

April 2022

# PR24 and beyond: Final guidance on long-term delivery strategies

## About this document

This document sets out our final guidance on long-term delivery strategies at PR24. This follows our [discussion paper](#) in November 2021.

To help make the right decisions for the long term, water companies should set out their five-year business plans in the context of a 25-year long-term delivery strategy. These strategies will outline the long-term outcomes the company aims to deliver, and how they will deliver them in a range of plausible futures.

This document outlines our requirements for what companies should include in their strategies at PR24. This includes using adaptive pathways planning to present the strategies, using future scenarios to test and develop the adaptive pathways, and providing evidence that the strategy represents the best way to meet long-term objectives. We also respond to company and stakeholder feedback on our discussion paper.

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# 1. Executive summary

## **The water sector in England and Wales faces a series of long-term challenges.**

Meeting these challenges will require business planning decisions to be made in a long-term context. At PR24, water companies should therefore set out their five-year business plans in the context of a 25-year long-term delivery strategy. This will help ensure that what is delivered in the short term is likely to maximise long-term value for customers, communities and the environment.

**Our statutory duties require us to look to the future as well as the present.** Among other things, we must carry out most of our work in the way we consider will best protect the interests of existing and future consumers, as well as to secure the long-term resilience of companies' systems, including to secure that companies take steps to enable them to meet the need for water supplies and wastewater services in the long term. Companies also have general duties to provide and develop water supply and wastewater systems to ensure they will continue to be able to meet their obligations in the future.

**Setting the price review in a long-term context helps to deliver the UK and Welsh Government's strategic priorities.** The UK Government's strategic policy statement (SPS) for Ofwat expects us to challenge the sector to 'plan, invest in, and operate its water and wastewater services to secure the needs of current and future customers, in a way which delivers value to customers, the environment and wider society over the long term'.<sup>1</sup> It considers a shift towards long-term adaptive planning by water companies will be required. The Welsh Government's SPS identifies the long term as a priority and states 'the regulatory framework should seek to ensure that Welsh companies do not delay appropriate investment in the short term to the detriment of the interest of future customers'.<sup>2</sup>

**We will therefore consider long-term delivery strategies when we assess business plans at PR24.** The higher the quality of the strategies that companies produce, the better we can take them into account in our decisions at PR24 and beyond. We expect the strategies to represent a significant shift towards long-term adaptive planning in the sector, and to improve decisions about how to deliver long-term outcomes.

## 1.1 Requirements for long-term delivery strategies

**We expect companies to develop their long-term delivery strategies in line with our guidance.** Companies may wish to go further than these requirements, for example to reflect their specific circumstances.

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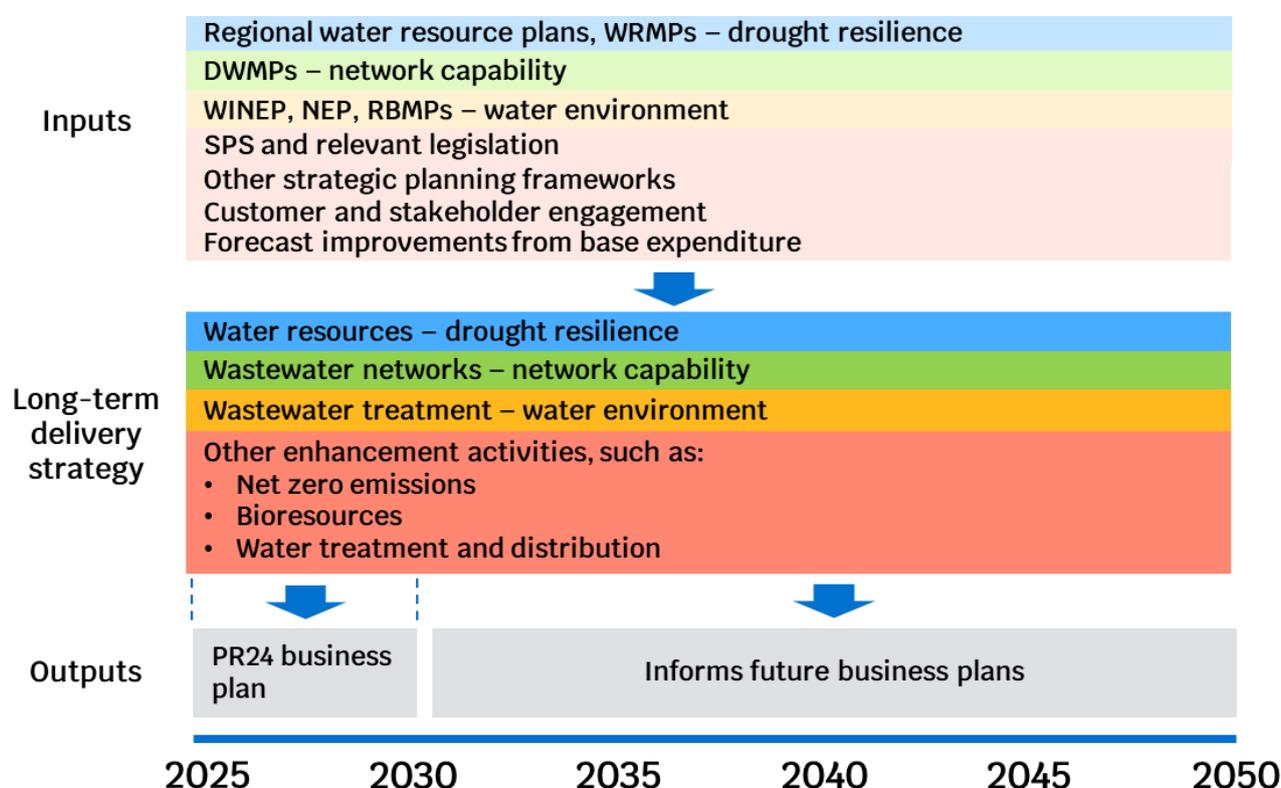
<sup>1</sup> Defra, '[The government's strategic priorities for Ofwat](#)', February 2022.

<sup>2</sup> Welsh Government, '[Strategic Priorities and Objectives Statement to Ofwat issued under section 2B of the Water Industry Act 1991](#)', November 2017.

The long-term delivery strategy should set out the long-term outcomes the company aims to deliver. It should then:

- bring together all the strategic planning frameworks and statutory environment programmes;<sup>3</sup>
- include planned enhancement activities that lie outside of these frameworks, taking into account forecast performance improvements from base expenditure;
- integrate these activities into a holistic 25-year framework; and
- use the first five years of the strategy to form the PR24 business plan (see Figure 1.1).

**Figure 1.1 Key inputs and outputs of a long-term delivery strategy**



Long-term delivery strategies should consist of five main parts, as set out in Figure 1.2. This information should include supporting data, including estimated costs, outcomes and bill impacts. It will be important that companies demonstrate how their strategy has been informed by customer preferences, and, in Wales, that the outputs of the collaborative approach have been used to develop the strategy.

<sup>3</sup> Strategic planning frameworks include regional water resources plans, water resources management plans (WRMPs), drainage and wastewater management plans (DWMPs), flood risk management plans (FRMP), river basin management plans (RBMPs) and shoreline management plans (SMP). Statutory environmental requirements are identified through the Water Industry National Environment Programme (WINEP) in England and the National Environment Programme (NEP) in Wales.

**Figure 1.2 Structure of a long-term delivery strategy**

<b>Ambition</b>	<b>What the company aims to achieve over the next 25 years</b>	<b>Informed by customer engagement and supported by data</b>
	Vision statement and performance commitment forecasts	
<b>Strategy</b>	<b>How the company will meet its ambition in a range of futures</b>	
	Adaptive pathways and accompanying narrative	
<b>Rationale</b>	<b>Why the strategy is the best way to meet the ambition</b>	
	Evidence provided in line with our guidance	
<b>Foundation</b>	<b>Underlying information behind the strategy</b>	
	Key assumptions and uncertainties clearly set out	
<b>Board assurance</b>	<b>How the Board has provided appropriate challenge and scrutiny</b>	
	Board assurance statements	

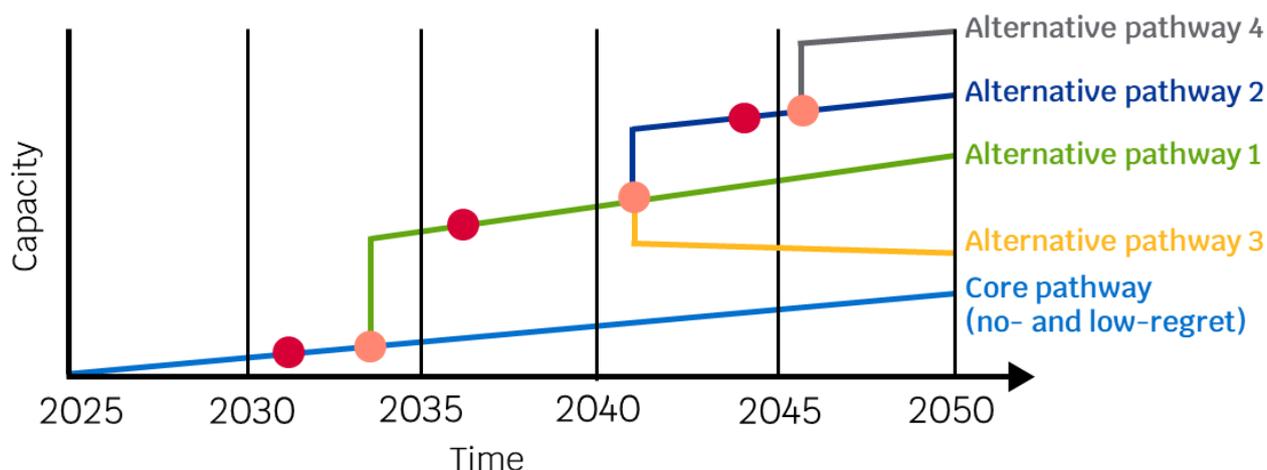
**Adaptive planning should be at the heart of the long-term delivery strategy.** Adaptive pathways help to show what activities will be dependent on certain circumstances, and what is required in most or all plausible futures. This helps to optimise the profile of key interventions across time, ensuring that decisions are not avoided when they are needed, while minimising the risk of stranded assets. It can establish what activities are needed now, and where decision points can be usefully scheduled later in the strategy, when there is likely to be greater certainty about what is needed. It can also help consider where to bring forward investment and where to invest to create flexibility.

**Under this approach, adaptive pathways set out how decisions will be made under different plausible circumstances.** The pathways contain decision points, indicating when a decision needs to be taken to deliver the company's ambition. At these points, pathways deviate from each other as different sets of options are chosen. These choices should be informed by pre-defined trigger points, which set out the conditions that would cause one pathway to be adopted over another, using clear and observable metrics supported by a monitoring plan.

**All key enhancement activities should be set out in terms of adaptive pathways.** This means showing how the strategy will adapt to changes in factors such as climate change and demand. Companies should aim to form the most efficient pathways possible to meet long-term outcomes, given future uncertainties. Companies should also provide a clear, holistic narrative on how they expect to meet their long-term ambition, including their approach to maintaining and improving existing assets as part of base activities.

The strategy should present a **core adaptive pathway of enhancement activities**. It should then set out **alternative adaptive pathways** which could be triggered depending on how future uncertainties develop (see Figure 1.3).

Figure 1.3 Example core and alternative adaptive pathways



- Decision point: the latest point at which a decision on moving to an alternative pathway should be taken
- Trigger point: the point at which an alternative pathway will be followed

**The core pathway is consistent with best practice adaptation techniques and should include all activities that need to be undertaken to be ready for all plausible future scenarios.** The core pathway must include any activities that meet the following criteria:

- **'no and/or low regrets'** investments, for example investments that are required:
  - in both benign and adverse scenarios;
  - across a wide range of plausible scenarios; or
  - need to be undertaken to meet short-term requirements; and
- investment **required to keep future options open** (such as enabling work or learning and monitoring), where possible, or is required to minimise the cost of future options.

Where investments do not meet these criteria, but are important for meeting more adverse scenarios specifically, they should be set out within alternative pathways, with decision and trigger points identified. Companies should integrate their water resource management plans (WRMPs) and drainage and wastewater management plans (DWMPs) into their strategies by presenting their central or 'most likely' pathway as an alternative pathway.

We set out our requirements for long-term delivery strategies in full in section 3.

## 1.2 Scenario testing

**Scenario analysis is integral to adaptive planning.** It helps to optimise pathways by testing their robustness to future uncertainties. This will help to ensure that long-term outcomes will be delivered as efficiently as possible, given the information available at the

time. It also improves the confidence of stakeholders that the strategy has been developed through a robust process.

Companies should test the whole of their enhancement investment strategy against the **common reference scenarios**, developed following workshops and discussions with companies and wider stakeholders. These scenarios set out two parameters for four material drivers of uncertainty around future enhancement spending: **climate change**, **technology**, **demand** and **abstraction reductions**.<sup>4</sup> We expect companies to use these scenarios as a starting point. They do not take away companies' ownership of the scenario planning that is needed to ensure strategies are robust to a wide range of plausible futures (see Figure 1.4).

**Figure 1.4 Expectations for scenario testing**

	Climate change	Technology	Demand	Abstraction reductions	Wider scenarios
'Adverse' scenarios	High: RCP8.5	Slower: slower development than expected	High: higher growth forecasts	High: 'Enhanced' scenario (in England)	Material local or company-specific factors, as appropriate
'Benign' scenarios	Low: RCP2.6	Faster: faster development than expected	Low: lower growth forecasts and legislation on building regulations and product standards	Low: Current legal requirements (in England and Wales)	Parameters between the reference scenarios, e.g. a 'medium' scenario, as appropriate
<b>Mandatory</b> Impacts presented separately					<b>Discretionary</b> Can be combined if plausible

**The reference scenarios are not necessarily the most likely scenarios that may happen.** Instead, they are 'plausible extremes', which offer a full spectrum of possible futures: from a more 'benign' future to a more 'adverse' one. Within this spectrum, the strategy should deliver its ambition for customers and the environment.

We therefore expect the set of core and alternative pathways in each long-term delivery strategy to be able to deliver the company's ambition under at least all the reference scenarios. However, this does not mean we expect an alternative pathway for each scenario. For example, the package of investment described by the core pathway might be able to meet outcomes under one or more of the reference scenarios. **It is up to companies to determine how many alternative pathways are required to achieve their long-term ambition in a range of plausible futures.**

<sup>4</sup> As we set out in section 2, 'plausible' means the scenario is possible, but not necessarily the most likely.

**It is essential that all scenarios used to test the long-term delivery strategy are plausible.** This is especially important when companies combine scenarios to create a new, less likely, scenario. Because each of the reference scenarios represent 'plausible extremes', combining them all together risks generating a very low probability scenario. To avoid this, when presenting the results of testing the strategy, companies should set out the estimated impact of each individual reference scenario.

To ensure the strategies are robust, they **should be subjected to wider scenario testing, beyond the reference scenarios we have set out.** This could include testing against scenarios that describe other material local or company-specific factors, where appropriate. It may also include testing parameters between the 'plausible extremes' described by the reference scenarios, such as a 'medium' scenario. Within wider scenario testing, scenarios may be usefully combined if they are considered relatively likely and, in aggregate, produce a plausible future scenario.

We set out our requirements for scenario testing in full in section 4.

## 2. Introduction

### **As we look ahead to PR24 and beyond, we face several long-term challenges.**

Together, we need to tackle demands from climate change and respond to rising expectations around service and the environment, while recognising increasing pressures on customers' ability to pay their bills. Since PR19, companies and governments have set a number of long-term targets and objectives for the sector, with further targets to be set under the Environment Act.<sup>5</sup>

### **To help make the right decisions for the long term, companies should set out their five-year business plans in the context of a 25-year long-term delivery strategy.**

These strategies will outline the long-term outcomes the company aims to deliver, and how they will deliver them in a range of plausible futures.

**This process will help companies to think carefully about how they sequence their activities to achieve their objectives in the best value way over the long term.** The strategies should identify, given future uncertainties, what activities need to be undertaken at PR24 to meet long-term outcomes. They should also show what can be better addressed in future periods. Therefore, they can help clearly set out the choices being made around the timing and scale of activities over the long term, and explain why those choices can maximise value for customers, communities and the environment.

**We want to support the enhancement investment that is needed to meet long-term goals.** At PR24, we will expect companies to demonstrate the need for enhancement investments with reference to the long-term delivery strategy. The higher the quality of the strategies that companies produce, the better we can take them into account in our decisions at PR24 and beyond. We expect the strategies to represent a significant shift towards long-term adaptive planning in the sector, and to improve decisions about how to deliver long-term outcomes.

**Companies should also consider how performance improvements from base expenditure will help to deliver their long-term ambition.** The effective management of assets is vital to meet the long-term challenges the sector faces. We expect companies to understand the long-term risks to customers and the environment from asset failure and to explain how they will effectively manage them. Enhancement investments should then build on these activities to meet long-term objectives.

**In response to our discussion paper in November, we were pleased that companies and wider stakeholders responded positively towards the introduction of long-term delivery strategies.** We received feedback on points of detail that we have endeavoured to address and respond to across this document. We set out the key feedback we received, and our response to each, in Appendix 1. We would like to thank everyone who has helped to

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<sup>5</sup> Defra, '[Consultation on environmental targets](#)', March 2022.

shape our policy thinking. We expect our approach will continue to evolve, in collaboration with the sector, for PR29 and beyond.

**This document represents our final guidance on long-term delivery strategies for PR24.** We will restate our guidance in this area in our PR24 methodology, but we do not anticipate making substantive changes. Recognising that long-term delivery strategies are being produced for the first time at PR24, we will provide an opportunity for companies to receive high-level feedback on the development of their strategies. This process will not be mandatory and will focus on high-level elements of the strategies.

### Box 1: Key definitions

**Adaptive pathway:** a package of planned investments over time (see section 3.2.1). 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 (see section 3.3.2). 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 (see section 3.3.3). These circumstances are described by a **trigger point**.

**No-regret investment:** investments that are likely to deliver outcomes efficiently under all **plausible scenarios** (see Box 3, section 3.3).

**Low-regret investment:** investments that are likely to deliver outcomes efficiently under a wide range of **plausible scenarios** (see Box 3, section 3.3).

**Trigger point:** the circumstances in which an **alternative adaptive pathway** would need to be followed (see section 3.3.3).

**Decision point:** the point in time when a decision would need to be taken about whether an **alternative adaptive pathway** is followed (see section 3.3.3). 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.

**Benign scenario:** a **scenario** that describes a less demanding change in a material factor than expected. Meeting long-term objectives under this scenario may involve lower enhancement investment than under an **adverse scenario**.

**Adverse scenario:** a **scenario** that describes a more demanding change in a material factor than expected. Meeting long-term objectives under this scenario may involve higher enhancement investment than under a **benign scenario**.

**Base expenditure:** routine, year-on-year costs, which companies incur in the normal running of their business to provide a base level of good service to customers and the environment and maintain the long-term capability of assets.

**Enhancement expenditure:** generally, investment to achieve a permanent increase or step change in the current level of service to a new 'base' level and/or the provision to new customers of the current service. Enhancement funding can be for environmental improvements required to meet new statutory obligations, improving service quality and resilience, and providing new solutions for water provision in drought conditions.

## 3. Requirements for long-term delivery strategies

This section sets out our guidance for long-term delivery strategies. Strategies should cover water and wastewater activities, including bioresources.

Long-term delivery strategies should be made up of five parts:

- **Ambition:** what the company aims to achieve over the next 25 years;
- **Strategy:** how the company will aim to meet this ambition over the next 25 years;
- **Rationale:** why the long-term delivery strategy represents the best way of meeting the ambition;
- **Foundation:** the key assumptions and uncertainties underpinning the strategy; and
- **Board assurance:** how the company Board has challenged management to deliver a high-quality long-term delivery strategy.

We expect the ambition and strategy sections to be informed by **customer engagement** and set out our expectations below. We also expect companies to provide **supporting data**, and we will propose data tables as part of the PR24 draft methodology in July.

This guidance outlines our minimum requirements for long-term delivery strategies. **Companies are welcome to go further than the requirements set out in this guidance**, for example, to reflect their specific circumstances or to cover additional areas as they consider appropriate.

### 3.1 Customer engagement

We expect companies to engage with their customers to support the development of long-term delivery strategies at PR24.<sup>6</sup> Customers and their representatives must be able to challenge the strategies. Challenge should be focused on the full range of areas where customers and communities can have meaningful views, including:

- water and wastewater services (where applicable to the company);
- customer services;
- significant investment (large one-off schemes);
- performance levels; and
- bill impacts.

Challenge should focus on important and material or urgent issues which companies should incorporate into their strategies. Engagement should support customers to inform the company's long-term ambition and the phasing of key investments. This includes future

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<sup>6</sup> Ofwat, '[PR24 and beyond: Customer engagement policy – a position paper](#)', February 2022, p. 4.

customers and those in circumstances that might make them vulnerable or hard-to-reach, including those that are transiently vulnerable.

We are conscious of the challenges around obtaining meaningful views on long-term preferences.<sup>7</sup> However, we consider these issues can be at least partially alleviated through good research design.<sup>8</sup> For example, research by CCW has found that one of the least appropriate areas for customer research relates to 'very long-term planning and future scenarios'. However, it also finds customers can make meaningful contributions about investment scenarios in the next 5-15 years. In terms of research design, it advises that 'rooting research in consumers' current and historic experiences and extrapolating from this the principles on which future plans should be developed' can produce meaningful inputs.

We expect companies to balance current customer preferences and priorities against other relevant considerations, such as longer-term efficiency and fairness between current and future customers. We expect company research on long-term issues to be 'fit for purpose', for example to ensure the sample and methodology is appropriate for the research objectives.<sup>9</sup>

Companies should present evidence that their strategies are informed by customer preferences in two key areas:

- **Ambition.** We will expect any long-term objectives, over and above any statutory requirements, to be informed by customer views. We will expect companies to consider the coherency between their proposed performance commitment levels for PR24, their forecast performance commitment levels up to 2050, and the customer evidence used to inform its ambition, and, where appropriate, to explain how and why these differ.
- **Strategy.** We will expect companies to use evidence of customer priorities and preferences to inform the selection and sequencing of key enhancement investments for the core pathway up to 2050.

## 3.2 Ambition: where will the company be in 25 years?

We received broad support for our proposed requirements for this section. We have therefore made no material changes from our discussion paper.

The long-term delivery strategy should start with the company's **vision** statement. This should articulate what the company would like to achieve over the next 25 years, how it wants to position itself and how it wants to be seen. It should provide a focus for the company

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<sup>7</sup> For example, research by CCW and Blue Marble has found that one of the least appropriate areas for consumer research relates to inputs relating to 'very long-term planning and future scenarios'. CCW, Blue Marble, ['Engaging water customers for better consumer and business outcomes'](#), April 2020, p. 5.

<sup>8</sup> CCW, Blue Marble, ['Engaging water customers for better consumer and business outcomes'](#), April 2020.

<sup>9</sup> Ofwat, ['PR24 and beyond: Customer engagement policy – a position paper'](#), February 2022, p. 6.

as well as being clear and concise. Company ambition should have regard to our public value principles.<sup>10</sup>

The strategy should then set out what this vision would **mean for customers and the environment over the next 25 years**. To ensure consistency and comparability across companies, it should set out what the company will deliver in terms of key performance outcomes during this period. This should include all PR24 common performance commitments, except those based on compliance (such as compliance risk index) or relative performance (such as C-Mex). It should also cover key output metrics from strategic planning frameworks, such as additional water capacity delivered and wastewater storage capacity delivered. We will be refining the list of common performance commitments during the development of the PR24 methodology.<sup>11</sup>

Company ambition for the level of performance outcomes and metrics should be informed by a range of factors, including:

- **for English companies, the UK Government's statement setting out strategic priorities and objectives for Ofwat**, referred to in this document as the UK Government's strategic policy statement,<sup>12</sup> and
- **for Welsh companies, the Welsh Government's statement setting out strategic priorities and objectives for Ofwat**, and the Water Strategy for Wales;<sup>13</sup>
- **relevant legislation**, including:
  - **in England, the Environment Act 2021 and targets to be set under it**,<sup>14</sup> and related targets set by the Environment Agency;
  - **in Wales, the Environment Act 2016**;
- outputs from **strategic planning frameworks** including regional water resource planning, WRMPs, DWMPs, River Basin Management Plans (RBMPs) and Flood Risk Management plans (FRMPs);
- outputs from **statutory environmental programmes**, such as the Water Industry National Environment Programme (WINEP) in England, and the National Environment Programme (NEP) in Wales;
- **customer and stakeholder preferences**; and
- **ongoing service improvements** that the company expects to make over time as technology and processes improve (see section 3.5.2).

Company ambition should also reflect the particular challenges the company faces. The long-term delivery strategy should therefore explain the current **issues facing the company and the sector**, how these are likely to impact the company over the short and long term, and

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<sup>10</sup> Ofwat, '[Ofwat's Final Public Value Principles](#)', March 2022.

<sup>11</sup> We set out our emerging proposals for performance commitments at PR24 in Ofwat, '[PR24 and beyond: Performance commitments for future price reviews](#)', November 2021.

<sup>12</sup> Defra, '[The government's strategic priorities for Ofwat](#)', February 2022.

<sup>13</sup> Welsh Government, '[Water Strategy for Wales](#)', May 2015.

<sup>14</sup> Defra, '[Consultation on environmental targets](#)', March 2022. The targets will be brought forward by 31 October 2022.

how these issues are expected to change over the next 25 years. The company should highlight the areas of **strength** that it expects to build on, as well as areas where the company is **working to improve performance**.

### Box 2: A collaborative approach to the long term in Wales

The legislative and policy frameworks in Wales encourage a collaborative 'way of working'. We have therefore engaged with the key stakeholders in the water sector in Wales, including the water companies, Hafren Dyfrdwy and Dŵr Cymru, Natural Resources Wales (NRW), the Welsh Government, the Drinking Water Inspectorate (DWI) and the Consumer Council for Water (CCW) and agreed that there would be merit to implementing a 'collaborative approach' in Wales for PR24.<sup>15</sup>

This would allow the relevant stakeholders to provide early feedback on the high-level, long-term outcomes that the water companies propose in PR24. We think the collaborative approach, and engagement with the key Welsh stakeholders at the Wales PR24 forum, will provide a platform to help clearly articulate which outcomes will be delivered, and when they will be delivered over the next 25 years.

The outputs of the collaborative approach, as well as what is learnt from wider stakeholder and customer engagement and the other factors listed above, should be used by the water companies to help develop their long-term delivery strategies.

## 3.3 Strategy: how will the company get there?

This section **should set out how the vision and ambition will be delivered**. This should be done in two main ways:

- 1) providing **a clear narrative on how the company expects to achieve the ambition and vision**. For each of the targeted areas of improvement, this should set out how the ambition will be achieved and the measures that need to be put in place, including how the company's approach to its future base and enhancement activities will contribute to meeting long-term outcomes; and
- 2) outlining the company's **strategy up to 2050, using adaptive planning techniques**. This should set out the key enhancement activities that will likely be required given a range of plausible circumstances. These activities should build on the company's forecast performance improvements through base cost allowances (see section 3.5.2). The first five years of the strategy should form the company's PR24 business plan.

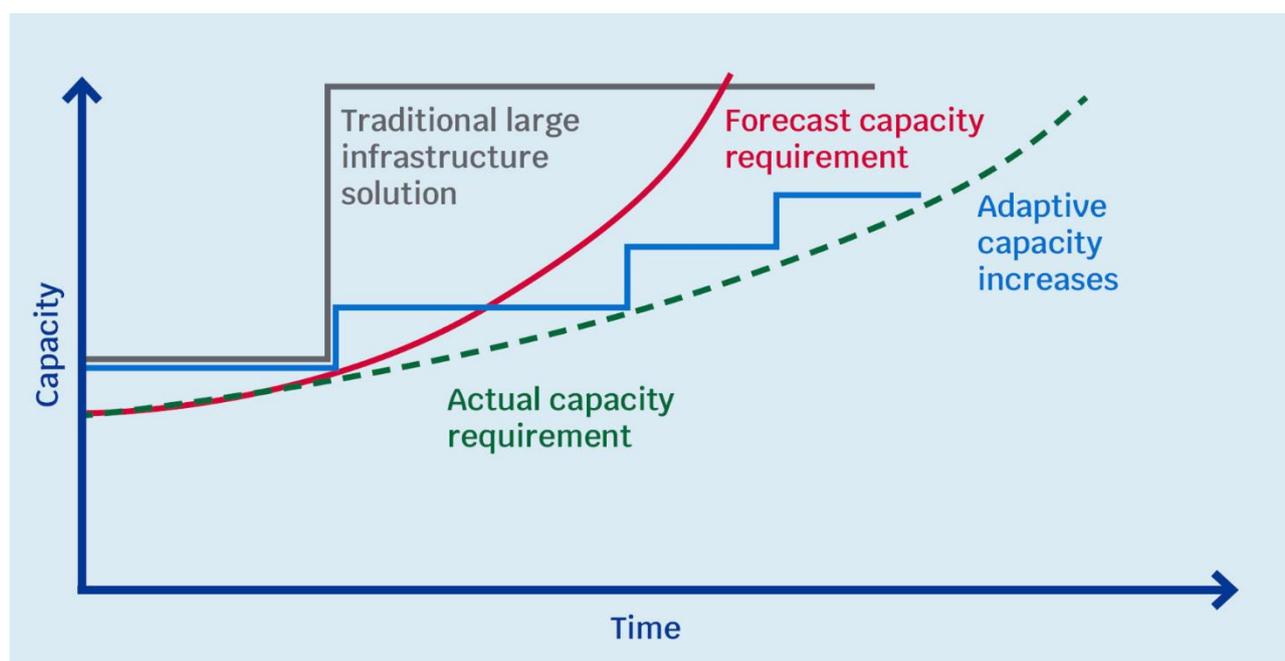
<sup>15</sup> Ofwat, '[PR24 and beyond: A collaborative approach in Wales](#)', March 2022.

**Adaptive planning** should be at the heart of the long-term delivery strategy. The future is inherently uncertain, and it is important that the strategy is flexible enough to cope with changes in circumstances so it is robust over time. The adaptive planning approach enables strategies to be developed in the context of different future scenarios. It aims to optimise the profile of key interventions across time, **ensuring that decisions are not avoided when they are needed** – for example, to ensure resilience against adverse scenarios – while **minimising the risk of stranded assets** should more benign scenarios come to pass.

Adaptive planning can therefore establish **what enhancement investments are needed now, and where decision points can be delayed until later in the timeline**, when there is likely to be greater certainty about what is needed, including possibly technology change. It can also help evaluate **where and when to bring forward investment to create flexibility**.

As shown in Figure 3.1, adaptive planning can facilitate the delivery of solutions that more closely reflect what later turns out to be required than building large infrastructure now on the basis of uncertain assumptions about the future.

**Figure 3.1 Adaptive solutions (e.g. modular or flexible solutions) versus traditional large infrastructure solutions**



It may be the case that a large infrastructure solution is likely to be the most efficient solution, even if it goes beyond the actual capacity requirement in the near term. This possibility is not ruled out by adaptive planning. However, in the first instance, we encourage companies to **explore options to meet long-term outcomes using flexible, modular or adaptive solutions where possible and efficient to do so**. These solutions can later be expanded as new information arises and there is a higher level of certainty around the impact of external factors.

We expect the adaptive pathways **to focus on the requirements for enhancement expenditure** to meet the company's ambition. Base expenditure will contribute towards this ambition, and companies should explain in their accompanying narrative how their approach towards asset management will help meet long-term objectives. Companies should also forecast long-term performance improvements from base expenditure (see section 3.5.2).

A major focus of adaptive planning is on the timing of large new investments. But companies should also consider wider interventions, such as:

- **modular or adaptive solutions**, that can be scaled up with time according to new information;
- **behaviour change**, for example to reduce water use;
- **operational solutions**, for example nature-based solutions;
- **partnership working**, for example around catchment management, and collaboration with other water companies where appropriate, for example to develop new innovations and solutions;
- **learning**, for example from the Ofwat innovation fund projects and from overseas and other sectors;
- **testing** through local and production scale pilots; and
- **interventions at systems level** as well as at the individual infrastructure level.

While the strategy should set out the interventions required to 2050, it should also have regard to major issues and pressures beyond this period which could justify interventions up to 2050.

### Box 3: Adaptive planning and pathways

The UK Government's strategic policy statement states that companies should 'shift towards long-term adaptive planning'.<sup>16</sup> The Water Strategy for Wales highlights the importance of taking adaptive and incremental measures in the short and medium term, given uncertainties around the rate and impact of climate change.<sup>17</sup>

Under the adaptive planning approach, **adaptive pathways** set out how decisions will be made in future, under different plausible circumstances. The pathways contain clear **decision points**, indicating when a decision needs to be taken about the right option to efficiently deliver long-term outcomes. At these points, pathways deviate from each other as different sets of options are chosen.

<sup>16</sup> Defra, ['The government's strategic priorities for Ofwat'](#), February 2022. Examples of how this shift has already started include the guidance for the production of the latest round of WRMPs and the first DWMPs, both of which promote the use of adaptive planning approaches, and the latest [National Flood and Coastal Erosion Risk Management Strategy for England](#), which commits that, by 2025, 'water companies and other risk management authorities will ensure that long-term adaptive planning for flooding and coastal change is better coordinated with the next and subsequent cycles of planning for water and wastewater investments'.

<sup>17</sup> Welsh Government, ['Water Strategy for Wales'](#), May 2015, p. 15.

These choices should be informed by pre-defined **trigger points**, which set out the conditions that would cause one pathway to be adopted over another, using clear and observable metrics supported by a monitoring plan.

Well-designed adaptation measures should, in most circumstances:

- not foreclose future options or unnecessarily constrain future choice;
- be efficient, effective and equitable under the widest set of all plausible futures;
- enable appropriate modification of policies, plans and projects as the reality of the future becomes known; and
- account for the potential impacts of adaptation across different groups and ensure that the reduction in social damage from adaptation justifies the costs of implementing the measure.<sup>18</sup>

The UK Government's Supplementary Green Book Guidance sets out that approaches which promote good adaptation should **identify 'no-regret' or 'low-regret' actions as an early priority**.<sup>19</sup> No-regret options are likely to deliver outcomes efficiently under all plausible scenarios. Low-regret options are likely to be the most efficient option under a wide range of plausible future scenarios.

Where there are long lifetimes associated with decisions, particularly where there are long lead times and risks of 'lock-in', the guidance advises that adaptive approaches should be used so that investments can adapt to changing risks. Decisions relating to adaptation should take account of the magnitude of risk, but also the urgency of the risks. This means different adaptation actions may be appropriate depending on the context of the decision.

## Strategic planning frameworks and statutory environment programmes

The long-term delivery strategy should draw on outputs from strategic planning frameworks, alongside planned investments in areas not covered by these processes. Strategic planning frameworks identify long-term programmes for regional water resources, water resources management (WRMP), drainage and wastewater management (DWMP), flood risk management (FRMP), improvement of the water environment at a river basin district level (RBMP), and management of coastal risks (SMP). Statutory environmental requirements will also be identified through the WINEP and NEP.

We have set expectations that adaptive planning should be used for WRMPs and DWMPs.<sup>20</sup> As explained in section 3.3.4, companies should present their 'most likely' pathway from their WRMPs as an alternative pathway in their long-term delivery strategies, where this is not the

<sup>18</sup> As set out in UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020, pp. 18-19.

<sup>19</sup> UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020, p. 19.

<sup>20</sup> Ofwat, '[Ofwat's expectations for strategic planning frameworks at PR24](#)', November 2021, pp. 9-10.

same as the core pathway. The same approach should be taken where a 'most likely' or 'central' pathway is used in DWMPs.

Companies should assume that all requirements set out in the current WINEP and NEP are completed as part of the strategy. Companies should also consider statutory environmental activities beyond current requirements. In England, the WINEP methodology sets out that actions should be developed as part of a long-term enhancement strategy and that companies should plan to a 25-year time horizon.<sup>21</sup> This should draw on long-term planning frameworks, including WRMPs, DWMPs, RBMPs and Local Plans where appropriate. We expect companies in Wales to draw on these frameworks and to develop their strategy collaboratively with Welsh Government, Natural Resources Wales and other stakeholders.

The Regulators' Alliance for Progressing Infrastructure Development (RAPID) is facilitating and assessing 18 different strategic water resource options through a gated process to be construction ready in 2025–30.<sup>22</sup> The options under consideration are likely to reduce over the next three years as they are refined and optimised through the strategic planning frameworks. These large-scale schemes are being considered within the regional water resource planning framework and therefore should be reflected in WRMPs. Any residual uncertainty in the need for and delivery of large-scale water resource options should be reflected in long-term delivery strategies.

### 3.3.1 How to set out adaptive pathways in the strategy

The company's long-term delivery strategy **should set out a core adaptive pathway of enhancement activities**, and **alternative adaptive pathways**, which could be triggered depending on how future uncertainties develop.

This should be undertaken in four stages:

1. identify the potential solutions that are likely to be needed under a range of plausible scenarios to meet the company's ambition;
2. select the core pathway according to the criteria set out in section 3.3.2, and include short-term actions into the PR24 business plan;
3. develop alternative pathways, decision points and trigger points to help meet the ambition in a range of plausible futures; and

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<sup>21</sup> The WINEP methodology will be published in 2022.

<sup>22</sup> RAPID was formed in 2019 by Ofwat, the Environment Agency and the Drinking Water Inspectorate to support strategically important new water resource infrastructure supply solutions and meet future water needs. [RAPID is overseeing a gated process](#), which assesses the quality of companies' plans at specific points to ensure that sufficient progress is being made, and that strategic resource options are developed further. In December 2021, RAPID published a [consultation document](#), setting out policy options for developing the regulatory and commercial framework in future.

4. monitor and evaluate the implementation of the pathways, and reassess future long-term options as future uncertainties change, for input into PR29 and beyond.

We will expect the strategy, as a whole, to be set up to deliver long-term outcomes under at least all the common reference scenarios (see sections 3.4.2 and 4). This does not mean we expect an alternative pathway for each reference scenario. The package of investment described by a pathway may deliver outcomes under one or more of the reference scenarios. **It is up to companies to determine how many alternative pathways are required to achieve their ambition in a range of plausible futures.** However, there should be a relatively small number of pathways, focused on the key areas of risk and uncertainty. We have proposed business plan tables that accommodate up to ten different pathways, including the core pathway, and consider this is a suitable maximum number.<sup>23</sup>

Further, adaptive pathways **should not necessarily be limited to those required to meet outcomes under the reference scenarios.** As explained in section 4, the reference scenarios are not designed to be exhaustive or comprehensive. Companies should consider a wider range of scenarios and uncertainties, as deemed necessary to form a robust strategy.

Adaptive pathways should focus on the main areas of risk and uncertainty. Therefore, companies should describe only key enhancement schemes in their adaptive pathways, for example where:

- they require material enhancement investment; and/or
- are relatively low-cost, but are important to support the strategy, for example to enable future schemes to be delivered or alternative pathways to be followed.

The full strategy, and not just key enhancement investments, should be covered in the accompanying narrative, and total enhancement expenditure for all pathways should be presented in data tables. It is for companies to judge which activities are key to their strategy and therefore should be described in adaptive pathways.

### 3.3.2 Core adaptive pathway: low-regret activities

The core adaptive pathway is designed to support long-term adaptive planning by **identifying no- and low-regret options in the first instance.** This is consistent with best practice adaptation techniques (see Box 3). It is not a 'central' or 'most-likely' pathway. It should include the following:

- **'no and/or low regrets'** investments, for example investments that are required:
  - in both benign and adverse scenarios;
  - across a wide range of plausible scenarios; or
  - need to be undertaken to meet short-term requirements; and

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<sup>23</sup> Ofwat, ['Draft long-term delivery strategies data tables'](#), November 2021.

- investment **required to keep future options open** (such as enabling work or learning and monitoring), where possible, or is required to minimise the cost of future options.

Therefore, the core pathway **should include all activities that need to be undertaken to be ready for all plausible future scenarios**. Activities which should only be carried out under certain circumstances, such as under more adverse future scenarios, are then set out in alternative pathways (see section 3.3.3). This **provides a framework for assessing the likely best timing for 'higher-regret' investments**, taking into account factors such as long-term efficiency, future uncertainties, customer preferences and fairness between current and future customers.

For the purpose of the core pathway, 'benign scenarios' refers to the low reference scenarios for climate change, demand and abstraction, **and the faster reference scenario for technology**. This is because faster technological developments are likely to reduce costs compared to slower developments. It **also refers to more benign wider scenarios**, which companies should test beyond the reference scenarios. These scenarios describe a less demanding change in a material factor than expected.

The core pathway should set out, up to 2050:

- the **improvements in performance that are expected from base expenditure**, considering improved technology and processes (see section 3.5.2);
- the additional **enhancement expenditure** that would likely be required to meet the ambition. This should take account of outputs from strategic planning frameworks and be a comprehensive view of potential enhancement expenditure over the long term; and the **key strategic investments** that are likely to be needed, and their estimated cost and timing, including lead and delivery times.

The core pathway may include investment for solutions that would only be needed if more adverse future scenarios come to pass, but that need construction to start during PR24. We encourage companies to explore options to meet long-term outcomes using flexible, modular or adaptive solutions where possible and efficient to do so. However, where companies do propose large construction schemes, we would expect to see robust evidence that it would be unlikely to be efficient to instead adopt a more flexible solution, or to defer starting construction until a later period. Companies' proposals should include appropriate customer protection mechanisms.

### 3.3.3 Alternative adaptive pathways: higher-regret activities

After describing the activities within the core pathway, the strategy should explain **how the enhancement investment programme may need to change in future**, in response to changes in circumstances. For example, a change in enhancement expenditure may be required in response to different levels of climate change or demand.

This should include setting out **alternative adaptive pathways**, which describe additional or alternative activities that would be undertaken under certain circumstances. As these pathways will usually be followed under more adverse scenarios, the additional or alternative activities may be described as 'higher-regret', relative to investments included in the core pathway.

In formulating alternative pathways, companies should consider the range of uncertainty described in the common reference scenarios, as well as relevant local or company-specific factors. The strategy should identify a relatively small number of alternative pathways, focused on the key areas of risk and uncertainty. We would expect a lower level of detail in the alternative pathways than in the core pathway, as there is a greater degree of uncertainty around whether the activities will be required.

For each alternative pathway, companies should identify:

- the point in time at which the alternative pathway deviates from the core or another alternative pathway;
- when the decision would need to be taken about whether the alternative pathway is followed (decision point);
- the circumstances under which the alternative pathway would need to be followed (trigger point); and
- how these circumstances will be assessed and monitored (see section 3.3.5).

To help stakeholders understand the likelihood of the alternative pathways, companies should provide an estimate of the relative likelihood of following each alternative pathway.

### **3.3.4 Aligning the long-term delivery strategy with WRMPs and DWMPs**

Long-term delivery strategies will bring together outputs from existing strategic planning frameworks, such as WRMPs and DWMPs, into a consistent and holistic long-term strategy. We have set out expectations that the WRMPs and DWMPs being produced for PR24 should follow an adaptive pathways approach.<sup>24</sup>

The current water resources planning guidance states that WRMPs should present:

- a pathway aligned to the most likely scenario or set of scenarios;
- a core pathway showing low-regret investment as described by Ofwat, with differences to the most likely pathway described and differences in selected options identified; and
- alternative pathways linked to clear triggers.

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<sup>24</sup> Ofwat, '[Ofwat's expectations for strategic planning frameworks at PR24](#)', November 2021, p. 9.

In their WRMPs, we therefore expect companies to present an investment programme to meet 'most likely' scenarios, and – in a separate section of the plan – to provide details of their core and alternative pathways.

Within their long-term delivery strategies, we expect companies to **present the 'most likely' pathway from their WRMPs as an alternative pathway**, where this is not the same as the core pathway. This will show where the activities required to meet 'most likely' scenarios diverge from those described by the core pathway. This allows for WRMPs to slot into the long-term delivery strategies, alongside other areas of enhancement activity. We consider that WRMPs provide a strong and mature framework for long-term planning and that long-term delivery strategies offer the greatest value in areas of the business that, before PR24, were not covered by formal planning processes.

The core pathway, as described in section 3.3.2, is designed to meet all short-term requirements. This includes more adverse scenarios in the short term, such as the high reference scenario for demand, which is based on local authority or Welsh Government forecasts. The core pathway should therefore **include investment to meet these forecasts in 2025–30**. Where investment goes over and above what is needed to meet the low reference scenario, we expect companies to include appropriate mechanisms to protect customers, such as to capture the investment in a price control deliverable (PCD). After 2030, investments to meet outcomes under the high demand scenario that do not meet the criteria for the core pathway should be presented within alternative pathways.

There is likely to be relatively minimal divergence between the 'most likely' and core pathways in 2025–30 and a greater divergence is likely to emerge later in the timeline. This is because there is lower uncertainty around key factors in the short term than the long term. This means that a greater proportion of enhancement requirements in 2025–30 can be classified as no- or low-regret investment or investment to keep future options open, than enhancement requirements in 2030–50.

As above, we have set expectations that DWMPs should use an adaptive pathways approach. The guidance for developing DWMPs does not specify a single approach to account for significant future uncertainties and does not provide instruction on how adaptive pathways should be formed.<sup>25</sup> Companies may therefore take different approaches to adaptive planning in their DWMPs, such as using a 'most likely' or 'central' pathway. Consistent with our guidance on incorporating WRMPs, we expect companies to present these pathways as alternative pathways in their long-term delivery strategies, in addition to the core pathway.

We will bring forward into the WRMP process key aspects of our PR24 approach to scrutiny of enhancement capex. This will include an additional check on utilisation risk for large water resource investments, to ensure that the selected options represent best value under normal operating conditions, and not just in an extreme drought. We expect a full consideration of

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<sup>25</sup> Water UK, ['A framework for the production of Drainage and Wastewater Management Plans'](#), September 2018, p. 44.

operational interventions, where these are appropriate, such as during low probability events. This will help avoid developing unnecessary infrastructure which may have very low utilisation or not be required if risks do not transpire.<sup>26</sup>

To enable this additional check, we expect companies to present in their WRMPs analysis of how they have developed large infrastructure investment options so that they represent best value. This should include but not be limited to the following:

- quantitative presentation of anticipated operational utilisation rates determined from company and/ or regional modelling;
- utilisation rates for dry year annual average operation, for events such as 1 in 500 year droughts, peak demand, or as part of emergency response, in addition to standby, or normal-year operation;
- where uncertainty exists in utilisation rates, a range of potential utilisation rates presented, evidenced with modelled calculations and description of scenarios considered. For options spanning a large geographical area, it may also be appropriate to include the impact of spatial variability of droughts on utilisation and uncertainty;
- where options are shared between water companies, how utilisation will be shared and consequent split of costs in each company's WRMP;
- how the water company proposes to use flexible or adaptable approaches, such as developing modular or scalable infrastructure options;
- how the water company envisages embedding the new infrastructure into its overall asset management system to reduce the risk of under utilisation;
- third party options explored to increase utilisation and value from option supply; and
- where multiple users (public water supply or third party) form part of the utilisation of the option, how water companies have begun to consider prioritisation rules and commercial models.

### 3.3.5 Monitoring the long-term delivery strategy

Effective monitoring of adaptive pathways is a key principle of an adaptive approach. The long-term delivery strategy should explain how, during its implementation, the metrics, trigger points and other key elements of the strategy will be monitored and reviewed. This should include monitoring how each of the common reference scenarios develop, together with any local or company-specific factors that have been reflected in alternative pathways.

The monitoring plan in the strategy should identify:

- the metrics that will be monitored, how these will be calculated and the source of the data;
- the frequency at which the metrics will be monitored and reviewed;

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<sup>26</sup> Ofwat, '[Ofwat's expectations for strategic planning frameworks at PR24](#)', November 2021, p. 8.

- the threshold that the metrics will be monitored against and what action will be taken when the threshold is reached; and
- how the monitoring of the metrics and the progress against the long-term delivery strategy will be reported (including to Ofwat and other regulators) and published.

At minimum, we would expect companies to report on the progress towards their ambition and towards meeting the trigger points for alternative pathways as part of their submissions for PR29.

### 3.3.6 Impact of the long-term delivery strategy on bills

Companies should set out the estimated bill impacts of the long-term delivery strategy. Bill impacts should be identified separately for the core pathway and the alternative pathways. Bill impacts for 2025–30 should be based on the PR24 business plan, with longer-term bill changes based on the forecast impact of enhancement expenditure, using PR24 assumptions on allowed returns as appropriate. Further detail is set out in Appendix 2.

## 3.4 Rationale: why is the strategy the best way of getting there?

This section should explain why the long-term delivery strategy represents the best possible approach to deliver the company's ambition, both in the short and long term, given future uncertainties, customer preferences (see section 3.1), affordability considerations and fairness between current and future customers. It should also explain how the company has developed its strategy.

### 3.4.1 Identification of core and alternative pathways

Companies should clearly set out how the core and alternative pathways have been developed to deliver long-term outcomes as efficiently as possible, given future uncertainties. This should include explaining **why the activities in the pathways have been chosen and how choices have been made**, including:

- how the options have been **identified and selected**;
- why the options and the mix of approaches – between capital and operating solutions and between traditional and nature-based solutions – **represent best value**; and
- why the investments are **sequenced to deliver optimally** in the short, medium and long term.

When considering whether options selected are best value, we mean taking into account environmental and social impacts over a suitable timeframe, in line with Ofwat's expectations

for strategic planning frameworks for PR24,<sup>27</sup> Ofwat's public value principles,<sup>28</sup> and the WINEP options and appraisal guidance.<sup>29</sup> A best value option can be the least cost option if the incremental costs outweigh the value of additional benefit proposals.

The strategy should also set out **how the adaptive pathways have been developed**, including:

- what **options were considered in identifying activities in the core pathway**;
- **why options in the core pathway were chosen over other options**, including how customer (see section 3.1) and stakeholder views have been taken into account in its development; and
- **why the specific alternative pathways and trigger/decision points have been chosen**, including why the uncertainty identified needs to be alleviated through an alternative pathway, and why the date(s) associated with the trigger/decision point is important.

The strategy should explain how the pathways reflect key principles of adaptive planning, including how they allow no or low-regret options to proceed where appropriate, do not foreclose future options or unnecessarily constrain future choice and are efficient, effective and equitable given the range of future uncertainty.<sup>30</sup>

### 3.4.2 Scenario testing

Scenario analysis is integral to adaptive planning. It helps to provide confidence that the investments contained within the pathways are likely to deliver the ambition efficiently in a range of plausible futures. We expect companies to take ownership of their scenario planning.

Companies should test the long-term delivery strategy against each of the common reference scenarios (see section 4.2) to demonstrate that, under different plausible futures, the strategy is likely to efficiently deliver the company's ambition. This evidence should include:

- **the sensitivity of the core pathway to the scenario**, i.e. how the scenario would affect the delivery of outcomes in the absence of alternative pathways;
- **how the strategy would adapt to the scenario**, i.e. any alternative pathways that would be followed if this scenario came to pass;
- **the long-term outcomes that would be delivered in this scenario**, as a result of following these pathways;

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<sup>27</sup> Ofwat, '[Ofwat's expectations for strategic planning frameworks at PR24](#)', November 2021.

<sup>28</sup> Ofwat, '[Ofwat's Final Public Value Principles](#)', March 2022.

<sup>29</sup> The WINEP methodology will be published in 2022. Additional guidance will be available from the Environment Agency, setting out further details of the approach.

<sup>30</sup> The UK Government's [Supplementary Green Book Guidance](#) advises that approaches to good adaptation, in particular where an iterative approach is being taken, should align with these principles.

- **how the scenario would affect the expenditure requirement over time**, compared to the core pathway; and
- **how, under the scenario, the strategy is likely to deliver fairness between current and future customers.**

The reference scenarios cover a limited range of factors and test only two possible parameters. Beyond the reference scenarios, therefore, we expect companies to **use wider scenario planning, as far as the company deems necessary, to ensure the strategy is resilient to a wide range of plausible eventualities**. The company should demonstrate that risks have been considered in the development of the strategy, and that wider scenario testing has been used to validate the strategy by testing alternative options, pathways and sequences. We set out further details around wider scenario planning in section 4.3.

### 3.4.3 Comparing to previous long-term strategies

It is important for long-term delivery strategies to take account of and learn from other long-term forecasting and planning exercises. This will help increase the robustness of the strategies and reinforce the importance of good long-term planning. In particular, we expect companies to explain the key differences between their strategy and their:

- strategic direction statements, where available and comparable;
- long-term performance commitment forecasts produced at PR19; and
- strategic planning frameworks produced at PR19, e.g. WRMPs.

Companies should identify the key differences between their strategy and these submissions, the reasons for these differences and any lessons that have been learnt to make their strategies more robust.

### 3.4.4 Impact on affordability and fairness between current and future customers

Companies should explain how their long-term delivery strategy secures:

- **long-term affordability:** how the strategy protects customers' ability to pay their water bill over the long term; and
- **fairness between current and future customers:** how the strategy delivers fairness between what existing customers will pay for and what is paid for by future customers.

Companies should present evidence that these issues have been explored with customers, including how the interests of future customers have been taken into account, and that these views have informed the strategy. We expect to see evidence that customers consider the forecast bill impacts of the strategy to be acceptable.

As set out in section 3.1, there are challenges around obtaining meaningful views on long-term preferences. However, we consider these issues can be at least partially alleviated through good research design. We expect company research on long-term issues to be 'fit for purpose', for example to ensure the sample and methodology is appropriate for the research objectives, in line with our expectations for standards of research.<sup>31</sup>

As set out in section 3.3.6, we expect companies to identify bill impacts separately for their core and alternative pathways. The strategy should aim to deliver intergenerational fairness and affordability in a range of plausible futures. The company's engagement with its customers should therefore reflect the potential range of affordability impacts in different futures.

Companies should consider using scenario testing to demonstrate the strategy is likely to be fair and affordable for both current and future customers. Strategies might consider a range of scenarios to test different future levels of affordability in their region, such as using different assumptions around economic growth or household incomes.

### 3.4.5 Enhancement funding for preparatory work

We recognise that **some enhancement investment may be necessary to keep future options open**. This would be where it is unclear whether a trigger point is likely to be met in the following price review period, but work is required in this period to ensure the potential need can be met. This investment, such as pre-planning application activities and investigations or part-delivery of the scheme, would be over and above normal option investigation, development and appraisal activity, which is covered through base expenditure allowances.<sup>32</sup> This would be expenditure that is normally incurred after the award of enhancement funding for a scheme.

We expect requests for enhancement funding for preparatory work to align with the following key principles:

- the scheme should be connected to an alternative adaptive pathway set out in a long-term delivery strategy to meet a defined externally driven uncertainty;
- the scheme requires a material enhancement allowance and has a long lead-in time to develop and deliver, which covers more than one price control period;
- the preparatory investment in the scheme in this price control period is better value for money than delaying the investment until there is certainty of need in a subsequent price review period;

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<sup>31</sup> Ofwat, '[PR24 and beyond: Customer engagement policy – a position paper](#)', February 2022, p. 6.

<sup>32</sup> Pre-planning application activities would be akin to the activities listed under gate three for the strategic resource schemes as set out in Ofwat, '[PR19 final determinations: Strategic regional water resource solutions](#)', December 2019, pp. 14–15. For PR24, we would expect expenditure to deliver gate one and two activities to be covered by base expenditure allowances.

- the scheme is the best option to meet the need and the proposed funding allowance is efficient and appropriate for the preparatory work; and
- there is appropriate customer protection in place to ensure that the preparatory work is progressed.

## 3.5 Foundation: what is underpinning the strategy?

This section should set out the key assumptions and uncertainties behind the long-term delivery strategy. This is important to help us and stakeholders understand how the strategy has been built up. It also helps the strategy to adapt to new information and circumstances over time, and helps form a clear line of sight between the previous and refreshed strategy.

### 3.5.1 Assumptions

The long-term delivery strategy will need to be based on a number of assumptions about how certain factors will change over time. Alternative pathways may be formed to account for specific circumstances where the core pathway is insufficient to meet the company's ambition, necessitating an alternative investment programme. However, **there will only be a limited number of alternative pathways, which in total are unlikely to account for all material factors.**

Therefore, **there will be a wider set of factors for which companies should make clear assumptions.** Where there is significant uncertainty around these assumptions, companies may consider using uncertainty testing to assess the robustness of the strategy.

Across the whole strategy, different assumptions around climate change, technology, demand and abstraction reductions will be presented within core and alternative pathways. Other alternative pathways may also be presented to account for changes in material company-specific or local factors. Here, **companies do not need to separately specify assumptions around how these factors will change** – only to ensure the strategy is robust to the full range of plausible assumptions.

We list below some examples of assumptions beyond those described in adaptive pathways that companies might include in their strategies. This list is not exhaustive and the company should explain the assumptions it considers are material to the delivery of its ambition.

- **socioeconomic factors**, such as economic growth and changes in household incomes;
- **government and regulatory policy**;
- the activities of **other water companies and sectors**, such as their contribution towards long-term targets;
- the condition of the **natural environment**;
- **consumer behaviour and attitudes**;

- customer **affordability and vulnerability**;
- the costs of **inputs**;
- the availability of **skills**;
- the capacity of the **supply chain**;
- levels of **asset health** and **resilience**;
- **innovation** within the company;
- **cost efficiencies**; and
- progress towards key **long-term outcomes**.

We will expect companies to set out details of the key assumptions that underpin the strategy and to explain on what basis the assumptions are being made. These assumptions should align with the PR24 business plan and be consistent across the entire strategy. Companies may consider aligning assumptions across strategic planning frameworks.

### 3.5.2 Performance improvements from base expenditure

Even without enhancement expenditure, companies will deliver performance improvements over the long term through their base cost allowances and ongoing technological improvements, as they have been doing in previous periods.<sup>33</sup>

We think it is important that companies develop their own forecasts of improvements expected from base expenditure, to inform the adaptive pathways in the long-term delivery strategy as well as strategic planning frameworks. We expect companies to clearly set out the expected improvements in performance towards each of the outcomes and metrics set out in their ambition.

In December 2021, we proposed an approach to determining 'what base buys' for a given performance commitment.<sup>34</sup> We will provide further details of our approach in the PR24 draft methodology. **We expect companies to take account of our approach in developing their own long-term forecasts of what base buys.**

We are considering publishing a provisional view of the performance we expect companies to achieve from base funding in the PR24 final methodology for selected performance commitments. By this point, we will have two years of data from the 2020–21 to 2024–25 period on which to base our forecasts, rather than only the one year of data that is available now. Should we choose to publish this information in the PR24 final methodology, we will

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<sup>33</sup> We define base expenditure as routine, year-on-year costs, which companies incur in the normal running of their business to provide a base level of good service to customers and the environment and maintain the long-term capability of assets. Enhancement expenditure, generally, achieves a permanent increase or step change in the current level of service to a new 'base' level and/or the provision to new customers of the current service. Enhancement funding can be for environmental improvements required to meet new statutory obligations, improving service quality and resilience, and providing new solutions for water provision in drought conditions.

<sup>34</sup> Ofwat, '[Assessing base costs at PR24](#)', December 2021, pp. 69–76.

expect companies to use our view to inform long-term delivery strategies and final strategic planning frameworks.

For avoidance of doubt, we intend to update our forecasts with latest outturn data when it becomes available during PR24. For example, at PR24 final determinations we will have outturn performance data available up to 2023-24. Therefore, any forecast of what we expect companies to achieve with base funding presented in the final methodology will be a provisional view of our expectations, rather than a final figure.

### 3.5.3 Uncertainties

Companies have always planned their activities in the knowledge that the future is uncertain and likely to change. A long-term delivery strategy can help to anticipate possible futures to ensure the company can adapt its activities as appropriate. The company should clearly describe the areas of greatest uncertainty in its strategy and explain how uncertainty has been appropriately accounted for in each area. It should set out the uncertainties that could have the biggest influence on the strategy, and how changes in these factors may affect the strategy in future.

Some of these uncertainties may be accounted for in alternative pathways or wider scenario or sensitivity testing. However, there may be uncertainties that cannot be meaningfully alleviated through these techniques, such as where appropriate parameters for testing cannot be established. It is important that companies highlight these uncertainties as well.

## 3.6 Board assurance

We expect the introduction of long-term delivery strategies to provide an important and enduring framework for companies to embed a stronger long-term focus. A fundamental shift towards a long-term mindset will require culture change at all levels of the business. We therefore expect the company's full Board to own and be accountable for the strategy.

The company Board should provide an assurance statement that explains how it has challenged and satisfied itself that the strategy:

- 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; and
- 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 should provide evidence of where it has challenged company management and an explanation of the process it has used to arrive at the view that its strategy is the best it can be. It is for companies and their Boards to determine how best to provide this assurance, including the role of external assurance. We will confirm our requirements for Board assurance more generally in the PR24 methodology.

## 4. Scenario testing

Many of the challenges faced by the water sector require long-term solutions. However, decisions about how best to meet them are complicated by uncertainty about what will happen in the future. This uncertainty creates risks around either underinvestment – which would see the sector falling short of long-term objectives and allocating disproportionate costs to future customers – or overinvestment, which would involve unnecessarily high costs for current customers and the prospect of stranded assets in future.

To help alleviate these risks, **we expect companies to use scenario planning to inform their long-term delivery strategies**, by testing their adaptive pathways against plausible variations in key assumptions. This can help demonstrate whether the strategy is appropriate for meeting long-term objectives in a range of plausible futures, and to assess whether alternative investment sequences are likely to deliver outcomes more efficiently.

**We have set out eight common reference scenarios, informed by engagement with the sector and beyond.** We expect all companies to use these scenarios to inform their strategy. These scenarios offer plausible 'benign' and 'adverse' assumptions around the future trajectories of climate change, technology, demand, and abstraction reductions. They are not necessarily the 'most likely' scenarios that may happen. Instead, they are 'plausible extremes', which offer a full spectrum of possible futures. Within this spectrum, the strategy should deliver its ambition for customers and the environment.

**Beyond the reference scenarios, we expect companies to test their strategies against the scenarios that they deem appropriate.** The reference scenarios are not intended to be comprehensive or exhaustive, and test a limited number of key parameters. To ensure strategies are robust, they must be subjected to wider scenario testing, including testing against material local or company-specific scenarios where appropriate.

### 4.1 Combining scenarios

It is essential that the scenarios used to test the long-term delivery strategy are **plausible**. This has been highlighted in best practice such as the UK Government's Supplementary Green Book Guidance and the Government Office for Science's Futures Toolkit.<sup>35</sup> This does not mean scenarios need to be 'likely', but there must be a material possibility that they will occur.

This approach is reflected in the parameters we have set for the reference scenarios. They aim to describe the outer limits of plausibility for each factor, or 'plausible extremes', and so

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<sup>35</sup> UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020, pp. 8, 19; Government Office for Science, '[The Futures Toolkit: Tools for Futures Thinking and Foresight Across UK Government](#)', November 2017, p. 56.

encapsulate a full range of plausible future trajectories. As such, the reference scenarios are not necessarily the 'most likely' scenarios. However, the 'most likely' scenarios probably lie between the parameters that they describe.

Since the reference scenarios represent 'plausible extremes', combining them together risks producing a very low probability scenario. Therefore, when presenting the results of testing the long-term delivery strategy, **companies should set out the estimated impact of each individual reference scenario**, rather than combining reference scenarios. This ensures investments are tested against plausible, rather than low probability, assumptions.

Where companies deem appropriate, **they can additionally present the results of combining two or more common reference scenarios**, if they consider it helps to demonstrate that the strategy is appropriate given future uncertainties. Within wider scenario testing, **scenarios may be usefully combined if they are considered relatively likely and, in aggregate, produce a plausible future scenario**.

Where interdependencies between the reference scenarios are identified, the impacts should be presented under the relevant scenarios. For example:

- when testing against the demand reference scenario, consider the parameters specified in that scenario (see section 4.2.3);
- when testing against the climate change or technology reference scenario, consider any changes in demand that are due to climate change or technology.

## 4.2 Common reference scenarios

The common reference scenarios have been developed following engagement with the sector and wider stakeholders, and taking into account established best practice in scenario planning.<sup>36</sup> They serve two main functions:

- **Developing the strategy.** Companies should use the reference scenarios, alongside wider scenario planning as appropriate, to help develop their strategy, for example by testing the sensitivity of their core pathway to different futures. Uncertainties can then be alleviated through refining the core pathway or developing alternative pathways as appropriate.
- **Demonstrating that the strategy is high-quality.** We expect companies to demonstrate that the strategy is likely to efficiently meet long-term outcomes, given the full range of uncertainty described in the reference scenarios. We set out the evidence companies should provide in section 3.4.2.

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<sup>36</sup> For example, see UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020; Government Office for Science, '[A brief guide to futures thinking and foresight](#)', February 2021.

## **We do not prescribe how the individual reference scenarios impact on the strategy.**

This is because the nature and magnitude of these impacts will often depend on localised or company-specific factors. Companies should explain how they have considered these factors in their analysis. We expect companies to consider a wide range of possible impacts of the scenarios. For example, climate change impacts on other sectors and regions may ripple out and impact others. These impacts could include changes to the natural environment, impacts on global supply chains, and increased risk to infrastructure.<sup>37</sup>

### **4.2.1 Climate change**

The reference scenarios for climate change are set on the basis of the **Representative Concentration Pathways (RCPs)**, as adopted by the Intergovernmental Panel on Climate Change (IPCC) and the latest UK Climate Projections (UKCP18).<sup>38 39</sup> The RCPs specify different future concentrations of greenhouse gases to create a wide range of plausible future emissions scenarios.<sup>40</sup> We are setting the **UKCP18 projections for RCP2.6 and RCP8.5** as reference scenarios. In line with the aims of the reference scenarios, we consider these projections represent the lowest and highest plausible parameters for climate change.

This reflects best practice guidance on climate adaptation techniques. For example, the UK Government's Supplementary Green Book Guidance advises that, when accounting for climate uncertainty against long time horizons, programmes should be appraised using both RCP2.6 and RCP8.5, with no indication as to which is more likely than the other.<sup>41</sup> It also notes that using scenarios aligned with global temperature rises of 2°C and 4°C is an approach widely adopted across UK and global government policy. A similar approach is taken by the Climate Change Committee (CCC) in its Third UK Climate Change Risk Assessment.<sup>42</sup> The CCC uses two main outcomes for its detailed analysis, including a pathway in which warming is limited to 1.5–2.5°C by 2080–2100, and one where warming reaches around 4°C. We consider that our reference scenarios align with this guidance (see section A1.4.2).

We consider that using the **50th percentile probability level** for each projection offers plausible high and low assumptions. This is because the probability of RCP2.6 and RCP8.5 coming to pass in the future is considered to be low but possible. Adding in a much lower or higher probability level to describe the impacts of each scenario would in effect combine two low-probability scenarios into an extreme scenario that is less useful for long-term

<sup>37</sup> As set out in UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020, pp. 4–5.

<sup>38</sup> IPCC, '[Climate Change 2014: Synthesis Report](#)', November 2014.

<sup>39</sup> Met Office, '[UK Climate Projections: Headline Findings](#)', July 2021.

<sup>40</sup> Met Office, '[UKCP18 Guidance: Representative Concentration Pathways](#)', November 2018.

<sup>41</sup> UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020, p. 9.

<sup>42</sup> Climate Change Committee, '[Third UK Climate Change Risk Assessment Technical Report](#)', June 2021, pp. 15–17.

investment planning. However, companies may consider testing against a wider range of climate assumptions than those specified in the reference scenarios.

For land projections, covering maximum temperature and total precipitation, companies should use the UKCP18 probabilistic projections where possible. The probabilistic projections are designed to provide the primary tool for assessments of the ranges of uncertainties in UKCP18, and provide information on known uncertainties in future climate changes.<sup>43</sup> To cover sea level rise, companies should use the UKCP18 marine projections.<sup>44</sup> We expect companies to apply the projections to their geographical region as appropriate.<sup>45</sup>

### High climate change scenario

**Land:** UKCP18 probabilistic projections, RCP8.5, 50th percentile probability level

**Sea level:** UKCP18 marine projections, RCP8.5, 50th percentile probability level

### Low climate change scenario

**Land:** UKCP18 probabilistic projections, RCP2.6, 50th percentile probability level

**Sea level:** UKCP18 marine projections, RCP2.6, 50th percentile probability level

## 4.2.2 Technology

The costs and availability of key technologies have historically influenced the options that water companies select to meet their objectives. Technological development and adoption can play a significant role to increase efficiency by reducing costs and improving outcomes. This has implications for what options should be selected in the short term, given uncertainties around how technologies might develop in future.

While it would be inappropriate to rely on uncertain future developments to emerge so that outcomes can be achieved, adaptive planning can identify opportunities to keep options open without creating significant extra costs. This can enable companies to take full advantage of potential technological advances when the decision point is met.

<sup>43</sup> Met Office, '[UKCP18 Guidance: How to use the UKCP18 land projections](#)', November 2018.

<sup>44</sup> Met Office, '[UKCP18 Factsheet: Sea level rise and storm surge](#)', November 2018. The marine projections can also be accessed using the [Met Office UKCP User Interface](#).

<sup>45</sup> For example, the [Met Office UKCP User Interface](#) allows for the generation of probabilistic projections of temperature and rainfall under RCP 2.6 and RCP8.5 at 25km grid-square level, according to a range of probabilities.

The technology reference scenarios **extrapolate key current technological developments inside and outside the sector**. The listed technologies have been informed by engagement with companies, regulators and stakeholders, as well as with reference to government publications and trends in the industry. The scenarios do not provide an exhaustive list of potential developments, some of which will be specific to companies or regions. Nor do they capture technologies that are in the early stages of development and have not already started to be adopted or considered by water companies, as their inclusion would be too speculative to be useful.

While the adoption of technologies is partially under the control of individual companies, this will primarily depend on whether the company considers it cost-beneficial to do so, which is in turn affected by a range of factors beyond company control. Therefore, the reference scenarios effectively **describe futures where full adoption and operationalisation become cost-beneficial by different dates**. We expect companies to explore the potential impact of technological development on the relative costs and benefits of options and the likely optimal sequencing of activities.

As set out in section 3.3.2, 'benign scenarios' as described in the core pathway refers to the faster scenario for technology. This is because faster technological developments are likely to reduce costs compared to slower developments, so are likely to have a lower impact on enhancement expenditure requirements. If companies' strategies plan to fully operationalise a technology before the date specified in the faster scenario, when testing against the faster scenario they should instead use the earlier date.

### Faster technology scenario

- 1) Smart water supply network by **2035**:
  - automatic detection of potential leaks; and
  - robust real-time asset condition information – including telemetry, robotic and drone inspection – enabling a risk-based maintenance approach across the business.
- 2) Full smart meter penetration by **2035**.<sup>46</sup>
- 3) New wastewater approach by **2040**:
  - monitoring and advance forecasting of localised surface water rainfall and related pollution/wastewater stresses, including intelligent sewer technology, enabling rapid response and/or prior action; and
  - automatic monitoring and enhanced sampling of environmental water quality.
- 4) Low-emission HGVs and fleet by **2030** and carbon-free baseload electricity by **2035**.
- 5) Full open access to datasets across water companies and other utilities, through common data sharing protocols by **2035**.
- 6) The whole-life financial cost of low-carbon construction materials equals that of conventional building materials by **2035**.

<sup>46</sup> 'Full' smart meter penetration does not need to refer to 100% penetration where this would involve prohibitive costs.

- 7) 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**.

### Slower technology scenario

- 1) Smart water supply network by **2040**:
  - automatic detection of potential leaks; and
  - robust real-time asset condition information – including telemetry, robotic and drone inspection – enabling a risk-based maintenance approach across the business.
- 2) Full smart meter penetration by **2045**.
- 3) New wastewater approach by **2045**:
  - monitoring and advance forecasting of localised surface water rainfall and related pollution/wastewater stresses, including intelligent sewer technology, enabling rapid response and/or prior action; and
  - automatic monitoring and enhanced sampling of environmental water quality.
- 4) Low-emission HGVs and fleet by **2040** and carbon-free baseload electricity by **2035**.
- 5) Progress on open data across the sector is limited **throughout the period to 2050**, with only a handful of water companies opening up large numbers of their datasets, beyond those required for regulatory purposes.
- 6) The whole-life financial cost of low-carbon construction materials continues to fall, but conventional building materials remain cheaper **throughout the period to 2050**.
- 7) Cyber and digital protection stays ahead of cybercrime and digital networks remain resilient **throughout the period to 2050**.

### Wider considerations around technological development

Technologies that are currently relatively unknown or unproven are likely to materially impact the sector over the long term. Beyond those set out in the reference scenarios, companies should consider a wide range of technological developments when forming their strategies. This may include, where appropriate, those set out below:

- **Internet of things:**
  - Smart metering and network telemetry;<sup>47</sup>
  - AI/data interrogation;<sup>48</sup>

<sup>47</sup> Smart meters and network telemetry are widely used in the water sector today to monitor data such as water consumption, flow, pressure and quality.

<sup>48</sup> Artificial intelligence solutions have a range of applications and are increasingly being adopted and developed across the sector and beyond. For example, see International Water Association, '[Digital Water: Artificial Intelligence Solutions for the Water Sector](#)', August 2020, and Global Infrastructure Hub, '[Self-learning autonomous control of water networks](#)', December 2020. Further, as part of our inaugural [Water Breakthrough Challenge](#), a coalition of companies and partners are piloting the use of artificial intelligence that monitors a waste catchment area in real time, to minimise the risk of flooding and sewage pollution. The [Water UK Vision for](#)

- common data sharing protocols;<sup>49</sup> and
- remote inspection/repair, including through the use of drones, robotics, and self-driving fleets.<sup>50</sup>
- **Wastewater network improvements:**
  - high resolution grid square advanced warning and forecasting of surface water events, and related pollution and wastewater stresses;<sup>51</sup>
  - intelligent sewer technology;<sup>52</sup> and
  - enhanced monitoring and sampling capability and capacity, including remote monitoring of water bodies.<sup>53</sup>
- **Fifth industrial revolution:**
  - self-healing networks;<sup>54</sup> and
  - developments in bioscience, for example to reduce carbon emissions and treat wastewater more efficiently.<sup>55</sup>
- **Nature-based solutions:**
  - state of the art nature-based solutions toolkit, enabled by monitoring and/or blockchain platforms.<sup>56</sup>
- **Emissions-reducing technologies:**
  - increasing availability, higher quality and lower cost of low-carbon construction materials;<sup>57</sup> and

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[2050 Discussion Paper](#) highlights the important of using big data and machine learning to identify high-risk assets in future.

<sup>49</sup> The [2050 UK Water Innovation Strategy](#) refers to the need to use 'open data and compatible digital infrastructure across water companies, supply chains, other innovators and customers' in order to deliver its ambition. Our discussion paper, '[H2Open – Open data in the water industry: a case for change](#)', sets out our expectations that companies make measurable progress in delivering open data over the next 12 months, to keep pace with the wider digital economy.

<sup>50</sup> A contemporary example is the use of real-time virtual or [augmented reality](#) by some companies to view existing or planned assets. The [2050 UK Water Innovation Strategy](#) sets out the industry's aim to develop options for the use of robotics to monitor asset health and performance.

<sup>51</sup> For example, the Flood Forecasting Centre (FFC), a collaboration between the Environment Agency and Met Office, delivers flood risk and other weather hazard forecasts up to 5 days ahead of the event. It uses high-resolution numerical weather prediction to generate these forecasts. See the [Flood Forecasting Centre website](#), or Price et al., '[Operational use of a grid-based model for flood forecasting](#)', February 2012.

<sup>52</sup> For example, United Utilities is [introducing a new wastewater network management approach](#) driven by real-time data and artificial intelligence. Thames Water [is trialling intelligent sewer technology](#) to reduce blockages in its network, and Severn Trent Water [plans to install 40,000 sewer sensors by 2025](#).

<sup>53</sup> For example, Water UK has called for a 'next-generation national monitoring system...that sees all rivers subject to timely, accurate, multi-source data on ecology, chemistry, public health and aesthetics'. Water UK, '[21st Century Rivers: Ten Actions for Change](#)', September 2021, p. 20.

<sup>54</sup> Water companies [such as Yorkshire Water](#) have started to explore the potential for self-repairing materials.

<sup>55</sup> The UK Government's bioeconomy strategy sets out the importance of developing bioscience to meet key challenges relevant to the water sector. BEIS, '[Growing the bioeconomy: a national bioeconomy strategy to 2030](#)', December 2018.

<sup>56</sup> The industry is continuing to develop innovations in building, monitoring and operating nature-based solutions. For example, the [Financing UK Nature Recovery initiative](#) is working with the UK government to develop a roadmap for scaling up environmental markets, including to develop approaches to monitoring and data.

<sup>57</sup> For example, green concrete products such as [geopolymer concrete](#), [ECO Pact concrete](#) and [graphene-reinforced concrete](#) have been developed and/or brought to market in recent years. The [Net-Zero Steel Initiative](#) aims to bring zero-carbon primary steel production technologies to market by 2030 as part of a path to reach net zero emissions in the global steel sector by 2050. The [SteelZero](#) initiative sees organisations commit to procuring, specifying or stocking 100% net zero steel by 2050.

- carbon-free baseload electricity and low-emission HGVs and fleet.<sup>58</sup>
- **Societal attitudes:**
  - varying speed of economy-wide openness to behaviour change.<sup>59</sup>
- **Resilience:**
  - possible need for low-tech fall backs as reliance on digital solutions increases: ensuring resilience to electricity/digital outages.<sup>60</sup>
- **Demand impacts:**
  - possible increases in demand from new technologies, such as carbon capture and storage, and blue/green hydrogen production.<sup>61</sup>

### 4.2.3 Demand

In the common reference scenarios for demand, we include the main drivers of uncertainty around long-term demand that we consider are beyond company control. We include high and low scenarios for **growth** that are aligned to assumptions used by companies in the latest round of WRMPs.

In the low scenario, we also include the potential for future changes to **building regulations and product standards** to reduce household demand for water. The possible impact of these changes has been explored in a 2019 study by Artesia and Water UK, which found that a mandatory government-led scheme to label water-using products, linked to tightening building regulations and water supply fittings regulations, was 'the single most cost-effective intervention to save water'.<sup>62</sup> While the study did not consider impacts at a company-specific level, we expect companies to refer to the study when estimating the impact of the scenario.

We do not include future changes in consumer behaviour, as companies can influence reductions in household demand and improved consumer flushing practices. Companies may consider using wider scenario planning to test different trends in consumer behaviour and ensure robustness. However, we expect companies to assume they will meet relevant performance commitments and government targets.

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<sup>58</sup> The electricity system in Britain has decarbonised by 66% between 2013 and 2020 and National Grid aims to deliver a carbon free system by 2025 (as cited in the [GOScience Trend Deck](#)). The UK Government's [Net Zero Strategy](#) commits to full decarbonisation of the power system by 2035, so we use this date in both the high and low reference scenario. Sales of new petrol and diesel cars [are due to end in the UK by 2030](#).

<sup>59</sup> For example, the Climate Change Committee has identified, in a publication alongside its Sixth Carbon Budget Advice, several sources of 'friction' that can slow societal adaptation to new ways of living and working. Climate Change Committee, '[Net Zero after Covid: Behavioural Principles for Building Back Better](#)', December 2020.

<sup>60</sup> The [National Risk Register](#) cites the increasing risk and potential consequences of cyber attacks on infrastructure, including possible disruption to essential services such as energy and telecommunications, stating that the country's vulnerabilities to cyber attacks 'become greater as we increasingly rely on cyberspace'.

<sup>61</sup> [The UK Hydrogen Strategy](#) sets out an ambition to deliver 1GW of production capacity by 2025 and 5GW by 2030. The government has also stated that 20-35% of the UK's energy consumption by 2050 could be hydrogen-based.

<sup>62</sup> Artesia and Water UK, '[Pathways to long-term PCC reduction](#)', August 2019.

As set out in section 3.3.4, in 2025–30, the core pathway should include investment to meet outcomes under the high demand scenario.

### High demand scenario

**Growth:** use the higher of the two forecasts specified in Box 4 below.

**Building regulations and product standards:** assume no change over the period to 2050.

### Low demand scenario

**Growth:** use the lower of the two forecasts specified in Box 4 below.

**Building regulations and product 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. Companies should refer to the 'Water labelling only (with minimum standards)' scenario used in the Water UK study, 'Pathways to long-term PCC reduction'.<sup>63</sup>

### Box 4: Growth forecasts to be used in England and Wales

#### England

1) population, property and occupancy forecasts derived from **local plans published by the local council or unitary authority**, as used in the latest round of WRMPs, in line with the water resources planning guideline.<sup>64</sup>

2) population, property and occupancy forecasts derived from **ONS population and household projections**, as used in the latest round of WRMPs, in line with the water resources planning guideline.

#### Wales

<sup>63</sup> Water UK, '[Pathways to long-term PCC reduction](#)', August 2019, pp. 3, 15, 54–55. The intervention is described as follows: 'water labelling of relevant products is legislated as mandatory and managed by government. The scheme would be operated in association with Building Regulations and minimum standards (i.e. based on changes to The Water Supply (Water Fittings) Regulations 1999). This would mean that only products performing at a baseline level will be allowed on the market and referenced in the Building Regulations. This would require not only the development of the labelling policy but also the development and agreement on the baseline standard and the amendment of the relevant Building Regulations. It is assumed that there would be 3 minimum standard intervention years over an 11-year period with the first minimum standard coming into force in year 5, then year 8 and finally year 11'.

<sup>64</sup> Environment Agency, Natural Resources Wales, Ofwat, '[Water resources planning guideline](#)', July 2021.

- 1) population, property and occupancy forecasts derived from the latest **local authority population and property projections published by the Welsh Government**, as used in the latest round of WRMPs, in line with the water resources planning guideline.
- 2) population, property and occupancy forecasts derived from the **national population projection for Wales produced by the ONS**.

#### 4.2.4 Abstraction reductions

The rate at which companies will need to reduce abstraction in future to protect the environment is uncertain. It is dependent on how climate change and demand affect the environment, as well as the policy changes that regulators enforce.

In England, the Environment Agency has published scenarios describing different levels of potential abstraction recovery required in the future.<sup>65</sup> These include a 'business as usual' scenario, which assumes the current policy and regulatory approach remains the same up to 2050, and the same percentages of natural flows are protected as today. An 'enhanced' scenario assumes these policies become insufficient to protect ecologically sensitive sites, so greater protection is provided by applying the most sensitive flow constraints.

As set out in section 4, the reference scenarios are designed to represent 'plausible extremes', and so offer a full spectrum of possible futures. **We consider that the Environment Agency's 'enhanced' scenario is appropriate for setting as a high scenario in England.** This scenario is intended to be a starting point for discussions with stakeholders and regulators. Regional groups and companies are expected to refine this information, including engaging on local priorities and undertaking further local and regional analysis.<sup>66</sup>

We consider that an appropriate low scenario would be to assume that currently known legal requirements continue up to 2050. This is a different scenario to that proposed for England in our November discussion paper. This is because we consider the 'business as usual' scenario set out by the Environment Agency does not represent a 'plausible extreme' low scenario. We explain further in section A1.4.5. This scenario should be tested in both England and Wales.

**The low scenario should represent the lowest plausible abstraction reductions that meet currently known legal requirements in force at that point in time.** This may be different to the 'business as usual' scenario, which was included as the low scenario in our discussion paper. The 'business as usual' scenario may not represent a low scenario because

<sup>65</sup> Environment Agency, ['Water resources national framework, Appendix 4: Longer term environmental water needs'](#), March 2020, pp. 4-5.

<sup>66</sup> As set out in Environment Agency, ['Long-term water resources environmental destination: Guidance for regional groups and water companies'](#), October 2020.

it assumes higher future greenhouse gas emissions than our low reference scenario for climate change. In line with our definition of the reference scenarios as 'plausible extremes', we expect the low abstraction reductions scenario to use 'benign' assumptions about the future, such as low climate change.

The 'business as usual' scenario, in common with the other environmental scenarios published as part of the water resources national framework, is not intended to be applied directly without considering the implications or other sources of evidence. This means that additional local and regional analysis can be used to validate and build on the scenario. Regional groups and water companies are doing this, alongside the environmental regulators, as part of the development of their plans and the low scenario should be able to include this evidence where appropriate.

In Wales, NRW has not published scenarios around abstraction reductions. To reflect the Welsh policy approach to setting an environmental destination, we do not require companies in Wales to test a high abstraction reductions scenario.

### High abstraction reductions scenario

In England, use a scenario aligned with the Environment Agency's 'enhanced' scenario.<sup>67</sup>

In Wales, we do not require companies to test a high abstraction reductions scenario.<sup>68</sup>

### Low abstraction reductions scenario

In both England and Wales, assume only currently known legal requirements for abstraction reductions up to 2050.

## 4.3 Wider scenario testing

The common reference scenarios are not intended to be comprehensive or exhaustive, and only test a limited number of key parameters. **Therefore, we also expect companies to use wider scenario planning, as deemed necessary, to:**

- test against **any relevant factors not specified in the reference scenarios**, such as company-specific or local factors;

<sup>67</sup> The Environment Agency sets out that the 'enhanced' scenario should be used to 'identify where it may be necessary to provide enhanced protection to buffer from predicted climate change impacts and use additional local information and evidence to refine which sites (water bodies and groundwater dependent terrestrial ecosystems) and catchments where these enhanced targets should apply to'.

<sup>68</sup> This includes sites in Wales managed by English companies.

- demonstrate that the strategy is **resilient to a range of risks**;
- demonstrate that **risks are understood and have been considered in the development of the strategy**; and
- help to **validate the strategy**, and/or to **test whether alternative options and programmes would be more appropriate**, including the different adaptive pathways set out in the strategy.

Companies may also consider undertaking **sensitivity analysis** to test alternative input assumptions.

We expect companies to take ownership of their strategies. Companies should judge for themselves how far wider scenario testing is required to ensure an appropriate level of long-term resilience, as well as the specific methods that need to be used to achieve this.

We note the findings from the third Climate Change Risk Assessment (CCRA) report, which identifies seven key risks facing the water sector as a result of climate change.<sup>69</sup> Companies may consider these risks in developing their strategies.

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<sup>69</sup> UK Climate Risk Independent Assessment, '[Water briefing](#)', June 2021.

## 5. Future long-term delivery strategies

**The introduction of long-term delivery strategies should represent a significant shift towards a stronger long-term focus in the sector.** We anticipate that PR24 marks a significant step towards integrating long-term considerations more fundamentally into the price review process, and we expect that our approach will continue to evolve for PR29 and beyond as we learn lessons from PR24. At the same time, we expect companies' long-term planning capabilities will improve over time, particularly in areas of the business that were not covered by long-term frameworks before PR24.

**We are setting out our guidance on the assumption that the strategies will need to be modified to some extent in future, taking into account new information and circumstances.** For example, changes in customer views, scientific evidence, government policies, or new innovations may mean changes to the strategy are in the interests of customers, communities and the environment. We therefore expect that, at future price reviews, companies would submit refreshed strategies.

**However, it will be important that there is a clear line of sight between the previous and refreshed strategy.** Adaptive pathways should ensure a level of continuity between strategies over time, by providing advance visibility of how the strategy is likely to change given different futures. Where appropriate, companies will need to set out what new information or circumstances have led to an evolution in the strategy. This should separately identify changes that were taken into account in the adaptive pathways, and those that could not have been considered in the previous strategy.

**The strategies submitted at PR24 should support this process.** This includes providing clear data around the assumptions being taken, explaining how the adaptive pathways are being monitored, and setting out under what circumstances alternative or additional investment would be triggered.

**We anticipate that the common reference scenarios will also be revisited in future, in consultation with the sector.** This will be necessary to ensure they use up-to-date information, as well as to use learnings from PR24 to consider which factors are appropriate for testing on a common basis, and which should be covered entirely by wider company-specific stress-testing.

## A1 Responses to our discussion paper

This section summarises the responses received to our November discussion paper, and sets out how we have taken these responses into account in our final guidance.<sup>70</sup>

Broadly, companies and stakeholders supported the introduction of long-term delivery strategies and the use of adaptive planning. Most respondents stated that the use of common reference scenarios, alongside wider scenario testing, was helpful. We have therefore retained our overall approach, with some changes to reflect stakeholder feedback. In terms of more detailed feedback, we received various responses, including around the use of a core pathway and the parameters used for the reference scenarios.

We summarise the key policy changes we have made since November in section A1.1. We then set out the key feedback we received, and our response to each, in the subsequent sections.

### A1.1 Key changes from our discussion paper

**Incorporating strategic planning frameworks:** We set expectations that companies should present their 'most likely' pathway from their WRMPs as an alternative pathway in their strategies, where this is not the same as the core pathway. This aligns with the updated water resources planning guideline. Where a 'most likely' or central pathway has been used in DWMPs, the same approach should be taken (see section 3.3.4).

**Scope of strategies:** We confirm that bioresources enhancement expenditure is within the scope of the strategies. We continue to consider that adaptive pathways should focus on future requirements for enhancement rather than base expenditure. However, the accompanying narrative should explain how the company's approach to its future base and enhancement activities will contribute to meeting long-term outcomes (see section 3.3).

**Assumptions:** We clarify that, where companies make assumptions about factors that are not covered by their adaptive pathways, they will need to clearly set out those assumptions (see section 3.5.1).

**Technology reference scenarios:** In response to stakeholder feedback, we make minor adjustments to the reference scenarios for technology (see section 4.2.2). This includes making the scenarios more ambitious with regard to smart meter penetration. We also increase the ambition of the faster scenario around low-carbon building materials, to better differentiate the faster and slower parameters. We include intelligent sewer technology

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<sup>70</sup> All responses to our discussion paper are published on our [website](#).

under the 'new wastewater approach' category to reflect progress currently being made by leading companies in this area.

**Demand reference scenarios:** We clarify that the high demand scenario should use the higher of the growth forecasts specified in Box 4, section 4.2.3, and the low scenario should use the lower of the forecasts. This is to ensure the most appropriate forecasts are used for each scenario.

**Abstraction reductions reference scenarios:** In response to stakeholder feedback, we change the low reference scenario for abstraction reductions to assume currently known legal requirements up to 2050. This applies to both England and Wales. We remove the requirement to test a high scenario in Wales, to reflect the Welsh policy approach to setting an environmental destination (see section 4.2.4).

## A1.2 Approach to long-term delivery strategies

### A1.2.1 Scope of long-term delivery strategies

Affinity Water, Anglian Water, Northumbrian Water, Thames Water, Wessex Water and Yorkshire Water suggested that base expenditure should be included in long-term delivery strategies, although Southern Water stated that the focus on enhancement spending at PR24 was appropriate.

We consider that the adaptive pathways in long-term delivery strategies should focus on requirements for enhancement expenditure. Enhancement spending will benefit most from scenario testing and consideration of sequencing. There is also less uncertainty around future base costs than future enhancement costs, as base costs are routine, year-on-year costs, but enhancement investments are more strongly driven by changes in external factors.

However, the effective management of assets through base expenditure is vital to meet the long-term challenges the sector faces. We expect companies to understand the long-term risks to customers and the environment from asset failure and to explain how they will effectively manage them. As part of their strategies, companies should therefore provide a clear narrative on how the company expects to achieve the ambition and vision, including how its approach to its future base and enhancement activities will contribute to meeting long-term outcomes (see section 3.3).

Companies will also need to develop their own forecasts of performance improvements from base expenditure to inform their strategies (see section 3.5.2). Enhancement investments should build on these activities to meet long-term objectives.

United Utilities stated that long-term delivery strategies should include bioresources. We confirm that bioresources enhancement expenditure is within the scope of the strategies.

### **A1.2.2 Enhancement funding for preparatory work**

We recognised in our discussion paper that some enhancement investment may be necessary where preparatory work is required in advance of an alternative pathway being triggered (see section 3.4.5). This allows options to be kept open for the future.

All respondents who commented on this proposal agreed that providing options funding was important to enable adaptive planning. Southern Water set out that we should not claw back this investment if the options it supports are not selected. We agree this would be counterproductive, as the intention of the funding is to reduce the risk of stranded assets by helping to schedule the decision point when uncertainty is likely to be lower.

Severn Trent Water, Southern Water and Yorkshire Water asked us to consider expanding our approach by allowing funding to support in-period trigger points. We do not think this is appropriate, for the following reasons:

- trigger points should be used to alleviate the greatest future uncertainties, and we consider that the greatest uncertainty around future enhancement investment requirements relates to requirements in the long term;
- we do not consider there is sufficient uncertainty in key measurable external factors, such as the pace of climate change, within the initial five-year period to justify funding further investment part-way through the period;
- insofar as uncertainties exist in the five-year period, the regulatory framework includes a number of mechanisms to spread risk between companies and customers; and
- where a solution will only be needed if more adverse future scenarios come to pass, but it needs to start construction during 2025-30, we would provide funding at PR24. This would be the case if there is no efficient option to instead keep future options open (see section 3.3.2).

## **A1.3 Requirements for long-term delivery strategies**

### **A1.3.1 Ambition**

Anglian Water stated it was unclear how common performance commitments will align with long-term delivery strategies. We expect strategies to include forecasts of performance against, at minimum, all the PR24 common performance commitments, except those based on compliance, such as compliance risk index, or relative performance, such as C-Mex (see

section 3.2). We will be refining the list of common performance commitments during the development of the PR24 methodology.

Dŵr Cymru asked us to clarify how price control deliverables (PCDs) should be reflected in long-term delivery strategies. PCDs will hold companies to account for scheme-specific outputs delivered at PR24, for example where the benefits of significant investment cannot be easily monitored. In their business plan, we expect companies to propose price control deliverables to protect customers against the risk of non-delivery of significant investment where they are not protected through PCs. We do not expect companies to propose PCDs for investment beyond 2025–30 in their strategies. However, where planned key investments are expected to deliver benefits that cannot be captured in common performance commitments, this should be highlighted.

### **A1.3.2 Core adaptive pathway**

Our discussion paper set out that companies should set out a core pathway in their long-term delivery strategies, along with alternative pathways that could be triggered depending on how future uncertainties develop (see section 3.3.2). The core pathway should include:

- 'no and/or low regrets' investments, for example investments that are required:
  - in both benign and adverse scenarios;
  - across a wide range of plausible scenarios; or
  - need to be undertaken to meet short-term requirements; and
- investment required to keep future options open (such as enabling work or learning and monitoring), where possible, or is required to minimise the cost of future options.

CCW, Dŵr Cymru, Portsmouth Water and South East Water expressed support for how we described the core pathway. However, Affinity Water, Severn Trent Water and Yorkshire Water set out concerns that using a core pathway risks underinvestment, and Yorkshire Water proposed that a 'most likely' pathway should be used instead. Severn Trent Water argued that meeting only low scenarios could cost more over the long term.

We do not consider that the use of a core pathway risks underinvestment. The core pathway does not just include investment to meet low scenarios, but also investments that will be required across a wide range of plausible future scenarios. This approach aligns with, for example, the UK Government's Supplementary Green Book guidance, which emphasises the need to identify no and low-regret measures as an early priority, and then to keep future options open to respond appropriately as the future develops.<sup>71</sup> We encourage companies to consider adaptive, modular or flexible solutions in the first instance to align with this approach.

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<sup>71</sup> UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020, pp. 19–20.

Where incremental investments will likely be needed to meet more adverse future scenarios, then companies can set out alternative pathways, containing alternative or additional packages of investment that may be triggered in future by changes in external factors. The core pathway enables those options by delivering investment to keep options open or ensure they do not become significantly more expensive.

The decision points associated with these pathways should be developed so that the necessary activities can be undertaken in advance of the scenario actually occurring. For example, an alternative pathway that is dependent on a certain level of demand being reached in the future should factor in the lead times of any investments required to meet that scenario. The trigger point should indicate the conditions under which the need for additional or alternative investment becomes clear, expressed as an observable metric.

Therefore, the use of core and alternative pathways, with appropriate decision and trigger points, prioritises no- and low-regret solutions, while also enabling any other actions that may be required to meet future high scenarios.

Dŵr Cymru noted that the water resources planning guideline (WRPG) specifies the use of a 'most likely' pathway. We expect a 'most likely' pathway, as included in WRMPs, to feature as an alternative pathway in long-term delivery strategies. This will show where the activities required to meet 'most likely' scenarios diverge from those described by the core pathway. This aligns with the current water resources planning guideline, which requires WRMPs to identify both a 'most likely' pathway and a core pathway, and to describe the differences between the two.<sup>72</sup>

Severn Trent Water asked for clarification on whether the core pathway could lie outside the range of uncertainty described by the reference scenarios. As the core pathway contains low-regret investment, and the benign reference scenarios represent the lowest plausible scenarios, the core pathway should, by definition, meet the company's ambition under each of the benign reference scenarios. Where the company considers that no- or low-regret investments are sufficient to meet the adverse reference scenarios, then the core pathway can meet these scenarios as well. However, where the need to invest is more uncertain, we expect companies to identify opportunities to schedule decision points later in the timeline, at which point there is likely to be greater clarity about what is needed. In this case, at least some of the investment required to meet the adverse reference scenarios would be included in alternative pathways, rather than the core pathway.

Bristol Water and SES Water asked for more explicit guidance around the core pathway. We have aimed to make our expectations clearer in this document (see sections 1.1 and 3.3.2).

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<sup>72</sup> Environment Agency, Ofwat, NRW, 'Water resources planning guideline', December 2021, pp. 108-9.

### A1.3.3 Alternative adaptive pathways

A number of companies agreed with our discussion paper that there should be 'a relatively small number of alternative pathways, focused on the key areas of risk and uncertainty' (see section 3.3.3). Affinity Water, Northumbrian Water and SES Water asked for additional guidance on what constitutes a 'material' change that should be accounted for by an alternative pathway.

SES Water requested that we clarify the number of pathways needed to meet the reference scenarios. Southern Water stated it did not support having to provide fully-costed plans for the core pathway and combinations of all eight reference scenarios. Water Resources West asked us to confirm that the business plan tables relate to pathways rather than scenarios, and that the number of pathways are optional.

We do not prescribe a specific number of pathways to be presented in long-term delivery strategies. However, there will be a minimum of three: the core pathway, the 'most likely' pathway aligned to the company's WRMP, and at least one further alternative pathway. We have set out business plan tables that accommodate up to ten different pathways, including the core pathway. It is up to companies to reassure themselves that enough alternative pathways have been described to achieve their long-term ambition in a range of plausible futures.

We do not expect an alternative pathway for each reference scenario or combination of scenarios. The core pathway should be designed to meet at least the benign reference scenarios. Further, an alternative pathway may be sufficient to meet long-term outcomes under two or more of the adverse reference scenarios. However, nor should pathways be necessarily limited to those required to meet the reference scenarios – these scenarios are not designed to be exhaustive or comprehensive, and companies should consider a wider range of scenarios and uncertainties as they deem necessary to form a robust strategy. As set out in section 4.1, companies are not required to combine the reference scenarios.

Bristol Water stated that local circumstances should be considered relevant to adaptive pathways and we should allow local drivers for adaptive pathways. We agree that, where appropriate, companies can define trigger points on the basis of local or company-specific factors. As explained in section 4, the reference scenarios are not designed to be exhaustive or comprehensive.

### A1.3.4 Regulatory burden

Affinity Water, Hafren Dyfwdwy, South Staffs Water, SES Water and Southern Water expressed concerns about the potential for long-term delivery strategies to impose significant regulatory burden. However, South Staffs Water noted that in the long term the regulatory burden may reduce, as companies will need to adjust rather than reset their

strategies, and Southern Water stated that focusing on enhancement spending was a proportionate approach for the first round of strategies.

In setting our requirements, we have sought to balance the benefits of simplification against sophistication. We consider our requirements are the minimum possible to develop robust strategies that can be meaningfully assessed and can inform the price review process. This has been informed by learnings from PR09, when we required companies to produce strategic direction statements (SDSs). We did not set any specific guidance for updating the statements or how they should influence the business plan, and we often struggled to see a clear line of sight from the SDSs to business plans. It also builds on the submission of long-term performance commitment forecasts at PR19.

We expect long-term delivery strategies to bring together the outputs from existing strategic planning frameworks, such as WRMPs and DWMPs, into a consistent and holistic long-term strategy, along with planned activities in other areas of the business. These frameworks cover a significant proportion of companies' enhancement activity, and they are being developed independently of the requirement to submit long-term delivery strategies. We therefore consider that key parts of the strategy are being developed already, and the main additional burden arises from considering areas not covered by these frameworks, such as achieving net zero emissions.

We have sought to alleviate concerns about regulatory burden by clarifying our guidance in this document. For example, we have set out that we do not expect companies to develop an alternative pathway for each reference scenario. It is up to companies to determine how many alternative pathways are required to robustly plan and demonstrate to stakeholders how they intend to achieve their long-term ambition in a range of plausible futures. However, we have published business plan tables that can accommodate nine alternative pathways. While companies can go beyond this, we suggest that up to nine alternative pathways would represent a proportionate approach.

Affinity Water called for the introduction of a materiality threshold for the enhancement investments that should be described in adaptive pathways. We agree that adaptive pathways should focus on the main areas of risk and uncertainty. However, we consider a materiality threshold risks excluding schemes that are relatively low-cost, but are important to support the strategy, for example to enable future schemes or alternative pathways. As set out in section 3.3.1, companies should describe only key enhancement schemes in their adaptive pathways, and then cover the full enhancement strategy in the accompanying narrative and data tables. It is for companies to judge which activities are key to their strategy and therefore should be described in adaptive pathways.

### **A1.3.5 Links to strategic planning frameworks**

Affinity Water, Bristol Water, Northumbrian Water and Yorkshire Water stated that there was some misalignment in timetables between the development of WRMPs and long-term delivery strategies. Affinity Water noted that it would need to prepare its draft WRMP while unsighted on our final guidance for long-term delivery strategies. Bristol Water stated that there was insufficient time to reflect the reference scenarios in draft WRMPs.

We recognise that companies are currently developing their draft WRMPs and that our guidance involves some additional requirements. We have taken steps to align strategic planning frameworks with long-term delivery strategies. For example, our guidance on the core pathway aligns with the current water resources planning guideline, which requires WRMPs to identify both a 'most likely' pathway and a core pathway, and to describe the differences between the two (see section 3.3.4).<sup>73</sup> A similar approach should be taken to align with DWMPs.

Many of the reference scenarios are already being tested in WRMPs and full integration will likely require testing a small number of additional assumptions. We appreciate that companies are currently developing their draft WRMPs, for submission in October 2022, with final WRMPs due to be published in September 2023. We consider this timetable is sufficient to reflect any additional reference scenarios. This final guidance largely retains the same reference scenarios that were set out in our November discussion paper. Further, we have been pleased to see, through our pre-consultation engagement on the WRMPs, that many companies have already begun to incorporate the reference scenarios.

Southern Water noted that the five parts of the long-term delivery strategies are all included in some form in WRMPs. We expect the strategies to bring together the outputs from existing strategic planning frameworks into a consistent and holistic strategy, along with areas of the business not previously covered by long-term frameworks. We consider that WRMPs provide a strong and mature framework for long-term planning and that long-term delivery strategies offer the greatest value in areas of the business that, before PR24, were not covered by formal planning processes. We also consider that the ongoing work on WRMPs and DWMPs means key parts of the long-term delivery strategy are being developed already.

### **A1.3.6 Customer engagement**

Affinity Water, Anglian Water, CCW, Northumbrian Water, SES Water, United Utilities and Waterwise agreed that long-term delivery strategies should be supported by evidence of customer priorities. Dŵr Cymru, Northumbrian Water and United Utilities noted that it is difficult to conduct meaningful customer engagement about long-term issues.

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<sup>73</sup> Environment Agency, Ofwat, NRW, 'Water resources planning guideline', December 2021, pp. 108-9.

We agree there are challenges around obtaining meaningful views on long-term preferences. However, we consider these issues can be at least partially alleviated through good research design (see section 3.1). Companies should balance current customer preferences and priorities against other relevant considerations, such as longer-term efficiency and fairness between current and future customers. We expect company research on long-term issues to be 'fit for purpose', for example to ensure the sample and methodology is appropriate for the research objectives.<sup>74</sup>

Bristol Water suggested that our requirements conflicted with our proposals for collaborative customer research, because we have stated that companies should not submit research that duplicates the collaborative research. Yorkshire Water stated that it was unclear how centralised research will support long-term delivery strategies.

We have set out that companies should undertake their own research for long-term delivery strategies.<sup>75</sup> We recognise that, in some areas, this could overlap with the collaborative outcome delivery incentive (ODI) rates research for common performance commitments, for example if companies conduct willingness to pay research to support enhancement proposals.<sup>76</sup> We expect companies to demonstrate they have considered the coherency between the evidence used to inform ODI rates and evidence collected to support their enhancement cases, where appropriate, explaining how they have accounted for differences. We expect companies to provide evidence that customer views have been generated in accordance with the standards set out in our position paper.<sup>77</sup>

### **A1.3.7 Future long-term delivery strategies**

Southern Water set out that a 'retrospective audit' of long-term delivery strategies at future price reviews may limit innovation and flexibility, and that adaptive planning should accommodate future changes to trigger points and pathways.

We agree that strategies will need to be modified to some extent in future, taking into account new information and circumstances (see section 5). We therefore expect that, at future price reviews, companies would submit refreshed long-term delivery strategies. However, it will be important that there is a clear line of sight between the previous and refreshed strategy, including to set out what new information or circumstances have led to an evolution in the strategy. This helps to ensure a level of continuity between strategies over time, while allowing for them to be updated as appropriate. Our approach takes into account learnings from PR09, where we did not provide explicit guidance on updating the SDSs. We

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<sup>74</sup> Ofwat, '[PR24 and beyond: Customer engagement policy – a position paper](#)', February 2022, p. 6.

<sup>75</sup> Ofwat, '[PR24 and beyond: Customer engagement policy – a position paper](#)', February 2022, p. 4.

<sup>76</sup> Ofwat, '[PR24 and beyond position paper: Collaborative customer research for PR24](#)', October 2021, p. 7.

<sup>77</sup> Ofwat, '[PR24 and beyond: Customer engagement policy – a position paper](#)', February 2022.

expect that our approach, as well as companies' long-term planning capabilities, will continue to evolve for PR29 and beyond as we learn lessons from PR24.

## A1.4 Scenario testing

### A1.4.1 Common reference scenarios

CCW, Northumbrian Water, Portsmouth Water, SES Water, Severn Trent Water, United Utilities and Water Resources West supported the use of common reference scenarios. South Staffs Water stated that the reference scenarios were too prescriptive, and it is for each company to own their long-term investment strategy.

We consider that scenario analysis is integral to an adaptive planning approach. It helps to provide confidence that the investments contained within the pathways are likely to deliver the ambition efficiently in a range of plausible futures. We do not consider that requiring strategies to be tested against a small number of reference scenarios impedes on companies' ownership of their investment strategies. Instead, it helps companies to demonstrate that their proposed enhancement investments are appropriate given plausible long-term variations in key factors. The reference scenarios we have selected reflect engagement with the sector and beyond, and companies are already required to test against scenarios for climate change, demand and sustainability reductions in their WRMPs.

Bristol Water stated that a SWOT approach may be a more meaningful way to assess the impact of external factors, as a scenario approach requires certainty around cause and effect. We do not agree that scenario planning requires certainty around cause and effect. We consider that potential impacts can be modelled given current information and results presented using confidence ranges if necessary. We expect companies to take this uncertainty into account when setting appropriate trigger points.

CCW, Northumbrian Water, SES Water, United Utilities and Water Resources West supported the four areas we proposed should be covered by the reference scenarios. Hafren Dyfrdwy suggested that the reference scenarios should be defined differently in Wales, as they are less relevant to the risks facing the country. A number of respondents suggested additional scenarios to be set on a common basis.

We have aimed to identify areas in which setting common scenarios are most likely to add value, and then to allow companies to use wider scenario planning as they deem appropriate. We consider that prescribing materially different 'common' scenarios for different companies would limit the usefulness of the exercise, as strategies would be less comparable. We have sought to reflect the Welsh policy context in our abstraction reductions scenarios, where we do not require a high scenario to be tested. However, we are keen to emphasise that the reference scenarios are not intended to be comprehensive or exhaustive, and only test a

limited number of key parameters. Companies should test against material local or company-specific scenarios where appropriate.

## A1.4.2 Climate change

Bristol Water, Hafren Dyfwdwy, Natural Resources Wales, Severn Trent Water, Water Resources West and Yorkshire Water expressed concerns that RCP2.6 is too low to be used as a reference scenario. Severn Trent Water and United Utilities stated that RCP8.5 is a very conservative scenario. The Wildlife Trusts commented that climate change scenarios aligned to global average temperature rises of 2°C and 4°C by 2100 were appropriate. Wessex Water stated that the reference scenarios for climate change aligned with those used for WRMPs.

We have aimed to set out reference scenarios that represent a wide range of plausible future uncertainties. This is in line with best practice in scenario planning for adaptation, which suggests that scenarios should outline plausible representations of how factors may unfold, based on past observations and future projections.<sup>78</sup> We note that many of the concerns expressed by some respondents question whether RCP2.6 and RCP8.5 represent plausible future eventualities.

At the 50th percentile, RCP2.6 corresponds to an average global mean surface temperature that is 1.6C higher in 2081–2100 than in the pre-industrial period.<sup>79</sup> We consider there is sufficient evidence that this scenario is plausible, even if it may not be the most likely scenario. For example, the goal of the Paris Agreement, set at COP21 in 2015, is to limit global warming to well below 2°C, and preferably to 1.5°C.<sup>80</sup> The Glasgow Climate Pact, agreed at COP26 by nearly 200 countries in 2021, finalised the Paris Agreement and states that a temperature rise of 1.5°C 'remains in sight', as long as 'concerted and immediate global efforts' are undertaken.<sup>81</sup> These aims are reflected in government policy in England and Wales.<sup>82</sup>

Water Resources West referred to a June 2021 report by the Climate Change Committee (CCC), which states that RCP4.5 and RCP6.0 are within the range consistent with current climate change policies, while RCP2.6 and RCP8.5 lie outside this range.<sup>83</sup> We note that the CCC uses two main outcomes for its detailed analysis, including a pathway in which warming is limited to 1.5–2.5°C.<sup>84</sup> This includes outcomes that meet the aims of the Paris Agreement, and

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<sup>78</sup> For example, UK Government, '[Accounting for the Effects of Climate Change: Supplementary Green Book Guidance](#)', November 2020, p. 9.

<sup>79</sup> Met Office, '[UKCP18 Guidance: Representative Concentration Pathways](#)', November 2018, p. 1.

<sup>80</sup> United Nations, '[The Paris Agreement](#)', December 2015.

<sup>81</sup> United Nations, '[COP26 keeps 1.5C alive and finalises Paris Agreement](#)', November 2021.

<sup>82</sup> For example, the UK's [sixth Carbon Budget](#), announced in April 2021, aims to secure consistency with the goal of the Paris Agreement. Wales is a founding member of the [Under2 Coalition](#), which commits to climate action in line with the Paris Agreement.

<sup>83</sup> Climate Change Committee, '[Third UK Climate Change Risk Assessment Technical Report](#)', June 2021, p. 18.

<sup>84</sup> Climate Change Committee, '[Third UK Climate Change Risk Assessment Technical Report](#)', June 2021, pp. 15–17.

incorporates the RCP2.6 scenario. The CCC advises in this report that a risk assessment for adaptation to climate change should include:

- 'an approximate minimum level of global warming that can be expected if humans take action to reduce their influence on climate';
- 'an approximate maximum rate of global warming consistent with a continuation of current human influence, accounting for uncertainties in anthropogenic greenhouse gas emissions and the climate system response'; and
- 'higher rates of warming above those currently considered consistent with the current trajectory, and low-likelihood, high-impact events such as climate system tipping points'.

We consider that our requirement for strategies to be appropriate in terms of RCP2.6 and RCP8.5, as well as scenarios in between, aligns with this guidance (see section 4.2.1).

Water Resources West noted that the Climate Action Tracker's 'optimistic' scenario corresponds to a predicted median 1.8°C temperature rise by 2100, which is slightly higher than our low scenario.<sup>85</sup>

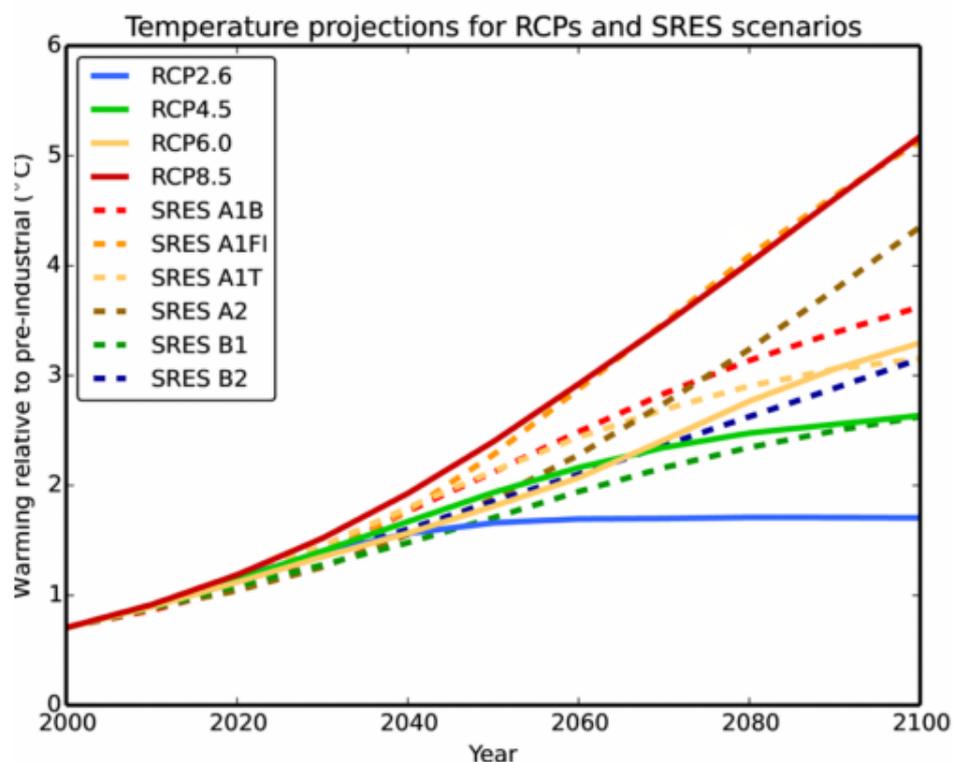
The 'optimistic' scenario is based on the assumption that governments will achieve the net zero targets they have adopted or are under discussion. We do not think it is implausible – or so implausible that it should not be used as one scenario to test the robustness of strategies – that governments achieve their stated pledges on net zero. While the Climate Action Tracker suggests this future would correspond to a 1.8°C rise, we consider this eventuality is better accounted for by testing against RCP2.6 than using any other RCP. The next highest RCP used by the UKCP18 projections, RCP4.5, corresponds to an average temperature rise of 2.4°C at the 50th percentile. Therefore, using RCP4.5 as a low scenario would not cover the possibility that existing pledges are met.

South East Water stated there was an 'enormous' difference between the high and low climate change scenarios, and that a central scenario might be considered as well. Bristol Water set out that, following initial testing, neither the high nor low scenario made material difference to enhancement expenditure.

We welcome companies testing a 'central' or 'most likely' scenario alongside the reference scenarios, as the aim is for strategies to be appropriate for meeting a full range of plausible scenarios, given what we know now. Due to the level of deep uncertainty around the pace of future climate change, this range is broad when considering a long time horizon. However, we would note that, in terms of average global temperature projections, the majority of the divergence between RCP2.6 and RCP8.5 takes place after 2050 (see Figure A1.1).

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<sup>85</sup> Climate Action Tracker, ['Temperatures'](#), November 2021.

**Figure A1.1 Global mean temperature projections for RCPs and SRES scenarios<sup>86</sup>**

Hafren Dyfwdwy and Natural Resources Wales stated that asking for Welsh companies to test their strategies against RCP2.6 conflicts with guidance from Natural Resources Wales for water resources planning. We have engaged with Natural Resources Wales and Welsh Government on this issue. Welsh companies should continue to test against RCP2.6, as well as against the climate change scenarios specified by the NRW guidance. We consider our requirements are additive to the NRW guidance and help to ensure the strategy is robust to a wider range of plausible futures.

Wessex Water proposed that a target for reducing carbon emissions is added to the reference scenarios. As set out in our net zero principles position paper, we expect company net zero plans to be clearly linked to national government targets.<sup>87</sup> We consider that focusing on the UK and Welsh government's 2050 net zero target, and the interim targets for 2035 (in England) and 2040 (in Wales) represents the most effective way forward for achieving net zero.

### A1.4.3 Technology

Wessex Water noted the technology reference scenarios were more subjective than the other reference scenarios and stated their impact could not be modelled in the same way as climate change or demand. Anglian Water argued that it was very challenging or impossible

<sup>86</sup> Met Office, '[UKCP18 Guidance: Representative Concentration Pathways](#)', November 2018, p. 2.

<sup>87</sup> Ofwat, '[Net zero principles position paper](#)', January 2022, pp. 5-6.

to set upper and lower parameters for technological innovation over the long term. Affinity Water, Anglian Water and Bristol Water stated that the factors described by the scenarios were not exogenous, with Affinity Water expressing concerns that the scenarios were driven by companies' own strategies. Yorkshire Water commented that the technologies and delivery dates were very specific.

We agree that the technology scenarios are more qualitative than the other reference scenarios. However, we do not consider this makes them unsuitable to consider in scenario planning. For example, the Government Office for Science states that scenarios are 'stories that describe alternative ways the external environment might develop', and are not intended to be predictions, but to provide a 'sand pit' to explore the choices that might be made under different conditions.<sup>88</sup> As such, the technology scenarios provide a tool to help companies consider the potential impact of future innovations when forming investment sequences (see section 4.2.2).

The relative pace of technological development is a material factor that needs to be examined when forming these sequences. Future developments are likely to affect the overall cost of meeting long-term outcomes, as well as the best options for doing so. The use of specific dates in the scenarios is not intended to imply any level of certainty around the pace of development, but to provide a yardstick for exploring two different plausible futures, and to help form a strategy that is robust to both of those futures.

We agree that the adoption of technologies is partially under the control of individual companies. However, adoption will largely depend on whether the company considers it cost-beneficial to do so, which is in turn affected by a range of factors beyond company control. The reference scenarios effectively describe futures where full adoption and operationalisation become cost-beneficial by different dates.

We do not agree that the scenarios are driven by companies' own strategies. Companies' strategies will be, at least initially, built up around assumptions around how technology will develop over the long term. The reference scenarios are designed to challenge those assumptions and test different ones. If companies' strategies plan to fully operationalise a technology before the date specified in the faster scenario, when testing against the faster scenario they should instead use the earlier date.

Yorkshire Water argued that the scenarios assumed all technologies would deliver greater efficiency, while Affinity Water stated that technology does not always lead to lower bills.

In all the reference scenarios, we do not prescribe how factors will affect companies and their strategies. It is for companies to analyse the long-term implications of the scenarios for

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<sup>88</sup> Government Office for Science, ['The Futures Toolkit: Tools for Futures Thinking and Foresight Across UK Government'](#), November 2017, p. 51.

their business and region. We have recognised that technological development can bring challenges, such as an increased risk from cybercrime.

Affinity Water, Bristol Water and Portsmouth Water stated that the faster and slower technology scenarios are not materially different from one another. We have made some adjustments to the scenarios that more clearly differentiate the faster and slower parameters. This includes increasing the ambition of the faster scenario around low-carbon building materials. We have also included assumptions around smart meter penetration in both scenarios.

Arqiva and Waterwise stated that the assumption in the faster scenario of 100% smart metering coverage was not sufficiently ambitious, while Affinity Water commented that it was not relevant as the company plans to achieve full coverage by 2035. Natural Resources Wales argued that the assumption was unrealistic in Wales, as no Welsh companies are subject to compulsory metering.

In response to this feedback, we have adjusted the scenarios so they are more ambitious with regard to smart meter penetration. If companies' strategies plan to fully operationalise a technology before the date specified in the faster scenario, when testing against the faster scenario they should instead use the earlier date. We consider it is useful to test the faster scenario in areas that are not currently subject to compulsory metering, so that the strategy can be made robust to a future where this may change.

Portsmouth Water requested clarification that the inclusion of carbon-free baseload electricity by 2035 under both the faster and slower scenarios was correct. We confirm this is correct. The UK Government's Net Zero Strategy commits to full decarbonisation of the power system by 2035, so we use this date in both the faster and slower scenario.<sup>89</sup>

Water Resources West requested clarification that the different technology scenarios would affect the cost of meeting targets for per capita consumption and leakage, but would not change the targets. In England, where targets for 2050 in both of these areas have been set by government, we agree that neither technology reference scenario changes what companies should be aiming for, though it may change the optimal sequencing of investments to reach long-term targets.

#### **A1.4.4 Demand**

Natural Resources Wales, South Staffs Water, Severn Trent Water, United Utilities, Water Resources West and Yorkshire Water set out that the low demand scenario, which requires companies to test their strategies against ONS projections, does not align with existing

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<sup>89</sup> HM Government, '[Net Zero Strategy: Build Back Greener](#)', October 2021, p. 19.

guidance for WRMPs. Thames Water stated that there was a good level of alignment between the reference scenarios and its regional planning scenarios.

The water resources planning guideline requires companies in England to base forecast population and property figures on local plans published by the local council or unitary authority. In Wales, figures should be based on the latest local authority population and property projections published by the Welsh Government. The guideline also specifies that forecasts must not constrain planned growth.

The use of these forecasts as high reference scenarios will not constrain planned growth. The core pathway, by definition, meets short-term requirements, including high scenarios in the short term. Therefore, the core pathway should contain the enhancement investment required to meet local authority forecasts over the 2025–30 period (see section 3.3.2). It should also contain any investment to prepare for alternative adaptive pathways beyond this period to meet high scenarios, such as that required to keep future options open.

As set out in section 3.3.4, we expect companies to present the 'most likely' pathway for WRMPs as an alternative pathway in the long-term delivery strategy. Therefore, where investment is required beyond 2030 to meet the high demand scenario, but does not meet the core pathway requirements, the 'most likely' alternative pathway will begin to diverge from the core pathway. This aligns with the latest WRPG, which requires WRMPs to identify both a 'most likely' pathway and a core pathway, and to describe the differences between the two.

Bristol Water, Natural Resources Wales, South East Water, Water Resources West and Wessex Water argued that the scenarios should include changes in consumer behaviour. We consider that consumer behaviour is at least partially under company control. All companies have performance commitments for reducing per capita consumption in the 2020–25 period, and we have proposed to continue setting performance commitments for the sustainable use of water in 2025–30.<sup>90</sup> The UK Government's SPS sets out that companies should be held to account for their contribution towards reducing per capita consumption to 110 l/h/d by 2050.<sup>91</sup>

We do not consider it appropriate to prescribe reference scenarios that assume companies do not achieve their targets. We consider strategies are more useful if it is assumed that companies achieve their statutory targets and long-term ambition in all future scenarios. Companies can then establish the likely optimal pathways to get there, given future uncertainties. We accept that there are factors that affect demand and are not under company control. This includes changes in government policy. A 2019 Water UK study suggested that the most cost-effective intervention to reduce water consumption was 'a mandatory government-led scheme to label water-using products, linked to tightening

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<sup>90</sup> Ofwat, '[PR24 and beyond: Performance commitments for future price reviews](#)', November 2021, p. 25.

<sup>91</sup> Defra, '[The government's strategic priorities for Ofwat](#)', February 2022.

Building Regulations and water supply fittings regulations'. We have included this measure in the low scenario (see section 4.2.3).

Natural Resources Wales and Waterwise stated that the scenarios should include changes in non-household demand. Waterwise also refers to other possible policy changes that could feature as part of a low scenario.

Water companies and business retailers have statutory duties to promote the efficient use of water by their customers. Companies also have a statutory duty to develop and maintain efficient and economical systems of water supply. Our recent discussion paper on performance commitments for future price reviews set out the need for appropriate incentives to improve water efficiency amongst business customers.<sup>92</sup> As business demand is at least partially under company control, we do not consider it appropriate to include it in our reference scenarios. We expect companies to assume they will meet any relevant performance commitments and government targets.

Water Resources West asked us to confirm that the element relating to building regulations and product standards does not affect expectations around meeting the statutory targets for leakage and per capita consumption. We agree that companies in England should plan to meet both targets in all plausible future scenarios, and that the scenarios will test how companies can best achieve them given uncertainties.

### **A1.4.5 Abstraction reductions**

Anglian Water, Dŵr Cymru, Natural Resources Wales, South East Water, Severn Trent Water, Thames Water, United Utilities, Water Resources West, Wessex Water and Yorkshire Water stated that the reference scenario for environmental destination was too narrow. A number of these respondents argued that it should be expanded to cover environmental water quality. There were a number of other suggestions for factors to include in this scenario, including future legislative changes (Anglian Water, Severn Trent Water), storm overflows (United Utilities, Wessex Water) and ambition on biodiversity (South East Water, United Utilities).

We consider the main uncertainties relating to future enhancement spending on environmental water quality are legislative in nature. Therefore, setting a reference scenario would require us to identify plausible future legislation that may be adopted by governments. In terms of water resources, we consider the Environment Agency's environmental destination scenarios, which describe different future approaches to sustainability reductions, resolve this issue to some extent in England. Further, all companies are required to test against scenarios for sustainability reductions in their WRMPs. This is not the case for environmental water quality, so we do not consider it is useful to set common scenarios in this area. We encourage companies to test wider scenarios as they deem appropriate. It is

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<sup>92</sup> Ofwat, '[PR24 and beyond: Performance commitments for future price reviews](#)', November 2021, p. 34.

also not the case for water resources in Wales, so we do not require companies in Wales to test against an abstraction reductions scenario beyond currently known legal requirements.

To be clearer about its focus, we have renamed the reference scenario from 'environmental destination' to 'abstraction reductions' (see section 5.3.4).

United Utilities and Water Resources West argued that the low scenario, which was based on the Environment Agency's 'business as usual' scenario, implies significant investment requirements and should not be used as a low scenario. Both respondents suggested that the scenario goes beyond current government policy, and a better alternative would be to assume the continued delivery of currently known legal requirements. Severn Trent Water also stated that the low scenario is 'extremely stretching' and would drive material enhancement investment. All three respondents noted an inconsistency with the low scenario for climate change (RCP2.6), since the 'business as usual' scenario assumes future emissions levels that correspond to average temperature rises between RCP6 and RCP8.5.

As set out in section 4, the reference scenarios are designed to represent 'plausible extremes', which offer a full spectrum of possible futures. After further consideration, we agree that the 'business as usual' scenario described by the Environment Agency is unlikely to fit this definition. This is because the scenario is based on a climate change scenario, SRES A1B, which assumes significantly higher future emissions than our low reference scenario for climate change. We have also received feedback that, in some regions, 'business as usual' may imply enhancement investment over and above the 'most likely' pathway as set out in WRMPs.

We therefore consider that setting 'business as usual' as a reference scenario would neither represent a 'plausible extreme' nor be consistent with the other reference scenarios. We consider an appropriate low scenario would be to assume that currently known legal requirements continue up to 2050. This scenario should be tested in both England and Wales.

## A2 Calculation of long-term bill impacts

We expect companies to follow a simple and transparent approach to forecasting the future bill impacts of long-term delivery strategies. We retain our approach from our November discussion paper. Bill impacts should be based on the change in bills from enhancement expenditure. Companies should submit their bill calculations with their strategies.

- Enhancement expenditure should be split into capital and operating expenditure;
- Capital enhancement expenditure should be added to a new enhancement Regulatory Capital Value (RCV);
- The return on the new enhancement RCV should be based on the PR19 allowed return on capital or any subsequent updates provided by Ofwat for PR24;
- The new enhancement RCV should be run-off based on the asset life of the enhancement expenditure;
- Where a company expects to pay notional corporation tax an allowance should be included for corporation tax funding. This can be approximated as follows:

$$\text{Corporation tax funding} = \text{Return on new enhancement RCV} \times \left( \frac{\% \text{ return on equity} \times (1 - \text{notional gearing})}{\% \text{ allowed return}} \right) \times \left( \frac{1}{(1 - \text{statutory tax rate})} - 1 \right)$$

- Total wholesale long-term revenue requirement should be based on operating enhancement expenditure plus return on new enhancement RCV plus new enhancement RCV run-off, plus corporation tax funding;
- Total long-term revenue requirement should be wholesale long term revenue requirement multiplied by 1.01 to account for retail margin;
- Total long-term revenue requirement should be split into revenue recovered from household and non-household customers; and
- The bill impact per year should be total long-term revenue requirement recovered from household customers divided by the number of household customers.

**Ofwat (The Water Services Regulation Authority)  
is a non-ministerial government department.  
We regulate the water sector in England and Wales.**

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