TAKING CARE OF ONE OF LIFE'S ESSENTIALS

NOW AND INTO THE FUTURE

PR24 LONG TERM DELIVERY STRATEGY

WONDERFUL ON TAP

SEVERN TRENT

WELCOME TO SEVERN TRENT'S FIRST FORMAL LONG TERM DELIVERY STRATEGY

As a company taking care of one of life's essentials – providing clean and wastewater services to millions of people across the Midlands – it's no surprise to learn we're already extremely experienced in long-term planning. But the strategy presented here represents a significant step forward in the evolution of Severn Trent's strategic planning, allowing us to outline our activities over the next five years but in the context of 25-year outcomes.

At the heart of this strategy is an absolutely vital balance for our customers between investing in service improvements, keeping water bills low, and doing the right thing for the environment and for society. We have paced our proposed investments carefully between now and 2050 to ensure the costs and benefits of our work are spread fairly across generations.

The quality of our thinking has been enhanced by the lessons learned from our ambitious Green Recovery programme in AMP7, and by acting on the feedback we've had from customers over the last two years. Following this rigorous approach, and with help from a whole range of experts from both inside and outside the industry, we've identified an ambitious programme of investments that sets us up to meet long-term challenges in a world that is ever more complex and uncertain.

I'm proud of my team at Severn Trent, who have truly embraced the opportunity to use Ofwat's adaptive planning approach to create the best long-term strategy for our customers and our region. That said, we've never been a company to rest on our laurels. We're already identifying ways we can improve our approach for PR29, when we'll need to make critical decisions about investment in several of our long-term outcomes.

In partnership with our PR24 business plan, this strategy outlines a clear, robust plan of action for Severn Trent for the five years to 2030. I know everyone here is ready to deliver that plan and to begin realising the benefits for our customers, our stakeholders, our society, our region, and our environment.

Liv Garfield
Severn Trent CEO

EXECUTIVE SUMMARY

This Long Term Delivery Strategy (LTDS) brings together every aspect of Severn Trent's planning over 25 years – strategic planning frameworks, statutory environment programmes and planned enhancement activities – into a single adaptive strategy that covers both water supply and wastewater services (including bioresources) for the first time.

This strategy builds on our Strategic Direction Statement (SDS)[1] and is based on a rigorous approach which has involved many iterative steps and engagement with customers, stakeholders and our Board.

INPUTS TO OUR LTDS

10 feedback meetings with regulators
including the Environment Agency, Natural England, the Drinking Water Inspectorate and Ofwat

Engagement with around 68,000 customers

Six pieces of written feedback from regulators

Five Board sessions before final sign off

12 stakeholder workshops

15 assurance audits

800 comments in responses
to our Water Resources Management Plan (WRMP) and Drainage and Wastewater Management Plan (DWMP)

The breadth of our evidence base and the challenge we have sought gives us confidence we are making the right choices at PR24. It ensures that all AMP8 enhancement investments represent 'no- and/or low-regrets' interventions that take the next step towards achieving our long-term outcomes and, just as importantly, ensuring bills remain affordable for our existing and future customers. Throughout this document, we have highlighted examples of how following this structured approach has improved our decisions about delivering long-term outcomes, increased the depth of our Board's engagement in future planning, and supported improvements in our business culture.

[1] https://www.stwater.co.uk/content/dam/stw/about_us/documents/strategic-direction-statement.pdf

AMBITION

25-YEAR VISION

Severn Trent is one of Britain's largest water and wastewater companies, serving 4.6 million homes and businesses across the Midlands. We want to be known as:

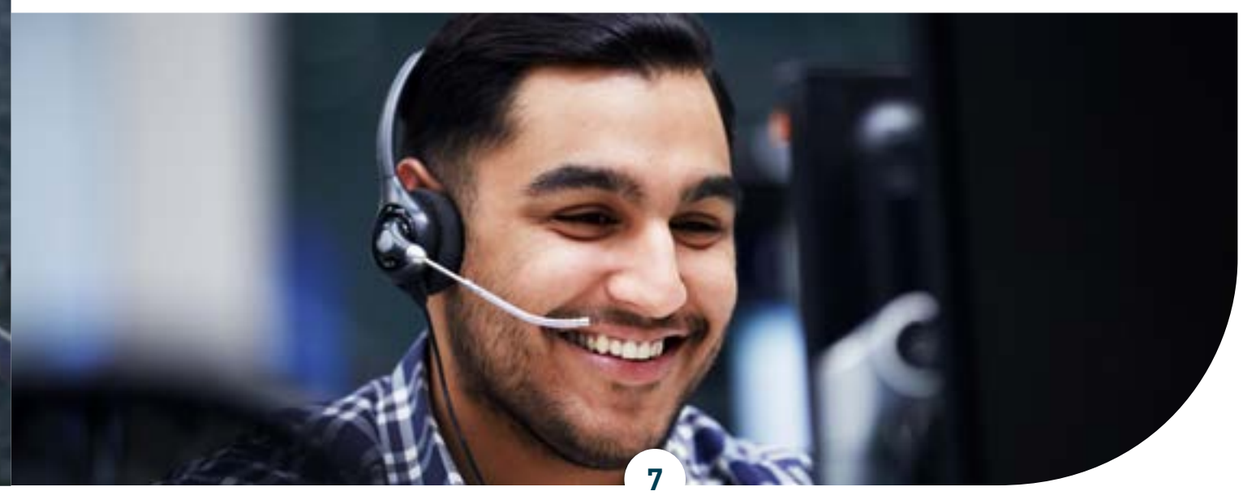
- Performance-driven in our unwavering focus on delivering on our promises to our stakeholders; and
- Sustainability-led because we emphatically believe in building a better, more sustainable future.

Our vision for the next 25 years, approved by the Board, is simple:

> No matter what the future holds, our customers can depend on our **high quality and reliable, sustainable and affordable service**

To stay in step with what our customers expect, we have put their priorities at the heart of our vision.

As a result of our extensive customer engagement, our LTDS is structured under three customer imperatives – high quality and reliable, sustainable, and affordable – based on our customers' consistent priorities over the long term. Throughout the lifetime of this 25-year strategy, we will keep listening, and adapting our ways of working, to meet our customers' expectations. This includes demonstrating how all aspects of our strategy align with Ofwat's public value principles.

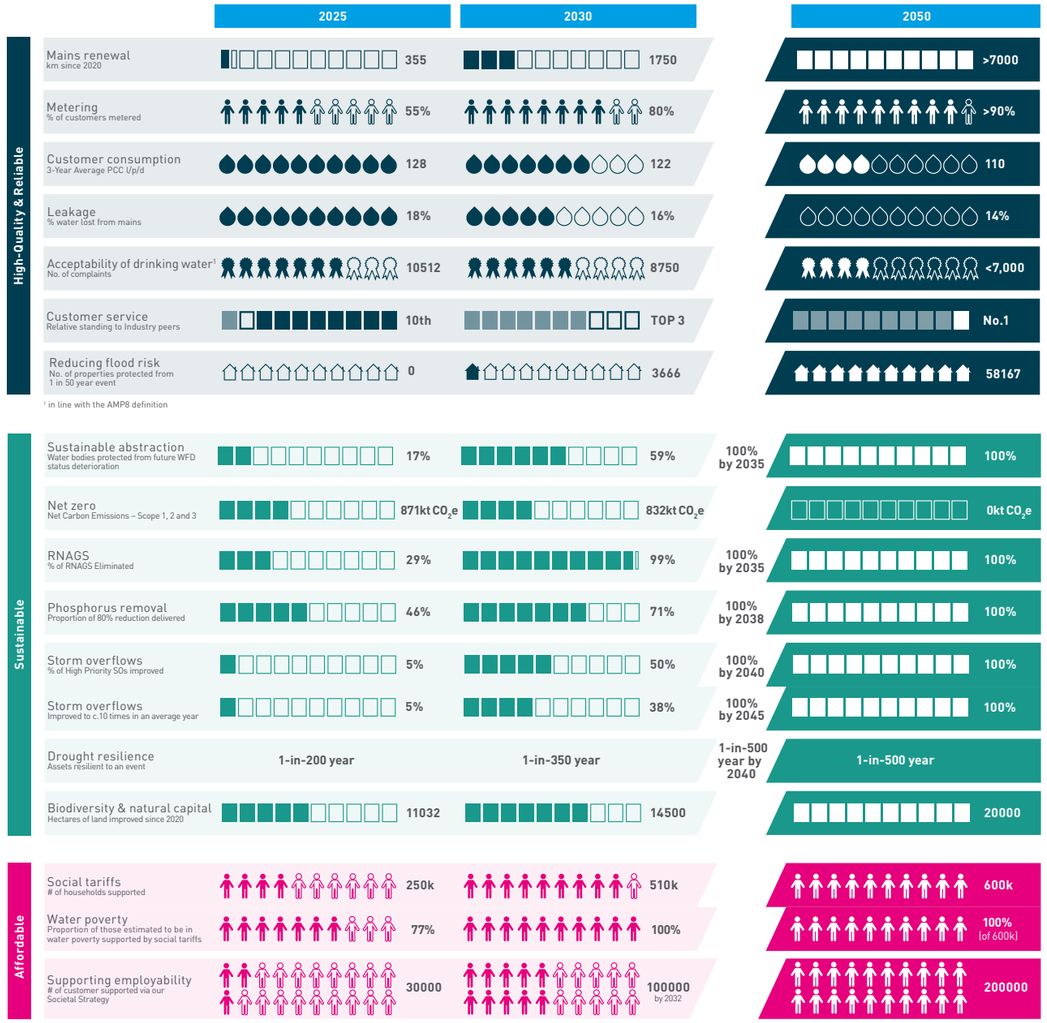


LONG-TERM OUTCOMES AND TARGETS

The figure below outlines the long-term outcomes, key actions and targets that provide the best value steps towards achieving our 2050 vision.

We have developed these outcomes and targets by considering a variety of inputs, including:

- A wide-ranging review of the current and potential future statutory requirements and ambitions set out in the strategic planning frameworks; and
- A candid review of current performance and scope for ongoing service improvements, analysis of future risks and opportunities, stakeholder and customer preferences, and the ambition set by our Board.



CUSTOMER SUPPORT

Long-term planning is a challenging subject for customers, because it requires a strong understanding of context. Our approach has been to engage people through deliberative research where possible, while ensuring each phase of engagement builds on the lessons learned from the previous one. We sought expert support to ensure the complex analysis and choices involved in adaptive planning were presented in an engaging and easily understandable way.

We have talked to customers about our AMP8 plans and our LTDS across our affordability and acceptability research, a specific piece of engagement on the LTDS, and through extensive research on our enhancement investments (our DWMP and WRMP).

In summary:

- 57 customers took part in the LTDS deliberative research (including a research workshop specifically with household and non-household, and future customers, as well as those in vulnerable circumstances) and 96 customers in the affordability and acceptability research;
- Customers are pleased to see that Severn Trent is planning for the future. They are particularly aware of the challenges of climate change and population growth;
- Customers broadly agree with our 2050 ambition, although they can find it hard to judge how stretching it is;
- Customers think the pace and sequencing of our proposed investment is reasonable. In general, they want improvements to be brought forward, which we have sought to do through our price control deliverables (PCDs). Customers want us to go further and faster on reducing greenhouse gas emissions but acknowledge the proposed pace is appropriate to manage bill impact; and
- Customers think our approach to managing uncertainty is fair across the generations who will be sharing the cost and experiencing the risks and benefits. Customers also sent a clear message that they expect us to work hard to minimise the future increases in bills driven by the effects of climate change.

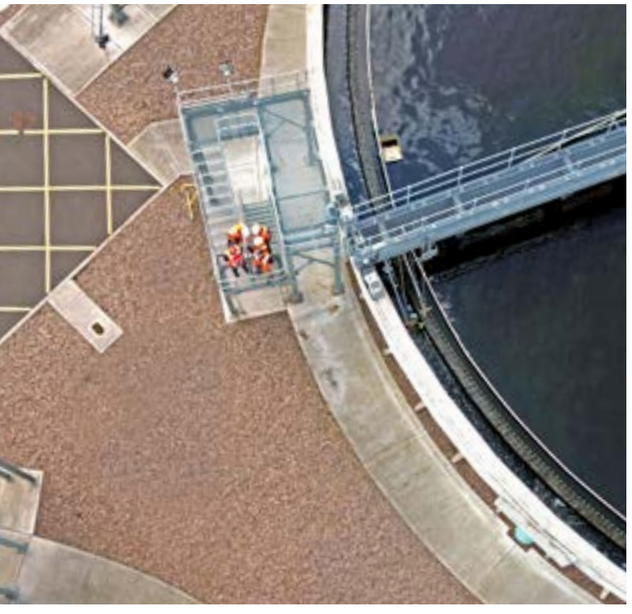
Full details of our extensive customer research programme can be found in Annex 3a Customer Engagement, and the key findings are highlighted in this document. The relevant customer insights informing our enhancement investments are set out in the relevant enhancement business cases.

IMPROVEMENT THROUGH BASE EXPENDITURE

Our long-term outcomes will be delivered through both base and enhancement investment. The Board has challenged us to be ambitious about how much we can deliver through base expenditure. The level of ambition for what this buys includes three categories of improvements:

- Performance Commitment improvements. The key areas in which we are challenging ourselves to deliver more through base expenditure are:
  - Leakage (through activities such as free repairs for vulnerable customers);
  - Pollution and greenhouse gas emissions reductions (for example through adopting low-carbon technologies when we replace like-for-like assets); and
  - Maintaining the pace of improvement over the next 25 years will be challenging, because we have already driven considerable improvement and the easier and more cost-efficient solutions have been delivered.
- Service improvements over and above PCs. This includes offerings such as:
  - A comprehensive and engaging schools education programme;
  - More localised and tailored engagement, with named contacts for communities when we build large projects; and
  - Transparent and proactive sharing of learning with the rest of the sector from our large-scale pilots tackling some of the sector's biggest challenges (such as our net zero hub).
- Wider benefits. This category of base-funded improvements aligns with our social strategy (and Ofwat's public value principles) and includes improvements such as:
  - Employability training;
  - Highly specialised apprenticeships;
  - Improving our sector-leading offering at our visitor centres;
  - Giving land over to communities for nature walks; and
  - Supporting local events.

Over the longer term, we have included ambitious assumptions about the benefits our innovation programme will deliver, particularly around wastewater services. Our AMP8 innovation programme is ambitious and will be delivered through our base expenditure, or through externally funded collaborations. Successful rollout of our AMP8 and AMP9 innovation portfolio could result in cost efficiencies of up to 15% between AMP10 and AMP12. More information on our innovation programme is provided in Annex 4c, Innovation.



STRATEGY

We have developed strategies that enable us to achieve our vision and long-term outcomes under a range of potential futures. This is not a new activity for us. What is new is that we have brought every aspect of our plan into a common adaptive planning framework, which has enabled us to improve consistency across outcomes and to create plans that predominately include investments needed under all eight of Ofwat's common reference scenarios (CRS).

We opted to use a computational decision support tool that can run a large range of structured sensitivity tests to understand which investments are most sensitive to each future scenario, and to interrogate the impact of varying the timing of transitioning between alternative pathways. This is why we are confident our LTDS sets out a realistic core pathway consisting of 'no- and/or low- regrets' investment under a wide range of plausible futures.

The sequencing of our investments has been informed by robust cost-benefit analysis, investment optimisation, and has been shaped by customer research and stakeholder engagement. Section 3 includes a summary of our key decisions, and more detail is provided in each of our 13 enhancement business cases.

There are three fundamental principles that underpin our strategy:

- **Consider a broad and flexible range of solutions.** A thorough options appraisal is the first key building block to our strategy. For each of our long-term outcomes, we have considered options based on behaviour change, nature-based solutions, partnership working, modular or adaptable technologies, optimisation, or system reconfiguration before traditional 'end-of-pipe' construction-based solutions;
- **Unlock wider benefits.** Our strategy seeks to join up areas of work (either past and future investment or investment across drivers) to unlock greater benefits. For example:
  - We have spent the last 15 years developing a sector-leading catchments programme focused on water quality. The next phase of our strategy will unlock wider benefits, including flood risk reduction, river quality improvement, carbon sequestration, biodiversity enhancement, and greater understanding of emerging contaminants such as PFAS; and
  - We have identified more than £100m of potential third-party investment in AMP8 alone, based on overlapping drivers or solutions, particularly related to reducing flood risk.
- **Track progress transparently.** The key to delivering a long-term strategy is taking small steps every day towards the end goal, on every project and every activity, no matter how small. Our strategy includes transparent deliverables that allow us to track progress between now and 2050, enabling us to identify where we need to adapt to deliver the outcome. This is covered in more detail in our monitoring plan.

FUTURE SCENARIOS

We have tested our plans using all eight of Ofwat's CRS, which means we have considered how our investment plans would change under both high and low assumptions about climate change, demand, water abstraction conditions (i.e. environmental policy on abstraction) and technology.

- When we outlined our SDS in February 2022, we completed a review of the external trends that impact our services and customers. We reviewed this analysis and found strong alignment with Ofwat's CRS and therefore decided not to add any further scenarios;
- We have carried out sensitivity tests on the assumptions within the CRS to ensure our analysis reflects a realistic range of uncertainty. The sensitivity tests typically include an uncertainty range on the solution costs and benefits, a plausible range on timescales for when the benefits will be realised or when a commitment must be delivered; and
- As well as testing the eight single scenarios, we have tested multiple combinations of adverse and benign scenarios to understand the combination effects. We have also compared the CRS to the EA Water Preferred Plan (WPP) and Most Likely Plan (MLP) for our WRMP and our Central Plan for the DWMP.

Collectively, we have run more than 1,000 optimisations to identify solutions that represent both least cost and best value under all plausible futures. This analysis has been used to facilitate informed conversations with customers, stakeholders and ultimately our Board before making our final investment choices.

ALTERNATIVE AND ADAPTIVE PATHWAYS

We have created three adaptive pathways, outlined in Figure 0.1, that reflect plausible and distinctly different routes that consider the CRS and other factors that may need to be navigated to achieve our 2050 ambitions. We have mapped how our three adaptive pathways could evolve over time: for example, by considering the potential impact of the 2028 update of the UK climate projections (UKCP28) or as result of the next census in 2031/32.

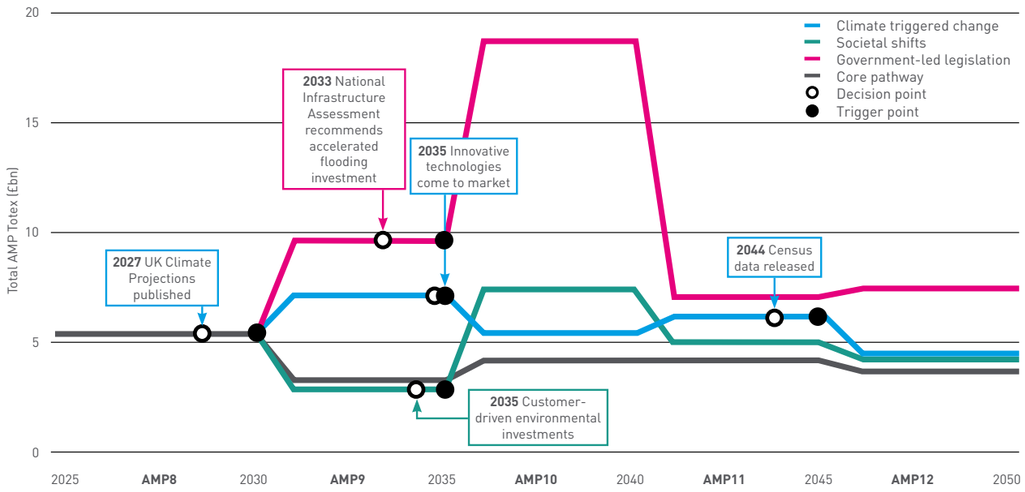
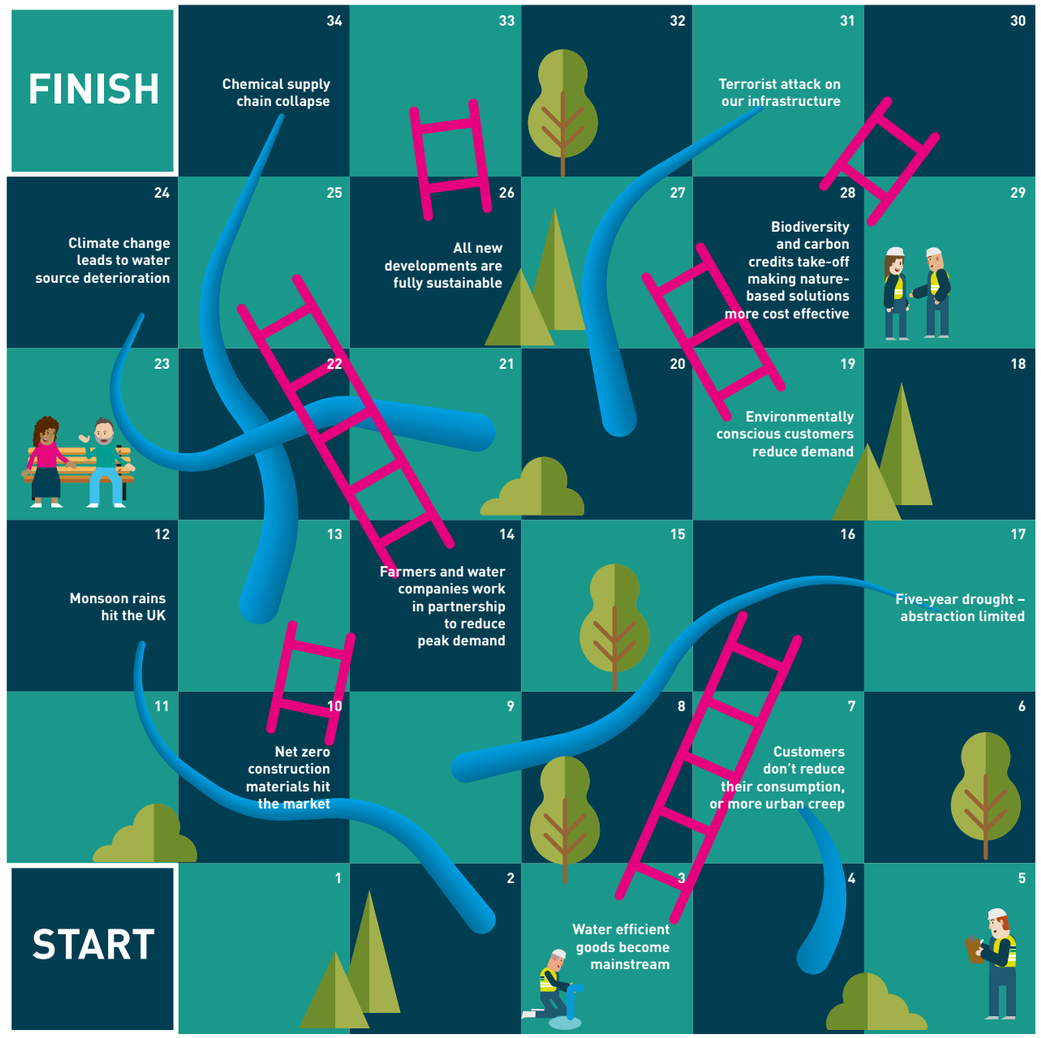


Figure 0.1: Illustration of our three adaptive pathways

We re-optimised our investment programme to respond to the three adaptive pathways, identifying whether we would make different investment choices if we knew we were heading to a different future. We talked to customers about the future triggers that could make it easier or harder for us to achieve the long term outcomes. This helped us better understand the role customer behaviour might play in adapting to the future circumstances.

Overall, this analysis has given us confidence we will be able to meet the 2050 ambitions and maintain an optimal investment profile under a range of alternative futures.



CORE PATHWAY

Over 99% of our core pathway represents the best value strategy to meet our 2050 ambitions – and this remains the case under all eight of the CRS. The remaining 1% is needed to keep future options open. The total investment in the core pathway is projected to be around £20bn by 2050, with more than £5bn of priority, cost-beneficial enhancements proposed for AMP8.

The AMP8 core pathway includes ambitious performance improvements from base expenditure (as described above) and 13 enhancement investments that drive progress towards long-term outcomes. We are seeking enhancement investment only where a step change in standards is substantiated by regulatory drivers and/or meets explicit customer and stakeholder expectations. Three of our seven long-term outcomes will be delivered through base expenditure alone. Figure 0.2 shows the breakdown of enhancement investment across the remaining four long-term outcomes.

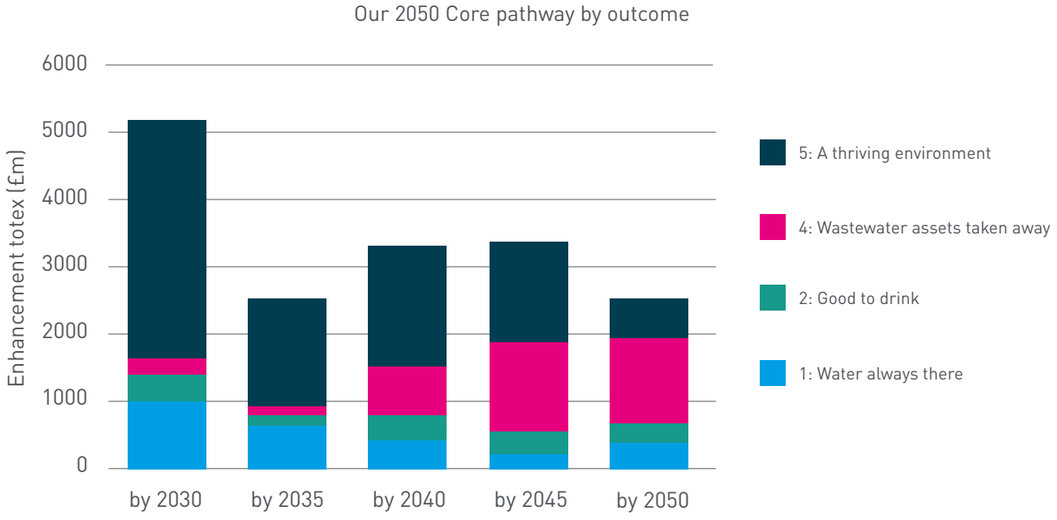


Figure 0.2: Enhancement investment in our core pathway

We have ensured our AMP8 core pathway is dominated by 'no-and/or low-regrets' investment.

No-regrets investment: 82% of our enhancement investment is statutory by 2030		Low-regrets investment: 18% of our enhancement investment has a statutory deadline after 2030 or is needed under almost all future scenarios		Keeping future options open: 1% of our enhancement investment is needed to ensure we can efficiently adapt our plans	
What	• Three WINEP cases across water, wastewater and bioresources. Key deliverables include resolving 250 RNAGs, improving 562 storm overflows, and making biodiversity improvements at over 260 sites. • Protecting around 340Ml/d from raw water deterioration. • Three security enhancements which will: improve physical security at key sites, provide alternative supplies in the event of an emergency scenario, and enhance our cyber security • Through a combination of demand reductions and supply increases, we will create 205Ml/d of sustainable water sources. • Meet extended requirements under the Reservoirs Act across 45 structures.	What	• Activities to reduce greenhouse gases (GHGs) by 226ktCO_2e as a step on our path to net zero. • Water system resilience improvements to create an additional 282Ml/d needed to meet peak demand. • Removing 230,000m^3 of water from our sewerage system to reduce the risk from flooding. • Protecting the most vulnerable from the health impacts of lead pipes. • Going further to reduce storm overflow spill frequency.	What	• Improving our understanding of emerging pollutants such as PFAS. • Contributing to national water resource solutions. • Studies to understand the impact of our operations on the environment.
Cost	£4,118m	Cost	£895m	Cost	£39m

MONITORING PLAN

Effective monitoring of our adaptive pathway is a key part of successful delivery of our LTDS. We have developed six high-level indices that make up our monitoring plan. Wherever possible, we have defined the thresholds that will trigger action, and the likely action to be taken. The thresholds will be kept under review and developed as we gather more data throughout AMP8.

We are integrating this monitoring plan into our wider performance reporting, which will include the 23 price control deliverables that track delivery of our enhancement investments. We also intend to provide a minimum of two progress updates during AMP8 as part of our Annual Performance Report (APR). We have committed to sharing our monitoring plan and data as part of an industry-wide study under consideration by UKWIR .

Our metrics were developed with advice from experts and are aligned with our climate change adaptation plan. We have identified the smallest number of measures that will give us reliable and meaningful insights across our investment programme, enabling us to navigate the alternative pathways and minimise the cost of data gathering.

Indices	Metrics	Trigger
Climate index	1. Current and projected GHG emissions 2. Precipitation levels 3. Change in temperatures 4. Extreme and compound events	1. RCP change
Demand index	1. Ratio of forecast to actual population 2. PCC for all customers on smart meters	1. Bespoke to each WRZ 2. More than 20% difference to our planning assumption (max sensitivity test)
Environmental index	1. Output of environmental studies 2. Outcome indicators for the 25 Year Environment Plan[2]	1. Time bound on study output aligned to Defra triggers
Technology and efficiency index	1. Triangulation of key unit costs (£/Ml/d and £/m^3 of surface water, £/$kTCO_2e$) 2. Ratio of forecast technology savings compared to actual 3. Ratio of forecast benefit to actual benefit on high technology investment areas (specifically net zero, advanced water treatment, nature-based solutions)	1. More than 20% difference (aligned to max sensitivity test) 2. More than 30% difference (max sensitivity test)
Legislation index	1. Hansard key term trend 2. Defra question time key term trend	1. Not used in isolation to trigger moving pathways
Social index	1. Social media scraping – key term trend 2. Water poverty trend 3. Percentage of customers on social tariff	1. Not used in isolation to trigger moving pathways

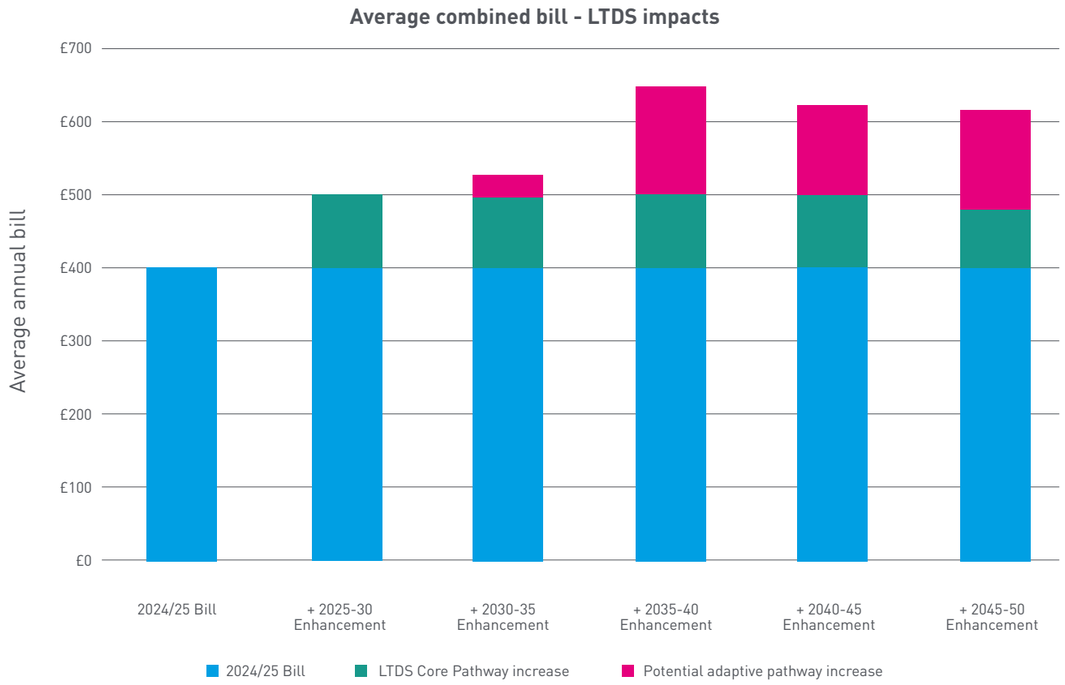
Table: Monitoring plan indices

One of our company values is curiosity and we already draw on this to foster an adaptive culture, and continuing to equip our people with the right tools, systems and governance is a key enabler to responding to changing circumstances and expectations.

[2] https://oifdata.defra.gov.uk/

BILL IMPACTS

There are many factors that will influence the long-term bill profile, but the figure below sets out the indicative bill impact of our core scenario, together with potential impact from our adaptive pathways. The Ofwat common reference scenarios all sit within this range.



We talked to customers about these bill profiles, including whether they would prefer us to plan for the worst case and spread the cost, or wait for certainty and accept the risk of greater bill fluctuations in the future. There were two areas of consensus: customers prefer stable bills and gradual changes over time, and they expect us to plan ahead to minimise steep increases, and to invest in innovation and technology to reduce future costs.

ASSURANCE

Assurance has been carried out throughout the development of our LTDS, as well as on the final analysis and documentation. This has enabled our Board to engage throughout the process. Their assurance statement is provided in Section 6.1, outlining the challenges the Board has made and how we have satisfied ourselves our LTDS is ambitious, high quality, informed by customers, equitable across the generations it serves, and represents a single adaptive strategy to ensure we are able to deliver our long-term ambitions and statutory obligations.

In response to the diverse range of requirements in the LTDS, which range from customer engagement to uncertainty modelling, we have designed an iterative assurance process, broken down into the following packages that enabled us to engage the most suitable experts (shown in brackets) for each element.

- **Package 1:** Our adaptive planning approach and interpretation of the guidance (Stantec);
- **Package 2:** Customer engagement (Sia Partners);
- **Package 3:** The decision-making process (Jacobs);
- **Package 4:** The analysis and tools (split between data inputs and decision support tools) (Stantec and Arcadis Gen). Additional assurance has also been carried out on our approach to cost-benefit analysis, and cost robustness and efficiency; and
- **Package 5:** Documentation and articulation of our LTDS in the round (Jacobs).

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SEVERN TRENT

Contents

1. Introduction

1.1 Context and background

Every day, Severn Trent provides around two billion litres of clean drinking water, and takes away 3.1 billion litres of wastewater, for more than 4.6 million homes and businesses in the Midlands. Over the last 35 years, we have invested around £21 billion in infrastructure to drive service improvements for customers and to meet tighter standards across a wide range of water quality and environmental improvements.

The next 25 years is set to be a period of significant investment. The Government has bold ambitions to tackle the state of the nation's rivers, which we will need to achieve alongside the delivery of our core services in a context of greater uncertainty due to the effects of climate change and population growth. Given that around two thirds of our asset base has an average age of 60 years or more, it is vital that we take an adaptive approach to investment, enabling us to respond to future change.

In this document, we set out our 2050 ambition and how we plan to achieve it, as well as our more detailed plan for AMP8 (2025-2030). We provide the key evidence to show our AMP8 plan offers best value, 'no- and/or and low-regrets' investment, and that it ensures our long-term outcomes can be achieved under a range of plausible futures.

This is our first formal Long Term Delivery Strategy (LTDS) in response to the new PR24 requirement but it builds on decades of long-term planning, particularly on water resources and drainage systems. Our robust approach to adaptive planning is based on Ofwat's common methodology, lessons learned from our own experience (see Appendix G), and insights from other sectors.

The process of developing the LTDS has challenged us to align our assumptions around key factors such as climate change and population growth, and inspired in-depth conversations with customers and stakeholders on our ambitions and the pace at which we meet them. Our commitment to delivering a high-quality LTDS is demonstrated by the key statistics below.

- **60%** of our team have experience in long-term planning;
- **130+ hours** have been invested in upskilling our team in adaptive planning techniques;
- **Six expert consultancies** have informed and challenged our approach (the Met Office, Stantec, Arcadis Gen, Economic Insight, Sia Partners and Jacobs);
- More than **15** assurance sessions have been delivered to ensure we are on the right track;
- **Over 850** pieces of feedback have been gathered from nearly 500 stakeholders; and
- **Engaged with 68,000+ customers.**

We have a strong culture of continuous improvement, and our processes and systems are designed to constantly improve all we do. As we deliver this strategy over AMP8 and beyond, we will look to improve our adaptive planning approach, using data collection and analytics to combine the latest technology with our deep-rooted culture of curiosity to help us adapt to changing circumstances. This combination of data and culture will allow us to validate our long-term models and to challenge ourselves to ensure we are meeting the needs and expectations of our customers and stakeholders. We will integrate these innovative adaptive planning tools into our business-as-usual delivery tools. In particular, we have updated our cost-benefit analysis (CBA) tools, which we use to refine projects once they are in the detailed design and construction phase, providing a clearer line of sight between

the benefits targeted and those delivered. We are integrating the monitoring plan metrics into our regular performance reporting.

1.2 Contents and structure

This document is structured in five chapters, aligned with Ofwat's final guidance on long-term delivery strategies:

1. **Ambition:** what we aim to achieve over the next 25 years;
2. **Strategy:** how we will aim to meet this ambition over the next 25 years;
3. **Rationale**: why the long-term delivery strategy represents the best way of meeting our short- and long-term ambitions;
4. **Foundations**: the key assumptions and uncertainties underpinning our long-term delivery strategy; and
5. **Board Assurance**: how our Board has challenged management to deliver a high-quality long-term delivery strategy.

There are a number of appendices providing more detail. The specific analysis relevant to each of the 13 enhancement investments is set out in separate documents. This document provides an overview and brings the results together.

There are a number of accompanying data tables (LS1-7) which cover:

- LS1 to LS4: Overview of expenditure and performance (split between base and enhancement investment) to 2050 for our core pathway;
- LS3a-d and LS4a-d: Expenditure forecasts for the alternative pathways;
- LS5 and LS6: Expenditure forecasts relating to the eight Ofwat common reference scenarios (CRS); and
- LS7: Bill impacts of the core and alternative pathways.

The assumptions we have made to complete these data tables are set out in Chapter 5, and foundations and signposting are included in the data table commentary.

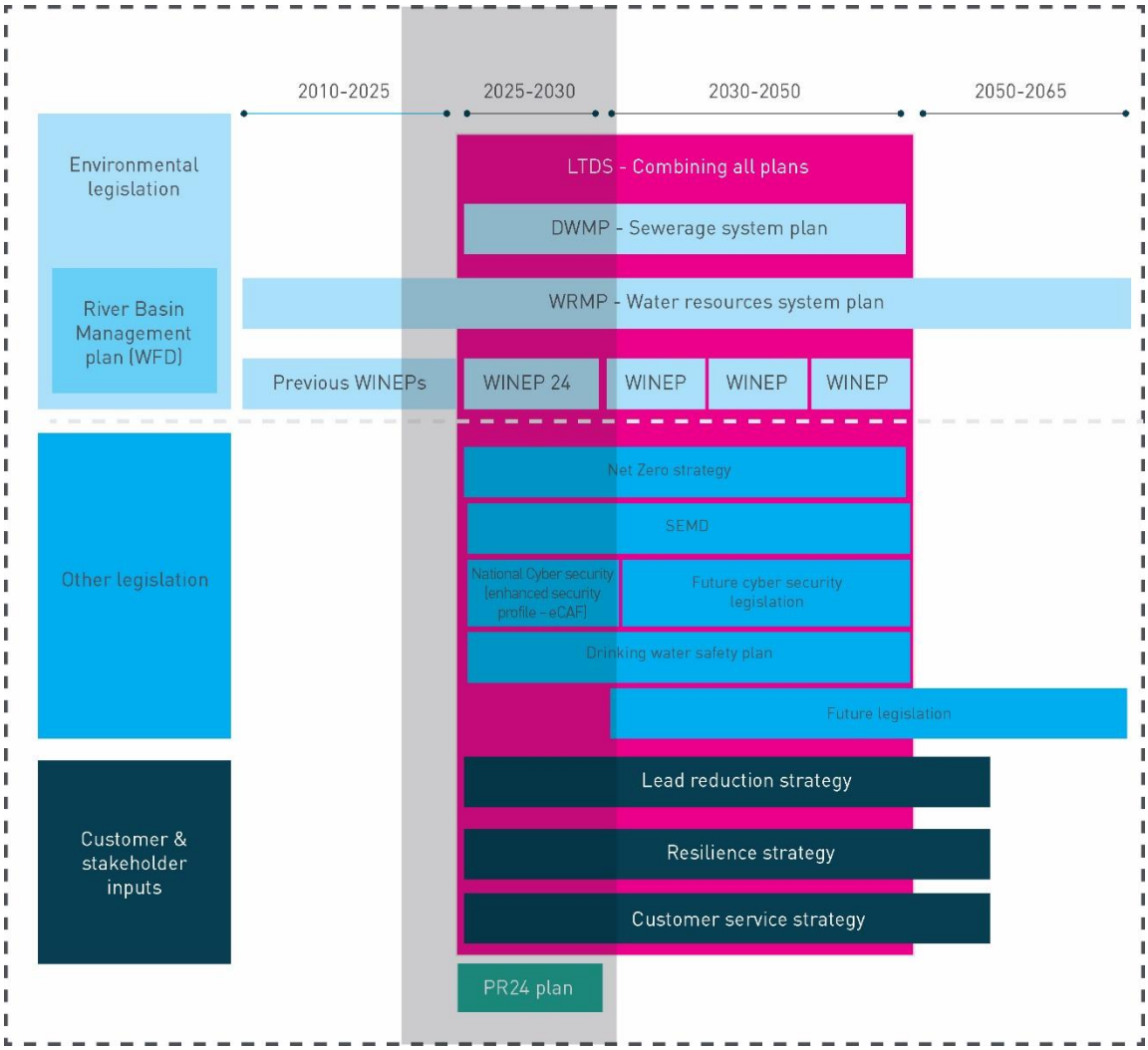
We also cross-reference a number of other Annexes that make up our PR24 plan, most notably, Annex 3a Customer and stakeholder engagement; and Annex 5a Common performance commitments.

We have adopted the terminology as specified in Box 1, page 11 of Ofwat's final guidance on long-term delivery strategies, replicated in Appendix A.

1.3 Developing the LTDS

Figure 1.0 outlines the key inputs to this LTDS, including statutory requirements, strategic planning frameworks, other relevant legislation, and customer and stakeholder inputs.

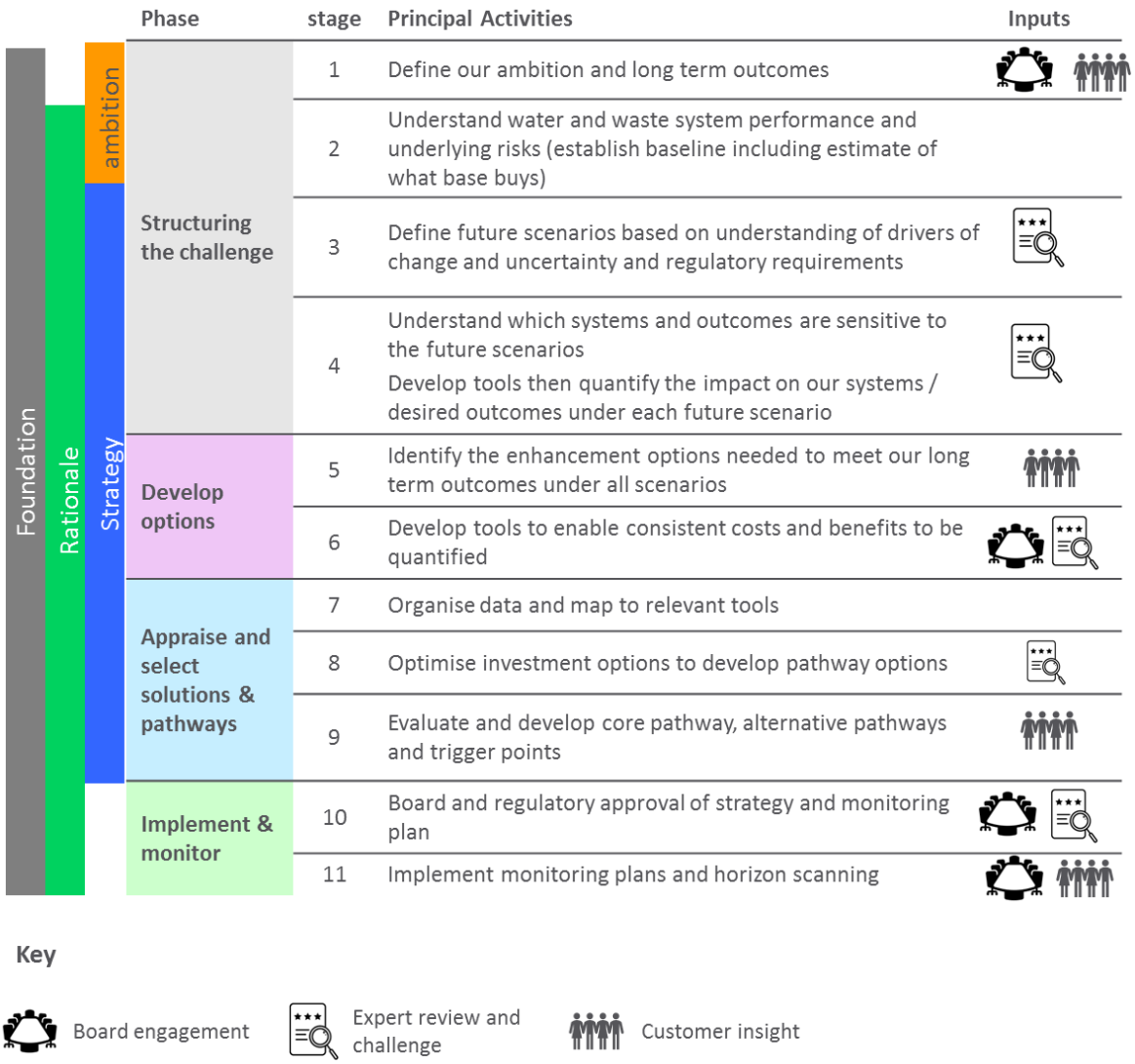
Figure 1.0: Key inputs to the Severn Trent LTDS



Our process for developing the LTDS is based on regulatory guidance from Ofwat[1], the Department for Environment, Food & Rural Affairs (Defra)[2] and the Environment Agency (EA)[3], as well as insights and best practices from other sectors and countries (for example, the Adaptive Planning Pathway Guidance from Melbourne Water). We have also reflected on our existing approach to long-term planning, drawing key lessons from the Severn Trent team and external stakeholders. This process is outlined in Figure 1.1 below.

[1] PR24 and beyond: Final guidance on long-term delivery strategies
[2] Accounting for the Effects of climate change: supplementary green book guidance, November 2020
[3] Statutory frameworks for DWMP and WRMP

Figure 1.1: Our adaptive planning approach



Although the figure above shows a linear process, a key feature of our approach has been to iterate through the steps as we complete each one and engage with a wider range of stakeholders. For example, across several of our enhancement proposals, it became clear following our initial appraisal of the solutions (Step 9) that we had too few options to meet the size of the problem under adverse future scenarios. We therefore looped back to Step 5 to identify a wider range of options, before continuing the process again. We provide more detail on this approach in Section 4.

2. Ambition

2.1 Introduction

In this chapter we set out our vision and ambition for 2050, and the key inputs that informed its development. It includes what we want to achieve over the next 25 years, how we want to be seen, and what this means for customers and the environment. We also explain how this is informed by the key issues facing the water sector, government policy and legislation, our regional profile and local challenges, and our current strengths and weaknesses.

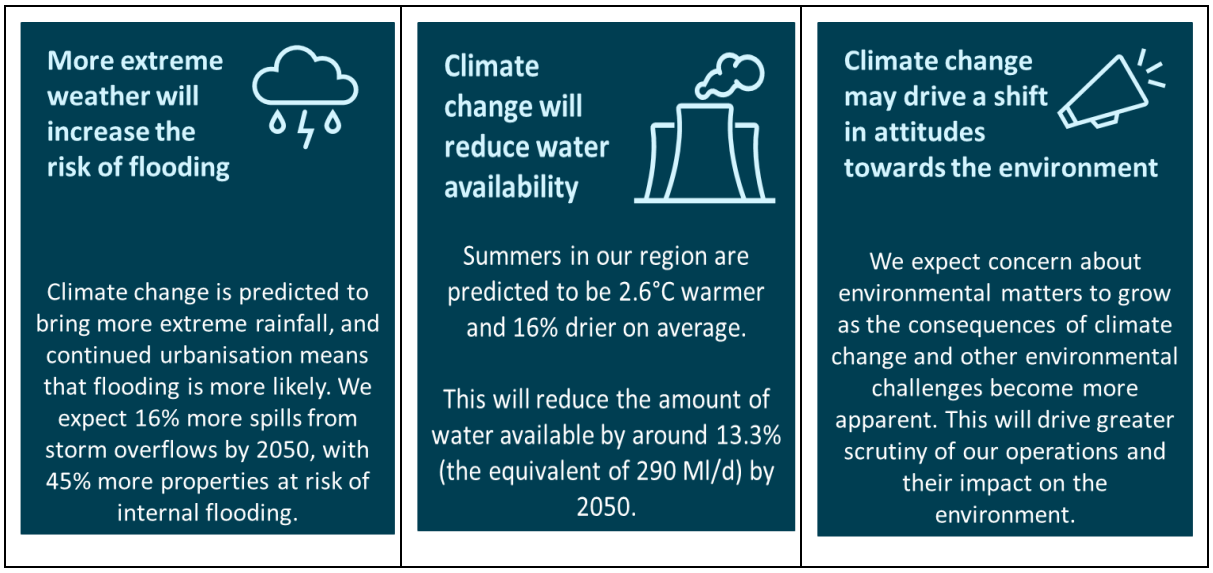
2.1.1 Challenges facing the sector

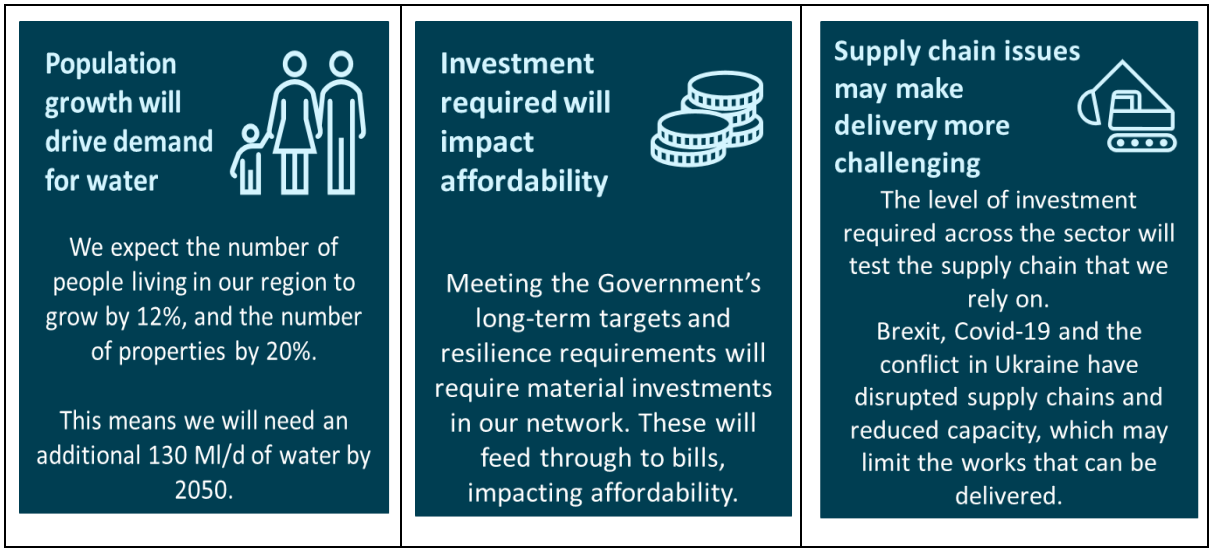
The twin challenges of climate change and population growth mean all water companies will need to balance shrinking water supplies with growing demand between now and 2050. At the same time, we are seeing significant societal change: our customers have higher service expectations, are more concerned about both their health and the environment, and continue to value fairness, particularly for vulnerable customers. During 2022, we saw public attitudes to our industry shift substantially as climate change began to affect water supplies, and the importance of river quality and biodiversity became apparent.

These trends take place against a backdrop of weak economic performance and, as the UK's economic outlook remains challenging, the need for affordable water bills has never been greater.

Tackling climate change, cleaning up our rivers, securing our future water supplies and enhancing biodiversity can only be solved with long-term thinking and planning. Based on research carried out for our Strategic Direction Statement in 2021, we foresee six main challenges that the water sector needs to navigate between now and 2050. These are outlined in Figure 2.1, and full details of the issues facing Severn Trent and the water sector can be found in Appendix C.

Figure 2.1: Priority 2050 challenges for Severn Trent





Meeting these challenges will require us to maximise the benefit of advancements in technology. We need to both roll out proven innovation quickly and to play our part in developing new technology and adopting newer, collaborative approaches (such as multi-utility customer behaviour change). This means we will need to work with customers, communities and other stakeholders to drive change – and to step up investment in data gathering and AI technologies.

We also need to make several informed, pragmatic choices about the scale and pace of our actions. Our 2050 challenges are strongly interlinked and, in some cases, in tension. For example, the high cost of living means we need to keep bills affordable; at the same time, we need to invest significantly to meet government targets on river quality improvement and greenhouse gas reduction. Taking a long-term perspective and balancing the needs of different stakeholders – present and future – are critical elements of setting our ambition.

2.1.2 Our region and local challenges

Severn Trent is one of the largest of the 11 regulated water and wastewater businesses in England and Wales. We provide high-quality services to more than 4.6 million homes and businesses in our region, which runs from the Bristol Channel to the Humber, and from Shropshire to the East Midlands. We do this by maintaining over 142,000km of water mains and sewers, sufficient to go round the world 3.5 times. This allows us to supply around 2 billion litres of clean drinking water and to remove 3.1 billion litres of sewage and drain water every day, at an average cost of just over £1 per household per day – one of the lowest in the industry. Appendix D details the key statistics for our region. Most of the challenges we face are not unique to Severn Trent. However, there are three specific issues that disproportionately affect our region:

- **High impact of Water Framework Directive (WFD) abstraction reductions.** One-third of our water sources are from groundwater. Because these groundwater sources are spread across our region, the impact of the WFD requirements will be felt region-wide. And, because we are the only landlocked water company, we have not previously invested to meet the seasonal demand increases caused by holidaymakers travelling to the coast, so the effect of licence capping cannot be offset by headroom elsewhere;
- **High number of storm overflows.** Severn Trent has more storm overflows than any other company[4]. Spilling of storm overflows is already a challenge, but when climate change is

[4] https://environment.data.gov.uk/portalstg/home/item.html?id=2f8d9b7628dd4f60a30fb1a8483fc2ae

factored in, the volume of water we need to take out of our sewers will increase by a further 23% by 2050, that equates to an additional 8 million m^3 of water.

- **High density of non-water development plans.** We are not the only organisation in our region with significant investment plans over the next 25 years. In fact, there are several high-profile activities in the Midlands that are likely to affect our plans between now and 2050. This offers opportunities but also challenges – specifically supply chain capacity, recruitment and salary pressures and planning permission challenges. Key activities include:
    - HS2 is the second most expensive infrastructure project in the world. Phase 1 (London to Birmingham) is expected to be completed between 2029 and 2033;
    - The West Midlands Gigafactory is due to start production in 2025 at a 530,000m^2 site located near Coventry Airport;
    - The East Midlands Freeport features three main sites: the East Midlands Airport and Gateway Industrial Cluster in North West Leicestershire, the Ratcliffe-on-Soar Power Station site in Rushcliffe in Nottinghamshire, and the East Midlands Intermodal Park in South Derbyshire; and
    - The East Midlands Hydrogen Innovation Zone is developing hydrogen technologies and projects for ground transport, equipment and aviation at East Midlands Airport.

These local insights have informed our LTDS in three main ways.

Firstly, they confirm the need for an affordability strategy that is commensurate with our investment needs. Most customers can afford their bill and are happy to pay for demonstrable improvements, but some cannot, and we must identify and support them. We are proposing the largest affordability package in the sector, worth around £550m and supporting up to 693,000 customers per year through bill discounts, payment breaks and payment plans. As a result of the additional support we are providing in AMP7, and because our customers support a larger cross-subsidy, we will be able to provide an additional 310,000 customers with a discount of around £120 per year by 2029/30 (in 2022-23 prices). This will make their bills much lower (32%) than the average current bill, even after customers have funded the large environmental investment programme in AMP8. More detail on our affordability strategy can be found in Annex 3b, Affordability.

Secondly, we need to consider deliverability in the context of supporting our communities (by recruiting locally and developing talent) and the likely impact of other regional major construction projects. We have taken steps to minimise supply chain risks by confirming capacity early and planning to source more than 60% of our capital programme outside the current Water UK supplier routes. This means that while our total spend equates to 13% of that of the sector, we will only be drawing on the traditional supply chain for around 6%. Our delivery plan is based on:

- 26% from Severn Trent-employed labour. Over the next 12 months, we are planning to insource 1,000 roles to reduce reliance on the market, including engineers, project managers, wastewater technicians and mains renewal teams;
- 27% from additional supplier capacity. At least 5% will be delivered through a new manufacturing factory facility that we have developed in partnership with the Manufacturing Technology Centre; and
- Developed relationships with suppliers outside the traditional supply chain to deliver the world's first waste treatment net zero hub.

Finally, our customers tell us they want to know more about the projects taking place in their local communities and want us to help them with local initiatives – especially where there is a common goal (e.g. environmental improvements). During the development of our enhancement proposals, we identified locations with multiple investment drivers and sent our asset strategists, engineers and operators to look for opportunities to work in partnership with local communities. We are carrying out a series of sessions across our region, identifying opportunities to support local community goals and to ensure we have fully considered the needs of all customer segments (e.g. household and non-household customers).

We used this knowledge of our region and customer base when developing our adaptive pathways – see Section 3.4 for more details.

2.1.3 Our company

Delivering a 25-year strategy is about much more than setting the right vision. We also need a strong company culture, organisational purpose, and tools for managing uncertainty and making the right decisions at every point in our journey. Our purpose, **taking care of one of life's essentials**, informs everything we do. Our values (showing care, taking pride, embracing curiosity, and having courage) shape how we act and the choices we make.

Severn Trent's reputation, built over many years, is for leading the UK water sector on many of the key issues facing our customers. We aim to build on these areas of strength over the next 25 years, delivering better outcomes for all our stakeholders and continuing to lead our sector.

There are also areas where our performance is weaker than we and our customers would like. By the end of AMP8, our ambition is for all our critical metrics to be 'green' (see Annex 5a Common performance commitments) and to be on track to delivering performance in the top three for overall performance in the UK water sector. Figure 2.2 outlines our areas of strength and areas for improvement.

Figure 2.2: Severn Trent's areas of strength and areas for improvement

Areas of strength	Areas for improvement
We do not shy away from challenges. We pride ourselves on our bold ambitions when tasked with a problem, often setting new standards for the sector. Examples include: • *Greenhouse gas reduction:* Creating the country's first net zero waste treatment facility at Strongford, and making our Triple Carbon Pledge, which commits us to net zero Scope 1 and 2 operational emissions, 100% renewable energy, and 100% renewable-powered vehicles by 2030. • *Green Recovery:* Securing £566m (in 2017/18 prices) of investment (more than 70% of the sector-wide Green Recovery programme) to trial new ways of working. This included protecting 90,000 customers in Mansfield from flooding using nature-based solutions and	**We always react swiftly if our performance falls below expectations. But we also aim to be proactive: anticipating challenges and taking action before they become a problem.** Planned actions include: • *Utilising data:* We will maximise the value to be gained from the wealth of new data that is starting to come online, and will continue to do this throughout AMP8. • *Horizon scanning:* We will use data to manage performance, drive cost efficiency and scan the horizon for future problems through extensive use of AI and digital twinning. • *Intervening proactively:* We will be improving monitoring and decision-making to move from reactive to proactive interventions, using data to help predict challenges before they arise.

finding affordable ways to safeguard customers from the harmful effects of lead pipes. • *Water quality turnaround plan:* Delivering an eight-year improvement plan that required work on key Severn Trent assets critical to water quality, recovering our position with the DWI in 2020, when we were moved out of their transformation programme.	
We have a consistent focus on the environment, performing at the highest level. For example, we are the only water company to be awarded four-star status by the Environment Agency across four consecutive years.	**We are focused on making improvements in key areas where we know we need to perform better, through dedicated improvement plans with executive oversight.** These areas are: • *Zero pollutions:* Despite a strong environmental track record, we have not managed to deliver zero serious pollutions. We committed to reaching zero pollutions and setting an ambitious target for a further 30% reduction in total pollutions (Cat 1-3). • *EDM operability:* We have the largest estate of event duration monitors (EDM) in the industry, and we achieved full coverage at the end of 2022. There is a shared desire to see an improvement in operability and we are replacing older monitors with the latest technology to improve operability.
We care about our communities, and take action to support them. Examples include: • *Affordability support:* Reacting swiftly to the cost-of-living crisis by ratcheting up financial support from our social tariffs to cover every household in water poverty. • *COVID-19 response:* Responding to the COVID-19 pandemic by giving an extra £1m of emergency funding to support over 300 charities and non-profit groups to help communities recover, on top of the 1% of profits we donate annually from our Community Fund.	**Consistently delivering a high quality customer experience** While we have shown the potential to deliver upper quartile on customer experience, we have not been able to deliver consistently good performance, and have tended towards the average for our industry. In this plan, we are making a firm commitment to address this, with accelerated expenditure in new systems designed to address some of customers' key concerns, including our ability to keep them better informed and ensuring we put ourselves in the best possible position to resolve their issue first time.

We have reflected on these strengths and weakness to inform our ambition, pace and sequencing in the following ways:

- **We are doubling down on the EPA.** This holistic measure of environmental performance allows stakeholders to differentiate between companies. Customers tell us they are reassured by metrics that are verified and published by independent regulators. We have therefore linked our enhancement PCDs to this metric wherever possible;
- We reviewed the **benefits we are predicting from the high technology scenario**. It is difficult to predict the benefits of technology that has not yet been invented, but it was clear from our

conversations with customers that just accepting the impact of factors such as climate change is unacceptable. We cannot control it, but we can influence and shape the cost and benefits of the investment needed to mitigate and adapt to it. Given our track record and commitment to innovation, we are taking an ambitious view of the benefits we can deliver through innovation and technology, and have revised down our forecast cost between AMP10 and AMP12 by around 20%. In addition to cost savings, the performance improvements we are targeting through base expenditure are largely based on better and more predictive data management and analytics; and

- We are planning to **make progress across all service areas** as part of our commitment to anticipate future challenges. This will allow us to avoid disappointing our stakeholders, and also to manage affordability over the long term. Given the significant focus on river quality, it is tempting to scale back ambition in other areas, but we are reluctant to commit to a programme that could lead to unacceptable long-term compromises, such as prioritising local environmental improvements over the global environmental challenge to reduce greenhouse gas emissions. We have robust evidence that our customers expect progress across all areas that are needed to secure long-term service, and support every one of our enhancement proposals. We have made sure our affordability support is commensurate with the bill increase that this will drive. Annex 3b sets out our approach to affordability.

2.2 Vision

We are alive to the challenges ahead and aim to take positive steps to transform our own business and deliver for our customers, communities and environment. To that end, aim to be a **performance-driven, sustainability-led** water company: performance-driven in our unwavering focus on delivering on our promises to our stakeholders, and sustainability-led because we emphatically believe in building a better, more sustainable future.

Our vision for the next 25 years, approved by the Severn Trent PLC Board, is simple:

No matter what the future holds, our customers can depend on our high quality and reliable, sustainable and affordable service

In a world of change and uncertainty, we will be a constant – recognising the value of water in everyone's lives and harnessing the value of waste to the benefit of everyone: the customers and communities we serve, and the environment we all depend on. We believe our vision is ambitious and necessary in the context of global trends, and that we have a credible plan for how we will rise to that challenge both in AMP8 and over the long term.

Our vision reflects the challenges and uncertainty outlined in Section 1.1, as well as Ofwat's public value principles (see Appendix B for details of how we will meet these principles). It is designed to support the four strategic priorities the Government set out for Ofwat in February 2022: a resilient water sector, which delivers value to customers, the environment and wider society over the long-term; providing a better and fairer water service for all to serve and protect customers, improving environmental performance, and using markets to deliver for customers.

The vision is built from the three things our customers consistently tell us are most important to them: 'high quality and reliable', 'sustainable' and 'affordable'. Below, we outline what we mean by each of these customer imperatives, and Section 2.4.4 gives details of how we defined them through our customer engagement.

- **High quality and reliable.** A reliable supply of clean, safe water – for hydration, hygiene and industrial uses – is critical for daily life in the UK. By 2050, we will need an additional 608 Ml/d of water to meet growing demand even as climate change reduces its availability, as well as a water network that is resilient to operational failure, extreme weather, peak demand and security threats. To meet customers' expectations, this water must not only be safe but also pleasant to drink – and supplied by a company that is responsive to their needs;
- **Sustainable.** As a company taking care of one of life's essentials – water – we know that the resilience of our business is intrinsically linked to the resilience of our region's natural environment. That also means we have a strong role to play in restoring our rivers, protecting environmentally sensitive sites and enhancing biodiversity, reaching net zero greenhouse gas emissions, and moving towards a circular economy; and
- **Affordable.** Fairness is a key concern for both Severn Trent and our customers, and we offer wide-ranging affordability assistance in response to immediate needs. Many in our communities are impacted by the current cost-of-living challenges, particularly in the wake of the COVID-19 pandemic. The resolve to end water poverty in our region is more important than ever, and we support upstream initiatives that reduce poverty by opening job opportunities.

It is important to note that, although we've assigned each of our long-term outcomes to a single customer imperative for simplicity, many will contribute to two or even all of these imperatives.

2.3 Long-term outcomes

This section sets out what our vision will mean for our customers and the environment over the next 25 years.

Figure 2.3 outlines the seven long-term outcomes and 17 key targets we will be delivering over the next 25 years. These outcomes and targets will be delivered from both base and enhancement investment. Appendix E sets out the profile of the targets over the next 25 years, and Section 3.2 outlines for the key actions we will need to take in the next 25 years in order to deliver these long-term outcomes.

Figure 2.3: Long-term outcomes for 2050

Vision	Customer imperatives	Long-term outcomes	Key actions	Key 2050 targets	AMP8 enhancement investment
No matter what the future holds, our customers can depend on our high quality and reliable, sustainable and affordable service.	**High quality and reliable** A high quality, reliable service that can be depended on no matter what, where our customers know they are valued.	**1: Water always there** Our customers can rely on water in the morning, and on throughout their day, every day. And we work together to make sure	Increase our ability to deliver water on demand – through better forecasting, reducing waste, increasing connectivity, trading water, and greater water re-use.	Water availability: Leakage >50% reduction from 2017/18 levels	Case 01: Resilient water networks
			Help our customers reduce	Customer consumption:	Case 08: Meeting our

		it stays that way for future generations.	water use, maximising insights gained from meter coverage of over 90% of our customers to reduce demand.	Metering 24% reduction from 2020 levels (to achieve the 110l/p/p/d nationwide target)	Future Water Needs
			Ensure every home has multiple, resilient sources of supply, while maintaining emergency supplies to cope with unexpected interruptions.	Drought resilience Meet 1-in-500 year standard (up from 1-in-200 year today)	Case 08: Meeting our Future Water Needs Case 15: Reservoir Act Extension
			Improve physical and cyber security for priority assets and across all our business activities.	Physical and cyber security Continue to meet all NIS-R and SEMD standards	Case 06a: SEMD physical security Case 06b: SEMD alternative water supplies Case 12: Enhancing cyber security
		2: Water that is good to drink Your water is consistently safe, clean and good to drink.	Improve treatment processes to deliver safe drinking water as standards evolve.	Water quality	Base expenditure (compliance) Case 13: Raw Water Deterioration
			Replace lead supply pipes to protect public health and the environment.	Lead supply pipes	Case 09: Lead Reduction
		3: An outstanding experience We consistently exceed our customers' expectations	Provide a more personalised customer experience, improving first-time contact resolution, and increasing the coordination and	Customer service	Base expenditure

		by delivering an outstanding experience ever hour of every day.	proactivity of our communications. To support this, we will increase the completeness and quality of key customer data.		
	Sustainable Confidence we are doing the right thing for the environment, society and future generations.	**4: Wastewater safely taken away** We safely take wastewater away, ready to be made clean again.	Work with others to improve river quality and ensure we are never the reason for rivers failing to meet quality standards.	Reasons for Not Achieving Good Status (RNAGs) 100% RNAGs eliminated	Case 04b: Wastewater WINEP
			Improve network monitoring and rainfall management. Shift to separate wastewater and rainwater in high-risk areas.	Storm overflows All storm overflows improved to <10 spills per year	Case 04b: Wastewater WINEP
			Increase customers' protection from flood risk, accounting for the impacts of climate change.	Flood risk More than 56,000 properties protected	Case 07: Urban catchments of the future Enhancement growth investment
		5: A thriving environment We safeguard the natural resources we use, and we work in partnership to improve rivers and habitats that provide them	Reduce greenhouse gas emissions to zero, based on science-based targets.	Net zero Zero greenhouse gas emissions across all scopes	Case 03: Net Zero Investments
			Improve the quality of the natural environment in our region, by using nature-based solutions, enhancing biodiversity and protecting environmentally sensitive sites.	Biodiversity and natural capital Sites of Special Scientific Interest (SSSIs) 20,000ha of land improved since 2020	Case 04a: Water WINEP

			Send zero waste to landfill and instead reuse, recycle or recover all materials across our business. Make meaningful reductions in single-use items.	Circular economy	Case 04c: Bioresources WINEP
			Investigate and replace unsustainable water sources with sustainable sources.	Sustainable abstraction 100% waterbodies protected from deterioration	Case 04a Water WINEP
	Affordable Water should be affordable for everyone – so that no person or generation is left behind.	**6: A service for everyone** Everyone can access our service and enjoy its benefits, no matter their circumstances.	Automate high-volume, low-value processes and increase levels of self-service. To support this, use data to better understand our customers' future needs.	Variable tariffs	Base expenditure
		7: Affordable for all Meaningful initiatives to help eradicate water poverty in our region and to help those in financial hardship.	Increase our specific support for customers who are vulnerable or in hardship. Provide customers with emergency support.	Social tariffs 600,000 households supported	Base expenditure Social tariffs

2.4 Developing the ambition

In setting our ambition we have considered a variety of inputs, including:

- An assessment of 'what base buys';
- Statutory requirements and strategic planning frameworks;

- Analysis of future risks and opportunities;
- Stakeholder preferences;
- Customer preferences; and
- Board engagement.

The details of these inputs are summarised in the following sections.

2.4.1 An assessment of 'what base buys'

This section provides an overview of 'what base buys' and the contribution to the PC targets is set out in data tables LS1 and LS2, with the supporting evidence included in Appendix F.

To understand the level of improvement driven by base across our PCs, we have considered four elements that would impact our future performance:

- Deterioration in the asset base;
- Comparative performance;
- Incremental improvements funded from base; and
- The impact of innovation scenarios (primarily technology advancements).
- The Board has challenged us to be ambitious about how much we can deliver through base expenditure. The level of ambition for what base buys includes three categories of improvements: **PC improvements.** The key areas in which we are challenging ourselves to deliver more through base expenditure are leakage (through activities such as free burst-main repairs on vulnerable customer property), reduced pollutions and risk of sewer flooding in a storm (through more sewer cleansing and improved monitoring and control and response and recovery to limit events), and reduced greenhouse gas emissions (through close partnerships with the supply chain and adopting low-carbon technologies when we replace like-for-like assets). Maintaining the pace of improvement over the next 25 years will be challenging because these are service areas where we have already driven considerable improvement, meaning that the easier and more cost-efficient solutions have already been delivered;
- **Service improvements over and above PCs.** This includes offerings such as a comprehensive and engaging schools education programme, a combination of smart analytics and thoughtful customer engagement combined with increased mains renewal to improve asset health and tackle low pressure issues, more localised and tailored engagement with named contacts for communities during the construction of large projects, transparent and proactive sharing of learning from our large scale pilots tackling some of the sectors biggest challenges (such as the net zero hub); and
- **Wider benefits.** This category of base-funded improvements aligns with our social strategy (and Ofwat's public value principles) and include improvements such as employability training, highly specialised apprenticeships, improving the sector-leading offering at our customer visitor centres, giving land over to communities for nature walks, and supporting local events.

Figure 2.4 outlines our targets for base expenditure between 2025 and 2050.

Figure 2.4: Base expenditure targets to 2050

PC	Unit	2034/35 Baseline	Base Improvement by 2039/40	Base Improvement by 2044/45	Base Improvement by 2049/50
Water supply interruptions	hh:mm:ss	00:05:15	3%	5%	6%
Customer contacts about water quality	Nr/1,000 customers	0.85	8%	11%	12%
Internal sewer flooding	Nr/10,000 prop	1.25	4%	6%	6%
External sewer flooding	Nr/10,000 prop	10.28	5%	8%	10%
Operational greenhouse gas emissions (water)	ktCO2e	211998	2%	4%	6%
Operational greenhouse gas emissions (wastewater)	ktCO2e	445618	2%	4%	6%
Total pollution incidents	Nr/10,000km	12.39	21%	35%	43%

Percentages are the cumulative percentage improvement from the 2034/25 position delivered by base. All other measures are assumed hold flat from base so just offset deterioration which is equal to c£120m per year of ODI benefit just to stand still.

For demand management schemes the value is the overall percentage improvement from the 2020 baseline delivered by base:

PC	Unit	Base improvement by 2034/35	Base Improvement by 2039/40	Base Improvement by 2044/45	Base Improvement by 2049/50
Leakage	% improvement from 2020 baseline	32.2%	37.0%	39.9%	41.7%
Per capita consumption		10.3%	13.6%	15.8%	16.9%
Business demand		-5.6%	0.2%	4.0%	6.0%

2.4.2 Statutory requirements and strategic planning frameworks

Many of the targets within our LTDS stem from legislative and regulatory obligations, which are administered through four statutory frameworks. Figure 1.0 in Section 1.3 shows the key inputs into our LTDS, and Figure 2.5 below shows the alignment between statutory frameworks and our long-term outcomes.

Figure 2.5: Alignment between statutory frameworks and long-term outcomes

Statutory framework	Regulator	Status	Primary long-term outcome
Water Resource Management Plan (WRMP)[5]	EA	Issued revised WRMP to the EA for recommendation to Secretary of State for approval.	1: Water always there
Drainage and Wastewater Management Plan (DWMP)[6]	EA	Final version published June 2023, with addendum to reflect final feedback from Defra, the EA and Ofwat.	4: Wastewater safely taken away
Statement of future risk mitigation measures and PR24 proposal summary (supported by Drinking Water Safety Plans)	DWI	Approved by the DWI in August 2023.	2: Water that is good to drink
Water Industry National Environment Programme (WINEP)	EA	Approved by the EA in July 2023, with subsequent updates from August 2023 and final sign off in September 2023.	5: A thriving environment

In addition to fully aligning with the statutory frameworks, our plans are also designed to support the four strategic priorities that the Government set out for Ofwat in February 2022: a resilient water sector, which delivers value to customers, the environment and wider society over the long-term, providing a better and fairer water service for all to serve and protect customers, and improving environmental performance; and to use markets to deliver for customers.

2.4.3 Analysis of future risks and opportunities

It is important to understand the factors that may make it easier or harder to achieve our ambition. Through a workshop with around 50 Severn Trent senior leaders, we carried out a structured assessment of the risks and opportunities using the PESTLE framework. Using prompts covering political, economic, social, technology, legal and environmental topics we captured 152 potential risks and opportunities that need to be considered. We used this insight in three ways:

1. As an input into the 'what base buys' analysis presented in 2.4.1;
2. To inform the development of the metrics included in our monitoring plan, presented in Section 3.5; and
3. As part of the assessment of investment needed to keep future options open described in Section 3.4 and 3.5.

2.4.4 Stakeholder preferences

We have aimed to reflect the priorities of all our stakeholders in our LTDS vision and ambition. Our stakeholder share a number of our priorities, and other priorities are closely interconnected. Figure 2.6 gives an overview of the priorities of our main stakeholder groups.

[5] https://www.severntrent.com/about-us/our-plans/water-resources-management-plan/
[6] https://www.severntrent.com/about-us/our-plans/drainage-wastewater-management-plan/

Figure 2.6: Overview of stakeholder priorities

Board	Communities	Employees
• Take steps across all service areas, ensuring we are not storing up problems for the future. • Deliver ambitious improvements and target sector-leading positions across all service areas. • Work hard to make our investment choices and decisions engaging and understandable to our customers. • Address local needs and articulate the plan so communities can see how they benefit and what role they need to play in meeting long-term challenges.	• Drive improvements to the quality of the local environment, such as rivers and streams. • Collaborate more with other agencies and stakeholders to solve community concerns, such as flood risk. • Create new community resources through support of local projects. • Support those in society who are vulnerable, disadvantaged, or in need. • Create new jobs and training opportunities, and support for social mobility. • Embrace diversity to ensure we reflect the communities we serve.	• Create meaningful roles that provide job satisfaction and offer a feeling of purpose. • Provide a fair, inclusive and safe place to work. • Create a vibrant workplace and high-performance culture. • Offer job security. • Invest in people, skills and knowledge, and long-term career development opportunities. • Provide staff with opportunities to give back to the communities we serve.
Supply chain partners	**Regulators**	**Shareholders**
• Better clarity on future plans. • Increased contract security. • Fair commercial terms that balance risk and return between all parties. • Clear deliverables and performance measures. • Efficient work allocation and management. • Timely payment. • Opportunities to work together to create efficiencies or open up new business options.	• Demonstrate compliance with licence conditions, standards, obligations and performance commitments • Demonstrate we are doing enough to protect and support customers who need it. • Deliver improvements to customer outcomes through efficiency, better customer insight and innovation. • Ensure full consideration of a wide variety of options, including an increased focus on collaboration and multi-stakeholder partnerships. • Deliver greater public value, delivering more for customers, society and the environment.	• Strong and predictable financial performance. • A fair return commensurate to the risk being taken. • Progressive dividend policy and opportunities for capital growth. • Robust governance processes and financial discipline. • Enhanced ESG (environmental, social and governance) credentials. • Retention of an investment grade credit rating. • Responsible financing with appropriate gearing.

As part of the development of our LTDS, we have sought challenge and review from key stakeholder groups, as well as from customers (see Section 2.4.5) and our Expert Challenge Panel (ECP). Figure 2.7 gives a summary of the feedback we have received, and the action we have taken as a result.

Figure 2.7: Key feedback on our LTDS and our response

Feedback	Source	How we have responded
There is insufficient evidence to demonstrate that enhancement investment is being sought only where a step change is being delivered beyond current expectations.	Severn Trent Plc Board Ofwat	Moved £58m of investment from enhancement to base investment (for leakage and sewer monitoring) where the evidence to justify a step change was not strong enough. Improved narrative to demonstrate the contribution from base and enhancement investment for each of the common PCs.
It is unclear how Severn Trent's ambition and culture of innovation is being used to shape the LTDS.	Severn Trent Plc Board Ofwat	Better articulation of the analysis completed on the technology CRS and wider technology opportunities. Our optimistic technology scenario includes a 16% cost saving across enhancement investment between AMP10 and AMP12, with the biggest opportunities in smart sewers, low-carbon technology, the use of digital twinning and the IoT (Internet of Things).
The LTDS does not show clearly where we are delaying investment and accepting a higher risk profile in the short term.	Severn Trent Plc Board	Improved narrative to highlight areas where we are delaying investment. The main areas are: • Emerging contaminants (e.g. PFAS) and reducing lead pipes, where we are focusing on monitoring and trials so that we are ready to act when the evidence/ mandate is stronger. • Preparing our wastewater network for climate change, where we are focusing in the short term on reducing storm overflows and keeping surface water out.
There is insufficient clarity on Severn Trent's approach to triangulation between the various customer research findings and the final LTDS investment choices.	ECP	Enhanced evidence that draws out the weighting we have placed on different insight sources. An overview is provided in Section 4.3, with more detail provided in the individual enhancement proposals.
If investment is only selected if it is best value under all plausible scenarios, then could our plan be excluding investment that is needed under a more likely future but more extreme (still plausible) future?	ECP	Added a sensitivity test to compare investment choices for each future. We have now assessed the likelihood of each scenario across the 25-year period and compared the most likely scenario to the 'no-regrets' investments to expose if this is an issue. Around 10% of 'low-regrets' investment is needed on a subset of more likely scenarios if the data quality and evidence justify it. The main area where this applies is on water resources, where we propose to close more than the AMP8 deficit as a result of high certainty in the long-term gap, and customer preference to share costs over the longest possible time period.

Some parts of the plan feel less ambitious. In particular, improvements in leakage should be part of business as usual, rather than part of a plan that customers will be paying more for.	Customers	Challenge partially accepted, as this theme emerged from several pieces of research. Moved £47m of active leakage control into base, retaining the additional mains renewal as enhancement. Over the long term, we assume the combination of rolling out smart meters and further innovation will mean we can maintain and increase this split despite the increasing cost of leak detection.
Could you significantly reduce investment if you align your plan to the more benign climate and population growth assumptions? Could the risks associated with taking more conservative/optimistic assumptions be managed?	EA	Climate experts say we are already operating at the low climate scenario, so we have not changed this assumption. We have already used Ofwat's definition of low growth (which is based on reliable ONS data) so there is no further possible reduction. Water Resources West (WRW) responded to the EA confirming this was also their view.

2.4.5 Customer preferences

We regularly talk to customers to ensure we understand how they feel about us, the services we offer and their expectations for the future in terms of both service and bills. In this section we demonstrate how customer insights have shaped our long-term vision and outcomes. Section 3.3 describes how customers have shaped our strategy and key investments.

We have engaged with over 68,000 customers on a wide range of subjects. We have identified the six key pieces of research through which have sought to understand customers' views on our 2050 ambitions, which involved discussions with 7,488 customers. Full details are provided in Annex 3a Customer and stakeholder engagement, and individual enhancement proposals. Figure 2.8 provides a summary of the key findings from these research studies and how they have shaped our LTDS ambition.

Figure 2.8: Key customer research inputs to shape our long-term ambition

Research Area	Method	No. of customers	How it shaped our ambition
Strategic Priorities (Dec 2021)	Tap Chat (online community) and telephone interviews	45	The first clear indication that customers want a broad focus across future investments, including a desire to go beyond the statutory minimum in areas relating to the environment and society.
WRMP (Jan-June 2022)	Deliberative workshops, online surveys	3,957	Leakage remains a top priority, and we are committing to outperforming the statutory deadline by five years. All other ambition is largely driven by statutory requirements, but customers have given clear views on some of the strategic investments (see Section 3 for details).
Understanding customers'	Tap Chat (online community)	624	Customers identified four key areas they want us to prioritise: (1) environmental protection (including healthier rivers, reduced leakage and planning for

priorities for the next 30 years			climate change); (2) providing a good customer service; (3) ensuring we have up-to-date and well maintained infrastructure; and (4) improve public perception of Severn Trent and to build trust.
DWMP	Online questionnaire	336	There are mixed views about the ambition on sewer flooding, with customers concerned about the cost relative to the small number of customers affected. Our ambition remains to work towards zero properties at risk, but more work is needed to establish an affordable strategy for achieving that ambition. Customers are clear that the original 25-year plan to reduce storm overflows was too slow. We have included an additional programme of storm overflow improvements in AMP8 that go over and above the statutory minimum (see 04: Wastewater WINEP).
Strategic Investment Choices	Online and face to face	2,469	Confirmation that customers support the range of ambitions across our 25-year plan, with the exception of creating bathing rivers, which customers do not think should be a key ambition. We have removed this from our AMP8 programme.
LTDS	Deliberative workshops and in-depth interviews	57	Customers find our long-term ambitions credible and the 2050 targets acceptable. They think more of the leakage ambition should be delivered through base expenditure.

Many of the themes were consistent across all of these research studies and have been used to group customer expectations into the three customer imperatives that underpin our 2050 vision: 'high quality and reliable', 'sustainable' and 'affordable'.

These imperatives have been consistent over the last decade of customer research. For example:

- Our PR14 research (2015-20) identified five customer expectations: Quality water, Service you can rely on, Affordable bills, Responsible service and Sustainable finance; and
- In our PR19 research (2025-30), we used the 'hierarchy of needs' to illustrate customer expectations: from hygiene factors (including a quality and reliable service) through to how our customers' experience feels, and culminating in our own behaviours – and whether we are operating our company responsibly and in the interests of our customers, communities, investors and the environment.

The customer imperatives build on these last two plans, simplifying our customers' priorities for the future of their water and wastewater services.

2.4.6 Board engagement

We discussed our LTDS ambition with the Severn Trent Plc Board on three separate occasions (out of five total meetings) before final signoff in September 2023. Their detailed feedback is included in figure 2.7 and focused on three key themes:

- Be clearer and more ambitious about the role of innovation in driving performance improvements. We reviewed our communication of the innovative elements of the LTDS to

our Board, ensuring they were highlighted. See Section 3.5.3 for details of the key technologies that we will drive in the short term to ensure they help us improve performance;

- Go further with what base buys in areas where we need to increase our pace – leakage and pollution in particular. See Section 2.4.1 for details of our ambitions and targets for base expenditure; and
- Better communicate how culture and governance processes are key to executing the LTDS and the seriousness with which we consider long-term talent and resource planning as well as all aspects of continuous improvement across people, process and systems. Our ambitions for our people, culture and governance are embedded throughout this document.

2.4.7 Synthesizing the views

We have considered all of these inputs (Sections 2.4.1 to 2.4.6) during the development of our LTDS, making decisions about priorities, sequencing and pace for both base and enhancement investment.

For three of our long-term outcomes, there is broad consensus among stakeholders on both the level of ambition over 25 years and what we need to achieve in AMP8.

In other areas, the picture is not so clear. We identified four long-term outcomes for which there were conflicting views, requiring consideration and balance before making a decision on our 25-year ambition. In these cases, we asked the senior leaders to assign a weight to each input in order to align on the right level of ambition. Figure 2.9 shows the relative weighting placed on inputs for each investment area. Each enhancement business case includes a summary of how we weighted differing views.

Figure 2.9: Weighting of inputs for ambition-related decisions

Long-term outcome	Benchmarking current performance	Statutory requirements	Analysis of future risks/ expert views	Stakeholder preferences[7]	Customer preferences	How views have informed ambition
1: Water always there (Particularly regarding leakage strategy)	High				Very high	The leakage ambition was endorsed by all groups, but there was divergence in views about who should pay. 80% of the improvements now come from base activities. This was also influenced by the fact that we are not yet performing at the UQ position and therefore more improvement should be funded through base
2: Water that is good to drink (Particularly around the pace of lead pipe replacements)		Very high			High	The ambition of a lead-free water system was endorsed by all groups, but there was divergence in views on the pace at which we achieve it. There is no statutory mandate for reducing the risk from lead water pipes, and Ofwat and the DWI have asked companies to focus on trials to inform future policy, but customers want to see faster progress, especially for vulnerable customers. In the short term, we are focusing on protecting the most vulnerable (children and those who are least able to pay) and trials to inform future policy.
4: Wastewater safely taken away (Particularly regarding pollution and sewer flooding incidents)			High	Medium	Very high	The ambition of zero pollutions was endorsed by all groups, but there was divergence in views about how much should be funded from base expenditure. There will be a small amount of coincidental pollution benefit from 04 (Wastewater WINEP) and 07 (Urban catchments of the future) but these will be very small. The feedback on our DWMP from Ofwat and EA challenged our ambition on sewer flooding. Our core pathway includes investment to hold the sewer flooding risk stable in the face of climate change, urban creep and population growth,

[7] Stakeholders' views varied across each investment driver. Specific details are provided in the relevant enhancement proposals.

						because customers were concerned about the cost to reduce it to zero given the small number of customers affected. We have provided an alternative pathway which includes working towards zero risk of sewer flooding and will continue to drive efficiency and reduce the cost of achieving this ambition until it is acceptable to customers.
5: A thriving environment (Particularly regarding net zero and spills from storm overflows)			Very high	High	High	The environment is a high priority for all stakeholders, but there is divergence in views on the pace at which we achieve our net zero and storm overflow ambitions. In Section 3, we explain how we have selected a pace that seeks to balance these differing views.

2.5 Conclusion

Our ambition for 2050 is intentionally broad and covers a wide range of service areas. We are confident it is the right ambition to meet our statutory obligations and the expectations of customers and other stakeholders because:

- It has been informed by a wide range of inputs and shows a clear line of sight to the key long-term statutory obligations;
- We gave customers information about our relative performance, relative cost efficiency and the improvements expected through statutory obligations to ensure the research was robust and well informed;
- When given appropriate context, our customers found our ambitions and targets to be stretching. In areas where they considered they were not stretching enough (or felt they should not pay the additional costs of meeting the targets) we have challenged ourselves to deliver more improvement from base expenditure;
- In two high priority areas – leakage and storm overflows – we propose to exceed elements of the statutory timeline by at least five years, driven by strong customer expectations; and
- Our Board has engaged throughout the development of our LTDS, giving clear and actionable feedback, and has approved our vision and ambition.

3. Strategy

3.1 Introduction

Severn Trent's LTDS is designed to deliver the long-term outcomes outlined in Section 2.3. It brings together several long-term strategies into one adaptive strategy that represents best value under a wide range of plausible futures.

In this chapter we explain how we will achieve our vision and ambition under a range of different futures. We provide the evidence which demonstrates how we can be confident that our investment plan (our core pathway) for the next five years represents the 'no- and/or low-regrets' investment needed to deliver our ambitions under a wide range of plausible futures. The details of our approach, tools and assumptions are provided in Chapters 4 and 5.

3.2 Key elements in our strategy

In this section we set out the key actions and investments needed to deliver our long-term outcomes. We aim to drive multiple benefits from each investment, which means there are overlaps in the long-term outcomes that are affected. For example, working with non-household customers supports our goal to reduce water demand, and also reduces pressure on our sewerage network.

Figure 3.1 outlines the key actions we will take to deliver each long-term outcome, and the building blocks needed over the next five years to work towards them.

Figure 3.1: Key actions and types of investment

Long-term outcome	Key actions	Related Enhancement Case
1: Water always there	Increase our ability to deliver water at peak demand through better forecasting, reducing waste and increasing connectivity.	01: Resilient water networks
	Help our customers to reduce water use, maximising the insights gained from meter coverage	08: Meeting Future Water Needs
	Ensure every household has multiple, resilient sources of supply, and maintain emergency supplies to cope with unexpected interruptions.	01: Resilient water networks 06: SEMD alternative water supplies
	Improve physical and cyber security for priority assets and across all business activities.	06: SEMD Physical Security 12: Enhancing Cyber Security
2: Water that is good to drink	Improve treatment processes to deliver safe drinking water as standards evolve.	13: Raw Water Deterioration
	Replace lead supply pipes to protect public health and the environment.	09: Lead Reduction
3: An outstanding experience	Provide a more personalised customer experience, improve first-time contact resolution, and increase coordination and proactivity of communications. To support	Base expenditure

	this, increase the completeness and quality of key customer data.	
4: Wastewater taken safely away	Work with others to improve river quality and ensure that Severn Trent is never the reason for rivers failing to meet quality standards.	0b4: Wastewater WINEP
	Improve network monitoring and rainfall management. Shift to separate wastewater and rainwater in high-risk areas.	04b: Wastewater WINEP (storm overflows) 07: Urban catchments of the future
	Increase customers' protection from flood risk, taking into account the impacts of climate change and population growth.	07: Urban catchments of the future Growth allowance
5: Thriving environment	Reduce greenhouse gas emissions to zero, based on science-based targets.	03: Net Zero Investments
	Improve the quality of the natural environment in our region, by utilising nature-based solutions, enhancing biodiversity and protecting environmentally sensitive sites.	04a: Water WINEP 04b: Wastewater WINEP 04c: Bioresources WINEP 07: Urban catchments of the future
	Send zero waste to landfill and instead reuse, recycle or recover all materials across our business. Make meaningful reductions in single-use items.	04c: Bioresources WINEP Base expenditure
	Investigate and replace unsustainable water sources with sustainable sources.	04a: Water WINEP (WFD licence capping)
6: A service for everyone	Automate high-volume, low-value processes and increase levels of self-service. To support this, use data to gain a better understanding of our customers' future needs.	Base expenditure
7: Affordable for all	Increase our specific support for customers who are vulnerable or in hardship. Provide customers with emergency support.	Base expenditure Social tariffs

This is a diverse set of actions and investment drivers, but there are three fundamental principles that underpin our strategy across all of these areas:

- **Consider a broad and flexible range of solutions.** A thorough options appraisal is the first key building block to our strategy. For each of our long-term outcomes, we have considered options based on behaviour change, nature-based solutions, partnership working, modular or adaptable technologies, optimisation or system reconfiguration before traditional 'end of pipe' construction-based solutions;
- **Unlock wider benefits.** Our strategy seeks to join up areas of work (either past and future investment or investment across drivers) to unlock greater benefits. For example:
    - We have spent the last 15 years developing a sector-leading catchments programme focused on water quality. The next phase of our strategy will unlock wider benefits including flood risk reduction, river quality improvement, carbon sequestration,

biodiversity enhancement, and greater understanding of emerging contaminants such as PFAS; and

- We have identified more than £100m of potential third-party investment in AMP8 alone, based on overlapping drivers or solutions (the most advanced discussions involve the catchment approach we are taking in the river Avon catchment, which have been accelerated thanks to the successful award of funding form the Nature Conservancy in August 23). See Appendix H for details of potential partnerships and third-party funding.

- **Track progress transparently.** The key to delivering a long-term strategy is taking small steps every day towards the end goal – on every project and every promise, no matter how small. Our strategy includes setting transparent deliverables that allow us to track progress between now and 2050, enabling us to identify where changes are needed. This is covered in more detail in our monitoring plan and across the 23 price control deliverables we have proposed to track AMP8 progress.

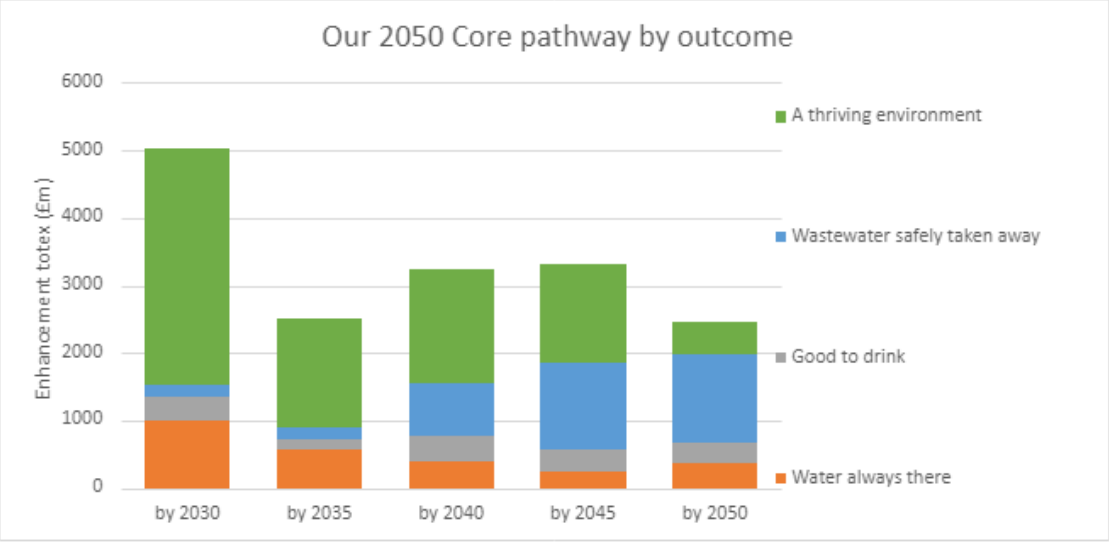
3.3 Core pathway to 2050

Our core adaptive pathway represents the key enhancement investments that are required under almost all plausible futures, which enables us to achieve our 2050 ambitions under a wide range of scenarios. The core pathway is not a central or most likely pathway between the alternative scenarios, but instead includes four types of investment, aligned with the Ofwat definition:

- 'No-regrets' investment: Required to meet statutory obligations by 2030;
- 'No-regrets' investment: Required in all plausible futures by 2050;
- 'Low-regrets' investment: Required in most plausible futures (we have set this at 70% or higher by 2050, which is explained in Section 4); and
- Investment required to keep future options open – predominately about gathering more information to reduce uncertainty.

This means it is not the total forecast investment needed by 2050, but the investment that can be demonstrated is no or low regrets. Three of our seven long-term outcomes will be delivered through base expenditure alone. Figure 3.2 shows our core pathway to 2050 across the remaining four long-term outcomes. This only takes into account legislation that is already in place today.

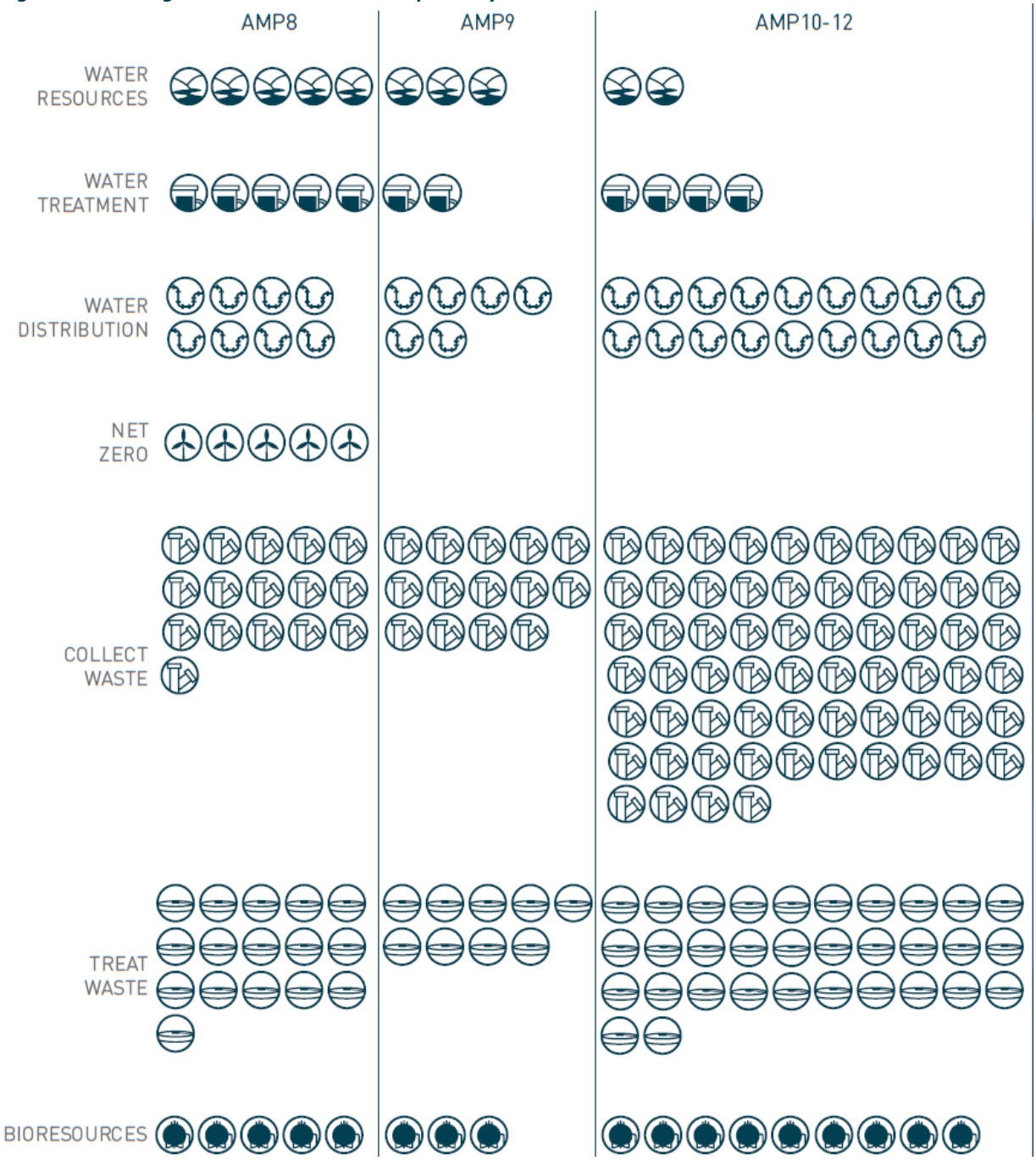
Figure 3.2: Core pathway to 2050



The figure above shows that our proposed enhancement investment over the next 25 years is dominated by environmental improvements. In the shorter term, this focuses on river quality improvements and in the longer term it will drive environmental improvements through the way we abstract water from the environment. In both cases, our investment is guided by statutory timelines, and we are prioritising interventions where there is clear evidence that improvement is needed: for example, where we must take action to prevent deterioration of water courses, or where Severn Trent is responsible for Reasons for Not Achieving Good Status (RNAGs).

Our core pathway consists of several key strategic investments illustrated in figure 3.3 below.

Figure 3.3: Strategic investments in the core pathway to 2050



We have aligned our assumptions across the programme when selecting our core pathway. This means that investment in the short term is based on:

- Low-growth (ONS) assumptions, in line with historical trends;
- Medium climate change scenarios in line with guidance from the EA and climate experts;
- Low environmental assumptions on environmental destination (but with studies to better understand the future requirements); and
- An optimistic view of the level of technology and innovation that can be deployed to support delivery of our outcomes.

Where we have a choice on the pace of improvement by 2050, we have sought to create a broadly even bill impact, as this is a clear and consistent message from customers.

3.4 Core pathway in AMP8

3.4.1 Sequencing choices

Our core pathway in AMP8 (2025-2030) includes performance improvements from base expenditure and 13 enhancement investments. In line with our statutory obligations and customer preferences, our AMP8 investment is dominated by statutory obligation, most notably river quality improvements and ensuring no harm is caused by our groundwater abstractions.

To better manage the bill impact on customers over the long term, we have considered options for balancing the cost fairly over the generations who will benefit from the improvements. We have considered all of the inputs and feedback on our proposed plans and have looked to slow the pace on the discretionary elements of our plan where improvements can be accelerated in future AMPs without undue pressure on future bills. Figure 3.4 outlines our key pacing decisions in AMP8, and the rationale behind our decisions.

Figure 3.4: Key pacing decisions in AMP8

Investment pace	Enhancement investment	Rationale
Accelerate pace: Investing now to make rapid progress or reduce costs or uncertainty in the future	**04a: Water WINEP** Monitoring and investigation to inform future investment, especially on environmental destination	This is relatively low-cost investment and the findings will significantly reduce uncertainty about future needs. It will also give us the longest possible time to spread the cost of any necessary improvements identified as a result of the studies, enabling a smoother bill profile.
	04b: Wastewater WINEP Reducing harm to river quality caused by storm overflows, starting with high-priority rivers.	Our plan is paced to go faster than the statutory minimum. It includes an additional 10% investment to tackle an extra 198 overflows. Largely based on customer desire for more urgent improvement and an opportunity to do more nature based solutions. Full evidence to support this decision is included in case 04b.
	04a: Water WINEP Ensuring no harm is caused by our groundwater abstractions.	This was originally a 10-year programme that the EA requires to be substantially complete by 2030

	08: Meeting Future Water Needs Demand-side reduction in consumption (water efficiency and leakage).	Demand-side water reductions are cost efficient and carbon efficient, but also extremely ambitious. Customers are hesitant to commit to their role in achieving this reduction.[8] During AMP8 we intend to redouble our efforts across every aspect of demand side reductions. Over 80% of our leakage costs are funded through base, and we are accelerating our metering programme[9] and increasing mains renewal rates. These activities are essential for delivery of the demand-side reductions, which offset the need for supply-side schemes.
Even pace: Maintaining an even investment profile over 25 years	**03: Net Zero Investments** Transforming wastewater treatment to reduce greenhouse gas emissions.	Our plan is aligned with net zero legislation and balances cost fairly across generations. Our customers support an even faster pace if we can demonstrate sector-leading efficiency. We have therefore proposed a full programme for Ofwat's consideration within the net zero competition.
	04b: Wastewater WINEP Meeting the 80% phosphorus reduction target by 2038.	By value, this programme is spread evenly between AMP8 and AMP9. We have prioritised locations where there are RNAGs or it is classified as a priority water course. On the sites not being tackled in AMP8, we need to find innovative solutions that enable us to go beyond the current technical achievable limit.
	01: Resilient water networks Resilience of our water network to peak demand.	We have targeted improvement in the highest risk areas and scaled it to create a broadly even profile of improvements needed as climate change trends increase over the next 25 years. Deferring these improvements would place undue risk and cost on future generations.
Slower pace: Balancing investment with affordability and ensuring we are prepared to tackle key challenges	**13: Raw Water Deterioration** **04b: Wastewater WINEP** Transitioning to more advanced water treatment to prepare for expected legislation on emerging contaminants such as PFAS, microplastics and pharmaceutical residues.	Our core pathway includes solutions to all evidenced risks against the current standards, and a small-scale programme of monitoring and investigations relating to future risks and tighter standards. Gathering robust data during AMP8 will help us make better decisions at PR29 and inform future policy on emerging pollutants.
	09: Lead Reduction Replacing lead water pipes to improve customers' health and the environment.	This has been one of the hardest drivers to balance. There is a strong ethical motivation to go faster, but a lack of statutory remit to justify the costs of doing so. AMP8 focuses on protecting the most vulnerable

[8] LTDS deliberative research, NHH group Worcester

[9] We accelerated 157,000 smart meters through our Green Recovery programme and a further 250,000 through Defra Acceleration, which means we will have delivered more than 25% of the AMP8 programme before 1 April 2025.

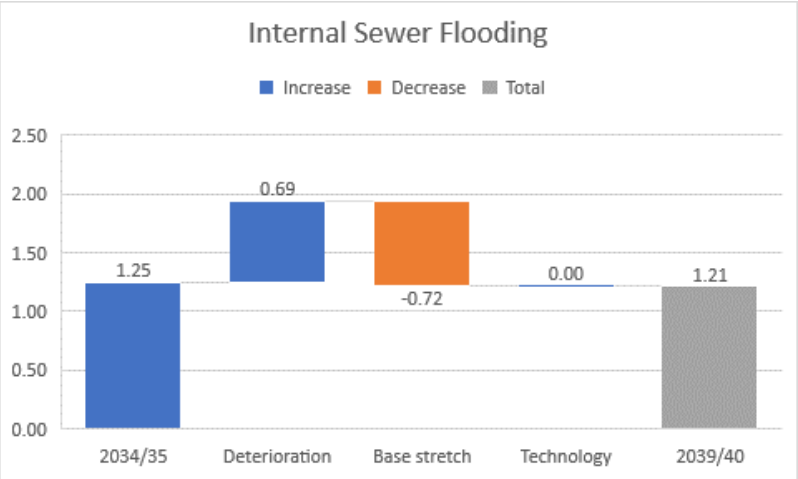
		in our society whilst filling gaps in knowledge that will inform future policy and enable us to make faster, more efficient progress in the future.
	07: Urban catchments of the future Preparing our wastewater network for climate change to reduce the risk of sewer flooding.	The pace we are proposing in AMP8 – focusing on the highest risk catchments and gathering data – this requires us to tolerate and manage increased risk in the short term. This will allow us time to understand the coincidental benefit of the large storm overflow programme, and to identify and develop partnerships to deliver flood risk reductions. There is an ongoing policy debate about a potential national flood risk standard. During AMP8, we will gather cost and benefit data, gain customer insight and push ahead with innovation that could significantly reduce the cost of this work – all of which will inform this debate.
	06: SEMD Physical Security Improving security at sites designated as critical national infrastructure (CNI).	We aim to keep pace with the minimum statutory requirement, and do not propose to increase security at sites that supply other sectors' CNI. There remains uncertainty around the timing and extent of any additional statutory requirements even though changes are likely to come into force during AMP8.
	15: Reservoirs Act extension Preparing for statutory inspections at our reservoirs and lagoons during AMP8.	There are clear signals from the EA that the approved changes to reservoir safety legislation will be enforced during AMP8. The exact timescales are not clear, and we have assumed that the inspections will not begin until 2026-27, enabling us to phase the cost across AMP8 and AMP9. We will manage the costs within our base expenditure if the requirements are brought in sooner than this, and money will be returned to customers through the PCD if the timescales are later than expected.

3.4.2 AMP8 base investment

To keep our customers' water bills as low as possible, we have challenged ourselves to deliver more improvement from base expenditure.

To calculate the contribution of base expenditure towards our long-term outcomes we have considered several factors, including relative performance, past improvement trends, deterioration data (which indicates how hard we have to work to keep pace with external trends), innovation in the pipeline, and the potential for technology to drive improvements. Figure 3.5 is an example of our analysis for internal sewer flooding. In this example our models forecast performance will deteriorate by 0.69 incidents/10,000km and that our base improvements (through activities such as rolling our smart sewer technology to better manage capacity in our network) will first offset the external pressures and then offer a small improvement.

Figure 3.5: Example analysis of the contribution of base expenditure – Internal Sewer Flooding



We are seeking enhancement investment only where a step change in standards is substantiated by regulatory drivers and/or explicit customer and stakeholder expectations. That means there is limited overlap between the common PCs and our proposed enhancement investment. For the PCs where overlap exists, we have included the target split by base and enhancement. This is also provided in data table LS2.

3.4.3 AMP8 enhancement investment

Our AMP8 core pathway consists of 82% investment (£4.1bn) that is needed to deliver 2030 statutory obligations, 12% (£0.6bn) is needed to make a proportionate step towards a statutory deadline required after 2030 and the remaining 6% (£0.3bn) is low regrets investment needed to deliver customer request improvements or to mitigate externally driven risks to ensure we are keeping pace with pressures such as climate change.

Below, we provide headlines of each enhancement investment proposed and a short summary is provided in Appendix D. Full enhancement proposals have been submitted with our business plan.

Figure 3.6 Overview of the AMP8 enhancement investments by main driver

Driver	AMP8
Statutory – wastewater WINEP	• Overflow interventions at 562 sites – solutions include a mix of increasing storage, treatment, surface water separation to reduce volume. Plus installing screens. • Installing advanced phosphate removal treatment such as CoMag across 126 WWTW • 13 large scale Catchment Nutrient Balancing projects (partnership working with farmers) • 13 small works upgrades to secondary treatment using nature- based solutions. • Install 772 flow monitors at WWTWs and sewage pumping stations. • Install 1,000 river quality monitors.
Statutory – water WINEP	• New drinking water catchment protection measures at nine sites. • Changes to pumps, treatment and controls at 63 groundwater sites affected by abstraction licence reductions.

	• Seven new pipeline and distribution projects to facilitate transfer of water into areas affected by abstraction licence capping. • Reconfiguring 38 control groups to accommodate the network effects of licence capping changes • Feasibility studies into how to achieve the EA's AMP9 environmental destination targets across 130 abstraction sites and 12 catchments. • Biodiversity improvements at 262 locations, improving SSSIs and SACs
Statutory – bioresources WINEP	• Creating cake pad storage at 12 sites to increase storage from 90 to 180 days • Installing two pelletisation plants • Installing technology at 20 sites to increase the dryness of the sludge product • Installing a phosphorus recovery plant
Statutory – Raw water deterioration	• Whitacre WTW Algae – a new dissolved air floatation (DAF) plant; • Homesford WTW Lead – a next generation ceramic membrane plant; • Groundwater crypto/bacti - 5 x UV plants, 1 x iron and manganese removal plant, and 1 x UF membrane plant; • Groundwater nitrate - 2 x Ion Exchange plant; and • PFAS treatment at two sites, including specialist laboratory equipment to determine PFAS removal
Statutory – Enhancing cyber security (NIS-R)	• Enhance security of all IT systems • Install cyber security at 36 (high risk classified) CNI and HPNI sites • Protect all connected water and wastewater sites
Statutory – SEMD Physical security	• Improve security at 29 sites classed as critical national infrastructure. Installing security features such as: • 48 Intruder detection systems • 33 Visual Verification systems • 7.7km high security fence lines • More than 300 points hardened (security doors, kiosks, window bar sets, gates, cages). • Over 350 access points upgraded on linear assets
Statutory – SEMD Alternative water supplies	• Enhance the network response fleet by: • 12 pumped tankers and 12 hook lift vehicles • 55 16,000l static tanks • 20 small LGVs
Statutory – meeting supply demand balance	• Replacing an additional 460km of mains to reduce leakage bringing the total to 1,400km. • Installing 1 million smart meters across our region. • Implementing modifications at Draycote dam to raise the top water level by 0.6m which will increase storage capacity by 1,400 million litres. • Building 83km of large diameter pipelines to connect Nottinghamshire and Stoke-on-Trent to our strategic grid. • Expanding four treatment works that will increase capacity by 42Ml/d.
Statutory by 2050 – meeting net zero	• Installing monitoring and control equipment at 105 sites • Covering and then destroying GHGs from wastewater processes at 23 large sites • Changing WWTW and sludge processes such as intensifying ASPs and reconfiguring digesters to prevent GHG formation at 31 sites

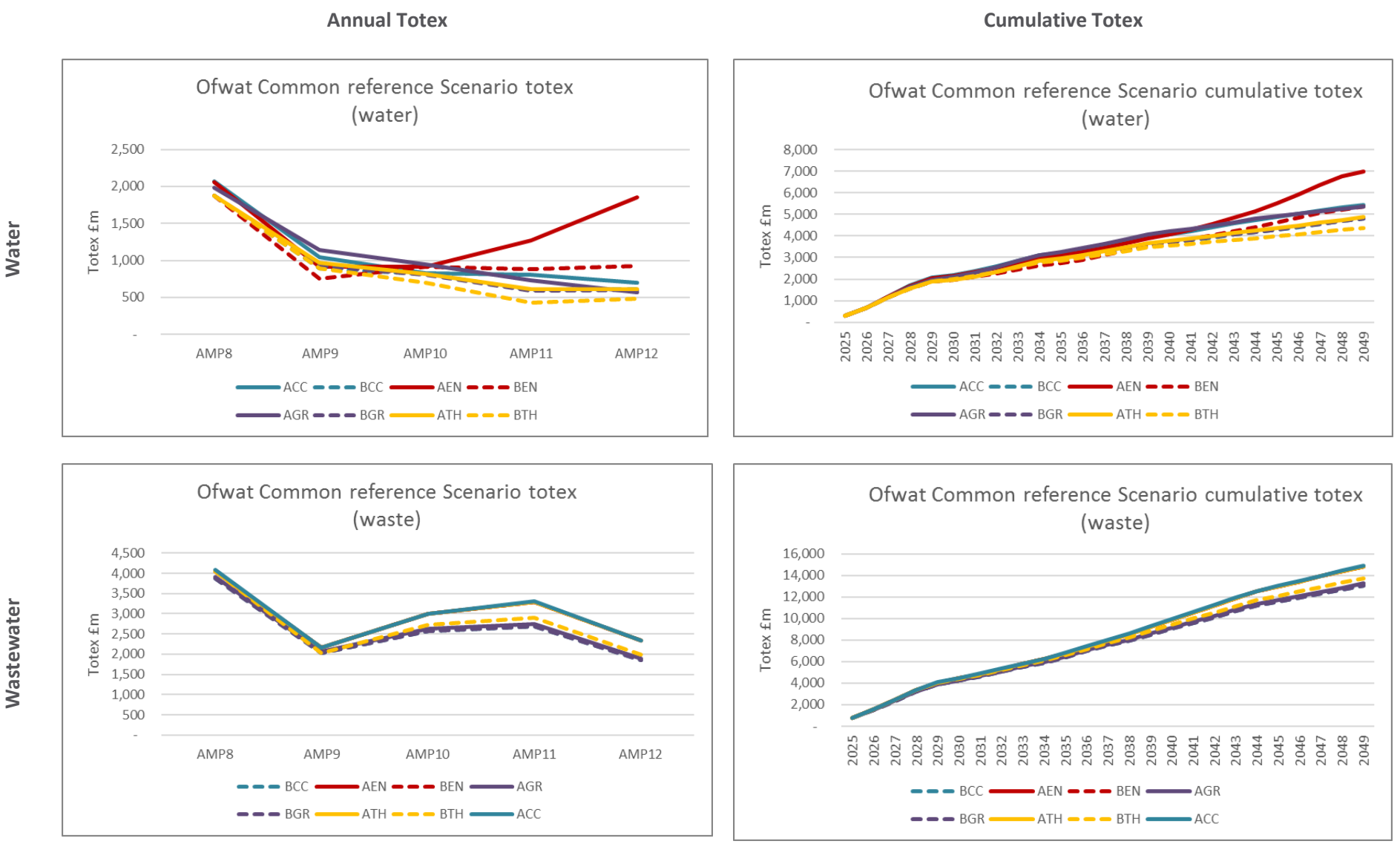
Statutory – Reservoir Act extension	• Inspecting 45 tanks against Reservoir Safety standards • Improving drainage and flow data at 45 sites • Enhancing the overflow arrangements to prevent overtopping at 16 of the sites • Installing bypass arrangements at three sites to enable isolation • Rebuilding two tanks to enable isolation
Discretionary (low regrets) - Resilience	Three schemes to provide additional capacity/ connectivity on our Strategic Grid: • 13km pipeline to move more water from the north of our grid through Leicestershire • 15km pipeline to move more water from the north of our grid through Warwickshire • 0.5km pipeline to allow our new Witches Oak source to provide resilience to Nottinghamshire Three pipelines to provide additional resilience within zones: • 6km of 700m pipe to provide additional resilience around Campion Hills • 11km of 800mm pipe to provide additional resilience to south Coventry • 12km of 450mm pipe to provide additional resilience from Shrewsbury in to the Wem and Whitchurch area
Discretionary (low regrets) - Resilience	• In four urban communities we will create 92 nature-based hubs with green-blue interventions • Redirect and manage 30ha of hardstanding in a sustainable approach • 150 monitors and smart controls across 4,000km of sewers • Create a team of 'Community Resilience Officers' to support design of community solutions
Discretionary – Customer-driven	• Investigate and replacing lead pipes in up to 1,000 schools and nurseries • Replacing lead pipes for up to 500 struggling to pay customers • Replace up to 2,000 lead pipes in a community to enable us to disengagement chemical treatment

3.5 Alternative pathways

3.5.1 Common reference scenarios (CRS)

We have modelled Ofwat's eight alternative pathways, as described in the common reference scenarios (CRS), outlined in Figure 3.7 and also provided in data tables LS5 and LS6. They set out 25-year expenditure forecasts that represent the optimum investments that would be needed if we were certain about the future. They represent a plausible range of options, but none of them are likely futures by themselves, as the drivers of uncertainty are interlinked and unlikely to develop independently of each other. See Section 4.2.2 for the parameters of each CRS.

Figure 3.7: Alternative pathways for the CRS



The annual charts show that the costs of all scenarios are quite similar. This is because the best value solutions tend to be the same irrespective of the driver be it climate change, growth or environment. The cumulative charts show we are phasing investment at a broadly even pace over generations.

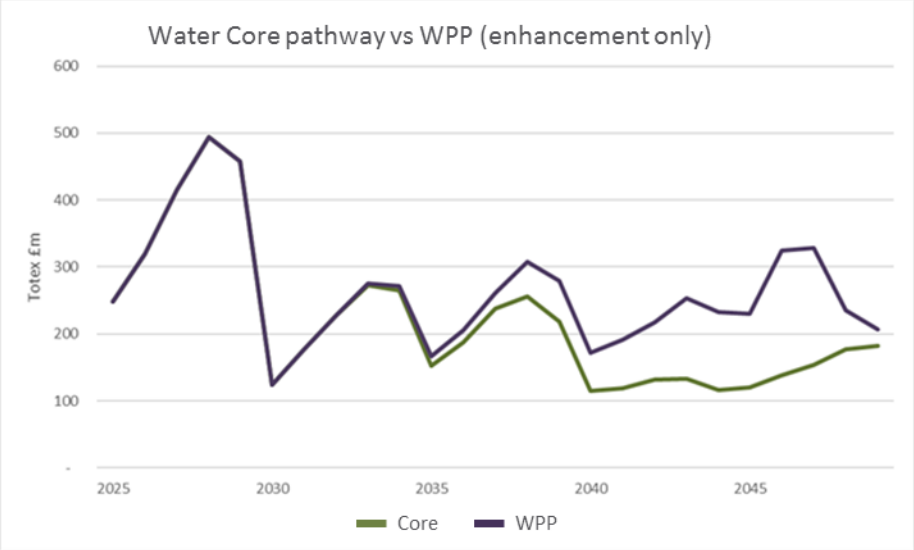
The water charts show that the high abstraction reductions (or adverse environment – AEN) has the most significant impact because we need to replace a high number of groundwater abstraction licences to meet the challenges of environmental destination. Even the low abstraction reduction scenario (or benign environment – BEN) has a greater impact than high climate change (ACC) and high demand (AGR) scenarios. The chart also shows that a focus on implementing technology faster (BTH) will mitigate some of the impact of abstraction reductions.

The waste charts show broadly similar investment levels due to their being dominated by climate change impacts.

We also considered the future scenarios as defined in the WRMP (the EA Water Preferred Plan - WPP) and DWMP (the EA defined Central Plan). The former has been entered as company specific rows in data table LS5. These also represent investment to work towards a defined future from day 1.

As shown in Figures 3.8, the EA preferred plan maps very closely to our core pathway between 2025 and 2035 but then diverges as the WPP follows the high environment scenario. For the DWMP the core pathway in our PR24 plan is identical to the central pathway in our DWMP.

Figure 3.8: WRMP EA WPP compared to EA MLP



Section 4 provides the rationale behind our analysis and more detail on the approach we have taken to generate these alternative plans. In summary, the eight CRS and EA-defined scenarios have helped us define our strategy in the following ways:

- We have identified solutions that are shown to be optimum under all scenarios ('no regrets') and included them in our core pathway;
- We have used the scenarios to understand which uncertainty drivers have the biggest impact on expenditure and solution selection, and therefore derived investment needs to keep future options open (see Section 3.5.2); and

- We have used them to create plausible adaptive pathways and an associated monitoring plan to help us test that our plan remains optimal as we adapt to change in the future (see Section 3.6).

3.5.2 Keeping future options open

Across a small number of investment drivers, there is significant divergence relating to one or two of the CRS. In these cases, the solutions to meet these divergent futures cannot be defined as part of a 'no- and/or low-regrets' programme, and have therefore not been included in our core pathway. There are three areas where this has occurred:

- **WRMP** – the high environment scenario drives almost a 50% increase in our water deficit, costing £2.2bn more than the core pathway. It is too early to tell if this future will materialise, and it will take more than one AMP to transition to this alternative pathway. To ensure we have sufficient time to prepare for this more demanding future, we have included a series of studies to better understand the impact of environmental destination policy (£40m in 04a: Water WINEP) and accelerated feasibility to develop more options (£9m in 08: Meeting Future Water Needs) that could offer better value solutions than we currently have available;
- **DWMP** – the factor driving the biggest difference in costs and solution selection is the pace at which we aim to achieve zero properties at risk of sewer flooding. There is currently no statutory standard, and the ambition could be triggered by customer expectations or regulatory change. Customers have expressed concern about the forecast costs and bill impacts of delivering these improvements over the long term, and we have therefore included £3m of investment in enhanced analytics and visualisation tools to enable proactive use of the vast amount of data being gathered across our wastewater assets. This investment is needed to keep future options for two reasons: it will help us reassess the improvements that can be expected through base expenditure over the long term; and it will enable us to verify the benefits associated with a wide range of associated interventions where the primary driver is not reducing sewer flooding risk. This will enable us to identify more synergies across our programme and reduce the overall bill impact; and
- **Adverse climate scenario** – in most cases, the adverse climate scenario drives the biggest investment programme. We have included £2.5m of climate impact modelling across a targeted set of assets. This is needed to validate our risk models and to assess the impact of any mitigation measures put in place over AMP8 to improve the resilience of our assets to the impacts of climate change.

We have reviewed the CRS and, through workshop discussions, documented the triggers that could prompt a transition to an alternative pathway.

Figure 3.9: Potential triggers for transitioning to an alternative pathway

Common reference scenario	Potential trigger
Climate change	• Updates to climate change projections (e.g. UKCP28, 38) • Changes to legislation (e.g. transcribing UK law into water industry law) • Increased asset failure linked to climate change
Demand (population changes)	• Census data (published 10-yearly) • Local authority data • Government decisions on national infrastructure projects

	• Customer alerting us to changes (especially non-household, e.g. through changes in trade effluent) • Local authority plans, especially on business development plans which could drive significant changes in demand (such as hydrogen production or significant change of land use) • Demographic changes triggered by climate change • ONS data on social factors such as home occupancy rates, social mobility, employment rates, household income statistics
Environment (abstraction)	• Results of our investigations (e.g. environmental destination studies) • EA or Defra policy (e.g. updates to the Environment Act) • Customer behaviour change (reduced PCC reduces pressure on abstraction) • National strategic resource option (SRO) decisions • Development of markets for nature • Groundwater levels, river flow levels (linked to climate change)
Technology	• Cost or availability of technology • Dissemination of innovation trials (known timetable across Ofwat, UKWIR and internal Severn Trent innovation programme) • Government policy (e.g. new legislation is a trigger for the market to respond) • National and international trading rules (including. Brexit)

3.6 Adaptive pathways

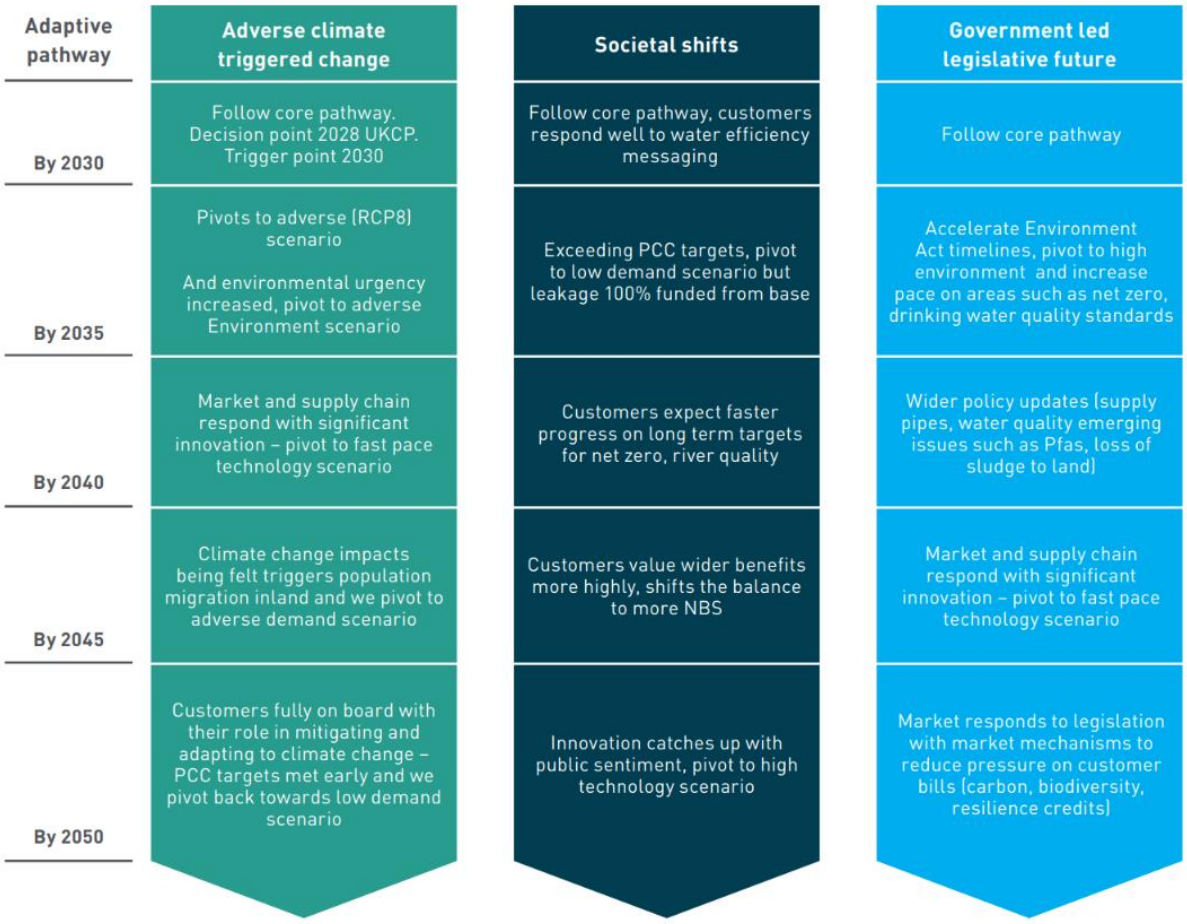
Using the expenditure and intervention forecasts for each CRS, sensitivity tests and the triggers listed in Section 3.5, we have created three adaptive pathways. We arrived at these by considering the most material issues i.e. those that would change the extent or pace of need and the efficiency of solutions, and then considering how they might change over time and interact. For example, the impacts of climate change felt locally might reasonably trigger more concern for the environment and therefore greater investment need, but would also stimulate a market and customer response to help solve these issues.

These adaptive pathways set out a plausible set of triggers that would require us to adapt by transitioning to an alternative pathway. Figure 3.10 explains the logic for the three adaptive pathways, whilst Figure 3.11 shows the expected expenditure alongside example triggers on each pathway.

We re-optimised our investment programme to respond to the three adaptive pathways, identifying whether we would make different investment choices if we knew we were heading to a different future. This resulted in one change to our core pathway. In our original core pathway optimisation, we selected two water resource schemes to solve the current AMP8 deficit. However, in all three of the adaptive pathways, that solution would fail to solve the new, bigger problem. We reviewed a wide range of options and found the lowest cost solution is to construct a larger solution in the short term to avoid the future cost. Full details of this analysis can be found in 08: Meeting Future Water Needs.

Overall, this analysis has given us confidence that we will be able to meet the 2050 ambitions and maintain an optimal investment profile under a range of alternative futures.

Figure 3.10: Description of the adaptive pathways



These adaptive pathways are all plausible, but we do not think it is possible to calculate the likelihood of any particular route or future. We have used our decision support tool to simulate these triggers and then reoptimized the solutions to meet the new future. The results are shown in Figure 3.11.

Figure 3.11: Cumulative totex across the adaptive pathways to 2050

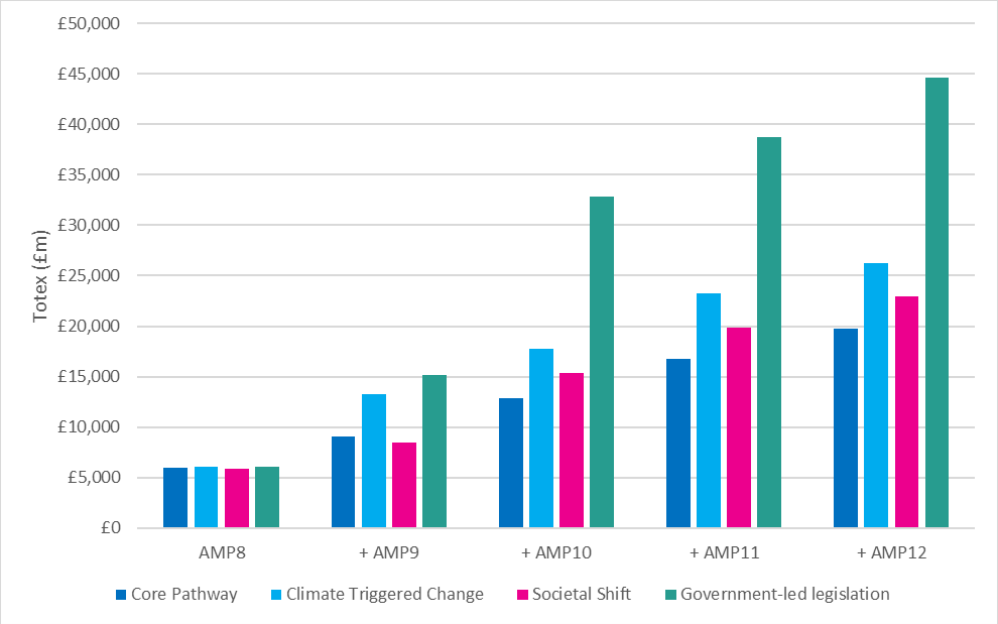
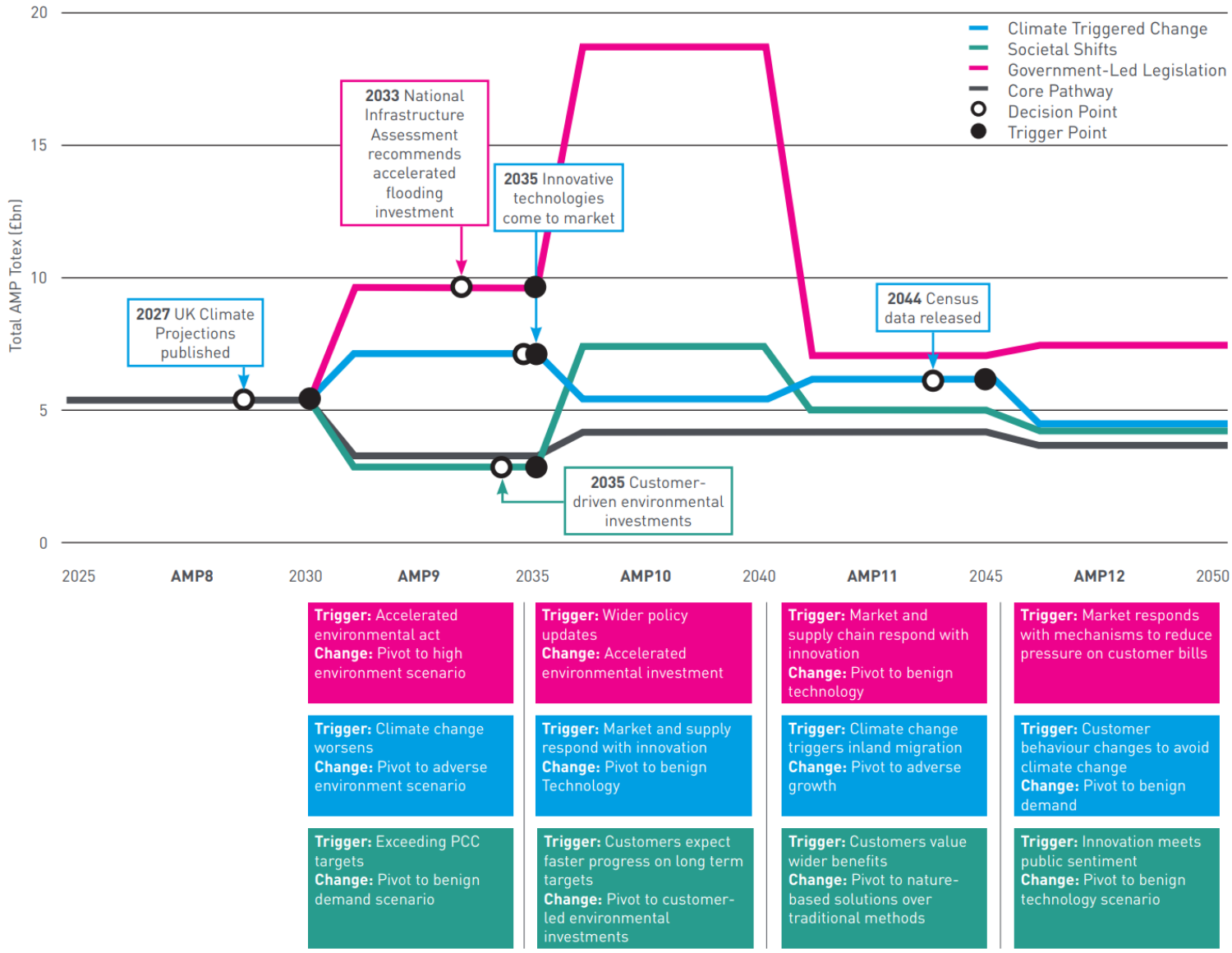


Figure 3.11 (continued): Adaptive pathways to 2050



3.6.1 Monitoring plan

Effective monitoring of our adaptive pathway is a key part of successful delivery of our LTDS. We have developed seven high-level indices that make up our monitoring plan. Wherever possible, we have defined the thresholds that will trigger action, and the likely action to be taken. The thresholds will be kept under review and developed as we gather more data throughout AMP8.

We are integrating this monitoring plan into our wider performance reporting, and intend to provide a minimum of two progress updates throughout AMP8 as part of our annual performance report (APR). We have committed to sharing our monitoring plan and data as part of an industry-wide study under consideration by UKWIR.

Our metrics were developed with advice from engineering consultants at Stantec and Jacobs, and are aligned with our climate change adaptation plan. We have identified the smallest number of measures that will give us reliable and meaningful insights across our investment programme, enabling us to navigate the alternative pathways and minimise the cost of data gathering.

Figure 3.12: Monitoring plan indices

Indices	Metrics	Trigger
Climate index	1. Current and projected GHG emissions 2. Precipitation levels 3. Change in temperatures 4. Extreme and compound events	RCP change
Demand index	1. Ratio of forecast to actual population 2. PCC for all customers on smart meters	1. Bespoke to each WRZ 2. More than 20% difference to our planning assumption (max sensitivity test)
Environmental index	1. Output of environmental studies 2. Outcome indicators for the 25 Year Environment Plan[10]	Time bound on study output Aligned to Defra triggers
Technology and efficiency index	1. Triangulation of key unit costs (for example £/Ml/d and £ per m^3 of surface water, £/kTCO2e) 2. Ratio of forecast technology savings compared to actual 3. Ratio of forecast benefit to actual benefit on high technology investment areas (specifically net zero, advanced water treatment, nature-based solutions)	1. More than 20% difference (aligned to max sensitivity test) 2. More than 30% difference (max sensitivity test)
Legislation index	1. Hansard key term trend 2. Defra question time key term trend	Not used in isolation to trigger moving pathways
Social index	1. Social media scraping – key term trend 2. Water poverty trend 3. Percentage of customers on social tariff 4. % customers struggling to pay their bill (bad debt trend)	Not used in isolation to trigger moving pathways

This framework will come into its own from PR29 onwards, when we need to make key decisions about investment in several of our long-term outcomes. For example, for water resources we will have substantially completed our environmental destination investigations into the cumulative impact of

[10] https://oifdata.defra.gov.uk/

licence reductions and will therefore be able to make an assessment on whether we would change adaptive pathways.

We utilised a wide variety of sources and sought expert advice to identify over 140 data points, which were then assessed based on the following principles:

- Availability and robustness of existing data to enable us to set thresholds and trigger levels;
- Contributing factor to many investment areas (to minimise cost of data collection and maximise benefit); and
- Strong engineering logic connecting the metric and the intervention/actions needed in response.

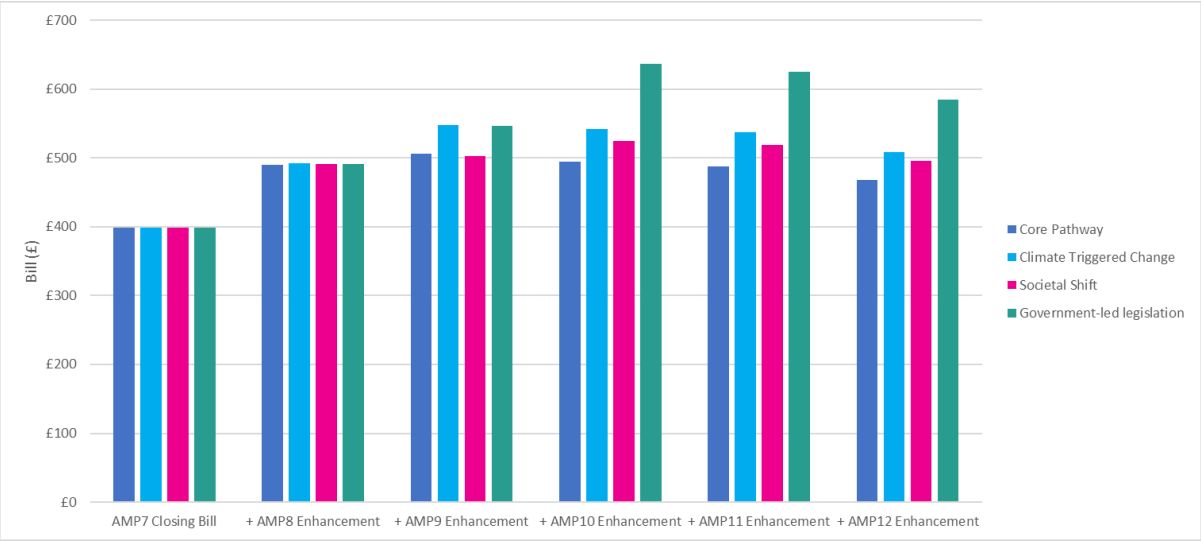
From this process we also identified a number of measures that have potential to be meaningful long-term metrics, but cannot be used in the short term because the data quality or our understanding of the metric is not yet mature. We have developed a data improvement programme to enable us to collect and 'shadow report' these candidate metrics, ready for incorporation into our monitoring plan when they reach a suitable maturity.

The monitoring plan is not only a critical tracking tool, but can also be used to realise future opportunities. We can use our insight about which areas of uncertainty would drive material investment if they came to fruition to drive forward opportunities (e.g. innovation ideas) and reduce risk (e.g. such as working proactively with non-household customers to manage any significant changes in demand).

3.7 Impact on bills

This section sets out the estimated bill impacts of the long-term delivery strategy. There are many factors that will affect bills over the long term and the bill model is a simplified version of the actual bill calculation. But this analysis does set out the potential range of bill impacts that may be experienced under different future scenarios. Figure 3.13 below shows the bill impacts for the core and adaptive pathways (all presented in 22/23 prices without inflation impacts). This data is also provided in data table LS7. The bill impacts of the 8 CRS fall within this range.

Figure 3.13: Bill impact of core vs adaptive pathways



This is a useful tool to use when talking to customers to discuss intergenerational fairness and also risk appetite. Some of the adverse futures would require significantly more investment and therefore it is really important that we identify effective leading measures to help us get a better understanding of the likelihood so that we can prepare and wherever possible influence the future outcomes.

The bill impacts have been calculated using the LTDS Appendix 2 guidance and the calculations have been through three lines of assurance.

3.8 Conclusion

We are confident that we are striking the best balance between ambition, uncertainty, customer preference and short-and long-term affordability. We have achieved this balance by:

- Providing high quality, engaging material to customers, stakeholders and our Board to provide opportunities to comment on the ambition of our 25-year plan. There is consensus that our plan is ambitious across key service areas;
- Applying a rigorous approach to identifying 'no-regrets' investment under a wide range of plausible scenarios and taking account of appropriate levels of uncertainty to ensure that our core pathway remains optimum within a c+/-20% uncertainty range (i/e our key inputs could be up to 20% out and this pathway remains optimum);
- Challenging ourselves to find solutions that drive multiple benefits and ways to drive cost efficiency to deliver more for customers; and
- Consulting on the long-term bill impact. We have altered the pace and sequencing of investment in order to find a fair balance of costs over the generations that will benefit from the investment for example re-phasing our phosphorous reduction programme to get greater benefits sooner.

4. Rationale

4.1 Introduction

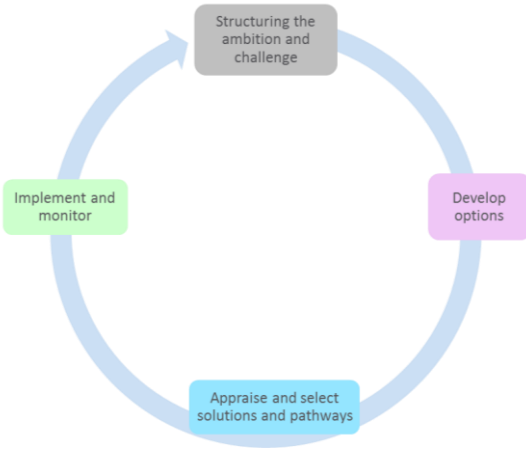
In this chapter we explain our method and why we are confident that this LTDS represents the best possible approach to deliver our ambition, both in the short and long term, taking into account future uncertainties, customer preferences, affordability considerations and fairness between current and future customers.

The LTDS is a significant step forward in the evolution of Severn Trent's strategic planning, and we have embraced the opportunity to consolidate and test our existing long-term plans using a consistent framework. To do so, we have drawn on a wealth of strategic planning knowledge at Severn Trent, stretching back 20 years and including water resources, drought and climate change adaptation[11], and we have sought to learn from other sectors where adaptive planning is more mature. We have consolidated this into a common adaptive planning approach, aligned with Ofwat's final guidance on long-term delivery strategies.

Figure 4.1 outlines the adaptive planning framework we used the develop the LTDS. This section covers Stages 2 to 9 in the framework, Section 2 outlines our approach to Stage 1, and Stages 10 and 11 will continue into AMP8 as we deliver our plan.

Figure 4.1: Our adaptive planning approach

Phase	stage	Principal Activities
Structuring the challenge	1	Define our ambition and long term outcomes
	2	Understand water and waste system performance and underlying risks (establish baseline including estimate of what base buys)
	3	Define future scenarios based on understanding of drivers of change and uncertainty and regulatory requirements
	4	Understand which systems and outcomes are sensitive to the future scenarios Develop tools then quantify the impact on our systems / desired outcomes under each future scenario
Develop options	5	Identify the enhancement options needed to meet our long term outcomes under all scenarios
	6	Develop tools to enable consistent costs and benefits to be quantified
Appraise and select solutions & pathways	7	Organise data and map to relevant tools
	8	Optimise investment options to develop pathway options
	9	Evaluate and develop core pathway, alternative pathways and trigger points
Implement & monitor	10	Board and regulatory approval of strategy and monitoring plan
	11	Implement monitoring plans and horizon scanning



Throughout this chapter, we explain the process involved in each of the stages in our adaptive planning framework, highlight key data points from our analysis, and (in some cases) provide a worked example the relevant stage.

[11] Appendix G includes a summary of the key lessons we have sought to learn from our previous long-term planning.

4.2 Structuring the challenge (Stages 2 to 4)

In Stages 2 to 4 (outlined in Figure 4.2), we looked to understand the size of the gap between our current performance and 2050 ambition under different future scenarios, focusing on circumstances that could make achieving our ambition easier or harder, and identifying those that are likely to materially impact our plans.

Figure 4.2: Stages 2 to 4 of our adaptive planning approach

Phase	stage	Principal Activities
Structuring the challenge	1	Define our ambition and long term outcomes
	2	Understand water and waste system performance and underlying risks (establish baseline including estimate of what base buys)
	3	Define future scenarios based on understanding of drivers of change and uncertainty and regulatory requirements
	4	Understand which systems and outcomes are sensitive to the future scenarios Develop tools then quantify the impact on our systems / desired outcomes under each future scenario

Understanding the level of complexity and range of uncertainties also helped us identify the best approach for modelling the impacts. Fewer and less complex uncertainties can be explored using simple tools and judgment, while multi-faceted, complex uncertainties require a computational approach. Addressing the challenge in this way allows us to focus time and effort where the uncertainties are greatest and most material to investment decisions.

4.2.1 Stage 2: Establishing the baseline

When considering our current performance against our 2050 ambitions (see Section 2), we carried out three main activities to establish a robust baseline:

- Collation of performance and risk trends (e.g. from previously reported data and asset health dashboards);
- Forecasting performance to April 2025 to ensure that existing commitments and funded enhancements are accounted for in our baseline (Annex 5a Common performance commitments, includes a detailed review of current performance against all common PCs); and
- Comparison of current performance against our best-performing peers and other external benchmarks to determine the level of stretch that we will commit to as part of 'what base buys' (as described in Section 3 and Appendix F).

We repeated this step periodically to refine baselines using feedback from both internal review and external challenge.

For example, through our industry-leading emissions monitoring and third-party review by Jacobs, our Scope 1 & location-based Scope 2 greenhouse gas baseline evolved to 642 $ktCO_2e$. Challenging ourselves through the Energy & Carbon Steering Group (a Severn Trent Executive Committee subgroup) resulted in us committing to a 115$ktCO_2e$ or 18% reduction through base expenditure.

Figure 4.3: Worked example of iterative approach to establishing baseline performance (Case 03 Net zero investments)

March 2021	June 2022 to March 2023	September 2023
Submission made to Science Based Targets (SBTi) covering Scope 1, 2 and 3 Process emissions factor increased in line with first set of findings from GHG monitoring programme With collaboration in mind, started sharing our learnings with the sector domestically and overseas.	Further uplift in process emissions factor following further data collection and third-party review. Net zero hub established Overview of impact of the AMP8 programme, including future Scope 3 carbon from AMP8 construction and projections for subsequent AMPs. We moved our default scenario to a 'Fast Paced Option 1' in response to the growing future Scope 3 challenge.	**Final AMP8 programme view** including proposed net zero investments. Returned to Energy & Carbon Steering Group to give refinement of impact of the wider PR24 enhancement programme. Refinement of forecast future emissions from delivering our core pathway resulted in a reduction in the baseline. Commitment to 115 ktCO2e reduction from base expenditure
Developing Forecasts of Operational GHG emissions (Scope 1 & location-based Scope 2)		
398 $ktCO_2e$	**676 $ktCO_2e$**	**527 ktCO2e**

4.2.2 Stage 3: Defining future scenarios

Ofwat's eight common reference scenarios (CRS), outlined in Figure 4.4, represent benign and adverse assumptions around the future trajectories of climate change, demand (growth), technology and environment (abstraction reductions). In all cases where they are relevant, we have calculated the impact of these eight plausible extremes of possible futures across our enhancement programme.

Figure 4.4: Ofwat's eight common reference scenarios (CRS)

Common reference scenario	High (or Fast, for Technology)	Low (or Slow, for Technology)
Climate change	UKCP18 probabilistic projections, RCP8.5, 50th percentile probability level.	UKCP18 probabilistic projections, RCP2.6, 50th percentile probability level.
Demand (population changes)	• Growth: Higher of the population, property and occupancy forecasts derived from the latest local authority projections published by the Welsh Government and the national population projection produced by the ONS. • Regulations and standards: assume no change over the period to 2050.	• Growth: Lower of the population, property and occupancy forecasts derived from the latest local authority projections published by the Welsh Government and the national population projection produced by the ONS. • Regulations and standards: assume the introduction in 2025 of a mandatory government-led scheme to label water-using products, linked to tightening building regulations and water supply fittings regulations.

Environment (abstraction)	Currently known legal requirements for abstraction reductions up to 2050.	Currently known legal requirements for abstraction reductions up to 2050.
Technology	• Smart water supply network by 2035. • Full smart meter penetration by 2050. • New wastewater approach by 2040. • Low-emission HGVs and fleet by 2030 and carbon-free baseload electricity by 2035. • Full open access to datasets across water companies and other utilities by 2035. • The cost of low carbon construction materials equals conventional building materials by 2035. • Increasing reliance on technology produces progressively higher risks of failure and threats from cybercrime, creating possible need for non-digital backups throughout the period to 2050.	• Smart water supply network by 2040. • New wastewater approach by 2045. • Low-emission HGVs and fleet by 2040 and carbon-free baseload electricity by 2035. • Progress on open data across the sector is limited throughout the period to 2050. • The whole-life financial cost of low-carbon construction materials continues to fall, but conventional building materials remain cheaper throughout the period to 2050. • Cyber and digital protection stays ahead of cybercrime and digital networks remain resilient throughout the period to 2050.

In addition to these eight scenarios, we explored the need to include other plausible futures to develop our investment plan. To inform our decision, we considered a wide range of information sources, including:

- A review of the external trends that impact our services and customers as part of our Strategic Direction Statement (SDS), published in February 2022;
- A review of the internal uncertainty analysis carried out by our senior leaders on each of the drivers of enhancement investment using the prompts from the PESTLE framework (political, environmental, social, technology, legal and economic factors as prompts to structure the analysis). See Section 3.2 for further details of this analysis;
- A review of resilience documents and existing plans – including our climate change adaptation report[12], PR19 resilience in the round action plan[13] and associated follow ups (including out in the cold and lessons learned from 2018 hot summer) - to identify any existing scenarios that we are planning for, and to validate the parameters of plausible and extreme scenarios;
- A desktop review of scenarios that other organisations are using in their planning assumptions that may impact our services or customers, including energy companies, HS2 and major infrastructure projects, scenarios recommended in Defra's adaptive planning for

[12] 2021 Climate Change Adaptation report
[13] PR19 Submission as part of DD representations

climate change guidance[14], Water Resources West scenarios, and West Midlands Planning Authority's long-term plan; and

- We sought expert advice in areas of complex uncertainty, notably the Met Office's review of our approach to considering climate impacts, which helped to identify alternative scenarios (including tipping-point scenarios) that are relevant to our asset systems.

When deciding whether to include additional scenarios, we considered the following questions:

- Does the scenario represent an exogenous factor outside company control?
- Is it likely to have a material impact on costs?
- Is there any data from which to do any analysis?
- Is the scenario already sufficiently covered by the CRS?
- Does the scenario represent a plausible or extreme future?
- Are additional scenarios required as part of other statutory frameworks, specifically the EA requirements for both the WRMP and DWMP (see Section 3.5). In most cases these use the same factors used in the common reference scenarios but are defined differently – in terms of pace and compounding issues – which means that some go beyond the adverse common reference scenarios. For example, for the Water Resource Management Plan we considered additional high demand alongside severe climate change assumptions, different timing of abstraction licence reductions to improve the environment, greater and lesser benefits from demand management and the pace of moving to a 1-in-500 year drought resilience standard. Figure 4.5 below shows the key differences between the core pathway and EA preferred plan, and Figure 4.12 depicts the WPP, core and additional WRMP scenarios.

Figure 4.5: EA alternative future scenarios

WRMP	DWMP
Water Preferred Plan (WPP) UKCP18 probabilistic projections, RCP6, 50th percentile probability level High growth (local planning authority) High environment (phased BAU+ Environmental Destination from 2035-2050) High demand reductions Drought standard required by 2040 Includes headroom uncertainty	**Central Plan** UKCP18 probabilistic projections, RCP6, 50th percentile probability level High growth (local planning authority)
Water PR24 Core pathway UKCP18 probabilistic projections, RCP6, 50th percentile probability level High growth (local planning authority) No environmental destination High demand reductions Drought standard required by 2040	

[14] Accounting for the Effects of Climate Change: Supplementary Green Book guidance, November 2020

After reviewing the information sources against the key considerations, we confirmed that the only necessary scenarios are Ofwat's 8 CRS plus the EA's preferred scenario. We did use this analysis to identify a series of sensitivity tests relating to key assumptions where there remains some uncertainty. These sensitivity tests are listed in Figure 4.6 below.

Figure 4.6: Additional sensitivity tests included in our analysis

Enhancement investment	Sensitivity tests carried out
01: Resilient water networks	**Climate**: Pace at which we should prepare for climate change, tested by varying the size and duration of peak events. **Demand**: How much customer demand can be controlled through behaviour change during peak demand events.
03: Net Zero Investments	**Pace**: Three plausible options around the timing of required reductions. **Solution efficacy (benefit value)**: Data on the performance of some of the technology is limited and therefore we have extrapolated the carbon reductions from test cases. We have added sensitivity ranges that are appropriate to each technology type, ranging from 10% to 40% depending on technology maturity.
04: WINEP	**Legislation**: Two sensitivity tests reflecting different pace of delivery of legal obligations, specifically (80% phosphate removal, environmental destination, pace on achieving the storm overflow spill reduction).
07: Urban catchments of the future	**Pace**: Two different long-term targets relating to internal sewer flooding (benign scenario is based on holding current risk stable; adverse scenario trends to zero properties at risk from flooding).
08: Meeting Future Water Needs	**Climate:** Pace and extent of change. **Pace:** How quickly we increase our drought resilience to 1-in-500 year standard. **Abstraction:** Pace and extent of environmental destination. **Demand:** Economic growth and effectiveness of demand reductions. **Solution efficacy (benefit valuation**): Including the availability of strategic resource options (SROs)
09: Lead Reduction	**Legislation**: Pace of legislative change. **Customer**: Expectations of removal of lead.
12: Enhancing Cyber Security	**Technology**: Several tests reflecting the risk and technology relating to cyber security. **Global security:** To test pace and technology suitability given differing levels of global threat
13: Raw Water Deterioration	**Legislation:** Implications of tightening standards, particularly around PFAS and other emerging contaminants. **Solution efficacy (benefit valuation):** Assumptions on utilisation rates and impact on cost/benefit ratios.
15: Reservoirs Act extension	**Legislation:** Pace at which legislation will be adopted.

4.2.3 Stage 4: Quantifying the impact of future scenarios

This stage details how we decided on the most appropriate approach to quantify the impact of the eight CRS and three EA-defined scenarios, carry out sensitivity testing (as described in figure 4.6), and identify our 'no- and/or low-regrets' plan.

Establishing the approach

Our first step was to review how sensitive each enhancement investment is to the CRS, gauge the level of uncertainty, and understand the robustness of the data underpinning the relationships. Each of these factors is relevant to deciding the level of decision support needed. Figure 4.7 sets out the results of this review, with green highlights indicating that the CRS would influence our investment choices. The final columns shows the level of computational decision support required to determine the 'no- and/or low-regret' investment for each enhancement investment.

Figure 4.7: Identifying the level of decision support required for each enhancement investment

Enhancement investments	Type of investment	Degree of uncertainty [15] (H,M,L)	Sensitivity to scenarios					Data robustness (H,M,L)	Decision support needed
			Climate	Technology	Demand	Environment	Other		
08: Meeting Future Water Needs	Statutory	H						H	Decision making under uncertainty (DMU)
01: Resilient water networks	Risk-driven	H						M	
04b: Wastewater WINEP (SOs)	Statutory by 2030	H						H	
03: Net Zero Investments	Statutory by 2050	H						M	
07: Urban catchments	Risk-driven	M						M	Cost-benefit analysis (CBA) and sensitivity testing
04a: Water WINEP	Statutory	L						H	
04b: Wastewater WINEP	Statutory	L						H	
04c: Bioresources WINEP	Statutory	L						M	
13: Raw Water Deterioration	Statutory	M						M	
06a &b: SEMD	Statutory	L						L	

[15] Uncertainty in the nature of the problem (scale and timing) or solution (effectiveness, time to deliver and cost).

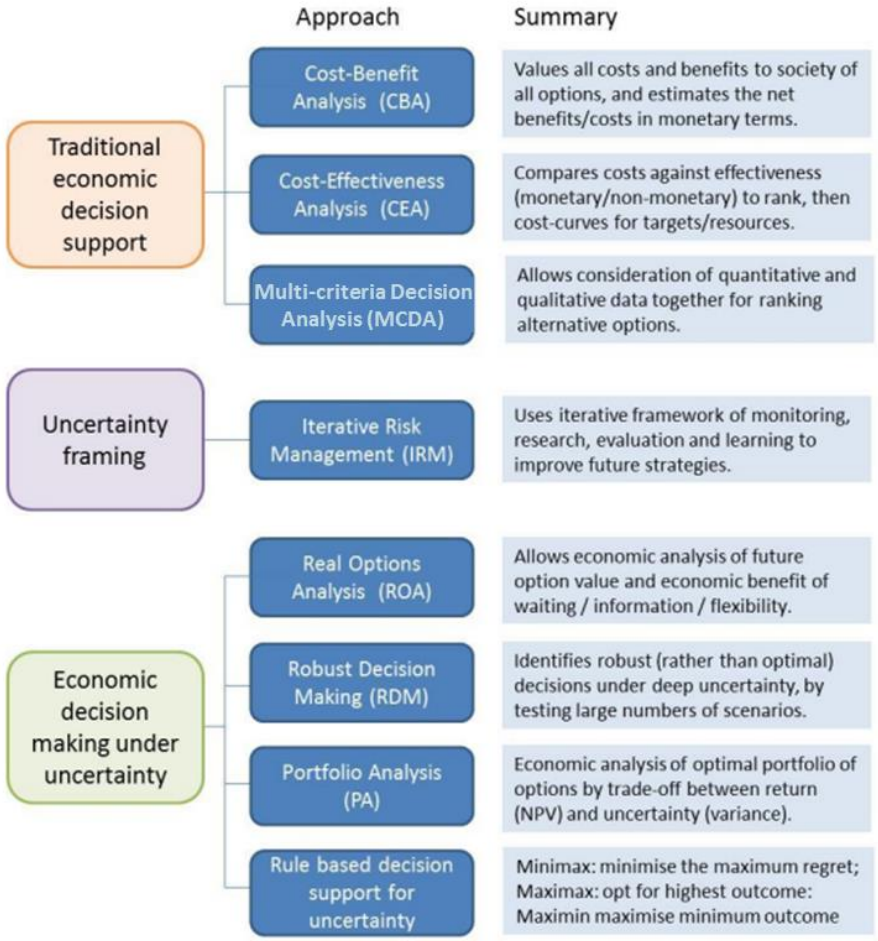
12: Enhancing cyber security									
09: Lead Reduction	Customer	L						L	
15: Reservoir Safety	Statutory	M						L	

Based on the analysis in Figure 4.7, we defined:

- **Four complex enhancement investments** with both complex uncertainties and an appropriate level of available, high-quality data to warrant decision making under uncertainty (DMU), a computational approach to adaptive planning; and
- **Nine simple enhancement investments** that have either simpler drivers of uncertainty and/or insufficient data quality to reliably model the uncertainty. These are more suited to traditional cost-benefit analysis (CBA), supplemented with sensitivity testing.

This approach is supported by Defra's supplementary Green Book guidance[16], as outlined in Figure 4.8.

Figure 4.8: Illustration from the supplementary green book guidance



[16] Defra: Accounting for the effects of climate change, supplementary green book guidance

Developing an adaptive plan

In order to develop a combined adaptive plan across water and wastewater services areas, we developed a model to bring together the outputs from the simple and complex approaches outlined above, which we have termed the Portfolio. This approach builds on the existing suite of models that we have used for previous WRMPs and price reviews. We worked with data experts Arcadis Gen to develop a LTDS model, described in Figure 4.9.

Figure 4.9: LTDS model configuration

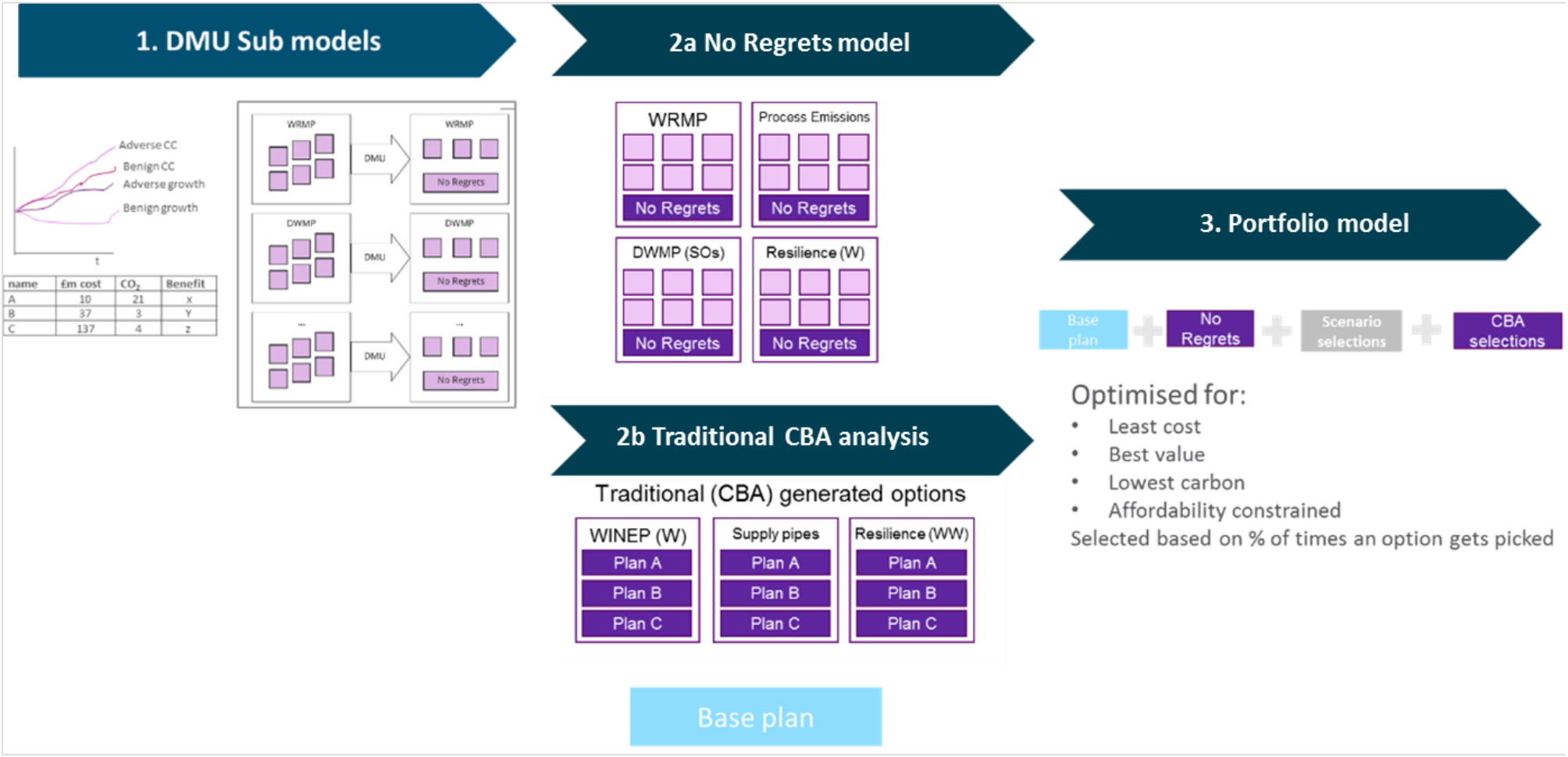
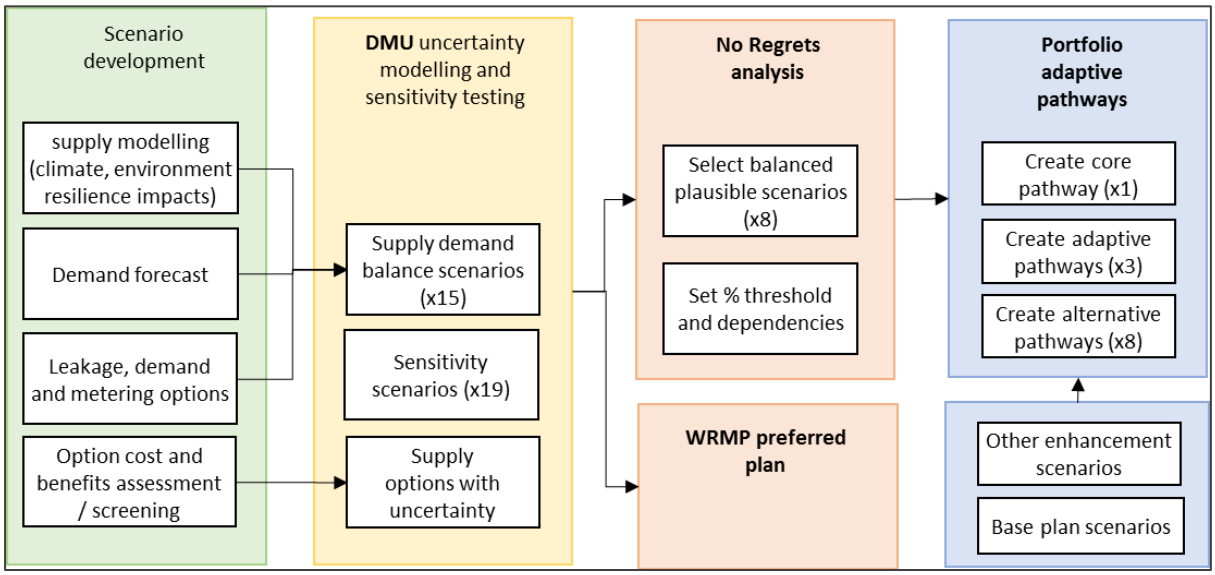


Figure 4.10 is a worked example of the process in action for one of the complex enhancement investments, 08: Meeting Future Water Needs.

Figure 4.10: Worked example of adaptive planning approach for meeting future water needs



The output of this analysis allows us to see the investment selections and selection frequency (i.e how many times does each scheme get selected as the optimum solution) for each optimisation. We can then interrogate the investment plan that is selected as the optimum way of meeting each of the CRS. These are set out in figure 4.11 for 08 Meeting Future Water Needs.

Figure 4.11: Quantifying the impact under the CRS for 08: Meeting our Future Water Needs

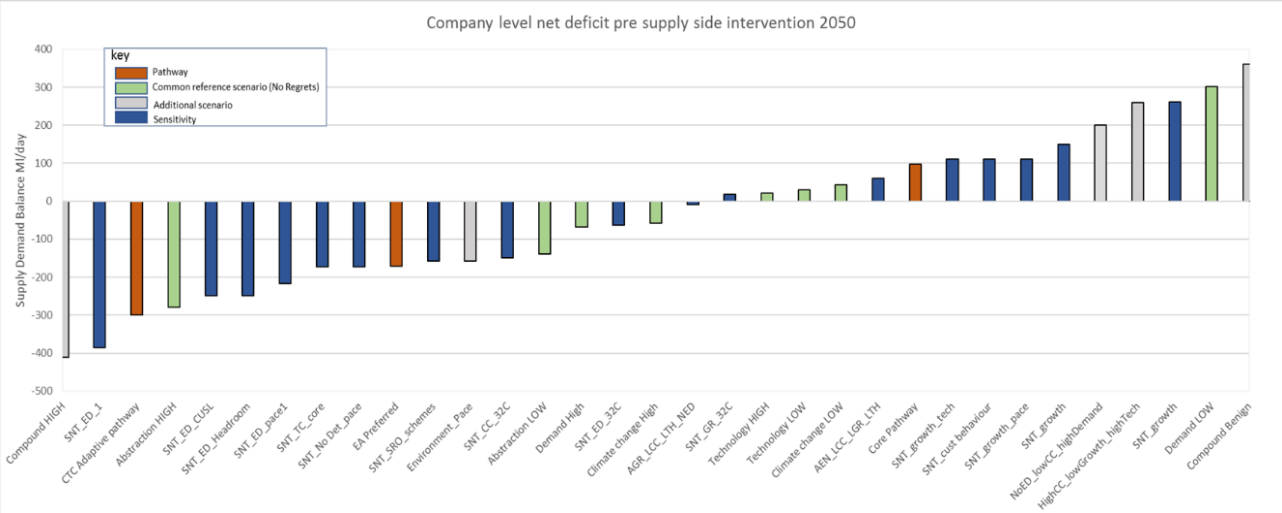
Common reference scenario		Deficit or surplus at 2050 (Ml/d)
Climate change	High	-57
	Low	44
Technology	Fast	7
	Slow	30
Demand	High	-68
	Low	302
Abstraction reductions	High	-280
	Low	-139

For the simple enhancement investments, subject matter experts manually define the impact of the scenario and then use CBA to build a set of solutions to meet the ambition under the CRS conditions. As shown in Figure 4.7 above, there are very few investment drivers that are sensitive to the CRS.

Sense-checking the adaptive plan in a range of plausible futures

The final part of this stage is to review the outputs of the CRS quantification to ensure they represent a balanced range of futures and are not biased towards any particular future. Figure 4.12 below gives a working example of the CRS problem and sensitivity tests that were carried out for Case 08. This exercise was carried out for all four of complex enhancement investments.

Figure 4.12: Representation of the full range of scenarios and sensitivity tests carried out for business case 08: Meeting Future Water Needs



4.3 Developing options (Stages 5 and 6)

In Stages 5 and 6 (outlined in Figure 4.13), we developed potential options to meet our 2050 ambition, and developed tools and an approach for assessing their costs and benefits consistently.

Figure 4.13: Stages 5 and 6 of our adaptive planning approach

Phase	Stage	Principal Activities
Develop options	5	Identify the enhancement options needed to meet our long-term outcomes under all scenarios
	6	Develop tools to enable consistent costs and benefits to be quantified

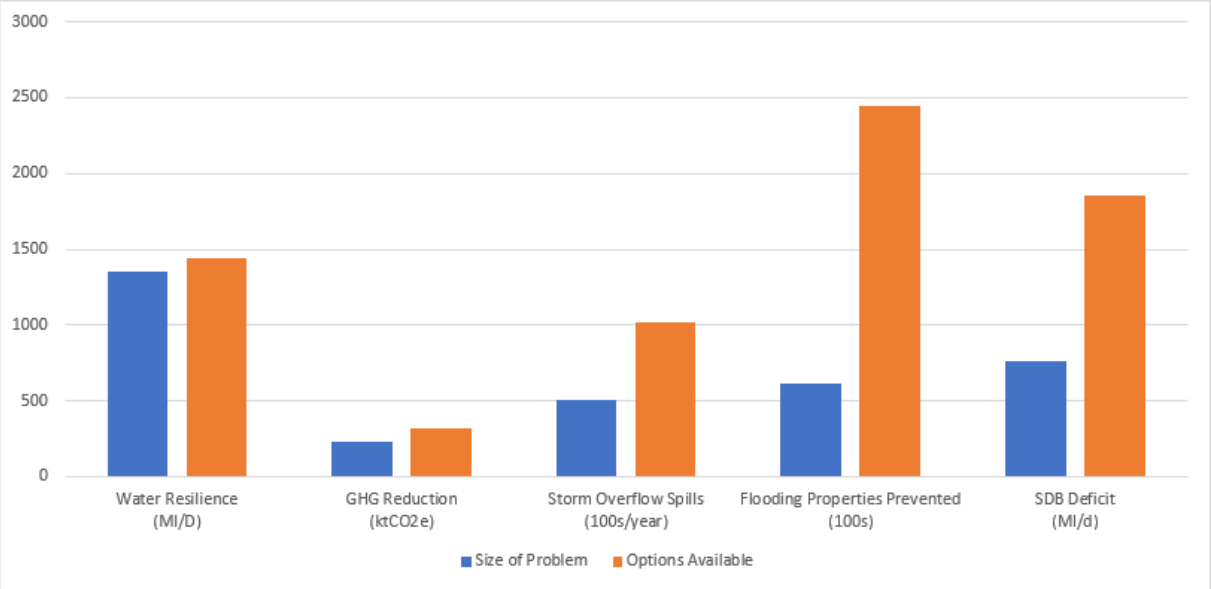
Both of these stages were implemented iteratively, often revisiting and expanding the options under consideration over many months. In this section we set out our approach to ensuring we have been innovative in creating possible options, that we have considered risks and opportunities in more detail for high value investments and that we have developed and implemented a robust approach for valuing and assessing costs and benefits.

Key improvements that were made as a result of this phase are listed below.

- Feedback through statutory frameworks (e.g. WRMP challenges that we needed to consider more options for targeting demand reductions through non-household customers);
- Independent challenge, e.g. our ECP challenging us to look harder for solutions that drive wider benefits, particularly on infrastructure projects which traditionally adversely impact the environment; and
- Concerns about bill impacts and the need to demonstrate efficiency resulted in a detailed review to identify more synergies across the programme. We identified over £60m of savings through synergies on our water programme.

As a result of this thorough, iterative process, we are confident the number of options under consideration were proportionate to the size of problem being solved. Figure 4.14 shows that for 75% of our complex enhancement investment there were at least double the number options available than were needed to meet the overall 2050 ambition, and at least three times as many as the AMP8 scope required.

Figure 4.14: Options under consideration vs. the size of the problem



Full details of the option development approach, assessment method and results are included in each enhancement proposal. The following sections provide an overview of the key activities we carried out to ensure we have a comprehensive and ambitious set of options to select from.

4.3.1 Stimulating innovation

In May 2022, we assembled our first full draft of the individual investment drivers, resulting in an enhancement programme totalling over £6.5bn in AMP8. In order to ensure we had maximised cost efficiency and driven maximum value through this investment, we worked with innovation experts SIT[17] to guide us through an eight-month high-impact innovation project. We followed a five-stage process:

1. **Kick-Off.** The project facilitators interviewed 20 key people involved in the strategic planning process, including senior executives, and identified points of focus for the Ideation phase. .
2. **Ideation**. A two-day workshop attended by 19 people, including strategic asset planning teams and subject matter experts, who identified 78 new and implementable ideas. Figure 4.15 shows part of the ideation process at the workshop.

[17] sitsite.com

Figure 4.15: Ideation workshop

3. **Assessment.** We assessed all 78 ideas and selected eight of the most promising concepts to undergo further development with a range of internal stakeholders. The assessment criteria considered the potential for cost efficiency, potential to add greater value, and readiness to implement.
4. **Convergence.** Each of the 78 ideas was converted into a project charter, with clear accountability for implementation. In total, the team produced seven 'quick wins' for implementation in AMP7 and six promising solutions that offer synergies across several enhancement drivers for implementation in AMP8. We transferred 10 ideas that were not yet mature enough for AMP8 into our innovation pipeline. They have been considered as part of our 'what base buys' assessment for AMP9 and on (see Section 2.4.1).
5. **Partnerships.** We developed four partnership charters, represented in Figure 4.16, by involving representatives from 10 external organisations – including NGOs, energy companies and supply chain companies – in the ideation process, exploring partnership and co-funding opportunities.

Figure 4.16: Potential partnership opportunities

This innovation project resulted the addition of around 33% more options into our process across all enhancement investments, particularly around non-household customers. It was also a key input into our overall approach to partnerships, which has developed into a large number of potential of third-party funding in AMP8 (see Appendix H for more details).

As well as the process for generating new ideas, we ensured we had fully captured the ideas from current or recent innovations. To do so, we created a mapping tool including over 60 live and recently completed innovation projects from the following sources to our investment drivers:

- UKWIR's Big Questions[18]
- Water UK research projects
- Ofwat innovation fund
- Knowledge Transfer Network (KTN)
- World Water Innovation Forum[19]

Each enhancement business case provides details of the relevant innovation and how it has informed our options development.

4.3.2 Site reviews

Using a manufacturing technique called Gemba[20], between February and May 2023 we carried out reviews in the six locations of our highest-value enhancement proposals that have multiple investment drivers. Figure 4.17 outlines these schemes, which collectively represent just over 10% (£545m) of our proposed AMP8 enhancement totex.

Figure 4.17: High-value investments of strategic importance

Site	Resilience Water Networks	Net Zero Investments	WINEP	Urban Catchments of the Future	Meeting our Future Water Needs
Carsington to Tittesworth					✓
Coleshill STW		✓	✓		
Draycote Reservoir			✓		✓
Finham STW		✓	✓	✓	
Hallgates to Elms Farm	✓				
Netheridge STW		✓	✓	✓	

The site reviews had two key objectives:

1. Ensure project costings were robust by understanding site-specific circumstances. As set out in Annex 4a Costs, efficiency and stretch, IPA best practice[21] emphasises the importance of capturing sufficient site-specific detail and ensuring that cost estimates have considered:

[18] https://ukwir.org/eng/big-questions-facing-uk-water-industry
[19] https://worldwaterinnovationforum.com/
[20] https://en.wikipedia.org/wiki/Gemba
[21] https://www.gov.uk/government/publications/cost-estimating-guidance

- Impact on support teams (financial, comms, HR, Technology, property);
- Enabling works to take assets offline to complete the construction phase; and
- Site-specific hazards and unknowns (e.g. possible water quality issues, access arrangements, issues with third-party services).

2. Identify wider benefits or more efficient solutions using the innovation skills learned in our high-impact innovation project (see Section 4.3.1). We sought to answer the following questions:
   - What opportunity is there for biodiversity benefit?
   - Are there opportunities to drive synergies by aligning investment drivers?
   - Are there opportunities to increase positive impacts (or reduce negative impacts) on the local community and/or environment?
   - Are there any partnership opportunities?

The site reviews had the following result:

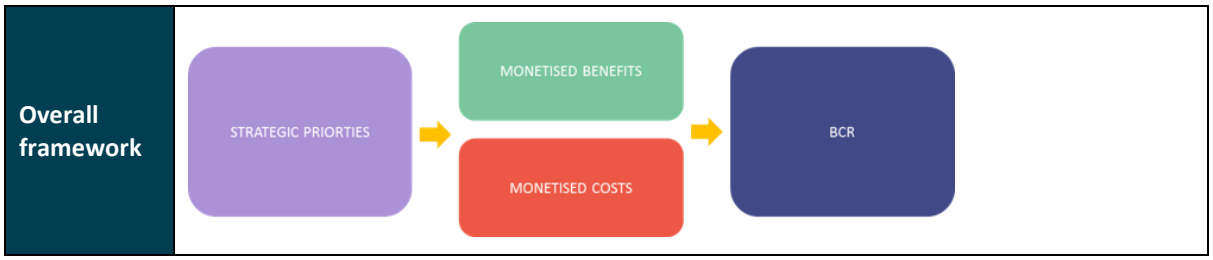
1. Improved cost robustness – on average, moving cost maturity from 2.1/5 to 3.5/5, which is better than a typical scheme at this stage in the planning cycle;
2. Reduced site setup costs by sequencing work across multiple drivers, avoiding multiple setup costs and disruption for operational teams; and
3. Provided a useful input to our deliverability review (see Annex 4b Deliverability) to identify considerations such as sequencing constraints and batching opportunities.

4.3.3 Benefit Assessment Tool (BAT)

Severn Trent's benefit assessment tool (BAT) is a robust methodology and valuation tool that ensures our decision making considers least cost and best value consistently across all enhancement investments.

Figure 4.18 gives an overview of the BAT and how it works.

Figure 4.18: Overview of the BAT



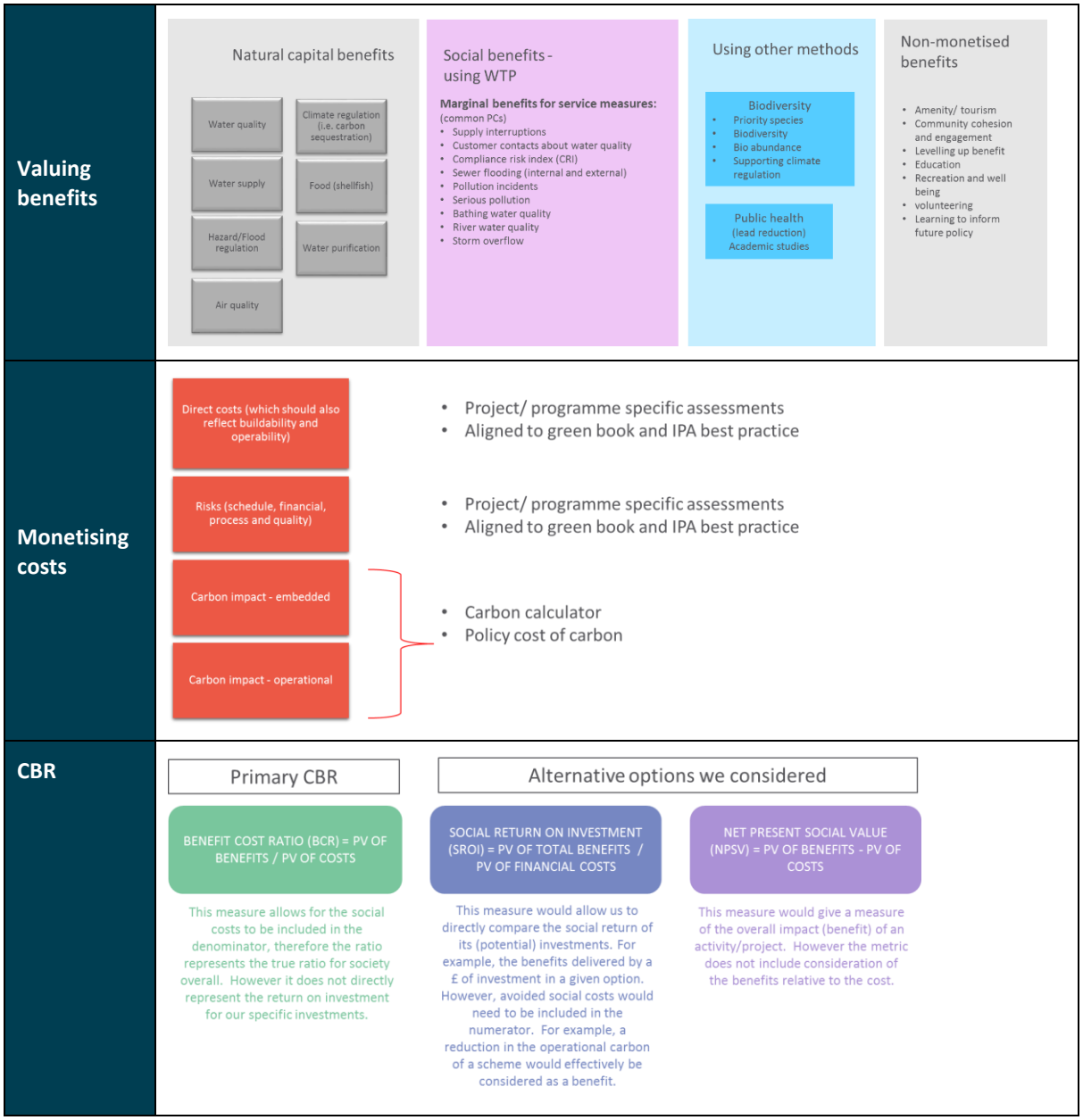


Figure 4.19 outlines the checks and balances built into the BAT that ensure it aligns with Government and regulatory expectations.

Figure 4.19: How our approach aligns with Government and regulatory expectations

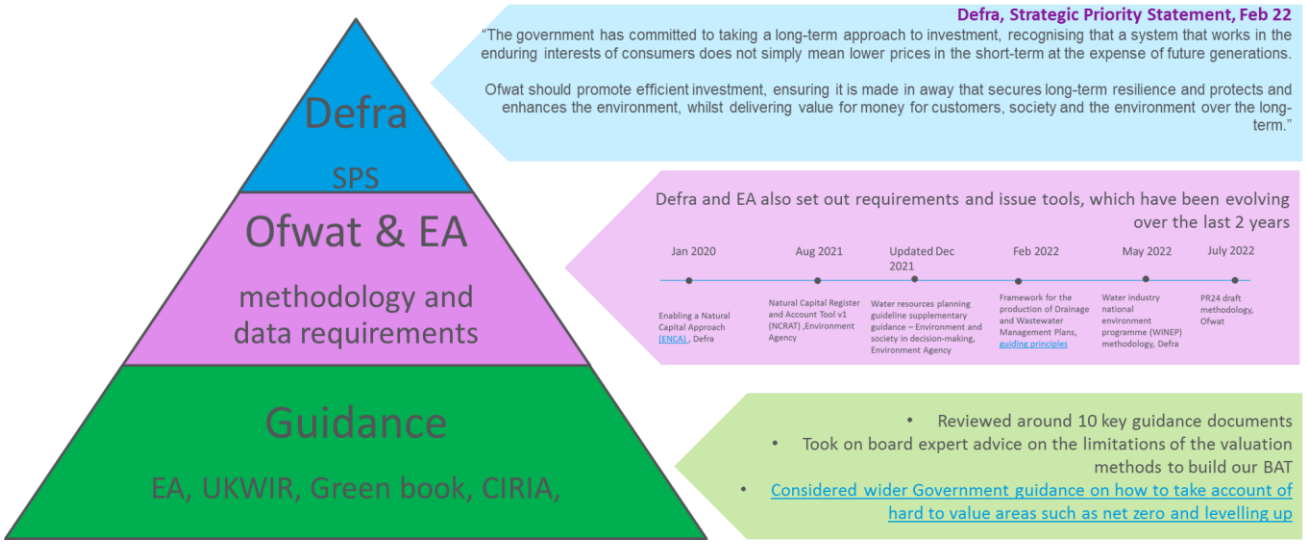


Figure 4.20 shows the resulting environmental benefits of our enhancement programme.

Figure 4.20: Key benefits of our plan

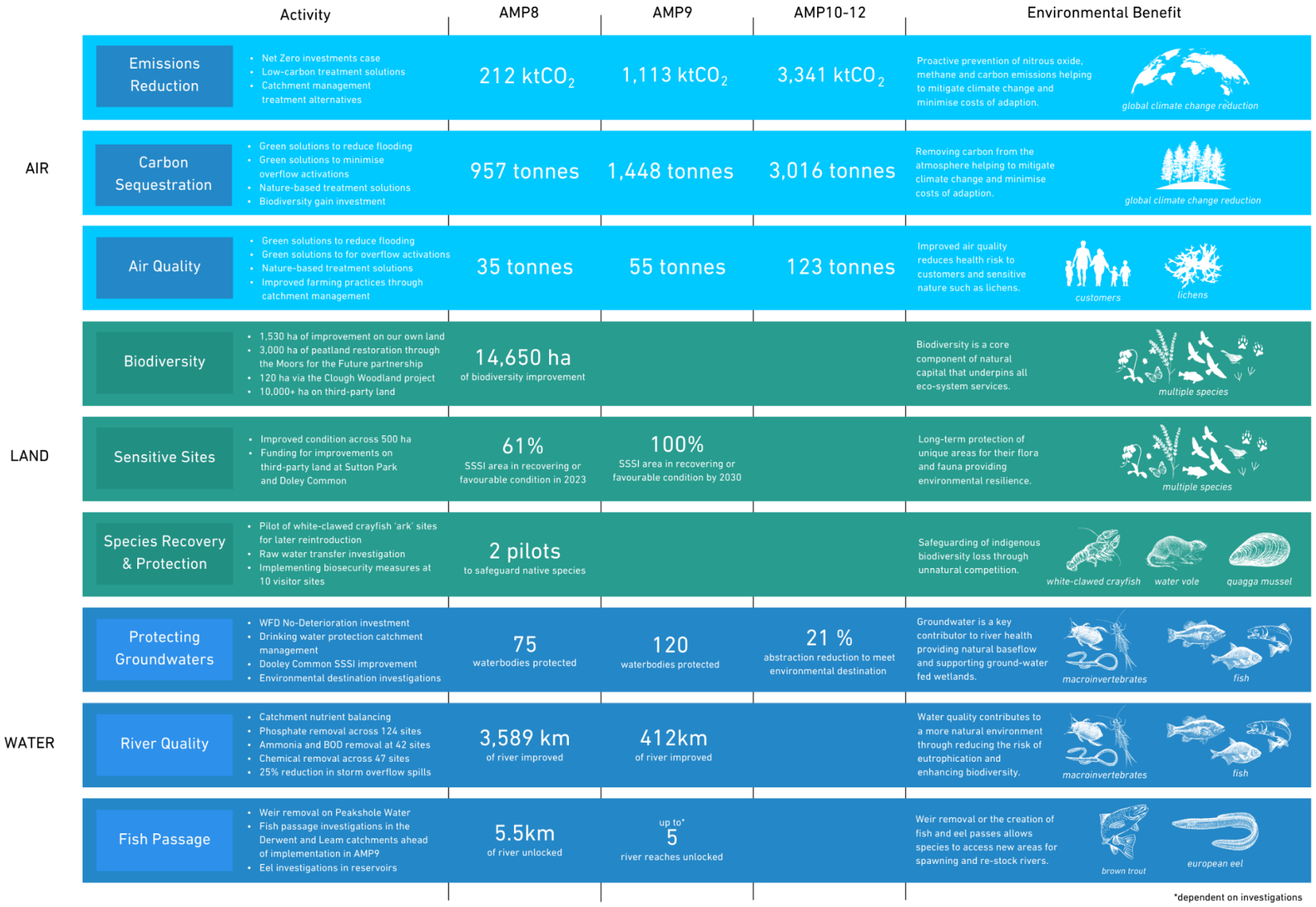


Figure 4.21 summarises how our approach to benefits assessment meets Ofwat's requirements, as outlined in Appendix 9 (Section A1.1.2) of its final guidance on long-term delivery strategies.

Figure 4.21: Alignment of our approach with Ofwat requirements

Ofwat requirement	How we have met the requirement
b) Has a robust cost-benefit appraisal been undertaken to select the proposed option? Is there evidence that the proposed solution represents best value for customers, communities and the environment over the long term?	• Each enhancement proposal sets out the results of the cost-benefit analysis (CBA). • Figure 4.18 above provides an overview of the benefit factors available in the BAT.
b) Is third-party technical assurance of the analysis provided?	• We employed Economic Insight to review our current approaches to CBA and compare it to best practice set out in Defra's green book guidance (see Appendix I). • CBA was also part of the three lines of assurance on the individual enhancement proposals and the data table production.
b) Met the technical requirements on NPV, discounting method, financing costs, use of the collaborative research ODI rates.	• Appendix I includes the evidence that we have set up the tool with the correct net present value (NPV) and financing costs. • The EA required a different discounting methodology (the Spackman approach) which is why the CBA outputs vary slightly between our PR24 plan and the WINEP obligations issued to the EA. This does not affect scheme selections or ranking. • The collaborative ODI rates were published after we had completed the majority of the CBA. To accommodate this, we used a combination of PR19 valuations (inflated) and results from our enhancement research. We updated the BAT with the functionality to test an upper and lower willingness-to-pay (WTP) range so that we could easily understand the sensitivity of the outputs to the WTP values. Following publication of the collaborative ODI rates, we reran the BAT on a sample of typical solutions to understand the impact. The results of this sensitivity are set out in Appendix 10, demonstrating that whilst the CB ratio is affected, the ranking (relative CBR) is not.
c) In the best value analysis, has the company fully considered the carbon impact (operational and embedded), natural capital and other benefits that the options can deliver? Has it relied on robustly calculated and trackable benefits (e.g. through PCD) when proposing a best value option over a least cost one?	• Operational and embedded carbon are inputs into the BAT. • We included carbon at a more granular level to ensure that we could accurately report the impact of the enhancement investment on operational carbon in the data tables (whereby the Ofwat common definition differs from the science-based targets definition).

	• Natural capital benefits are included, using valuations from the EA's natural capital register and account tool (NCRAT). • The benefits have a clear line of sight into our optimisation process. Figure 4.20 above shows which enhancement proposals drive which benefits.
c) Where benefits cannot be robustly valued they should not be a material driver of costs	• Across almost all investments, the best value and least cost plan are identical. In areas where the best value plan costs more than the least cost plan, unless the difference can be offset by third party funding (see Appendix H), we have selected the least cost plan. Therefore all PCDs reflect the primary driver of the investment rather than any secondary (free) or low-value coincidental wider benefit.
d) Has the impact (incremental improvement) of the proposed option on the identified need been quantified, including the impact on performance commitments where applicable?	• The benefits have a clear line of sight into our optimisation process. Figure 4.20 above shows which enhancement proposals drive which benefits.
e) Have the uncertainties relating to costs and benefit delivery been explored and mitigated? Have flexible, lower risk and modular solutions been assessed – including where forecast option utilisation will be low?	• Uncertainties are taken into account in the DMU, where we have set option-specific uncertainty ranges on costs, benefits and time to realise the benefits. • We have evidenced our approach to ensuring a wide range of options have been considered in Sections 4.3.1-4.3.3.
h) Has stakeholder feedback taken into account (in particular feedback from the statutory frameworks) on our CBA approach	• In each enhancement proposal we explain how we have taken customer and stakeholder views into account • General feedback across all aspects of the plan, and the actions taken, is described in Section 2.4.4.

4.4 Creating core and alternative pathways (Stages 7 to 9)

In Stages 7 to 9 (outlined in Figure 4.22), we configured the data on scenarios and options and then optimised them to produce our core and alternative pathways, as well as adaptive pathways and a monitoring plan for transitioning between pathways in the future.

Figure 4.22: Stages 7 to 9 of our adaptive planning approach

Phase	Stage	Principal Activities
Appraise and select solutions and pathways	7	Organise data and map to relevant tools
	8	Optimise investment options
	9	Evaluate and develop core pathway, alternative pathways (CRS), adaptive pathways and trigger points

Stage 7 is a data organising exercise to make sure the information is input into the correct models. We have carried out a series of checks and assurance to ensure this has been done correctly. See section 6 for more detail on our assurance approach.

4.4.1 Stage 8: Optimising investment options

The building blocks of our core and alternative pathways are the eight Ofwat CRS.

For the complex enhancement investments, we created the optimised investment plans for each scenario using a best value optimisation algorithm. The algorithm solves each scenario 100 times using randomly selected values for option costs, benefits and time to realise the benefits, from within a predefined uncertainty range. The optimisation creates a 25-year plan that shows how often (as a percentage) each project is selected in each year over the 25-year period. If appropriate, the process can be repeated to include natural capital-based valuations to produce a best value output.

The worked example in Figure 4.23, from 08: Meeting Future Water Needs, shows scheme frequency selection for the high-demand scenario. In comparison, the low-demand scenario only selects the Shelton WTW expansion.

Figure 4.23: Scheme frequency selection for 08: Meeting our Future Water Needs, Shelton Zone

High-demand scenario (best value)	Selection frequency (%)				
	25 years	AMP8	AMP9	AMP10	AMP11
Shelton WTW expansion	100	100	0	0	0
New borehole Dee Permotriassic Sandstone	68	52	5	11	0
West Midlands raw water storage	100	1	53	44	2
Hampton Loade WTW to Nurton DSR	54	0	23	31	0

For the simple enhancement investments, policy experts load the 25-year plan that aligns to each relevant CRS into the Portfolio repository.

4.4.2 Stage 9: Core pathway selection

As described in Section 3.3, our core pathway represents the key enhancement investments that are required under almost all plausible futures, which enables us to achieve our 2050 ambitions under a wide range of scenarios. The core pathway is not a central or most likely pathway between the alternative scenarios, but instead includes four types of investment, aligned with the Ofwat definition:

- 'No-regrets' investment: Required to meet statutory obligations by 2030;
- 'No-regrets' investment: Required in all plausible futures by 2050;
- 'Low-regrets' investment: Required in most plausible futures (we have set this at 70% or higher by 2050); and[22]
- Investment required to keep future options open – this is predominately data gathering to reduce uncertainty.

[22] The threshold sections are explained in each Enhancement business case

‘No-regrets’ components

Each of the four complex enhancement investments has a ‘no-regrets’ App. This part of the process combines the outputs from the 100 optimisations of each individual scenario to produce a single balance frequency across scenarios. Using these frequencies, we can identify the ‘no- and/or low-regrets’ options that are needed across many futures. In creating our ‘no- and/or low-regrets’ plan, we have taken care to ensure a balanced range of scenarios that are not biased towards a particular future, utilising only the Ofwat CRS, without any weighting.

We then set a threshold to create the ‘no-regrets’ component of our core pathway. Figure 4.24 shows the thresholds we used for the four complex enhancement investments.

Figure 4.24: Threshold selection for ‘no-regrets’ plan

Enhancement investment	Probability threshold	Totex defined as ‘no-regrets’
01: Resilient water networks	95%	100%
03: Net Zero Investments	99%	100%
04b: Wastewater WINEP (storm overflows)	100%	100%
08: Meeting Future Water Needs	80%	93%

Table 4.24 shows that a lower threshold was required for case 08 compared to the other three cases. This is because the eight CRS drive materially different investment profiles (resulting in a seven-fold difference between the minimum and maximum totex plans). For the other complex enhancement investments, the minimum and maximum totex plans varied by less than 35% across the eight CRS.

These thresholds were set by testing three threshold levels (80%, 90%, 95%), meaning that only schemes selected more than the probability threshold at some point between now and 2050 are considered 'no-regrets’. At each probability threshold, we considered four key outputs:

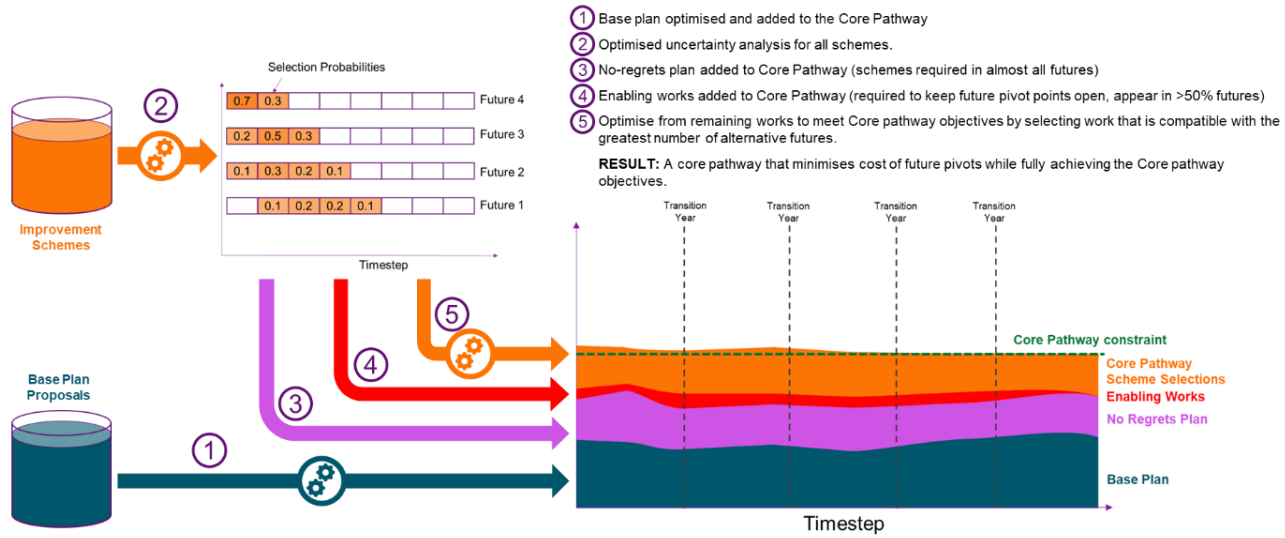
- 25-year totex;
- % of our estimate of the most likely scenario that is being solved by ‘no-regrets’ solutions;
- Value of the wider benefits; and
- The sequencing profile (based on the probability of selection).

Where there were significant differences in the outputs between thresholds, we created additional plans at more granular thresholds (e.g. 92%, 93%, 94%) until we found a discontinuity or significant change in any of the outputs. This gave the final thresholds in Figure 4.24.

‘Low-regrets’ components

The next phase, as illustrated in Figure 4.25, is to combine the ‘no-regrets’ plans with the simple enhancement investments. They have all been inputted into the Portfolio repository with the totex and benefit forecasts for the most likely plan (which reflects statutory requirements required by 2030) and all relevant CRS and any alternatives that we want to be considered in the final optimisation stage (e.g. where there is a difference between least cost and best value plans).

Figure 4.25: Portfolio process to build pathways



The final optimisation stage then optimises to create optimum investment plans for:

- The least cost core pathway (for simple enhancement investment, this translates to the statutory plan required by 2030);
- The best value core pathway;
- Eight Ofwat CRS alternative pathways; and
- The EA-defined alternative pathways.

Investment required to keep future options open

The final component of the core pathway is to identify any investment that is needed to keep future options open. These investment needs were created manually and loaded into the repository. This was an iterative step and could not be completed until the alternative and adaptive plans had been created.

4.4.3 Stage 9: Alternative pathway selection

The Portfolio was used to create alternative pathways that align to the eight Ofwat CRS, as illustrated in Figure 4.26.

For the complex enhancement investments, the models are used to create alternative pathways that represent the optimum investment based on the least cost way of meeting the ambition under each future. It continues to consider selection probability and phases the solutions in line with the year of the highest probability.

The optimisation tool simply sums all the plans (from simple and complex methods) that relate to each of the 8 futures and presents them (as shown in Section 3.5.1).

Figure 4.26: Optimised common reference scenarios

4.4.4 Stage 9: Adaptive pathways and trigger points

Following a review of the core and alternative pathways, we created three adaptive pathways that describe a plausible route which pivots between the futures (see Section 3.6 for details of the pathways).

For the complex enhancement investments, we defined these pivot points and instructed the Portfolio App to optimise against the adaptive pathway. Each time we create a pivot, the optimisation tool re-evaluates the gap between current performance and the size of the problem in the new future to meet the 2050 ambition. If the future is more adverse, the optimisation tool will select additional schemes, if it is more benign, no further investment is needed. At each pivot point, the tool calculates the cost of pivoting.

For the simple enhancement investments, we created the adaptive pathway manually and inputted it into the repository.

The final optimisation stage then simply sums the adaptive pathways from the complex and simple methods.

This analysis helped us identify schemes that are sensitive to sequencing, and trigger points that are hard to re-optimise. For example, there were several instances where a larger problem could not be solved because the pivot could not be completed – most commonly because there was insufficient time to build additional schemes. This insight was used in three ways:

1. To consider the gap required between the trigger points and decision points;
2. To consider the suitability of the monitoring plan metrics, in terms of lead times; and
3. To consider whether any low-value activities could be completed sooner to facilitate a swifter pivot to a new future.

The analysis also highlighted a number of key risks that we will track carefully to ensure we are prepared to adapt:

- Policy relating to environmental destination (UME04: Water WINEP) is extremely material, and the timing of when we understand the full consequences of this policy is material to our bill impact;

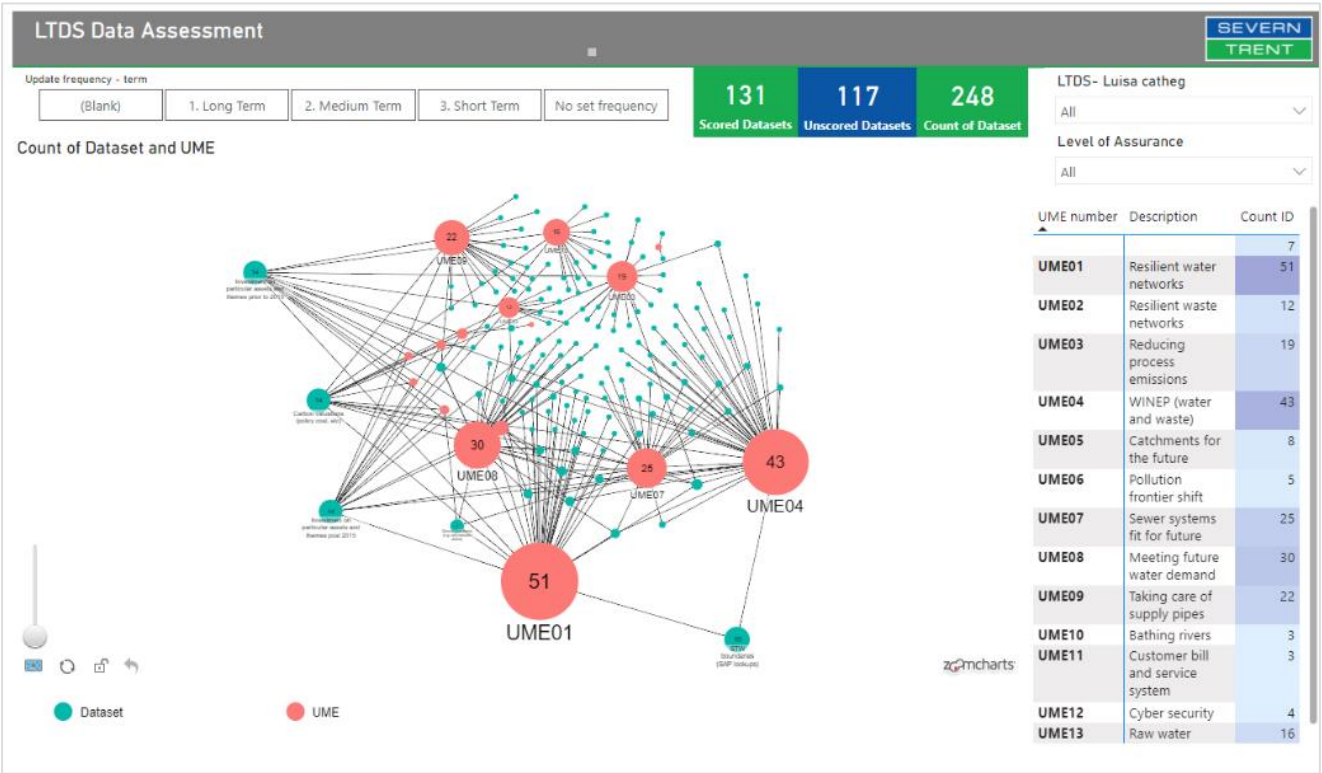
- Climate change scenarios drive the biggest differences in our Wastewater WINEP (Case 04b) and significantly alter the cost of reducing the risk of sewer flooding;
- Sudden legislative changes are difficult to respond to across the whole investment programme. In several cases, we found we needed to extend the period between the trigger point transition period to enable the optimisation to succeed. This supports the need for our AMP8 investigations and trials, which will inform policy decisions and ensure our solutions are ready when the pivot point occurs; and
- Technological solutions are critical for cost efficiency in particular. We will drive the innovation agenda in the areas where we most need to make cost savings – leakage, storm overflow, embedded carbon – through base expenditure in AMP8.

4.4.5 Stage 9: Monitoring plan

We set out the seven high-level indices in our monitoring plan in Section 3.6.2. We have designed our plan around indices (baskets of measures) because there are very few instances where one data set is enough to trigger a totally different plan or to justify selecting a high-value investment. The rationale for selecting these indicators was based on the following approach:

1. We reviewed the 148 data sets that have been used to generate all inputs to the LTDS, in each case documenting key characteristics such as data source, purpose, and collection frequency, and also assessed the quality and reliability of the data;
2. We tagged each data set to understand the interdependencies between investments, as shown in Figure 4.27.

Figure 4.27: Tagging data sets to understand interdependencies



3. We identified all metrics that are used in four or more enhancement investments to either inform the right solution or help us understand the size of the problem. This created a long list of candidate measures;

4. Through workshops, we identified which of those measures would help us predict the adaptive pathways described above; and
5. With support from experts at Stantec, we carried out a desktop review of adaptive planning monitoring plans in other sectors. We also reviewed several of our own documents, including climate change adaptation reports and resilience strategies.

Figure 4.28 provides full definitions for all the metrics that sit behind the indices, the data sources, monitoring frequency and details of the calculation methods. Wherever possible, we have defined the thresholds that will trigger action, and the likely action to be taken. The thresholds will be kept under review and developed as we gather more data throughout AMP8.

Figure 4.28: Metrics behind the indices

Indices	Metrics	Trigger
Climate index	1. Current and projected GHG emissions 2. Precipitation levels 3. Change in temperatures 4. Extreme and compound events	• RCP change
Demand index	• Ratio of forecast to actual population. • PCC for all customers on smart meters.	• Bespoke to each WRZ. • More than 20% difference to our planning assumption (max sensitivity test).
Environmental	• Output of environmental studies. • Outcome indicators for the 25 Year Environment plan[23]	• Time bound on study output. • Aligned to Defra triggers
Technology and efficiency index	• Triangulation of key unit costs (£/Ml/d and £m^3 of surface water, £/kTCO2e). • Ratio of forecast technology savings compared to actual. • Ratio of forecast benefit to actual benefit on high technology investment areas (specifically net zero, advanced water treatment, nature-based solutions).	• More than 20% difference (aligned to max sensitivity test). • More than 30% difference (max sensitivity test).
Legislation index	• Hansard key term trend. • Defra question time key term trend.	• Not used in isolation to trigger moving pathways.
Social index	• Social media scraping – key term trend. • Water poverty trend. • Percentage of customers on social tariff. • Percentage of customers struggling to pay their bill (in relation to bad debt data).	• Not used in isolation to trigger moving pathways.

[23] https://oifdata.defra.gov.uk/

4.5 Affordability and intergenerational fairness

Spreading the costs and benefits fairly across generations is at the heart of our strategy. We cannot allow future generations to carry an unfair share of the total cost of improvement, but we also need to be aware that our existing customers are experiencing a challenging economic climate. We need to protect those who are least able to cope with increases in water bills, now and in the future.

In Section 3, we provided a summary of the customer insight inputs to our long-term strategy. In this section we provide the rationale to support our view that our LTDS ensures fairness between current and future customers. We also set out the findings from the research on long-term affordability and how our strategy protects customers' ability to pay their water bill over the long term. Our affordability offering for AMP8 is set out in Annex 3b. Within our monitoring plan we will track customers' ability to pay their bill over time and use that to help inform any changes to the affordability support. This is exactly what we have done during AMP7 and informed our decision to increase the support we offer to customers.

4.5.1 Intergenerational fairness

Through the LTDS research, we explained to customers the choices around pace and the impact it could have on bills and delivery of the benefits. Full details are provided in Annex 3a Customer and stakeholder engagement. We found that customers already have an expectation that water supply will become more challenging in the future, and climate change is raised spontaneously as an issue likely to impact the water cycle. This is balanced with some optimism that technology is advancing all the time, and that we should find ways to benefit from it. The key findings on intergenerational fairness from our customer research are shown in Figure 4.29.

Figure 4.29: Customer views on intergenerational fairness

Customers are resigned to paying to benefit future generations – provided the bill increase is gradual	People can see that it is necessary to make improvements to shore up the infrastructure in the face of future challenges and are resigned to an increase in their water bills. However, this is less the case where they are unlikely to see the benefits themselves, and where it involves a particularly steep and sudden bill increase.*
Customers feel that assuming their water use will reduce significantly is a risk	Overall, customers think that it is risky for ST to assume behaviour will change substantially, and that people will need incentives, as well as penalties, to convince them to make these changes.
Customers fear a sharp bill increase, but would accept a gradual one	Customers accept that investment will be needed to future-proof the water supply – but their willingness to pay for it is limited in that they don't want a sudden/large increase in bills, especially if they won't see the benefit in their lifetime.

*NB: These findings differ from PR24 affordability and acceptability research findings, which may be because the stimulus for this project focused more on the phasing of increases, rather than increases themselves.

Customers are supportive of sharing the costs over multiple generations but raise some concerns about the lack of clarity on when the benefits would be delivered and how progress could be tracked. Goals to 'improve' or 'reduce' with no specific success measure are felt to be too vague. Some customers express frustration with organisations announcing sustainability targets with no clear, measurable end point. Some consider these poorly defined 'moonshot' targets to be greenwashing. We have included clear targets against the key metrics out to 2050 and have proposed PCDs across all AMP8 investment (including where they are below Ofwat's materiality threshold) to ensure we have fully taken account of this feedback. We will also consider how we could make the monitoring plan indices more accessible to customers. We found no material differences in the views of any specific customer group (future customers, vulnerable customers, household and non-household customers).

We asked customers to consider a range of bill impacts and then to discuss their views on different profiles. Most customers preferred a gradual increase for two reasons: the risk of wasting money on investments that ultimately are not needed feels acceptably small; and (more importantly) there is no single large bill increase to negatively impact customer finances.

Customers found it difficult to comment on whether the long-term bill impact would be affordable or acceptable, but they were concerned about the potential long-term range. There was a general view that gradual increases were better, and that having more notice of bill increases is important.

5. Foundations

5.1 Introduction

We have opted to take a predominantly computational approach to assessing the optimum plan under a wide range of plausible scenarios, and have included extensive sensitivity testing to reflect the number of assumptions that are inevitable when trying to predict complex systems and macro-level trends 25 years into the future. Details of the sensitivity ranges used are provided in Section 4.2.2, giving a degree of confidence that the assumptions we have made need to be within a c.30% tolerance (in some cases bigger) for the investment plan to remain 'no-or low-regrets' and optimum over the long term. This chapter sets out the key assumptions we have made and basis for them.

It also describes the areas of greatest uncertainty in the long-term delivery strategy, the factors driving this uncertainty, and how it has been accounted for. It also cross-references the monitoring plan (see Section 3.6.2) to demonstrate how we will track progress and identify when to adapt our plans.

5.2 Assumptions

Figure 5.1 outlines the assumptions we consider are material to the delivery of our ambition. Many of these assumptions were made as part of the DWMP and WRMP and detailed reasoning is provided in those documents.

Figure 5.1: Material assumptions

Assumption type	Nature of assumption	How/where is it used	Basis of assumption
Climate	Method for mapping UK projections to WRZ and waste catchments	To generate CRS	Aligned with WRMP and DWMP guidance
	How RCPs 50%ile relate to peak events	Case 01 Resilient water networks problem definition	Met office advice
	How asset groups behave under different climatic conditions	01 system risk to service analysis	Met office advice
Population growth	Mapping of ONS data to our WRZ and catchments	To generate CRS and inputs to DWMP and WRMP	Aligned with WRMP and DWMP guidance
	Location of new developments	07 urban catchments problem definition	Local plans
Technology advancements	Across c.20 areas of expected technology advancements, we made assumptions about how costs and benefits could change over time	To create alternative and adaptive pathways	See Appendix J

Target setting (including assumptions about relative performance into the future)	The targets between now and 2050 of all common PCs and the allocation between base and enhancements This also includes assumptions on AMP7 exit positions (and progress on Green Recovery and Defra Acceleration)	To form part of the benefit assessments and to complete the LTDS data tables	See Appendix E
Investment delivery profiles	Forecast project sequencing and therefore totex profile	To set PCD profiles	Delivery team review of scope and outline delivery plan plus STEC review on ambition
Solution benefits and benefit valuations	Used EA NCRAT valuations Used our WTP data sensitivity tested using common ODI rates Discount period 25 years	Options assessment	Externally published data, Ofwat published ODI rates, Customer WTP
Input costs	We have assumed inflation suitably covers all inflationary pressures	Across all enhancement cases to inflate historical project costs into 22/23 prices	CPIH year average
Condition of the natural environment	To baseline current performance or baseline benefits Third-party performance in areas that could impact delivery of our outcomes (e.g. river health)	03: Net zero investments baseline 04: WINEP baselines	EA data: APR data Internal monitoring trials
Regulatory or policy changes	Assumptions used as inputs to the sensitivity testing and to shape the logic of the adaptive pathways	All enhancement cases	Expert view and SDS horizon scanning
Skills/resource availability	We have assumed there will be no restrictions on the basis that we are planning for skills gaps and correcting it before it becomes an issue	All enhancement cases but especially 04a-c WINEP, 03 Net Zero Investments, 07 Urban catchments	See Annex 4b Deliverability
Efficiency (and RPE)	To estimate productivity improvements out to 2050	Ann enhancement tables and pre and post efficiency data tables	See Annex 4a Costs, efficiency and stretch

Customer behaviour change	For the low demand scenario and some sensitive tests we are assuming that customers will change their behaviour in a consistent way as trials indicate and that this change will be maintained over the long term	Case 08: Meeting future water needs – demand reductions, 01:resilient water networks, behaviour change during peak weather events 07: urban catchments, customers rain water capture behaviour and involvement/ acceptance in SUDs	SVE and sector wide trials

We have not made any explicit assumptions about affordability or household incomes out to 2050, but have set out a strategy that seeks to observe trends in affordability and ensure that we periodically update our support offerings to reflect the economic circumstances. .

5.3 Comparison to previous strategies

In this section we explain the key differences between our proposed strategy and previous long-term plans. The statutory timelines have not fully aligned, so Figure 5.2 sets out a comparison across the final WRMP, DWMP and approved WINEP to demonstrate that the assumptions are aligned and the outputs are consistent.

Figure 5.2: Alignment and consistency with other long-term plans

Document	How this has informed the LTDS
Strategic Direction Statement	Our work on the SDS has helped inform our approach to the risks, trends and challenges facing our business over the next 25 years. The SDS articulates how we propose responding to these challenges and how we will realise our Strategic Priorities. These were supported by customers, and have become the bedrock of our LTDS. This helps us ensure we are setting a clear, congruent vision for 2050.
WRMP	Our baseline starting position incorporates the benefits of all AMP7 investments, including Green recovery. This methodology builds on the adaptive planning approach used in previous WRMPs. It is also consistent with our WRMP24 update which will be published at the same time as our PR24 plan. The targets, activity and investment proposals are consistent.
DWMP	The DWMP cycle 1 was the first formal DWMP and it was a key input to the LTDS. The analysis and feedback was used to create the plan of the next 5 years and the long term analysis was used directly to inform the CRS.
WINEP reform (10-year view)	Our AMP7 WINEP and AMP8 WINEP are totally aligned with the later being a natural progression, in many cases studies and investigations have been used to set the requirements for this period

6. Assurance

6.1 Board assurance statement

The Board has fully engaged with the LTDS and the long-term planning process over the last 2 years. It has challenged and commented on our approach, analysis and resulting core and adaptive pathways. Board members sought reassurances from the wide ranging independent advice we have taken on technical aspects of this process and it has satisfied itself that the LTDS:

- reflects a long-term vision and ambition that is shared by the Board and company management;
- is high quality, and represents the best possible strategy to efficiently deliver its stated long-term objectives, given future uncertainties;
- is based on adaptive planning principles;
- has been informed by customer engagement;
- has taken steps to secure long-term affordability and fairness between current and future customers; and
- will enable the company to meet its statutory and licence obligations, now and in the future.

The Board statement is included in Annex 1 (section 4).

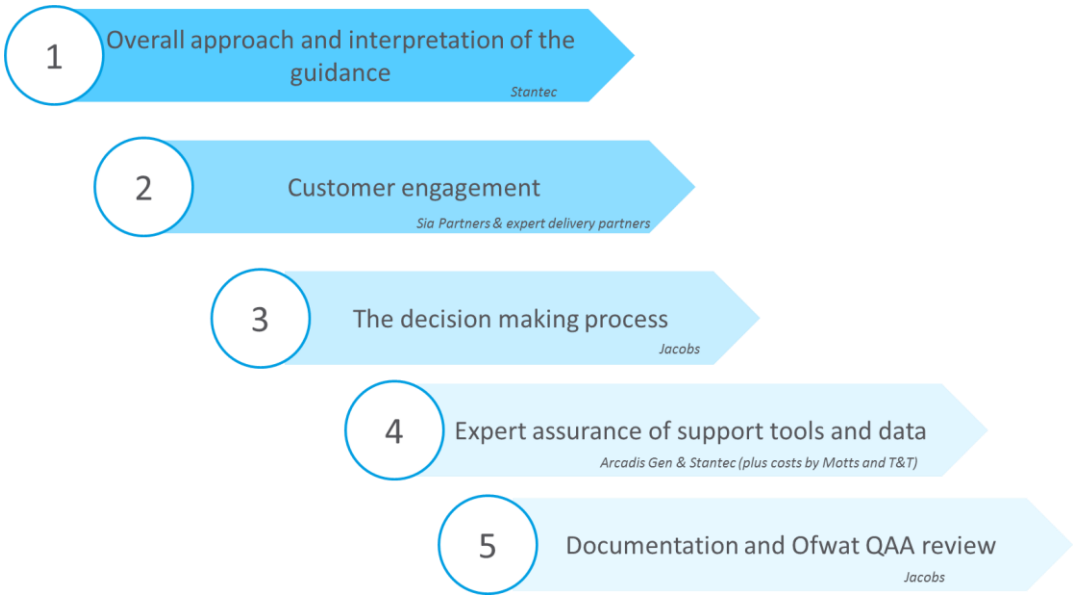
6.2 Board challenge

During the development of the LTDS, we have provided updates and shared extracts of the narrative with the Severn Trent PLC Board on six occasions (five discussions and then final sign off), providing opportunities for review and challenge. Figure 2.7 in Section 2.4.4 provides a summary of the main areas where the Board has provided challenge, and the action taken in response. Figure 6.2 in Section 6.3 sets out the timeline and process of the Board's engagement in the development of the LTDS.

6.3 Assurance process

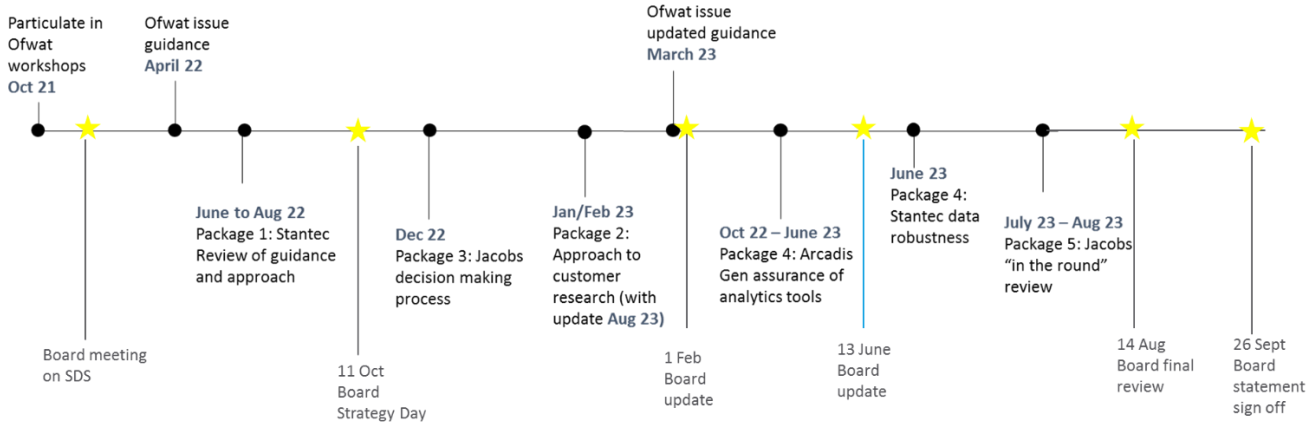
The LTDS is a new requirement for PR24 and includes a diverse range of requirements ranging from customer engagement to uncertainty modelling and investment optimisation. Figure 6.1 shows the iterative assurance process we designed for the LTDS, broken down into the following packages that enable us to engage the most suitable experts for each element.

Figure 6.1: Overview of the assurance workstreams



Assurance has been carried out throughout the development of our LTDS approach, as well as on the final analysis and documentation. This has enabled our Board to engage iteratively throughout the development of the LTDS, as shown in Figure 6.2.

Figure 6.2: Assurance and Board engagement timeline



The Board assurance statement is provided in Section 6.1, outlining the challenges the Board has made and how we have satisfied ourselves that our LTDS is ambitious, high quality, informed by customers, equitable across the generations it serves, and represents a single adaptive strategy to ensure we are able to deliver our long-term ambitions and statutory obligations.

7. Appendices

Appendix A: Key definitions

Source: Box 1, p.11, Ofwat Ofwat's final guidance on long-term delivery strategies, April 2022

- **Adaptive pathway:** a package of planned investments over time. Long-term delivery strategies will contain a core adaptive pathway and a number of alternative adaptive pathways.
- **Core adaptive pathway:** a package of no- and low-regret investments, including investment required to keep future options open. This helps to expose what activities should be undertaken regardless of circumstances.
- **Alternative adaptive pathway:** a package of investments that should be undertaken only under certain circumstances. These circumstances are described by a trigger point.
- **'No-regret' investment:** investments that are likely to deliver outcomes efficiently under all plausible scenarios.
- **'Low-regret' investment:** investments that are likely to deliver outcomes efficiently under a wide range of plausible scenarios.
- **Trigger point:** the circumstances in which an alternative adaptive pathway would need to be followed.
- **Decision point:** the point in time when a decision would need to be taken about whether an alternative adaptive pathway is followed. This is either set at the same point in time as the trigger point, or in advance.
- **Scenario:** a description of the future.
- **Plausible scenario:** a scenario that is possible, but not necessarily the most likely.

Appendix B: Delivering on Public Value Principles

Public Value Principle	How we will meet the principle
1: Companies should seek to create further social and environmental value in the course of delivering their core services, beyond the minimum required to meet statutory obligations. Social and environmental value may be created both in direct service provision and through the supply chain.	• **Biodiversity net gain:** Committed to a 15% net biodiversity gain per project (10% statutory). Increased our biodiversity target from 5,000 ha to 10,000 ha and brought it forward to 2025. • **Social strategy:** Commitment to help 100,000 people over the next 10 years. Longer term approach to tackling water poverty, focusing on creating value. • **Employability:** Decade-long commitment to employability support for [10,000] people. School work experience placements for 500 children from socially deprived areas per year, helping a much more diverse range of people benefit from these opportunities. • **Supply chain expectations:** Sustainability supply chain charter sets out minimum social and environmental requirements for suppliers. • **Community Fund:** Will continue in AMP8, supporting hundreds of community projects. • **Customer financial support:** Doubling the number of customers we offer financial support to, so our support grows faster than forecasts of future water poverty. • **Operational net zero by 2030.**
2: Social and environmental benefits should be measurable, lasting and important to customers and communities. Mechanisms used to guide activity and drive decision-making should support this, for example through setting and using company purpose, wide external engagement and explicit consideration of non-financial benefits.	• **Corporate strategy:** Our strategy is to be a performance-driven, sustainability-led water company. • **Measured and reported:** Continue to report a wide spectrum of environmental and social performance through our annual sustainability report and ESG data book, aligned with sustainability reporting standards including TCFD, GRI, SASB, SBTi and GHG Protocol. • **Consideration of non-financial benefits:** Tools in place throughout design process to ensure wider social and environmental outcomes are considered, e.g. Total Value Tool. • **Social impact:** Will be measured in accordance with the National TOMs (Themes, Outcomes and Measures).
3: Companies should be open with information and insights on operational performance and impacts (both good and bad). This will support stakeholder engagement, facilitate collaboration and help identify opportunities for delivering additional social and environmental value.	• **Performance and impact reporting:** Broad range of publications set out operational performance and impacts (Annual Performance Report, Annual Sustainability Report, ESG data book), and subject-specific publications (Green Recovery Report, Get River Positive Report). • **Open information:** Installing [1,000] water quality monitors so everyone can see what is happening in our rivers.

4: Delivery of social and environmental value outcomes should not come at greater cost to customers without customer support.	• **Customer imperative:** Across all the customer insight, sustainability is one of the key themes fundamentally important to customers. • **Customer support:** Customers support the proposed environmental investment and associated bill increase, and prefer it to a least cost plan with smaller environmental improvements. • **Community Panel:** Projects chosen by our customers via our established Community Fund.
5: Companies should consider where and how they can collaborate with others to optimise solutions and maximise benefits, seeking to align stakeholder interests where possible, and leveraging a fair share of third-party contributions where needed. Companies' public value activities should not displace other organisations who are better placed to act.	• **Commitment to collaboration:** Many of the challenges the water sector faces cannot be solved alone: water scarcity, climate resilience, net zero, biodiversity collapse, river health and poverty. They require a multi-agency approach, co-ordinating and collaborating to find the right long-term solutions. We have identified more than [£100m] of third-party investment in AMP8 with overlapping drivers or solutions. • **Tackling surface water:** Combining nature, tried-and-tested engineering and AI to establish a model for sustainable drainage in four urban areas, creating [92] 'nature hubs' with advisers to help communities find collaborative solutions • **River partnerships:** Rivers are a shared natural asset and we know partnership working is key. Our river rangers are already working in local communities and plan to play our part in other community focussed initiates, e.g. the catchment thinking systems cooperative project. • **Partnerships upstream:** Taking a holistic approach to addressing river and raw water quality by working upstream of the point of usage with other stakeholders to reduce the impact on nature and find ways that nature can be part of the solution, e.g. we will work with over 1,000 farmers in the region. • **Catchment approach:** By taking a catchment approach and involving local stakeholders, we can deliver better outcomes more cheaply. This is integral to our WRMP and DWMP approaches. • **Societal partnerships:** Worked with organisations such as Business in the Community to help shape our societal strategy. For delivery, we are working with regional and municipal government to understand local needs and determine how to best support communities. We have identified charities and support organisations who have access to those communities, ensuring we access those in most need. • **International net zero partnership:** Collaboration on future net zero innovations – including the net zero hub – with water companies in Denmark (Aarhus Vand) and Australia (Melbourne Water).

	• **Water company partnerships:** Partnered with Anglian Water on Get River Positive commitments. • **Supply chain partnerships:** Committed to working with our supply chain to drive greater environmental and social outcomes. Networks such as Sustainability Supply Chain School provide valuable resources and formats to share knowledge.
6: Companies should take account of their capability, performance and circumstances in considering the scope for delivering greater social and environmental value.	• **Strong foundations:** We are the only company to achieve four consecutive years of 4* status on the Environment Agency's Environmental Performance Assessment (EPA). • **Land ownership:** Well positioned to drive future renewable energy and biodiversity improvements. • **Societal strategy:** Well placed to play a wider role in society, with significant areas of deprivation within our region. • **Significant employer:** As a larger employer, we will create new employment opportunities that are accessible to a diverse range of people who may not previously have considered a role in our sector. • **Supply chain influence:** Recognise our important role in influencing and supporting our supply chain to decarbonise. Target to sign up 70% of our supply chain (by emissions) to science-based targets by 2026.

Appendix C: Priority 2050 challenges facing Severn Trent

The future is by its very nature uncertain and will be influenced by the actions (or lack thereof) of multiple actors in the near-term. In our SDS, we outlined a number of key challenges that we will face and that will make our task more complicated and less predictable:

1. Demand for water will continue to grow driven by population growth and warmer weather unless we make considerable inroads into reducing household and business consumption.	By 2050, we expect to see 12% more people living in our region – the third fastest rate of any region in the UK. At the same time, we expect average household occupancy levels to fall, meaning that we will need to serve around 20% more households than today. This could add a further 130 Ml to daily demand. Customers understandably tend to use more water when it is hot and one consequence of climate change is an increased probably of heatwaves. These are likely to be hotter and more prolonged than in the past. Data from 2022 showed that peak demand rose by 30%, equivalent to an extra 350 Ml of water each day.
2. Climate change will reduce the amount and quality of available water, for both human use and for nature.	By 2050, we expect that summers in the Midlands will be on average 2.6°C warmer than today with 16% less rainfall. This will extend the effective duration of the summer period and reduce seasonal rainfall when demand is most acute. Lower summer water levels will impact water quality and reduce the amount that we can abstract sustainably, meaning greater reliance will need to be placed on storage reservoirs filled over winter. Internal modelling suggests that 4.6% of current abstraction is vulnerable to climate change and a further 8.7% may need to be forgone to ensure the sustainability of our rivers, streams and aquifers. Collectively, this could amount to 290 Ml per day.
3. More extreme weather will increase the risk of flooding	By 2050, we expect there to be an increased risk of flooding as a consequence of climate change, more housing and greater urbanisation. Winters will be warmer and around 13% wetter across the Midlands, with more extreme heavy rainfall events increasing the risk of rivers breaking their banks or saturated ground flooding. Summers will be drier overall, but subject to heavier, torrential downpours with the potential to spark localised flash flooding as drains fill and the excess water has nowhere to go. The rise in impermeable surfaces caused by more housing will only exacerbate the issue by increasing surface run-off and reducing absorption into the ground. Without further intervention, we could see 65% more flood water escaping from the sewer network; 45% more properties at risk of internal flooding in a 1-in-a-50-year rainfall event than would be affected today; and 16% more spills from storm overflows.
4. Concern about climate change will drive a shift in attitudes towards the environment	As we move towards 2050, we expect that concern over the level of progress towards climate goals will continue to grow as the impacts of climate change become more apparent and global endeavours risk falling short of what is needed. This concern will lead people to be more conscious of the impacts of their lifestyle choices and drive a desire to consume less, lower waste and increase recycling. Our customers will be looking to us to help inform and support their endeavours to use less water. Society will also demand that businesses act; to be more sustainable in their own operations, to pay for the damage they cause, and to make it easier and cheaper for their consumers to be environmentally friendlier. We have already committed to becoming carbon net zero for our Scope 1 and 2 emissions by 2030 but can also foresee the need to reduce waste and adopt more of the principles of a

	circular economy. Additionally, as all forms of environmental pollution become less socially acceptable, there is likely to more scrutiny of the materials we return to the environment as part of our normal operations (i.e., bio-solids or wastewater effluent) or that are permitted in times of network stress (i.e., sewer overflows). Habitat preservation, restoration and biodiversity will also become increasingly important as the value and role of nature is more widely recognised, and the loss of the globally significant habitats inspires action. As a landowner with an estate covering 10,500 hectares, we will need to show we are making the best use of our land and improving its natural capital.
5. Combating climate change could lead to more regulation and policy interventions	Through to 2050, we anticipate that Government will need to assume a larger role to overcome barriers that are hindering consumer, business, and wider societal change. Potential policy interventions will differ dependent on the prevailing political priorities but are likely to be focused on speeding up decarbonisation efforts and managing the impacts of climate change, both through adaption and mitigation. This will impact all sectors of the UK economy but as designated critical national infrastructure there will be particular emphasis on us to enhance the resilience of our assets and strengthen our contingency measures and plans, for example as required by the Security and Emergency Measures Direction (SEMD). We also anticipate changes to laws, regulations and standards related to environmental matters which will require us to adopt more stringent standards alongside increased transparency around data collection and reporting. Carbon taxes and other market-based incentives will likely be used to limit fossil fuel use and the carbon content of products and services. Whilst this will increase the cost of large capital solutions, it may present opportunities to make greater use of nature-based solutions or participate in new markets, such as green hydrogen or ammonia.
6. Mitigating climate change will require rapid decarbonisation	The 2008 Climate Change Act enshrines in law the UK's ambition to reduce net emissions of carbon dioxide and other targeted greenhouse gases to zero by 2050. For us, that means reducing our total annual operational emissions of 102,113t CO2e by finding new ways to use less and adopting zero-carbon renewable alternatives. Given that 71% of our greenhouse emissions (primarily methane and nitrous oxide) arise from processing 1.4 billion litres of sewage every day[24] across 1,017 waste treatment sites[25], this will not be straightforward. Nor will finding workable solutions to power our larger vehicles (i.e., HGV Tankers and construction vehicles).

With all these challenges looming, we recognise that we need to be flexible in our approach and devise solutions which can accommodate a range of scenarios. The introduction of adaptive pathways is a welcome addition to PR24, which should allow us to evolve our plans in a judicious way, as new developments arise.

Additionally, there are two further practical considerations which we cannot overlook:

[24] https://www.stwater.co.uk/my-supply/waste-water/about-your-waste-water/
[25] https://waterprojectsonline.com/listing/severn-trent/

7. The investment required will impact customer bills and affect affordability for some	Planning for higher levels of resilience and meeting long-term targets like carbon net zero, lower leakage or reducing the impact of storm overflows will require material investments in our physical assets and changes to how we operate. In proposing new investments, we need to be conscious of the impact on customer bills, especially for those that already struggle financially. Though we have some of the lowest average bills in the country, we know that []% of our customers already find their bills unaffordable and that the cost of living crisis will have created anxiety for many more regarding their ability to pay in the future.

Climate change stands out as a crucial issue which will dominate the agenda for the next few decades, as society wrestles with how best to transition away from fossil fuels and cut the amount of harmful greenhouse gases emitted into the environment. As the UK Metrological Office[26] note 'even given strenuous efforts to limit the cause of global warming, further climatic changes are inevitable in the future and the UK will need to manage the growing risks from climate change'. The heatwave of 2022 perhaps provides an early peek at what our future could look like; with the Midlands reaching 38.8°C[27], notably low river flows for both the Upper Severn and Trent[28], water volumes falling below 50% in the Vyrnwy, Clywedog and Elan Valley reservoirs[4], and peak water demand spiking 40% to 186l/p/d[29]. Forward projections suggest that the likelihood of the UK exceeding 40°C in any given year even with current pledges on emissions reductions, is 1 in every 15 years by 2100[30], and in the worse scenarios with very high emissions, as frequently as 1 in 3 years[31].

But climate change is not some future event, it is with us already. According to the latest Climate Change Risk Assessment[32], the average surface temperature in the UK has risen by 1.2°C since pre-industrial times, and further warming is predicted under all decarbonisation pathways set out by the Intergovernmental Panel on Climate Change. More specifically, the 3rd UK Climate Change Risk Assessment Evidence Report[33] noted that the water sector faces the following generic risks:

- Water infrastructure, such as reservoirs, dams, pipelines, water treatment plants and sewage treatment plants, are all at risk from the impacts of climate change,
- Water treatment facilities could be impacted by more frequent flooding leading to potential reductions in water quality, in turn impacting upon health.

26 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18_headline_findings_v3.pdf

27 Based on meteorological records from 1880s onwards. https://www.birminghammail.co.uk/black-country/west-midlands-records-hottest-day-24537231

28 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1107734/Water_Situation_Report_for_England_August_2022.pdf

29 https://www.shropshirestar.com/news/environment/2022/08/11/severn-trent-sends-millions-of-advice-texts-on-saving-water/

30 https://news.un.org/en/story/2022/07/1122732

31 https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2022/july-heat-review

32 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1047003/climate-change-risk-assessment-2022.pdf

33 https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Water.pdf

especially increases in the frequency and intensity of surface water and coastal flooding.

- Water infrastructure assets represent a key element of the UK infrastructure system and could affect, or be affected by, failures of other assets due to extreme weather, such as energy systems, transport, and information and communications technology (ICT)
- Buried infrastructure, such as water pipelines, could be damaged more frequently in future due to flooding and subsidence.
- Future projections of more frequent and intense dry periods lead to concerns around the availability of public water supplies in future, especially in England and parts of Wales. Private water supplies are also at risk.
- Aquifers near the coast could be at greater risk from saltwater intrusion due to sea level rise, though the risk is thought to be low in places where aquifers are important water sources.

Obviously not all water companies will be affected equally. Severn Trent for example is very unlikely to succumb to coastal flooding or saltwater intrusion given our location. That said, such risks highlight the need to focus on **security of supply and resilience** across our business.

However, that is only part of the picture. There is little to be gained by adapting to climate change if our actions are still contributing to it or magnifying its impacts (for example, by continuing to use fossil fuels or abstracting from low flow rivers). Therefore, it is imperative we embrace innovation and shift towards **more sustainable ways of working** as quickly as is pragmatic. But in saying this, we recognise that we are amidst a cost-of-living crisis that is buffeting the poorest in society, and that we need to carefully consider the impact of our future investment programmes on **affordability** and ensure we are fair in what we ask current and future customers to pay for. Unfortunately, our region includes some of the poorest in the UK, with Birmingham, Nottingham, Stoke-on-Trent and Leicester collectively accounting for 1 in 8 LSOAs in the bottom decile nationally for deprivation[34]. For these customers especially, we need to ensure they have the long-term security of knowing their water bill will be affordable, and if not, that support through social tariffs is available to them.

[34] MSOA – Middle Layer Super Output Area. For government data, England and Wales is divided into 181,408 Output Areas (OAs), 34,753 lower layer super output areas (LSOA) and 7,201 middle layer super output areas (MSOA). There are approx. 3-5 LSOAs per MSOA.

Appendix C: The Severn Trent region

The Severn Trent region in numbers

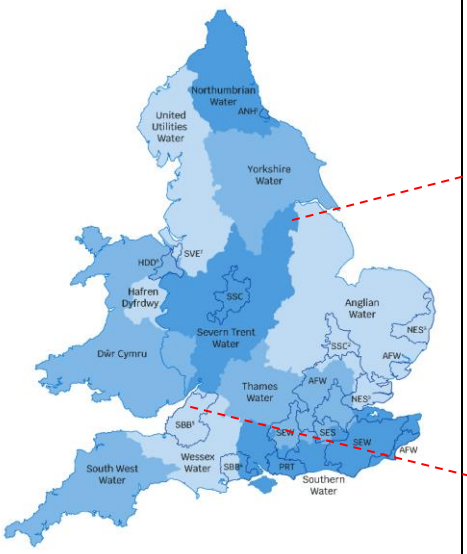
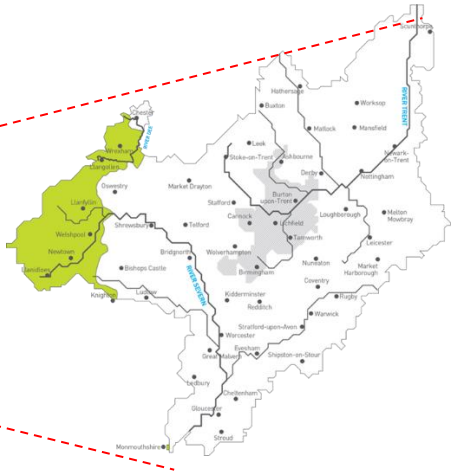
Water and waste companies in England and Wales	Severn Trent Water region in detail	
		One of 11 water and waste companies
		One of three UK listed companies
		Covers area of 21,000km²
		6,800km of rivers across our region
		4* Environmental Agency Rating
		500 hectares across 72 sites of Special Scientific Interest
		£21bn invested since 1990

Figure C1: Key characteristics across our region

Characteristic	West Midlands	East Midlands
Population	5,954,240	4,880,094
Area km²	12,998	15,623
Urban population	85%	73%
Rural population	15%	27%
Population density/people per km²	458	312
GDP	£157bn	£126bn
Average salary	£36,785	£35,131
Labour force	3,754,717	3,097,054

Figure C2: Severn Trent's support of our region

Characteristic	West Midlands	East Midlands
Community Fund donations	£908,000	£643,000
Organisations supported through Community Fund	146	83
Covid-19 Fund donations	£610,000	£344,000
Vulnerable customers helped	106,933	63,045

Appendix D: Overview of our AMP8 enhancement cases

04a-c: WINEP (Water Industry National Environment Programme) – £3,094m

Severn Trent's WINEP programme is covered in three business cases split by price control: Water, Waste and Bioresources.

The **Waste WINEP** covers a wide range of environmental improvement measures across 25 main driver families, covering water and wastewater services. Specific improvements are agreed with and governed by the Environment Agency (EA).

Under the Environment Act 2021, water companies must make progress towards the 2050 requirement to ensure no storm overflow causes ecological harm, as well as spilling fewer than 10 times a year on average. All overflows must also be fitted with screens by 2050. Defra's Storm Overflow Discharge Reduction Plan sets out interim targets that will be enforced by the EA through WINEP. Approximately 1670 overflows will require a spill reduction by 2050 and approximately 2,477 will require screens.

Also under the Environment Act 2021, water companies have a new duty to install river quality monitors up- and downstream of our c.4,000 qualifying discharge locations by 2035, publishing the data in near-real time. The precise requirements, and some exemption criteria, are still being developed with the EA and Defra. In line with the Defra guidance issued in August 2023, we have reduced the AMP8 component to 1,000 monitors.

The Environment Act 2021 requires water companies to reduce phosphorus loadings from treated wastewater by 80% by 2038 (against a 2020 baseline). We propose to phase investment evenly across AMP8 and AMP9.

Under the Water Framework Directive (WFD) regulations, we tackle Reasons for Not Achieving Good Status (RNAGs) in relation to phosphate, ammonia, and storm overflows. There is some overlap between these obligations and those of the Environment Act, but under WFD there is greater scope for using nature-based solutions such as catchment nutrient balancing.

Under the Habitats Directive, to achieve nutrient neutrality across three designated catchments by 2030, we will upgrade qualifying sewage works to technically achievable limits for phosphorous. We also have statutory nutrient removal requirements in other protected areas (Sites of Special Scientific Interest (SSSIs) and Ramsar sites (wetlands of international importance).

All that means in AMP8 we will:

- Eliminate at least 250 RNAGs.
- Reduce phosphate levels in 1,375km of rivers.
- Improve 562 storm overflows to benefit 1,868km of rivers.
- Enhance ammonia removal to benefit 346km of rivers.

The **Bioresources WINEP** aims to improve resilience of the sludge-to-land-disposal route. The technical requirements for sludge that is used in agriculture shorten the sludge to land spreading window and require us to increase resilience against disruption of the sludge to land supply chain (triggered by issues such as pandemics, outbreaks of notifiable agricultural diseases, or changes to cropping patterns). We propose meeting these requirements in two ways: firstly, at two thermal hydrolysis process (THP) sites we will install sludge to fertiliser plants and, secondly, at all other sites we will ensure we have up to six months storage of sludge cake.

The **Water WINEP** covers the investigations and implementation activities that meet the objectives set out in the EA's National Framework for Water Resources. This has defined ambitious environmental destination scenarios that quantify the future abstraction reductions (estimated at 418Ml/d across WFD no-deterioration and environmental destination) needed to improve all water bodies by achieving and maintaining the Environmental Flow Indicator (EFI) by 2050 in the face of climate change impacts. We will undertake investigations into 12 areas across our region to gather data, update models, undertake catchment and system impact assessments and develop options.

We will be required to deliver nine catchment protection schemes under the Drinking Water Protected Areas drivers. These are largely catchment management schemes to reduce nitrates, phosphates and pesticides that have been identified as needing improvements as part of AMP7 investigations. In addition, all Severn Trent-owned SSSIs will be improved to recovering or favourable status.

There are several other smaller statutory elements that make up the overall WINEP, which are included in the detailed enhancement proposal.

13: Raw Water Deterioration – £317m

Twelve of Severn Trent's raw water sources (collectively contributing 338Ml/d of our overall water into supply) are exhibiting measured changes in raw water quality and volatility over time. If left unmitigated, these changes will impact our ability to treat or supply customers with water from these sources. The DWI has confirmed support for our preferred solutions, including:

- Whitacre WTW Algae – a new DAF plant.
- Homesford WTW Lead – a next-generation ceramic membrane plant.
- Groundwater Crypto/Bacti - 5 x UV plants and 1 x UF membrane plant.
- Groundwater Nitrate - 2 x Ion Exchange plant.
- PFAS treatment at two WTWs.

12: Enhancing Cyber Security – £71m

The Government has recognised the need for improvement in cyber resilience across the public sector and operators of essential services, and has laid out a plan in the National Cyber Strategy 2022. Underpinning this strategy are two relevant regulations: The Security and Emergency Measures (Water and Sewerage Undertakers and Water Supply Licensees) Direction 2022 (SEMD) and the Network and Information Systems Regulations 2018 (NIS). These changes represent a demonstrable enhancement in the level of security required compared to PR19. The requirements are based on compliance with a risk framework and do not include specific, enforceable targets.

There is strong evidence of increasing cyber risk. The likelihood of a cyber attack is increasing due to increased digitalisation (exposing more data to attack) and the increasing number of, and level of sophistication of, attackers. The consequence of an attack is also increasing because the connectedness of our data means a single breach can affect multiple data and control systems, potentially causing disruption to services.

Our proposal is to implement zero-trust design principles across our systems. These improvements will make it considerably harder for hackers to gain access to our systems and, even if they succeed, they will have to re-verify on a regular basis, making it more difficult for them to cause significant damage. The system will also minimise the potential for viruses or similar spreading between our

systems, enable more secure use of cloud-based applications, and enable greater security of automated operations.

06: SEMD Physical Security – £38m

The revised SEMD and the associated Protective Security Guidance (PSG) 2022 set out an updated view on the security requirements of our assets that are classified as critical national infrastructure (CNI) as well as covering security requirements of all operational assets. These changes mean the number of assets being classified as CNI will increase from seven to 36. We propose a number of physical security improvements in order to comply with the new regulations and to address risks identified under the new risk assessments.

06: SEMD Alternative water supplies – £31m

Changes to the SEMD legislation mean that we will have an increased need to supply our customers from alternative sources during a significant event. Currently, we must have the capacity to supply at least 50,000 people with 10 litres of water for five days, but the changes to SEMD mean that figure has increased to c.131,000 from 1 April 2025. The increase, of 163%, is second only to Thames Water across the industry.

Following an assessment of a range of options, the lowest cost to customers is to meet this new requirement through bottled water supplies. We are considering alternative options with a marginal cost increase (to be funded from base expenditure at no extra cost to customers) which will meet the new statutory obligation with a reduced carbon impact, increased resilience benefit, and support delivery of the wider enhancement programme.

08: Meeting Future Water Needs – £678m

Investment in previous AMPs (including our Green Recovery investment) means we enter AMP8 in surplus but modelling shows that, without investment, we will leave it with a deficit of 184Ml/d – the equivalent of around 8% of the water we treat and distribute every day. If left unchecked, the deficit is predicted to increase to 608Ml/d by 2050.

Our AMP8 proposal will increase water supplies by 205Ml/d by 2030, which will meet the 2030 deficit and start to tackle some of the longer-term deficit driven by the requirement to increase drought resilience as part of a ‘no-regrets’ plan to meet the long-term challenge.

We will do this by:

- Reducing demand by 110Ml/d through leakage reductions, and working with our customers and with business to reduce their demand.
- Replacing 95ML/d of capacity with sustainable sources.

We will also carry out investigations to understand the sustainability of our existing sources that might need to be withdrawn to meet future environmental improvements.

Please note that c£300m is included for licence capping in our Water WINEP (UME04).

03: Net Zero Investments – £430m

The UK is one of the few countries with a legally binding commitment to reach net zero greenhouse gas emissions by 2050, with an interim reduction target of 78% by 2035 (from a 1990 baseline). Our Science Based Target is to reach a 46% reduction by 2030/31, which puts us on an even trajectory to the interim 2035 target.

Our enhancement proposal focuses on process emissions – those resulting from our wastewater treatment processes – because they account for 82% of our operational emissions and around 30% of total emissions. As we produce nitrous oxide, a greenhouse gas 273 times more potent than carbon dioxide, as part of our wastewater treatment, and methane, another damaging greenhouse gas, can escape from our bioresources processes, we can make substantial inroads into our targets by concentrating on those areas. However, because wastewater treatment processes are unique to the water sector, we cannot rely on the development of market-based solutions. The proposal also includes several smaller investments to decarbonise our heat and fuel.

We are continuing to evaluate and assess the best value set of interventions, but the current view includes interventions to reduce 223ktCO2e through interventions at over 120 WWTWs across three solution categories:

- Elimination – changing a process to prevent GHG production or replace fossil fuel use.
- Reduction – optimising processes to reduce GHG emissions.
- Treatment – installing additional processes to capture and destroy GHGs.

64% of customers surveyed support plans to invest in reducing our emissions as soon as possible, and 73% of current and 81% of future bill payers picked the proposed level of investment or higher.

15: Reservoir Act extension – £29m

This enhancement proposal calls for an investment of £5m in a programme of investigation and evaluation work to enable us to carry out statutory inspections at 45 of our reservoirs and lagoons should they, as expected, fall under the amended Reservoirs Act. A further £24m is required for new reservoirs and tanks at several sites to support or replace existing assets that cannot be isolated (to allow the statutory inspection to take place), plus anticipated overflow upgrades and other measures to meet the likely enhanced asset standard required under the Act. This has come about after changes to the way reservoirs in England are regulated under the Reservoirs Act 1975, as amended by the Flood and Water Management Act 2010. The Act covers the safety of all large, raised reservoirs that can hold at least 25,000m³ of water above natural surrounding ground level.

The Act makes provision to alter this volume criterion to include smaller reservoirs with an escapable volume of over 10,000m³. To date, this lower volume criterion has not been applied, but we believe it will be adopted in England by 2026-27. When this new legal requirement is enacted, it would increase the number of our reservoirs covered by the Act by 62 (but we believe only 45 can be inspected in AMP8).

01: Resilient water networks – £128m

One of the biggest threats to the resilience of water supplies is the additional stress caused by periods of peak demand for water. This is usually driven by hot weather, when customers use significantly more water than usual – an issue that is already manifesting as observed by restrictions and service interruptions in the south east over the summer. Observed data patterns show a correlation between increasing temperature and increased water use, and with expert support from the Met Office we predict that our systems will need to be able to transfer enough water to cater for peak demand over 30 days, which equates to an additional transfer capability of 282Ml/d (i.e. the ability to transfer water from areas in surplus to those in deficit during times of peak demand).

We are tackling this increasing climate risk broadly evenly between now and 2050. Investments in the next five years will include:

- Building three new pipelines to transfer water to where it is needed most, and removing single points of failure.
- Refining our behaviour change messaging to reduce peak demand.
- Using our tanker fleet, where appropriate, to provide a speedy response to customers.

These interventions will provide greater resilience against a wider range of hazards, not just peak demand. We have tested this proposal with customers who told us that improving long-term resilience is a priority.

07: Urban catchments of the future – £170m (£360m including botex + implicit allowance)

We have identified four specific catchments particularly affected by climate change, population growth and urban creep, where we plan to take a nature-based approach to system management to protect homes and businesses.

Based on the learning from our Green Recovery pilot in Mansfield, we believe we can:

- Protect more than 840 homes and businesses from internal flooding.
- Remove 158,000m³ of rainfall from our system.
- Improve wider flood resilience by using a nature-based approach.

Our activities will also future-proof the catchments against the effects of urban creep and population growth.

We have tested this proposal with customers who told us that improving long-term resilience is a priority.

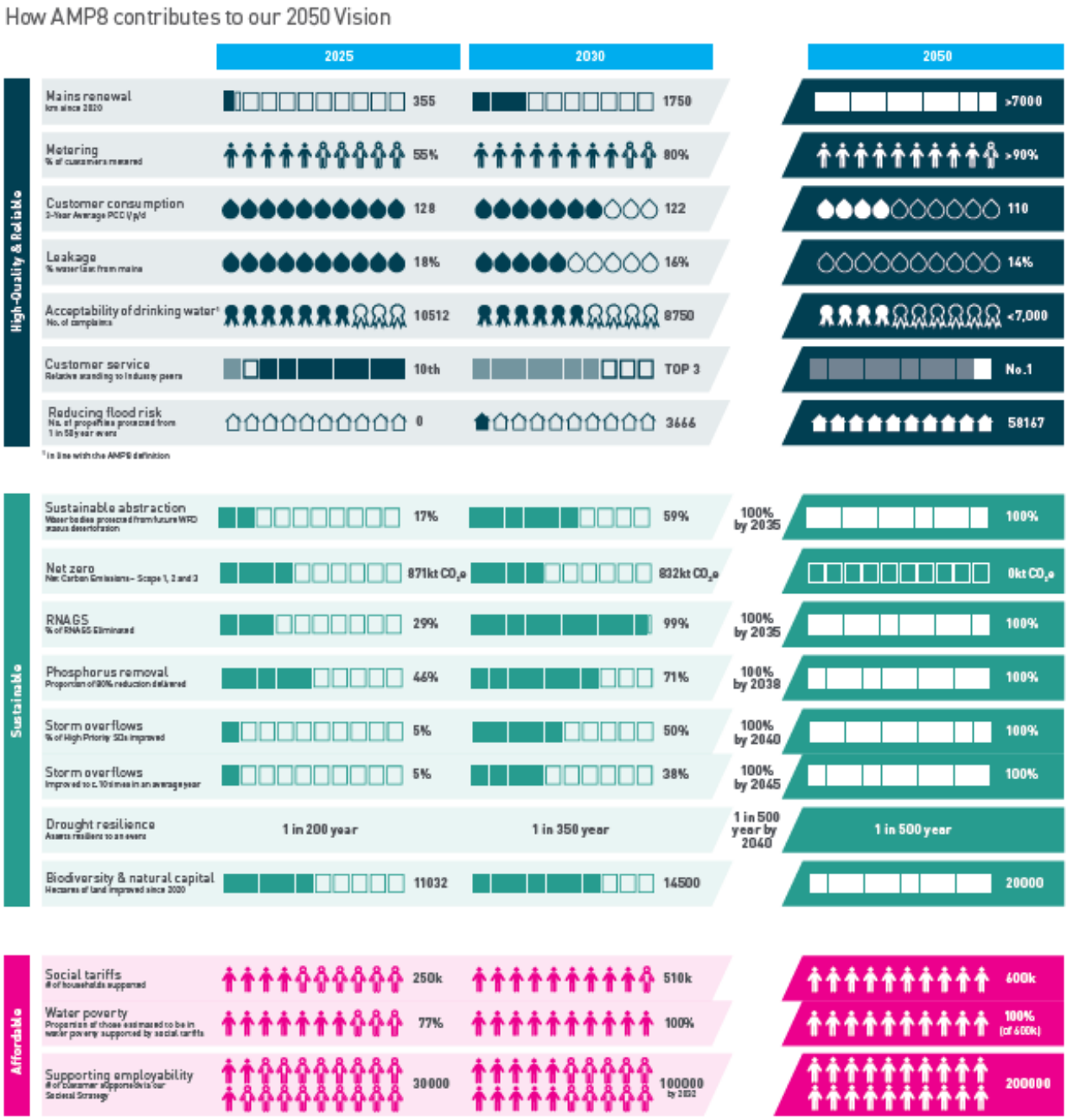
09: Lead Reduction – £27m

We want to continue to drive the replacement of customer-owned lead pipes while also making progress towards the long-term goal of reducing the use of phosphate dosing. The DWI expects companies to have a long-term strategy (submitted in March 2023) for working towards lead removal, but there have been no changes made to the lead standard and therefore there is no statutory driver for this investment. As part of overall affordability and acceptability testing, we needed to find areas of the plan where we can defer investment to manage the overall bill impact. In the short term we have reduced our ambition, but we have still challenged ourselves to identify interventions that offer the greatest benefits at the lowest costs to ensure we make some progress towards our long-term aim of being lead free. This proposal focuses on the most vulnerable groups and aims to:

- Investigate sources of lead in up to 1,000 schools and nurseries and replace lead communication pipes where needed. As part of this we are trying to establish a partnership with the Department for Education.
- Support up to 500 struggling-to-pay customers with lead supply pipe replacement.
- As part of our phosphate disengagement plan, investigate 2,000 homes and businesses for lead supply pipes and make replacements where needed.

Our research has shown more than 75% of customers feel the health impact of lead pipes is unacceptable and support investment to work towards eradicating it.

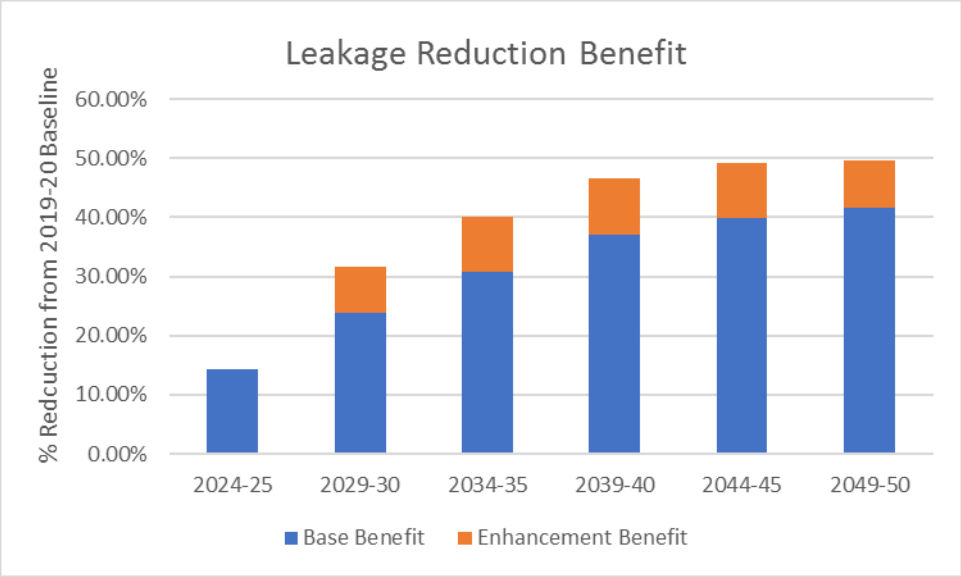
Appendix E: Long-term targets



Below are some examples of how we have generated our long-term performance forecasts across base and enhancement.

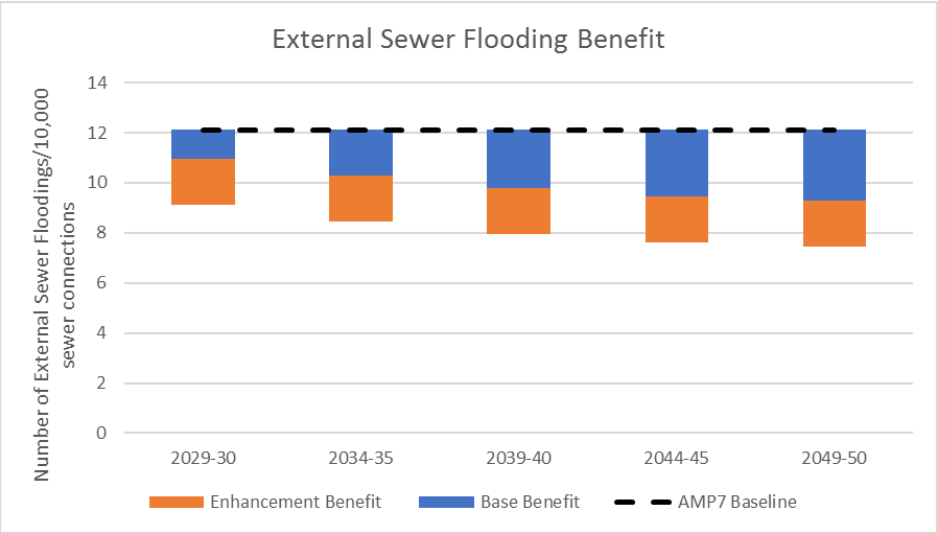
Leakage:

Across AMP8 and AMP9, we see sizeable benefits coming from enhancement due to our smart metering rollout, but by 2050 80% of the overall improvement has come from base spend. Our long-term targets align with WRMP targets.



External sewer flooding:

We have assumed that AMP8 enhancement will deliver some performance improvement, but after that point our enhancement programme will primarily maintain flooding performance. Further improvements to 2050 will be delivered through base.



Appendix F: Forecasting performance from base

To understand the level of improvement driven by base as part of the LTDS we have considered four elements that would impact our future performance:

- Our comparative performance level – this analysis is set out in full in Annex 5 Common Performance Commitments.
- Deterioration in the asset base.
- Impacts of climate change.
- Incremental improvements funded from base.
- The impact of innovation scenarios (primarily technology advancements).

In the following section we explain each of the elements in turn, detailing the underlying assumptions that impact on each measure and the delivery from the base programme. Wherever possible we seek to quantify this and express it in terms of outcome delivery incentive (ODI) performance using the AMP8 ODI rates defined in the OUT7 table. This allows us to explain what base buys as a value recognising the customer benefit it delivers.

Deterioration in the asset base

Each year we offset deterioration which would lead to a worse level of service for our customers. The assets for each sub-service are impacted by different pressures, from exogenous factors such as temperature, to customer behaviour and mechanical/electrical deterioration. Some performance commitments have a well understood level of deterioration, also expressed as a natural rate of rise, for these we have been able to use a bottom-up analysis. For other measures, especially those being introduced for AMP8, we have determined a bottom-up or top-down assessment of deterioration.

Table F1 outlines the assumptions made for each measure.

Table F1: Asset base deterioration assumptions

Measure	Assumption	Value	Bottom-up/ Top-down
Water supply interruptions	3m31s event equivalent to the potential impact of the December 2022 freeze/thaw event	£39m	Top-down
Compliance risk index (CRI)	1 point per year based on risk of coliform failure at a large works	£11m	Top-down
Customer contacts about water quality	2,035 complaints per year based on AMP7 annual deterioration and an uplift for the new definition	£27m	Bottom-up
Internal sewer flooding	11% annual deterioration based on AMP7 performance analysis	£14m	Bottom-up
External sewer flooding	13% annual deterioration based on AMP7 performance analysis	£54m	Bottom-up

Leakage	Natural rate of rise equal to 380Ml/day each year	£395m	Bottom-up
Per capita consumption	0.5 l/p/d deterioration per year	£8m	Bottom-up
Business demand			
Total pollution incidents	11% annual deterioration – aligned to internal sewer flooding as same asset base	£14m	Top-down
Serious pollution incidents	Two incidents per year based on average number of incidents 2019-22	£11m	Top-down
Discharge permit compliance	0.54% risk based on four failing works per year	£15m	Bottom-up
Storm overflows	11% annual deterioration – aligned to internal sewer flooding as same asset base	£15m	Top-down
Mains repairs	Deterioration funded through base programme	N/A	Top-down
Unplanned outage	Deterioration funded through base programme	N/A	Top-down
Sewer collapses	Deterioration funded through base programme	N/A	Top-down

Collectively this level of deterioration is equal to £120m of ODI performance per year. The vast majority of this (c£395m) is related to offsetting the natural rate of rise in leakage. We have assumed this is static through the planning period form 2035 onwards.

Impacts of climate change

We have assessed the likely impact on performance of climate change projections based on the Met Office climate change predictions. The Met Office analysis predicts that, even without any population growth, we can reasonably expect performance by the middle of the 2050-time horizon to have changed in the following ways:

- 5% increase in the number of supply interruption events per year.
- 7.5% increase in customer contacts regarding low pressure complaints.
- 4% increase in customer contacts regarding discolouration complaints.
- 21% increase in properties at risk of sewer flooding

The above deterioration in performance is a central estimate, and it is worth noting that this deterioration could be significantly higher (i.e. 15-20%+) if the more extreme possible ranges of temperate and peak demand are reached.

Collectively, the impacts of climate change will require us to offset an additional £24m of ODI performance each year through base expenditure. We have assumed this is static through the planning period from 2035 onwards.

Incremental improvements funded from base

We have considered the incremental improvement from base as a component of the frontier shift productivity gains. Historically we have assumed a frontier shift of 1.1% each AMP period all delivered through reductions in expenditure. Our forecasts have assumed that an element of the frontier shift is delivered through performance improvements, delivering more for the same level of investment.

Our PR24 submission assumed a frontier shift of 0.61% efficiency on our totex plan. We have assumed the remaining 0.49% improvement is delivered through performance and equal to around £60m of productivity gains or, in performance terms, ODI benefit.

Across AMP8 we are forecasting that our base programme will deliver at least £76m of ODI benefit not including improvements on C-MeX, D-MeX or BR-MeX. This will reduce to around £57m in AMP9 as our performance forecasts improve and we get diminishing returns on investment.

We have used this analysis as the basis for determine ambitious but achievable improvements from base across the AMP10, AMP11 and AMP12 periods by factoring in diminishing returns on investment assumptions to the AMP9 benefits forecast:

- AMP10 delivers 75% of the AMP9 base benefit equal to £41.3m of ODI benefit
- AMP11 delivers 50% of the AMP9 base benefit equal to £28.9m of ODI benefit
- AMP12 delivers 25% of the AMP9 base benefit equal to £16.5m of ODI benefit

The improvement is spread across the performance measures with greater degrees of stretch applied to measures with more opportunity to improve, where long-term Government targets set a sector-wide ambition or where our historic performance has been behind the industry average.

Table F2: Long-term base stretch

Measure	Base ambition
Water supply interruptions	1%
Customer contacts about water quality	6%
Internal sewer flooding	4%
External sewer flooding	8%
Leakage	23%
Per capita consumption	30%
Total pollution incidents	11%
Storm overflows	11%
Mains repairs	6%

The impact of innovation scenarios (technology)

We have considered the impact of an innovation scenario around technology that delivers faster than anticipated. Much of the benefits associated with this scenario manifest as reduced cost and have, therefore, been considered in the frontier shift calculations for costs. We have identified two specific improvements that relate to performance driven by access to open data. They are:

- A 2% improvement in leakage performance
- A 2% improvement in pollutions performance.

Collectively this is equal to around £1.15m additional ODI performance benefit each AMP.

Appendix G: Lessons learned from previous long-term planning cycles

DWMP

Redundancies in the Process

Catchment Screening

At the start of the DWMP planning process, every catchment was screened to assess its risk (pollution flooding, treatment work compliance, etc…) with the aim of removing catchments that aren't at risk before we invest in them. The second stage, BRAVA (baseline risk and vulnerability assessment), is then completed on the remaining catchments. Questions were raised on the usefulness of the first stage as with BRAVA, the initial screening seems redundant. The investigation into this found that 60% catchments got through initial screening, but this only converted to 0.6% of the connected population. There is a continuous improvement step following this, stakeholder workshops are being organised to understand how useful each step has been to each stakeholder and improve for cycle 2. In cycle 2 we will now understand these catchments better, we won't reproduce this analysis, we can just look at catchment change and build this into the model however this needs formalising to get buy in from Ofwat.

CSO Modelling

During initial modelling we looked at storm overflow spills per year, this informed how much storage we would need. Later we looked at surface water separation and realised this would reduce spills. We should have done this at the same time. Understand the exact output of each stage of the process when setting out a timeline for the project will avoid this redundancy at PR29.

Planning Objectives

Some planning objectives don't feel relevant to the DWMP. The team was expected to produce work that wasn't relevant to the original goal (understanding capacity of the network). Examples like internal flooding and sewer collapses were built into the DWMP as primary objectives where they should have been considered wider benefits. To improve from this industry knowledge sharing events have been set up to understand how to avoid deviation from the core objective of the DWMP and improve its framework for cycle 2.

Consultation for Draft Publication

We offered stakeholders (planning and flood authorities) an ARK GIS hub that they could use to pin areas with potential for collaboration. An initial workshop was ran to present the platform and identify an sample of catchments to add to the hub. Following this, the stakeholders were expected to continue their engagement but only had one user continued to submit to the platform. 90 areas identified but 85 of these were added in the initial workshop. In the future more face to face interaction could be useful but we need to understand the core reasons why engagement failed. Current thinking surrounds resource, a lack of perceived value in the platform, a failure to keep the platform salient, and funding issues. We want to engage with our stakeholders but the feasibility of collaboration in the face of insufficient funding is questioned.

Getting Ahead of the Curve

Initial guidance stated no data tables would be required for the DWMP. 10 weeks before draft submission the regulators sent out an additional piece of guidance including data tables. This meant

the modelling outputs collated to that point weren't formatted for the tables provided. Through the team's foresight and production additional analysis early in the process they were able to quickly adapt to the new changes where other companies pushed back.

Similarly, during the introduction of the DWMP we brought together working groups to look forward and consider what Ofwat might ask for. These groups identified the fact that only considering one, most likely, future was an overly simplistic approach and began work investigating different scenarios. Having the foresight to investigate different futures prior to introduction of common reference scenarios (CRSs) made considering the CRSs much simpler than starting from the ground up. We could interpolate the pilot data we had considered and fill the gaps. These groups were vital in ensuring we were prepared for any potential requirements and avoid being surprised.

Working With (Not Against) Regulation

We always took a stance of engaging and helping the regulator where other companies stood their ground and fought against the guidance changes. For example, Ofwat published principals and asked companies to confirm they had met them. Where other companies fought them, we put an extra section in to explain how we had met them. This builds our credibility and gives the perception of a higher quality plan.

WRMP

Having the Correct People

The WRMP24 team is well established and consists of experts in the field. The WRMP is a mature process, EA technical guidance is well defined and understood. Our models and datasets as well as knowledge and capabilities are good. Going into PR19 this was not the case, we required upskilling which took resource from the project and put it into training, it also made the process less efficient as individuals were learning on the job. Having the right individuals who have learnt and understood the process and concepts involved is vital in ensuring the work can be completed efficiently and to a high enough standard first time.

Timing

Introduction of New Requirements

For PR24 the EA introduced new technical methodology requirements e.g. draught analysis. This was a large step up from previous plans and we didn't have enough time to understand these techniques prior to starting work. This led to a lack of understanding and confidence in the solutions we had produced. Being confident in the solutions we propose is important to ensure the narrative can explain them in sufficient detail to convince Ofwat to sign off on our plan and to ensure we are confident that the solution itself is valid. We need forewarning of when these new methods and expectations are coming so we have time to understand these changes.

Misalignment in Timelines

There is a misalignment in the regulatory timelines of the WRMP and PR24 that has created a significant challenge. As per the established sequence, the WRMP is mandated to be completed and submitted ahead of the completion of the PR24 business plan. This arrangement has produced a situation where the WRMP relies heavily on key information in the PR24 business case for its full development. This incongruity in timings has hindered the team's ability to write the WRMP to the required standard prior to their deadlines.

Regional Planning

The second big change from PR19 is regional planning. PR19 regulators were frustrated at the lack of scarce resource sharing between companies (water being plentiful in the north but scarce in the southeast). In response, Ofwat introduced strategic resource option funding with the expectation that it will appear in business plans. Regional plans split the country into 5 regions, each made up of multiple water companies which are expected to work together to reduce the imbalance. However, all regions are working to the same timeline. This presents an issue as STW need to know the amount of water the west region is required to give to the southeast region before they can submit their WRMP. This information is decided by the companies who form the southeast region however they submit according to the same deadline as STW meaning STW cannot complete their analysis before submission. This circular issue presents a significant problem for the WRMP.

Assurance

The WRMP requires board sign off. This means it requires at least 3 lines of assurance which takes too much time. The process was found to be inefficient and resource/time consuming. Since assurers need to have technical knowledge to produce valid assurance, individuals with little capacity are moved onto assurance work. This would be a poor use of their time but without them, assurance moves to the surface level.

Data Expectations

In PR19 we considered one potential future scenario and planned to target the SDB with the understanding that uncertainty is built into our modelling. Following PR19 it was understood that considering one future was overly simplistic and did not provide enough adaptability when the future does not conform to our plans. In response we were asked to consider the CRSs. This was a great improvement from PR19 in terms of our planning but raised a secondary problem surrounding data. The Ofwat and EA data capture systems and expectations are based in data tables that do not translate well to the new CRS methodology as they haven't been sufficiently adapted. This disconnect between planning and data generates more work than is necessary and holds very little value.

WINEP

WINEP Reform

In AMP4/5 the EA provided water companies with a list of obligations that they were to meet. In AMP6, we wanted to be more involved in shaping the program in terms of how the objectives should be delivered. Our involvement was increased in AMP7, working with local EA officers to ensure the objectives are well suited to our regional environment. Despite this, PR19 was still EA led. In consideration of all this the EA and DEFRA put forward the WINEP reform project. Under the recognition that they were not best suited to tell us how to reach our objectives and are better suited to telling us what to hit, the EA produced a new process for WINEP with a new framework that focuses on outcomes rather than outputs. Individual projects are now allowed to be grouped into tier 2 outcomes with a single action ID with sub-actions within. The obligation is to reach the outcome not the individual outputs. This makes switching the output we use to achieve the same outcome a lot easier. This has two main benefits; firstly, as WINEP is made public, previous submissions using outcomes weren't transparent to non-experts. By shifting to an outcome perspective, it becomes more transparent and understandable to the layman. Secondly it allows water companies the flexibility to achieve their target in whatever manner they please.

The objective setting itself has also become company led. At PR24 the spreadsheet containing the 2000+ objectives was filled out by us. This has been a massive improvement as we now have flexibility

to deliver programs in the most efficient and suitable way while still producing the environmental benefits the WINEP program is designed to push through.

There have been two major improvements in timings since the WINEP reform. Firstly, we were given freedom of phasing which allowed us to deliver programs over multiple AMPS. This provided us massively increased flexibility and freedom to produce projects that ran over multiple AMPs or to move schemes into later AMPS. Secondly, regulators have begun communicating the types of outcomes they will be including in the next AMP. This means we can manage schemes across multiple AMPS to deliver more extensive projects. It also provides the benefit of a head start for PR29. As we know what sorts of things will be included in the AMP9 requirements, we won't have to work from a clean slate as some of the planning will already have been completed.

Wider Benefits

In recent years the EA have asked for more information that captures the wider benefits of work being completed. PR24 has been the first time they talked in terms of best value solutions rather than lowest whole life cost. This has allowed STW the freedom to consider the wider benefits of our programs and expand them where appropriate to get better value for money. The longer-term perspective of this price review has given us more opportunity to tailor our solutions accordingly.

Due to the increased flexibility in site investment, we can target investment at sites which are also covered in base expenditure. We have selected sites based on maintaining assets for long term rather than short term trials. We can now tailor our program to maximise economies of scale by targeting sites that have multiple investment drivers (even if some of these are base) which allows us to implement holistic solutions. The ideal assets to invest in are those where multiple improvements can be made at once rather than individual improvement projects. Not only is this more efficient in terms of planning time/costs, but it also produces broader benefits.

Appendix H: Partnerships and third-party funding

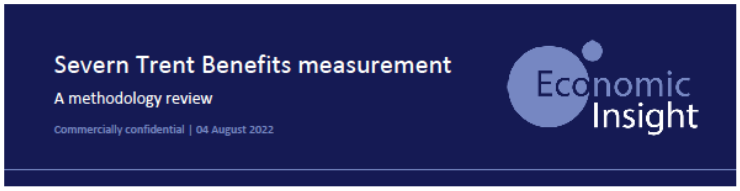
Table H1: Partnerships and third-party funding opportunities

Business Case Ref	Project / Programme	Third-party contribution (£22/23 prices)	Description of Non-Financial Input	Funding Status
08	demand reduction	£2.5m	Innovation partnerships through a variety of routes	Potential
08	biodiversity net gain element of supply schemes	£5m	Partnership agreement and commercial element to arrange partnership	Potential
Base	Keadby Flood risk management scheme	£0.20m	Partnership agreement	In discussion
Base	Melbourne Sewerage and Surface Water Strategy	£1.87m	Partnership agreement	In discussion
Base	Lydney Catchment Strategy	£0.80m	Partnership agreement	Potential
Base	Appleby Magna Sewerage Strategy	£0.20m	Partnership agreement	Potential
Base	Ilkeston Sewerage Strategy	£6.14m	Partnership agreement and land access	In discussion
Base	Perton and Tettenhall scheme	£1.03m	Partnership agreement	Potential
Base	Great Wyrley, Staffordshire	£1.20m	Partnership agreement	Potential
Base	Falcon Lodge, Sutton Coldfield	£0.20m	Partnership agreement	Potential
Base	Tipton & Swan Brook / Walker Street	£2.62m	Partnership agreement	Potential
Base	Bishops Cleeve, Gloucestershire	£0.72m	Partnership agreement	Potential
Base	Coleham, Shrewsbury, Flood Risk Management Scheme	£3.74m	Partnership agreement	Potential
Base	River Teme, Tenbury Wells Community Flood Alleviation Scheme	£14.23m	Partnership agreement	Potential
Base	River Severn, Beales Corner, Bewdley	£7.99m	Partnership agreement	Potential

Base	Wesley Brook, Shifnal, Flood Alleviation Scheme	£2.30m	Partnership agreement	Potential
Base	Blue Lake Road, Solihull	£0.34m	Partnership agreement	In discussion
Base	Hockley Heath, Stratford Road, Solihull	£0.10m	Partnership agreement	In discussion
Base	Derby Flood Risk Management Strategy (OCOR)	£74.94m	Partnership agreement	In discussion
Base	Matlock, Derbyshire	£0.17m	Partnership agreement	In discussion
Base	Hol Brook, Leicester	£0.40m	Partnership agreement	In discussion
Base	Wood Brook and Tributaries Flood Risk Management Scheme	£9.29m	Partnership agreement	Potential
Base	Upper Daybrook Flood Alleviation, Nottinghamshire	£0.25m	Partnership agreement	Potential
Base	Larksmill, Wolverhampton	£0.35m	Partnership agreement	Potential
Base	Eccleshall, Staffordshire	£0.10m	Partnership agreement	Potential
Base	Sandyford Brook Flood Alleviation Scheme, Stafford	£5.10m	Partnership agreement	In discussion
Base	Weddington, Nuneaton	£0.21m	Partnership agreement	Potential
Base	Further Partnership Aspiration on Severn Trent priority areas	£38.90m	Partnership agreement and other inputs	Potential
07	Finham, Stoke Bardolph, Netheridge, Kidderminster	£10.03m	Partnership agreement and other inputs	Potential
04a	INNS Monitoring	£0.27m		Confirmed
04a	INNS Investigations	£1.00m		Confirmed
04b	Catchment	£3.00m		In discussion
Base, 04a, 13	Catchment	£0.25m		In discussion
04b	Catchment	£0.07m		Potential
base 04a, 13	Catchment	£0.20m		Potential
Base	Catchment	£6.80m		Potential

04b	Catchment	£5.30m		Potential
04 a	Catchment	£4.80m		Potential
13	Catchment	£0.15m		Potential
04b	Avon catchment funding through The Nature Conservancy	£0.25m		Confirmed

Appendix I: Independent review of our Benefit Assessment Tool



In this report, we set out the results of our review of Severn Trent's benefits measurement methodologies. To complete our review, we have detailed the methodologies and tools Severn Trent uses to measure benefits across a consistent framework. Overall, we have found that Severn Trent's methodologies for measuring benefits is robust. Specifically, its methodologies follow best practice; and have been developed using the input from external experts; and guidance from bodies such as the Environmental Agency (EA). Nevertheless, on the basis of our review we have developed a series of practical recommendations as to how we consider Severn Trent should measure benefits going forward.

1 Introduction

Severn Trent has a number of tools and methodologies it uses across the business to measure the wider (i.e. social or environmental) value of its activities. These tools and methodologies are used within various teams - and at different points in a project's (or activity's) lifetime. Often these methodologies have been developed specifically in relation to required reporting guidelines. For example, Severn Trent is required to use the EA's National Water Environment Benefit Survey estimates for valuing changes to river quality.

In this context, Seven Trent has asked us to review these tools and methodologies. In particular, Severn Trent would like to understand: (i) which benefits are measured in each methodology; (ii) whether there are major differences or similarities between the methodologies; and (iii) how the methodologies should be used together at PR24.

In the remainder of this report, we set out the following.

- Our framework for reviewing Severn Trent's benefits methodologies.
- Our detailed review of each tool/methodology.
- Practical recommendations for how Severn Trent should measure benefits going forward.

In the accompanying excel file, we also provide our full review of each methodology.

Appendix J: Technology scenario assumptions

Theme	Technology description	Timing	PR24 plan asking customers to pay to get there faster?	Our plan assumptions	how are we stress testing this? Have we assumed tech costs reduce over time? does it support/ justify our timing and sequencing?	Cost and benefit assumptions
smart water network	Auto detection of leaks	Fast: 2035 Slow: 2040	No: included in innovation programme	no change in CBA to 2030, doing 8% leakage reduction from base and 8% from enhancements (mostly mains renewal)	Sensitivity tests on WISDM models to see how cost uncertainty changes mains renewal strategy which then flow into the LTDS optimisation process	£0m in AMP8 as included in innovation programme. Ramped up roll out costs in AMP9 will reduce ALC costs in future scenarios by 20% over current modelled investment
	Real time condition monitoring	Fast: 2035 Slow: 2040	Yes: included tech to monitor network behaviour related to climate triggers in UME01.	no change in CBA to 2030	The insight we already have is helping us target the burstiest mains.	£5m in AMP8 investment absorbed in UME08 enhanced mains renewal. Ramped up roll out in AMP9 (+£25m) and cost saving thereafter by 10% per annum
	Full smart metering	Fast: 2035 Slow: 2045	Yes: Tech uplift to go from AMR to AMI end date 2035 front end loaded	benign (80% by 2030?)	scenarios in UME08 of slow and fast meter installation and we have stress tested AMI v's AMR (50:50 split, 100% AMI). Used same unit cost over time	AMP8 / AMP9 already modelled and therefore factored into ALC and mains renewal costs in CORE pathway
smart wastewater network	Predictive flood and pollution forecasting	Fast: 2035 Slow: 2045	Yes: UME04 to push this faster Extra monitoring at Sutton park in AMP7 base	no one wants to wait to 2040 that's why we're trialling to speed it up.	Add the tech scenarios into UME07 non mod sheets	Roll out costs now included in UME02 for AMP9. Reduced investment in UME07 and UME04 Storm overflows (10% - 20% from 2030?) Urban catchments and overflows) . Pollutions – 10% benefits may accrue
	Automated monitoring and sample of discharge WQ	Fast: 2035 Slow: 2045	Partially we're saying customers pay for the meters and AI set up - stat deadline for WQ monitors is 2035	monitoring in place by 2030 - but high level of uncertainty over the automation. Part of UME04 thinking	the installation of the WQ monitors is statutory by 2035 so can't go slower and can't wait for tech to catch up - what mitigation measures are we taking for the inevitable upgrades to make it easier to switch out - leasing options?	Already modelled and included in UME07 and UME04 with costs reflecting advancing tech from 2030 onwards Reduce unit costs in AMP9 Asset replacement vs maintenance. improved targeting of lower spills and pollution?
	High resolution grid square advanced warning and forecasting of surface water events	Fast: 2035 Slow: 2050	No	will be part of innovation to drive spills down	considered as an enabler for future drive to improve spills and flooding	included in UME07 to mitigate costs of AMP10 to AMP12

Theme	Technology description	Timing	PR24 plan asking customers to pay to get there faster?	Our plan assumptions	how are we stress testing this? Have we assumed tech costs reduce over time? does it support/ justify our timing and sequencing?	Cost and benefit assumptions
	Intelligent sewer technology	Fast: 2035 Slow: 2050	No	will be part of innovation to drive spills down	considered as an enabler for future drive to improve spills and flooding	included in UME07 to mitigate costs of AMP10 to AMP12
	Enhanced monitoring and sampling capability and capacity, including remote monitoring of water bodies	Fast: 2035 Slow: 2050	No	Assumed that will be available in future AMPs	considered as an enabler for future drive to improve river water quality	Factored into scenario for UME04
net zero	Low emission HGV fleet	Fast: 2030 Slow: 2040	Partially have currently got some EV charging points in base other in enhancement	part of our plan to get to net zero has enhancement investment	replacement cost - Stretch efficiency in base	Already factored into core pathway. No further impact from tech scenario
	Decarbonised energy grid	Fast: 2035 Slow: 2035	No covered in base	we're assume that this will happen to Government timescale	OK - noted nothing for us	Already factored into core pathway. No further impact from tech scenario
	Low carbon construction materials	Fast: 2035 Slow: 2050	No: low carbon construction trials in base	We need to offer up some form of notional cost saving as we move - should apply to all	68% of prog is statutory by 2030 so don't have much opportunity but to wait for low carbon tech - we are trying to use as much NBS as possible.	Factor in post 2035 on all water and waste programmes ie reduced LEG investment cost for WINEP and WQ related investments
data	full access to open data	Fast: 2035 Slow: 2050	No: we will trial this in selected catchments	we currently haven't made any assumptions about having access to this data making it easier or harder for us	We have looked at a trial catchment and used this to make an assessment	Other peoples data - what would the savings be. Hackathon benefits (leakage, pollutions, surface water..?) top three areas and savings. 2% saving on future based on wider appreciation on asset deterioration and the impact of failure
	digitisation increases cyber threat	Fast: never Slow: 2050	yes	Our analysis suggests cyber crime is already out pacing us so we will be overwriting the high tech scenario.	We have forecast an Adverse and benign scenarios for UME12	Future costs - in tech scenarios Use ATH / BTH scenarios. No action needed
Internet of Things	smart metering and network telemetry resilient joints etc? AI/ data interrogation.	Fast: 2035 Slow: 2050	No all in base and some in innovation programme	factored in as base efficiency enabler	need to link these innovations to our what base buys out to 2050 analysis	productivity improvements in base 0.5% / year. Consider scenario for a 5% in later AMPs

Theme	Technology description	Timing	PR24 plan asking customers to pay to get there faster?	Our plan assumptions	how are we stress testing this? Have we assumed tech costs reduce over time? does it support/ justify our timing and sequencing?	Cost and benefit assumptions
	Common data sharing protocols remote inspections					
Fifth industrial revolution	Self-healing networks	Fast: 2035 Slow: 2050	No	Not included in core pathway	qualitative assessment of likely impact	Will not impact renewal rates until the long term - negligible impact. But benefits will be to base
	Developments in bioscience, for example to reduce carbon emissions and treat wastewater more efficiently	Fast: 2035 Slow: 2050	No	Not included in core pathway	qualitative assessment of likely impact	Avoidance of replacement cost of existing Net Zero process emissions investment post 2035. Impact on base - relating to treatment opex Impact on base - relating to treatment opex
	Treatment/ mitigation of emerging pollutants (e.g. PFAS)	Fast: 2035 Slow: 2050	No	UME08 - assume that future treatment will keep pace with emerging pollutants. UME13 - increasing future challenges	qualitative assessment of likely impact	Already covered in an UME13 legislative adaptive pathway
	Low carbon treatment and disposal of sludge	Fast: 2035 Slow: 2050	No	UME13 - will this offset some of the challenges? UME14	qualitative assessment of likely impact	Already covered in an UME14 legislative adaptive pathway. Considered unlikely based on AMP8 proposals.
	Nutrient recovery tech - circular economy stuff	Fast: 2035 Slow: 2050	No	Not included in core pathway	qualitative assessment of likely impact	Recovery costs far exceed cost of raw material at present, only viable if there is a renewables obligation. Assume 1% reduction post 2035
Nature-based solutions	State of the art nature-based solutions toolkit, enabled by monitoring and/or blockchain platforms	Fast: 2035 Slow: 2050	No	factored into AMP10 to AMP12 assessment of core pathway	notionally 6% already factored into AMP8 (UME07). UME08 - CRT/Mine water	6% ramping to 15% of lines relating to third party funding (UME07, UME04 08/13 will get something) post 2030. increase secondary benefits - biodiversity and carbon
	NBS to achieve Technical achievable limit? Space saving tech?	Fast: 2035 Slow: 2050	No	factored into AMP10 to AMP12 assessment of core pathway	NBS currently treat to c2mg/l P with TAL at 0.25mg/lP so not considered a viable option.	technical achievable limit (P, NH4) - upward pressure (how many sites beyond TAL?) add on. Upward pressure

Theme	Technology description	Timing	PR24 plan asking customers to pay to get there faster?	Our plan assumptions	how are we stress testing this? Have we assumed tech costs reduce over time? does it support/ justify our timing and sequencing?	Cost and benefit assumptions
Emissions-reducing technologies	Increasing availability, higher quality and lower cost of low-carbon construction materials	Fast: 2035 Slow: 2050	No	covered in Net Zero analysis	n/a	Factor in post 2035 on all water an waste programmes ie reduced LEG investment cost for WINEP and WQ related investments
	carbon-free baseload electricity and low-emission HGVs and fleet	Fast: 2035 Slow: 2050	No	covered in Net Zero analysis	n/a	Already factored into core pathway. No further impact from tech scenario
Societal attitudes:	Varying speed of economy-wide openness to behaviour change	Fast: 2035 Slow: 2050	No: aggressive behaviour change on PCC	link to LTDS customer research	Covered in uncertainty analysis and sensitivity tests as part of DMU	impacts on benefits covered in Societal Adaptive pathway
Resilience:	Possible need for low-tech fall backs as reliance on digital solutions increases: ensuring resilience to electricity/digital outages.	Fast: 2035 Slow: 2050	No	covered mostly by cyber scenario	n/a	include in narrative only
Demand impacts:	Possible increases in demand from new technologies, such as carbon capture and storage, and blue/green hydrogen production	Fast: 2035 Slow: 2050	No	do we have an UME08 scenario to cover this?	part of WRMP analysis - covered in the uncertainty modelling	Covered off in WRW regional plan and therefore factored into our PR24 plan. Small impact in the region.
Company added	lead detection and replacement technology	Fast: 2035 Slow: 2050	No	not affecting core AMP8 pathway	will impact a plausible future enabling faster delivery of desired outcome	review legislation scenario Covered in LEG scenario. Top down adjustment of assumed 20% increase in efficiency
	phosphate dosing efficacy lower than 10ug/l	Fast: 2035 Slow: 2050	No	not affecting core AMP8 pathway	n/a - may drive increased costs	negligible impact - not factored in
	WWTW bacteria removal processes (bathing rivers)	Fast: 2035 Slow: 2050	No	not affecting core AMP8 pathway	n/a	No longer an UME but monitor for PR29