Dŵr Cymru
Welsh Water

WSH35-CS00 - Resilience and Security

Contents

1. Introduction

Resilience means our ability to continue to provide our services no matter what kinds of chronic stresses and acute shocks we experience. Ofwat defines operational resilience as "the ability of an organisation's infrastructure, and the skills which run that infrastructure, to avoid, cope with and recover from, disruption in its performance"[1].

Because of the nature of the services that we provide, almost every aspect of what we do is concerned with resilience in one way or another. We strive to prevent service failures whatever the cause, and plan for the future to ensure we have assets that can deliver stable or improving services over the long-term in the face of any adverse trends.

It follows from the above that most of our expenditure, including enhancement investment planned for AMP8, has a link to resilience. Ofwat acknowledges that funding is provided to manage resilience through both base and enhancement funding, including enhancement funding under the Water Resources Management Plans (WRMP), Security and Emergency Measures Direction (SEMD) requirements and Drainage and Wastewater Management Plans (DWMP). Ofwat has a particular definition for tagging enhancement expenditure as 'resilience enhancement' which is expenditure to manage increasing risks, or changing acceptance/acceptability of risk, from hazards that are beyond company control and not covered by other enhancement areas.

There are many different areas of activity relevant to resilience. Ahead of PR19 Ofwat published its Resilience in the Round document, which set out its expectations and thinking across Corporate, Operational and Financial Resilience. As part of our PR19 submission we responded to this framework with information on how we ensure resilience in each of these areas, as well as explaining our framework for the assessment of resilience, our 2050 Vision as a 'world-class, resilient and sustainable water company for the benefit of future generations, and our plans for AMP7.

In this document we:

- provide an update on our independent resilience assessment using the integrated resilience framework first used at PR19.
- provide an update on our approach to corporate resilience, including enterprise risk management, asset management and investment delivery including an update on our Resilience Action Plan.
- briefly cover financial resilience with reference to detail on AMP8 available elsewhere in this submission.
- describe our approach to operational resilience, including emergency planning, business continuity and an update on how we are improving the way that we measure resilience to low likelihood, high consequence events through a portfolio risk assessment.
- we then summarise our plans for AMP8 on resilience, including plans for resilience under:
    - base costs including catchment management, leakage reduction and enhanced emergency planning,
    - WRMP including our metering strategy and inter-zonal transfers,
    - DWMP, the National Environment Programme (NEP) in Wales and the Water Industry National Environment Programme (WINEP) in England including a significant investment in addressing storm overflows, and
    - resilience enhancement proposals including: SEMD, cyber defence, flood mitigation, impounding reservoir safety and improvements in water distribution capability.

We consider that all of the above, taken together, will demonstrate the adoption of best practice approaches to resilience, and our Integrated Resilience Framework, Strategic Asset Management Plan and the PR24 document WSH50-IP00 Our Approach to Investment Planning collectively show a line of sight between risks to resilience, planned mitigations, package of outcomes and corporate governance framework.

[1] Ofwat's PR24 Final Methodology, Appendix 9 (Setting Expenditure Allowances), Section 3.4.3

Resilience is a fundamental consideration in everything that we do. It is embedded into our systems, processes and governance in an integrated way that means practically everything that we do is in some way contributing to the maintenance and enhancement of resilience. This document offers an overview of the key components of resilience but to get the full detail it is necessary to look across to other documents within our Business Plan submission or on our website, references for which are included.

This document, CS00 – Resilience and Security, is part of our 'Hierarchy of Documents' described in Figure 1 below and sits alongside WSH50-IP00-Our Approach to Investment Planning in capturing the guiding principles that govern our approach to developing our Business Plan.

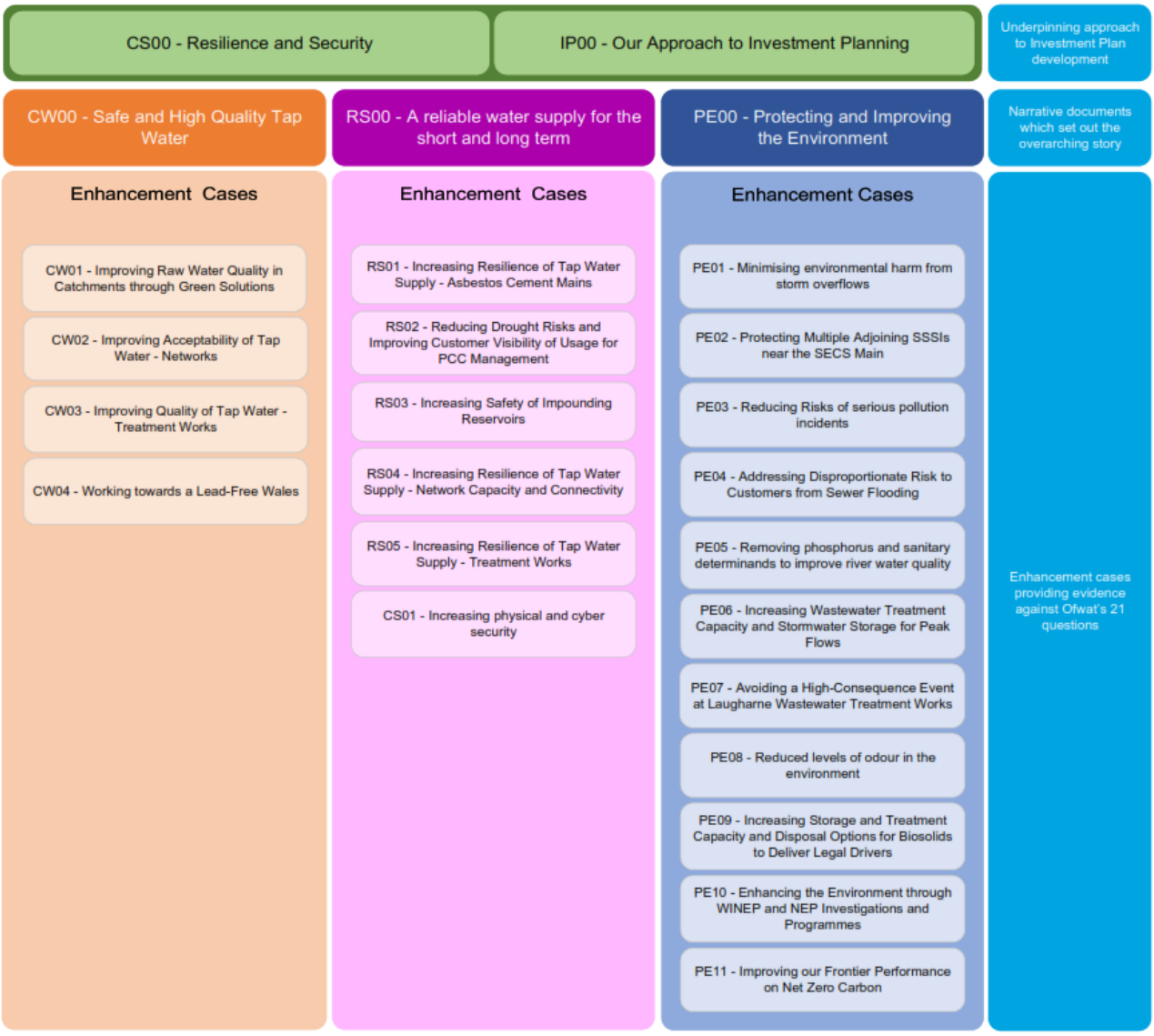

Figure 1: The hierarchy of documents in our Business Plan

2. Background

As a result of investments and operational improvements, we have a more flexible and 'smarter' water network than ever before. One that allows us to move water faster to where customers need it, and to detect bursts more quickly so we can respond faster. We have invested to protect our critical assets from failures and strengthened physical and cyber security. We are also making better use of data and analysis to understand the causes of sewer flooding and pollution incidents, and to target remedial investments. Our Water Resources Management Plan sets out our long-term plans to ensure our water resources are sufficient, and our Drainage and Wastewater Management Plans will continue to enhance the equivalent long-term planning on the wastewater side of the business.

We recognise there is more still to do, we need to improve our resilience to extreme climatic events, we need to explore how to make our systems more resilient to low likelihood, high consequence events at a cost that is affordable to customers.

We know our customers generally take the availability of clean, safe drinking water as a given. When there is a problem it can come as a shock. Customers expect us to do our best to help and to communicate clearly what is happening. Our research indicates that short outages are tolerable for most customers, but longer ones cause a major inconvenience, and they tell us that incidents of sewer flooding are the worst service failure that they can suffer.

In line with the views of customers, we are starting now on what customers tell us are the priorities on a 'no regrets' basis, while recognising that delivering the long-term plan will require game-changing innovations. Taken as a whole, our investment programme will deliver a significant improvement in resilience, increasing our ability to protect customers from the impact of extreme events, and to recover quickly when they occur, both now and in the future. Our Water Resources Management Plan will ensure that we have sufficient water for our customers over the long-term.

3. Integrated Resilience Framework

We were one of the first water companies in the UK to develop a Resilience Framework and to undertake a comprehensive, comparative assessment of its resilience. In early 2017, we commissioned Arup to work with us to create the Welsh Water Resilience Framework to identify areas of strength and areas for improvement. This was used to underpin our long-term strategy, Welsh Water 2050.

In 2022 we invited Arup to return to rescore our current level of resilience maturity following our work to address many of the actions identified in the previous assessment combined with the broader work to improve our asset management maturity. At the same time, we took the opportunity to adjust our Resilience Framework to better reflect Ofwat's 'Resilience in the Round' published after our original assessment, and to enhance our framework with how our thinking and the wider resilience landscape has evolved over the last few years.

The new assessment covers corporate, financial and operational resilience components and reflects Arup's view of our relative maturity in the sector, acknowledging that in some cases resilience standards have moved forward from the position at 2017.

Arup held a series of interviews and a review of key documents to assess our maturity against a range of resilience indicators scoring based on the five levels of maturity set out below.

Level 5: Sector leading
Level 4: Response in progress
Level 3: Response developed
Level 2: Aware a response should be developed
Level 1: Unaware of indicator

Across the three key areas, Arup assessed our current level of maturity and future maturity (based on existing plans and initiatives) as:

- Corporate resilience – Current average 3.7, end of AMP8 average 3.8
- Financial resilience – Current average 3.5, end of AMP8 average 3.8
- Operational resilience – Current average 3.4, end of AMP8 average 3.9

We are using the scores and recommended actions to enhance our action plans to ensure we are addressing any areas needed and remain amongst the sector leaders for resilience. Our Resilience Framework sits alongside our Strategic Asset Management Plan (SAMP) which plays a significant role in driving our asset management capabilities including many of the components of our Resilience Framework. As such any remaining, continuing or emerging actions from our Resilience Action Plan developed in 2019 have been merged into the SAMP.

The full document is available on request.

Figure 2: Our revised Integrated Resilience Framework

Arup highlighted key areas of progress since the last review in 2018 including:

- Ensure effective business continuity - Arup noted our appointment of a business continuity manager in 2022 and the creation of a more comprehensive business continuity plan.
- Develop our workforce for the future - It was acknowledged that we have developed a clear 5-year plan across a variety of key risk areas.
- Establish integrated and clear risk management processes - Arup commented on the improved company wide approach taken on risk management.
- Taking a value driven approach - Our development of a capitals-led approach with a Service Measure Framework being in place was noted.

Arup made a number of recommendations that would support us in enhancing resilience, many of which we had already identified and had actions in place to address. We will continue to incorporate these recommendations into our Strategic Asset Management Plan as we further develop our Asset Management capabilities, see document WSH50-IP00 Our Approach to Investment Planning.

3.1 Resilience Action Plan Review

In August 2019, we published 'Our action plan for developing our approach to resilience in the round' outlining improvements we would make to our processes in order to strengthen our approach to planning. Our Resilience Action Plan helped set us on the path to improving resilience planning that was then picked up through the actions arising from the Asset Management Maturity Assessment 2021 (AMMA), see document WSH50-IP00 Our Approach to Investment Planning, and ultimately into our SAMP. All of these documents and processes are about enabling us to make better decisions and this process continues. We will continue to enhance our capabilities to take a systems based approach, to better quantify risk and value and to drive for efficiency and innovation in how we tackle risks today and going forward. Our plan for developing our approach to resilience in the round will be captured and managed through our SAMP in future.

The table below shows the actions from our Resilience Action Plan, the progress made and, where appropriate, additional actions arising from what we have learned so far.

Table 1: Our Resilience Action Plan progress

#	RAP Action	Progress	Next steps
1	Complete first pass system interdependencies mapping	Complete - A first pass mapping of threats to systems has been completed in the Operational Resilience Assessment (see section 6.6). The threat external systems pose to our systems is captured through assessment of threats to power, telecoms and transport. The threat our systems pose to external systems is captured through the assessment of consequence of failure and customer impacts.	The Operational Resilience Assessment will continue to be developed, for example, we will build a digital twin of our upstream systems to better quantify risk.
2	Complete our initial strategic risk assessment and gap analysis of detailed risk processes	Largely complete - The Resilience Matrix is being developed with the impact of future trends. During 2023 we have produced a 'Climate Change Adaptation Report' and refined our oversight of climate adaptation risks, reflected in our reporting of Taskforce for Climate-related Financial Disclosures (TCFD) in our 'Annual Report and Accounts 2022-23' and our PR24 Plans. However our knowledge of how trends like climate change affect some risks needs to develop further which we will progress ahead of PR29. Development of the Resilience Matrix and the Long Term Delivery Strategy has enabled us to become more aware of the gaps in our knowledge which will be addressed in our revised SAMP for future improvement.	We need to develop better models for quantifying the impact of climate change on some strategic risks. We will engage with academics and industry groups to advance this.
3	Update the horizon scanning peer review of business risks	Complete – The Welsh Water 2050 review with Cardiff University is complete. A revised resilience framework with Arup is complete.	We intend to update Welsh Water 2050 again ahead of PR29.
4	Complete our data collection of prioritised risks	Complete - We identified flood and erosion risk as key gaps and have commissioned work to enhance our knowledge of the risk posed to our assets. We will keep the plan to review remaining gaps under constant review in the SAMP.	We will continue to explore information and modelling that can help improve risk knowledge.

#	RAP Action	Progress	Next steps
5	Identify methodology for assessing likelihood of failure across the plan	Complete - We have worked with Bath University to review our approach to assessing the likelihood of rare events and have incorporated their recommendations into our approach.	We will continue to refine our approach and drive best practice.
6	Review all our bottom up risk identification processes for alignment with the service measure framework	Complete - A major rewrite of our risk identification procedure IM_(03)_02 was completed in October 2021.	Our risk identification procedure and service measure framework will be kept under review and updated on a regular basis.
7	Undertake a review of our social valuations to identify additional sources	Complete - Our multi-capitals framework has been developed including social valuations and incorporated into AMP8 planning, it is being rolled out now for incorporation into business-as-usual risk prioritisation processes.	We will embed our multi-capitals framework into our decision-making and keep valuations under review.
8	Implement natural capital approach	Complete - Our multi-capitals framework has been developed including natural capital valuations and incorporated into AMP8 planning, it is being rolled out now for incorporation into business-as-usual risk prioritisation processes.	
9	Create solution identification framework that ensures consideration of different types of response	Complete – Our solution identification framework has been created and applied during long listing of solution options for PR24. It is documented in our feasibility reports for each project.	We will continue to develop the information used to identify preferred solutions and ensure cost and value are fairly assessed to identify best overall solutions.
10	Roll out of solution identification framework	Complete - Solution Identification framework has been created and applied during long listing of solution options for PR24. It is documented in our feasibility reports.	
11	Review resilience framework assessment and create detailed action plan to make ongoing improvements	Complete - We have reviewed and updated the resilience framework and, where appropriate, actions from this review will be incorporated into our SAMP and reported as part of our corporate governance review.	We will deliver the actions in the SAMP and review the resilience framework ahead of PR29 and update as appropriate.
12	Implement risk and solution prioritisation methodology	Complete - The revised service measures framework (SMF) and new multi-capitals approach were used to optimise the AMP8 plan. The Exec and Board used this information combined with the wider regulatory and political context and customer and stakeholder feedback to make adjustments to the plan where appropriate.	There is more to do on risk appetite to low probability high consequence events. The new Cardiff model build currently in progress will be a pilot for this.

#	RAP Action	Progress	Next steps
13	Engage with industry on development of asset health and resilience measures	Complete - We have engaged with numerous industry groups and activities looking at development of asset health metrics including the AMMA assessment, the UK Water Industry Research (UKWIR) project and Ofwat's Operational Resilience Working Group. We have also created an industry group to share knowledge on Asset Management approaches including Asset Health.	Welsh Water remains committed to working with the wider sector on Asset Health.
14	Collect data and test / benchmark new asset health measures	Complete - Despite the industry groups established, to date no consensus on new asset health metrics have emerged. We have developed our own measure of asset health and incorporated this into our key performance indicators (KPIs) and as part of our corporate risk framework.	We are exploring options for developing a common framework for asset health reporting in the water sector.
15	Establish a revised set of resilience measures for use in the PR24 plan	Superseded - In line with Ofwat's PR24 methodology requiring a reduced number of bespoke performance commitments (PCs), we are not proposing to retain the resilience performance commitments from AMP7 but to link resilience enhancement spend to outputs through a price control deliverable (PCD).	We will explore how the Operational Resilience Assessment could be used to create resilience KPIs or PCs in future.
16	Establish the reporting that shows line of sight from resilience risks to plans to outcomes	Complete - Through development of the SMF, the multi-capitals, the solution identification framework and the prioritisation process we can show the priority of risks in our plan, the options considered for mitigating the risk and options selected. The multi capitals framework enables us to show and quantify wider benefits.	The various frameworks will continue to evolve and we are developing tools to more easily share reporting on plan progress.
17	Publication of our next long term plan	Complete – The Welsh Water 2050 review with Cardiff University is complete.	We intend to update Welsh Water 2050 again ahead of PR29.

4. Corporate Resilience

Resilience is the quality that enables us to achieve our ambitions in the face of sudden shocks and longer term stresses. It is critical therefore that governance, accountability and assurance processes put resilience at the core of our corporate systems. Delivering corporate resilience supports our delivery of financial and operational resilience through robust risk management and making good, well evidenced decisions to help avoid, cope with and recover from, disruption of all types; and to anticipate trends and variability in our business operations.

In this section we will describe our systematic approach to risk management, how it is governed, our risk management framework and what this tells us about our principal risks.

We will then set out how we prioritise the mitigation of those risks through our Asset Management capability and associated decision-making processes, balancing the need to deliver stretching performance targets and at an efficient, sustainable cost to customers and the environment. In 2019, we set out our Resilience Action Plan, to build on our approach to delivering 'Resilience in the Round'. We describe in this section how we have delivered against that plan and continue to go further to develop a truly systemised approach to resilience.

4.1 Governance of Risk

Welsh Water manages enterprise-level risks based on the principles outlined in the international risk management guidelines (ISO31000:2018). The procedures required to implement and operate these principles are set out in the risk management policy[2] and framework[3] approved by the Board.

4.1.1 Role of the Board

The Board has oversight of the system of governance in operation throughout the Group. This includes a robust system of internal controls and a sound Risk Management Framework which includes risk identification, assessment, mitigation and monitoring throughout Welsh Water at an asset, project, function and strategic level. It is also responsible for ensuring that Group policies which address specific risk areas are aligned to the Group's risk appetite and clearly inform the business as to how it should conduct its activities to remain within risk appetite.

The Board has specific roles:

- Define and agree a clear, documented risk appetite.
- At each Board meeting, review the Executive team's overview of strategic and any emerging risks affecting the business.
- Regularly review the company's key risks and ensure that they are mitigated and managed in line with risk appetite.
- Review and place reliance on the work of the Audit Committee in their review of the effectiveness of the Enterprise Risk Management (ERM) framework and associated processes.
- Carry out in-depth review of strategic risks twice a year (May and November Board meetings).

The Board plays a key role in strengthening resilience and Board members are able to bring their experience and expertise from a variety of backgrounds and industries to the Company to improve resilience in the round.

The Nomination Committee of the Board is responsible for appointments to the Board ensuring its composition is regularly reviewed and refreshed and that there are established plans for orderly succession to positions on the Board, having regard to the Company diversity objectives.

[2] Enterprise Risk Management Policy – June 2022
[3] Enterprise Risk Management Framework – June 2022

4.1.2 Role of the Audit Committee

The Audit Committee acts on behalf of the Board with the following roles:

- Review the effectiveness of the risk management processes and procedures and report to the Board on the reliability of these processes and frameworks.
- Oversee risk management processes at the highest level, ensuring that all areas of risk are being overseen, mitigated, and reported on appropriately within the company.
- Receive assurance as to the effectiveness and reliability of management's oversight of the individual areas of the business/other committees that are performing risk oversight, and provide a recommendation to Board that it is satisfied with the governance and oversight being provided.
- Receive assurance reports from the Internal Audit function that the risk management framework is effective and reliable including reports from both first and second line of defence (see below).

4.2 Risk Management Principles

The purpose of risk management is the creation and protection of value. It improves performance, encourages innovation and supports the achievement of objectives. We use eight principles to provide guidance on the characteristics of effective and efficient risk management, communicating its value and explaining its intention and purpose. The principles are our foundation for managing risk.

Effective risk management is delivered through the following elements:

- Integrated: risk management is an integral part of all of our significant activities.
- Structured and comprehensive: our framework uses standard terminology and methodologies such as financial assessment of risk impacts to contribute to consistent and comparable results.
- Customised: the risk management framework and process are appropriate to the risks faced by Welsh Water given its size, complexity and status.
- Inclusive: appropriate and timely involvement of stakeholders through communication and regular engagement enables their knowledge and expertise to be considered. This results in improved risk awareness and informed risk management.
- Dynamic: risks can emerge, change or disappear as our external and internal context changes. Risk management anticipates, detects, acknowledges, and responds to those changes and events in an appropriate and timely manner through top down and a fully embedded risk management process.
- Best available information: the inputs to risk management are based on historical and current information, as well as on future expectations. Information is timely, clear and available to relevant stakeholders.
- Human and cultural factors: human behaviour and culture significantly influence all aspects of risk management at each level and stage. The risk management culture is integrated with our values.
- Continual improvement: risk management is continually improved through learning and experience.

4.3 Enterprise Risk Management

Our Enterprise Risk Management (ERM) Framework provides the structure for the business to anticipate and report threats to meeting these customer commitments and to respond effectively when risks materialise. This framework includes:

- A Group-wide risk management process.
- A well-established governance structure providing Board oversight of risks, supported by oversight of the risk management process by the Audit Committee and a 'Three Lines of Defence' model that establishes ownership of risk management processes.
- A Board-led approach to risk appetite, based on our customer commitments and strategy

Welsh Water operates the ‘three lines of defence’ model. Under this model:

- First line – Operational management has ownership, responsibility, and accountability for directly assessing, managing, and mitigating risks.
- Second line - Specialist control functions and internal governance bodies provide the frameworks for, and monitor and support, effective risk management by the first line and ensure the flow of information on risk up and down the organisation, including risk escalation protocols.
- Third line - Independent assurance over the adequacy of design, effectiveness of operation and sustainability of the systems of internal control.

The Board and Audit Committee sit outside the ‘three lines of defence’ process and scrutinise reports and assurance generated by it.

The ERM process describes how risks will be identified, evaluated, mitigated, monitored and governed across Welsh Water. This is illustrated in Figure 3 and each element of the process is described in turn below.

Figure 3: Our Enterprise Risk Management Process

4.3.1 Risk Identification

The purpose of risk identification is to identify our exposure to uncertainty. This requires an intimate knowledge of the organisation, the market in which we operate, the legal, social, political and cultural environment in which we exist, as well as the development of a sound understanding of our strategic and operational objectives, including factors critical to its success and the threats and opportunities related to the achievement of these objectives. We use a range of techniques for identifying uncertainties that may affect one or more objectives. The following factors, and the relationship between these factors, are considered:

- changes in the external and internal environment within which we operate.
- events and materialised risks.
- vulnerabilities and capabilities.
- early warning indicators and emerging/changing risks.
- the ‘stretch’ required to achieve the plan.
- limitations of knowledge and reliability of information.
- biases, assumptions and beliefs of those involved.

It is also important to consider and assess major risks raised by third parties. These might include reports relating to risk from Ofwat, internal audits, external audits, identification of major areas of risks by insurers, or consultants' reports. Our Executive Team and the Board get regular opportunities to discuss our existing and emerging risks. Risk sessions are held with the Executive Team every month to track progress with mitigating actions, they hold quarterly sessions to identify and value new and emerging risks often escalated from business unit level risk reviews. The Board hold an annual horizon scanning exercise to look across the sector and wider society at what trends may be appearing that could affect our future risk profile.

4.3.2 Risk Evaluation

The risk evaluation process provides insight on whether risks need to be treated and how, and on the most appropriate risk treatment strategy and methods. Risk evaluation should consider:

- the likelihood and severity of events.
- the complexity and connectivity of events.
- the effectiveness of existing controls.
- early warning (EWIs) and key risk indicators (KRIs), particularly for significant volatile risks.
- all risks will be assessed on an 'inherent' and a 'residual' basis. This allows us to understand the effect of the controls in operation and the effect of control failure.
- Business units should highlight where residual risk assessments include incomplete projects.
- 'target' risks will be set for the strategic risks to allow us to ensure that individual strategic risks are within or have timed actions to progress to risk appetite.

Risks are evaluated using performance commitments and the valuations contained in the 'service measures framework' (SMF).

4.3.3 Decision-Making and Mitigation

The purpose of risk evaluation is to support decisions. Risk evaluation involves comparing the results of the risk analysis with the established risk criteria to determine where additional action is required. This can lead to a decision to:

- do nothing further.
- consider risk treatment options (such as avoidance, mitigation, insurance).
- undertake further analysis to better understand the risk.
- maintain existing controls.
- reconsider objectives.

The purpose of risk treatment is to select and implement options for addressing risk. Risk treatment involves an iterative process of:

- formulating and selecting risk treatment options.
- planning and implementing risk treatment.
- assessing the effectiveness of that treatment.
- deciding whether the remaining risk is acceptable.
- if not acceptable, taking further treatment.

Selecting the most appropriate risk treatment option(s) involves balancing the potential benefits to the achievement of the objectives against costs, effort or disadvantages of implementation. Options for treating risks involve:

- Accept – retaining the risk by informed decision.
- Stop – avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk.
- Mitigate - changing the risk impact and/or likelihood with controls or investment.
- Insure – offset the financial impact of a risk (normally reserved for high impact and relatively unlikely risks.

Justification for risk treatment is broader than solely economic considerations and considers all our obligations, voluntary commitments, and stakeholder views. Risk treatments even if carefully designed and implemented might not produce the expected outcomes and could produce unintended consequences. Monitoring and review are an integral part of risk treatment implementation to give assurance that the different forms of treatment become and remain effective.

4.3.4 Risk Reporting

Reporting is an integral part of our governance and enhances the quality of dialogue with stakeholders and supports top management and oversight bodies in meeting their responsibilities. Reporting outputs allow us:

- to communicate risk management activities and outcomes across Welsh Water (formal reporting to committees).
- to provide information for decision-making; (Board and Executive team decision papers)
- to improve risk management activities - consistency, risk ranking.
- to assist interaction with stakeholders, including those with responsibility and accountability for risk management activities.

4.4 Principal Risks

The Board tracks 17 strategic risks, those that they consider to be the most significant to our short- and long-term resilience. These are combined into the 9 'principal risks' described in Figure 4 to make our risk picture more accessible to stakeholders and customers. Our 'principal risks' are those that are carefully assessed on an ongoing basis for their likelihood and the potential severity of damage caused to customer, reputational and financial impacts. We also give consideration to the mitigating actions and controls we apply.

The profile of residual risk on these principal risks, that is, the level of risk having accounted for mitigating actions, has broadly increased through AMP7. This reflects increasing stakeholder focus on environmental performance, alongside continued elevated risk from key areas such as cyber, climate impacts on resilience and the effects of the economic downturn.

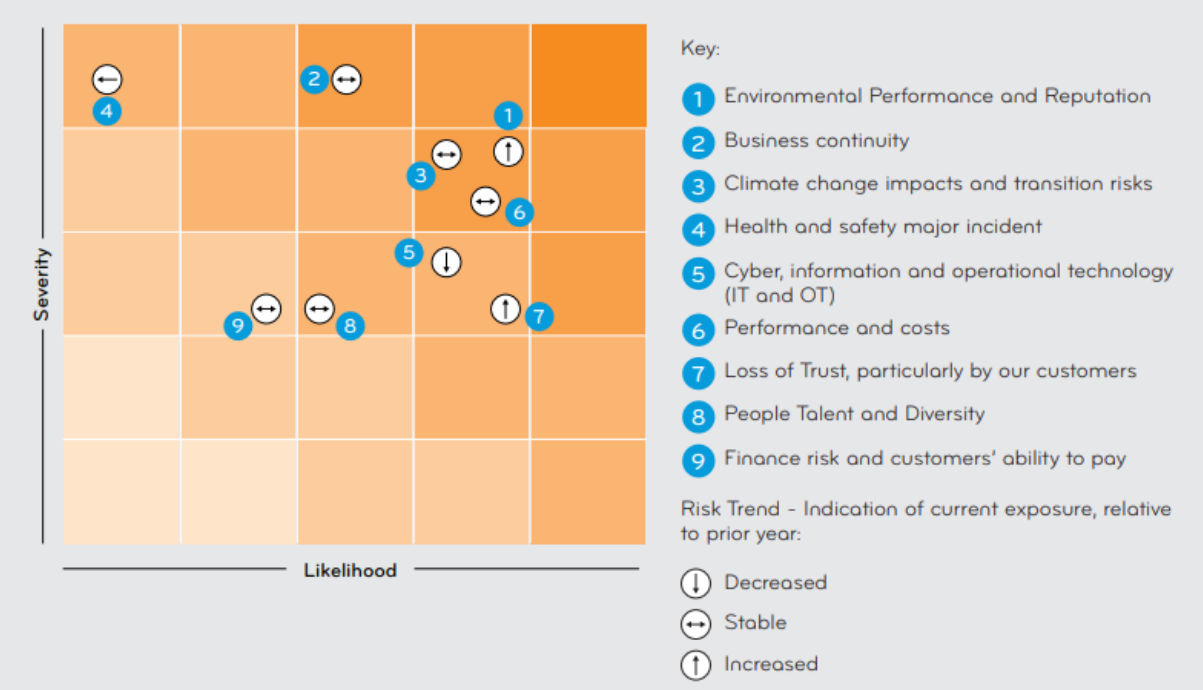

Figure 4: Our Principal Risks in 2023

Our ongoing and planned actions to mitigate these risks and enhance our resilience forms the basis of our Business Plan and is described across the portfolio of documents as set out in Table 2 below.

Table 2: Our principal risk impacts and where to find our mitigation plans

Principal Risk	Potential impact	Mitigation
Environmental Performance and Reputation	The risk of failing to manage our impacts on the environment and meet standards; and to respond to stakeholders' concerns regarding environmental issues and climate change, leading to loss of trust from stakeholders and inadequate planning for the future.	Environmental performance is a consistent theme across our Business Plan. Some key programmes that support managing our impact on the environment are covered in the following documents: WSH53-CW01 - Improving Raw Water Quality in Catchments through Green Solutions WSH70-PE01 - Minimising Environmental Harm from Storm Overflows WSH74-PE03 - Reducing Risks of Serious Pollution Incidents WSH68-PE05 - Removing Phosphorus and Sanitary Determinands to Improve River Water Quality WSH69-PE06 - Increasing Wastewater Treatment Capacity and Stormwater Storage for Peak Flows WSH71-PE10 - Enhancing the Environment through WINEP and NEP Investigations and Programmes
Business continuity	The failure of strategic assets, workforce, corporate systems, supply chain provision or external events leading to the inability to deliver essential service provision of clean and safe drinking water, environmental protection or cash collection.	Our approach to business continuity planning is described in Section 4.9.
Climate change impacts and transition risks	The risk of failing to mitigate/adapt to accelerated climate change, leading to our infrastructure being overwhelmed by weather events in a part of our operating area; or significantly damaging multiple assets, impacting significantly on the environment, service provision, customers and our reputation.	Our updated Climate Change Adaptation Report[4] is introduced in Section 6.9. This document presents our key climate risks and our plans to mitigate them.

[4] https://corporate.dwrcymru.com/en/about-us/our-plans

Principal Risk	Potential impact	Mitigation
Health and safety major incident	There is a risk of an employee, contractor, visitor or member of the public suffering a serious injury, ill health or fatality arising out of, or in connection with, our work activities. This raises the risk of prosecution, potential for fines and criminal prosecutions against individual directors, and loss of reputation. This could occur as a result of failure to establish and/or implement safe assets, safe working practices or suitable contractor management arrangements in accordance with legal requirements and best practice.	A description of our approach to health and safety can be found in Section 6.8.2.
Cyber, information and operational technology (IT and OT)	A major loss or disruption to an Information Technology (IT) or Operational Technology (OT) systems, or significant breach of sensitive information, such as from a cyberattack, could lead to significant disruption to operational and customer services, significant reputational loss and potential regulatory censure and fines.	A description of our approach to cyber security can be found in Section 6.3 and WSH57-CS01 - Increasing Physical and Cyber Security.
Performance and costs	Performance below agreed efficiency targets risks restricting delivery of customer outcomes and eroding customer trust and regulator confidence in the Company.	Our plan to deliver our performance targets in AMP8 and beyond is introduced in Section 6.8 and described in detail in WSH01 Long Term Delivery Strategy.
Loss of Trust, particularly by our customers	Failing to earn the trust and confidence of our customers risks a loss in customer confidence in our services. As a monopoly supplier of essential public services, we are subject to a high level of scrutiny by, and direction from, government and regulators.	We continue to focus on strengthening customer involvement and engagement in our activities and maintain good stakeholder relations. We regularly meet representatives of key stakeholder groups and seek to optimise the effectiveness of our communications activities.
People Talent and Diversity	The risk that we will fail to attract or retain talent to support all areas of our business; and/or we fail to improve the diversity of our workforce in order to better represent the communities that we serve.	Our approach to securing the skilled workforce we need is described in Section 6.8.1.

Principal Risk	Potential impact	Mitigation
Finance risk and customers' ability to pay	The risk that the wider economic situation means customers struggle to pay their water bills and/or our ability to obtain finance from third parties is impacted. They could be reflected in increased bad debt costs, loss of confidence from investors and ultimately increased borrowing costs. Key factors include rising commodity costs above revenue and investor appetite to invest in Welsh Water.	Our approach to financial resilience is introduced in Section 5 with more detail in Stepping up to the Challenge: Business Plan 2025-30 and in our Annual Report and Accounts 2022-2023.

We are also aware of emerging risks; these are discussed in depth by the Board twice each year. Our primary emerging risks at this time are considered to be:

- Public health (micropollutants in drinking water and plastics in wastewater) - The risk of public concern around micropollutants – chemicals and microplastics – in drinking water and treated wastewater leading to possible onward impacts on treatment processes that may affect our carbon targets.
- Legislative divergence - This is a risk of increased costs from complying with water and environment obligations that may diverge in England and Wales.

More details on our approach to mitigating our principal and emerging risks can be found in our 'Annual Report and Accounts 2022-2023'[5].

4.5 Horizon Scanning

We have a long-term strategy Welsh Water 2050[6] that is updated every 5 years, the latest revision was published in March 2022. We consulted with a wide range of experts from outside the business, but also relied heavily on the insights and expertise of those in the business with responsibility for delivering on our long-term goals. It sets out the key trends that we face over the very long-term:

1. Changing climate patterns.
2. Decarbonisation and sustainable business practices.
3. Price caps, affordability and potential trade-offs.
4. Public health.
5. Regulatory changes.
6. Major economic fluctuations.
7. Drainage and pressure to tackle Sewer Overflows (SOs).
8. Emerging and persistent contaminants.
9. Increasing customer and stakeholder expectations.
10. Cyberattacks.
11. Resourcing disruptions.
12. Water transfers.
13. Legacy infrastructure.
14. Environmental responsibility.
15. Demographic and behaviour changes.
16. Unsustainable land use.

This review was undertaken before the current situation in Ukraine which has created an additional shock affecting supply chain security and costs.

[5] https://corporate.dwrcymru.com/en/library/group-annual-report-and-accounts
[6] https://corporate.dwrcymru.com/en/about-us/our-plans

The overall high and seemingly increasing level of uncertainty has led us to draw the following conclusions that are taken forward into our strategic thinking:

- The importance of protecting our services against the 'big risks' and being agile in responding to 'big opportunities'.
- Protecting our service against the impacts of climate change is a top priority.
- We need to work collaboratively to make the most of the opportunity for regulatory innovation.

We must be prepared to overcome and adapt to the stresses, shocks and challenges ahead, so that we can meet the needs of customers and the environment both today and long into the future, recognising the uncertainty through adaptive planning, and updating our view regularly. Our adaptive planning approach is described in detail in WSH01 Long Term Delivery Strategy.

4.6 Asset Management and our Decision-Making Processes

Our Asset Management capability is central to maintaining and enhancing resilience 'in the round' as it ensures we are prioritising addressing the right risks at the right time, delivering operational resilience, and addressing them as efficiently as possible, contributing to maintenance of our financial resilience.

Our approach to Asset Management and how we make investment decisions using multi-capital valuations is covered in detail in WSH50-IP00 Our Approach to Investment Planning.

4.7 Sustainability

Sustainability is part of the fabric of everything we do, and without being a sustainable business we cannot claim to be resilient. Our approach to enhancing sustainability is described in detail in our Annual Report and Accounts 2022-2023[7]. Sustainability is governed by our Environment, Social and Governance (ESG) Committee. Our ESG strategy[8], including our ESG objectives, was reviewed and approved by the ESG Committee in February 2022. A key component is our roadmap to deliver full Net Zero Carbon by 2040[9].

4.8 Innovation

With the support of our customers, regulators, and governments alike for improved performance and resilience and reducing our carbon and environmental footprint at an affordable cost, we continue to look for better ways of working or advances in technology. Our approach to innovation is described in more detail with case studies in our Annual Report and Accounts 2022-2023.

Over the past 12 months, we've made good progress delivering the agenda set out in our Innovation Strategy[10] which we refreshed and published in 2022 with links to over 100 academic and other institutions, technology specialists, and global innovation concerns. We have developed Innovation Journey Plans to map our journey to improving efficiency, reducing our impact on the environment and providing a better service to our customers across our key challenges.[11]

We are also very active in the support of Spring Innovation Ltd, the centre of excellence for innovation in the water sector. We hope to see the new Company flourish and enable us to more efficiently undertake trials of treatment processes etc, as well as share knowledge more effectively across the whole sector.

[7] https://corporate.dwrcymru.com/en/library/group-annual-report-and-accounts
[8] https://corporate.dwrcymru.com/en/library/environmental-downloads
[9] https://corporate.dwrcymru.com/en/journey-to-zero
[10] https://corporate.dwrcymru.com/en/innovation
[11] Innovation Journey Plans - https://corporate.dwrcymru.com/-/media/Project/Files/Page-Documents/Corporate/Innovation/Our-Challenges/Innovation-Journey-Plans-2022.ashx

4.9 Business Continuity

We are committed to maintaining our essential services during any business disruption. We achieve this by:

- Working toward gaining accreditation to the recognised Business Continuity standard (BCS ISO 22301);
- Adopting best practice and methodology from the Business Continuity Institute (BCI) to implement Business Continuity into the organisation;
- Delivering a Business Continuity Management Programme, owned by the dedicated Business Continuity Manager;
- Regularly reviewing the Business Continuity Management Programme to ensure the business is adequately prepared to guard against disruptive business defining events;
- Implementing a Business Continuity Steering Group, who meet at regular intervals, ensuring the effectiveness of the overall Business Continuity programme;
- Ensure all Business Continuity risks are logged via the Business Risk Register;
- Producing and reviewing Business Impact Analysis and Business Continuity Plans based on emerging risks and horizon scanning;
- Implementing governance arrangements for Business Continuity by carrying out reviews and audits of the Business Continuity Management Programme, Policy, Plans, and Procedures to ensure continuing suitability and compliance in accordance with adopted standards (BSC ISO 22301);

To ensure the effective implementation of the Business Continuity Management Policy, we are audited and certified annually to ensure obligations under The Security & Emergency Measures (Water & Sewerage Undertakers) Direction 2022 are fulfilled.

5. Financial Resilience

We are a long-term business: as a water and sewerage provider, our commitment to our customers is to provide continuous high quality and reliable services at the lowest possible cost, and our ongoing financial resilience is key to our ability to deliver on this commitment. The Group has a long-term commitment to the provision of resilient services for the communities it serves and plans on the basis of stewardship in perpetuity.

5.1 Long Term Viability Statement

Our Annual Report and Accounts 2022-2023[12] includes our latest Long Term Viability Statement. The Directors have undertaken a robust assessment of the long-term financial viability of the Glas Cymru Group, taking account of the current position, the potential impact of the principal risks facing the business in severe but plausible scenarios, and the effectiveness of any mitigating actions.

This assessment considers the Group's prospects to ensure that, despite being exposed to inflation and rising interest rates, the business is able to withstand material cost shocks and pressures under various severe but plausible scenarios and to continue its operations, access financing arrangements and deliver critical customer services. Based on this viability assessment, the Directors have a reasonable expectation that the Group will be able to continue in operation and meet its liabilities as they fall due over the 7-year period to March 2030.

We have successfully retained our credit ratings at A3, A- and A from credit-rating agencies Moody's, S&P and Fitch respectively. These continue to be among the best in the UK utility sector. Gearing remains low and one of the market leaders at 58%.

The financeability of our plan is a key consideration, this is enhanced by retaining strong financial resilience. Stepping up to the Challenge: Business Plan 2025-30 covers the financeability of our AMP8 plan.

5.2 Delivering an Efficient Plan

Pushing for greater efficiency of costs is key to our resilience as it helps us to keep plans affordable for customers, contributes to maintaining financeability of our plan and enables us to deliver more scope improving our service and reducing resilience risk. Our approach to ensuring our costs are efficient is outlined in WSH50-IP00 Our Approach to Investment Planning.

[12] https://corporate.dwrcymru.com/en/library/group-annual-report-and-accounts

6. Operational Resilience

Resilience is at the core of our operations and has always been central to our planning. We have demonstrated that we have a robust and flexible service that enables us to avoid, cope with and quickly recover from disruption. The resilience experienced by customers day to day is delivered by a combination of our infrastructure and the skills and commitment of our people. It is a systemised approach, all of the components have to work together to deliver the resilience customers expect. Our systems don't work in isolation, there are interdependencies with other systems such as other utilities, transport infrastructure and with natural ecosystems that are crucial to our performance and long-term sustainability. We are always improving our knowledge and understanding of these interdependencies and looking to mitigate the risks to ensure that whatever shocks occur we are as prepared for them as possible.

In this section we describe the key components of operational resilience:

- Emergency Planning - No matter how robust our infrastructure, there is always the need to be ready to respond to extreme events and restore service as quickly as possible where disruption occurs.
- Business Continuity – Our people, data and IT systems are key components in the overall system that delivers our 24-hour service. How we ensure those components are always available is key to our overall resilience.
- Learning from events – In the last few years we have had to cope with a number of significant events that meant we had to be prepared for changes to operational practices and costs including the COVID-19 global pandemic and the effects of Brexit. We have also had to cope with some extreme weather conditions from flood to drought to freeze-thaw. We always seek to learn from these events to make us better prepared for future shocks.
- Asset health – We are heavily reliant on our extensive asset base to deliver a resilient service. How we manage these assets and their health is critical to our long-term resilience.
- Portfolio Risk Assessment – Whilst a lot of focus goes on maintaining service levels day to day, we are also very aware of the need to plan for those rare events that can have a big consequence for customers or the environment. We are developing our portfolio risk assessment approach to understand the risk of individual components, the key inputs and outputs and of the systems that deliver our operational resilience.
- Climate Change Adaptation – We are highly interdependent on the health and viability of the environment in which we operate. Weather has a big influence on our resilience and climate change represents a significant long-term threat to that resilience. How we adapt to an uncertain future is a key function of our planning.
- Long Term Delivery Strategy – Our Business Plan for AMP8 represents the first 5 years of our long term strategy to deliver improved performance and enhanced resilience at an affordable cost. Our strategy has to be adaptive to cope with a high degree of uncertainty. Continuing to deliver improvement through that uncertainty is key to our long-term operational resilience.

6.1 Emergency Planning

Our capability to respond to and recover quickly from any shock or extreme event is a key component of our resilience approach. We deliver an emergency planning, security and business continuity service so that any emergency, security or crisis situation is managed effectively and efficiently. This includes:

- A comprehensive Incident Response Manual (IRM)[13] which is regularly improved and updated and is the basis for action in managing major incidents. A range of Emergency Plans are also available to guide our response to particular situations.
- Incident management training specific to key roles within the IRM.
- A programme of investing in the security of our sites in line with Security and Emergency Measures Direction (SEMD), advice from Welsh Government and relevant stakeholders.

[13] Incident Response Manual – March 2023

- We run a major incident simulation every year, the exercise is risk based and seeks to ensure capabilities and readiness throughout the business to respond to incidents.
- Total loss contingency plans for all of our key operational depots and water treatment sites.
- Maintaining an emergency stockpile of equipment in order to respond to a range of incidents (such as loss of power).
- A full Business Continuity Management System integrated within the business to manage continuity of key business requirements during incidents.
- Conducting Post Incident Reviews (PIRs) to identify lessons learnt and to ensure continuous improvement.

Under the Civil Contingencies Act, we also collaborate with Category 1 responders such as the local authorities, blue light services and public health bodies through Local Resilience Forums (LRFs) to ensure we are effectively planning for cross sector/national emergencies.

In AMP8, our Emergency Planning function will replace ageing equipment and improve storage facilities to ensure equipment stays in better condition for longer and is more 'deployment ready' for responding in emergency situations. More detail on this can be found in WSH57-CS01 - Increasing Physical and Cyber Security.

6.2 Physical Security and SEMD

Our operational assets fall into two categories: National Infrastructure (NI) or, in some cases, Critical National Infrastructure (CNI). All water CNI sites must adhere to the Protective Security Guidance (PSG) and SEMD (Security and Emergency Measures Direction) regulatory standards. Comprehensive guidelines cover the ongoing security management of these assets in line with SEMD requirements. Compliance standards include the PSG set by Welsh Government and Defra and Water UK Security Standards (WUKSS).

A review was conducted, directed by the Welsh Government, to assess CNI assets using expanded criteria, resulting in the identification of 17 new CNI sites that require security upgrades during AMP8. The proposed investment aims to bring all non-compliant security assets up to the mandated SEMD and PSG standards.

To comply with SEMD, Welsh Water must maintain an emergency stockpile of equipment and resources in readiness to promptly provide support during incidents. The current SEMD stockpile, which is up to 15 years old, is facing challenges. Replacement parts, identified either during annual servicing or breakdowns, are becoming increasingly hard to source, which has led to delays in restoring equipment. Similarly, certain components of our security assets, like hatch alarms and closed-circuit television (CCTV) components, are reaching the end of their operational life. This has resulted in more frequent callouts and false alarms. In contrast, the equipment we've been procuring throughout AMP7 is more robust. It incorporates readily available components and benefits from technological advancements that enhance operational efficiency. The new replacement technology is not only more efficient but also allows for remote access to diagnose issues and address alarm activations (after verification).

Asset replacement schemes we intend to carry out in AMP8 are part of our normal operation, funded from base, as they involve replacing existing assets or technology. This expenditure ensures our ongoing adherence to SEMD compliance. Specifically, the areas of focus are:

- CCTV and PIDS (Perimeter Intrusion Detection Systems).
- Hatch Alarms.
- Replacing the existing SEMD stockpile.

In most instances, these expenditures are allocated to existing framework providers. This approach ensures compatibility with our current systems, provides a clear understanding of the support levels we can expect (given their familiarity with the assets), and guarantees the reliability of our systems.

We will also add new SEMD stockpile equipment based on insights from Post Incident Reviews, emerging risks, and resilience improvements (again from base expenditure). Enhancement expenditure on physical security will be used to upgrade operational sites both newly identified as meeting Critical National

Infrastructure (CNI) requirements after completing criticality assessments as directed by the Welsh Government and NI sites which have not been previously upgraded.

For a detailed perspective on our plans to enhance physical security, see Section 2 of the enhancement case, WSH57-CS01 - Increasing Physical and Cyber Security.

6.3 Cyber Security

Cyber security's core function is to protect our information, systems and devices we all use from unauthorised access, theft or damage, to allow our company and services to operate and to help earn the trust of our customers. We are legally obliged to conform to the Network & Information Systems regulations.

Welsh Water follows the Center for Internet Security Controls (CIS 18) framework as the minimum standard for IT systems and activities, which is recommended by international organizations like the European Telecommunications Standards Institute (ETSI). The company's strategic objective is to improve the overall Cyber Maturity score against the CIS Maturity Matrix, a recognized industry standard. Welsh Water has established Key Risk Indicators to identify areas requiring enhanced investment and guide the Cyber Programme.

As a water company, we hold customer and colleague data on our systems - as well as sensitive business data about how we operate – so we're a target for cyber criminals who want to sell data for money, or hold it to ransom by threatening to publish it online unless we pay. We're also classed as critical national infrastructure (CNI). Some cyber attackers, such as state-sponsored attackers, go after CNI for espionage and to bring mass disruption to a country.

The Cyber Security Team is part of the Group business function at Welsh Water. We have four teams of experienced and qualified cyber security specialists with a wide range of roles and responsibilities - from monitoring and responding to security threats, to consulting with colleagues on how to deliver projects and initiatives securely. They work to protect Welsh Water from cyber security attacks, threats and the risks inherent in our systems, IT networks and our IT suppliers.

To help the business, they provide cyber security governance, as well as assisting colleagues with support and advice. They also provide cyber security design and solutions for all projects and changes that involve data or technology and provide the following information security business capabilities:

- Governance, compliance & risk management.
- Consultation for new suppliers and changes or projects that involve data, IT or OT.
- Security design & architecture.
- Threat intelligence, threat response & incident resolution.
- Advice and support to all colleagues.
- Monitoring our IT and OT systems, networks, assets, information, access, and privileges.
- Promoting a positive security culture, providing security awareness and training.
- Cyber security risk is managed by the Cyber Security Team and owned by the business. This feeds into the business risk managed by the Business Assurance team for the whole of Welsh Water.

The Chief Information Security Officer chairs the Information Security Steering Group (ISSG), working closely with the Technology and Audit Committees, senior stakeholders across the business, and colleagues in ITS and OT to manage our cyber security risk.

Our AMP8 plan will enable us to stay one-step-ahead as cyber risks are constantly evolving and making use of new technology. Our plan includes upgrading out-of-support equipment, switching to utilisation of cloud services wherever possible and supporting our restructured and resized Cyber Security team to be able to react to events. For a detailed perspective on our plans to enhance cyber security, see Section 3 of the enhancement case, WSH57-CS01 - Increasing Physical and Cyber Security.

6.4 Learning from Events

The five years since our last Business Plan submission has seen a number of significant events including some unprecedented in living memory. We have experienced major economic upheaval due to Brexit and COVID-19 (and more recently events in Ukraine) and some significant and diverse weather events consistent with the more erratic weather patterns expected in a changing climate with significant floods, droughts, heatwaves and freeze-thaw. Reflecting on events we have experienced (and those we see happening elsewhere) and ensuring we learn from them to reduce or eliminate disruption from future events forms a key component of our resilience strategy.

6.4.1 Brexit

With uncertainty over post-Brexit arrangements following the 2016 referendum still in place at the time of our last Business Plan submission, Welsh Water and the rest of the sector had time to plan and prepare for disruption particularly to key supply chains and loss of access to the European Investment Bank.

40% of the chemicals currently used by Welsh Water are manufactured in the EU, and supply chains in the UK can be unstable. We recognise that chemical supply chains have not been managed efficiently within the industry, but the company is now ensuring that they become resilient to changes caused by Brexit.

We undertook a risk assessment of the impacts on costs, tax, supply chains and procurement processes. There was a significant programme of activity by our Commercial Team in conjunction with key internal stakeholders (business areas, Tax, Legal) as well as seeking external advice to assess how various scenarios might impact our systems. We worked internally and with the broader sector to secure mitigations against the most significant supply chain and financial risks. We also developed plans to enable us to respond should the worst plausible situation emerge to ensure critical supplies and finances could continue to support the business functions.

6.4.2 COVID-19 (2020-23)

The COVID crisis caused an important and rapid economic shock, forcing the UK into recession in 2020 following the first lockdown period. As restrictions on normal economic life got extended, some companies ceased trading while others reduced their workforce. The COVID crisis led to a rise in unemployment rates and it is estimated that 68% of UK households experienced a fall in disposable income. This increased the number of bad debts and rates of water poverty, leading Welsh Water to write off bills for both domestic and business customers. It has been a difficult financial period for Welsh Water and there is a risk that costs will outweigh the income the company generates.

The crisis put a financial burden on water companies due to increased treatment costs arising from changes in wastewater load provoked by the disposal of vast quantities of excess produce, such as milk and beer, and decreased revenue due to the shift in water consumption from metered commercial establishments to primarily unmetered domestic properties.

We demonstrated resilience in our operational and financial activities all through COVID. The company's operational activities, construction and engineering projects were put on hold until they were made COVID-secure. The COVID crisis has been an opportunity for the whole industry to try new ways of working based on the use of new. The use of these new tools, made necessary for safety reasons, have changed the way companies interact with their customers. There has been an increase in digital meter reading processes, and in the use of low-costs digital channels such as virtual consultations, which might have helped make some customers more at ease, especially those reluctant to have operational staff members entering their homes.

Lockdown also led to a shift to home working for the majority of employees working in the water industry with most of them feeling able to continue their usual role. While many perceived a necessary adaptation to the crisis, some employees report that this shift was challenging and impacted their mental health. Homeworking has continued beyond the COVID crisis. However, the full impact of the COVID crisis on the water sector is still unclear and further research will be required.

Outdoor water usage increased, especially during periods of hot and dry weather, with the uptake of activities such as gardening that helped improve mental health and wellbeing. People recognised that they also invested more time in activities within the home, which led to increased showering. The behaviour changes resulting from COVID were identified as:

1. using water at home rather than at work,
2. using more water at home,
3. flushing and putting inappropriate things down the drain,
4. paying more attention to water,
5. not paying water bills, and
6. people reporting higher intentions to save water.

In addition to responding to an increased demand for water, we had to address issues of sewer blockages resulting from the use of non-flushable items necessary to deal with toilet paper shortages.

6.4.3 Storm Dennis (2020)

Storm Dennis impacted the UK on Saturday 15 and Sunday 16 February 2020, just a week after Storm Ciara which also brought strong winds and heavy rain to the whole of the UK.

Rainfall totals from Storm Dennis caused the most significant impacts with flooding in parts of south Wales and England. Between midnight on the morning of Saturday 15 February and 10:00 on Monday 17 February a Natural Resources Wales site at Crai Reservoir in Powys, South Wales, recorded 157.6mm of rainfall. A number of locations recorded significant portions of their monthly average rainfall totals for the month.

The strongest wind gust was recorded at Aberdaron in north west Wales, where 91mph was recorded at 18:00 on Saturday. The winds were not confined to the west, with gusts over 50mph recorded quite widely from Kent to Aberdeenshire

The River Wye and River Severn which were reported to have reached their highest-ever levels. Areas of several towns including Hereford and Pontyprydd were inundated. The Environment Agency issued over 600 flood warnings and alerts including several severe flood warnings The flooding also caused major travel disruption with roads blocked, damaged railway lines and hundreds of flights cancelled. Large areas of farmland were also underwater. Strong winds and large waves battered exposed coastlines.

The storm affected several parts of Wales, but communities in Rhondda Cynon Taf were some of the worst hit, suffering mass flooding. At one point, Natural Resources Wales (NRW) had over 150 alerts and warnings in place.

The weather affected our water and wastewater networks as a result of flooding, landslides and power outages in south Wales and north Herefordshire, with several sites becoming inaccessible.

Mayhill and Llwyn-on water treatment works were both flooded, resulting in police instructing us to evacuate the Mayhill works due to severe flooding. Customers in the area were largely kept in supply due to our emergency response with tankers deployed and bottled water provided.

Through the summer of 2022, we undertook a wide re-assessment of the flood risk exposure to our above ground assets including site surveys of 50 of our highest risk sites. This has led to two flood mitigation schemes being included in our Business Plan to protect critical water supply sites and a broader, more in depth knowledge of our risk exposure to help with development of emergency plans and to feed into future investment programmes to reduce resilience risk.

6.4.4 Drought (2022)

After an averagely wet winter, the spring of 2022 was exceptionally dry. This was followed by a warm summer, with a new record high temperature for Wales of 37.1°C being recorded at Hawarden in July 2022, causing a considerable increase in customer demand for water. As the incident emerged, we followed our drought plan (published in 2021) with the first Drought Incident Group meeting held on 3rd May and the Welsh National Drought Group established from early July.

A number of operational actions were undertaken to support continuation of service through the drought. Around 180 individual actions were taken as part of normal spring preparation for summer. As the extent of the drought emerged, over 100 additional actions sought to mitigate the impact on both the demand side (leakage reduction and water efficiency) and production (optimising treatment works and bringing temporary sources online). There was also extensive activity on customer communications, working with stakeholders and the media to explain our actions and to encourage everyone to play their part in managing the situation.

The 7 months between March 2022 and September 2022 were the driest across Wales in 150 years. The first temporary use ban for over 30 years commenced in part of our region on 19th August. In September 2022, the southwest of our region saw 115% of its long-term average rainfall enabling the lifting of the temporary use ban on 25th October. No other formal drought actions were required. Our latest Water Resources Management Plan reflects the learning from this event and this learning will also be incorporated into the next update to our drought plan.

6.4.5 Freeze-Thaw (2022)

A period of intense cold weather between 6th and 17th December 2022 followed by a very rapid thaw from 17th December led to an increase in leakage which had an acute negative effect on large parts of our operating area. Primarily this impact was seen in rural areas and, in particular, West Wales (Mid & South Ceredigion), the Gwendraeth Valley (Carmarthenshire) and Herefordshire/Mid Wales. Disruption to water supplies continued to affect some customers up to 24th December. Burst mains were experienced resulting in a loss of storage at a number of assets affecting customers supplied from both inlet and outlet mains. Distribution input rose to in excess of 1000 ML/d during the event, exceeding peak summer demand in many of the affected areas.

Planning for the expected cold weather started on Friday 9th December 2022 with a preparation call to discuss the incoming weather risks followed by a series of calls through the week to review resource availability, storage position, weather forecasts with requests to our volunteer force asking for people to make themselves available on Sunday and Monday 18th/19th December for bottled water deliveries or tankering, if required. A Gold Incident Management Centre was opened on the morning of Saturday 17th December to manage the event and coordinate activity to minimise the impact on the quality of water supplied to customers.

We proactively contacted priority services customers with an immediate need for water, ahead of any potential issues being encountered, via proactive texts. Bottled water was also proactively delivered to Priority Services Register (PSR) customers supplied by assets not immediately affected to try and minimise the potential impact of the incident should further assets be affected.

Six bottled water stations were set up across West Wales which consisted of bottled water and in some cases Arlington tanks. Pallets of bottled water were also delivered to a number of individual areas where reports of low pressure no water were reported. Our full tankering fleet was deployed in an attempt to move water around the network to the depleted areas and to refill service reservoirs.

Rezoning, adjustment of pumping regimes and other manual interventions such as throttling of inlet/outlet valves were used to manage resources and maintain levels within reservoirs to ensure disruption to customers' supplies were minimised.

Following a review of our response to this event, the Drinking Water Inspectorate (DWI) welcomed our proactive planning and concluded that our actions were generally satisfactory given the difficult weather conditions. We undertook a comprehensive post incident review and have identified a number of areas to improve preparedness for future similar events including hydraulic modelling of affected areas and some mains replacement.

6.5 Asset Health

6.5.1 Definition of Asset Health and Asset Health metrics

We define Asset Health as the probability of an asset failing to deliver its function. This probability is derived from our deterioration models that consider parameters such as previous failure rates of an asset / asset group, observed condition, age, material, location, soil types etc, resulting in an asset specific probability of failure.

Our water infrastructure assets are ageing and on average are deteriorating faster than rates of renewal. To avoid deferring investment costs to future generations and to reduce negative customer and environmental impacts, we need to target investment in asset health at the right assets and at the right times.

The UK water sector uses traditional and limited tools to monitor, predict and communicate asset health. But modern survey methods are in use in other sectors or in development. Some of these present the opportunity to 'see into' the fabric of the structures and equipment that form our systems and deliver services. This innovation will demonstrate technologies and techniques which will quantify asset health with precision and map it onto a deterioration curve, inform intervention methods enabling decisions to be made to preserve intergenerational equity and improve outcomes for customers and society.

6.5.2 Measuring Asset Health

Deterioration is 'the process of becoming progressively worse' such as a water main corroding until it bursts, or a pump wearing out. Deterioration modelling is an analytical technique, using a mathematical model to simulate the process of deterioration. It gives us an estimation of the annual probability of failure and the rate of deterioration.

We analyse all asset related failure data since 2008 and use statistical diagnostics to assess the effect of different predictors (individually or in combination) on the failure and deterioration rate.

Statistical modelling is concerned with finding relationships between variables in order to make predictions about a variable of interest, for example, the relationship between the number of pipe bursts and a set of predictor variables such as pipe characteristics, location and environmental factors.

To achieve the above, a variety of standard statistical techniques are applied based on an understanding of the assets, their underlying failure process, and the data that is available. For water mains failures we assume that all bursts are repairable in nature, therefore we use a Generalised Linear Model (GLM) counting process for this analysis. The GLM is a generalisation of the linear regression model and can model non-symmetric distributions and discrete data.

As part of this process, stepwise regression is used to select the final model predictors, interactions between them, and any appropriate data transformations. It involves the selection and testing of predictor variables in a systematic/automatic manner.

Based on all the predictors identified we are then able to form an equation to predict the probability of failure at equipment/pipe level, we then use this to understand the base asset health of our assets.

6.5.3 Working with the Sector

We have continued to improve the internal understanding of asset health through further refinement of our asset modelling capability which gives us an understanding for every asset a probability of failure (Base Asset Health), the criticality based on the consequence of failure and therefore the Asset Health risk associated with an asset. This then allows appropriate investment scenarios to be run to allow us to best optimise cost, risk and performance into the future.

We remain committed to working with the wider sector on Asset Health. In 2021 we setup the Asset Management industry working group, where key issues are discussed. Asset health measurement remains a key priority for the group.

In 2022 Welsh Water worked with Northumbrian Water and United Utilities to produce a bid to the Ofwat Innovation fund on an 'Asset Health demonstrator' which proposed focussing on:

- Identifying promising new technologies and ways of predicting and reporting which are at an early stage of development and bring them to market quickly and demonstrate them at scale in the water sector.
- Applying proven technologies used at scale in other industries for monitoring, predicting and reporting and to demonstrate them at scale in the water sector.
- Developing a common framework for asset health reporting in the water sector.
- Creating a training course to teach the water sector about asset health.

Whilst the funding bid was unsuccessful we are looking for alternative ways to take this work forward. We are also working closely with South West Water and Severn Trent Water on Ofwat's Asset cohort analysis condition grading to ensure that we have good alignment in approach.

6.5.4 Service Impact Models

As well as understanding the probability of failure of an asset we also look at the consequences of failure for every asset. This service impact modelling activity then allows us to look at the deterioration through the lens of risk, predicting the impact of failures at individual locations using information about the characteristics of the assets and location.

This is achieved by mapping our assets and all possible failure modes within our Asset Investment Manager (AIM) system, see Figure 5.

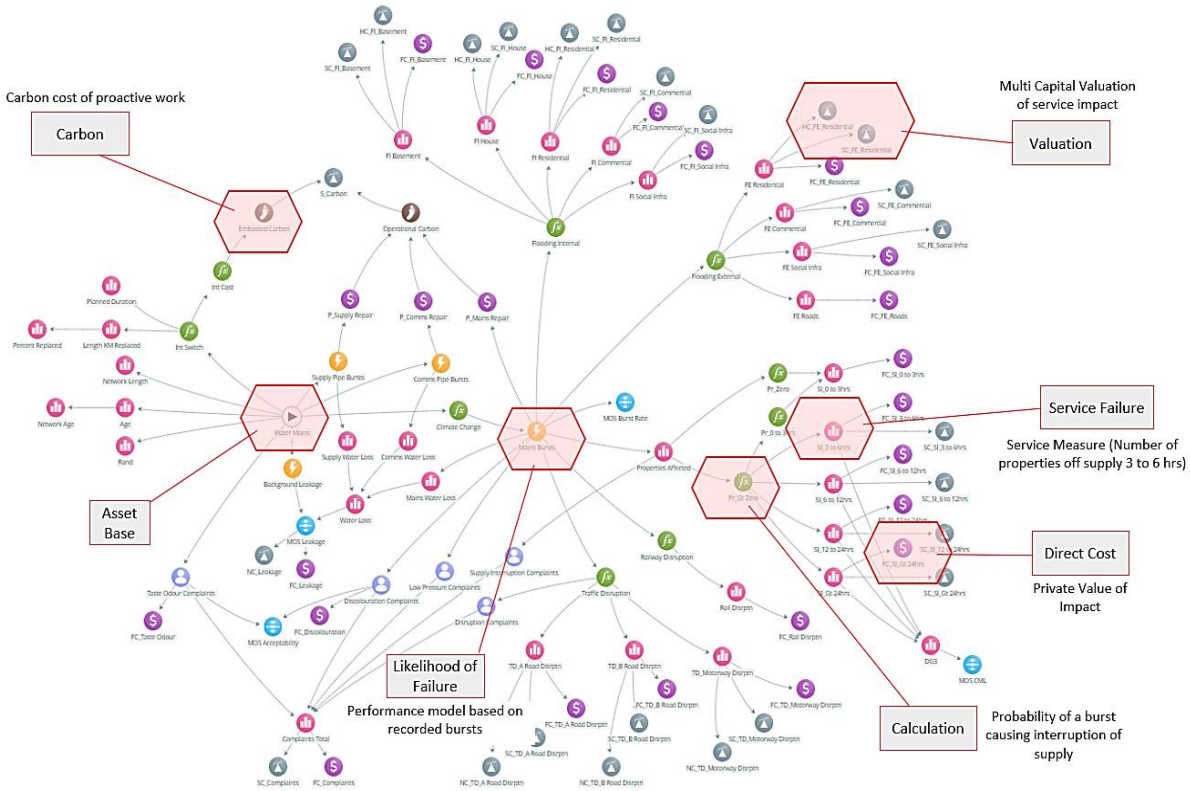

Figure 5: Example of an AIM Risk Map for Water Infrastructure

The consequences are monetised using our Service Measure Framework (SMF) and this takes a multi-capital approach to risk and benefit. This allows us to either forecast service performance of a particular investment scenario or calculate the required investment to achieve a desired performance outcome, this can be done at any time period.

This supports asset management decision-making by answering questions such as:

- How much do we need to spend to maintain service in the face of deterioration?
- What would we have to spend to meet a new performance target?
- Given an expenditure limit, what maintenance programme would give us the best asset health outcome?

6.5.5 Enhancing Our Modelling Capabilities

We have undertaken a significant amount of activity over the last few years to improve the confidence that we have in our asset health modelling approach. We have added another 5 years of failure/event data, this meaning that we now have 20 years of failure data built into our models.

As part of our continual improvement of our Service Measure Framework, Multi-Capital Accounting has now been incorporated into our assessment to move us beyond our previous approach of simply using financial metrics on a cost-benefit basis to make decisions, this enables us to better account for the true public value, including wider societal and environmental benefits, of the investments that we make. This also enables the alignment of our investment decisions to our long-term strategy as set out in Water 2050.

We have undertaken a full review of our 'risk maps' which assesses all potential nodes of failure to align with our new multi-capitals approach to valuation of risk and value within Welsh Water. We have also reviewed all the potential investment interventions employed by Welsh Water and refreshed the benefits these will then realise to ensure that when we generate an optimised plan, this more accurately reflects what can be achieved.

In March 2023, we asked PwC to undertake a review of our service impact models. The PwC review found that our deterioration and service impact model is a "substantial and flexible model that aims to predict asset deterioration and its potential consequences to the business and wider society to inform investment decisions." PwC identified many areas of good practice and made recommendations on how our modelling could be improved in future, many of which were already in our development plan. PwC identified that we "have made and are continuing to make significant progress in developing the different elements influencing asset investment planning practices".

6.5.6 Asset Condition

We quantify asset condition in many ways, dependant on the type of asset that requires assessment.

For mechanical and electrical assets we utilise a number of condition based monitoring techniques to identify potential faults, including thermal imaging cameras, vibration analysis, endoscopes, oil analysis and review of asset performance such as pumping capacity. Our approach also includes the developing automation system used to monitor and diagnose equipment performance through a process control system. This enables potential faults to be identified without having to dismantle equipment, thus reducing costs and time and enabling more checks to be undertaken.

For civils assets, as these assets are typically longer life, we undertake specific site investigations to capture the appropriate physical data to enable us to monitor the lifecycle of the asset.

6.5.7 Analysis and Forecast

In order to create the most effective AMP8 investment plan, our plan has been optimised through a service impact model. In this model we have assessed multiple investment scenarios and mapped this to expected performance outturn and an Asset Health risk.

It is observed that historical expenditure has not always been sufficient in order to keep asset health stable, this is due to the recent improvements in performance being achieved by investment in operational strategies and mitigation rather than reduction in risk of asset deterioration as described in Figure 6.

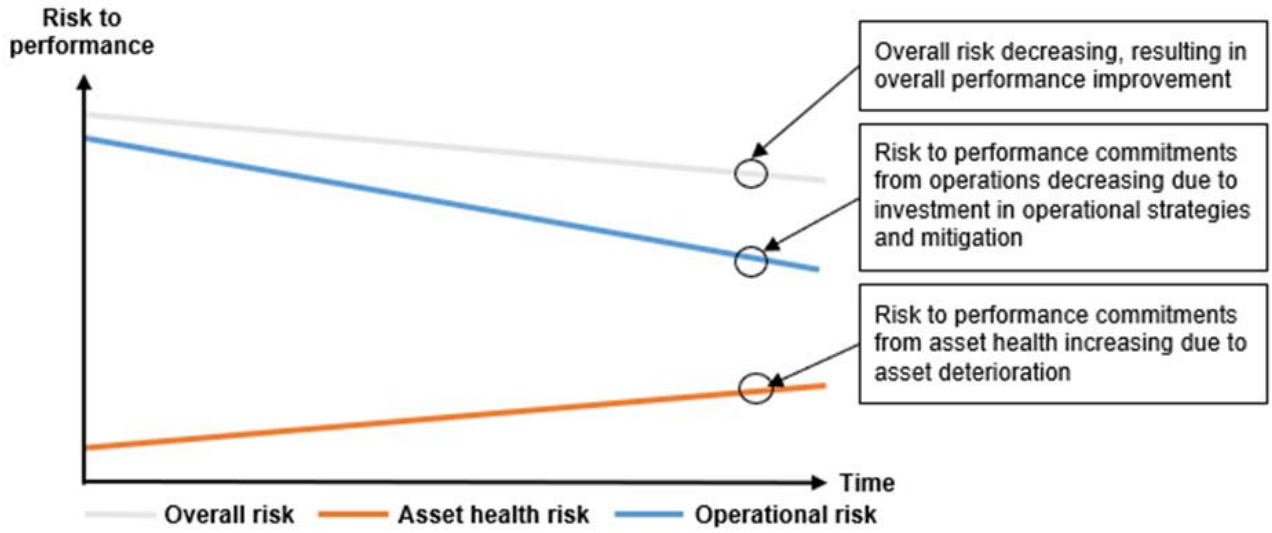

Figure 6: A representation of how operational strategies and asset health combine to reflect overall risk

The risk that now needs to be considered is achieving the optimal balance of asset health risk reduction compared with operational risk reduction in order to sustain health and service performance for the long term.

We will use the outputs of the modelling to better target maintenance investment in AMP8 and seek to hold asset health risk broadly stable over this period. How we are using our service impact models to support AMP8 investment plans is covered in more detail in WSH50-IP00 Our Approach to Investment Planning.

6.5.8 Future Development

We have now incorporated our service impact modelling into our 'business as usual' Asset Management activity, so as further asset data is incorporated into the system, so the models confidence and accuracy will continue to grow even further. We are looking for further integration of 'operational intelligence' into our corporate systems that can be used to support future models such as more complex and frequent condition data.

Implementation of a new multi-capitals value framework was a massive step forward for Welsh Water in preparation of our PR24 plan, but further iteration of this framework is planned to ensure future investments continue to capture value appropriately.

We are looking for further improvements of our corporate memory through better asset information. We will deliver this through our new Asset Information Requirement (AIR) - This has been developed through engagement with all key stakeholders in Welsh Water to understand their asset information needs and to ensure this can be captured appropriately across our range of corporate systems. As part of better asset information we aim to capture better measured condition data through new innovative techniques to capture condition data on our infrastructure assets.

We previously recognised the importance of a sub-process of equipment in our modelling, but not individual equipment as redundancy was not systemised in our corporate system. A project to address this was undertaken in 2022 and this has delivered an improved view on criticality in our non-infrastructure assets. We will use this new understanding to drive an enhanced criticality driven approach to maintenance to improve reliability but to also reduce cost through reduction in non-value add maintenance.

To better help visualise and communicate asset health we will be developing dashboards to support and add insight on asset health information in a standardised manner as a way to present key metrics and risk to the Board and key internal stakeholders.

6.6 Resilience Portfolio Risk Assessment

In our 2019 Resilience Action Plan, we committed to development of a first pass system interdependencies mapping. Our initial view was a simplistic matrix linking risks to systems and assets. We then expanded this to try to start to quantify the risk posed to assets and systems in a resilience portfolio risk assessment (PRA). This would allow us to start managing resilience risk in a similar manner to that adopted for managing impounding reservoir safety, which is appropriate given the similarity of wanting to manage exposure to rare but high consequence events.

The concept involves being able to assess system-by-system the degree to which components of that system are outside risk tolerance when looking at the consequence of failure of those components to the system as a whole and their exposure to threats that could cause them to fail to the extent that service is severely impacted, such as flooding, asset failure, power loss, transport disruption, river and coastal erosion, 3rd party damage, communications failure or fire. The probability of failure can be combined with the consequence of failure measured by service or environmental impact to create a risk score by component and then built up to risk score by system.

This will also enable us to forecast how the risk profile will change over time as consequences grow with more customers attached to each system and as hazard probability grows due to trends such as climate change and ageing assets.

Figure 7: Representation of the resilience portfolio risk assessment

This will enable us to have conversations with customers and stakeholders about the current level of exposure to high impact, low probability events and their appetite to address the highest risks. By considering the 4R's of potential interventions: resistance, reliability, redundancy and response/recovery, we can offer costed options to achieve potential target risk levels and get a truer picture of the level of risk that customers and the Board are willing to tolerate.

One system that this assessment highlights as having a relatively high level of risk is the Cardiff area due to high consequence of failure in this densely populated area. This has led to the development of a new all

mains hydraulic model for the entire Cardiff area to gain more insight into the specific assets driving the risk in that area and will lead onto an assessment of what mitigation could be considered to reduce those risks.

The resilience PRA uses the best available data for assessing the probability of failure to a range of threats. In some cases the data available for predicting rare events (and how they are likely to evolve over time) was limited, so we initiated a range of studies with consultants and academic institutions to improve our information across our asset base.

6.6.1 System Interdependencies

We have considered key system interdependencies as part of our resilience portfolio risk assessment. The key inputs from an interdependency perspective are:

- Power
- Telecommunications
- Transport infrastructure (affecting bulk chemical deliveries or sludge disposal activities)
- Environment (water sufficiency for abstraction and water quality for wastewater disposal)

Many commercial sectors are dependent on our services to function however in talking to key utilities, most are not reliant on potable water services to maintain their services. Some components of the power generation sector use a lot of water for cooling but generally abstract this themselves directly from the environment, so the interdependency is more indirect albeit there is a need to include their demand needs in future water resources planning. Their view was that the main impact a loss of our service would have on their function is on personnel impacted by the loss of supply to schools meaning that employees have to return home to care for children although most felt that the impact would be manageable particularly for short term interruptions.

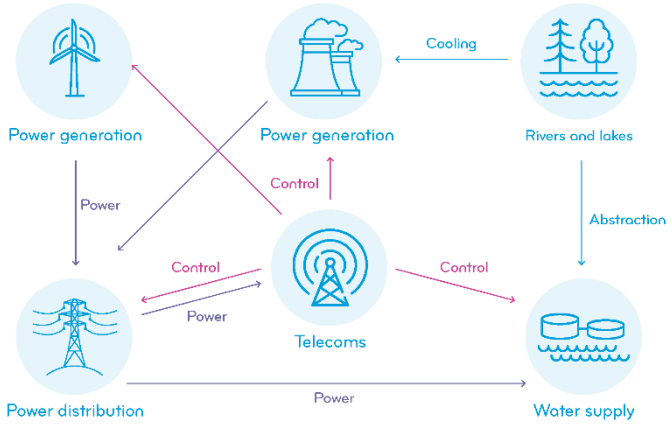

Figure 8: Key system interdependencies

Our Security and Emergency Directions (SEMD) assessment has a reporting outcome on understanding our asset base, including supporting infrastructure, in which we acknowledge that our dependencies on supporting infrastructure are not as fully risk assessed as we would like them to be and we have actions in place to enhance this understanding and secure 'green' status by March 2024. Defra's Critical National Infrastructure (CNI) criticalities review includes a questionnaire on interdependencies including power, gas, transport, space and communications. This is currently being completed for our CNI sites.

We have 35 sites on the Electricity Supply Emergency Code (ESEC) protected list, this means that in the event of limited power availability these sites will be prioritised and have power restored first following a national power outage. We are working with Welsh Government and Defra to try and get support for an additional 11 sites to go onto the protected list. There are only 120 sites nationally on the protected list so we have good coverage compared to the rest of the sector.

We engaged with the UK Government exercise 'Mighty Oak' simulating a national power outage and following this are developing a national power outage plan for Welsh Water. This is in addition to a 3-hour rota power cut plan we introduce earlier this year supported by visualisation tools to better understand the assets affected by the rota cuts. The plan will be tested next year to validate this information. We will continue to work closely with the local resilience forums, the wider sector and governments on all aspects of power and communication interdependencies.

Our emergency planning team is equipped to mitigate the loss of dependent systems including permanent and temporary power generators and satellite phones across the business to support coordination activities as we seek to bounce back from any outages.

6.6.2 Erosion Risk

Through development of the resilience Portfolio Risk Assessment, we recognised that our information on river and coastal erosion risk needed to be improved. We got in touch with Liverpool University who had undertaken an assessment of erosion and deposition risk for National Grid and appointed them to repeat the appraisal of risk for our assets. The study involved observations of historical rates of erosion and deposition, information on soil type, land cover and, for coastal erosion, the planned defence regime for sections of coast taken from the Shoreline Management Plans. Liverpool University's model predicts the speed of erosion and deposition over different timeframes with the future pace impacted by climate change.

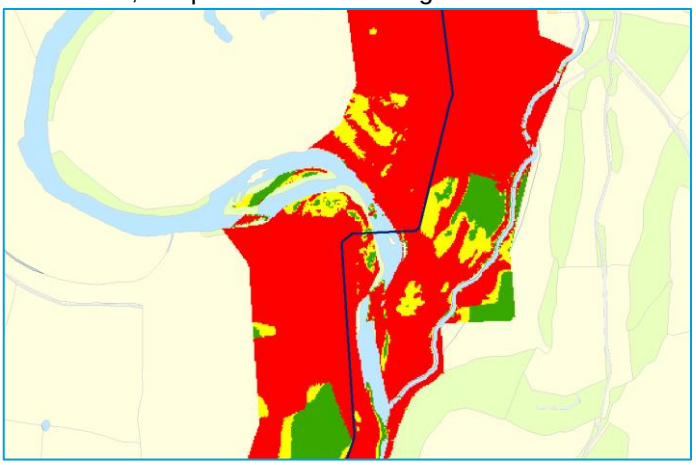

Figure 9: Example output showing high levels of erosion risk to a raw water trunk main crossing the River Wye

Given the number of assets and the length of river and coastline in our region, this was a significant modelling exercise involving 4.15 $x10^{16}$ permutations requiring 20 days of continuous computer processing time.

The next phase is to undertake site specific studies of the highest risk sites to confirm the risk and any existing mitigation measures and develop optimised plans for protecting sites in future to evolve into a programme of work prioritised on need.

6.6.3 Flood Risk

Following the flooding caused by Storm Dennis in February 2020, we undertook a review to update and enhance our understanding of flood risk exposure of our assets. One of the challenges with understanding this threat is the scale of our asset base, we have over 6,500 above ground assets so visiting each one in order to carry out detailed site surveys would be prohibitively costly. So we carried out an initial screening exercise using geoprocessing to compare asset locations with flood risk maps from Natural Resources Wales and the Environment Agency. As asset locations in our mapping system are generally centroids we included a buffer around each centroid to ensure we don't disregard sites at this stage where outlying assets within the site boundary could be affected. Where the buffer coincided with either surface water, fluvial or coastal flood risk polygons the site was taken through to the next phase. More than half the above ground assets were filtered out at this stage.

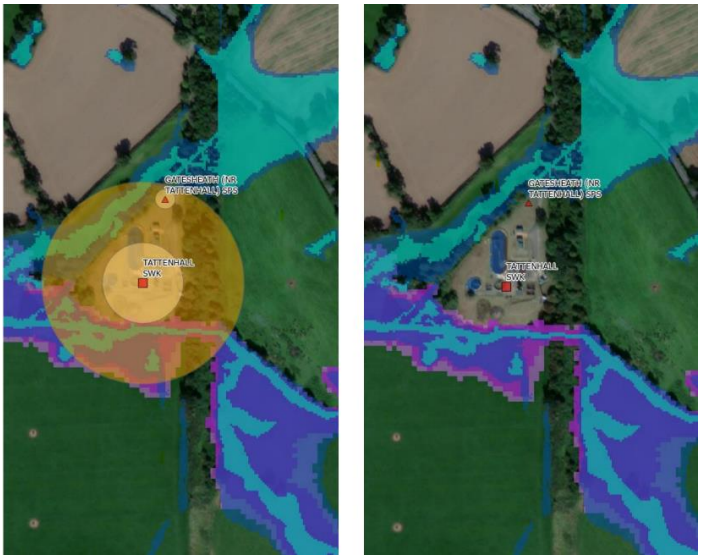

Figure 10: Example use of buffers versus centroids in flood analysis

The second phase, again desk-based, involved determining more accurate site boundary information using our own records and those of the land registry. At this stage we also removed some of the very small assets from the assessment on the basis that the consequence of loss would be lower and the time to recover relatively short. We also filtered out sites with existing flood defences. This reduced the number of sites

at potential risk to flooding of some form to around 700. We believe this to be a conservative view as surface water flooding is more complex to model and a visual inspection of the results suggests that some forecast surface water flooding would not occur in the real world.

Following this, we have undertaken site surveys of the highest risk sites, those with a high return period for flood risk (so worse than 1 in 1,000 year return period) and those where the site has a high consequence of failure or would be very costly to repair. We have high level flood mitigation costs for each of those sites and these options have been included in the long listing for optimisation into the Business Plan. Where permanent flood defences are not currently in place we are working with the Emergency Planning team to strengthen the site-specific flood action plans. We are also continuing to improve our flood risk assessments, trialling the use of drones to take accurate radar imaging of sites and use this information to improve site modelling of flood risk.

We are actively engaged with local National Flood and Coastal Erosion Risk Management (FCERM) strategies and collaborative groups and are seeking to further the development of joint plans to tackle flood and erosion risk to our systems and local communities.

6.7 Climate Change Adaptation

For more detail on how we model climate change impacts, our understanding of climate risks and our plans to mitigate climate risks, see our Climate Change Adaptation Report, our WRMP and our DWMP all of which are available on our website under 'Our Plans'[14].

In addition to understanding resilience risk today, we are mindful of the many stresses that will cause many risks to grow over time unless we take action. One of the most significant stresses is climate change.

There is **unequivocal evidence that climate change is happening now**. We know that we need to mitigate climate change to play our part in keeping the aims of 1.5°C[15] alive, while at the same time preparing for the worst effects of a changing climate. We must plan and prepare for higher global temperatures and its effects. Our customers expect no less.

The main hazards that we can expect to face as a result of climate change are:

Warmer summers and lower summer rainfall	More intense rainfall events	Increased flood risk of all types	Higher sea levels
A drier climate could result in water supply deficits and the potential for increased water demand and reduced availability for public water supply, agriculture, industry and the environment.	Intense rainfall increases the risk of sewer and surface water flooding, leading to increased damage caused by overflows of stormwater water into the environment. It could also lead to increased erosion and landslips which affect our catchments.	More frequent flooding (from rivers and coasts) and coastal erosion increase the risk of disruptions to our services. Our network's resilience, or support supply chain network (such as transport, energy and telecoms) resilience, could be reduced and some of our assets could fail.	Rising sea levels and more frequent and intense storm events increase the risk of coastal and river flooding and speeding up the rate of coastal erosion.

6.7.1 What We are Doing to Adapt Now

Climate change adaptation is focused on addressing the potential physical impacts of climate change: adjusting systems, processes and practices in response to the changing climate, both extreme events such as flooding and heatwaves and long-term stresses such as sea level rise. Our goal is to **adapt to a world**

[14] https://corporate.dwrcymru.com/en/about-us/our-plans
[15] Compared to pre-industrial levels

that is 2ºC warmer in 2050. At the same time, **we will assess the risks and plan for the effects of more extreme warming by the end of the century**. This way, we will be able to prepare for projects that take a long time to implement. We will use this goal as the basis to plan and decide on investment for the long term.

Following the identification of our primary climate change risks, we have identified ways in which we can adapt to respond to these risks. Between 2025-2030, subject to agreement of funding for our Business Plan, we expect significant progress in activities that contribute to climate change adaptation and support this planning as part of 'no/low regrets' programmes including those described in WSH01 Long-Term Delivery Strategy such as:

- Leakage – We are planning significant reductions in leakage by 2030, set within a longer-term ambition to halve leakage levels by 2050.
- Customer metering – We will proactively install meters on unmeasured properties, moving towards full metering by 2035 with customers switching to paying by meter on change of occupier.
- Water efficiency – We will enhance water efficiency messaging to customers and businesses, delivering to the ambitious PCC target of 110 litres per person by 2050.
- Catchment management – We will continue to enhance the condition of our water catchments, protecting water quality and improving biodiversity.

Our plans for 2025-2030 include targeted investment in areas where service impacts are likely to be significantly impacted by a changing climate including tackling overflows, improving wastewater treatment and replacing mains that are bursting more frequently in hot, dry conditions.

On drainage there is progress to make in defining new design standards to take account of changing flow rates, improving collaborative working with other flood risk authorities to better integrate flood defence planning, promotion of control of surface water at source and drive innovation on reducing the environmental impact of stormwater discharges.

Where possible, we have detailed adaptation actions, with timescales for delivery, for each of our principal risks. However, there is more data gathering, modelling and research planned, notably on development of our next Drainage and Wastewater Management Plan. Many of our responses to the climate change risks identified also form part of our Water Resources Management Plan which, alongside the DWMP are, at the time of writing, in development. All adaptation options will need the right funding and regulatory environment to enable us to deliver. We have confirmed the role of our management team and Board in managing these risks and delivering progress.

6.7.2 A More Resilient Future

We have started on a journey to enhance our resilience, and we are proud of what we have achieved. There is more to do, and to enable us to take an adaptive approach, we will monitor our progress including updating this Climate Change Adaptation Report at least every 5 years to review and reflect on the latest climate science and on our adaptation progress. We will continue to focus on further analysis to optimise our long-term adaptation plans.

We will continue our focus on reducing leakage, promoting water efficiency and restoring catchments. We will learn from research and innovation and, with five more years of climate data and global efforts to limit greenhouse gas emissions, we will have a clearer idea of the future climate path. By the time we write the next iteration of this Climate Change Adaptation Report we will be better placed to narrow down the likelihood of adaptive strategies being triggered.

This report sets out our adaptation approaches to respond to our principal risks. All these risks require partnership and collaboration, as interdependencies and cascading consequences mean that we cannot solve them alone, or without innovation. We know we are stronger together and look forward to continuing to work with others on this critical endeavour.

6.8 Long Term Delivery Strategy

Our Long-Term Delivery Strategy describes our plan to achieve our long-term ambitions, including an enhanced level of resilience, whilst being able to adapt to the shocks and stresses we're likely to experience over the years ahead. The sector is facing a lot of uncertainty, both in terms of the implications of the growing societal trends for ever higher environmental standards and in the impacts of long-term stresses like climate change and population growth. Our Long Term Delivery Strategy considers the key strategic themes of:

- Safe and high quality drinking water.
- Reliable water supply.
- Protecting the environment and communities.

For more detail on how we intend to deliver long-term resilience, see WSH01 Long Term Delivery Strategy. In the rest of this section, we highlight two cross-cutting themes that underpin all of our strategies and plans and are critical to delivering operational resilience across our systems and processes: a skilled workforce and managing health and safety.

6.8.1 Skilled Workforce

We recognise that to be resilient we need to ensure we have the right capabilities in our workforce to deal with events today whilst also being mindful of the need to adapt to new skill requirements in the future.

We have a human resources (HR) plan for the entire business with sub-plans in place for water, wastewater and retail. These currently vary between groups but work is ongoing to move to a standard harmonisation. The team are planning across 5 years with the next year mapped in detail. Within the 5-year HR plan there are key actions set until 2026 with yearly objectives set. There is a quarterly review process and monthly reporting - this includes development plans, leadership capability & development, coaching & mentoring, development multiskilling, learnings from employee exit surveys, support for career paths, and support for HR metrics development and training. Examples of activity include:

- Workforce planning is based on business planning to understand the workforce implication of each major project. The team is also assessing demography with a yearly assessment in place. This process is challenging as it is being undertaken while 'live'. Succession planning is included within the wider business strategy. This has been tested in the last few years with nominated staff attending assessor development days to determine key skills and abilities. There are leader plans in place with training materials, but we are looking to augment this.
- Remuneration is a key area of change. There has been a pilot on bonuses to ensure they are clearly linked to performance. Executive pay is benchmarked externally.
- Ownership for training is with line management but HR is responsible for providing central training expertise and ensuring competence. There is ongoing training to support resilience around maintenance, operations and incidents.
- Staff retention is strong. There are some areas of hard to fill roles, but we have not seen the 'brain drain' seen by other companies with turnover rates generally at less than 1%. We consider the national skills shortage in our plans and are taking a collegiate approach to creating a national skilled workforce, working with the rest of the sector to boost training in future areas of need.
- We believe that being an active employer in the community is important. We have targeted recruitment for Cardiff/Newport to increase diversity, including initiatives such as working with mosques and schools in each area, to raise the profile of Welsh Water as an employer. We have also expanded our contact centre remit beyond Cardiff with recruitment extending beyond the capital.

6.8.2 Health and Safety

The safety of our colleagues and the public is paramount in everything that we do. We have a strong health and safety culture within Welsh Water and taking care of ourselves and others contributes to our resilience as an organisation.

In FY 23 we achieved our best ever safety performance with a total of 5 reportable injuries and 18 less serious lost-time incidents. This continues a trend of progressive reduction over the last decade. Our 'Safety Takes Every Person' (STEP) training programme is well established and continues to be used to engage our people in contemporary health, safety and wellbeing best practices. STEP also supports our safety culture and long-standing elements of our improvement plans, such as our quarterly executive-led 'Safety Days', the 'Take 5' personal risk assessment process and our monthly 'Safety Conversation' engagement plan; all of which are helping us firmly embed a safety-first mindset in our people and our contract partners.

Alongside our direct safety plan, we expend a lot of effort on occupational health and wellbeing. We have retained our RoSPA Gold Award and the Welsh Government Platinum Award for occupational health. Through the COVID-19 pandemic period we recognised the whole-life impact it had on our people and we have sustained our focus on mental wellbeing, with provision of free services such as our Employee Assistance Programme which is available to all colleagues.

6.9 Delivering Resilience in AMP8

Our plan for AMP8 includes a number of programme areas that will enhance our resilience as part of our Long Term Delivery Strategy, incorporating key plans such as our WRMP, DWMP, the NEP and WINEP.

- **WRMP** – Our plan includes ambitious targets in order to achieve drought resilience to a 1 in 200-year event by 2029/30, leading towards resilience to a 1 in 500 year event by 2039/40. We will reduce leakage by 10% during the AMP as part of the long-term plan to achieve a 50% reduction (compared to 2019/20) by 2050. We will also reduce domestic demand (targeting 110 l/head/day by 2050) and business demand (targeting an 8% reduction by 2050). Our water efficiency programme (Cartref) will continue and develop through the AMP. This programme is also supported by our new metering strategy installing 'Smart' meters on unmeasured properties (but not initially billing on this basis), increasing the level of metering from 47% in 2021 to 79% by 2030 to support customer communications and leakage detection. See WSH58-RS02 - Reducing Drought Risks and Improving Customer Visibility of Usage for PCC Management. We will also deliver some network enhancement schemes to make better use of existing resources in supporting areas that would struggle in very dry years. See WSH56-RS00 - A Reliable Water Supply for the Short and Long Term.

- **DWMP and NEP/WINEP** – Our wastewater plan includes a significant level of investment that contributes to long-term resilience. We are delivering our largest ever programme of environmental improvements including investing in reducing storm overflow spills through increasing capacity and, where possible, sustainable drainage schemes and nature-based solutions, providing resilience to storms and future climate change. This investment will also contribute to resilience to flooding for customers and communities. Our environment programme also delivers a reduction in nutrient discharge to rivers and seas, contributing to environmental resilience in our region and the ability of the environment then to continue to support our functions. See WSH63-PE00 - Protecting and Improving the Environment and DWMP, WSH71-PE10 - Enhancing the Environment through WINEP and NEP Investigations and Programmes and WSH69-PE06 - Increasing Wastewater Treatment Capacity and Stormwater Storage for Peak Flows.

- **Resilience programmes** – Through our base and enhancement expenditure we will maintain and make improvements to the resilience of our systems including our optimised maintenance strategy, supported by our service impact modelling. Other key resilience programmes include:
    - Emergency planning – Consisting of replacement of existing equipment, purchase of new equipment to address emerging risks and construction of new storage facilities to better protect emergency assets. For more information see WSH57-CS01 - Increasing Physical and Cyber Security.

- Cyber security – Responding to a dynamic threat landscape with a diverse array of increasingly sophisticated threat actors, we will enhance our security controls across all areas of the business. This includes upgrading out-of-support equipment, switching to utilisation of cloud services wherever possible and supporting our restructured and resized Cyber Security team to be able to react to events. See WSH57-CS01 - Increasing Physical and Cyber Security.
- Catchment management – We will continue to collaborate with partners in our catchment areas to prevent raw water quality deterioration and improve biodiversity. Installing monitoring stations to observe trends, supporting initiatives like PestSmart and weed wipers to encourage landowners to use less pesticide and undertaking research into taste and odour compounds to identify future interventions. This is on top of the continuing management of the land in our owned catchments and supporting landowners in non-owned catchments to enhance catchment condition. See WSH53-CW01 - Improving Raw Water Quality in Catchments through Green Solutions.
- SEMD – Meeting the requirements of the Security and Emergency Measures Direction on our sites. See WSH57-CS01 - Increasing Physical and Cyber Security.
- Impounding Reservoirs – Continuing to reduce the risk of failure of our impounding reservoirs including incorporation of new requirements emerging following the Toddbrook incident in 2019. See WSH59-RS03 - Increasing Safety of Impounding Reservoirs.

- **Resilience enhancement projects** – There are a number of schemes in the AMP8 plan that will contribute to enhancing resilience in the short and long term that are not covered by one of the programmes described above. They are providing improved resilience to shock events or to long term stresses. These schemes have been collected together and described in more detail in:
  - WSH67-PE04 - Addressing Disproportionate Risk to Customers from Sewer Flooding.
  - WSH72-PE07 - Avoiding a High-Consequence Event at Laugharne Wastewater Treatment Works.
  - WSH62-RS01 - Increasing Resilience of Tap Water Supply - Asbestos Cement Mains.
  - WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity.
  - WSH61-RS05 - Increasing Resilience of Tap Water Supply - Treatment Works.

  These include:
  - Flood mitigation – Continuing our programme of protecting our most critical sites to flooding from rivers or sea. WSH61-RS05 - Increasing Resilience of Tap Water Supply - Treatment Works.
  - Proactive replacement of Asbestos Cement mains – Addressing the rapid deterioration in performance of this specific asset type to reduce interruptions to supply. WSH62-RS01 - Increasing Resilience of Tap Water Supply - Asbestos Cement Mains.
  - Improving interconnectivity – Enhancing our ability to move water between our biggest supply zones providing increased water supply security to customers. WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity.
  - Erosion protection – Realigning a critical main to avoid future damage from erosion by the River Wye. WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity.
  - Dry weather intervention – A series of small schemes to boost supplies in some areas that struggle to meet high demand during spells of very hot weather. WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity.
  - Landslip mitigation – Relocation of a wastewater treatment works that is prone to future landslip risk. WSH72-PE07 - Avoiding a High-Consequence Event at Laugharne Wastewater Treatment Works.
  - Feasibility studies – To assess the optimal future programme to enhance the resilience of water supplies in areas currently reliant on single points of supply. This includes an ongoing review of the Cardiff area and the resilience of the trunk main system to withstand the shock of the loss of individual sections. WSH60-RS04 - Increasing Resilience of Tap Water Supply - Network Capacity and Connectivity.