



Dŵr Cymru
Welsh Water

WSH56-RS00 –
A Reliable Water Supply
for the Short and Long
Term



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1. A Reliable Water Supply for the Short and Long Term

1.1 Background and Purpose of this Document

This document describes Welsh Water's plan for a reliable and secure water supply. It provides a source to tap overview of the base-funded activities to maintain and optimise current performance and highlights where we need enhanced investment to improve performance to achieve our end of AMP8 performance commitments. It also sets out the linkage between our proposed interventions during AMP8 and where the associated enhancements address specific challenges and contribute to our overarching objectives. Further detail for the enhancement interventions can be found within the individual business cases.

The PR24 Business Plan summarises our AMP8 approach which has been developed in conjunction with the Long Term Delivery Strategy. The AMP8 intervention programme provides the foundations for our long term plan and the Long Term Delivery Strategy outlines our comprehensive long-term vision. This document provides connecting narrative to the enhanced cases. Its purpose is to show coherence and the relationships between our objectives, needs and solutions. The intervention programmes that we have developed are dependent on each other with some solutions meeting multiple needs and/or combining with other solutions to deliver increased levels of performance.

Firstly, the document reflects our customer wishes received through customer and stakeholder consultation, the legislature, and our own Long Term Delivery Strategy. These are covered in greater detail in other parts of this submission: PR24 Forum High-Level Steers see (Stepping up to the Challenge: Business Plan 2025-30 (Section 2.3) and WSH30-Customer Engagement and Research. They have informed our Performance Commitments for 2025-2030 (AMP8) and beyond.

The second half of the document addresses the challenges including their root cause and how we are working to mitigate them through our base and enhancement interventions have been split into three sections from source to tap, see bullets and Table 1 below.

1. Catchments,
2. Water Treatment Works
3. Clean Water Network & Customer

Table 1 – Summary of the Challenges, Location and Interventions to Meet them

Challenges	Water Resources	Raw Water Storage	WTW Clean Water Storage Tank Resilience	Demand Reduction	Increased burst rates & Interruptions to supply	Leakage Reduction	Supply Resilience
Challenge Root Cause	Insufficient Raw Water resource resilience	New Impounding Reservoir Risks due to changing standards	Updated regulatory tank inspection regulatory requirements	Unmeasured supplies Customer Side use	Increased AC Mains Failures	Leakage Supply/Customer Side	Climate change and flood risk, limited network connectivity & capacity
Root Cause location	Catchment	Catchment	WTW	Customer	Water Network	Water Network & Customer	Catchment WTW Network
Base interventions	Provide temporary pumping station on a reactive basis	Maintaining Impounding Reservoirs to current standard	Inspection of tanks short duration outages	Customer information	Pipe repairs and reactive replacement	Leakage find and fix programme	Maintaining current network assets
Enhancement interventions	Provision of a Permanent WPS	Improving impounding Reservoirs	Improved resilience to facilitate long duration outages	Customer inspections, repairs and visits Metering Strategy	Proactive AC mains programme	Project Cartref Customer side leak repairs	Flood mitigation schemes, network enhancement studies and schemes to improve connectivity and capacity.

This document overlaps with some of the interventions identified within Welsh Water's Water Resources Management Plan (WRMP). Which was developed in accordance with Ofwat's requirement to produce a 25-year plan to manage supply and demand but focusses on AMP8 investment. It also should be read in conjunction with:

- WSH35-CS00 Resilience and Security, which has a specific focus on security, business continuity and resilience throughout our business; and
- Welsh Water Leakage Strategy, see Appendix C WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management, which details all the components of our overall approach to leakage reduction in AMP8 and for the next 25 years.

Our approach to providing a reliable and secure water supply reflects that water supply issues include both short-term reliability and long-term security challenges. These issues include the following;

- Comply with the regulatory limitations on how much water we can abstract from the environment to ensure that our catchments are protected.
- Maintain the asset health of our network and continue to improve our performance on burst mains and leakage so that water is not wasted.
- Address end-of-life issues on assets that are now due for replacement.
- Adapt to emerging challenges, such as urban growth and the effects of climate change including the more frequent extreme weather events. There is a need to adapt our asset base to meet forecast demand for water to 2050 and beyond and working in a timely way to implement the changes to deliver this.

An overview of challenges, how we are optimising existing assets through our base interventions and our improved performance through enhancement can be seen in Sections 1.1.1 to 1.1.3 below.

1.1.1 Our Challenges

Although Wales has significant rainfall, only a small portion of it is captured for water supply, and there is a continual need to anticipate water resource pressures in the future. Most customers are supplied by upland reservoirs, and the connected treatment works feed water to local supply

networks. The sources and treatment assets need to be protected against the growing impact of Climate Change. The aging network requires careful asset maintenance and replacement, with a large network of water mains operated under high pressure, causing frequent bursts and leaks. Parts of our network are highly dispersed with only a single main serving small and remote communities. This affects detection and response times and leaves us with limited alternative options for supply when things go wrong.

Over the past 25 years, the demand for water has decreased. In part, this is due to our efforts to control leakage, domestic demand reductions and a drop in industrial demand. Further intervention programmes are planned to support customers in managing water demand, reducing leakage, and maximising available water resources for resilience against drought and climate change. Planned strategic network schemes will maximise the use of available water resources and increased network resilience interventions will reduce the risk of asset outages and further contribute to demand reduction, including through leakage.

1.1.2 Optimising Existing Assets

During AMP8 we will continue to optimise and improve our current levels of performance through a wide range of operation and maintenance activities including the refurbishment and replacement of assets. This intervention programme will largely focus on maintaining the levels of performance achieved at the end of AMP7. This assumes that between now and then we achieve the planned level of improvement in those of our key performance commitments that we are currently targeting. By targeting interventions to address the natural rate of rise, for example in leakage and interruptions to supply, we will achieve this.

This it will require a step change in our operational performance and implementation of emerging techniques. It will not be possible to meet all these needs in AMP8 just by operating and maintaining our current assets (network assets and treatment works) at their current levels of service. Even refining and innovating how we operate them will not suffice. Additional 'enhancement' expenditure will be required to meet our improved performance and resilience needs.

1.1.3 Improved Performance Through Enhancement

Our enhancement programme has been developed to focus on the needs, including performance improvements, that cannot be delivered through our base interventions programme. Our enhancement programme has undertaken an optioneering assessment that includes: longlisting, shortlisting and thoroughly testing our options. Our approach to investment, see WSH50-IP00 Our Approach to Investment Planning, is designed to identify the blend of base and enhancement expenditure that will result in the optimal 'low regrets' set of interventions.

1.1.3.1 Catchments, Resources, Dams and Impounding Reservoirs

There is significant work to be done in AMP8 across our clean water asset base from Catchment to Tap to understand the requirements of the resources that underpin our supply: as part of our response to the National Environment Programme (NEP) and Water Industry National Environment Programme (WINEP), our most extensive ever program of water resource environmental investigations is set to take place during AMP8.

Our catchments programme aims to enhance our understanding of how to achieve long-term sustainable water abstraction, ensuring compliance with the requirements of the Environment (Wales) Act 2016, assessing the potential future impact of climate change on river flows and how these changes may affect ecological needs. We intend to establish strong links between quantity (water flows) and quality (water ecological health) initiatives in the rivers from which we draw water, supporting the development of comprehensive, catchment-wide solutions. These investigations are discussed in WSH63-PE00 – Protecting and Improving the Environment.

Our Dams assets enhancement works are associated with upgrades to address climate change related impacts, which are reflected in the Long Term Delivery Strategy core pathway (WSH01 Long Term Delivery Strategy). As reservoirs are upgraded to adapt to climate change forecasts,

enhancement related spend is forecast to reduce over the long-term strategy. Welsh Water have identified an alternative pathway focused on potential future remedial works in line with legislation changes from the Balmforth review into the Toddbook incident. Further details related to the core and alternative pathway for impounding reservoirs are contained in the document WSH01 Long Term Delivery Strategy. The enhancement is focused on the need to upgrade spillways at 29 of our sites to meet “probably maximum flood” conditions and our pipework to facilitate draw down levels quickly during emergency conditions. This will be achieved through the timely and ongoing interventions to address essential works as identified by Section 10 reports.

We also identify investment to protect our assets from the risk of flooding and erosion. That could impact our ability to supply water.

1.1.3.2 Water Treatment, Distribution Networks and Customer

We also need to take a thorough approach to choosing low-regrets options for strategic resilience schemes by undertaking a range of feasibility studies. This will address the current limitations of our water supply system due to a lack of asset and resource redundancy across our areas.

Our treatment and distribution networks carry many risks relating to low-probability but high-consequence events affecting the supply to large parts of the population. This is mainly due to the limited redundancy in the system and may areas reliant on a single source of supply. This is discussed further in the two documents: WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity and WSH61-RS05 - Increasing Resilience of Tap Water Supply - Treatment Works. The programme of work will also undertake four strategic feasibility studies to define, scope and cost further strategic improvements to meet our long term resilience objectives and in line with the Long Term Delivery Strategy.

At the same time, it is imperative that in addition to our base leakage programme we address proactively the issue of rapidly increasing asbestos cement (AC) mains failures. This investment will be in addition to our base funding and operational management of this issue. The rapid rate of increase for AC mains failures has increased beyond our modelled expectations and investment cannot be delayed further without a significant impact on burst mains, leakage and interruptions to supply.

Within this document we will show that, for water supply, the dominant themes in the coming period will be:

- Leading the way in reducing leakage on our network and supporting our customers to play a part in reducing leakage and consumption through customer engagement and services.
- Gaining a fuller understanding of water resources in the environment and how our network interacts with supply and demand, developing smarter and better ways to meet demand, save water and protect the environment.
- Carry out an intensive programme of works to secure and improve our distribution mains for the long term.

Other investments also consider how we can manage our water resources and reduce single points of failure at our treatment works.

1.1.3.3 References which Support Our Enhancement Programme

This document should be read in conjunction with its associated Enhanced Cases Appendices, see bullets below, which offer a structured treatment of the criteria for enhanced funding:

- WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management
- WSH59-RS03 - Increasing Safety of Impounding Reservoirs
- WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity
- WSH61-RS05 - Increasing Resilience of Tap Water Supply - Treatment Works

1.2 Our Customers' Expectations

Customer expectations regarding the security of water supply are considered when planning our intervention programmes. It should be noted that water companies have statutory duties on water resources planning, irrespective of customer views. Welsh Water consulted household customers and businesses to inform our AMP8 investment programme the Water Resources Management Plan and gained applicable insights that have also fed into PR24 planning. Details of the customer research and findings are presented in WSH30-Customer Engagement and Research.

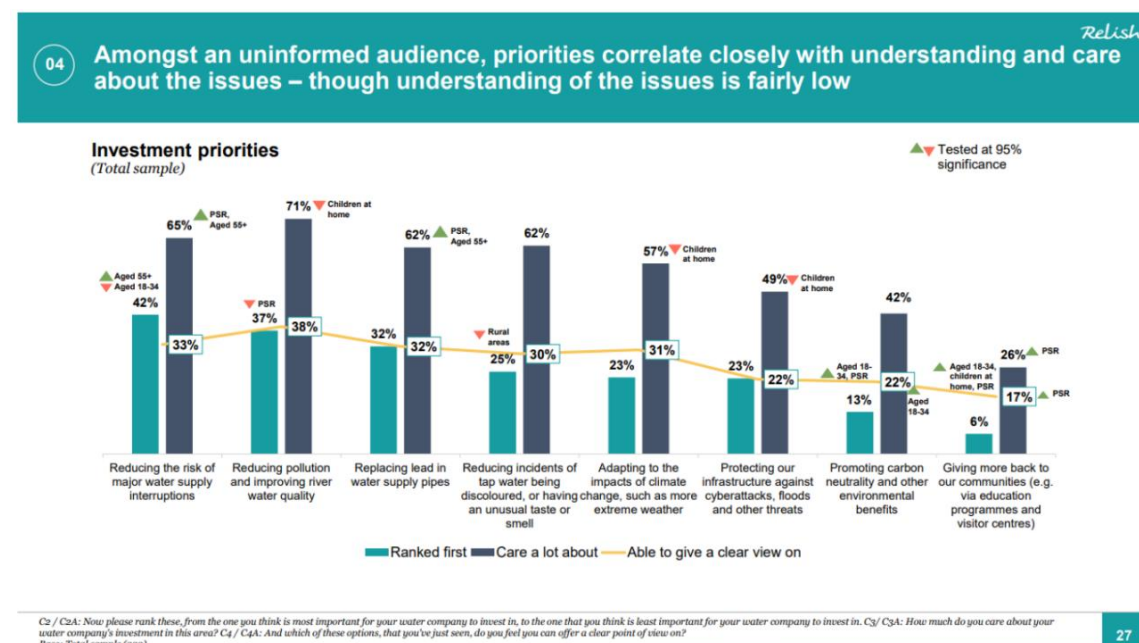


Figure 1: Investment priorities for customers from phase 1 research

Our customer research has included two projects carried out in November 2021, focusing on water supply and demand options and metering/water efficiency. The research involved quantitative surveys with 800 customers and in-depth online community discussions.

We have learned that reducing the risk of major supply interruptions is a priority. Customers, particularly those over 55, prioritise reducing the risk of major water supply interruptions and this is considered a core responsibility of Welsh Water, even though supply interruptions have not been a significant issue.

In Phase 2 research, a substantial 40% of customers expressed a preference for ensuring a reliable water supply over keeping bills as low as possible. This preference was even higher (46%) among non-household customers.

While being without water ranked fairly low in customers' ranking of objectives for Welsh Water, focus group comments suggest that customers find the current performance on supply interruptions satisfactory. Short-term interruptions of a few hours are generally not considered a major inconvenience.

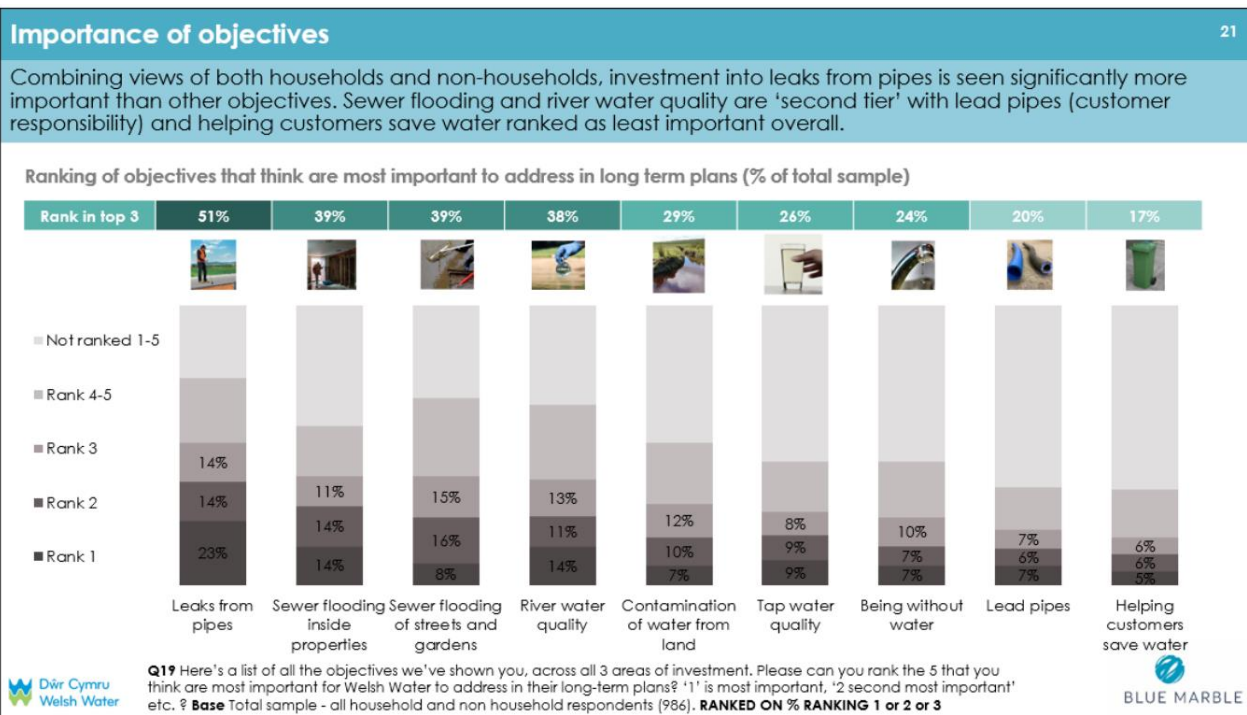


Figure 2: Importance of objectives for Welsh Water from Phase 2 research

Leakage consistently ranks as a priority issue for customers. Research shows that leakage undermines efforts to persuade customers to reduce their water consumption. Customers believe that both current leakage levels and future reduction targets could be more ambitious.

Customer engagement on Personal Consumption Commitment (PCC) reduction targets can be challenging, as customers themselves need to make reductions. However, the majority accept the need for restrictions when it comes to water usage during droughts.

Providing a reliable water supply in the short and long term

Themes emerging from the immersion day

- As expected, **leakage remains a core topic for many of our customers**. Giving them more information on leakage can affect perceptions – 20% loss through leakage feels very high, but finding out half of this is from household leaks can help shift the dial and give customers a sense of responsibility/empowerment to act. This then influences how customers view the ambition to reduce leakage by half by 2050.
- The figure of **167 litres of water consumed per person per day is felt to be high and fairly shocking** – but more from the visual of a wheelie bin to demonstrate volume than the figure itself.
- On supply interruption, **16 mins per household per year doesn't feel very much** – in fact, some think it is a good result, irrespective of comparisons with other water companies. The concept of paying more on bills (esp. in the current climate) to reduce this further does not always land well with customers. **However, of great importance to customers in supply interruptions is getting a timely notification from DCWW** – example of customer who had experienced 5 interruptions but didn't find it too disruptive due to the timely comms.

Implications for Welsh Water?

- There is a real sense that **if leaks occur on a customer's property then they should fund the repair** rather than DCWW subsidising this from increases in all customer bills. Customers want more education on how to act to identify leakage on their properties.
- But **comms around leakage also needs to demonstrate how DCWW is taking a lead on this**, otherwise our messaging asking customers to change their water behaviours can lack credibility.
- Comms on PCC needs to find more ways of making the amount of consumption understandable to customers**, starting at school age and using kids to help educate parents as well as communicating across platforms.
- Pushing for improvements on water supply interruptions may not be such a key area for big investment** – consider collating evidence from more robust research sources to make this case and potentially take to Ofwat.
- Continue to work hard to ensure we get as many notifications on planned (and any unplanned – where we can) supply interruptions out to customers as we can**, now we can see how important they are to reducing negative perceptions.

Figure 3: Customer views from Welsh Water's Long Term Outcomes Integrated Report

Importantly, customers expect the company to take the lead in improving practices before they are willing to change their own behaviours. This was where tackling water leakage in both the network and in homes was a priority for customers, with a desire for Welsh Water to address leaks alongside their own efforts to conserve water.

Nevertheless, customers are also interested in learning how to reduce water consumption without significantly impacting their lifestyles, and they appreciate guidance from Welsh Water on how they can make changes.

Customers often lack understanding about water systems, water management, and the impact of climate change on water resources, but the awareness of climate change impacts and the need for resilience in water management is growing. This has been intensified by recent real-life experience of extreme weather events and feeds a heightened sense of responsibility for sustainable resource management.

There was a preference for billing systems based on actual water usage, similar to the adoption of energy smart meters, and around 80% of customers supported targeted and progressive approaches to metering. These were seen as fair and effective.

Customers indicate an awareness of wider responsibility and a willingness to engage in a social contract with their water supplier if they see that we are taking similar actions. For instance, the imposition of hosepipe bans has generally had a neutral or positive impact on customers' perception of Welsh Water, since customers appreciate the company's actions and understand the importance of managing resources.

When it comes to reducing supply interruptions of three or more hours, based on their personal experience of reliable supply, customers do not regard this as being as important an investment area as many others. For the majority, the long-term target of reducing interruptions by 90% is regarded as being the right level of ambition as outlined in the document WSH30 – Customer Engagement and Research.

1.3 What Our Stakeholders have Told Us

The Welsh Government, Consumer Council for Water (CCW), Independent Challenge Group, and other stakeholders closely monitor performance in areas like resilience and asset health. The Welsh Government's Strategic Policy Statement (SPS) emphasizes the need for reliable water and wastewater services.

Our long-term outcomes are collaboratively developed with the PR24 Forum, which is chaired by the Welsh Government and includes all our key regulators as well as benefitting from the input of customers and wider stakeholders.

Members of the PR24 Forum

Welsh Government (Chair)

Consumer Council for Water

Drinking Water Inspectorate

Hafren Dyfrdwy

Natural Resources Wales

Ofwat

Welsh Water

Representatives of companies' customer challenge group arrangements

Figure 4: Members of the PR24 Forum

The forum's processes and conclusions are outlined in Stepping up to the Challenge: Business Plan 2025-30 (Section 2.3).

The PR24 Forum has issued strategic directions for water companies and Ofwat, as well as addressing challenges and priorities for the water sector. In respect to the reliability and security of our water supply, it has stated:

- We expect companies to improve their asset health to support planned and future growth.
- We expect Welsh Water to move all water supply zones to a 1 in 500-year level of resilience to drought.
- We expect Welsh Water plan for investment for water resources, and drought resilience at PR24 should be consistent with its final Water Resources Management Plan.
- We expect Welsh Water to demonstrate how it has learned from the experiences of prolonged dry weather, peak demand, heatwaves, and droughts of 2018, 2020 and 2022.
- We expect Welsh Water to reduce leakage by 15% by 2025, a further 10% during PR24 and by 50% by 2050 (against a 2017/18 baseline).
- We expect Welsh Water to encourage customers to reduce consumption, to achieve a 6% reduction during PR24 and to 110 litres per capita consumption by 2050 and set out a comprehensive water efficiency plan to meet these targets.
- We expect Welsh Water to collaboratively lead on behaviour change campaigns on respecting water resources especially during periods of prolonged dry weather and the recovery from such periods.
- We expect Welsh Water to encourage non-household customers to reduce their usage, recognising the wide variety of types and sizes of business customer. The target should be set in accordance with the WRMP, making an appropriate assumption about background increase in demand from economic growth, and adjusting for new large industrial water users.
- We expect Welsh Water to seek further reductions in leakage where possible as tackling leakage is a priority for customers.
- We expect Welsh Water to continue with its multi-AMP programme of upgrading reservoirs to meet new regulatory standards and adapt to climate change, in accordance with risks identified in the rolling programme of Section 10 inspections.
- We expect Welsh Water to ensure that any dams identified and classified as 'high-risk' are prioritised for safety and resilience improvements to address this as an immediate priority.

1.4 Regulatory and Legislative Requirements

1.4.1 Limitations on Abstraction of Water from Natural Sources

Natural Resources Wales NRW's National Environment Programme (NEP) and the equivalent Water Industry National Environment Programme (WINEP) in England, identifies the investigations and subsequent changes that need to be made to our abstraction licences to meet environmental obligations.

The NEP in AMPs 6 and 7 resulted in significant expenditure to manage the impact of reductions in permitted licence volumes at a number of our river abstractions, driven primarily by the requirements of the Habitats Regulations and, to a lesser extent, the Water Framework Directive. In AMP6, the habitats directive resulted in amended license conditions to 10 of our key abstraction points.

In England, the Environment Agency's National Framework requires water companies and regional planning groups to set a long term 'environmental destination' to ensure the future sustainability of abstraction.

In Wales, NRW has not been as explicit in prescribing potential changes to our abstraction licences, taking a different approach that applies Sustainable Management of Natural Resources (SMNR) principles to addressing the future risk that our water resource operations may pose.

1.4.2 OFWAT

In its methodology for PR24, Ofwat has detailed a performance measure designed to incentivise water companies to minimise the number and duration of supply interruptions. This is defined in terms of the average number of minutes lost per customer for the whole customer base for interruptions that lasted three hours or more. It is reflected in the Performance commitment, 'Water Supply Interruptions'. Ofwat's stipulation of a measure based on three-hour-or-more outages regardless of cause gives rise to particular challenges in meeting the performance commitment which are discussed in Section 3.3.

1.4.3 Drinking Water Inspectorate (DWI)

The DWI sets standards, conducts inspections, and enforces compliance with drinking water regulations. Water companies must meet the requirements set by the DWI to ensure the delivery of safe and clean drinking water.

For example, on the specific issue of lead pipes, the DWI's PR24 guidance position is as follows:

"Reducing the risk of lead in drinking water should remain a priority. Companies should be ambitious in their long-term lead strategies and continue to plan and invest in the reduction of lead exposure through drinking water. Pilot trials should inform wholesale lead pipe replacement programmes and consider any future reduction in plumbosolvency control. Companies should use the findings of the report [Long-term Strategies to Reduce Lead Exposure from Drinking Water](#) and any findings from Green Recovery lead trial schemes in their plans." ([Price review process - Drinking Water Inspectorate \(dwi.gov.uk\)](#))

Outside of the PR24 Forum, we have engaged extensively with the DWI over our plans for AMP8 and through to 2050 regarding water quality. The Drinking Water Inspectorate supports the delivery of the following schemes to maintain a reliable water supply as confirmed in the following letter issued by DWI:

Scheme	Letter Reference	Comments
DWR3 - Critical Tanks Extended Maintenance Strategy - Bacteriological Parameters and Resilience of Supply	DWR3	Caveats: We note Bretton contact tank is also on the list of sites for enabling works but is not due to be undertaken until AMP9. Timescale: within AMP8 Cost: £18.7m Legal Instrument Required: Regulation 28(4) Notice

Where legal instruments are in place, we are legally bound to deliver the proposed schemes or face fines.

1.5 Long-Term Ambitions

1.5.1 Long Term Delivery Strategy

Our Long Term Delivery Strategy sets out the 2050 outcomes that have been agreed with the PR24 Forum, along with the interventions needed to achieve those outcomes. It articulates how we will accumulate successful outcomes in each of the 5-year planning periods to reach our goals in a range

of plausible futures. These have been informed by and are consistent with Welsh Water 2050, published in 2018 and updated in 2022, which set out our broad vision, priorities and direction of travel for the coming decades and included the following long-term outcomes affecting water supply:

- Enough water for all
- Improving the reliability of drinking water supply
- Smart water system management

The full Long Term Delivery Strategy forms part of this business plan submission and can be read in WSH01 Long Term Delivery Strategy.

Investment scheduled for AMP8, in respect to water supply, will significantly contribute to the long-term outputs in the following performance areas:

- Supply interruptions for customers
- Drought resilience
- Leakage reduction
- Per capita consumption
- Impounding reservoir enhancement
- Meter installation
- Resilience of the water network
- Resilience of water treatment works to flood events
- Mains repairs/asset health
- Unplanned outages/asset health

Our AMP8 programme is a milestone in achieving our longer-term ambitions. The projects within our intervention programme have been assessed against the Ofwat scenarios and developed company-specific scenarios to ensure they are all no/low regrets investments, and that the solutions are appropriately adaptive where required. Further details can be found in our WSH01 Long Term Delivery Strategy, on our core pathway for each of the long-term output areas listed above, along with our scenario analysis and alternative pathways.

The long term delivery outcomes are summarised in Table 2 below. An overview of the current position, history and AMP8 performance and performance targets can be found in Section 2 below.

Table 2 - PR24 Long Term Delivery Outcomes, Measures and Target

Outcome	Measure	2050 Target
Leakage Reduction	Leakage (Ml/d) Annual	104
Per Capita Consumption	Consumption per person per day (l/h/d) dry year target	110
Drought Resilience	% customers achieving drought resilience target 2050 (1:500)	100
Meters Installed	% of household customers metered	96

1.5.2 Water Resources Management Plan (WRMP)

Like all water companies, every five years we update our WRMP which describes the basis for ensuring sufficient water supplies over the long-term. This incorporates the latest evidence on the future demand for water and water resource reliability, including the potential impact of climate change, through use of the best available science and technology. The plan is based on extensive research and analysis of future risks, aiming to identify adaptations to secure a reliable water supply. It considers input from regulators, stakeholders, and customers to select the most appropriate solutions for the challenges ahead. The WRMP has gone through a public consultation process with extensive input from our key regulators Natural Resources Wales and Ofwat.

The key objectives of this plan are as follows:

- Leakage Reduction: Targeting a 10% reduction of the levels in water leakage during AMP8 and achieving a 50% reduction by 2050
- Per Capita Consumption: Reducing water usage per person to an average of 110 litres per household per day during dry years by 2050
- Business Demand: Aiming for an 8% reduction in water demand from businesses by 2050, based on the normal year demand from the 2019/20 position
- Drought Resilience: Achieving a water supply resilience to a 1 in 200 year drought scenario by 2029/30 and further enhancing it to 1 in 500 by 2039/40

The plan offers a range of options that focus on measures to reduce water demand and increase storage and supply capabilities. The schemes planned in the WRMP for AMP8 are folded into the PR24 plan and presented here in that context, alongside base maintenance activities and three cases for enhanced investment in AMP8 which are not part of the WRMP:

- Strategic Feasibility studies: for Cardiff, the North and East areas and Tywi West to Pembrokeshire.
- Asbestos cement (AC) mains renewal
- Increasing the transfer capacity within Tywi/SEWCUS mains

1.6 Efficiency challenge

As described in WSH50-IP00 Our Approach to Investment Planning, on recommendation from the Executive Team, our Board has set ambitions in our PR24 Plan and WSH01 Long Term Delivery Strategy in relation both to outcomes and efficiency of expenditure. The CapEx efficiency target set by the Board on the planned AMP8 CapEx investment in a reliable water supply amounts to £76M.

It is important to note that **all the costs mentioned in this document, the data tables and other parts of the PR24 Plan** and WSH01 Long Term Delivery Strategy **already reflect the efficiency challenge posed by the Board.**

This challenge represents an ambitious **7.1%** efficiency in AMP8 CapEx investment in a reliable water supply (on top of the efficiencies already identified by the business during the development of the business plan) and ensures best value for customers.

2. Performance Commitments

2.1 Water Supply Interruptions

Continuity of the water supply is measured by a single metric: interruptions to supply, measured in minutes and seconds.

This measure is identified as the average number of minutes lost per customer for the whole customer base for interruptions that lasted three hours or more. Calculation of performance is carried out using the following equation:

$$\frac{((\text{Properties with interrupted supply} \geq 180 \text{ mins}) \times \text{Full duration of interruption})}{\text{Total number of properties supplied (year end)}} = \text{average number of minutes lost per customer.}$$

2.1.1 Past Performance, Trends and Targets

Reducing interruption to the water supply is a very important component of our long-term delivery strategy and 2050 ambitions.

At the start of AMP7, Welsh Water had an average score of 11:08 minutes lost per customer. As a result of the works completed and planned in AMP7 by the end of this AMP the customer minutes lost score is forecast to reduce to 8:00 minutes.

In our PR19 Business Plan, we proposed a Supply Interruptions PC target of 8:00 minutes for 2025. At the Final Determination, a target of 5 minutes for all companies was set by Ofwat. While we accepted the Final Determination in principle and agreed to strive towards this target, our original goal of achieving 8:00 minutes remains challenging. There are many factors outside our control and given the point-to-point nature of much of our trunk main and distribution systems as discussed in Section 3.3 below.

In recognition of the 5:00 target set Final determination PR19 and accepted, we have proposed 5:00 as the proposed 'performance from base' for AMP8 through to 2030. We are targeting improvement in our performance to achieve this as soon as possible in AMP8, and with the help of the proposed enhancement investment in AC mains, we are targeting a further improvement to 4:30 overall by 2030.

Table 3 - Performance on supply interruptions

Year	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Reported Value	00:21:44	00:12:09	00:43:18	00:16:02	00:14:43	00:11:08	00:16:17	00:44:31
AMP7 Target	00:36:00	00:24:00	00:12:00	00:12:00	00:12:00	00:06:30	00:06:08	00:05:45

Table 3 provides a summary of performance over the period from 2015/16 to 2022/23. The reported values in 2015/16 show the impact of significant weather events on this measure.

2017/18 reflects the impact of 'Beast from the East' and 'Storm Emma' colliding over Wales with the first 'red' weather warning. 2022/23 reflects the impact of the drought conditions and rapid freeze thaw event impacting West Wales with an unprecedented impact on our network.

The other years show a slowly improving, more stable trend. Peaks in this trend, for example in 2021/22, are driven by significant trunk main bursts where no mitigation through rezoning is possible.

Our annual Board review of our CML Strategy has highlighted the following areas we are pursuing to improve performance:

- Prevent – tackle our known leaks on trunk mains to prevent them becoming catastrophic bursts; align our pressure management strategy with CML (not just leakage); install more monitoring devices; maintain our estate of air valves to prevent bursts.
- Respond – restructure our response teams to provide faster responses out of hours; Upskill our SmartHub to respond better to out of hours alarms; relocate our tankering fleet to more optimum locations
- Invest – focus our investment on our poorest performing AC mains

In AMP8, our proposed AC mains replacement programme will have a significant impact in improving service in West Wales where the greater proportion of our older AC mains are located. Furthermore, trunk main interconnectivity schemes will reduce low likelihood/high impact events and help to protect our major cities.

2.2 Leakage

Welsh Water has set a target to reduce our overall company level of leakage by 15% (equivalent to 26 MI/d) by April 2025 against 2019/20 levels. This is the first phase of our longer-term ambition to achieve a 50% reduction from 2017/18 levels by 2050.

In the re-statement of our ‘water balance’ in our WRMP, reported leakage levels have increased to 253 million litres per day (MI/d) in 2022/23. This has resulted in a restated 2019/20 position of 225.8MI/d and a substantial challenge to reduce leakage levels by 15% during AMP7 to achieve 191MI/d by April 2025. The revised leakage target level for April 2025 meets the commitment to deliver a 15% reduction against the 2019/20 level, it does not, however, meet our AMP7 final determination performance commitment which is measured on a 3-year average basis.

The target for AMP8 leakage reduction is 19 MI/d, which is a reduction of 10% of the 2024/25 leakage value.

Given the level of drought risk identified across our supply area within our Water Resources Management Plan, we believe that our demand management programme provides the right balance of ambition against the costs to our customers, whilst achieving our target levels of resilience to drought. Our modelling indicates that a further increase, beyond that proposed in AMP8 for leakage, would incur significant further transition and maintenance cost. Any further investment to reduce leakage would move the level of drought resilience beyond proposed targets and so does not represent good value for money against either regulatory or customer expectations.

Table 4: 2056/26 to 2050 leakage targets

Measure	2025/26	2026/27	2027/28	2028/29	2029/30	2050
Leakage total annual (megalitres per day)	187.8	183.9	180.8	178.0	172.7	104.0
Leakage (% reduction from 2019/20 baseline, 3-year rolling average)	7.2%	13.6%	15.2%	16.7%	18.4%	50%

During AMP8 the majority of the 10% reduction will be delivered by improvements on the customer side through a combination of the Customer Metering and Cartref programmes. There will also be a substantial amount of effort required through our base leakage programme to maintain the end of AMP7 levels. Our focus for base maintenance activities will be to target both upstream losses across our trunk mains network and leaks across our distribution network.

2.3 PCC - Water Efficiency

A longer-term target has been set to reduce the average per capita consumption (PCC) of our domestic customers to 110 litres per person per day (l/p/d) by 2050. The restated normal year average household PCC for 2019-20 was 145.8 l/p/d. The target for the end of AMP8 is 133 l/p/d in 2029/30.

There has been a clear impact on PCC as a result of the Covid-19 pandemic, following the lockdown measures introduced in 2020/2021. An increase in daytime occupancy levels through a large increase in home working and schooling has meant that the consumption of water has shifted from non-household to household for many of our customers. Behavioural change has also been observed due to an increased focus on hand washing and spending more time at home. With society now fully 'open', we are seeing demand patterns return towards pre-pandemic levels but not completely.

2.3.1 Past Performance

During AMP7, Project Cartref, our ongoing programme to support and encourage water efficiency for customers has sustained a programme of water efficiency audits and the installation of water saving equipment for schools. The range of free home water efficiency audits for high usage and vulnerable customers includes signposting customers to wider Welsh Water services such as social tariffs.

Project Cartref aims to deliver private leak repairs to achieve a specific target reduction in water leakage of 7.2 million litres per day (Ml/d) during AMP7. The program focuses on identifying and repairing leaks in homes and businesses, to minimise water losses from leaks that may not be immediately visible or detected in the network.

To date, 47,000 customers have signed up to "Get Water Fit", providing access to free water efficiency equipment, and this is forecast to be 94,000 customers by the end of AMP7.

7,500 free plumber appointments have been taken up by customers, forecast to 12,500 by the end of AMP7.

In year one of AMP7, the effects of Covid resulted in a lower than average number of home visits at the start of the AMP. This challenge grew into an innovation in how we engaged with our customers, driving the use of a video analysis tool that a customer could upload a video to. The tool could then assess the suitability of their plumbing arrangements for a visit. This has now driven a far greater efficiency in our selection of suitable homes.

2.4 Mains Repairs

The mains repair rate is measured as the number of repairs carried out per 1000kms of main.

At the start of AMP7 Welsh Water had a mains repair rate of 139.9 per 1000kms of the water network. At the end of AMP7 this is forecast to reduce to 128.4 per 1000 km of network.

Welsh Water's goal is to end AMP8 with a mains repair target of 122.4 per 1000km of the network.

The longer-term goal as outlined in our long term delivery strategy is to continue to realise improvements in this area with a 2050 ambition of 99.1 repairs per 1,000 km of network mains.

There is a direct benefit from planned works related to AC mains and Acceptability of Water, these benefits are captured under other outcome measures (Supply interruptions and customer contacts about water quality). Interventions to reduce the number of mains repairs required will be primarily driven through base maintenance, with secondary benefits from other base and enhanced cases. It should be noted, however, that the further we have to drive down leakage the more leaks we will find and repair.

2.5 Unplanned WTW Outages

Unplanned outage is the unplanned loss of peak week production capacity. Total unplanned outage is measured as a percentage of a company's total production capacity

This gives a measure of the 'availability' of our water treatment works (WTWs) to produce water. This measure highlights where we have a reduced capacity but have not planned any maintenance. A higher percentage indicates any resilience issues arising from the condition of equipment. This is a new measure and Welsh Water has not yet gained any insight in terms of a trend although currently the rate looks low. As our data set grows, we will analyse it to assess the effectiveness of our maintenance activities and adjust them where necessary. From this our customers will benefit from greater resilience at WTWs by having less water quality or quantity related events.

2.5.1 Past Performance, Trends and Targets

Welsh Water's final determination target for AMP7 was to achieve an unplanned outage percentage of 2.34%, which we are forecasting to outperform.

By the end of AMP8, we are targeting an unplanned TW outage percentage of 1.5% and this will be maintained until 2050, see Table 5 below.

Table 5: Targeted unplanned outages to 2050

Performance Commitment	2025	2030	2040	2050
Unplanned outage - percentage	1.5	1.5	1.5	1.5

Welsh Water's long-term plan is to maintain the level of unplanned outage of WTW. This is seen to be providing an optimal balance between performance and cost.

Unplanned outages of a treatment works do not necessarily mean an impact on customers as, where resilience is either designed or built into a works or network, the impact is mitigated. Failures, either planned or unplanned, are not always a negative. Where consequence of failure is minimal, due to resilience, then 'running to failure' or having unplanned outages is the most cost-effective way of operating an asset as it means the asset is operated until it fails, using it for the full duration of its operational life. In other words, if an asset is proactively replaced due to an unacceptable consequence of failure, then the life remaining in the asset is lost.

2.6 Business Demand

In developing our WRMP24, consultees asked us to be more ambitious in supporting businesses to reduce their demand for water. For the English companies, UK Government has set formal targets for business demand reduction, these being a 9% and 15% reduction by 2038 and 2050 respectively, set against a 2019-20 baseline. We do not have a formal target set in Wales but we are mindful of the need to support demand management.

Within our WRMP24 we have set targets in line with available evidence around savings in potable water use that can be achieved across small, medium and large businesses, these being a 9% saving by 2037/38 in line with targets in England and an 11% saving by 2050.

We aim to achieve these reductions through a range of water efficiency measures with the largest contributor being the savings we hope to make through the "deep dives" whereby we would visit our business customers and undertake a detailed review of their onsite processes and usage of water to identify where efficiencies can be achieved.

The estimated reductions from business demand management activity from the 2019/20 position to 2050 are shown in Table 6 below.

Table 6: Business demand reductions (Individual year % reduction against 2019-20 position)

	2019-20	2025-26	2030-31	2037-38	2040-41	2045-46	2049-50
Business Demand (Ml/d)	183.29	171.74	170.73	167.08	166.21	165.130	163.61
% reduction		6%	7%	9%	9%	10%	11%

3. Meeting the Challenges to a Reliable Water Supply

There are challenges to the water supply and opportunities to maintain and enhance supply at different points in the water cycle. Put simply these points are in raw water catchments, at treatment works, and in the distribution network. To meet our targets in the long term, Welsh Water is continually adapting to challenges that emerge along the path of water with an overarching consideration of the whole system – source to tap. Risks in one part of the system can often be more cost-effectively mitigated by intervening in another part of the system, so it is important to understand challenges in their overall context as shown in the bullets below.

1. The challenges that arise in each of the three areas of the water supply pathway (catchments including water resources and dams, treatment works, and the distribution network including customers). It should be noted that Catchment Challenges as well as being resolved by catchment related interventions are often resolved by using a water treatment or a network solution. For example the reducing in demand through lower customer consumption and leakage across the network will be used to address this challenge. A summary of the main challenges, where they occur and where they can be rectified can be seen in Table 1 above.
2. The base interventions that we are proposing in each of the three areas for AMP8 and their impact on performance.
3. The enhancement interventions that we are proposing in each of the three areas for AMP8 and their impact on performance.

When developing our programme of work we start with the need and then develop a comprehensive long-list of options to meet water supply challenges. This process has considered the following:

- Whether there are ways the challenge can be eliminated, reduced or delayed so it is no longer causing a risk
- How we can manage risks by maintaining effective controls that are already in place
- What enhancements to existing resources or addition of new resources are needed to meet the challenge and future risks

This hierarchical approach, see Figure 5, makes sure that we consider wider approaches that are beyond the asset base alone, as well as building a good understanding of how we can maximise the potential of our existing services before needing enhanced schemes.

Some case studies will be highlighted within the discussion along with the relevant detailed enhanced cases.

Some of the challenges outlined are ongoing risks that can be met through our base-funded activities to maintain current service levels. Other challenges represent escalating or emergent risks driven by factors outside of our control. They may therefore call for new or better interventions just to maintain current levels of service or to meet more demanding targets, and consequently require enhanced investment.

To meet the challenges in maintaining a reliable source of raw water, Welsh Water uses robust optioneering approaches as outlined in WSH50-IP00-IP00 Our Approach to Investment Planning (Section 4.3). The process of identifying the challenges, longlisting and shortlisting options and testing against future scenarios is described in the WRMP; see, Section 5: “Developing Best Value Investment Solutions”. This section highlights the results of our shortlisting for AMP8, showing where we can optimise from base-funded activities and where we need enhanced investment.

Solution Category	Example	Certainty of Success	Increasing TOTEX
Eliminate, reduce or delay the need for change	Manage demand, influence future legislation	Low/Medium	
Maintain the effective risk controls already in place	Maintain, replace the existing asset like-for-like, or mothball/dispose of the existing asset or service	Medium/High	
Enhance existing resources or add new resources	Upgrade an existing asset, create/acquire a new asset or service	High	

Figure 5: Hierarchy of solutions

Within development of each of the solutions discussed within this document the assessment of need, long listing the options considered and the shortlisting of options and selection of the preferred options has been undertaken. This approach has been applied in each of the Enhanced Case documents and is summarised in WSH50-IP00-IP00 Our Approach to Investment Planning (Section 4.3) which describes how we have systematically considered possible solutions using the hierarchical approach.

3.1 Meeting Challenges in Catchments

Welsh Water takes raw water from more than 100 topographically discrete catchments covering a combined area of almost 11,000km², in Wales and on the England border. 95% of our raw water is derived from surface water catchments (shown in blue in Figure 6). This consists of major river sources such as the Usk, Wye and Dee as well as upland impounding reservoirs. The remaining 5% of raw water comes from groundwater, consisting of boreholes and springs (shown in red in Figure 6).



Figure 6: Welsh Water's surface water catchments

3.1.1 Challenges in our Catchments

With regards to our sources of raw water, the following risks and challenges need to be addressed:

3.1.1.1 Climate change and its impacts

3.1.1.1.1 Dry periods and drought

Our Resource Needs

Wales is heavily reliant on open sources of water (rivers and reservoirs) for most of the water supply, as opposed to groundwater (boreholes). We only abstract around 5% of the effective rainfall that falls across our supply area, so most of the rainfall in Wales directly supports the environment. This does leave us with a challenge and a risk during extended dry periods, particularly if they begin early in the year. These dry periods, caused by climate shifts, can lead to reduced water availability in reservoirs, but also deterioration of raw water quality. When quality deteriorates beyond the capability of a treatment works to treat the water, resource and resilience issues will emerge. This adds complexity to managing water resources effectively.

Droughts will become more frequent and more severe in the future. To model the potential effects of drought in the future, Welsh Water uses experience of previous severe drought benchmark years such as 1976, 1995 and now 2022. The models show how a repeat of similar droughts to these would impact us under future climate change scenarios.

Moreover, higher demand during the summer, both in average and peak periods, puts pressure on water supply systems, requiring strategic planning and infrastructure improvements to meet demand.

Supporting Others – Canal and Rivers Trust (CRT)

This challenge is included because it is part of the whole picture of our planned activity within catchments, enhancing the deployable water output for the CRT to support water availability during dry periods. This is for the benefit of, and entirely funded by the CRT.

Under 'New Authorisations' legislation, the Canal and River Trust's (CRT) abstraction at Brecon came under the licensing system in December 2022 and needs to comply with Habitats Regulations. This significantly reduces how much water can be abstracted from the river to support the losses from the Monmouthshire and Brecon Canal, meaning it will need to close from time to time for extended periods. We are working with the CRT to find a way of providing alternative supplies of water from Welsh Water's raw water resources.

3.1.1.1.2 More intense rainfall events

More intense rainfall can lead to issues within our catchments related to the following;

River and hillside erosion

Several of our river crossings (when a pipe goes under a river) are at risk due to erosion of river banks, we will continue to monitor these and put in place diversions where they present a risk to supply.

Flooding

Increased intensity of rainfall can lead to flooding of assets in our catchments or at our downstream pumping and treatment facilities.

Dams and Impounding Reservoirs

All dams in Wales holding back over 10Ml must be inspected at least every 10 years and issues arising addressed to fulfil the legal need stipulated in the Reservoirs Act (1975) and the Flood and Waters Management Act 2010. This need has evolved, ensuring that lessons are learnt from the Toddbrook incident (Balmforth review), and new guidance to respond to changing climate which has put dams under more strain. Much of the focus on Dam safety in recent years has been in upgrading assets to allow the passing of a "Probably Maximum Flood" event and through enhancing draw down capabilities to be used during an emergency. If we do not step up the level of funding of our dams, we can expect to see deteriorating safety standards which will ultimately put the public at greater risk.

3.1.1.2 Regulation and Standards Governing Abstraction

In general, the regulation in this area is moving towards maintaining existing levels of abstraction or reducing them to provide environmental benefit. Reducing river abstraction in specific areas may pose challenges to supply, requiring alternative sources or strategies to meet demand. Additionally, there is a growing need to increase compensation flows from our reservoirs to protect rivers from which water is abstracted. This is to ensure that environmental impacts are adequately mitigated and the ecosystem is safeguarded.

The only abstraction we have in England that may be impacted during the AMP8 period is our small (circa 1 Ml/d) groundwater source at Leintwardine, in Herefordshire. Studies completed in AMP7, as requested under WINEP, show that abstraction at Leintwardine alone, may not significantly impact local river flows below environmental flow targets. However, this may be the case when other upstream abstractions are considered in tandem, particularly under low flow conditions. We are therefore seeking funding in PR24, supported by the WINEP, to undertake further investigations.

Our AMP8 programme of investigations at other locations including our most sensitive rivers such as the Wye, the Usk, Tywi, Cleddau, Dee and Teifi which are European designated sites and key salmonid rivers in Wales. These investigations will be designed to improve our understanding of how to achieve long term sustainable abstraction to meet the requirements of the Environment (Wales) Act 2016. This work will enable us to understand the potential future impact on river flows under climate change and how this may affect ecological needs.

3.1.2 Options to Overcome Challenges in our Catchment

To meet the challenges of raw water reliability, Welsh Water has followed a robust optioneering approach as outlined in WSH50-IP00-IP00 Our Approach to Investment Planning. This section highlights the results of our shortlisting, showing where we can optimise from base-funded activities and where we need enhanced investment.

3.1.2.1 *Eliminating, reducing or delaying the need for change*

3.1.2.1.1 *Dry Periods and Drought*

Demand Reduction

Ongoing programmes, that are part of Welsh Water's business-as-usual approach, are aimed at monitoring and managing water use and leakage more efficiently to reduce demand. By achieving reductions in both household and business use and reducing levels of leakage this will ease the pressure on our catchments.

Our base programme will focus mainly on our leakage programme which will maintain the ever more challenging leakage targets. Our enhancement programme, through Project Cartref, customer education on water use and an increased metering programme will deliver improvements to demand reduction. These actions are implemented in our Distribution system so will appear in Section 3.3.

Maximising Existing Abstraction

During AMP8 we will continue to monitor our raw water assets. We currently inspect and maintain our catchment assets including intakes and catchwaters, boreholes and river intakes through our base intervention programme which maintains the existing asset base and the abstraction capacity.

Our base interventions manage our raw water assets so that the optimal yield can be achieved, and the use of our resources optimised. We control the management of releases from our reservoirs and use water resources modelling to predict demand requirements.

To maximise abstractions there are changes made to the operation of our raw water and network assets. This includes the need to reverse flows through the system, tanker supplies and the use of temporary raw and treated water pumping. As an example, and requiring investment in AMP8, we install temporary pumping between Carno and Shon Sheffrey impounding reservoirs to meet the increasing frequency of peak demand periods in dry weather.

During AMP8 we will also install four network interconnector schemes within our South Wales clean water network. Two of these will be in the South East Wales Conjunctive Use System (SEWCUS) and the other two will be in the Tywi Conjunctive use system (TCUS). Further details of these schemes and their associated benefits can be found in Sections 6.5.2 and 6.5.3 of our WRMP respectively.

The four schemes will provide an increase in WAFU by facilitating the maximisation of our Beacons reservoirs when water is available and to support this with additional resource from our Llandegfedd pumped storage impounding reservoir. The overall benefit to WAFU of the network enhancement schemes is 65.5Ml/d at an AMP8 TotEx cost of £50.9m (22/23 prices).

3.1.2.1.2 *More intense rainfall events*

To mitigate the impact of intense rainfall at our existing assets we undertake the following;

Flood Risk Assessment

We have undertaken flood risk assessments at our pumping and treatment facilities and compared these against a benchmark standard. Where flood protection is already in place this will be maintained to the required standard. Any gaps will be identified and put forward for future investment. As the gaps for AMP8 appear at Treatment works and Raw water pumping we have included the enhancement solutions in Section 3.2 below.

Coastal and River Erosion

To protect our critical pipe crossings (where a pipe crosses a river), we have collated a list of the highest risk locations. Base maintenance activities are used to carry out any repairs as they are required. Enhancement solutions are identified and outlined below for raw water assets and in Section 3.3 for distribution assets.

Dams and Impounding Reservoirs

We have worked with independent specialists, All Reservoir Panel engineers and the dam safety team within Welsh Water to develop an approach to reduce the risk to our portfolio of dams and ensure that improvements are made to safety in line with legislative requirements. The guidance provided by the Guide to Risk Assessment for Reservoir Safety Management (RARS), published by Defra and the Environment Agency is incorporated into our Portfolio Risk Assessment (PRA) tool.

This tool focuses on the Dams response to internal and external 'threats' and loads and the release, direction and consequences of flood water from the reservoir. The threats and loads influence the assessment of the probability of failure, informing the inherent risk of an asset and the need for investment to manage that risk. The Dams programme has a total CapEx value of £147.0M, including third party enhancement contributions of £8.7M. Of the total Capex £79.0M is enhancement and £68.0M base. The base funding is required to fulfil the legal need stipulated in the Reservoirs Act (1975) and the Flood and Waters Management Act 2010. These sites require regular inspection and maintenance to ensure their function and structural integrity. The maintenance activities associated with meeting current legislation is covered in the base activities.

3.1.2.2 Enhancing existing or adding new resources

While our current procedures are effective for preserving the current level of risk, these existing measures have limitations when it comes to addressing emerging risks like climate change that impact our raw water sources.

3.1.2.2.1 Dams and Impounding Reservoirs

Our AMP8 plan includes investment of CapEx £78.9M (2022/23 price base) of enhancement funding, including third party contributions of £8.7M to improve our impounding reservoirs. The enhancement funding is focused on the need to upgrade 29 of our sites to upgrade spillways to meet "probably maximum flood" event conditions and our pipework to meet draw down requirements so that levels can be quickly and safely reduced during emergency condition. This programme will be facilitated through the timely and ongoing addressing of essential works as identified by Section 10 reports. Following the identification of actions to be addressed, Welsh Water will undertake the necessary works, and report to NRW biannually, ensuring that there is no work outstanding beyond agreed dates.

Enhancement works are associated with upgrades to address climate change related impacts which are reflected in WSH01 Long Term Delivery Plan core pathway. As reservoirs are upgraded to adapt to climate change forecasts, enhancement related spend is forecast to reduce over the long-term strategy. Welsh Water have identified an alternative pathway focused on potential future remedial works in line with legislation changes from the Balmforth review into the Toddbook incident. Further details related to the core and alternative pathway for impounding reservoirs are contained in Welsh Water's long term delivery strategy.

The preferred approach for the Long Term Delivery Strategy is to include reservoir enhancements in the list of 'known additions' that have been included in the core pathway post-2030. Dam safety is an essential ingredient in securing long term reliability; it is the subject of legal obligations based around the system of periodic inspections followed by remedial works; we have a plan that defines the programme of works for AMP8; thereafter we can be certain that there will be a substantial programme of works, however as the next ten yearly set of inspections has not yet taken place it is a risk based projection on anticipated funds required.

The list of sites planned for enhancement investment during AMP8, are listed in Table 7 below with further detail available within Sections 2 to 5 of the WSH59-RS03 Increased safety and lower risk for impounding reservoirs enhanced case.

Table 7 – List of the 29 impounding reservoirs sites in the Dams Enhancement Programme

Site Name		Site Name	
1	Aled Isaf	16	Llyn Anafon
2	Beacons	17	Llyn Bran
3	Blaen-y-Cwm	18	Llyn Cefni
4	Brithdir Mawr	19	Llyn Celyn
5	Cantref	20	Llyn Cwellyn
6	Castell Nos	21	Llyn Gelli Gain
7	Cilcain No 3	22	Nant Hir
8	Cilcain No 4	23	Nant Moel
9	Clydach	24	Penderyn
10	Court Farm	25	Pond-y-Gwaith
11	Cwm Dulyn	26	Tynywaun
12	Cwm Wern Deri	27	Upper Lliw
13	Dolwyddelan	28	Usk
14	Llwyn-on	29	Wentwood
15	Llyn Aled		

3.1.2.2.2 Abstraction Assets

There are two schemes that are proposed to manage the impact of dry and wet periods, made more extreme by climate change, on the use of our raw water resources. A third programme of work will provide water supply support to the Canal and Rivers Trust during dry periods.

Nantybwlch WTW Additional Resource scheme

During AMP8 the Nantybwlch WTW Additional Resource scheme will improve the resilience of the water resource for Nantybwlch WTW. The chosen option is to improve the resilience of the transfer between Carno and Shon Sheffrey impounding reservoirs, by creating a permanent raw water pumping station (replacing a temporary setup) to secure transfer of raw water capacity from Carno impounding reservoirs (where there is a larger resource) to Nantybwlch WTW. The permanent electrical pumps will be housed within a secure building with an upgrade power supply, at a cost of CapEx £3.1M (2022/23 price base). Once installed, operational flexibility would be achieved through remote automatic control of the transfer system.

The transfer is required more regularly to meet the increasingly frequent dry periods when the Shon Sheffrey source quickly drops to a low level and cannot provide the required flow (25MI/d) of water.

Without this investment, the temporary pumping arrangements currently used increasingly often during the summer and autumn periods, will not provide a sustainable long term solution. This will mitigate a low probability high consequence risk to resilience of the raw water supply that currently exists.

For further detail on how these schemes meet the Ofwat criteria for enhanced expenditure, see WSH61-RS05 - Increasing Resilience of Tap Water Supply - Treatment Works.

Moving the Wye Transfer Main where it crosses the River Usk

The Wye Transfer Main is a raw water main that transfers water from the River Wye Intake, located in Monmouth, to Court Farm WTW. The raw main is a 50-inch diameter steel pipeline that has several river, dual carriageway and road crossings along its c35 km length. The main has failed several times over the last 15 years due to riverbank erosion where the main crosses the river Usk. The pipeline is 40 years old, and over the last 15 years the river has begun to significantly change course and undermine the pipeline.

The regular erosion of the main and supporting evidence from a third-party erosion report indicate that levels of erosion will continue and the risk of catastrophic failure of the pipeline will continue to increase. We currently see a loss of at least 0.5m of soil over the main. Operational mitigation has been put in place but this is becoming more difficult and more expensive to maintain each time further erosion occurs. A permanent solution is required to reduce the risk of failure and safeguard this strategic raw water supply.

Following our optioneering process we proposed to relocate the main. The total length of pipeline that will be laid as part of this scheme is planned to be 720m. This solution diverts a length of 490m, in addition to a further 230m of dual pipeline sections, at a cost of CapEx £4.8M (2022/23 prices). This option avoids the high-risk areas of riverbank erosion and reduces the number of pipeline bends, reducing frictional losses.

Increasing deployable output for the Canal and Rivers Trust (CRT)

Although there is limited water available within the Usk catchment, we have assessed options to support the Canal and Rivers Trust. There is still some uncertainty around the requirement for support water as the CRT are currently challenging the loss of their abstraction licences.

Should an intervention being required the programme of work consists of two projects, see Schemes 1 and 2 below which will enable us to maintain our level of service to customers should we reach agreement to provide the CRT with a bulk supply of water.

- CRT water supply support Scheme 1 – use of Grwyne Fawr reservoir
- CRT water supply support Scheme 2 – increase the deployable output of Court Farm WTW

These schemes were not included in the WRMP programme as they are third party funded and no net cost for Welsh Water. The CapEx has been included in Table CW3 line CW3.41 and funding has been added to the grants and contributions in Table DS1w.

3.2 Meeting Challenges in Water Treatment

Across our water treatment works a wide range of challenges are reviewed and assessed as a business as usual activity. The challenges set out below are those that are key to the challenges forecast during the AMP8 period.

3.2.1 Challenges in Reliable Treatment of Water

3.2.1.1 Climate Change Impacts – More intense rainfall

3.2.1.1.1 Flooding of water treatment works

The majority of our water treatment works and raw water pumping stations are located close to reservoirs or rivers. Those next to rivers were designed to recover from flooding relatively quickly and equipment was elevated to prevent contamination following a flood. However, the frequency and scale of flooding at some of these sites has resulting in increased outage periods and rectification works. Consequently, there is a need to undertake flood risk assessments and the associated intervention programmes to mitigate risk to acceptable levels.

Factors that are impacting the frequency and solution options to mitigate flooding are summarised below.

Climate change: The impact of climate change is leading to more frequent and prolonged flooding events, further increasing the risk to water treatment works.

Engineering difficulty: The geographical and environmental characteristics of some locations in Wales can make it more challenging to protect water treatment works from flooding. The immediate surrounding of a treatment works can also make flood protection difficult, for example Mayhill WTW is surrounded and posed a challenge when we installed a flood defence wall in AMP7.

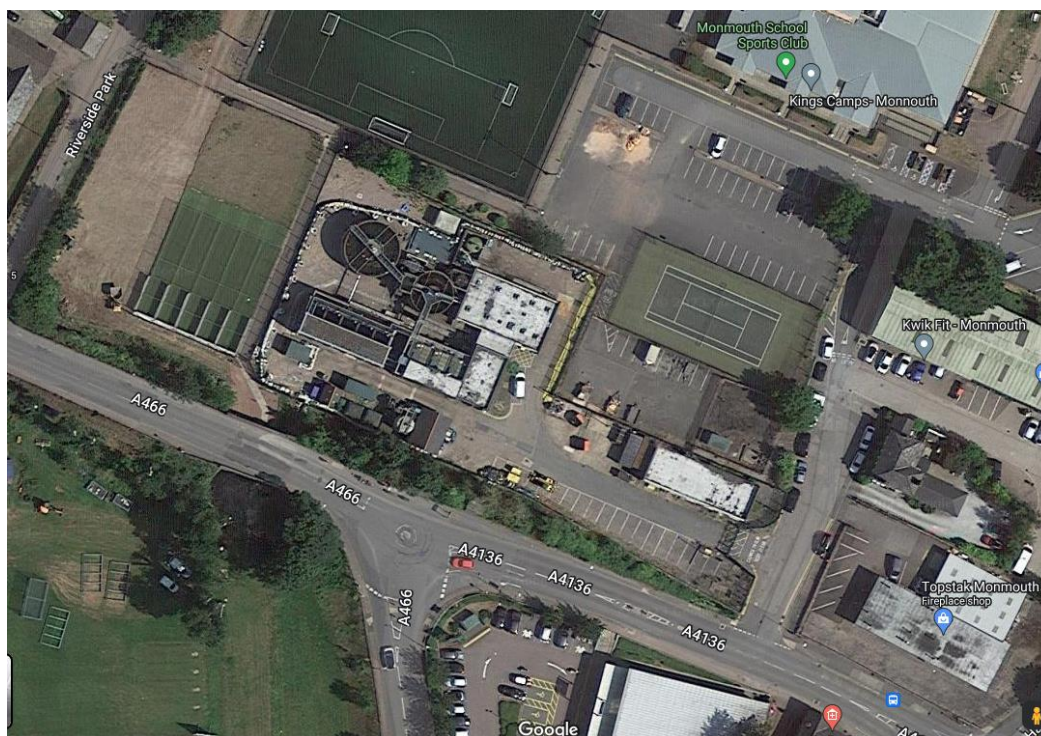


Figure 7: Google maps image of Mayhill, showing proximity of sports facilities.

3.2.1.2 Regulatory Change

3.2.1.2.1 WTW Treated Water Tank Resilience

There is a need to increase the resilience of supply at water treatment works (WTW) sites through elimination of single points of failure. Those related to process or storage tanks currently prevent long term outages to facilitate site inspections and maintenance. An assessment of these tanks at our WTW identified that there are critical tanks, built at a time when adequate redundancy or bypass facilities were not part of standard design, that now need to be upgraded to enable essential maintenance activities to take place.

The current position means that if during regular inspection or maintenance of these tanks, a problem was identified, the entire WTW would need to shut down whilst the issue was rectified. If this period were to exceed the available storage on site and no alternative were available, then the reliability of our customers supply would be at risk. We have a letter of support from the DWI (DWR 3) to remove these deficiencies by providing an alternative arrangement.

Sludge to Land Legislation Changes

There is a risk to the sludge disposal activities that are required to manage the waste streams at our treatment works sites. This is due to a change in the statutory guidance within the following documents: 'Environmental Permitting (England and Wales) Regulations (2016)' and 'Code of Good Agricultural Practice for the Protection of Water, Soil and Air for Wales (2011 No.20)'. The guidance

specifically limits the spreading of WTW sludge to land during excessively wet or frozen conditions. Consequently, we will need to change our sludge management techniques, particularly at key WTW sites to factor in the impact of this change which will limit the available landbank for agricultural spreading, particularly in winter months.

3.2.1.3 Strategic WTW Resilience

Cwm Taf WTW

Within our PR19 submission we identified the need to build a new WTW at Cwm Taf to provide a resilient and long-term water supply for customers in the SEWCUS area. A DPC scheme has been continuing during AMP7, developing the solution and meeting the required Ofwat gateways. This process will continue into AMP8 along with the scheme delivery which will require supervision and management outside of our base maintenance activities.

3.2.2 Options to Overcome Water Treatment Works Challenges

Our base maintenance programme maintains effective risk controls that are already in place. As part of our long listing process when assessing needs, the ability to mitigate risks has been assessed but where there are changes to legislation the need for enhancement may be unavoidable.

3.2.2.1 Maintaining the effective risk controls already in place

3.2.2.1.1 Flooding of water treatment works

Within our base intervention programme, we maintain effective flood risk controls already in place at our water treatment works sites. The interventions include the maintenance of embankments, buildings, clearing drains, grounds maintenance and replacing seals on temporary flood protection equipment. These interventions are limited to maintaining the current position but do not address locations where the frequency and level of flooding is forecast to increase.

3.2.2.1.2 WTW Critical Tank Resilience

Within our base maintenance programme we manage our clean water storage tanks across all of our water treatment works. Our interventions include inspections, cleaning and maintenance activities. At some of our sites however, where the tank is a single point of failure, the outage period that can be achieved without impacting customers is less than 24 hours. Where potential maintenance activities could exceed this timeframe, improvements are required that are not covered by our base maintenance activities

3.2.2.1.3 Sludge to Land Legislation Changes

The maintenance of our existing waste water and sludge treatment facilities at our water treatment works is undertaken within our base programme. This maintains the existing sludge facilities to meet existing legislation. Where changes do occur, a temporary solution may be developed to mitigate the risk in the short term. The base programme does not address the sludge treatment improvements required to address the resilience risks associated with changes to sludge disposal legislation.

3.2.2.1.4 Strategic WTW Resilience (Cwm Taf WTW)

During AMP8 we will continue to maintain and operate the existing WTW sites at Pontsticill, Llwynon and Cantref whilst the DPC scheme for the Cwm Taf scheme goes through the tendering process and construction. These sites will remain in use until early AMP9.

3.2.2.2 Enhancing existing or adding new assets

Where base activities are not sufficient to meet the challenges faced, then enhancement funding is required to improve the asset base.

3.2.2.2.1 Flooding of water treatment works

This programme of work has been developed to meet the ambition to ensure all critical above ground water assets have at least a 1 in 30 year flood event protection, informing the core pathway of the

overarching Long Term Delivery Strategy. The programme of flood risk assessment has highlighted the vulnerability of specific water above ground assets.

The sites identified as the highest priority were selected for further detailed assessment and mitigation options costed and tested for whole life benefit. The proposed intervention programme for AMP8 is for flood mitigation projects at five WTWs to be undertaken at a cost of CapEx £5.2M (2022/23 price base).

This programme would enable 100% of critical above ground WTW and water pumping assets to be protected against 1 in 30 year or greater flood events. This assumes that Pontsticill and Llwyn-on WTWs will be decommissioned as part of the new Cwm Taff WTW (AMP9).

3.2.2.2.2 Critical Tanks Programme

A programme of work has been developed to address the resilience needs for the single points of failure identified in some of our WTW tanks. This will enable us to meet the requirements of the DWI improvement notice by providing an alternative arrangement to maintain supplies to customer during essential maintenance.

Following a review of these tanks across our WTW sites, 18 tanks were identified as high priority. Of those, 15 tanks at 11 sites were identified for rectification during AMP8. The remaining three are located at one site and need further investigation prior to submission of a scheme for delivery in AMP9. A summary of the interventions and locations can be seen in Table 8 below which are forecast to cost Capex £13.5m (2022/23 price base).

Table 8 - Location and Type of Critical Tanks and Proposed Solutions for the AMP8 Programme

WTW	Tank	No of Tanks	Proposed Solution
Llwynon	Contact Tank, Final Water Tank 1 and 2	3	Network solution required to facilitate removal from service.
Bolton Hill	Contact Tank and Pump Sump	2	New bypass and a new bypass or tank
Builth	Contact Tank	1	New bypass manifold utilising Llanellwedd SRV as contact tank.
Whitbourne	Final Water tank. (used as Contact tank)	1	New tank
Glascoed	Contact Tank	1	Network solution to reduce demand on Glascoed WTW.
Cwellyn	Contact Tank	1	New bypass
Elan	Contact Tank	1	New bypass, reutilising one half of treated water tank for contact tank.
Preseli	Contact Tank	1	New bypass (also to include bypass of the onsite backwash tank)
Mayhill	Final Water Tank 1 and High lift sump	2	New tank
Gwastadgoed	Interstage tank (post membrane)	1	New pre-membrane booster pumping station. Abandon tank.
Pen y Bont	Treated water pump tank	1	Construct second tank (10m3)
Total Number		15	

3.2.2.2.3 Client management activities for Cwm Taf Water Supply Strategy scheme

Our PR19 DPC (Direct Procurement for Customers) scheme covers the delivery of the Cwm Taf WTW to replace the treatment works at Pontsticill, Llwynon and Cantref. The current programme for the delivery of the Cwm Taf project is allowed for in the 5 years of AMP8. To ensure this is successfully delivered, further investment of £24.5M CapEx (2022/23 prices) is required for us to take the project forward. This involves coordinating various stakeholders and contractors to achieve the project's objectives. Contract award is currently programmed for January 2026, with a completion date of 31 March 2030. Once delivered, the scheme will ensure our ability to protect the reliable supply of safe drinking water to around 400,000 people across SEWCUS operating area.

3.3 Meeting Challenges in the Distribution Network

Even with a high quality of water entering the distribution system, further challenges can emerge between treatment and the customer's tap.

3.3.1 Challenges in delivery of a reliable supply to customers' homes

There are four main challenges that we are highlighting that risk a reliable supply to customers' homes. Each of these is detailed below, followed by our current management controls and our options to enhance this service. Further details will be found in the associated individual Investment Cases.

3.3.1.1 Asset Health of our Network Assets and the Risk Factors impacting them

The most significant challenges to reliability of supply in the distribution network (mains and supply pipes) are both chronic (long term background issues eg leakage) and acute (short term immediate impacts eg mains bursts). These are due to a variety of causes but primarily come down to a legacy of ageing infrastructure with deterioration exacerbated by climate change factors.

Welsh Water's Infrastructure Service Impact Model, which predicts future investment needs to meet our performance targets for burst mains and supply interruptions, shows that there is a looming risk of significant escalation in bursts, customer service disruptions, and water leakage over the next 5 to 15 years unless we intervene proactively now.

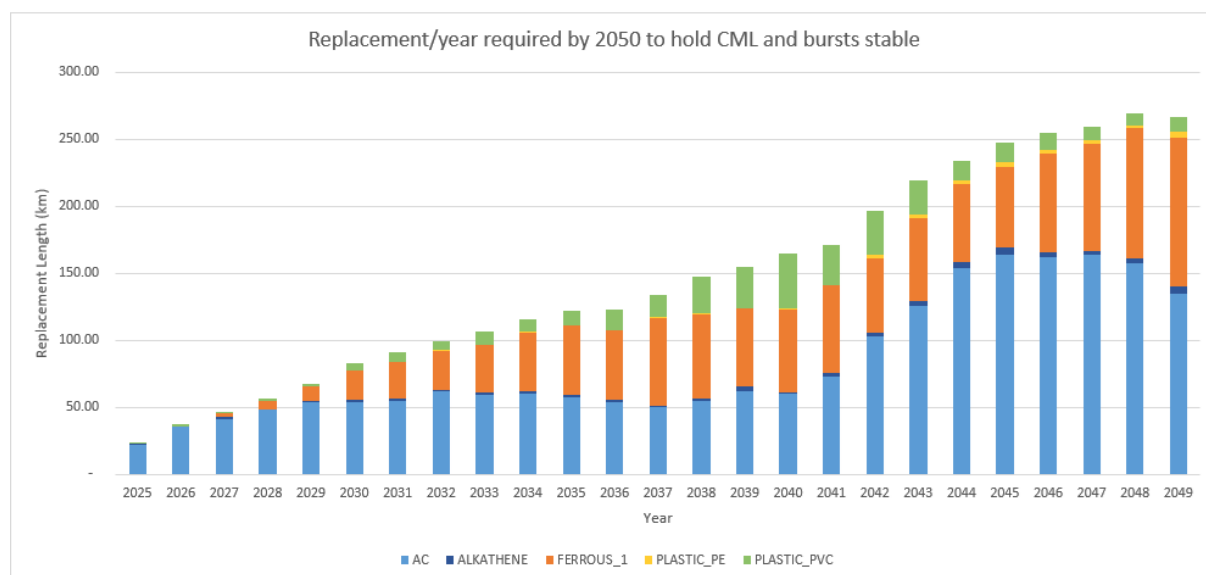


Figure 8 – Mains Replacement Requirement by Year to Maintain CML at End of AMP7 Levels

The chart in Figure 8 above shows the increasing requirement to replace our water network in order to hold health and performance stable from 2025 to 2050. This replacement requirement is driven in the shorter term by the deterioration rate of our Asbestos Cement mains which has been demonstrated to be higher than the rest of England and Wales. This is due to the particular environmental factors in our operating area. More latterly the replacement is driven by the large proportion of cast iron mains that will require replacement as this material also approaches end of life.

To further highlight the shorter-term challenge with Asbestos Cement mains, the chart below shows the current high rate of bursts that we are experiencing and the clear increased rate of deterioration that we have with this problem material since 2010. As this increase in rate is relatively recent it is not reflected in base maintenance allowances.

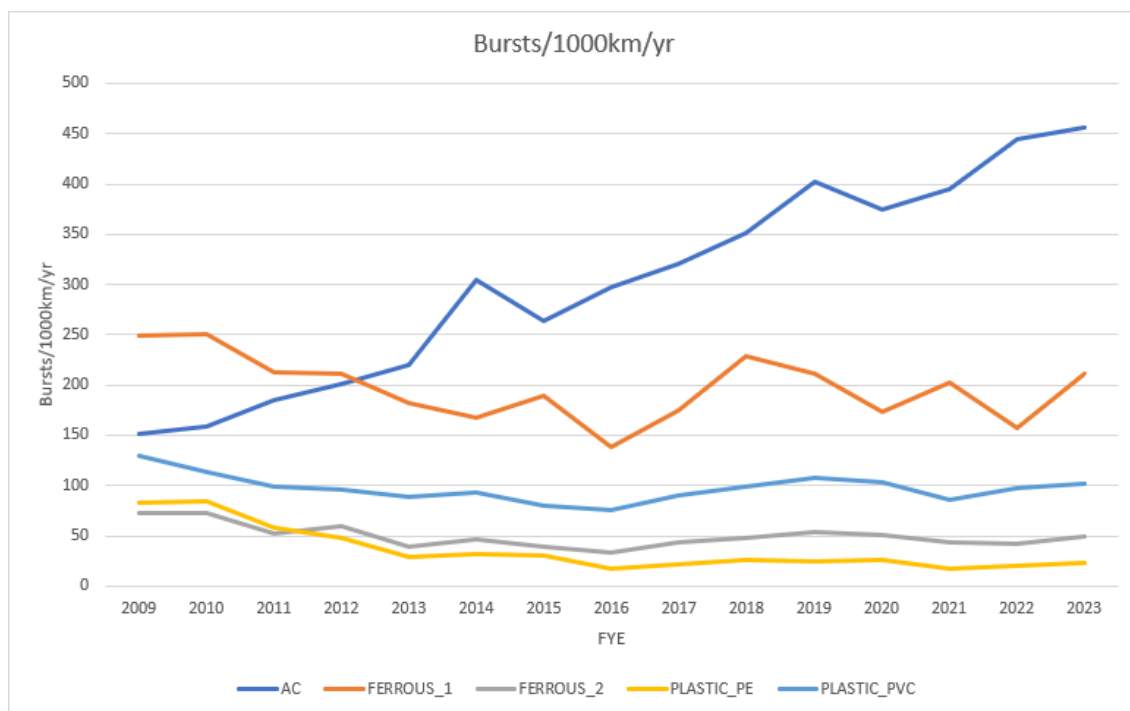


Figure 9 – Mains Bursts Per Year by Pipeline Material

The risk factors impacting our performance are summarised below.

3.3.1.1.1 Risk 1: Ageing infrastructure

The rapid construction of the water supply infrastructure during the late 19th and early 20th century in parts of Wales was driven by industrialisation and urbanisation. While this expansion was crucial for meeting the growing demand for water at the time, many of the physical assets built during this period are now approaching or exceeding their intended design life.

As these assets age, they become less efficient and more prone to failure. In combination with evolving operational and environmental challenges this puts pressure on Welsh Water to repair or replace ageing assets at an accelerating rate.

The consequences of not addressing the ageing infrastructure can include increased frequency of leaks, bursts, and interruptions in water supply. This can have negative impacts on customer service, water quality, and operational efficiency. Furthermore, the cost of reactive repairs and emergency interventions may be higher compared to planned maintenance or asset renewal.

Asbestos cement distribution mains (AC mains), of which Welsh Water operates and maintains approximately 3,752km, are experiencing higher failure rates compared to other materials and to AC mains in other companies, resulting in more bursts, leaks, and interruptions to the water supply.

Over time, we have managed to meet performance expectations regarding mains repair rates and have reduced interruptions to supply, through a combination of targeted investments to manage mains repair rates, and continued implementation of effective operational practices, and incident responses. These strategies have allowed us to maintain CML performance while tolerating a higher failure rate in AC mains.

3.3.1.1.2 Risk 2: Impact of climate, soil and water softness on AC and CI Mains

The effects of climate and groundwater on our infrastructure are particularly notable for asbestos cement (AC) and cast iron (CI) mains. AC mains are more susceptible to bursts during dry summer months due to the ground movement that results from drier soil conditions. Conversely, cold temperatures in winter lead to bursts in CI mains, causing supply and quality concerns. A notable

instance in December 2022, with temperatures changing rapidly from -8°C to +14°C, resulted in supply disruptions and water discoloration.

Our treated waters are generally soft (i.e. water inside our pipes) as is much of our groundwater (i.e. water outside of our pipes). These soft waters attack AC mains from both sides, contributing to both internal and external deterioration. They dissolve the cement matrix of the pipe walls leading to 'softer' pipes more prone to bursting. Climate change modelling indicates that AC mains failures will accelerate with warmer summers, while CI mains may experience slower deterioration with milder winters. Finding a balance between these effects is essential for effective management.

Another challenge linked to climate change is the impact of dry weather and freeze-thaw events both of which result in higher-than-normal levels of demand. As a result, over 20 areas across the network regularly require tankering to keep up with demand during periods of higher and lower temperature.

While operational interventions have maintained supplies to date, additional investment to improve the connectivity and resilience within these areas, will address this until the more strategic investments are delivered in the future. This brings us back to the challenge of supplies being affected by single points of failure, with few built-in alternative routes to maintain supply in large parts of the network.

3.3.1.1.3 Risk factor 3: The cost of pipe replacement

In undertaking pipe replacement activities, customer research indicates that longer interruptions are acceptable to customers if they are forewarned. To take advantage of this, we have sought agreement with Ofwat to differentiate between planned and unplanned supply interruptions in our targets. This was outlined in the Sept 2022 Draft Methodology consultation. By proposing that the three-hour target should apply solely to unplanned interruptions, we aimed to better manage customer expectations and enhance operational efficiency, allowing us to replace more mains lengths within budget constraints.

The current target places a significant cost burden on mains replacement, particularly in urban areas. This impacts our efforts to implement the Acceptability of Water and our AC mains replacement program. The requirement for work within a three-hour windows significantly inflates costs, driving the use of open-cut methods, which involves laying new mains alongside existing ones before transferring connections. This approach is often at the expense of more cost-effective "no dig" techniques, as temporary mains must be laid to connect all properties before replacing pipes. Consequently, it limits our ability to replace mains within our base maintenance allowance efficiently.

Although Welsh Water's view was not initially accepted, we will continue to advocate for adjustments to the target that promote more cost-effective and efficient approaches to mains replacement.

3.3.1.2 Resilience improvements to supply systems

The longer-term goal of managing supply interruptions will become increasingly difficult over time. Bursts on critical trunk mains can result in significant impacts on Customer Minutes Lost performance. Due to the size of the mains and the number of customers supplied, single trunk main failure events have a substantial adverse effect. Welsh Water's resilience programme will work to mitigate these risks where possible as part of the longer-term strategy. However, for our large trunk main systems interconnectivity is the only viable mitigation once the carrying capacity is beyond a response led by tankers.

The need for projects to improve the resilience of our networks during AMP8 can be summarised as follows.

- Improvements to network connectivity to provide long and short duration resilience across our networks
- Reducing the risk associated with critical crossings of major roads, railways and rivers
- Developing our strategic understanding further through regional feasibility studies to inform our investment needs and the Long Term Delivery Strategy
- Prevention of third party impacts to our network resulting in compromised water quality and interruptions to supply

3.3.1.3 Reducing Demand for Water

There is a need to reduce demand from our household and non-household customers both to support the delivery of our WRMP and reduce the need to develop and to work toward the achievement of our long term target of 110 litres per person per day. This can be split into the challenges below.

3.3.1.3.1 Reducing Leakage

Manage our impact reducing the levels of leakage across our network to achieve the additional 10% reduction target of the 2024/25 leakage level at the end of AMP8.

3.3.1.3.2 Increasing Customer Consumption Awareness

There is a need to increase the awareness of customers regarding the volume of water that they use and what they can do to reduce this. One of the key ways to raise awareness is measure the volume of water that customers are using and to make them aware through SMART meters and supporting technology.

3.3.1.3.3 Supporting Customers to Reduce Demand

Supporting our customers to understand how they use water and steps that they can take to reduce consumption. A significant volume of water is used on the demand side of our network that could be reduced. This results from external leaks on customer communication pipes, dripping taps and toilet overflows running constantly for example on the domestic site. For business customers management of process water use, correct operation of flow control devices and operational housekeeping issues can all contribute to significant additional water use can greatly reduce the use of water within Welfare facilities as well as Understanding how to reduce consumption and then implementing it will require support for our customers. Practical support to repair supply pipe leakage and domestic plumbing, reducing water wastage from dripping taps and overflowing toilets for example.

3.3.1.4 Reducing Third Party Impacts

The fourth area is the need to reduce the risk associated with low probability high consequence network contamination events because of third party safeguarding failures. There is a significant risk of contamination of our water supply from third party non household locations. Currently we manage risk by undertaking water regulations inspections at the highest priority sites. However a significant risk remains and an additional level of inspection of both non household and household high risk locations is required.

3.3.2 Options to overcome challenges in delivery of a reliable supply to customers' homes

To meet the challenges in the delivery of a reliable water to customers' premises, Welsh Water has followed a robust optioneering approach as outlined in WSH50-IP00 Our Approach to Investment Planning (Section 4.3). This section highlights the results of our shortlisting, showing where we can optimise from base-funded activities and where we need enhanced investment.

The detail on how we have systematically considered available options can be seen in each of the enhanced case documents.

3.3.2.1 Effecting change without additional investment and maintaining control already in place

3.3.2.1.1 Asset Health

As noted above the deterioration in performance of our AC mains asset base see Section 3.3.1.1 the rate of AC mains burst has roughly doubled since 2012, see Figure 9 above. To date our base maintenance programme has managed the network through operational and maintenance activities to minimise busts and reduce interruptions to supply.

This has been the foundation of our performance improvements along with targeted mains repairs and replacement in delivering our CML targets. However, the programme of operational maintenance alone cannot address the challenges of AC mains replacement and an additional enhancement programme of work is required to achieve this, see 3.3.2.2 below.

3.3.2.1.2 Resilience of Treated Water to Customers' Premises

The operation and maintenance of our network provides an effective water supply system. The network has the capacity to meet customer demand under normal conditions. However, during extreme conditions, for example drought periods, freeze thaw events or a catastrophic failure of a single source of supply either a water treatment works or trunk main, the existing network does not have the resilience to maintain supply.

3.3.2.1.3 Reducing Demand for Water

Ongoing programmes, that are part of Welsh Water's business-as-usual activities, are aimed at monitoring and managing water use and leakage more efficiently to reduce demand. By achieving reductions in both household and business use, this reduces the pressure on our catchments and water treatment works.

Our base programme will replace existing meters when they fail and provide information for customer regarding reducing consumption through information on our website.

Our leakage investment will provide a significant programme of find and fix network and trunk mains interventions across our clean water network during AMP8. This work will maintain the levels of leakage achieved by the end of AMP7 which will be 15% lower than the 2019/20 values. This focuses on continued efforts to maintain and address potential risks in the water supply network. The 'Find and Fix' Leakage programme and managing upstream losses, contribute to minimizing water losses. We have invested significant additional funds (circa £60m forecast by end of AMP7) in targeting upstream losses in our trunk main network over the last 2 years and will continue this focus into AMP8.

Operational maintenance of our pressure management and SMART network will continue. This involves improving the control and monitoring of PRVs and SMART networks to enhance the efficiency of water distribution without requiring additional investment. We will also optimise our existing pumping stations to minimise pressure fluctuations resulting in burst mains and maintain service reservoir structures to identify and repair assets whilst minimising losses.

Further detail of our Leakage programme can be seen in our Leakage Strategy, see Appendix C of WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management enhanced case.

3.3.2.1.4 Inspections to Reduce Third Party Impacts

Currently our base programme manages risk by undertaking water regulations inspections at the highest priority sites. However, a significant risk remains which will not be covered within our base intervention programme.

3.3.2.2 Enhancing existing or adding new network assets

3.3.2.2.1 Asbestos Cement Mains:

The unique combination of water and soil chemistry in our operating area means that AC mains are degrading at a rate much faster than the UK average. This has an adverse effect on several areas, particularly mains repairs and interruptions performance.

Without our proposed enhancement programme, to step up the level of investment in our AC mains in AMP8, we can expect to see:

- Increases in mains repairs, worsening interruptions to supply, and worse service (particularly repeat failures for certain customers and communities).
- Significant increases in OpEx expenditure in AMP9, of around £20m per annum.

We have worked with independent specialists to analyse the drivers behind the condition of our AC mains and understand the subsequent impact on performance. We have a well-developed understanding of the statistics and science behind the observed trends and have been able to use this insight to effectively target our response.

We have assessed over 40 scenarios using cost benefit analysis within our investment modelling software to consider how best to scale and target our response. Our chosen option is to invest to hold mains repair and supply interruptions steady (despite a step change in deterioration), and thereby provide a basis from which improvements in services can be delivered. We will need to invest in AC mains replacement at a level significantly higher than in previous periods. We will invest CapEx £66M (2022/23 prices) of enhancement funding to replace 174km of AC water mains.

In developing schemes, we have modelled the costs for a basket of intervention types (open cut, directional drill etc.), by surface (grassland to urban) and diameter. We have built on insights gained through our previous mains replacement programs and in the development of investment models to generate efficient and cost beneficial schemes.

The investment will maintain compliance with the performance commitment for mains repairs and interruptions to supply. Delivering a resilient asset base will allow us to build in additional stretching performances improvements in mains repairs (reduce by 130 pa) and interruptions (reduce by 30 seconds). The work will reduce repeat failures and strengthen the resilience of rural water supplies which are disproportionately AC fed.

3.3.2.2.2 *Network enhancement of the ability to transfer water and build resilience (raw water and treated water).*

This option focuses on improving the network's ability to transfer water, both in its raw state and after treatment so that water can be more efficiently moved and distributed to meet demand.

3.3.2.2.3 *Strategic Feasibility Studies*

The proposed programme of strategic feasibility studies is an essential precursor to developing low-regrets options for strategic resilience schemes for the North, East, Tywi West to Pembrokeshire, and resilience for the Cardiff water supply, CapEx £4.9M (2022/23 price base). We need to understand the limitations around the water supply across Wales and the need to incorporate the significant areas of growth to provide a long-term clean water solution.

Increasing the reliability of short- and long-term water supply by increasing transfer capacity within Tywi Conjunctive use System (TCUS)/ South East Wales Conjunctive use System (SEWCUS)

The "Increasing the reliability of short- and long-term water supply by increasing capacity within Tywi/SEWCUS" scheme builds on work that started in AMP7 as part of the 'Extending the South Wales Grid' initiative. In AMP7, this scheme focused on providing short-duration resilience for water supply in TCUS and SEWCUS.

In AMP8, we are taking it a step further. The proposed scheme aims to enhance resilience by improving this strategic network, enhancing Birchgrove WPS and Margam WPS, and dualling a 4.4km section of pipeline in an otherwise dualled length of mains. This section causes both a flow restriction and represents a single point of failure. These improvements are vital for the long-term capacity and reliability of our network.

Our goal is to transition from short-term resilience, as achieved in AMP7, to long-term solutions, considering the latest growth forecasts for the area during AMP8. We are planning further assessments in AMP8 to define additional interventions and plan for AMP9.

For details on the enhancement components of these options, see the following Enhanced Cases:

- WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management
- WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity

Reducing Demand for Water

Our demand reduction programme will work with customers to engage with them and communicate and support them to use water more efficiently as well as repairing domestic plumbing to reduce

consumption. It will also include customer supply side leak repairs. The projects are forecast to reduce demand by 29Ml/d and leakage by 19Ml/d by the end of AMP8.

Further detail can be found in WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management (Section 2 to 5).

Reducing Leakage

Our leakage reduction programme targets a 10% during AMP8 compared to the 2024/25 baseline. The target level of leakage reduction in 2029/30 is forecast to be 18.58 Mld. This will be achieved by a combination of improvements from base and enhancement. The enhancement elements included below.

Transitioning to advanced area leakage control methods will improve our ability to manage and reduce water losses. The enhanced approach is set out in our Leakage strategy that accompanies this submission. This will be a £0.7m (2022/23 price base) programme of work.

Project Cartref

The AMP8 Project Cartref programme builds on past efforts to manage PCC with a long-term target of 110 litres per person per day by 2050. This project will also address customer-side leaks to reduce water wastage and enhance water efficiency.

Our plans for AMP8 include upscaling the Project Cartref service to align the ten Strategic Objectives outlined in the UK Water Efficiency Strategy 2030, focusing on direct customer engagement and social contracts. This programme of work to reduce consumption will cost £15.3M.

The expanded Cartref program in AMP8 encompasses:

- **Leaky Loo Support:** Continuing our Leaky Loo identification and repair service, which is offered to customers across our operating area. Over the AMP, we anticipate conducting around 25,000 customer appointments as part of this effort.
- **School Initiatives:** Expanding our education program, which includes school assemblies and workshops aimed at educating children about the water cycle and water efficiency. We plan to conduct water efficiency audits and installations in approximately 200 schools annually.
- **Access to Products and Education:** Promoting our online Consumption calculator, offering access to free water efficiency products, and providing education to encourage behavioural changes.
- **Water Home Audits:** Identifying high water users and conducting home visits to perform water audits, educate customers about efficient water usage, and offer free installation of water efficiency products and Leaky Loo repairs. We aim to complete 25,000 home audits during AMP 8, building on trials conducted in AMP7.
- **Community Engagement:** Recognizing the power of community engagement, we will focus on areas undergoing progressive metering and support various initiatives, such as the Water Resilient Community program, to reduce water wastage and promote the uptake of water efficiency measures.
- **Water Efficiency Partnerships:** Collaborating with partners, including the Wales Water Efficiency Group, to explore innovative ways of achieving water savings, such as flow controller installations and retrofitting products. This effort includes providing education as part of the voids process in social housing.

In addition to these initiatives, media campaigns and educational programs will be launched to raise awareness and encourage customers to adopt water-saving behaviours, ultimately reducing PCC and overall water demand.

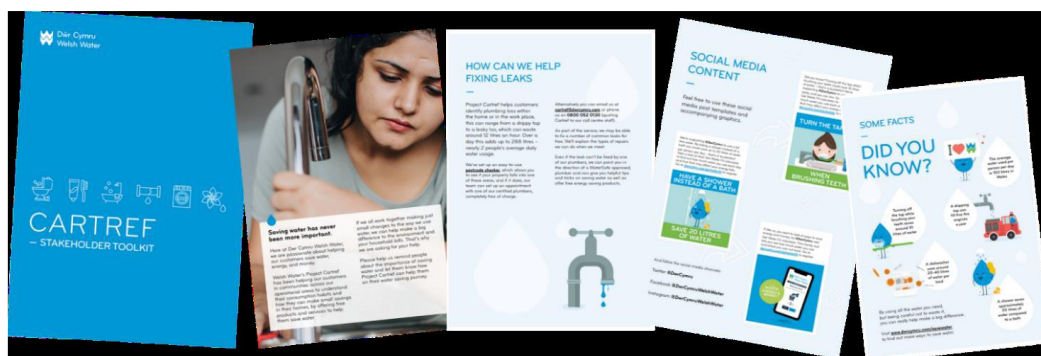


Figure 10: An example of our Stakeholder Engagement Pack designed to promote Cartref, and water efficiency, within the community.

Within our project Cartref programme of work as well as the consumption improvements described above, we have an additional programme of work which will find and fix external leakage on customer supply pipes. This programme of work will cost £4.3M (2022/23 price base).

For further detail on how these schemes meet the Ofwat criteria for enhanced expenditure, see WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management.

Customer Metering:

This involves implementing customer metering initiatives to monitor and manage water usage efficiently. It aims to promote water conservation by encouraging customers to be mindful of their water consumption and identify potential leaks or wastage. Customer metering also encourages water conservation by promoting behavioural change and enabling the early identification and resolution of leaks or abnormal water usage patterns. The planned enhancement programme will cost £128.8M (2022/23 price base) to deliver.

The categories of investment for our customer metering programme enhancement are set out in the bullets below.

- **Meter Optants:** Customers choosing to have a meter installed.
- **Progressive Metering:** the metering of unmeasured properties in line with Welsh Water's AMP8 Meter Strategy and WRMP
- **Proactive Replacements:** early replacement of dumb meters with AMR meters
- **Reactive Replacements above Business As Usual (BAU):** the additional unit cost of an AMR meter, c£40 (2022/23 prices) when replacing an end-of-life or failed basic meter and addressing increased AMR meter asset mortality failure rate. The increased failure rate has been derived by work undertaken for Welsh Water by Artesia Consulting identified that for AMR/AMI meters there is a higher rate of failure when first installed compared with basic meters.

The number of meters that are planned for customers metered first time and for enhancement related replacement are summarised in Table 10 below.

During AMP8 439,266 meters will be replaced. Our Metering Strategy includes an additional 313,115 meters in AMP8 that will be replaced through the enhancement programme. This will be in addition to the 126,151 meters due for replacement as base BAU reactive replacement. The base investment will replace basic meters with AMR meters and the additional cost of a SMART meter will be funded through the enhancement programme.

The installation of Automatic Meter Reading (AMR) SMART meters for customers, will provide a step change to finding leaks and high levels of demand across the demand side of our network. The consumption data from the AMR meters will support the Project Cartref programme by the identification of properties to target for inspection and repair visits.

Table 9 – Enhancement Meter Installation and Replacement Intervention Numbers

Meter Intervention	Household	Non-household
Meter Optants (AMR)	40,179	503
New meter installations (AMR)	319,883	5,494
Proactive meter replacements (Basic to AMR conversion)	237,720	46,208
Reactive Replacements above BAU: (additional AMR infant mortality)	28,168	1,019

Inspections to Reduce Third Party Impacts

An enhanced programme of Non household Water regulations inspections targeted to reduce the risk associated with low probability high consequence network contamination events is proposed because of third party safeguarding failures. This programme of work focuses on promoting good practice and a step change in the level of Water Regulations inspections with the aim of identifying where regulation infringements may impact on our level of service for water quality, discolouration, taste & odour and maintaining a reliable water supply.

The programme of work, costing OpEx £5.2m (2022/23 price base), can be summarised within four key areas of work which are summarised in the bullets below.

- **Plumbers:** Increasing the number of approved plumbers during AMP by implementing a Welsh Water Plumber Approval Scheme moving away from the Water Regs UK managed one. The main purpose of bringing the scheme in house would be to ensure closer management of members, but to allow members to be part of the Welsh Water brand which is trusted by our customers. The scheme will provide different approvals for example approved plumbers and approved groundworkers to undertake inspection and approval work on behalf of Welsh Water for examples Trench inspections, Completion of Water Regulation infringement rectifications and new connections inspections.
- **Inspections:** Increasing the number of inspections to move away from the very highest risk premises only to all high risk premises which will mean an additional 35,000 inspections during AMP8. This is based on an assessment of 247 high risk premises inspected in 2021/22 which accounted for 409 infringements with 174 of those being of the highest risk category. To Inspect all High-risk premises based on 1 officer doing 450/year over an AMP equates to an extra 15 officers to do an extra 35,000 inspections. This would also require an increase in the number of Customer Resolution officers (CRO's) for planning and scheduling which would require an increase of 2.
- **Point of Sale:** The technical team receive around 2,000 notifications which would have multiple installations of pipework and fittings that have the potential to not comply with Regulation 4. The team will focus on working with; merchants, wholesalers, retailers and manufactures in Welsh Water's operational area to have a greater awareness of their requirements, responsibilities, and obligations under consumer protection to ensure that all saleable items are compliant. This would also include collaboration with other enforcement bodies including trading standards to increase awareness of water regulations and their enforcement.
- **Education & Support:** for the key stakeholders from merchants and wholesalers to ground workers and contactors provide standard training in these areas; The Water Supply (Fittings) Regulations 1999, Application of the regulations, Consequence of non-compliance, Awareness of the Approved Plumber scheme, The benefits of using an Approved Plumber. In addition to this support in all areas of the scheme would be provided by the Welsh Water inspections team.

4. Conclusion

Welsh Water is resolutely committed to ensuring a secure and reliable supply of high-quality drinking water. Our approach is grounded in comprehensive knowledge, achieved through a thorough source-to-tap assessment of intervention options, considering all facets of the water journey from Catchment to Customer Tap.

Our customers expect us to set an example in tackling leakage and reductions in PCC to reduce demand. While achieving our targets in these areas needs cooperation and behavioural change from our customers. We acknowledge our duty to lead by enhancing our network and supporting customers to reduce their consumption.

While we emphasise improving short-term supply interruptions, we recognize the deeper-rooted risks of more severe disruptions. We are actively augmenting our understanding of these risks, encompassing potential causes and identifying areas of greatest vulnerability. This aspect holds particular significance for the Government, especially in the context of national critical infrastructure and emergency planning.

We are in the process of developing a comprehensive set of risk and resilience metrics as well as planning a programme of feasibility studies that will empower us to understand the risk associated with all critical assets and to consider potential causes and optimal solutions as we prepare for PR29.

By undertaking substantial work on major water mains, whether for repair, replacement, or establishing alternative supply routes to eliminate single-point vulnerabilities. The failure of these single point supply locations where failure usually result in scheduled interruptions exceeding three hours. Regrettably, such interruptions adversely affect our service to customers and impact our interruptions to supply performance commitment score. Our research has shown that customers are willing to accept interruptions exceeding three hours, provided they are well-informed and understand the reasons behind the interruption. But there is still a need to reduce the risk of long-term interruptions to supply and high risk single point of failure locations.

We face challenges posed by ageing assets, pipe materials vulnerable to the effects of climate change, the wide dispersion of our network, and the limited redundancy afforded by point-to-point supplies. At the end of AMP8 we will have significantly reduce the risk of interruptions to supply through improvements to connectivity, increasing network capacity and a greater understanding of the long term needs for our strategic asset base. We will continue to meet the demands of growth and climate change. We will also have a clearer understanding of the best, low-regret intervention options to further improve our resilience in the medium and long term.

In crafting our PR24 investment plan to align with our ambitions, Welsh Water has adhered to a Totex solutions hierarchy, effectively exploring options 'without additional investment' or 'improvements from base funding' and only considering 'enhancements' where there is no alternative viable solution option. Our decision-making relies on a comprehensive value framework that quantifies costs, risks, and benefits, encompassing societal and environmental considerations.

Looking forward, we continue to challenge cost estimates with stretch targets for AMP8 efficiencies, incorporating industry best practices and collaborating with academic institutions and the supply chain to drive innovation.

As a result, we are confident that our plans for delivering a secure and reliable water supply in AMP8 represent the most effective, efficient, and best-value mix of investments for our customers. These plans align with our Water Resources Management plan and meet the expectations of the Welsh Government, our regulators, and our broader stakeholders.

5. Price Control Deliverables

For cases where the delivery of benefits is not directly linked or costs cannot be fully covered by performance commitments and Outcome Delivery Incentives (ODIs), Welsh Water has clearly outlined Price Control Deliverables (PCDs). These specify the key outcomes or outputs expected from the enhancement expenditure, ensuring transparency for stakeholders and customers. If these outcomes are not delivered as intended, the PCDs will allow for the return of funding to our customers. The PCDs relevant to reliable and secure water supply are summarised below and fuller accounts are available in each of the enhancement document summarised in the bullets the PCDs below.

PCD1 Number of reservoirs: This PCD will focus on the number of impounding reservoirs where remedial enhancement works, as identified from legislative Section 10 inspections, have been undertaken. Given the range of expected costs within the forecasts programme, for each of the 29 sites the company will apply a specific estimate for each site to protect customers.

PCD2 Number of meters: Ofwat have set out a clear PCD with respect to customer metering which Welsh Water will follow largely based around the number and types of different meters being installed or replaced.

PCD3 Length of mains replaced by diameter: This PCD is focused on Welsh Waters Asbestos Cement mains programme of works. Mains replacement will reduce burst rates and customer supply interruptions. The measure will be based around kms of mains replaced by different diameter band.

PCD5 Improving long Term WTW Resilience: In line with DWI and NRW requirements and this PCD looks at single points of failure, final and contact tanks and sludge dewatering associated located at water treatment works. The PCD will measure two areas: 1) How many of the 15 tanks that are removed from risk across 11 water treatment works sites. 2) Whether the two sludge dewatering schemes are delivered.

PCD6 Improving Long Term Resilience within the Water Network: To improve resilience in the Cardiff area and across the Welsh Water area, this PCD will measure the length of main delivered and the relocation of a strategic raw water main.

Enhanced Investment Cases

- WSH62-RS01 - Increasing Resilience of Tap Water Supply - Asbestos Cement Mains
- WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management
- WSH59-RS03 - Increasing Safety of Impounding Reservoirs
- WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity
- WSH61-RS05 - Increasing Resilience of Tap Water Supply – Treatment Works