individual options, metrics were compiled for the options and fed into the best value investment modelling process. This resulted in four environmental metrics being assessed and considered:

- SEA environmental benefits
- SEA environmental disbenefits
- Natural capital
- Biodiversity net gain

A series of other best value metrics covered related environmental topics, including:

- Capital (construction) and Operational carbon emissions
- Reliability metrics, including water quality, soil health etc

Through the best value investment modelling a series of model runs were undertaken to seek to maximise the best value metrics, initially individually, and then collectively. This enabled plans with differing levels of environmental performance to be identified and assessed on a comparative basis. As well as the best value plan, a best environmental and societal plan is also identified for comparison purposes, as well as a least cost plan.

Environmental Assessments of individual options

As noted above, a series of environmental assessments of individual options have been undertaken by us and our member companies. These assessments have enabled the potential environmental effects, and likely significant effects of options to be identified and assessed, and measures to avoid, reduce or mitigate them identified.

As part of this work, a number of the environmental assessments identified that some of the options were carrying a higher level of likely significant effects and greater potential environmental impact than others. In discussion with our member companies, we excluded these options from the list available for selection by the investment modelling. This process directed the investment modelling to not select those options.

However, when undertaking the least cost and best value investment modelling, the relative lack of options to provide water to some parts of the region in the longer term, in response to the scale of challenges and supply demand deficits being faced, meant that the investment model could not solve the planning problem in some WRZs in the Kent area in the longer term, typically post 2050.

In response we, in consultation with our member water companies and regulators, allowed the investment model to re-select some of the options previously excluded on environmental grounds, in order to solve the planning problem. A series of investment model runs were undertaken to limit the number of options in the Kent area down to a minimum and ensure that they could not be selected at the beginning of the plan. In doing this, the model was not allowed to freely select the option, and it was 'held back' in the modelling to only be allowed to be selected at a point when an otherwise unresolvable deficit would have resulted in a WRZ.

As a consequence of needing to do this, the draft regional plan included some options later in the planning period, in Kent, that had identified significant SEA, HRA and other impacts and risks associated with them. WRSE recognised that further work would need to be undertaken on risks and uncertainties relating to those options, to seek to resolve them as far as achievable for the regional plan before the final plan (and the final HRA). It was considered that should residual likely significant effects remain at that stage, it would be possible for WRSE to manage these uncertainties by identifying a specific alternative 'no adverse effects' option that would be employed if options (or subsets of options) prove unachievable due to their impact on Habitats (European) sites.

It should also be noted that for options identified late in the planning period, there is substantial time for impacts, risks and uncertainties to be resolved as part of subsequent regional plan and WRMP planning cycles, and subsequent applications for consent. If necessary, the option could be abandoned and replaced in future regional plan and WRMP cycles. It is also the case that new technologies will emerge over time that could assist in avoiding or reducing some of the effects associated with some of the longer term options, and this would also be taken into account in subsequent regional plan and WRMP cycles.

Work undertaken since publication of the draft regional plan

WRSE and our member companies have continued to progress the environmental assessments of the options in the regional plan and individual WRMPs since the publication of the draft regional plan. This has included ensuring that the assessments take account of updated information submitted on Strategic Resource Options (SROs) as part of the RAPID gated process, including updated environmental, carbon and biodiversity net gain assessments. WRSE and the companies have also reviewed and updated the assessments in light of comments received on the draft regional plan.

The environmental assessment reports undertaken for the draft regional plan have been further updated for the revised draft regional plan, taking account of updated environmental and scheme information, and to consider and respond to comments submitted on the draft regional plan, including from the environmental regulators and other organisations and individuals.

WRSE and our member companies have engaged with our environmental regulators over the details of the environmental assessments undertaken, and the comments received as part of the draft regional plan consultation. This included comments on the approach to assessments and the details of the assessment outcomes on individual options. WRSE and our member companies have developed a tiered approach for the environmental assessments of the regional plan and the options selected within it, through engagement with the Environment Agency and Natural England. This approach ensures that appropriately detailed environmental assessments are completed for the plan, with a greater level of detail focused on the plan and options within it in the periods 2025 to 2035, and 2035 to 2050, than for the longer term options in the 2050 to 2075 period, as illustrated in Figure App6.3 below.

Updated environmental reports are published alongside the revised draft regional plan. Where options with a potential for adverse environmental effects are selected in the plan, this is identified in the environmental reports, along with details of appropriate mitigation or compensatory measures that may be required to be considered through subsequent and more detailed work as part of applications for planning and other consents. A summary of the environmental report outcomes is presented in Section 16 of this revised draft regional plan.

Figure App6.3: Summary of assessment approach for updated assessments

For those options later in the planning period, a description of environmental risks relating to the options is set out in the environmental reports, and additional work to further investigate them will be undertaken through subsequent regional plan and WRMP 5 yearly plan making cycles. For some longer term options, potential alternatives to these options may need to be identified and considered as alternatives through subsequent plan cycles should environmental risks and impacts not be capable of being overcome.

More information

Summaries of the environmental assessments undertaken both of individual options and of the regional plan as a whole will be published alongside this revised draft regional plan. The following documents will be available for review in the WRSE Document Library:

- Habitats Regulation Assessment
- Natural Capital and Biodiversity Net Gain
- Strategic Environmental Assessment Summary Table
- Strategic Environmental Assessment Environmental Report
- Water Framework Directive Assessment

Appendix 7: Revised draft regional plan model run summary for key schemes

Section 17 of the regional plan provides commentary around the investment modelling undertaken by WRSE for the revised draft regional plan, including explaining how a number of key schemes form the core of the options selected across multiple model runs and the 9 situations (branches) in the adaptive plan.

Table App7.1 below provides a visual summary of the investment modelling outcomes for these key schemes for the reviewed draft regional plan. The rows in the table are different model runs undertaken. The columns to the right of the table identify the key schemes, and identify how many time in that particular investment model run the scheme was selected in the modelling in the 9 adaptive plan situations.

A green dot means that the scheme was selected in all 9 of the adaptive plan situations for that model run. A red dot indicates the scheme was not selected at all. The yellow dots indicate the scheme was selected in some but not all situations.

Table App7.1: Summary of scheme selection in revised draft regional plan investment modelling

Type of Model Run	Investment Model Run ID	SESRO Reservoir	STT - Pipeline Transfer	STT - Canal Transfer	GUC Transfer	Teddington DRA	Broad Oak Reservoir	Blackstone Reservoir	Beckton Desalination	Beckton Water Recycling	Deephams Water Recycling	Hampshire Water Transfer and Water
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybrida-2075	9	1	0	9	9	9	9	2	2	0	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridb-2075	9	1	0	9	9	9	9	2	2	0	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridb-sws2a-delay2-ht-2075	9	1	0	9	9	9	9	2	2	0	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-2075 Least Cost Plan	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-2075-bvp-07_50-v2	9	1	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-2075-bvp-07_50-v3	9	1	0	9	9	9	9	2	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-2075-envsoc-07_50-v2 Best Value Env&Soc Plan	9	1	0	9	9	9	9	2	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-2075-envsoc-07_50-v3	9	1	0	9	9	9	9	2	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-2075-resilience-07_50-v2	9	2	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-2075-resilience-07_50-v3	9	2	0	9	9	9	9	1	0	1	9
scenario	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-adj-existing-beckton-do-01-2075	9	2	0	9	9	9	9	1	0	1	9
scenario	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-adj-existing-beckton-do-02-2075	9	1	0	9	9	9	9	1	0	1	9
scenario	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-chingford-2030-2075	9	0	0	9	9	9	9	1	0	1	9
scenario	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-delay5-sesro-2075	2	9	0	9	9	9	9	0	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-dmp-breakdown-v2-2075	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-dmp-breakdown-v2-2075-b	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-drpo-v5-2075	9	0	0	9	9	9	7	1	0	2	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-lon-1in200-2033-2075	9	0	0	9	6	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-lon-1in200-2034-2075	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-lon-1in200-2035-2075	9	0	0	9	4	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-low-dmp-sew-med-gov-led-2075 Low demand managem	9	3	0	9	9	9	9	2	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-ltrisks-rts-2075	9	1	0	9	9	9	9	1	9	0	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-ltrisks-rts-v2-2075	9	0	0	9	9	9	9	1	9	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-ltrisks-rts-v3-2075	9	0	0	9	9	9	9	0	9	2	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-ltrisks-rts-v4-2075	9	0	0	9	6	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-ltrisks-rts-v5-2075	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-rts-2075	9	1	0	9	9	9	7	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-2075 Least Cost Plan with SWS delayed delivery d	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-2075	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-2075-bvp-05_00-v2	9	1	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-2075-fix	9	0	0	9	9	9	4	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-ford12_5-2075	9	2	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-gaters-hse-nyaa2_5-2075	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-prt-time-ltd-licence-2075	9	1	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-pwc-exports-nyaa2_5-2075	9	1	1	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-pwc-hardham-nyaa2_5-2075	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2a-delay2-ht-pwc-hardham5-2075	9	0	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-sws2b-2075	9	1	0	9	9	9	9	1	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridd-2075	9	2	0	9	9	9	9	2	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridd-sws2a-delay2-ht-2075	9	1	0	9	9	9	9	2	1	0	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybride-2075	9	0	0	9	9	9	9	2	1	0	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybride-sws2a-delay2-ht-2075	9	0	0	9	9	9	9	2	1	0	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridf-2075	9	1	0	9	9	9	9	2	1	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridf-sws2a-delay2-ht-2075	9	1	0	9	9	9	9	2	1	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridg-2075	9	1	0	9	9	9	9	2	0	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridg-large-sws-prt-transfer-2075	9	2	0	9	9	9	9	2	2	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridg-sws2a-delay2-ht-2075	9	1	0	9	9	9	9	2	1	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridh-large-sws-prt-transfer-2075	9	2	0	9	9	9	9	2	2	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridh-large-sws-prt-transfer-v2-2075	9	2	0	9	9	9	9	2	1	2	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridh-large-sws-prt-transfer-v3-2075	9	2	0	9	9	9	9	2	1	2	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridh-large-sws-prt-transfer-v4-2075	9	2	0	9	9	9	9	2	2	1	9
Free choice	jet-20230612-181202	st-hybrid-dy-w1-tree16.08-options-v61-gov-led-hybridcp2-2075	9	0	0	9	9	9	9	0	0	1	9