Anglian Water

SYSTEMS THINKING

Response to Action: ANH:LR:A2

RESPONSIBLE BUSINESS OF THE YEAR 2017
BUSINESS IN THE COMMUNITY

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2015

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anglianwater

EXTERNAL RECOGNITION

Winner

Utility Week Utility of the Year

Glassdoor Best Places to Work Employee's Choice 2019

Business in the Community Responsible Business of the Year

ROSPA Gold – Anglian Water and @One Alliance

Queen's Award for Enterprise: Sustainable Development

Glassdoor Highest Rated CEOs Employees' Choice 2017

Leading Utilities of the World

Green Finance Award

British Construction Industry Award

Utility Week Awards

PR19 IAP Action – Systems Resilience

1. SUMMARY

In response to action ANH.LR.A2, this document explains our systems based approach to resilience in the round.

We take an integrated systems approach to resilience, considering the needs of our customers, stakeholders and the environment.

Resilience and systems interdependency is central to Anglian Water's Strategic Direction Statement – our long term plan for providing excellent service to our customers in our region, facilitating sustainable growth and improving our environment. This is an integral part of our Business Model, culture and decision making. It has been developed over the past 15 years and we plan to continue to enhance it in AMP7.

We have developed a business plan that has resilience at its heart, reflecting the importance of maintaining our assets as well as investing in new infrastructure, systems and demand management, and understanding how all of this contributes to system resilience and the sustainability of the service quality that customers value. Our plan aims to safeguard long term asset health, and help to ensure future customers are not adversely impacted by short-term decisions.

Key elements of our approach include:

- **Creating our Resilience in the Round framework with Arup to further develop and enhance resilience and embed integrated systems thinking with a clear line of sight to our business strategy. This approach is central to our business plan and to our day to day decision making, through our business model. (Section 2)**
- **Incorporating resilience, risk and systems-based thinking into governance processes and decision-making. This allows us to make the right investment decisions, taking a long-term view, improving our efficiency and avoiding unnecessary capital expenditure though improved management, natural solutions and investing in our people.[1]**
- **Seeking different and innovative solutions to our resilience challenges. We have learnt from our past experience and others by incorporating the 4Rs and six capitals thinking into our processes and developed robust methods of measuring our progress towards our customer outcomes. This includes working with our customers, and with third parties to build a resilient future. Examples include our smart metering trials and linked behavioural change programmes; partnership schemes to deliver flood alleviation and extensively testing customer and stakeholder support for proposed investments to make our region more resilient.**
- **Becaming the first utility to embed public interest within our Articles of Association. This locks in a long-term approach to how we will work today and in the future and enhances resilience and systems thinking.**
- **Stress testing our financial resilience against a range of extreme scenarios. We expect current concerns regarding financeability arising from the Draft Determination to be resolved. This, alongside our stress testing, allows us to attest to our long term financial resilience.**
- **Strong operational management of our systems which has ensured a robust performance when faced with shocks and stresses. For example:**
  - **Our industry leading performance on service to customers;**
  - **Our industry leading performance evidenced in the recent Drinking Water Inspector's report[2]: "Anglian Water and Welsh Water are typical of expected performance";**
  - **Our systems thinking and pre-planning that ensured there was minimal impact on customers during the "Beast from the East" in 2018, followed by the long hot summer period later that year;**
  - **Our effective incident planning that has avoided major customer impact during other incidents and our post incident learning to improve our approach after each event;**

1 Providing Appropriate Regulatory Funding For Capital Maintenance Activity: Ensuring Capital Sustainability And Service Resilience, Dr Harry Bush & John Earwaker, May 2019

2 p78 Drinking Water 2018, Summary of the Chief Inspector's Report for drinking water in England, July 2019

    - A critical part of securing robust operational resilience has been our on going collaboration with multi agency partners. We work together in a Multi Agency Support Group to exercise and prepare for our response and recovery phase for multiple hazards across both agency and county boundaries, and;
    - Being the only Water Utility to have ISO 223001 Business Continuity certification, ensuring a rigorous focus on operational resilience.
- Being a resilient business and operating as part of many systems, our clear and adaptable future plan develops our systems-based approach to developing resilience in an uncertain future. This includes:
    - An extensive range of activity, working with other organisations, academia, companies from around the world to create a more resilient region for our customers, including setting up the Anglian Centre for Water Studies at the University of East Anglia (See Section 5).
    - Further improving our governance, assurance and management processes so that we meet our public interest commitment, embedding six capitals and systems thinking into all that we do.
    - Developing our horizon scanning to ensure we monitor and plan for shocks and stresses that could impact our region. We plan to ensure that this includes a quantitative approach to prioritise our risks.
    - Mapping and understanding interdependencies between internal and external systems to optimise decision making and resilience strategies.
    - Working with the sector as a whole, our regulators and others to develop asset health modelling and implementing this approach for our assets.
    - Building on our existing investment modelling and decision making to further incorporate six capitals thinking. Section 4 outlines how our Business Plan investments have included resilient thinking.
    - Learning from others and identify new ways to deliver investments that optimise resilience and incorporate adaptive approaches to delivery.
    - Working with our regulators and others to help further develop the Industry's understanding and implementation of resilience.
    - Developing the best approach to monitoring our resilience performance through our performance commitments.

Our resilience and systems thinking

This document provides details about our Business Model, which is our approach to delivering our long term Strategic Direction Statement ambitions. It incorporates systems and resilience thinking.

We have continued to work with ARUP in reviewing our progress and maturity (Appendix 4). Since the submission of our plan in September 2018, ARUP has reviewed our Systems Thinking and Resilience in the round framework:

> *"Arup was commissioned by Anglian Water to undertake a review of the work that Anglian Water has undertaken to build their resilience. This provides an update to Arup's previous Resilience in the Round maturity assessment in August 2018. Based on Arup's review, they stated "we confirm we have seen continued progress towards delivering Anglian Water's current and future plans, outlined in the 2018 assessment, to improve resilience across the business. The business has set a clear direction and has plans to continue to embed systems thinking in the business".*
>
> *Arup: August 2019*

Delivering our public interest commitments

Earlier this year, we became the first utility company to embed public interest within our Articles of Association. This fundamental change legally enshrines public interest objectives for the communities we serve and for the environment within the core documents that drive the governance and management of the business. These are also reflected in the legal duties of all Directors of the company. Embedding public interest objectives in our Articles of Association means that, even if ownership changes hands, and management teams change, the organisation in the future must take full account of the wider impact Anglian Water has on customers, communities and the environment, as well as delivering a fair return for shareholders.

We also intend to sign up to a set of Responsible Business Principles, following extensive engagement with customers and stakeholders around our social contract. Following this, we will develop an approach to effective external validation of our public interest commitments, and to report on our performance as a responsible business, including a commitment to publish a statement which sets out our performance in relation to key environmental, social and ethical activities. We believe that this change locks in for the long term a way of working that we have already demonstrated, and links well to the "resilience in the round" approach that Ofwat has set out.

Financial Resilience

We have stress-tested our financial resilience against a range of extreme scenarios, as we set out in our September Business Plan and related appendices. Furthermore, we have taken a number of proactive steps to address Ofwat's comments in the run up to PR19, including a commitment to de-gear to the mid-70s during AMP7, and accepting Ofwat's gearing outperformance sharing mechanism.

We are concerned about the financeability of the notional and actual company, in the light of Ofwat's current proposed Weighted Average Cost of Capital (WACC) and the overall balance of risk and return reflected in the Draft Determination, with these concerns being echoed in recent reports reflecting on the current position from credit rating agencies.

However, we believe these concerns will be resolved following due process as Ofwat's financeability duty is discharged. On this basis, and given the extensive stress-testing that we have carried out, referred to above, we can attest to our long term financial resilience.

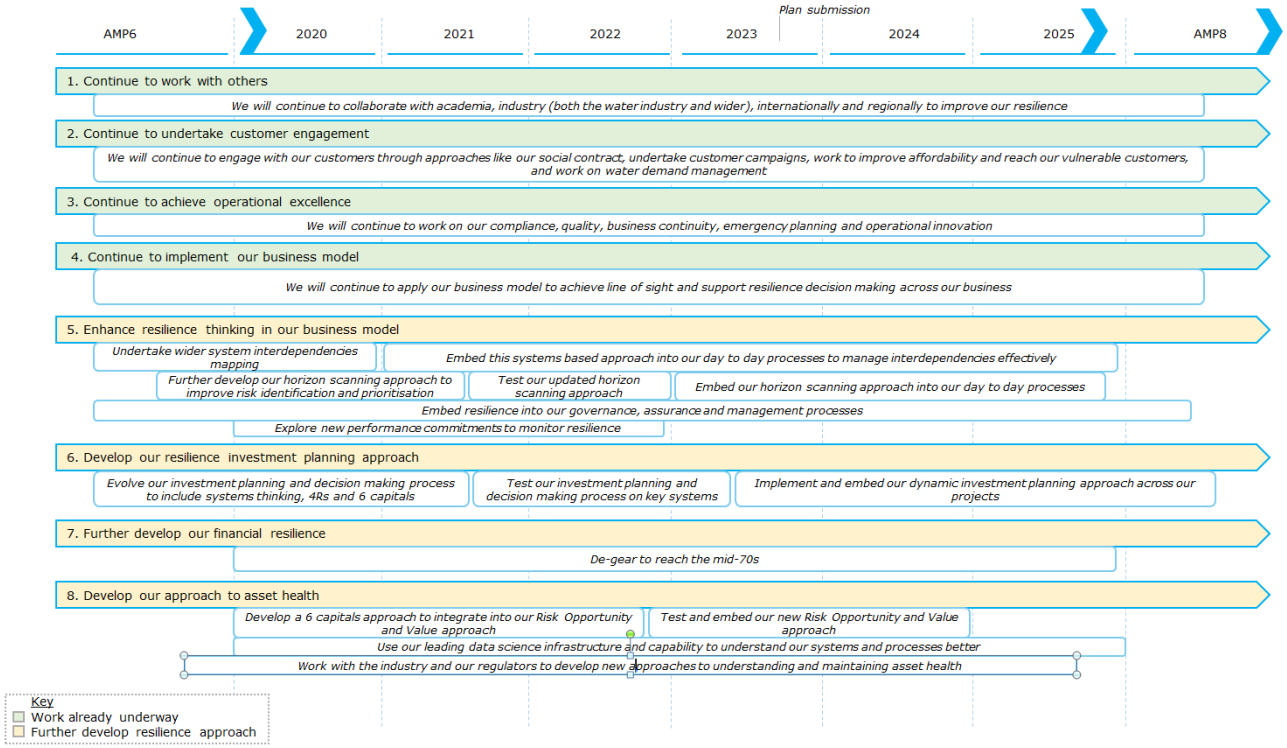
Our Board will address our concerns relating to the proposed WACC set out by Ofwat at the Draft Determination, and its impact on financeability, within its Assurance Statement to our Representation on the Draft Determination.

In section 4 we provide a number of examples to illustrate our systems thinking in practice that draw on all elements of our resilience framework:

- How our systems based approach to resilience has enabled us to have the lowest risk to water quality in the industry.
- How our established resilience preparations and practiced response to the Freeze Thaw event ensured minimal impact to our customers
- How our response to an incident on the Humber Bank in 2018 has had resilience benefits wider than just to Anglian Water – creating great resilience and understanding between competing companies as well as a more robust system and sharing this learning.
- The line of sight of how our approaches to delivering two outcomes (Pollutions and Interruptions to supply) draws on all aspects of our Business Model from assessment of shocks and stress, the application of 4R's and our Resilience Framework through to delivering our Strategic Direction Statement ambitions.
- How working with others (e.g. Highways authorities, local communities, EA etc) we have applied systems thinking to make communities more resilient to flooding and how we have optimised the long term health of our assets.

Our Plan for the future

We have already been working hard to help build a resilient future for our region, working with a wide variety of stakeholders to challenge traditional approaches, and listening to our customers, who do not want to defer investment that makes our region more resilient to the challenges we face in the future from climate change. In AMP7 we will continue to develop our systems thinking as the chart below shows (section 5 gives more detail on our current activity and on-going plans).



2. INTRODUCTION

In the year since the submission of our business plan, we have continued to develop our systems and resilience thinking within the business.

> "Resilience is the ability to cope with, and recover from, disruption and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future" (Ofwat's definition of resilience).

We have also drawn on a more generic definition of resilience, where resilience reflects the overall "capacity of individuals, communities, institutions, businesses and systems to survive, adapt and thrive no matter what kinds of chronic stresses or acute shocks they experience" (adapted from Rockefeller Foundation 2013)

This section outlines our historic approach and the development of our Systems thinking.

- Section 3 outlines our Business Model and how this supports the delivery of our business plan
- Section 4, provides some case studies that illustrates our resilience thinking, it also describes how our investments within our Business Plan have incorporated the need to be resilient and how we have assessed risk reduction
- Section 5 provides outline details of our action plan into AMP7 to further improve our resilience as an organisation, financially, operationally and corporately.

Our challenge

We operate in the driest and one of the fastest growing regions of the UK. We face significant challenges from climate change, and recognise that we can't stand still as those risks escalate. We will therefore continue to bring outside thinking into our organisation, work with those who have a dependency on us in our region, as well as others who can help deliver our long term plans.

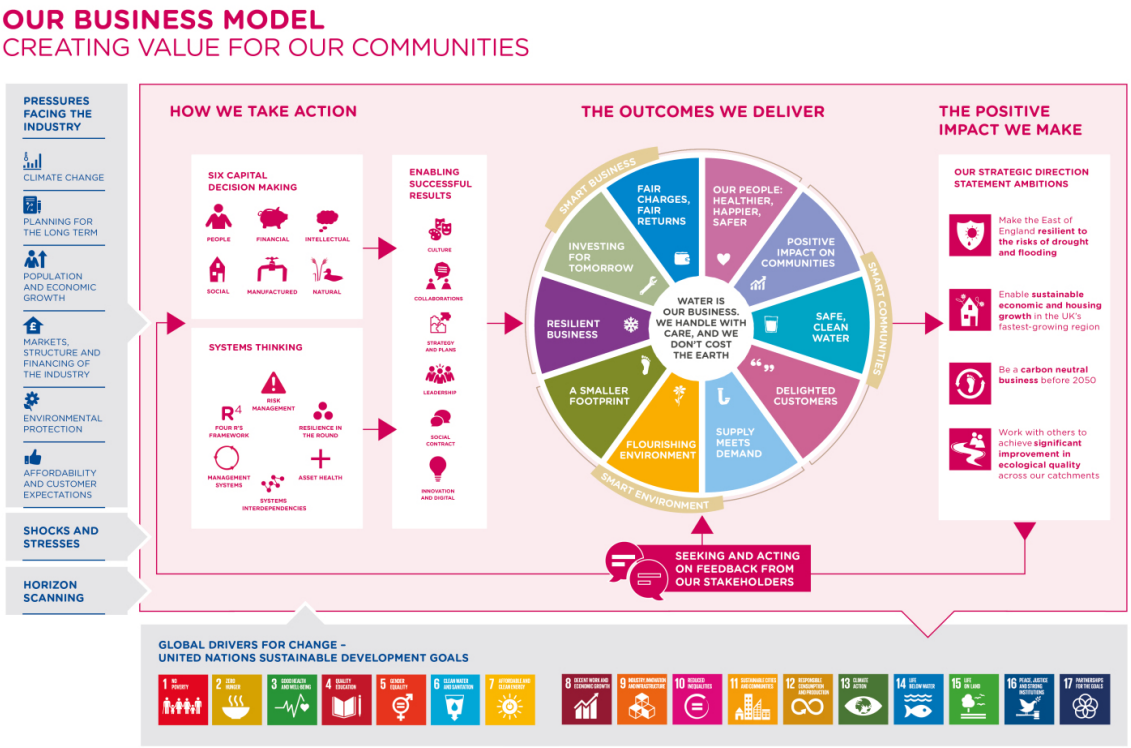
During the past 15 years Anglian Water has been at the forefront of resilient thinking both nationally, regionally and within the business with the development of our revised Strategic Direction Statement (SDS) that was based around resilience service for our customers and protecting the environment in a region that is seeing climate change and is the fastest growing region in the UK.

Our business model

Resilience is embedded into our business model. The Business model below outlines the key components of this which includes our resilience framework developed with Arup. In section 3 and 4 we describe how these components help provide resilience and systems thinking. The model incorporates:

- External horizon scanning, identifying the risks, shocks & stresses we face.
- Testing our resilience to these risks, shocks and stresses and ensuring mitigations are in place.
- Developing Six Capitals decision making and reporting.
- Embedding systems-thinking in our plans and decision making.
- Testing that we are delivering successful results and the outcomes our customers want, refining our plans if we are not.

All of this aims to enable us to deliver the long term strategy and ambitions outlined in our revised Strategic Direction Statement, with our Business Plan setting out the five year stepping stones towards these long term goals.



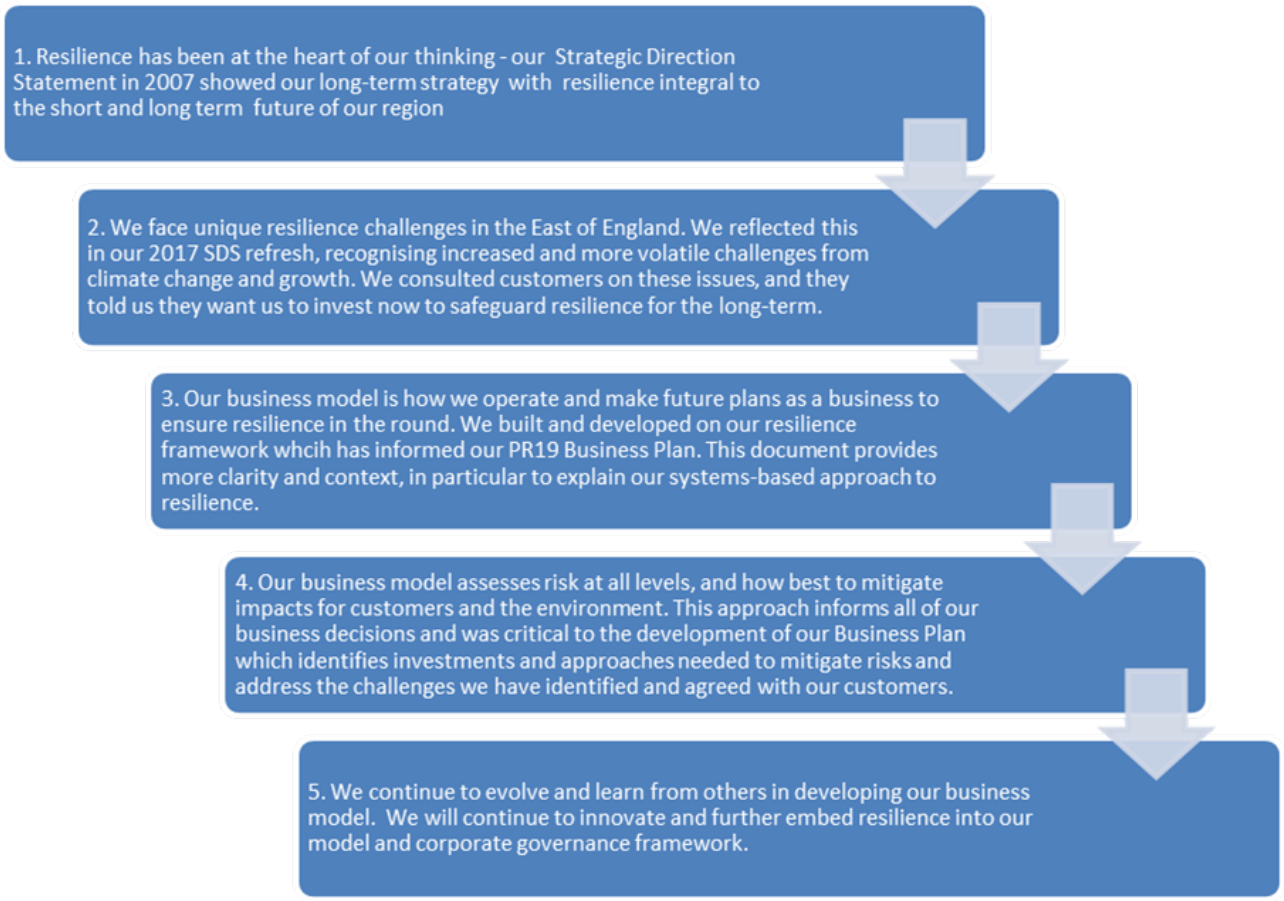
How our resilience approach has developed

Anglian Water has been at the forefront of systems and resilience thinking over the past 15 years. Our approach has developed over that time, including through:

- publishing our first long term Strategic Direction Statement in 2007 (then refreshed in 2017), which places resilience at the centre of our corporate strategy;
- setting up Water Resources East, recognising the cross-sectoral nature of addressing resilience to drought and flood in our water-scarce, rapidly-growing and low-lying region;
- delivering sector-leading performance on leakage reduction, underpinning the approach in our Water Resources Management Plan, which combines demand reduction strategies with supply enhancements to ensure that we can maintain supply over the longer term, despite the challenges of climate change and growth.

The diagram below shows the evolution of our resilience thinking, bringing us to the systems-based approach to resilience that is now embedded throughout our organisation.

The evolution of our resilience thinking



In this document we outline the work that has established our systems thinking within Anglian Water, along with further actions that will continue to underpin our operations, showing the line of sight between identifying risks to resilience, putting in place planned mitigations, tailoring our investment priorities, defining outcomes with customers, and our wider corporate governance framework.

We have developed a plan that we believe is the right plan for our customers and our region. It builds on our historic achievements, acknowledges where we have further to go; and creates a platform that allows our region and our customers to prosper. It also responds positively to the priorities on resilience and affordability that Government set out in its Strategic Policy Statement to Ofwat, and to the conclusions of the National Infrastructure Commission's "Preparing for a Drier Future" report.

Our business plan has systems thinking at its heart, and we will only deliver our Strategic Direction Statement ambitions by working collaboratively with a wide range of stakeholders and with strong customer engagement. Our plan has been based around the needs of our customer whilst protecting the environment and being resilient to the potential future shocks and stresses.

Ofwat scored our plan scored the highest for customer engagement and the plan reflects the priorities of our customers – incorporates many aspects of becoming a more resilient business, importantly balancing the investment needed now that our customers are prepared to pay for against deferring it into the future for others to fund.

In a "Framework for Resilience PR19 and beyond"[1] we published the main shocks and stresses facing our business. Our 'Resilience in the Round' framework aimed to help us apply Systems Thinking at a practical level.

1 see Appendix 1

We outlined our approach to systems thinking and resilience in the round in a number of documents submitted as part of our business plan: (included in the appendix).

- Section 13 of the business plan for 2020-2025, outlined our approach and thinking.[2]
- Appendix 14a – provided more detailed information around our governance, systems and progress as well as how we manage our shocks and stresses.[3]
- Appendix 14b – provided a maturity assessment carried out by Arup.[4]

Our past delivery has demonstrated systems thinking, working externally with government, regulators, environmental groups, agriculture, emergency planners, local authorities to create a more resilient region. For example, setting up the first regional water resources multi sector body to plan for future demand, leading multi agency emergency response planning approaches in our region through to delivering sustainable environmental solutions; incorporating natural capital solutions, involving local communities and charitable organisations, to exploiting and developing renewable energy sources (wind or even extracting heat from our effluent).

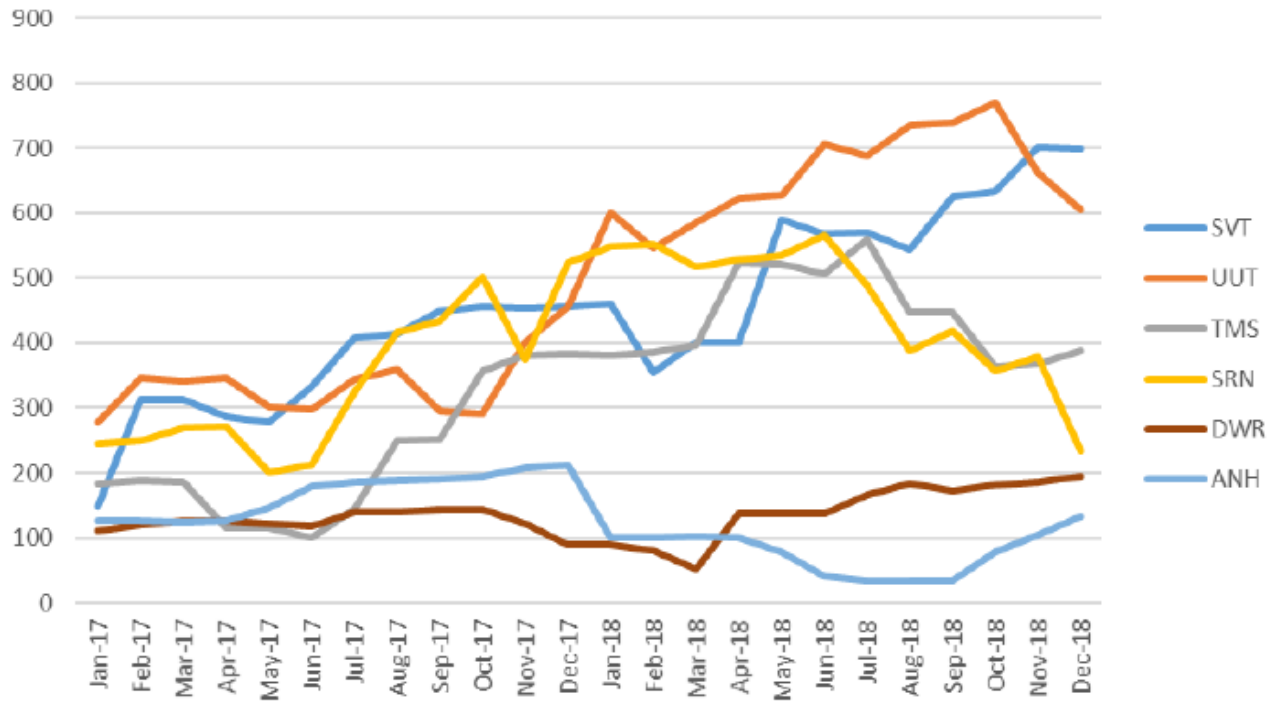
Evidence of the effectiveness of our approach

Evidence of the effectiveness of our resilience in the round approach can be seen by reference to our quality performance and in protecting customers from the short term impact of shocks and stresses.

In the Drinking Water 2018, Summary of the Chief Inspector's Report for drinking water in England, July 2019 Anglian Water is referenced as one of two companies that is delivering the expected performance

"..As a way of showing the difference between companies who are performing less well, both Anglian Water and Welsh Water are typical of expected performance for reference"

Tracking the performance of companies for RRI (source: p78 Drinking Water 2018, Summary of the Chief Inspector's Report for drinking water in England, July 2019. (RRI: Recommendations Risk Index))



2 see Appendix 2
3 see Appendix 3
4 see Appendix 4

Another notable recent example was that we were able to protect customers from impacts from the 2018 Freeze/ Thaw event (as reviewed by Ofwat), and similarly we were able to protect customers from negative impacts during the subsequent prolonged hot dry spell.[5]

In section 3 we provide more detail about our systems-thinking approach, how this is embedded within our business model, and how this supports the delivery of the long term ambitions within our revised Strategic Direction Statement. In section 4 we provide case studies help evidence our approach.

Our resilience framework

Drilling down from our overarching business model, we have created a detailed resilience framework with Arup, which identifies the shocks and stresses we face and how we assure ourselves we are able to cope with them should they materialise. This leading "resilience in the round" approach has since been adopted by various companies, and we continue to evolve the framework as we use it.

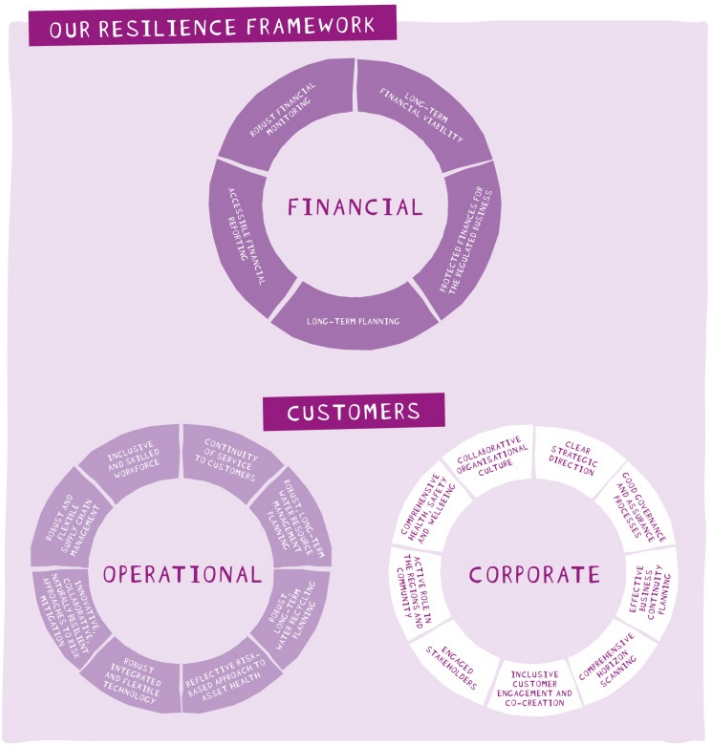
The shocks and stresses identified for Anglian Water

Shocks		**Stresses**	
Disruptive events, which impact the ability to provide a high quality service. In the water industry, acute shocks include sudden events such as floods, fires or cyber attacks.		Chronic conditions which weaken the function of the organisation or system long-term. Examples highlighted in particular by Ofwat include population growth and climate change. Stresses are also often felt as shocks when they reach a tipping point.	
Terrorist attack	Failure of climate change mitigation and adaptation	Demographic change	Land use change
Civil unrest	Temperature extremes	Urban creep	Coastal erosion
Extreme vandalism	Infectious diseases	Migration	Environmental change inc.invasive species
Hoax calls	Environmental pollution	Skills shortages	Inequality and increasing income disparity
Cyber attacks	Fire events	Unemployment and underemployment	Growth vs recession
Power outages	Nuclear incident	Lifestyle change	Financial crisis
Asset failure	Flooding	Rising chronic and lifestyle diseases	Unmanageable inflation
Telecommunication failure	Severe energy price change	Shortage of skilled labour	Bad debt
Data fraud / theft	State collapse or crisis	Rising urbanisation	Resource scarcity (inc. fuel)
Dam failure	Industrial disputes	Leakage	Increased cost of borrowing
Power cuts	Supply chain failure	Ageing infrastructure	Structural change

5 see Appendix 5

False positive alarms	Abstraction licences change	Digital revolution	Macro industry change
Water supply contamination	Failure of regional, national or global governance and planning	Climate change (inc.drought and sea level rise)	Changing regulation, policy and international governance
		State provision of services	Legal structures

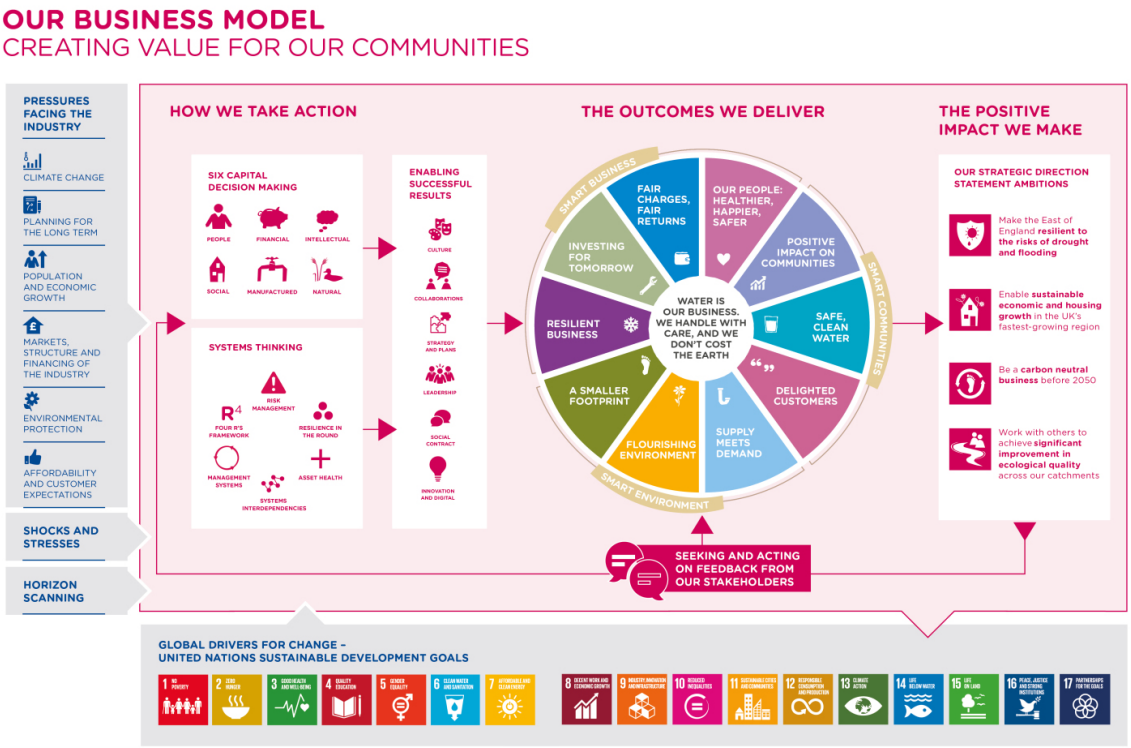
Our resilience framework



This systems thinking is integrated within our business, with our internal systems, processes and decision making all being strongly interconnected and linking back to our assessment of shocks, stresses and mitigants. We will continue to develop and strengthen the interdependencies between our internal systems as well as collaborating with external organisations.

3. OUR BUSINESS MODEL INCORPORATES SYSTEMS THINKING

Our business model helps explain how our system thinking fits within our business. This has been a key element to the development of our business plan and our long term Strategic Direction Statement. The diagram below summarises its main elements.



Strategic Direction Statement and our Customer Outcomes

We first set out our 25 year vision in 2007. In 2017, in consultation with our customers, we refreshed that vision and committed ourselves to four long term ambitions: These four ambitions changed as a result of our consultation, with customers and stakeholders telling us that our original proposed long term ambition around digital services should be considered as business as usual, and that an ambition on improving ecological quality across our catchments should be added.

Our Strategic Direction Statement's (SDS) four key long term ambitions are:

- Make the East of England Resilient to the Risks of Drought and Flooding,
- Enable Sustainable Economic and Housing Growth in the UK's fastest growing region,

- Be a carbon Neutral business by 2050[1], and
- Work with others to achieve significant improvement in ecological quality across our catchments

Our Strategic Direction Statement ambitions are focused on supporting our region to be resilient to the challenges we will face over the next 30 years. We will continue to test these ambitions and our investments to support this resilience journey.

Pressures Facing the Industry

In developing these Strategic Direction Statement goals, we assessed the external pressures facing the industry, our region and our customers. Our strategy is guided by the things our customers have told us are important to them, hence our Strategic Direction Statement ambitions are clearly aligned to our customer outcomes and the challenges we face.

The Strategic Direction Statement outlines the main challenges we face

These challenges are described in detail in our SDS.

This horizon scanning of the pressures we face closely aligns to the shocks and stresses. Table 1 below outlines the relationship between the SDS categorisation of challenges and the shocks and stresses we face, which supports the categorisation of these 6 challenges as being the most important we face as a business.

1 This ambition has now been stretched to a 2030 timeline

Shocks and Stresses: Alignment to the challenges we face

SHOCKS	Climate Change	Population and Economic Growth	Environmental Protection	Affordability and Customer Expectations	Planning for the Long Term	Markets, Structure and Financing of the Industry
Terrorist Attack			☑	☑	☑	☑
Civil Unrest		☑		☑		☑
Extreme Vandalism		☑		☑		
Hoax Calls				☑		
Cyber Attacks			☑	☑		☑
Power Outages		☑	☑	☑		
Asset Failure		☑	☑	☑		
Comm's Failure			☑	☑		
Data fraud/theft				☑		☑
Dam Failure		☑	☑		☑	
Power Cuts			☑	☑		
False Positive Alarms			☑	☑		
Water Supply Contamination		☑	☑	☑		
Failure of Climate Change mitigation and adaptation	☑	☑	☑	☑	☑	☑
Temperature Extremes	☑		☑	☑		
Infectious Diseases		☑		☑		
Environmental Pollution		☑	☑	☑		
Fire Events	☑		☑	☑		
Nuclear Incident		☑	☑	☑		
Flooding	☑	☑	☑	☑	☑	
Severe energy pricing change				☑		☑
State collapse or crisis		☑	☑	☑	☑	☑
Industrial Disputes		☑	☑			☑
Supply Chain Failure		☑	☑	☑		☑
Abstraction Licence Change		☑			☑	
Failure of regional, national or global governance and planning		☑		☑		☑

STRESSES	Climate Change	Population and Economic Growth	Environmental Protection	Affordability and Customer Expectations	Planning for the Long Term	Markets, Structure and Financing of the Industry
Demographic Change	☑	☑		☑	☑	
Urban Creep	☑	☑	☑	☑	☑	
Migration	☑	☑		☑	☑	
Skills Shortages	☑	☑		☑	☑	
Unemployment & Underemployment	☑	☑		☑	☑	☑
Lifestyle change	☑	☑	☑	☑	☑	
Rising chronic & lifestyle diseases		☑	☑	☑	☑	
Shortage of skilled labour	☑	☑		☑	☑	☑
Rising urbanisation	☑	☑	☑		☑	
Leakage	☑		☑	☑	☑	
Ageing infrastructure		☑	☑	☑	☑	
Digital revolution			☑	☑	☑	
Climate change	☑	☑	☑	☑	☑	
State Provision of Services		☑				☑
Land use change	☑	☑	☑		☑	
Coastal Erosion	☑	☑	☑		☑	
Environmental changes inc invasive species	☑		☑	☑	☑	
Inequality & increasing incomes disparity		☑		☑		☑
Growth v Recession	☑	☑		☑	☑	☑
Financial Crisis	☑			☑	☑	☑
Unmanageable inflation				☑	☑	☑
Bad Debt				☑	☑	☑
Resource Scarcity (inc Fuel)	☑	☑	☑	☑	☑	☑
Increased Cost of Borrowing				☑	☑	☑
Structural Change				☑	☑	☑
Macro Industry Change				☑	☑	☑
Changing regulation, policy and international governance			☑	☑	☑	☑
Legal structures				☑	☑	☑

We will continue to integrate and demonstrate how we are utilising and managing risks and opportunities arising from horizon scanning. Bringing this thinking to all levels of our organisation, assessing how the interplay between these can impact our business and our Strategic Direction Statement ambitions.

Six Capitals

In our Strategic Direction Statement we describe ourselves as a "Natural Capital Business", relying on healthy ecosystems to supply water, to help manage floods and to help us recycle water after it has been used. We recognise that our primary resource and our operational activities are embedded in natural ecosystems. We also understand that a successful business must be supported by a strong foundation underpinned by the remaining five capitals and an understanding of the role they play in delivering success for our customers, communities and all those who rely on an efficient, effective and affordable water services.

Understanding the interplay between the six capitals, Natural, Social, Human, Manufactured, Financial and Intellectual is not something new to our business.

In creating our business plan during PR19 we decided to build on this success and develop an approach to embed metrics for all six capitals (Natural, Social, People, Intellectual, Financial and Manufactured) into our investment decision making processes. This will ensure that we look at our investments through a lens of six capitals from conception and assessment of need, through optioneering and the selection of the solution, to commissioning and benefits realisation.

Why is this important? We believe that by taking this approach throughout the investment system we will keep our obligations to customers, communities and the environment at the front of mind and will unlock and deliver more innovative solutions with wider value (such as the development of Ingoldisthorpe natural treatment system delivered in AMP6). Moreover, in the context of resilience, keeping these capitals in balance and not putting too much reliance on any one of the six capitals ensures we don't reduce our ability to cope with shocks and stresses.

Our commitment to working in the public interest has now been enshrined in the changes to our Articles of Association, putting environmental and social considerations in line with financial returns. The six capitals approach will give us a clear line of sight from the Board to our decision making. These metrics and others at the corporate level will be reported annually in our Annual Integrated Report and more than this we are working with others across our region to understand how collectively we can use capitals thinking to contribute to a more efficient and effective system for recording and managing these resources at a landscape scale. This has started with the most advanced of the six capitals – Natural Capital, with the development of a multi-sector group Natural Capital East and inputting to the creation of the Ox-Cam ARC Local Natural Capital Plan.

We are developing systems to ensure that we use the six capitals lens to inform and support our resilience decision making across the business not just in investment delivery. We are also improving our investment processes to ensure the six capitals are incorporated in our Risk, Opportunity and Value methodology.

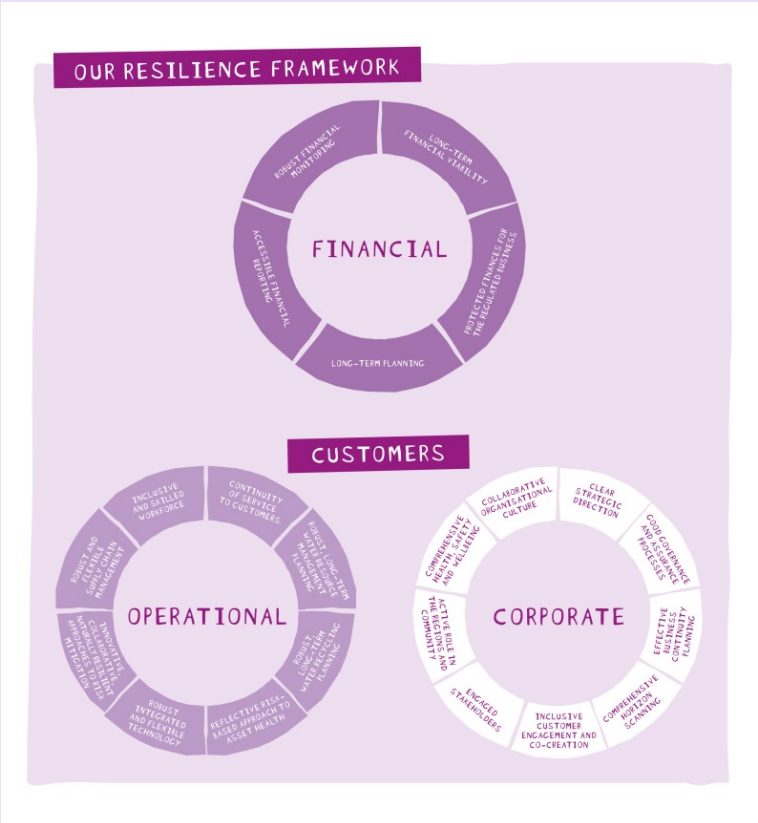
Systems Thinking

We recognise that to deliver an effective service to our customers we must understand how our own systems interact and how we share interdependencies on external systems and stakeholders.

In many areas, we already understand how pressures, shocks and stresses impact on our systems and we plan to improve our understanding, and in particular, work to communicate a clear line of sight into these complex relationships.

Our systems-based approach to resilience in the round is made up of the following six key parts. They combine to provide line of sight from risk to resilience to mitigation options and our corporate governance framework:

1. Risk management	We regularly assess shocks and stresses that could affect our business, reviewing national and regional risks and use this process to identify mitigation plans across our systems. Our risk management processes are regularly reviewed by the Board and business units to ensure we assess the appropriate risks at the right levels within the organisation as well as testing the impact of combinations of risks.

	
2. Resilience in the Round framework	We took a resilience in the round approach to identify the resilience of our corporate, financial and operational systems. We used this assessment to identify where we had an opportunity to invest in our systems to further develop our resilience. More detail is contained in Appendix 2, 3, and 4. 
3. Asset health approach	Our physical assets are a critical part of our operational systems. Our asset health analysis supports our understanding of our ability to operate in the face of shocks and stresses and supports the need for maintaining appropriate levels of maintenance of our assets (see Section 4)

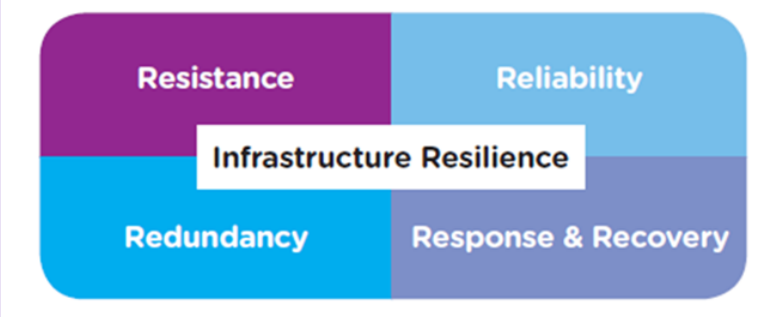
4. Systems interdependencies

Our business has many complex interactions to enable us to provide a robust service to our customers. To ensure that we are resilient and understand these interactions we take a systems-thinking approach to decision making. This helps us to understand and manage our system interdependencies.

We consider the impact of a decision on our internal systems (those owned and managed by Anglian Water) and our external systems (those that feed into our service provision but are not managed by Anglian Water).

Key internal systems		**Key external systems**
Financial	Long term planning	Education
	Financeability	Economy
Corporate	People	Food and agriculture
	Risk Management	Housing
	Customer	Transport
	Governance and strategy	Customers
Operational	Water	Water companies
	Water Recycling	Natural environment
	Bioresources	Emergency response
	Water Resources	Communication and digital
	Digital	Governance
		Supply chain
		Tourism and recreation
		Local communities
		Energy generation and storage
		Energy transmission and distribution networks

We aim to explore how we can use this mapping to inform and develop our approaches to decision making and collaboration in future.

4. The 4R's framework	Our Risk, Opportunity and Value (ROV) methodology uses the 4Rs (resistance, reliability, redundancy, response and recovery) to identify systems, process and projects to invest in to improve our resilience. This forms part of our systems-based approach to the optimisation of investment options. 
6. Management systems	Our Integrated Management System (IMS) aligns our management system processes into a complete framework, enabling our organisation to work as a single unit with unified objectives. We are certified against a significant range of standards (being the first in the industry to achieve certifications on a number of occasions) which provides controls and standards to support our business resilience. These include being an early adopter of the Pitt report and achieving ISO 22301 Business Continuity (the only Water Company to have this) as well as ISO 45001 (Health & Safety), ISO 9001 (Quality), ISO 14001 (Environmental), ISO 55001 (Asset Management), ISO 27001 (Information Security), BS18477(Customer Vulnerability) and the first UK company to achieve PAS 2080 (Carbon Management). Anglian Water recently became one of only two water companies to achieve approval against the requirements the new Drinking Water Inspectorate Risk Management Assurance Scheme (DWIRMAS), administered and assessed by the Drinking Water Inspectorate (DWI) and Lloyd's Register (LR).

These elements all form part of our business model, which underpins our operations and future plans.

In AMP7 we will continue to integrate and demonstrate how we are utilising and managing risks and opportunities arising from horizon scanning and how the interplay between these can impact our business. This includes:

- Undertake wider system interdependency mapping: Building our Social Contract with our customers and communities understanding our impact on other systems as well as their impact on ours.
- Developing our modelling to incorporate digital thinking and new approaches to minimise risk whilst seeking optimal investment decisions
- Continue to develop and map our systems interdependencies to help us, our customers and our region to be more resilient to the challenges we face.
- To continue to integrate 4 R's thinking into our ROV methodology to support business investment decision making.
- Continuing to create an integrated approach to our management systems to ensure interdependencies are managed effectively.

Our approach to Water Resources East is an example of how our systems thinking has led to the first independent organisation focused on bringing stakeholders together to seek to resolve the impact of operating in a water stressed region.

CASE STUDY: Water Resources East - the use of systems thinking to enhance Water Supply Resilience

How collaboration and working in partnership is central to our approach to building water resource resilience across our region

Eastern England is home to some of the UK's most exciting businesses, most beautiful natural sites, most fertile agricultural land and most prestigious academic institutions – and it is set to grow rapidly over the coming decades. Three of the UK's five fastest-growing cities, the Thames Gateway and the M11, A11 and M1 growth corridors are all in the Eastern region – making a significant contribution to growth nationally.

But Eastern England has other attributes that make it uniquely vulnerable to water shortage and severe weather events. Nearly 30% of the land mass is below sea level, a huge proportion of the area is used for agricultural production, it is the driest region in the UK and has one of the longest coastlines of any region.

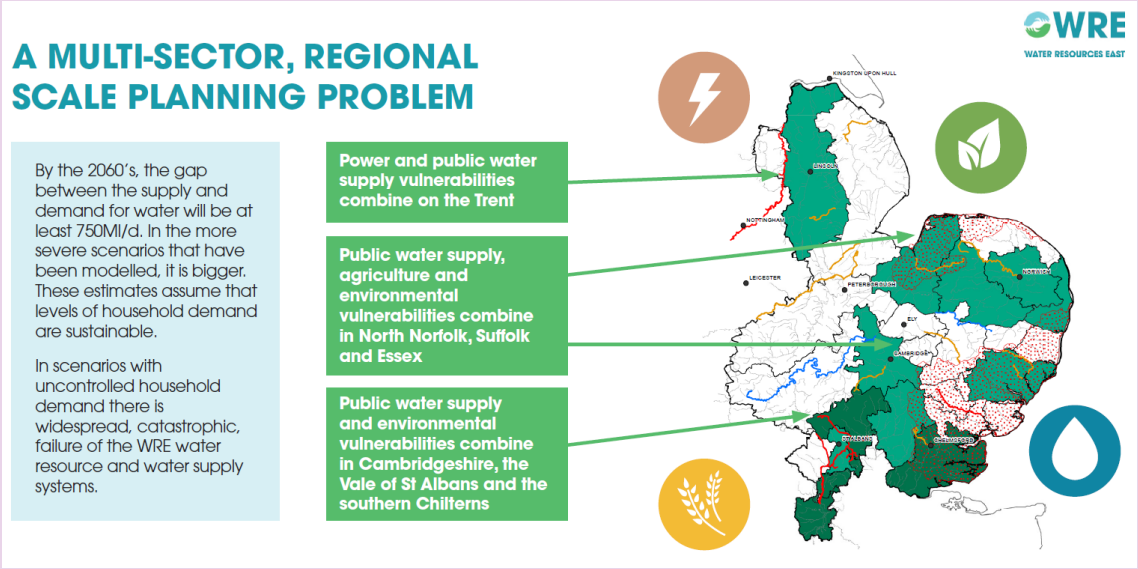
Shocks such as drought, flooding, temperature extremes and pollution pose an acute threat to our region, and sit alongside significant stresses such as climate change, the surge in demand for food, energy and services that are likely in future and changes in agricultural and land use practice as we endure a period of political uncertainty.

Acutely aware of these factors in our region, we have undertake research and worked with various organisations to help develop our response to these challenge – reports such as A Right to Water; Water Allocation through effective Water Trading; Markets, Water Shares and Drought – lessons from Australia; and Financing Multi-Sector Water Supply Assets.

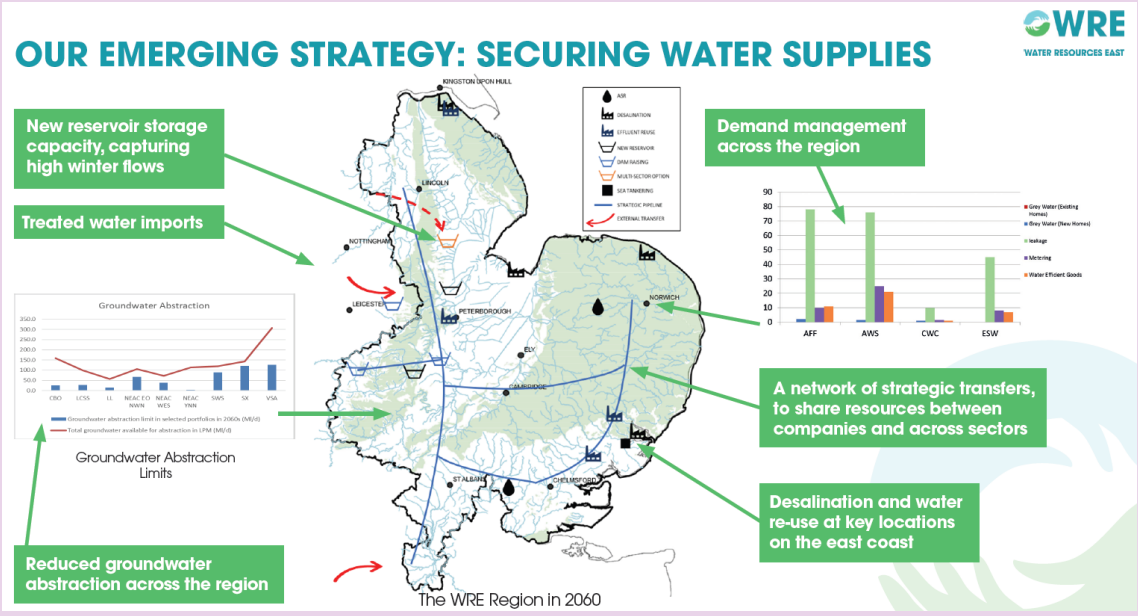
Anglian Water commissioned the Cambridge Institute for Sustainability Leadership (CISL) in 2013 to challenge traditional, single-sector, geographically restricted water resource planning, and to identify the significant benefits of taking a broader, regional multi-sector approach to water investment and management. This work was published documented in a report entitled 'Sink or Swim: A multi-sector collaboration on water asset investment'.

Shortly after the publication of this report in 2014, Anglian Water formed Water Resources East (WRE), bringing together regulators, companies, retailers and individuals in the water, agriculture, power and environmental sector to look at the needs and potential trade-offs across all these organisations and balanced considerations of customers, agriculture, the economy and the need for environmental improvement.

Since 2014, with sole funding from Anglian Water, WRE has undertaken cutting edge, multi-sector modelling work to understand the water resource challenges faced by the region. The output of this work was the stark conclusion that the region is predicted to face a gap between supply and demand of 750 mega litres a day (ML/d) if water resources continue to be managed in the same way.



With the issues clearly quantified, Water Resources developed and agreed a long-term strategy for the region to provide resistance, reliability and spare capacity. This includes multi-sector enhanced demand management, reduced groundwater abstraction for environmental improvement, the provision of additional storage of water within the landscape, a strategic water transfer system across the region, and investigation into potential new sources of water, including the sea. This is the first stage of this multi-decade approach to collaborative water resource management and we will be a lead member of this group and deliver Anglian Water's Water Resource Management Plan activities in AMP7.



There has been significant recent government effort in moving the agenda on regional water resource planning forward since 2016. This has been led by Defra and the Environment Agency, and has been informed by work by Water UK, lead by Anglian Water, and from the National Infrastructure Commission.

Water Resources East has responded to the challenges set by stating its intention to develop a plan to secure long-term resilience in water resources which also seeks to improve and enhance the environment in Eastern England. This single, multi-sector Regional Plan will be co-created with water companies, Local Authorities and Local Enterprise Partnerships, the energy and agricultural sectors, landowners and key environmental NGOs.

The plan will use Six Capitals thinking to:

- Future proof long term plans for water resources for all sectors, whilst looking at wider benefits e.g. flood risk management
- Meet the needs of customers (of all sectors) and local communities
- Facilitate sustainable economic growth in the region
- Enhance the environment, ensuring that Natural Capital accounting is embedded in decision making to identify the best value solutions for the region

The Regional Plan will include:

- Multi-sector water resource management supply and demand planning
- The outputs from numerous catchment pilot schemes, looking at innovative collaborative approaches to abstraction management, land use (looking at Environmental Land Management (ELM) approaches), together with testing the opportunity for multi-sector markets and trading. This technical programme will be underpinned using a new regional academic partnership
- The 'water' components of other organisations' strategies, for example the Local Industrial Strategies published by Local Enterprise Partnerships, Local Authority development and environmental plans, environmental organisation strategies, feedback from community groups and agricultural water abstractor networks

In order to ensure that Water Resources East can deliver this plan over the next five years and beyond, in December 2018, the multi-stakeholder WRE Leadership Group that, to be truly successful, WRE needed to be independent of water companies and other abstractors and users of water. To this end, in June 2019, Water Resources East became independent of Anglian Water, and a new independent legal entity, Water Resources East (WRE) Ltd, a not for profit company limited by guarantee, was formed.

Ensuring Successful Results

Having considered the six capitals and our systems thinking, being a resilient organisation is also dependent on our ability to deliver successful results.

Achieving this is through a combination of our: culture, collaborative approaches, innovation, leadership, social contract and strategy and planning.

We have continued to develop strategies in all of these areas, which support our approach to systems thinking and resilience.

As an example our approach to managing shocks is illustrated in the process below. A culture where we proactively seek to minimise operational impacts to our customers, and seek to continuously learn and improve when we identify deficiencies.

CASE STUDY: Resilience - Incident Management and Response

Our structured and collaborative approach to planning provides resilience for our day to day operations

There are many hazards that can challenge us from severe weather to pandemic influenza, but no matter what the cause, the focus has to remain on continuity of service and our ability to minimise the impact on customers to ensure they continue to have the best customer experience.

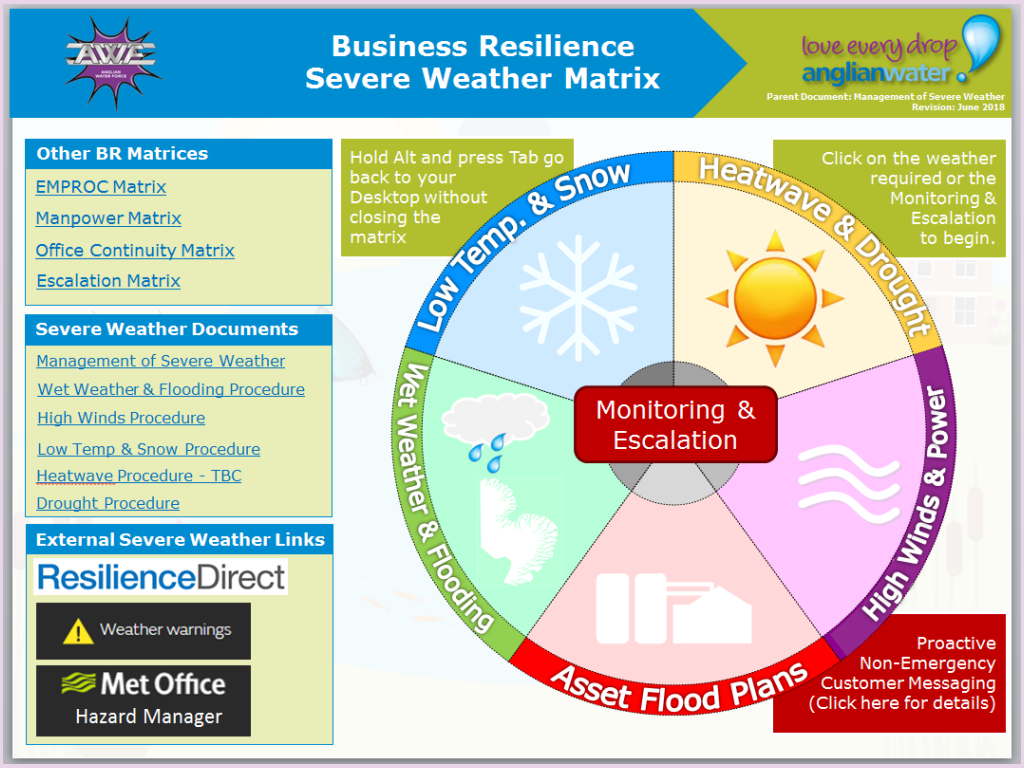
Severe Weather events are a growing challenge; from high winds, snowfall, freeze/thaw events, wet weather, flooding to the ever-looming drought. All these require meticulous resilience planning, but more than ever early escalations and responses are required to minimise their effects on the public and other agencies.

Our plans for incident management and response are governed through a sub- committee of our Management Board – Resilience Steering Group, chaired by our Chief Executive and attended by the majority of Anglian Water Directors. This group focuses on all aspects of our operational and cyber resilience. It assesses and reviews key plans, procedures, issues and lessons learnt from major incidents.

Anglian Water has a comprehensive training and exercising programme which incorporates and tests our well rehearsed Policies, Plans and Procedures for dealing with all manner of incidents, both internal and external.

To further prepare our incident teams there are a number of tools and tactics that we can utilise to provide a quicker response such as our severe weather matrix.

We are actively engaged in our LRFs across the east of England in both planning, risk mitigation and exercising. In large scale multi-county events it's essential that multi-agency forums collaborate together to provide the best possible outcomes for the communities we serve.



CASE STUDY: Our Operational Management Centre – centralised 15 years ago, is well established to provide operational and incident monitoring supporting our systems resilience

Our Operational Management Centre monitors our operation activity and our telemetry platform (IRIS - one of the largest Scada systems in Europe) which monitors our asset performance across the whole of our region. We use both internal and external triggers monitored 24/7 to ensure we have a highly responsive and efficient escalation process which issues happen. This has three layers of escalation and can often trigger early opening of our Operation Management Centre Incident Room to initiate a rapid response which seeks in all cases to minimise impact to customers. The Freeze Thaw event and Summer Demand are prime examples where this escalation was timely and effective.

CASE STUDY: Collaborative approach with multiple agencies creating a operational resilience region

Anglian Water is one of the founding members of the Multi-Agency Support Group - East (MASG). MASG works with all different types of agencies and responders to practice a whole range of different scenarios that one or all of us could be faced with. Other members include power companies, the Military, the Met Office and a number of Local Resilience Forums. MHCLG's RED team also attends and supports MASG.

Not only does MASG work in a prepare and response phase of an event it is a fantastic forum for sharing information, for example Anglian Water shared multiple updates during the heat wave in 2018; updates included our operational status and any impacts which could have affected agencies, promoted our water-wise initiatives and kept everyone up-to-date with our proactive response to managing the water demand issues.

CASE STUDY: Creating a flexible approach to flooding resilience

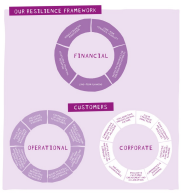
Our programme of flooding resilience measures to maintain service in the event of pluvial, fluvial and coastal flooding occurring has been to include permanent flood defence walls/mounds, flood proofing buildings and the raising of vulnerable plant.

We have also purchased additional lengths of temporary flood barriers. These compliment those purchased by others such as the EA to ensure more robust response to local flooding issues. These have been extensively exercised with our multi agency partners, an example of this was with Exercise Jerboa.

Ensuring successful results is a core foundation of a resilience organisation. We will continue our systems thinking, working with external organisations, bringing outside in thinking to be an organisation that employees want to work for, is proactive in resolving threats from shocks and stresses and continues to apply innovative and proactive approaches to managing the challenges we face.

4. OUR SYSTEMS THINKING IN PRACTICE

Resilience in the Round Framework



We are on a journey to establish systems thinking within our business.

We have made great progress in a number of areas and the following are some highlights of this progress.

The following examples illustrate how our resilience and systems thinking is having a positive impact on our region, customer and stakeholders helping to support our Strategic Direction Statement ambitions.

Financial Resilience

Our business plan submission outlined elements of our extensive financial resilience and stress testing carried out. P268-279 of our Business Plan Submission 2018 sets this out, and further detail is provided in the Shocks and Stresses appendix.

As the Plan shows, we have stress-tested our financial resilience against a range of extreme scenarios. Furthermore, we have taken a number of proactive steps to address Ofwat's comments, including a commitment to de-gear to the mid-70s during AMP7, and accepting Ofwat's gearing outperformance sharing mechanism.

We are concerned about the financeability of the notional and actual company, in the light of Ofwat's current proposed Weighted Average Cost of Capital (WACC), and the overall balance of risk and return reflected in the Draft Determination. Recent reports reflecting on this from credit rating agencies underline these concerns.

However, we believe these concerns will be resolved following due process as Ofwat's financeability duty is discharged. On this basis, and given the stress-testing that we have carried out, referred to above, we can attest to our long term financial resilience.

Our Board will address our concerns relating to the proposed WACC set out by Ofwat at the Draft Determination, and its impact on financeability, as part of its Assurance Statement to our Representation on the Draft Determination.

In addition we have a track record of being financially resilient:

- Our securitised structure with the tight financial and operational covenants has ensured we focus on the interests of the customers, and created strong governance and controls to ensure compliance with financing
- In AMP5 our shareholders injected equity when needed to improve our resilience to the financial crash at that time.
- In AMP6 Anglian Water was the first UK Utility to issue a Green Bond – demonstrating our investments and operational processes meet stringent lending requirements.
- In 2018 we were the first securitised company to remove its Cayman Island company to ensure full transparency of our corporate structure
- We have reconfirmed our commitment in reducing gearing in AMP7, achieved by substantial reduction in dividends to shareholders.

Our Investment Planning

Our approach to investment planning

Our SDS has a specific focus on asset health and long-term investment planning to 'enhance our resilience to growth and climate change'. We recognise the long term need to develop sustainable asset management strategies to extend the life of our assets and ensure that we take a whole-life approach to developing all our assets, physical and otherwise.

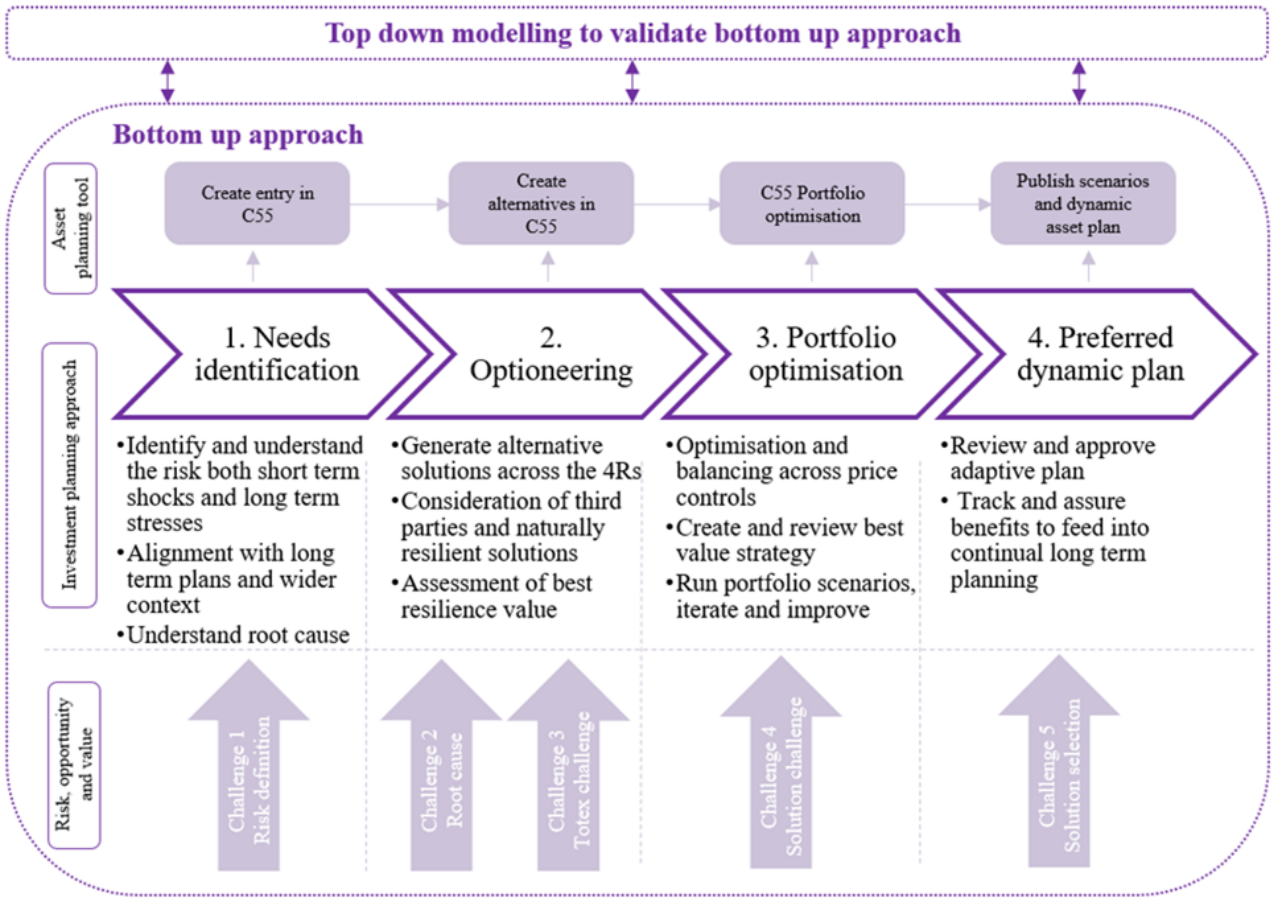
Collaboration is a key part of our culture at Anglian Water. When developing our PR19 investment plan we engaged widely with our customers who told us that good stewardship and investing in assets to ensure reliability of our service was our core responsibility. We have engaged with our all our stakeholders and our teams to create a plan that is both aspirational and deliverable to enhance our resilience for the long-term.

Assessing the future requirements

We have an integrated investment planning processes aligned with our three business streams: Water, Water Recycling and Customer & Wholesale. This is a key part of our business model to help us to ensure resilient and successful results and strengthen our decision making. This process sits at a tactical level, bringing together our strategic planning work and our operations.

Our process is driven from top down and bottom up and is informed by econometric modelling to give us further insight. The high-level investment planning process is detailed below.

High-level investment planning process



Bottom-up investment planning approach

Over the last 15 years we have developed our bottom up investment planning approach. This can be characterised as a four-step approach, overseen by robust governance processes, with internal review and challenge, as well as a robust external review and assurance. Through this 'bottom-up' planning process, we develop investment to address the business, customer and regulatory needs, taking a risk-based approach.

Asset investment planning tool: "C55"

In 2016, we upgraded our asset planning tools with Copperleaf's C55 which provides a robust and flexible common approach to understand, assess, prioritise, optimise and report on all our investments and uses a common value framework. The tool supports each of our four steps of our approach.

Risk, opportunity and value (ROV), and benefits process

We have an established risk, opportunity and value (ROV) challenge process. It is designed to help make the best value investment decisions. Challenges are provided at various gateways of the process which allows us to reflect and ensure we make the most resilient decisions.

Investment planning approach - 1. Needs identification

We understand the wider context for our assessment by considering our long-term objectives and strategies to deliver our SDS, provide a robust service to our customers and the wider community, while complying with our regulators.

We assess the ability of our systems and assets to deliver a service by understanding the impact and likelihood of risk. We undertake detailed modelling to understand these risks at a systems and asset level, through:

a System risk modelling through our Asset System plans. These are live visualisations of risks, issues, planned investments and performance at single works or at system level. The dynamic plans provide a complete view of business risk and investment needs across our asset base, allowing comparison across asset groups, sites and areas. This provides us with the opportunity to take an adaptive approach in response to changing circumstances.

b Understanding the system impact through consequence of failure modelling, we seek to understand the impact a failure could have on our ability to provide a robust service. We also have a proprietary model to undertake a resilience analysis of our systems which allows us to understand the impact of a single point of failure on the whole system. This means we can prioritise investment to enhance the resilience and robustness of our network

c Likelihood of risk through historic activity, historic performance and historic cost run rate. We have forecasted upwards pressures that have not previously been in our base level of spend to improve our understanding of extreme events to ensure that our investment meets the changing conditions of an uncertain world.

d Bottom up asset risk modelling using detailed deterioration models that assess the remaining life of our assets to ensure that our approach is robust. These assess the likelihood of requirement for maintenance spend and allows us to invest in our assets to deal with extreme events.

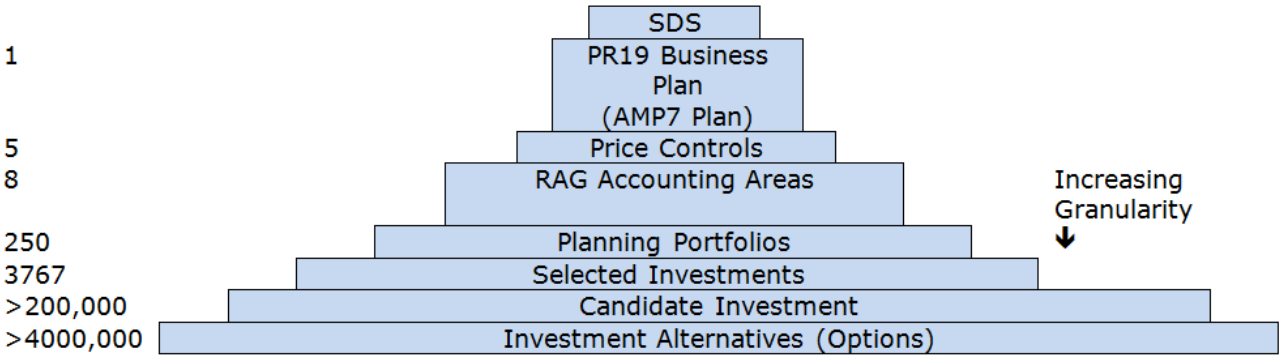
Investment planning approach - 2. Developing alternative solutions (Optioneering)

Once risks and needs are understood, we develop a range of alternative interventions based on how investments enhance our resilience, meet our long-term needs and deliver the best value to customers. Our Totex approach enables us to consider options to improve efficiency and alter processes.

At this stage we also define benefits for delivery of investments, so that these can be tracked and assured. Some of these benefits are articulated as a monetised reduction of risk and others classified under our system of capitals. We bring in new ideas and approaches, considering good practice and innovative solutions from elsewhere. We consider opportunities to collaborate with third parties and create naturally resilient solutions, such as our proposed wetlands to support phosphate removal.

Investment planning approach - 3. Portfolio optimisation

We undertake a balanced portfolio optimisation approach, through an iterative process to build a transparent plan at multiple levels. C55 allows us to develop and run multiple scenarios through varying constraints to ensure that each provides the best value portfolio. We develop cross portfolio scenarios to test this across price controls, to identify better value resilient options, following technical review and assurance.



At this stage we also finalise the benefits for delivery of the portfolio of investments, identified in step 2 of this process, so that these can be tracked and assured.

Investment planning approach - 4. Preferred dynamic plan

We identify, review and approve the investments and plans that provide resilience and the best value to our customers. This enables us to work with our partners and supply chain collaboratively. We publish our plans through a dynamic dashboard which gives transparency of the planned investment to our business and the supply chain. We continually learn from all our projects to ensure we deliver our expected resilience benefits and feed this learning back into our development of future approaches and costs.

Top-down modelling validation

Our top down modelling enables testing of our bottom up approach to investment planning. This provides us with confidence that our investment planning approach is robust and resilient while also being within reasonable limits of affordability for our customers. This stage of the process involved both econometric modelling and a review of the potential future challenges which were not in our historical costs for botex.

How we robustly plan for an uncertain future

It is vital for us to understand how demand will change in the future based on housing growth. We recognise that the data for this is primarily provided by Local Authority Plans. However, since these are aspirational rather than a firm commitment, they are only an indication of what that future may look like.

Therefore, to develop our plans in a more robust manner, we looked for additional sources of data to increase the level of confidence. To support this approach, we assessed Local Plans based on their certainty of growth, this aims to ensure that our service is reliable and there is always some spare capacity in our systems for future growth. This highlights our dynamic approach which allows us to adapt to changes in forecasts and business needs.

CASE STUDY: Systems Thinking – Sewer Smart Infrastructure

How we future-proof, improve the capacity of our systems enable adaptability to change by using innovative approaches

In AMP6 we have developed an Optimised Sewer Networks Strategy. The strategy has been developed in response to the significant operating costs due our topography (flat area requires lots of pumping), tighter flooding and pollution targets and the ability to maintain the operational efficiency of our water recycling assets.

The focus for AMP6 is on risk based, tiered upgrade of our pumping stations monitoring and control and the development of platforms. This enabled near real-time control and visitation of our network with weather integration to improve resistance and reliability of our service.

The heart of the initiative is the ICM Live tool. ICM Live is a new tool that has been designed to enable operational modelling for sewerage systems, it uses real-time data to run and simulate our sewer systems. This provides the capability to predict up-coming issues and implement mitigation strategies, this ensure that we have redundancy, or spare capacity, in our systems. This innovative tool is currently being trailed in the Newmarket area prior to role out across the region.

Our smart sewer network will help:

- prevent repeat flooding complaints by mitigating the issues early on;
- prevent pollution complaints by attending site before it is reported;
- issues would be predicted at specific locations to enable resource planning;
- coupled with event monitoring at specific locations, it could also help prevent ‘other cause’ flooding.

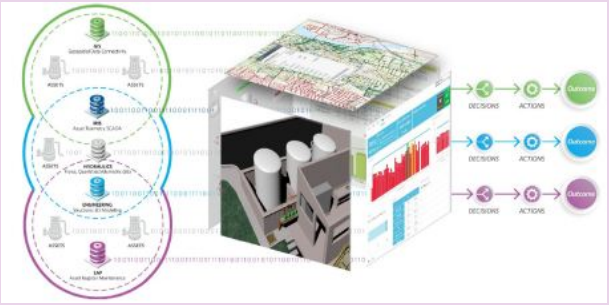
Future plans: The development of this initiative will continue in AMP7 with the more network coverage and the integration of weather information and other external sourced information into the models.

CASE STUDY: Systems Thinking – Creating a Digital Twin of our Strategic Pipeline

How we future-proof, improve the capacity of our systems enable adaptability to change by using innovative approaches

Our Digital Twin for the strategic pipeline can be defined as an integrated accurate digital representation of our physical assets, systems and treatment processes. It will unlock value by enabling improved insights that support better decisions, greater operational resilience and leading to better outcomes in the physical world.

It will enable a resilient network by allowing us to dynamically optimise the asset base from component to systems level in both operational and strategic contexts. This will include the use of predictive techniques for near real-time scenario planning of different operational situations encompassing demand and quality management as well as the means to predict asset performance and failure.



These insights will be made available to the entire organisation ensuring a unified view of the network, with action being initiated proactively in a manner that risks are understood through scenario testing and mitigated by predictive intelligence.

Strategically the digital twin will dynamically inform our risk-based investment decision making process through directly captured asset data ensuring we proactively identify deterioration to intervene at a cost, risk and performance optimum thus completing the asset lifecycle and sustaining asset resilience.

Operational Resilience

The fundamental basis of operational resilience has been to maintain a strong performance track record, focusing on leading customer service in the sector as well as delivering excellent water quality, leakage levels and water recycling compliance. We are one of the best performing water companies across the suite of operational measures and in AMP6 achieved the top performing customer service WASC.

We maintain good relationships with our quality regulators (DWI /EA) based on our open communication and performance – this has led to us supporting others to improve their performance.

- We have built on our incident responses – over the past 10 years we've seen the hottest, driest, wettest, coldest periods for over a century. As a business our approach to resilience has ensured we remain within our operational parameters with minimal impact on service to our customers or the environment,
- We were referred to as having benchmark Water Quality Performance by the DWI compared to poorer performance of other large Water Companies. See Section 2.

In 2019, an external high level review of our operational resilience within Anglian Water was carried out to provide an assessment of the capabilities, processes, behaviours and systems that we have put in place to create an integrated resilience programme. The review found that:

- A robust framework of plans has been put in place that would support our crisis management response. The framework allows the plans to be scaled and flexible in order to provide a proportionate response to a crisis event.

- Central coordination of the plans is the responsibility of the crisis response team. Roles and responsibilities for the team have been defined and is resourced with capable senior individuals within AWS who have received a good level of training for their role.
- A variety of communication strategies are in place to support the sharing of updates and information during a crisis. The strategies consider requirements for both internal and external stakeholders. A variety of communications channels are available, including email, SMS text messaging and an established social media presence.
- An exercising programme is in place to test and validate the plans. Furthermore, plans have been used in an active scenario to respond to a real incident, and were seen to be effective.
- There were also some minor improvements recommended, which are currently underway.

Corporate Resilience

We are the first Water Company to have embedded public interest at our core, a fundamental change which legally enshrines public interest objectives within the company's constitution of which resilience is a key component.

We continue to seek opportunities to embrace innovation – where it is beneficial and cost effective. Our strategy is not to develop products ourselves, but to work with others to help them achieve this – our Innovation Shop Window in Newmarket is a prime example of this in action.

We also continue our commitment to professional skills development through our Licence to Operate programmes. In January 2019 we became the first water company in the UK to secure the latest Competent Operator Scheme (COS) certificate from the water industry competency assessment body Energy and Utility Skills, in close coordination with the Drinking Water Inspectorate (DWI) regulator.

We want to ensure our culture is one where people are able to bring their whole selves to work; we are able to attract talent that reflects the diverse nature of our community and develop skills for the future of our Industry. To give us a broader perspective we have signed up to the EU Skills Inclusion Commitment statement, which, amongst other things is a commitment to ensure that our workforce reflects the diverse nature of our communities. #energisinginclusion and the BITC Race at Work.

Recognition and feedback by others is important to ensure we're doing the right things and over the past few years we have received many awards:

- The first water company in England and Wales to be invited to join the **Leading Utilities of the World** (A global network of the world's most successful and innovative water and wastewater utility providers)
- **Water Company of the Year** 2019: Water Industry Awards
- **Responsible Business of the Year** 2017 (Business in the Community),
- Glassdoor **Best Place to Work** 2018
- **Utility of the Year** 2018 (Utility Week),
- **Queen's Award** 2015: Sustainable Development
- The Royal Society for the Prevention of Accidents – **Gold Award**

Our Life (safety) programme and wellbeing initiatives are all focused on increasing our employees resilience to the demands of the business, ensuring they are safe at work, but also maintain their own wellbeing.

We are also implementing a re-organisation that increases the line of sight between our activities– ensuring everything we do links to the end needs of our customers

The utilisation of information and data is critical in to the future – we have establish a Data Science capability working closely with local academic institutions and our alliance partners to be able to exploit the use of data to support the delivery of customer outcomes and asset maintenance in AMP7.

We provide a number of examples to illustrate our systems thinking in practice that draw on all elements of our resilience framework:

- How our systems based approach to resilience has enabled us to have the lowest risk to water quality in the industry.
- How our established resilience preparations and practiced response to the Freeze Thaw event ensured minimal impact to our customers
- How our response to an incident on the Humber Bank in 2018 has had resilience benefits wider than just to Anglian Water – creating great resilience and understanding between competing companies as well as a more robust system.
- The line of sight of how our approaches to delivering two outcomes (Pollutions and Interruptions to supply) draws on all aspects of our Business Model from assessment of shocks and stress, the application of 4R's and our Resilience Framework through to delivering our Strategic Direction Statement ambitions.
- How working with others (e.g. Highways, local communities, EA etc) we have applied systems thinking to make communities more resilient to flooding and how we have optimised the long term health of our assets.

CASE STUDY: How our systems based approach to resilience has enabled us to have the lowest risk to water quality in the industry

Resilience elements	How our systems based approach to resilience has enabled us to have an industry leading water quality risk profile
Financial	
Protected finances for the regulated business	• Clear budget and investment allocation by the Board to ensure maintenance priorities are managed and addressed
Sustainable long-term financial planning	• Clear linkage of our Business plan - investments and activities with line of sight to our Strategic Direction Statement and customer priorities • Long term priorities identified addressing Maintenance, Customer, Supply Demand and Quality of key strategic investment areas – see P17 Anglian Water PR19 Resilience Assessment Update in Appendix.
Robust financial monitoring	• Detailed Financial and Performance reporting to Management Board and AWS Board • Strong assurance processes to verify data reporting processes to ensure accuracy and reliability of reports • Our CTA compliance processes are extremely robust providing additional assurance and controls due to the ring-fencing arrangements relating to financing.
Corporate	
Clear strategic direction	• Clear line of sight between our Strategic Direction Statement, out customer outcomes (and ODIs) and business priorities – ensures management focus reflects the range of challenges we face. • We have documented our longer term strategy for water quality our Long Term Planning for the Quality of Drinking Water Supplies. This complements our Water resources long term management plan. Together these provide the framework for meeting the long term challenges of increasing resilience to drought and climate change for our customers, improving the environment in our region and supporting significant economic and population growth in our region.

	• Clear linkage and line of sight of business priorities down into teams through the development of our "Strategy on a Page" concept within Anglian Water
Effective governance and assurance processes	• Director led sub-committees provide strong governance – e.g. Water Quality Group applies lessons learnt from both Water quality compliance and pollution incidents. Our Resilience Steering Group is key component of operational risk management governance and is a board level group • All our management systems are being assured against the Common Framework, achieving our goal of operating to an Integrated Management System within our Business • First in the industry to be certified against a range of business standards – e.g. ISO 22301 Business Continuity which ensures our processes are designed appropriately and followed within the business • We operate to a suite of policies, standards and procedures including those for water supply (POSWSH) reviewed on a regular basis and assured under ISO 9001. • We are certified to a range of management systems which are part of our overall governance and assurance process.
Effective business continuity planning	• We have system and processes in place for all elements of business continuity planning and the only water company certified to the Business Continuity Standard IS0223001 through Lloyds Register. • We have specific site Response and Recovery Plans and for critical activities specific Team Process Recovery Plans • We regularly run exercise incidents with multi-agencies across the region to ensure preparedness in the event of a real incident.
Comprehensive horizon scanning	• We review Mega trends at management board level to assess future trends • We also engage with various academic institutions to bring outside thinking in. • We monitor changes in regulations and standards that will impact our operational approach or need for further testing of samples. • We are also active in cross industry groups to maintain Water Quality standards and understand best practice.
Inclusive customer engagement and co-creation	• Our Love Every Drop strategy and our PR19 customer engagement programme puts customers at the heart of our operational focus and water quality thinking. • We have extensive Water Efficiency programme as well as bylaw inspections that help protect customers from Water Quality issues • We have also engaged with customers in our Newmarket shop window which supports are approach to quality and efficiency.
Engaged stakeholders	• We work closely with DWI and have helped pioneer the use of secondments between our organisations to help develop individuals as well as understanding of each other. • We've developed a unique Multi Agency Support Group which provides additional response during major incidents affecting our region
Active role in the regions and community	• We have various customer and community programmes, such as Keep Water Healthy Water and our water saving initiative 'Bits and Bobs' • We also actively work with schools and colleges as part of our Water Education programme improving awareness of water quality issues and water efficiency
Comprehensive health, safety and wellbeing	• Life programme including wellbeing, approaches to safety delivering strong safety performance • Employer of choice – strong culture to support and deliver for our customers and environment

Collaborative and adaptive organisational culture	• We have made organisation changes to increase line of sight of water supply activities and to create line of sight to our customers • Working with external companies through our Shop Window to test new approaches to water quality, leakage and working with partner and suppliers to test solutions • Water Innovation Network – unique partnership between Anglian Water, Allia and Opportunity Peterborough creating innovation and collaboration in our region with suppliers
Operational	
Continuity of service to customers	• A systematic approach to Business Impact Assessment ensures team Processes Recovery Plans are in place to continue all critical services • All hazards approach used to ensure we manage risk and are prepared able to respond effectively and ensure appropriate recovery • Asset Response and Recovery plans are in place to minimise customer impact • We have emergency plans in place and assure these plans through training and exercising both internally and with external agencies • We ensure continuation of supply through a dedicated supply restoration team (see I2S case study) • Use latest technology (acoustic noise logging) allow us to identify and repair leaks before customers notice them and they have an impact on service • "Calm" our network through pressure management and transient identification reducing bursts and supply interruption events. • We have used a structured Hazop style approach to identify single points of failure and develop mitigation measures under our 'too critical to fail framework'. Risks are dynamically visualised using a dashboard. • Alternative supply plans are in place to minimise customer impact • During events where ever possible tankers are used to pump in to supply to ensue continuation of service • When alternative supplies are needed we have water tankers, tanks and bowsers. • Collaborate with LRFs and other agencies to provide a combined approach to minimise service impact • Engage with others to ensure best benefit from Mutual Aid if needed • Collaborate with others to ensure Lessons Learned are fully embedded • We have certification to ISO223001 business continuity standard
Robust long-term water resource management planning	• For the first time this AMP we have documented our longer term water quality plans: Long Term Planning for the Quality of Drinking Water Supplies • Our Water resources management plan ensures we plan for the long term provide the framework for meeting the long term challenges of increasing resilience to drought and climate change for our customers, improving the environment in our region and supporting significant economic and population growth in our region. By using adaptive planning principles we ensure that our plans provide for known challenges and future uncertainties.
Reflective risk-based approach to asset health	• Water quality risk is effectively managed at a systems level using a well embedded drinking water safety planning (DWSP) approach. The primary objective of this approach is to identify and quantify the risks to water quality from catchment to consumer. • Our Policies and Standards for Water Supply Hygiene documents all control measures at a policy, standard and procedural level and underpins our DWSP approach.

	• Our regulatory and internal monitoring sampling programmes are key validation tools to confirm the effectiveness of our approach. The sampling teams are fully accredited through UKAS. • Anglian Water is one of only two companies recently certified (01 August 2019) through Lloyds Register for the DWI Risk Management Approval Scheme, which verifies that water companies have implemented a risk based drinking water safety plan process. • Our impact planning process ensures risks to water quality are assessed before any planned work is undertaken on our water treatment works and distribution network. This robust process has been reviewed by the DWI and seen to be industry leading and maintains the highest level of water quality. • We actively seek to understand and learn from industry events and near misses relating to water quality through our robust "could it happen here" process. Key learning points are disseminated throughout the business using a variety of communication channels. • Moving from a 10 year internal inspection frequency to a risk based asset condition score to inform the inspection frequency for our storage point assets on WTW and in the distribution system in conjunction with risk based sample point replacement and our hatch refurbishment programme have resulted in a reduction in coliform failures at our WTW and storage points. • Our strategy of operational response to small clusters of acceptability complaints in conjunction with our risk based planned preventative maintenance programme and customer engagement through social media has resulted in a year on year reduction in the number of customers contacting us in relation to the acceptability of their water – a key DWI measure. • Our Water in Buildings strategy is predominantly delivered through a robust risk based programme of Water Fittings inspections protects water quality through identifying plumbing issues and cross connections. • We have a significant AMP6 Capital Maintenance and Quality Enhancement programme to ensure that we maintain and improve our drinking water quality. Investment is prioritised using our Risk and Value process. Risks are identified and quantified using our Business Impact Matrices (BIMs) which prioritises investments on customer service measures. Water quality, safety and continuity of service contribute the highest weighting to the BIMs scoring process • Historical asset performance and maintenance strategies are regularly reviewed. Maintenance tasks are prioritised with water quality and safety related task given the highest priority. • We have led the industry in adopting process principles and learning from hazardous industries applying it to safety and water quality. Using HAZOPS and layers of protection analysis (LOPA) to identify hazards and control/mitigation measures. • We look at risks from 'Source to Tap' using system level thinking to identify all risks to our customers and the most cost beneficial investments to mitigate those risks. • A number of water quality scientists have undertaken 6 month secondments to the DWI which has brought significant learning back to the business and developed our team. We use this learning to regularly carry out 'DWI style' in depth risk based audit programmes across all aspects of our operation (catchment, site and network operations)
Innovative, collaborative, naturally-resilient approaches to risk mitigation	• Our focus on catchment management protects water quality at source by preventing pollution getting into the water rather than relying on costly, less sustainable, end of pipe treatment. • Our metaldehyde strategy has delivered us significant benefits in reducing metaldehyde levels in our reservoir tributaries and treated waters. Our Slug It Out programme of collaborative working, stakeholder engagement and taking a

	catchment-based approach via our team of catchment advisors combined with management of our abstraction points have significantly improved our Compliance Risk Index (CRI) due to reduced metaldehyde failures. • Our catchment surveillance process uses our operational teams to identify and report up changes in land use around our raw water sources. Immediate actions can be taken through our catchment advisors and the water quality risk reassessed. • Through our innovation team, and our strong links with academic partners at key universities, we are currently working to understand what the next generation of water treatment processes will be. • Our industry leading lead strategy covers all seven measures which should be in all companies risk based approach to lead. A key focus in this strategy is stakeholder and customer engagement. • Keep Water Healthy campaign to educate and change customers behaviours in the home. The campaign is actively promoted through our website, social media channels and events across the region. The clear aim is to raise awareness of potential water quality issues and what can be done to prevent these in the home. • Our innovation programme works in collaboration with the industry and suppliers to identify new technologies to better manage risk. Innovation projects are selected and sponsored by business experts to meet operational risks and opportunities.
Robust and flexible supply chain management	• Long term relationships with capital Alliance partners ensure that there is resilience in our fully integrated workforce with our extended supply chain being familiar with our assets, risk management processes and procedures • We ensure that critical chemicals have robust supply chains and where possible multiple supply sources to increase resileince. • Chemicals used in our water treatment processes and compliance with Regulation 31 has been a significant area of focus. A 'chemicals in contact' process, workshops with all suppliers and a risk based audit programme gives us confidence in Regulation 31 compliance.
Inclusive and skilled workforce	• Large intake of apprentices every year in Mechanical, Electrical, Operations and Fleet management and digital apprentices. Also Wisbech training centre is not just AW but also skills for our Alliance partners • We are leading the industry in developing a Licence to Operate for our water quality scientists which covers training, competency, external validation and continuing professional development (CPD). • Our LTO programme for all our operational staff and managers covers training, competency, external validation and continuing professional development (CPD). There are modules specifically focussed on operational risk management and incident management. We have invested heavily in leadership skills development for our managers improving team performance. This is evidenced in our high Employee engagement scores
Robust, integrated and flexible technology	• Our Water Quality risk portal allows the business to easily visualise water quality risk at an asset. • Significant investment at our WTW has resulted in a multi barrier approach to our key water quality shutdown systems reducing single points of failure and providing greater protection for our disinfection processes. • Using process safety principles we have developed SIL rated disinfection shutdown systems trialled in AMP6 with the clear aim of roll out in AMP7.

	• Our industry leading telemetry systems has the most extensive coverage of our asset base in the industry. This links to our operational management centre, ensuring accurate information for all operational decisions • We have established working with Airbus, advanced cyber controls and systems that help protect our assets and operations.

CASE STUDY: Freeze Thaw Event and Hot Summer

How our established resilience preparations and practiced response to the Freeze Thaw event ensured minimal impact to our customers

In 2018 we faced several severe weather events which put a significant strain on infrastructure across the UK. Both the 'Beast from the East' in March 2018 and the heat wave in July 2018 have put our extensive plans into practice to manage and mitigate the impact. MASG and LRFs across the East of England were engaged in regular updates to share the latest information and promote good practice.

Freeze Thaw Event

In the water sector the rapidity of the thaw following an extended freeze caused challenges with burst mains and leaks from customer pipes and company networks. The combination of freeze and rapid thaw also caused substantial ground movements and resultant mains bursts, particularly in the Fens. Getting personnel to and from work safely remained a key priority for our critical staff and we utilised our 4X4 fleet as well as booking hotels close to key working locations.

Our well-practiced emergency response and incident management meant that the majority of our customers experienced no impact from this event. We even initiated our incident response before the event to ensure we were prepared, and that our response and recovery was effective. Our incident rooms and incident teams worked 24/7 for 10 consecutive days to respond and recover from this event. An Incident Director was also appointed throughout to ensure strong leadership, governance and direction.[1]

Our success in minimising the impact on customers stemmed from a number of factors, including:

Putting innovation at the heart of what we do: from the work of our Insight and Data Science team and our dashboard information system, which drove our operational response and ensured we targeted our resources to address areas of greatest need, to how we work differently with our supply chain and our customers, to investments in our Integrated Remote Intelligence Service (IRIS) system, including our leading Integrated Pressure and Leakage Management System (ILPM), co-developed with Schneider, to our enhanced telemetry, condition monitoring and modelling and information systems:

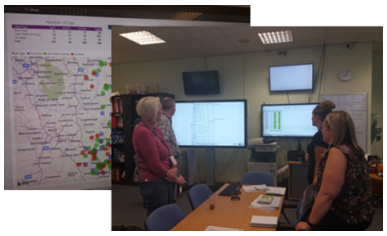
- Our industry-leading position on leakage. This means we lose less water from our networks, we are more resistant and so are better placed to cope with spikes in demand that flow from an event like this;
- Our customer-centric approach of 'restore, repair, recharge' to focus first on meeting customer needs (including redeploying water recycling assets) rather than fault repairs;
- The collaborative approach we have pioneered with our supply chain: our unique alliancing model saw us quickly deploy 119 gangs and over 400 people to address problems;
- The quality of our customer and stakeholder communications, both proactive and reactive, across all channels to try to reach the widest range possible;
- Investment in resilience schemes, which has reduced the numbers of customers dependent on a single source of supply, improving service reliability, gave us more options to minimise customer impacts in this event. This was combined with strong preparation across the company for this

1 see Appendix 5 – How Anglian Water responded to the 2018 Freeze/Thaw Event

event, to ready ourselves operationally and to ensure proactive communications with customers before the event occurred. We executed our resilience planning systems and incident room approach, before the incident (to ensure we were ready) and during, and showed strong leadership throughout, with a Director heading our response, 24 hours a day.

Summer Heat Wave

The UK was hit by a heat wave during July 2018 and Anglian Water alone saw a 20% increase in water use by customers across the East of England due to the hot weather. We opened our tactical incident room throughout this period to ensure our water supplies remained resilient. The incident room was open for over 35 days and involved over 250 staff directly in the incident room.



Our operational teams worked around the clock to manage water supply and demand. MASG partners were engaged throughout the event.

Our Think Fast, Think Big approach meant that customer impact was minimal across both severe weather events. Our success stemmed from a number of factors;

All of the above work is in place to ensure we are able to quickly and effectively respond to incidents and events, ensuring our services are resilient and our customers are unaffected in all but the most serious incidents.

CASE STUDY: Humber Bank

How our response to an incident on the Humber Bank in 2018 has had resilience benefits wider than just to Anglian Water – creating great resilience and understanding between competing companies as well as a more robust system.

This case study is an example of how we responded to a major incident following the burst on a strategic raw water main supplying major oil refineries and power generators on the south Humber Bank. It also highlights how as a result of our approach to response and we recovery use innovative approaches for lessons learned and project delivery. Therefore we have a more resilient system far beyond simply fixing a burst pipe. By building resilience incrementally from "source to tap" rather than focussing solely on the burst as the perceived root cause, the risks of future service failure in this UK important supply system are now materially lower in all respects.

Background

Around 42Mld of raw water is abstracted from the River Ancholme at Cadney and pumped to Elsham WTW's to be treated to a non-potable standard suitable for the major industries of the Humber Bank. These end-users include two major oil refineries responsible for around 25% of UK petroleum production and two power generators material to the resilience of UK power infrastructure. Abstraction is continuous and 45Ml of treated water storage at Elsham provides demand resilience.

The Event

In January 2018, a burst occurred in a 5m deep valve chamber adjacent to the M180 motorway leaving water production at Elsham WTW's off-line. Our alliance repair teams were mobilised immediately but given the scale, location and complexity of repairs, supplies from treated water storage at Elsham were ultimately lost to end-users. Our Company Incident Room opened early to manage the event supported by our Anglian Water Force (AWF) and whilst the speed of repair allowed water supplies to be restored at factory gates within hours, the effects on water quality and end user site treatment processes were extended into days. The LRF was opened and end-users/retailers were updated through regular conference calls over the course of a week as we supported their full restoration of supply. This was a major event and the reputational impact at the time was material within the non household end user community. Our end users later admitted

that they took their water supplies for granted given the historic reliability of our supply system operations and unlike power, they had given little consideration as to how to manage even short term low pressure or interruptions to water supply.

Post Review Process

A comprehensive lessons-learned report was commissioned within a week of the burst which was led by an independent operational senior manager. The report made 24 recommendations & suggestions. It confirmed that a number of individual contributing factors led to service failure.

A governance board was created within a month of report publication with a brief to oversee recovery and re-build resilience incrementally across assets, processes, communications with end-users/retailers, upstream assets managed by the EA and downstream assets managed by end-users. As the project progressed, it exposed the breadth of interdependencies between stakeholders served by this system and enabled proper understanding of the root causes and actions needed to drive incremental resilience improvements. By example, we liaised with over 80 landowners and tenants both formally and informally during pipeline investigations and minor works. We also ran 2 Non Potable end-user/retailer-wide events and ran 4 workshops with the oil refinery and power generation representatives. We have run 3 workshops with the EA to date covering upstream assets on the regulated river system and continue to share our learning with the EA to encourage intelligent investment to benefit all abstractors.

An innovative and collaborative approach to project delivery was adopted across our operational teams, partners (IMR & @ONE), the EA, our end-users/retailers and supply chain. This is delivering a 2 year programme of asset, process and communications improvements to lessen the risk of a further event occurring but also will underpin our communications and collaboration with all partners during any future event which will drive more timely and robust event recovery and outcomes.

Lessons Learnt and Post Review Enhancements

To illustrate the comprehensive approach we have taken and the far reaching benefits to building incremental resilience, the following areas are highlighted:

Processes, Assets and Maintenance: to address concerns about why a cast iron fitting suddenly failed and whether the risk of further failures existed, 27 chambers were inspected, cleaned and covers renewed. Cover renewal was an enabler to build capability for safe and efficient access for future maintenance along the pipeline source to tap but also enabled innovative Non Destructive Testing of all cast iron fittings in-situ without service interruptions. A remote camera inspection process for chambers has also been trialled and will be used by our own Network Technicians during routine PPM to remove regular confined space entry. At Elsham works, extra on-line monitors linked to telemetry have been fitting both at inter-stage and on final waters to enhance treatment processes during BAU and in emergency start-up. On the steel pipeline, we have also installed modern cathodic protection systems with new ground beds to enhance asset life and reduce whole life costs. New pipeline marker posts have been installed to help landowners/tenants along the pipeline route to identify the pipeline route and to provide emergency contact details. Circular discs were mounted on top of marker posts; a simple innovation to assist leakage surveys by drone in future.

Transient Analysis: continuous transient pressure monitoring is in place both on the upstream pumped and downstream gravity mains from Elsham works. (Transient graph) With pumps optimised and new pump operating protocols in place, transient pressures have reduced and a material risk reduction achieved. Recognising transient pressures can originate from end-users, analysis of downstream transients identified an end-user with a harsh inlet valve to on-site storage. Sharing data with this end-user and working closely with them, their valve actuator was re-programmed and transient pressures eliminated. This had an immediate benefit in reducing risk of burst mains in the local AWS network and gave an explanation for those bursts seen in the past decade. Analysis

has also been recently done on the EA upstream river transfer pumping station moving water from the river Witham to Ancholme upon which we depend. This has identified damaging pressure waves during pump operations. Collaborative work continues here to find a solution thereby adding further incremental resilience to this supply system.

Asset Reinforcements: our hydraulic model was recalibrated for the pumped system from Cadney to Elsham and existing surge protection was optimised to reduce the amplitude of transient pressure waves on pump shutdown & start up. This mitigated the extent of shock on the pipeline for the future adding another vital element of incremental resilience. A further 41 fittings along the pipeline were tested by taking small core samples from individual flanges and doing laboratory microscopy. 4 bends of similar or more significant weakness were identified and an external structural wrap to withstand 16 bar pressure was applied immediately to each fitting in-situ without service interruption thus eliminating risk of future catastrophic failure.

Response preparation: whilst the mobilisation of repair teams was immediate, learning was captured to both create an enhanced range of critical large diameter network repair spares in the area and to provide a road ready Resilience Trailer containing all essential equipment to access and carry out large diameter mains repairs. Large diameter pipe cutters are an example of equipment that is in short supply from contractors in the UK and often available out of our region but essential to carry out large diameter pipe cutting safely. Based at Elsham in an area of important strategic mains but available region wide, this trailer has been used to support repairs and reduce downtime already in the south.

Business Collaboration: to re-build end user/retailer confidence, we ran a non potable user event in the area within 3 months of the event to apologise, to give open and honest feedback on our investigation and to outline our plans to explore contributory factors to the event. This was also a call to action for our key end users/retailers to engage in separate workshops to improve communication and understanding of our respective water supply systems. We ran a further event "1 year on" to feedback our work and findings inviting 2 end-user speakers and a senior EA speaker as public recognition of our embedded collaboration. We ran 4 workshops with the refineries and the principal power generator to test water supply and water quality scenarios designed to develop a market compliant play book for each of the four 24-hour control rooms. We have also scenario tested resilience flows of water available from our groundwater system if Elsham water is unavailable. As a result, end-users have now pre-planned their site actions to reduce demand and support continuation of oil processing and power generation at reduced levels whilst normal water supply is restored. Feedback from end users/retailers suggested that the end-users had never met in such a forum owing to their competitive positions and the co-creation of shared operational protocols has enhanced their own site understanding, resilience and collaboration. One end user quoted that "this valuable process would not have happened had AWS not facilitated these workshops". Finally, we have also led workshops with the EA to share learning and apply this to upstream assets upon which we depend. An EA/AWS Working Group has been formed with membership to include an end-user representative; further evidencing our approach to embedded collaboration source to tap. Sub groups continue to work to develop plans to enhance resilience of systems, water quality and communications between AWS/EA. Finally we have shared our learning of our event management through presentations at MOSL specifically around incident management/ communication via retailers and have had bipartite discussions with one other wholesaler.

Resilience Dividend

Through a logical and thorough event investigation, a robust "source to tap" resilience position was fully understood and a baseline created. With this baseline, plans were then set to improve resilience incrementally in the belief that each small step brings a material and valued stepwise reduction in risk. Big winners were prioritised first (transient reductions) with improvements in asset integrity (NDT testing and structural wrapping) followed by scenario testing in workshops with end users and separately for the EA. Had our approach to the burst been to simply "find and fix", the opportunity to leverage the significant resilience dividend we have achieved would have been missed both within AWS but also upstream (EA) and downstream (end users & retailers).

CASE STUDY: How working with others (e.g. Highways, local communities, EA etc) we have applied systems thinking to make communities more resilient to flooding and how we have optimised the long term health of our assets and avoided the need to invest over £20m in the future.

Overview

Our pioneering partnership funding approach (the first in the industry to actively do this), was established in AMP6 with £8.5m of funding available to support the Government's approach to funding flood and coastal erosion risk management. Back in 2011, Defra announced changes to the way funding is allocated to flood and coastal risk management projects. Government will meet a proportion of the costs, with beneficiaries expected to make up any shortfall. We therefore decided that during AMP6 we would take a positive stance on Partnership Funding where the customer benefits.

Such an approach also means that we can do more for less, whilst working with our customers and partners to make the East of England resilient to the risks of drought and flooding. Such an approach also helps to meet Defra's goals for Enabling Resilience in the Water Sector (Defra, pp16). Defra highlight that 'Collaboration with other parties who have drainage responsibilities is important. Sewerage companies can continue to develop partnerships with local authorities, environmental groups and others'.

During AMP6 we are working in partnership on 49 separate schemes with 22 separate Risk Management Authorities. This will deliver a range of benefits, including reduced flood risk from a range of sources, including surface water, sewer, fluvial and coastal flooding, reduced loss of service, reduced pollution, creating resilient infrastructure, and improving places for people to live, and significant cost avoidance to our customers, currently over £22m.

Two examples of working in partnership are outlined below:

Stamp End, Lincoln

Back in 2007, a storm event passed over Lincoln that resulted in 77 dwellings flooding internally, including a large block of flats. There were additional properties that flooded externally, extensive flooding of the highway and local businesses, and 80 households were evacuated to temporary shelter. All of the properties affected by this flooding fall within the 20% most deprived areas as defined by the Office of National Statistics.

This incident also prevented access to Anglian Water's offices at Enterprise House in Lincoln, causing major disruption to the running of our Operations Management Centre (OMC) on an unbelievably busy day.

The same area flooded again in 2009, although not as severely this time around, resulting in external flooding in several streets.

The Lead Local Flood Authority in this area, Lincolnshire County Council, identified a partnership approach to jointly fund a flood risk reduction project. Completed in early 2018, this approach significantly reduced the risk of flooding to the properties previously affected and ensured that Anglian Water's OMC is reachable by staff even in times of heavy rain.

The partners involved in the scheme included Lincolnshire County Council, the Environment Agency, a major local business and the local Internal Drainage Board, as well as Anglian Water. Cllr Lewis Strange, Chairman of Lincolnshire County Council's Flooding and Drainage Scrutiny Committee said: "This scheme will help to reduce the risk of flooding to hundreds of residents in the Stamp End area and I am delighted that Anglian Water are helping to fund this work in partnership with ourselves, the Environment Agency and the Witham Third Internal Drainage Board. This is a fantastic example of how the different authorities involved in managing flood risk can work together to benefit the lives of our communities".

Clacton on Sea

In Clacton on Sea we have a very large trunk sewer along the sea front, constructed in 1999 to collect all the wastewater from the town, which was at risk from coastal erosion. If this tunnel was to fail, approximately 90% of Clacton would be without mains sewerage service and bathing waters would become polluted.

Tendring District Council led work to deliver enhanced sea defences that would protect the town, and our critical infrastructure from coastal erosion.

To assess if we should contribute to the works we undertook an independent review of the rate of erosion, as well as cliff face and slip circle analysis, to see when and if our sewer would be affected in the event of coastal erosion. The work identified that the sewer would fail if the coast was allowed to erode at some point between 15 and 50 years time.

Given the potential widespread disruption to customers and the impact on the environment, as well as the substantial costs of building and/or repairing a trunk sewer, we concluded that it would be appropriate to work in partnership with Tendering District Council and contribute £3m (less than 10% of the total scheme costs) towards the project, a potential saving to customers of c. £20m.

CASE STUDY - Interruptions to Supply and our Business model approach

This case study highlights how our Business Model approach has supported the delivery of our Interruptions to Supply strategy; drawing on all aspects of our Business Model from assessment of shocks and stress, the application of 4R's and our Resilience Framework through to delivering our Strategic Direction Statement ambitions. It also shows how delivering this particular outcome has strong interdependencies across our business, as well as but fundamentally helps support delivering our long term strategic direction statement

Pressures Facing the Industry

(Horizon Scanning / Shocks and stresses)

The likelihood of interruptions to supply and their impact on customers can be caused by a range of shocks and stresses.

In developing our Interruptions to Supply strategy – we have assessed relevant shocks and stresses that are contributing factors

For example – shocks such as:

- power outages,
- asset failures,
- extreme temperatures
- third party damage to our infrastructure

and stresses such as

- ageing infrastructure,
- shortage of skilled workers,
- high leakage in the system,
- the impact of weather linked to changes in our climate,
- increase growth in our region.

Whilst our customers in our region have said they are satisfied with our performance during AMP6, we are targeting to improve.

In AMP7 we plan to go further to reduce the impact of interruptions to supply on our customers, with increasingly challenging targets being set for AMP7, targeting companies to deliver upper quartile industry performance

Six Capitals Thinking

We recognise the impact our activities have on the six capitals and will continue to develop our thinking to support our decision making. Our six capitals thinking already includes a strong natural capital – carbon reduction, but will look to understand further the interplay between the six capitals (Natural, Social, Human, Manufactured, Financial and Intellectual).

In our systems thinking we already see elements of all of these, from use of innovative technologies, our communication with customers, and our use restoration teams.

The Positive Impact We Make

Reducing interruptions has a positive impact on the communities and customers we serve. Increasing our resilience to drought and continued improvement in the management of our infrastructure will support our long term ambitions :

- Make the East of England Resilient to the Risks of Drought and Flooding,
- Enable Sustainable Economic and Housing Growth in the UK's fastest growing region,
- Be a carbon Neutral business by 2050 and
- Work with Others to achieve significant improvement in ecological quality across our catchments

The Outcomes we deliver

Delivering a reduction in interruptions supports a range of our customer outcomes . From providing safe, clean water through to a positive impact on our communities, a systems approach to interruptions

By delivering on this commitment we also support the delivery of other outcomes – such as leakage reduction, providing evidence for others to save water, through efficiency and behavioural change.

Our Planned Investments in AMP7

To deliver our proposed targets, investments include:

- Auto / remote rests of pumps and critical assets
- Installation of generator sockets
- Securing critical communication links and site monitoring / new alarms
- Deep main risk mitigations at sites and in the network
- Increased restoration equipment, resources and line stops
- Increase network interconnectivity and critical booster installation
- Critical spares stock increased and emergency equipment increased – e.g. mobile generators for sites
- Data analytics to further develop system models
- Event data capture app to improve data quality
- Valve operation transient app to capture valve operation data

Systems Thinking

Risk Management
Analysis of performance and risks informs our strategic planning, regular reviews of root causes of failures and process controls are in place with regular management review of performance.

Resilience in the Round
Strong connection between our operational processes, financial and corporate governance, business processes, reporting and strategic development.

Asset Health
Infrastructure modelling developed to identify opportunities to optimise our investment to minimise interruptions – e.g. deep mains, optimising re-zonings, soil/main condition monitoring. Investment in non-infrastructure assets; e.g. reduce shutdown risks from critical supply assets and unplanned outages

Systems Interdependencies
Utilising digital, technology, people, resources internally helps deliver successful results – it also ensures our customers, businesses and the environment who are dependent on our services are not adversely impacted

Management Systems
Assurance of controls through regular audits, lessons learnt reviews and business systems provide opportunity for continuous improvement

4 R's

Reliability

- Increasing network interconnectivity to reduce impact of failures along with automated valves enabling rezoning of supplies
- Integrated Leakage and Pressure Monitoring system, Asset condition monitoring, pressure monitoring and data analytics too target risk areas
- Strategic Pipeline network to increase distribution resilience
- Asset remote resets to reduce impact of pump failures and investment in critical non-infra assets to enable event avoidance and mitigation

Redundancy

- Deep main mitigation programme to pre-empt large main failures
- Transient training for internal and external people to reduce the impact of valve operations on the network
- Planned leakage detection, hydrophonic sensors deployment and mains repair

Resistance

- Mains replacement programmes utilising low/no dig technology
- Pump schedule modelling and pressure vessel maintenance programmes
- Intelligent alarms to detect underperforming assets providing early warning alarms
- Data and analytics to identify and optimise asset maintenance an identify deteriorating assets

Response & Recovery

- Restoration plans for every event embedded in a developed operational/ event system to speed recovery and re-zoning
- In hours and out of hours teams, supporting tankers and overland mains equipment to ensure continuity of supplies
- Improved event response and mitigation, with stocks of critical spares
- Exercise planning internally and with external organisations
- Customer communication plans – social media, texts, In Your Area website
- Specialist samplers, flushing and laboratory testing to ensure water quality is maintained
- Advanced event and incident preparation – e.g. freeze thaw, hot summer
- "Plug & Play" equipment for treatment and pumping – e.g. generators, UV trailers.

Ensuring Successful Results

Culture
Dedicated teams to support the 'restoration first' approach to ensure customers are not impacted. Planned interruptions designed to avoid impact on customers with lessons learnt reviews driving continuous improvement and best practice. Developing a planned response to all interruptions 'making the unplanned planned'

Collaboration
Integrated working between our partner organisations to deliver seamless service and problem resolution for customers.

Social Contract
Our strategy towards interruptions supports our commitment to the communities we serve.

Strategy & Plans
Clear strategies in place with targeted investment to ensure interruptions are minimised. Plans are consulted with our customers to assess the level of performance they expect.

Leadership
Development of high performing teams, supported by clear strategic direction and monitoring at Board level, creating the right environment to deliver the level of performance our customer expect.

Innovation & Digital
Exploiting our integrated systems to analyse and improve performance. Use of pressure loggers to capture data to minimise risk of unplanned interruptions. Development of early warning systems to identify events, with automated response capability (valves/actuators)

CASE STUDY – Pollutions and our Business model approach

This case study highlights how our Business Model approach has supported the delivery of our strategy to reduce pollutions; drawing on all aspects of our Business Model from assessment of shocks and stress, the application of 4R's and our Resilience Framework through to delivering our Strategic Direction Statement ambitions. It also shows how delivering this particular outcome has strong interdependencies across our business, as well as but fundamentally helps support delivering our long term strategic direction statement

Pressures Facing the Industry

(Horizon Scanning / Shocks and stresses)

The likelihood of pollutions and their impact on the environment can be caused by a range of shocks and stresses.

In developing our Pollutions strategy – we have assessed relevant shocks and stresses that are contributing factors

For example – shocks such as:

- flooding,
- power outages,
- asset failures,
- extreme temperatures
- third party damage to our infrastructure

and stresses such as

- ageing infrastructure,
- shortage of skilled workers,
- the impact of weather linked to changes in our climate,
- increase growth in our region.

Whilst our customers in our region have said they are satisfied with our performance during AMP6, we are targeting to improve.

In AMP7 we plan to go further to reduce the impact of pollutions on the environment, with increasingly challenging targets being set at the Final Determination for companies to deliver upper quartile performance

Six Capitals Thinking

We recognise the impact our activities have on the six capitals and will continue to develop our thinking to support our decision making. Our six capitals thinking already includes a strong natural capital – carbon reduction, but will look to understand further the interplay between the six capitals (Natural, Social, Human, Manufactured, Financial and Intellectual).

In our systems thinking we already see elements of all of these, from use of innovative technologies, our communication with customers and our integrated partnership approach to flood resilience.

The Positive Impact We Make

Reducing pollutions has a positive impact on the environment and the customers we serve. Increasing our resilience to growth and flooding along with continued improvement in the management of our infrastructure will support our long term ambitions :

- Make the East of England Resilient to the Risks of Drought and Flooding,
- Enable Sustainable Economic and Housing Growth in the UK's fastest growing region,
- Be a carbon Neutral business by 2050 and
- Work with Others to achieve significant improvement in ecological quality across our catchments

The Outcomes we deliver

Delivering a reduction in pollutions supports a range of our customer outcomes ,from flourishing environment through to a positive impact on our communities.

By delivering on this commitment we also support the deliver of other outcomes – such as attaining excellent bathing waters status, reduced internal & external flooding, through efficiency and behavioural change.

Our Planned Investments in AMP7

To deliver our proposed targets investments include:

- Removal of surface water from our sewerage networks to eliminate overloading during storm conditions
- Enhanced modelling and monitoring of sewerage networks
- SuDS schemes developed
- Data analytics to further develop predictive capabilities
- Keep it Clear and Pollution Watch behavioural campaigns
- Proactive mitigation and preventative maintenance
- Enhanced automation, control and monitoring of pumps
- Long term plan sfor growth
- CSO investigations and improvements
- Further Partnership funding to address complex flooding issues

Systems Thinking

Risk Management
Analysis of performance and risks informs our strategic planning, regular reviews of root causes of failures and process controls are in place with regular management review of performance. Lesson learnt processes run alongside root cause reviews to enable continuous improvement

Resilience in the Round
Strong connection between our operational processes, financial and corporate governance, business processes, reporting and strategic development.

Asset Health
Infrastructure modelling developed to identify opportunities to optimise our investment to minimise pollutions– e.g. optimising sewer rehabilitation programme, CSO improvements and investigations and rising main condition & performance monitoring. Investment in non-infrastructure assets; e.g. increased pump monitoring,

Systems Interdependencies
Utilising digital, technology, people, resources internally helps deliver successful results – it also ensures our customers, businesses and the environment who are dependent on our services are not adversely impacted

Management Systems
Assurance of controls through regular audits, lessons learnt reviews and business systems provide opportunity for continuous improvement

4 R's

Reliability

- Enhance network monitoring and data analytics to predict and target risk areas
- Increase control and automation capabilities on critical pump stations to reduce the impact of failures
- Investment in critical non-infra assets to enable event avoidance and mitigation

Redundancy

- Removal of existing surface water connections to reduce storm flows in sewer networks
- Increased investment in SuDs

Resistance

- Planned preventative maintenance of pump stations and sewer networks
- Intelligent alarms to detect underperforming assets providing early warning alarms
- Condition monitoring to aid identification and optimisation of asset maintenance
- Keep it Clear behavioural campaign to raise public awareness about the causes of sewage pollution
- Live hydraulic modelling combined with enhanced network monitoring to proactively target risk areas
- Protecting assets and infrastructure from the impacts of pluvial, fluvial and coastal flooding through increased partnership working

Response & Recovery

- Increased investigations and improvements to CSOs
- Pollution watch campaign to aid early identification of pollutions
- Improved event response and mitigation, with stocks of critical spares
- Customer communication plans – social media, texts, In Your Area website
- Increased automation of pumps to avoid delays in response to asset failure
- Continued exploitation of Apps to improve event and incident data collection

Ensuring Successful Results

Culture
Dedicated analysts to consume network monitoring data, generate insight and drive proactive investigations. Continued focus on sharing event data with the EA to improve our response to incidents.

Collaboration
Integrated working between our partner organisations to deliver seamless service and problem resolution for customers. Continue to work with Keep Britain Tidy, River Care and Beach Care to help spread the importance of Environmental protection & Pollution Watch. We'll build on the success of AMP6 partnership working to improve the resilience of our assets to the effects of pluvial, fluvial and coastal flooding.

Social Contract
Our strategy towards pollutions supports our commitment to the communities we serve.

Strategy & Plans
Clear strategies in place with targeted investment to ensure pollutions are minimised. Plans are consulted with our customers to assess the level of performance they expect.

Leadership
Development of high performing teams, supported by clear strategic direction and monitoring, creating the right environment to deliver the level of performance our customer expect.

Innovation & Digital
Exploiting our integrated systems to analyse and improve performance. Use of flow monitors to capture data and live hydraulic models to identify risk. Development of early warning systems to proactively respond to events, with automated response capability where possible and appropriate

5. ACTION PLAN FOR AREAS OF FOCUS

Our approach to systems thinking and resilience in the round is already well established within our business, both internally and the way we work across sectors.

Our resilience in the round and systems thinking will continue to develop in AMP7 and beyond. We have created a solid foundation to build upon. Our customer consultation was the leading in the industry scoring the only A in the respective Ofwat's IAP assessment and as a business we have been focused on the importance of resilience thinking for over 15 years – publishing our first Strategic Direction Statement in 2007.

Our customers have supported our Business Plan - specifically the need for investment to meet resilience issues. Moreover our customers support our proactive approach - investing today to address issues in the future.

"Our customers tell us that they do not want to delay investment in making our region more resilient." Business Plan submission 2018.

As a company we already have well established ways of working systems, policies and processes that is a strong foundation for our actions into AMP7. For example:

- Material risks are regularly discussed and reviewed at Management and AWS Boards.
- A culture of open reporting and issue escalation through to the AWS Board, ensuring issues are discussed at the earliest opportunity.
- A weekly Water Quality Group – attended by the Chief Executive and key operational Directors that reviews all Water and Water Recycling quality issues and lessons learnt.
- A monthly Resilience Steering Group that reviews our policies and actions relating to wider operational resilience – including cyber, security, emergency planning, threats and national issues.
- A Strategic Priorities Board, chaired by the Chief Executive that reviews the investment strategy and prioritisation to deliver on our commitments.
- Encouragement of employees to bring outside thinking into the Company – with our people working with UK Universities and companies from around the world to bring innovation, new ways of thinking into our organisation.
- 15 years of Alliance working, where we are now seeing the integration of teams, which provides significant resilience in our operations.
- Long term historic investment in our Emergency Planning processes and emergency equipment along with our centralised Operational Management Centre, creating a culture focused on service and recovery when issues do happen.

More specifically, the table below outlines our actions for AMP7 to further increase our systems thinking and resilience in the round. These interdependent activity, actions and plans taken together help create our approach to system thinking and increase our resilience to the shocks and stresses we face.

Resilience in the Round

Financial	• We have taken a number of proactive steps to address Ofwat's comments, including a commitment to de-gear to the mid-70s during AMP7, and accepting Ofwat's gearing sharing mechanism. • We will evolve our investment planning and decision-making process to include the integration of six capitals, Cabinet Office 4Rs (resistance, reliability, redundancy, and response and recovery) and systems thinking. This will include an update to processes such as the Risk, Opportunities and Value (ROV) investment process. • We will aim to publish our 25 year stress testing to support our five year viability statements.

Corporate	• Ensure through the price review we deliver on the resilience objectives within our Strategic Direction Statement that our customers have told us are important. • We are the only Water Company working on Project 13 (Institute of Civil Engineers) – a cross sector supply chain initiative to boost certainty and productivity in delivery of assets, improve the whole life outcomes in operation and support a more sustainable innovative, highly skilled industry. • Continue to strengthen our Alliancing approach within our business, not only to effectively deliver our investments but to also provide a source of knowledge, expertise and resource that underpins our business resilience when faced with challenges. We will also promote further pan-alliance working to share ideas, innovate and use resources differently especially as we seek to exploit new technology in AMP7. • Implementing our culture, performance and strategy framework within the business that ensures line of sight and alignment throughout the business. In addition we will embed the organisational changes, currently underway that has been designed to increase the line of sight through to our customers. • We will continue to adapt our award winning Licence to Operate programme and our professional chartered qualifications programmes – which helps create appropriately skilled workforce. • Seek to retain our Glassdoor Award of the Best Place to Work in the UK – demonstrating a positive culture which underpins our resilience as an organisation. • Continue to seek external recognition for our Well Being strategy with the aim of retention of employees and as a recruitment tool • Continue our award winning focus on health & safety with a particular emphasis on mental health • We will continue to chair the BTiC Regional Advisory Board, working with companies across the region to support addressing the significant challenges in East Anglia - vulnerability, climate change, skill and employment; supporting work in specific areas of our region such as Lowestoft and Wisbech.
Operational	• We will continue to work with academic organisations, at all levels of education, to support future resource and skills requirements and develop innovative approaches to close skills gaps. • We plan to work with the University of East Anglia on climate change research and it's impact in our region. Specifically our partnership with the Anglian Centre for Water Studies – with cross business teams formed to bring the outside into our organisation and applying leading edge scientific thinking into our operational business. For example programmes of work around key risk areas such as climate change as well as in areas of opportunity such as data science. • We are the only company carrying out a full pilot of reviewing systems operations at a catchment level with Norfolk Rivers Trust – creating at a local level a different level of governance to create a resilient catchment. We intend to roll out this trial to our other catchments in AMP7. • Co-hosting with the Rivers Trust the CamEO partnership - to improve the quality and resilience of the water environment on the Cam and Ealy Ouse Catchment. • We have led Bio-Resources thinking in the industry, developing the leadership Biosolids Assurance Scheme. Our plan is to ensure this is effectively implemented across the country so we can mitigate the risk of loss of land bank for the industry. We will continue to actively develop the trading scheme between companies – providing resilience for the industry on biosolids disposal. • We will continue to support supply chain resilience; developing with partners centres to help develop skills in our future workforce needed to deliver our

investments and day to day operations – we have already established a centre in Wisbech and are launching further centres in our region via relationships regional FE colleges and University Technical Colleges.
- Develop our commercial models aligned to AMP7 delivery outcomes that incentivises alliances aligned to deliver our objectives, building on the stable 15 years of alliance working, a framework that has successfully delivered 3 AMP investment cycles.

Asset Health

- We will continue to develop our Public Interest Commitment; leading on carbon reduction – targeting net zero emissions by 2050 and working to tripling the rate of leakage reduction across the industry.
- We will continue to work as part of the Prince of Wales' corporate leaders group on climate change Climate – a multi-sector approach delivering national and international work on mitigation and adaptation to climate change.
- We will develop 6 Capitals approach and integrate into our Risk Opportunities and Value investment approach – ROV to further strengthen our asset investment decision making process.
- We have developed and implemented a leading data science infrastructure and capability that we will exploit to optimise maintenance activities, as increasing our system resilience.
- We continue to innovate and deploy sensors across our water and water recycling networks to optimise our maintenance and operational performance – including hydrophone deployment, pressure sensors, sewer flow monitors and transient monitoring.
- We will work in partnership with the industry and our regulators to develop new approaches to understanding and maintaining asset health.
- We will continue to develop natural capital solutions, building on the innovative and collaborative approach to develop the treatment wetland at Ingoldisthorpe. Our Business Plan sets out our intention to invest (with Partners) in over 30 more schemes in AMP7
- We will implement our Information & Technology strategy including further exploitation of our digital and data capabilities – for example to create near real time modelling in our Water Recycling catchments or system digital twins of our Water Network to predict potential customer and environmental impacts.
- We are developing a digital twin for our Strategic Pipeline project which will create a resilient network by allowing us to optimise in real time the network and assets on the system. This will include the use of predictive techniques for near real-time scenario planning of different operational as well as the means to predict asset performance and failure.
- We will continue to develop our current asset health system models to consider wider internal and external system interdependencies.
- Our market leading C55 copperleaf asset system will remain the basis of tracking our investments and their impact on resilience and reducing our risk to the impact of shocks and stresses.

Systems Interdependencies

- As BTiC chair of the Water Task Force, working with a wide range of national and international companies we are looking at how we work at a catchment level with a wide range of organisations to manage risk and improve water quality. For example; we are developing a mobile app for farmers sharing data with retailers; reviewing the impact of big infrastructure projects, working with Highways England to create a more resilience and co-ordinated approach; leading a catchment declaration and national coalition to

manage quality risk in our catchments – this includes a wide range of companies and organisations (M&S, Nestlé, NGOs, River Trusts and other NGOs etc)
- Leading the Cambridge Institute for Sustainably leadership (CISL), bringing together academia to work on the long term sustainability challenges we face.
- Continue to develop Water Resources East to help deliver our long term Water Resources Plan, integral to our long term catchment and water resources planning.
- Continue our global learning, invited to be part of the Leading Utilities of the World – we will develop key global relations to develop smart network, for example visiting Italian and Dutch companies to share best practice.
- Continue, as part of business plan to utilise partnership funding to resolve complex and cross sector issues, creating system solutions that provide resilience for the benefit of our customers.
- Making more of our abstraction trading – in 2019 we have traded with farmers to allow them to take water during the summer – we will look to develop this further in other areas to enhance our systems resilience.
- Developing our strategies with Natural Capital East to further develop approaches to long term sustainable solutions – for example our commitment to support the planting of over 11m trees across the industry.
- Continuing to develop our community regeneration approach. This will include rolling out the partnersip with the College of East Anglia to other areas including Lowestoft through the BTiC.
- Working with local and regional government to support growth plans in our region for example the OXCAM ARC, and major greenfield development in our region.
- Working with charities and other organisations to support our vulnerability and affordability strategy.
- Establishing a digital skills pipeline via degree apprenticeships and sponsored courses at Further Education Colleges.

The 4 Rs Framework

- We will be taking our learning from the Humber Bank lessons learnt to other areas of our region, creating a resilience to events and potentially reducing their likelihood. We have already started in Colchester.
- Continue to develop with Airbus our approach to cyber security - a combination of cultural change (continuing our award winning cyber essentials programme) as well as maintaining strong protection against the continuing changing cyber threats.
- Continue to develop our scada/telemetry system – one of the biggest in Europe to provide data, predictive analytics and insight that will reduce asset system issues.
- We will use data analytics to exploit the development of our smart networks and smart metering, which bring an untapped level of data to increase resilience and service to customers.

Risk Management

- We will seek to further develop our risk prioritisation – we already review top tier risks with our Board, but will look to develop new innovative and relevant prioritisation methodologies that captures our horizon scanning approach, updating our scenarios to inform our long term plans.
- We will continue to integrate and demonstrate how we are utilising and managing risks and opportunities arising from horizon scanning and how these can impact our business.

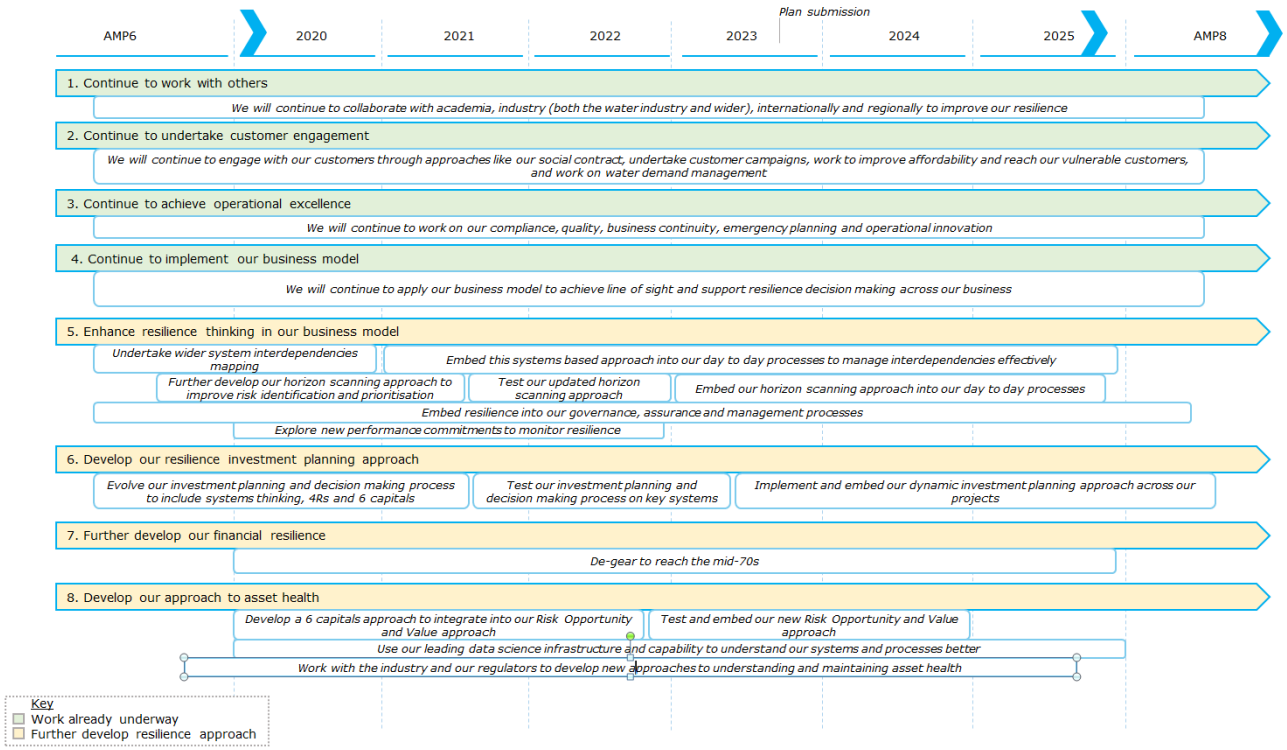
- Through our outside in activity will being further understanding of the shocks and stresses we face, integrating systems thinking into day to day process and help the business to understand how these may impact on customer outcomes into the future.
- Our approach to risk management includes assessing major risks, not just operational – for example our talent pipeline, succession for critical roles and development of the future workforce to address expected skill shortages in the future

Management Systems

- Continue to evolve and develop our governance assurance and management processes – integrating our management systems in to the Common Framework to create our Integrated Management System.
- Work with BSI to develop a new standard around our commitment to our Social contract and the changes in our Articles of Association.
- Continue to apply lessons learnt, not only from our own incidents and near misses but also sharing and learning from across the industry as issues arise. This will also help us to ensure our emergency planning and incident response continues to be effective, minimising impacts on our customers by anticipating and being prepared for shocks and stresses in our region.
- Using the a resilience and 6 capitals lens to inform all our decision making in the business, not just in our investment planning processes.

As demonstrated above, we have a wide range of activity both underway and planned that demonstrates our systems thinking approach to managing our business. This approach creates the line of sight through to our customer outcomes and in helping to deliver our Strategic Direction Statement.

The table below provides a summary of our plan into AMP7 to continue to develop our resilience and systems thinking. The plan reflects activity already underway (such as working with external organisations, maintaining operational excellence, continued customer engagement and maintaining our business model approach) and areas where we will continue to develop our resilience approach (such as financial resilience during PR19, approaches to asset health, incorporating into investment planning and decision making and embedding our resilience strategy further in our organisation).


Plan submission
AMP6
2020
2021
2022
2023
2024
2025
AMP8
1. Continue to work with others
We will continue to collaborate with academia, industry (both the water industry and wider), internationally and regionally to improve our resilience
2. Continue to undertake customer engagement
We will continue to engage with our customers through approaches like our social contract, undertake customer campaigns, work to improve affordability and reach our vulnerable customers, and work on water demand management
3. Continue to achieve operational excellence
We will continue to work on our compliance, quality, business continuity, emergency planning and operational innovation
4. Continue to implement our business model
We will continue to apply our business model to achieve line of sight and support resilience decision making across our business
5. Enhance resilience thinking in our business model
Undertake wider system interdependencies mapping
Embed this systems based approach into our day to day processes to manage interdependencies effectively
Further develop our horizon scanning approach to improve risk identification and prioritisation
Test our updated horizon scanning approach
Embed our horizon scanning approach into our day to day processes
Embed resilience into our governance, assurance and management processes
Explore new performance commitments to monitor resilience
6. Develop our resilience investment planning approach
Evolve our investment planning and decision making process to include systems thinking, 4Rs and 6 capitals
Test our investment planning and decision making process on key systems
Implement and embed our dynamic investment planning approach across our projects
7. Further develop our financial resilience
De-gear to reach the mid-70s
8. Develop our approach to asset health
Develop a 6 capitals approach to integrate into our Risk Opportunity and Value approach
Test and embed our new Risk Opportunity and Value approach
Use our leading data science infrastructure and capability to understand our systems and processes better
Work with the industry and our regulators to develop new approaches to understanding and maintaining asset health
Key
Work already underway
Further develop resilience approach

6. APPENDICIES

Appendix 1: Framework for Resilience PR19 and beyond

Appendix 2: Resilience Section 13 Our 2020-25 Business Plan

Appendix 3: Appendix 14a A Systems Approach to Resilience

Appendix 4: Appendix 14b Anglian Water Resilience Assessment

Appendix 5: How Anglian Water responded to the 2018 Freeze Thaw Event

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Appendix 1

love every drop anglianwater

ARUP

A Framework for Resilience: PR19 and Beyond

January 2018

1. Introduction

Anglian Water recently published its Strategic Direction Statement 2020-2045. Water is a long-term business. Our ability to provide excellent services for our customers now and in the future depends on making the right choices now.

No one can know what the world will be like in 25 years' time: how the needs of customers and society more broadly will develop; what future technology will look like; exactly how the climate and environment will change; or what new challenges will emerge.

Our biggest challenges are climate change, growth and the need to protect the environment. As well as being able to cope with these particular long-term challenges, we need to be resilient to shocks and stresses, now and in the future, that can impact on our ability to maintain services for our customers and protect the environment.

So, working with Arup, we have developed a framework to help us think about how we manage risks over the short-term alongside longer-term trends and lower likelihood risks. The framework builds on Ofwat's approach to 'Resilience in the Round' and best-practice resilience frameworks, for example, the City Resilience Index – CRI (Arup for the Rockefeller Foundation 2016) and the Cabinet Office's definition of resilience. We are publishing this paper as a contribution to the thinking about how we deliver 'Resilience in the Round' for customers and the environment.

We will use this framework to test our current and future plans, to empower us to become a truly resilient water company.

Jean Spencer,
Executive Director of Strategic Growth and Resilience

Developing a Resilience Framework

Arup was commissioned to develop a framework to enable Anglian Water to apply 'Resilience in the Round' thinking at a practical level. To do this, current objectives and resilience practices were analysed against Anglian Water's current initiatives and future resilience investment. The framework was developed on the basis of:

- Arup's knowledge of best-practice resilience frameworks and approaches, for example, the City Resilience Index – CRI (Arup for the Rockefeller Foundation, 2016) and the Cabinet Office's definition of resilience. In particular, the CRI identified resilience qualities, which are true of any resilient system (see figure 1);
- Anglian Water's objectives and way of working, which Arup gained through a review of key plans and strategies, such as the draft Strategic Direction Statement (SDS), the Corporate Risk Register, and the Business Guide to AMP6;
- The key shocks, stresses and risks that Anglian Water might face, drawn predominantly from the Corporate Risk Register, the draft Strategic Direction Statement, and other key documents and sources on risks and megatrends, such as the National Risk Register and the World Economic Forum's Global Risks Report 2017;
- Ofwat's resilience planning principles and guidance, including Delivering Water 2020: Consulting on our methodology for the 2019 price review, and Resilience in the Round (see figure 3 overleaf).

With support from financial, corporate and operational resilience experts from around Arup, the holistic resilience framework incorporates Ofwat's 'Resilience in the Round' concept, with sub-themes to explore activities within the three themes in more detail.

The framework is presented in Figure 4, page 7, and an overview of the sub-themes in Tables 2-4 on the following pages.

The next step will be to carry out an assessment of Anglian Water's approach and maturity using the resilience framework. The assessment will include a rating 0 to 4 against each sub-theme, based on a Maturity Matrix approach where:

- 0 is unaware;
- 1 is aware but no response developed;
- 2 is a response has been developed but no action undertaken;
- 3 is a response has been developed and is in use; and
- 4 is leading edge performance. Areas of strength and areas for improvement can be identified.

Figure 1: Resilience qualities or characteristics, from Arup, City Resilience Index / 100RC

2. Towards a definition of resilience

2.1 Resilience background

What do we mean by resilience?

Overview

Resilience reflects the overall 'capacity of individuals, communities, institutions, businesses and systems to survive, adapt and thrive no matter what kinds of chronic stresses or acute shocks they experience' (adapted from Rockefeller Foundation, 2013)

In the 21st century, pressures that happen at scale – such as climate change, disease pandemics, economic fluctuations, and terrorism – pose new challenges (Arup, 2013). Risk is increasingly unpredictable due to the complexity and interdependencies between systems and the uncertainty associated with many hazards – notably climate change.

Risk assessments and mitigation continue to play an important role in responding to business challenges. However, in order to create truly resilient organisations in the face of growing uncertainty, this will need to be supplemented with a broader consideration of resilient systems. Hollnagel (2014) describes a Safety-II approach, providing a focus on success, and how systems function when 'things go right', as well as risk which focuses on when 'things go wrong'.

Cabinet Office guidance

The Civil Contingencies Act (2004) sets an important framing for resilience in the UK. The Cabinet Office (2011) describes Infrastructure resilience as "the ability of assets and networks to anticipate, absorb, adapt to and recover from disruption". Resilience is secured through a combination of the principal components shown in Figure 2:

- Resistance: Concerns direct physical protection, e.g. the erection of flood defences;
- Reliability: The capability of infrastructure to maintain operations under a range of conditions, e.g. electrical cabling is able to operate in extremes of heat and cold;
- Redundancy: The adaptability of an asset or network, e.g. the installation of back-up data centres; and
- Response and Recovery: An organisation's ability to respond to and recover from disruption.

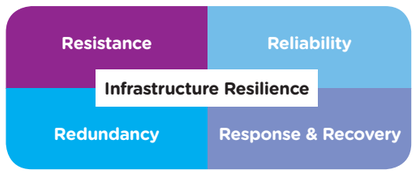


Figure 2: Infrastructure Resilience Components (Cabinet Office, 2011)

These four components align with the seven characteristics of resilience described by the CRI.

Ofwat guidance

> ***'Resilience is the ability to cope with, and recover from, disruption and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future.'***
>
> *Ofwat's definition of resilience*

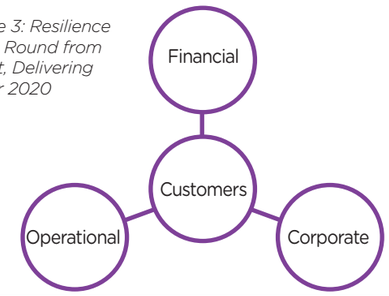
Ofwat has published guidance on resilience in their PR19 final methodology (Ofwat, Delivering Water 2020: methodology for the 2019 price review). This includes the concept of 'Resilience in the Round' shown in Figure 3 (below), which recommends that customers should be the focus of the business and three themes of resilience should be considered:

- Corporate resilience: the ability of an organisation's governance, accountability and assurance processes to help avoid, cope with, and recover from, disruption; and to anticipate trends and variability in its business operations.
- Financial resilience: an organisation's ability to avoid, cope with, and recover from, disruption to its finances.
- Operational resilience: the ability of an organisation's infrastructure, and the skills to run that infrastructure, to avoid, cope with, and recover from, disruption in its ability to provide critical services to customers.

In addition, Ofwat published a report Resilience in the Round (Ofwat, 2017). Ofwat's report advises 'Resilience in the Round' should be at the core of how companies approach the resilience challenge, but they should create their own approach to resilience planning.

Ofwat has provided an illustration of what resilience might look like, which includes subjects such as systems thinking, an environmental foundation, customers at the heart of resilience, smart approaches to resilience, and monitoring and measuring resilience. It is worth noting that Anglian Water appear as examples of resilience that other companies should follow including the 'Keep it Clear' campaign, and the 'Slug it Out' initiative.

Figure 3: Resilience in the Round from Ofwat, Delivering Water 2020



2. Towards a definition of resilience
2.2 Shocks and stresses

The Ofwat guidance is directing water companies to be resilient to short-term shocks and long-term stresses. Table 1 sets out a range of shocks and stresses that we have identified that may be relevant to Anglian Water.

Stresses
In the Strategic Direction Statement 2020-2045, Anglian Water has identified the particular challenges to their business from long-term stresses. These are population change, environmental protection and the impacts of climate change which will be acutely felt in their area, including sea level rise and increased water stress.

Arup reviewed the work that Anglian Water has done with PWC to identify megatrends that might impact on the business as part of this study.

Shocks
Anglian Water identify and manage shorter-term shocks, through the Strategic Business Risk Map (the AWS Corporate Risk Register). Anglian Water takes an all risks approach, mapping risks from the National Risk Register, to understand the potential impact on their business.

The business risks identified are wide-ranging and include potential cyber attacks, legal risks and toxic gas leaks.

Uncertainty
As much as an organisation can review and assess both short and long-term risks, it is widely accepted that within today's dynamic environment, these shocks and stresses are increasing in frequency and diversity, requiring successful businesses to adapt their operations beyond risk management of likely and understood shocks.

The Ofwat guidance recognises that resilience as well as risk management is needed to overcome short-term disruptive shocks and chronic long-term stresses, especially when these are uncertain and unknown. Therefore, the characteristics of the organisation, as well as the mitigation plans they have in place, are important in developing resilience.

Shocks		Stresses	
Disruptive events, which impact the ability to provide a high quality service. In the water industry, acute shocks include sudden events such as floods, fires or cyber attacks.		Chronic conditions which weaken the function of the organisation or system long-term. Examples highlighted in particular by Ofwat include population growth and climate change. Stresses are also often felt as shocks when they reach a tipping point.	
Terrorist attack	Failure of climate change mitigation and adaptation	Demographic change	Land use change
Civil unrest	Temperature extremes	Urban creep	Coastal erosion
Extreme vandalism	Infectious diseases	Migration	Environmental change inc. invasive species
Hoax calls	Environmental pollution	Skills shortages	Inequality and increasing income disparity
Cyber attacks	Fire events	Unemployment and underemployment	Growth vs recession
Power outages	Nuclear incident	Lifestyle change	Financial crisis
Asset failure	Flooding	Rising chronic and lifestyle diseases	Unmanageable inflation
Telecommunication failure	Severe energy price change	Shortage of skilled labour	Bad debt
Data fraud/theft	State collapse or crisis	Rising urbanisation	Resource scarcity (inc. fuel)
Dam failure	Industrial disputes	Leakage	Increased cost of borrowing
Power cuts	Supply chain failure	Ageing infrastructure	Structural change
False positive alarms	Abstraction licences change	Digital revolution	Macro industry change
Water supply contamination	Failure of regional, national or global governance and planning	Climate change (inc. drought and sea level rise)	Changing regulation, policy and international governance
		State provision of services	Legal structures

Table 1: The shocks and stresses that may impact Anglian Water

Towards a definition of Resilience: Resilience framework
A resilient water company for customers and the environment

A scoping study provided the underpinning theory for our approach for a resilience framework, which considers what a well-functioning system will look like, comprising corporate, financial and operational resilience.

This framework is designed to enable Anglian Water to think about short-term management of risks, alongside longer-term trends and lower likelihood risks. The framework is designed to help Anglian Water to become a truly resilient water company for the benefit of their customers and the environment.

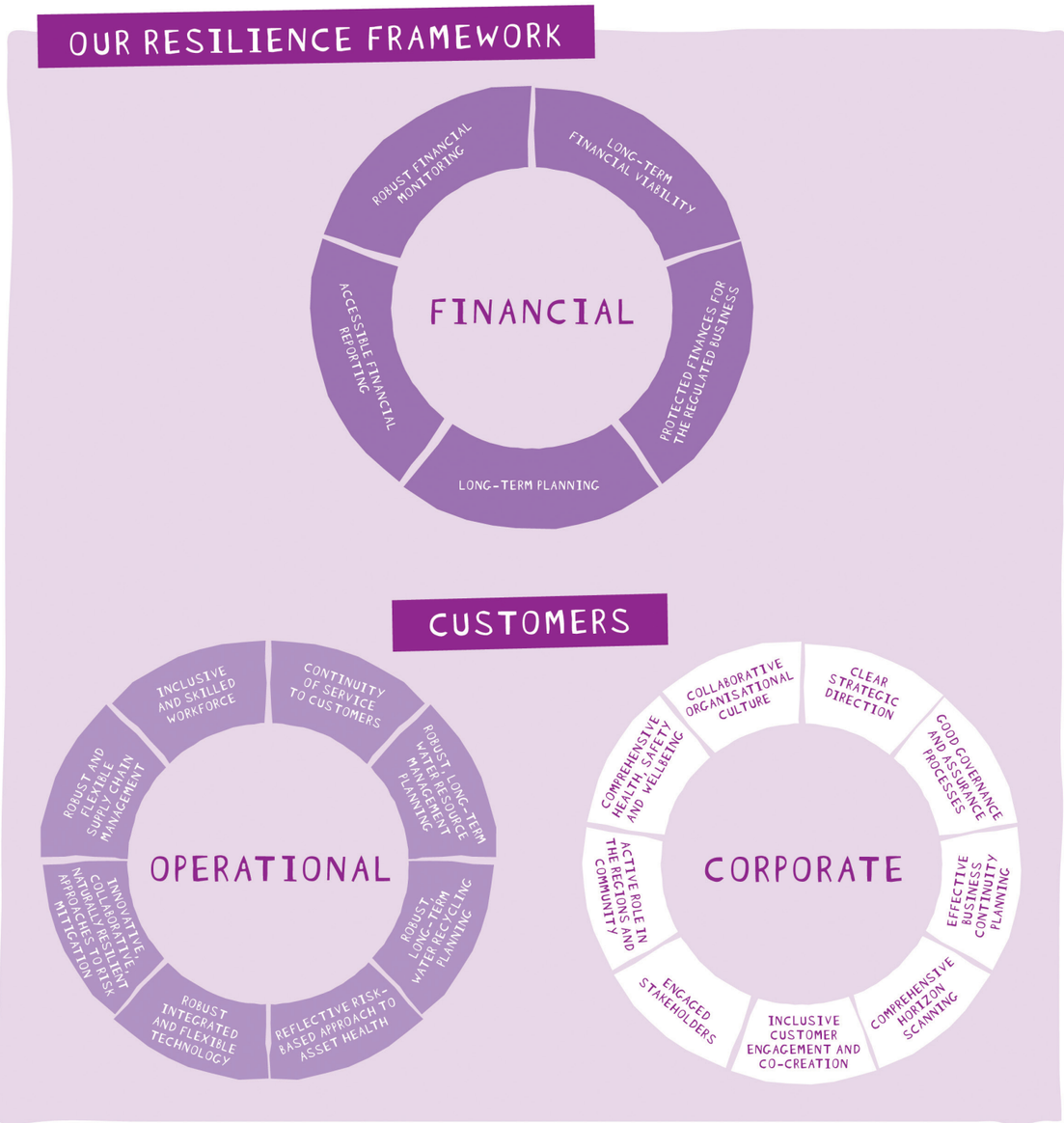


Figure 4: The Anglian Water resilience framework

Resilience framework: Financial

Theme	Description	Sub-theme	Description
Financial resilience	An organisation's ability to avoid, cope with, and recover from, disruption to its finances	Long-term financial viability	The company should consider their long-term financial viability, in light of key long-term trends (or stresses). The Directors shall review the longer-term viability of the company as an extension of their business planning process, which includes financial forecasting, robust risk management assessment, regular budget reviews and scenario planning. These activities are to make sure that operations are resilient and finances are sustainable and robust.
		Protected finances for the regulated business	The company should ring-fence finances of regulated activity to protect the interests of customers. In the event of a shock to the company's finances, this should provide enough flexibility to keep the core of the company operating.
		Long-term planning	25 year expenditure plans linked to the strategic direction of the company shall be approved by the Board and regularly reviewed. Base operating and maintenance expenditure together with any additional enhancement expenditure to meet customer and regulatory requirements shall be identified.
		Accessible financial reporting	In order to be transparent and inclusive, the company should publically report on its financial performance using non-technical language.
		Robust financial monitoring	In order to provide a continued check and balance that the company is continuing to support its long-term viability and protect the finances of the regulated business, regular monitoring to track trends and scenario test the potential risk of these is critical. This should be reported and discussed at Board level.

Table 2: The financial resilience sub-themes within the resilience framework

Resilience framework: Corporate

Theme	Description	Sub-theme	Description
Corporate resilience	The ability of an organisation's governance, accountability and assurance processes to help avoid, cope with, and recover from, disruption; and to anticipate trends and variability in its business operations.	Clear strategic direction	There should be one clear company aim and strategy which is well communicated and is recognised by all, both internally and externally. All plans and decisions should be based on how they will work towards this strategy.
		Effective governance and assurance processes	There should be a reliable and well disseminated process, roles, governance and reporting covering all aspects of the business. There is a clear process for assurance, approval and Board sign-off.
		Effective business continuity planning	There should be an all hazards approach to resilience planning linked to the National Risk Register and the likely impact on service to customers. A business continuity plan should be in place to prepare for, respond to and recover from the potential impact. This plan and the associated controls should be regularly trained and exercised. All critical assets should have emergency response plans and all critical teams should be able to recover to minimise impact on service. These approaches should follow recognised best practice as in ISO 22301.
		Comprehensive horizon scanning	Plans, strategies and actions should all be based on the outcome of comprehensive and robust horizon scanning which takes into account future shocks and stresses that may impact any area of the business. This should be regularly reviewed.
		Inclusive customer engagement and co-creation	There should be a clear two way dialogue with customers to ensure that customers are included and to improve transparency, cooperation and collaboration on current performance and future direction for the business. Customer policy and practices shall be established to meet the needs of customers in vulnerable circumstances. The company shall aim to establish trust, confidence and legitimacy.
		Engaged stakeholders	There should be regular and clear communication with stakeholder groups and organisations. Collaboration should be demonstrated through multi-agency participation with tangible outputs that improve the resilience to customers and the business.
		Active role in the regions and community	The company should undertake activities which have wider benefits to the communities that are served, enable these communities to grow and develop through enabling sustainable growth both at a regional and local level, demonstrating corporate citizenship in the process. The company shall establish goals to meet the carbon challenge contributing to the global and local impact.
		Comprehensive health, safety and wellbeing	There should be reliable and robust plans for health, safety and wellbeing which should make significant and measureable improvements to the lives of the workforce.
		Collaborative organisational culture	There should be an organisational culture that puts customers and a naturally resilient environment at the heart of all that they do. This is apparent in the practices and values of all employees.

Table 3: The corporate resilience sub-themes within the resilience framework

Resilience framework: Operational

Theme	Description	Sub-theme	Description
Operational resilience	The ability of an organisation's infrastructure, and the skills to run that infrastructure, to avoid, cope with and recover from, disruption in its performance.	Continuity of service to customers	Operations should focus on providing a continuity of service to customers and avoiding critical service failures, such as supply interruptions and internal sewer flooding. It should take into account the different needs of customers, particularly those who are vulnerable. It should also focus on delivering value for money for customers so that their service is tailored to those in vulnerable circumstances.
		Robust long-term water resource management planning	Water resource management planning and drought planning should be undertaken for the long-term and integrated into business planning to ensure that water companies can meet their supply obligations and facilitating sustainable growth. They should be produced collaboratively with the EA and regional planning groups to ensure best value for customers with respect to cross-company, regional and national supply options.
		Flexible, long-term water recycling planning	Water recycling planning should be undertaken for the long-term, enabling sustainable growth in the region without impacting existing customers. Water recycling plans should be developed with stakeholders and integrated into their business plans. They should focus on critical service failures such as internal sewer flooding and pollution incidents.
		Reflective risk-based approach to asset health	There should be a comprehensive assessment of asset risk, including long-term low-likelihood risks, having detailed and accurate information on the state of assets, the way they are configured and the way they are operated. The focus should be on criticality; protecting customers and the natural environment from exposure to known risks, and reducing vulnerability to future uncertainties. There should be a region wide asset strategy which is adaptive, regularly reviewed and has considered the changing requirements into the long-term (25 years). They should follow recognised best practice for asset management, such as ISO 55000.
		Innovative, collaborative, naturally-resilient approaches to risk mitigation	There should be a robust consideration of the approaches to risk mitigation. These approaches should be collaborative, innovative, and embrace technological change and the role of the natural environment. Collaboration should be integrated into business plans, working with customers, other companies, and wider stakeholders (such as Local Resilience Forums, local councils, landowners, and other utilities and highways agencies). Approaches to be considered include encouraging customers behavioural change through smart customer engagement, and use of smart technologies to improve asset performance, customer information, leakage management and water efficiency, natural solutions, such as catchment management to improve raw water quality, and blue-green infrastructure to manage storm water and reduce flooding and pollution incidents.
		Robust and flexible supply chain management	Companies should consider the impact of their energy, resource and skills supply chains on their operations and ensure diverse and competitive supply chains that deliver the best outcomes for their customers. They should also consider the flexibility of their supply chains, particularly during shock events. Companies should also consider how they can effectively utilize options beyond their boundaries to mitigate their risks, for example, the use of water trading and bioresource trading markets.
		Inclusive and skilled workforce	Companies need to identify and plan to fulfil the requirements of their future workforce. They should ensure they have workforce continuity plans to identify skills gaps between their current and future workforce, and ensure that these can be filled through training and development, succession planning and increasing diversity. Companies should work across the water industry and utility sector to address these skill gaps.
		Robust, integrated and flexible technology	Technology should be used intelligently to deliver real operational gains. Integration should happen across systems, including Operational Technology and Information Technology systems. Independent elements should be transformed into a more cohesive network, and interoperability and integrated with systems in other sectors should be considered. Cyber security should be paramount. Technology should be designed with end users in mind.

Table 4: The operational resilience sub-themes within the resilience framework

Find out more at **anglianwater.co.uk**

Contact us at **public.affairs@anglianwater.co.uk**

Anglian Water

OUR PLAN 2020-2025

RESPONSIBLE BUSINESS OF THE YEAR 2017
BUSINESS IN THE COMMUNITY

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2015

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anglianwater

EXTERNAL RECOGNITION

Winner

Business in the Community Responsible Business of the Year

ROSPA Gold – Anglian Water and @One Alliance

Queen's Award for Enterprise: Sustainable Development

Glassdoor Highest Rated CEOs Employees' Choice 2017

Glassdoor Best Places to Work Employees' Choice 2018

Leading Utilities of the World

Green Finance Award

British Construction Industry Award

Utility Week Awards

WINNER Capital Project Management Award

WINNER Supply Chain Excellence

OUR PLAN 2020-2025

14. RESILIENCE IN THE ROUND

Overview

- Our customers see tackling resilience as our core remit. Strengthening resilience has been business as usual for us for many years. But the major challenges we face continue to evolve, including climate change, growth and the need to protect the environment.
- We have worked with Arup to co-create a framework for understanding how Ofwat's outline approach to Resilience in the Round might be applied in practice in managing risks over the short term alongside longer term trends and lower likelihood risks.
- Arup have independently assessed our maturity in managing risks, shocks and stresses against our resilience framework. They scored our current performance as 4 or 5 (where 5 is the maximum score) in 17 of 22 areas. For our AMP7 and beyond performance, we scored 4 or 5 for all 22 areas. Areas where we are leading include our approach to governance, inclusive customer engagement and co-creation, continuity of service to customer, integrated and flexible technology, and supply chain management.
- In AMP7, we will build on our strengths and develop in those areas where there are opportunities to improve.

14.1 Introduction

Customers expect us to provide a reliable, high quality service, whatever happens. So resilience has been an important part of our planning and operations for a long time. 'Resilient Business' is one of the ten core outcomes we agreed with customers in 2013 and we have set ourselves the long term ambition to make the east of England resilient to the risks of drought and flooding.

Resilience definition

Ofwat's definition of resilience is 'the ability to cope with, and recover from, disruption and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future' (Ofwat, 2017, Resilience in the Round).

Ofwat published 'Resilience in the Round' in September 2017, expanding on three resilience themes:

- Corporate resilience: the ability of an organisation's governance, accountability and assurance processes to help avoid, cope with, and recover from, disruption; and to anticipate trends and variability in its business operations.
- Financial resilience: an organisation's ability to avoid, cope with, and recover from, disruption to its finances.
- Operational resilience: the ability of an organisation's infrastructure, and the skills to run that infrastructure, to avoid, cope with, and recover from, disruption in its ability to provide critical services to customers.

14.2 What does resilience mean to our customers and stakeholders?

As well as considering Ofwat's approach, exploring customer views on the topic of resilience has been a major focus of our research and engagement activity. For many customers, imagining the future is a difficult and sometimes worrying task. The pressures of everyday life mean many customers are focused on getting through the next few weeks or months.

In our engagement activities, the term "resilience" was not well understood; people preferred simpler terms such as "long term planning". But, once they spent more time exploring the topic, customers became much more interested and "awakened" to resilience challenges. When asked to rank our four ambitions, "making the east of England resilient to drought and flooding" was voted top priority by two thirds of customers. They saw these issues as likely to affect everyone in the region

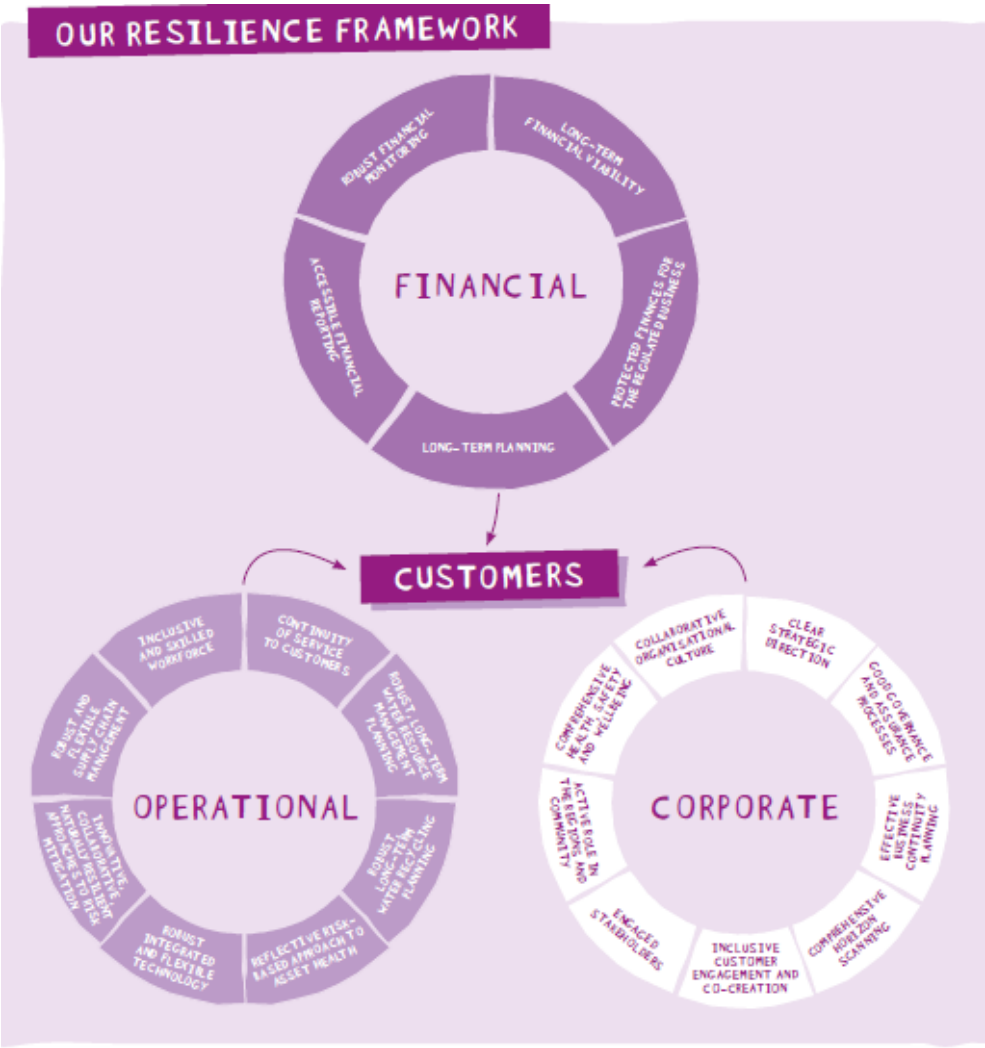
on a personal level. Tackling resilience was regarded as our core remit and customers felt that mitigating drought and flooding was especially important in light of pressures on infrastructure associated with the long term growth in the region. Without mitigating actions, the modelling we have carried out for our WRMP shows that the supply-demand balance for water is at risk in coming years. That is why our Plan proposes a twin-track approach to reduce demand and enhance supply options, as set out in Chapter 7. Resilient water supplies.

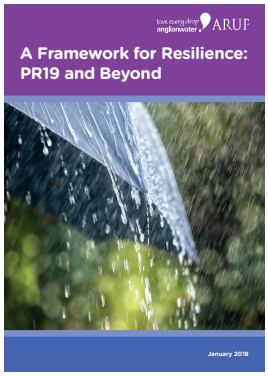
Our customers' views on resilience are explored in more detail in our Customer Research and Engagement Synthesis (see Annex 12c).

14.3 Our resilience framework

Working closely with Arup, we have co-created a framework for understanding how Ofwat's outline approach to Resilience in the Round might be applied in practice in managing risks over the short term, alongside longer term trends and lower likelihood risks.

In January 2018 we published A framework for resilience: PR19 and beyond. The framework is designed to help us to become a truly resilient water company for the benefit of our customers and the environment.





14.4 Shocks and Stresses

The Framework considers a range of shocks and stresses that may impact our business, building on best practice resilience frameworks, for example the City Resilience Index (Arup for the Rockefeller Foundation 2016) and the Cabinet office definition of resilience.

Disruptive events, which impact the ability to provide a high quality service. In the water industry, acute shocks include sudden events such as floods, fires or cyber attacks.

Chronic conditions which weaken the function of the organisation or system long term. Examples highlighted in particular by Ofwat include population growth and climate change. Stresses are also often felt as shocks when they reach a tipping point.

We have identified a comprehensive list of shocks and stresses that might challenge our business. We have assessed and prioritised these challenges, considered a range of possible options, and then developed suitable mitigation actions to address them. This process is set out in Annex 14a A Systems approach to resilience.

14.5 How mature is our approach to resilience?

We have well established, tested frameworks for managing resilience, including an Integrated Management System. Strong governance makes these frameworks effective. Our Board and management are highly engaged and focused on resilience of our operations, finance and business. Our Board regularly reviews our Top Tier risk register and they consider emerging risk as well as current risk. This review challenges our level of controls and our risk appetite to ensure we understand our position and resilience to the risks.

Below the Board, risks are considered in further levels of detail by the Management Board, Business Unit Senior Leadership Teams and down through the structure to individual teams. Risks are also considered by other relevant governance groups including, for example:

• The Resilience Steering Group – chaired by the Chief Executive and made up of directors and other senior managers, this group is responsible for resilience issues and providing strategic direction and tactical intervention in relation to business resilience and management system issues, including security, emergency planning, business continuity, and training and exercising activities of operational sites, offices, Anglian Water Services employees, third party contractors and suppliers working on behalf of Anglian Water.

• Monthly financial meetings, chaired by the Chief Financial Officer that review the cash position of the business, current funding requirements and market risks.

Our maturity in managing risks, shocks and stresses against our resilience framework has been independently assessed by Arup and their assessment is summarised below. The results are presented using an assessment in the range from 1 to 5, where 5 is “leading”.

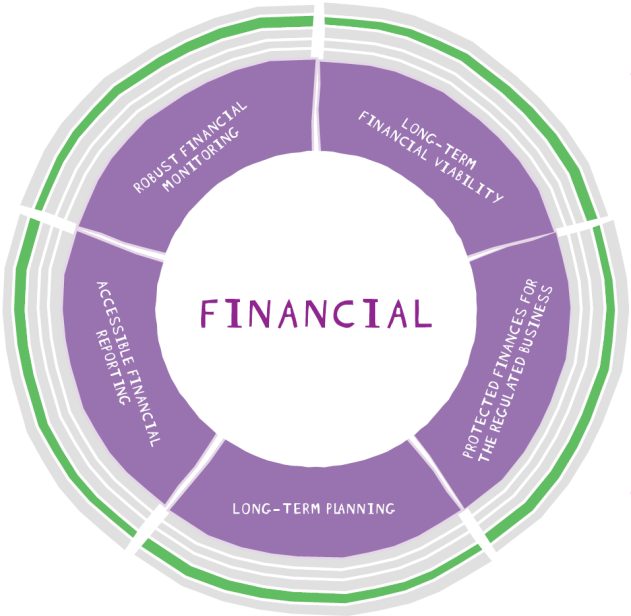
Since publishing our framework, a number of companies have adopted the same or similar framework and Arup has carried out a maturity assessment for seven companies, including Anglian Water. Where companies have an equally robust approach this has been assessed as 4 “response actioned”.

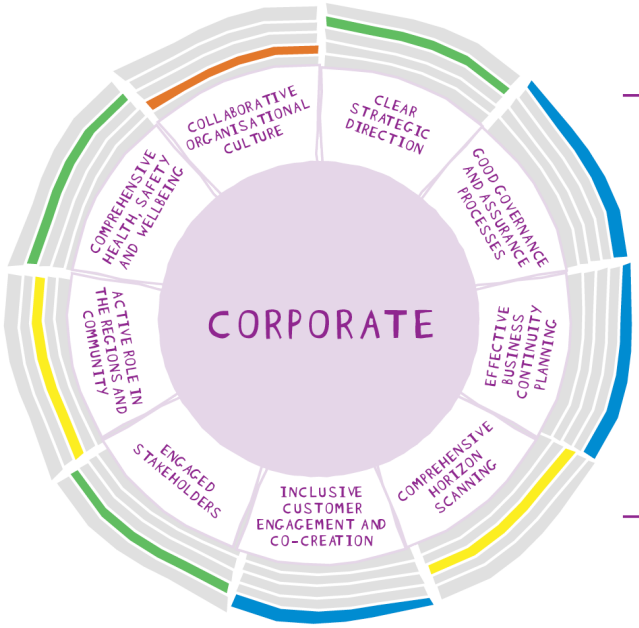
Arup's assessments are summarised below. The full assessment is given at Annex *14b Anglian Water PR19 Resilience Assessment update*. We scored 4 or 5 in 17 of 22 areas for our current performance. For our AMP7 and beyond performance, we scored 4 or 5 for all 22 areas.

MATURITY ASSESSMENT RESULTS

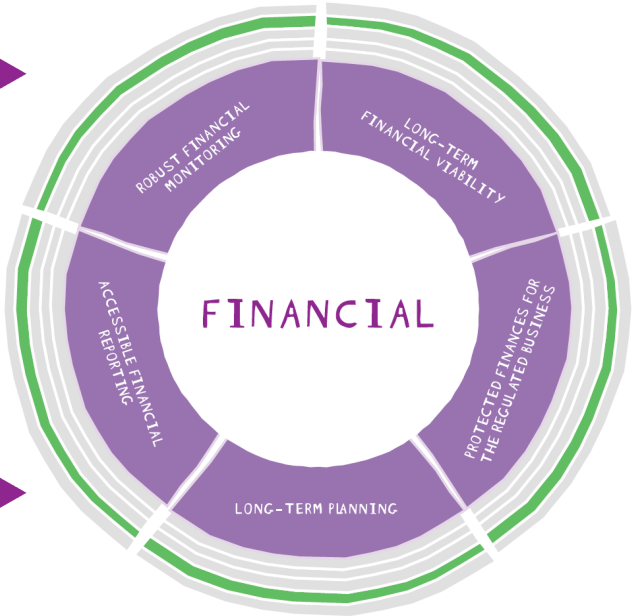
Unaware · Aware · Response Developed · Response Actioned · Leading

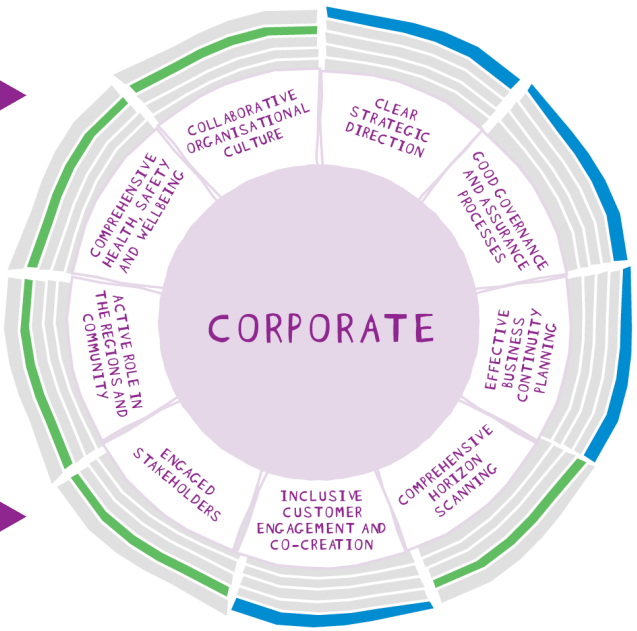
Current





Future





Arup noted a number of strengths, including our approach to customer engagement, an excellent risk management culture, robust continuity management, a leading approach to resilience governance, effective supply chain management and a world-leading telemetry network, as well as the steps we have taken to improve our financial resilience. We will continue to develop these strengths.

Arup also noted a number of opportunities for us to improve to reach 'leading' status. Some build on our leadership so far, notably Water Resources East and using our excellent evidence base of catchment solutions to make natural capital and catchment solutions business as normal.

14.5.1 What does this mean for our plan?

Our Strategic Direction Statement 2020-2045 sets out the major challenges we face and our long term strategies for delivering our outcomes in the face of those challenges. All four of the long term ambitions we have set ourselves increase our resilience, addressing drought, flood, climate change, growth and the environment. Our plans follow the resilience planning principles set out in Ofwat's Final Methodology (see box).

Our Plan for 2020-2025 sets out how we will address key risks that are developing or increasing. More detail is given in Chapter 7. Resilient water supplies, Chapter 8. Flourishing environment, Chapter 15. Balancing Risk and Reward, our Board Assurance Statement and Tables WS2 and WWS2.

Resilience planning principles

This box summarises how our Plan adheres to Ofwat's resilience planning principles, and further detail is given throughout our Plan.

Principle 1: Considering resilience in the round for the long term

We take a long term view of our business and so do our investors. We have a 25 year Strategic Direction Statement that considers the main challenges we face and how we will address them.

Our Water Resources Management Plan (WRMP) is a key part of developing our understanding the operational risks associated with our water supply system. It assesses our immediate risks and associated investment proposals in AMP7, and over a 25 and 50 year planning horizon. In the development of our WRMP we have used a systems modelling approach to assess the impacts of drought, climate change and sustainability reductions on the amount of water we have available to supply to our customers in the future.

Our Water Recycling Long Term Plan (WRLTP) describes the investment needed over the next 25 years to balance the supply and demand for water recycling services. The plan considers risk from growth, climate change, urban creep and customer behaviours. It promotes sustainable solutions for maintaining reliable and affordable levels of service.

Principle 2: A naturally resilient water sector

Ecosystem resilience and biodiversity have been key considerations in the development of our Plan. We have started to build a balance sheet of our region's natural capital and will build it into our decision making. We have adopted a natural capital assessment approach as part of our WRMP options appraisal process to consider which portfolios of options offer the best outcome for the environment. We are using more natural capital solutions to meet our environmental obligations.

Principle 3: Customer engagement

Our Plan has been informed by our extensive customer engagement programme. We have undertaken targeted engagement to understand customers' views around resilience.

Principle 4: Broad consideration of intervention options

We have considered a broad range of intervention options in developing our plans. These are described in Chapter 7. Resilient water supplies, Chapter 8. Flourishing environment and tables WS2 and WWS2.

Principle 5: Delivering best value solutions for customers

Chapter 10. Efficiency and Innovation sets out our approach to delivering best value for our customers. In the development of our WRMP strategy we have adopted an adaptive planning approach. This means that the investments we intend to make now are the best value solution for a range of future scenarios. We have tested our AMP7 supply side schemes to ensure that they are future proof against factors such as lower than anticipated savings from our water efficiency programmes, extreme drought events, alternative climate change scenarios and longer term impacts, beyond the statutory 25 year planning period. This approach ensures that we are making the most informed choices now, to implement a minimum regret strategy.

In our WRLTP, we have developed long term strategies that are adaptive to change and respond to the key indicators we monitor. This long term view enables us to identify least regret solutions that are phased according to our confidence in the need for investment.

Principle 6: Outcomes and customer-focused approach

We have agreed specific performance commitments on resilience, but all our outcomes depend on our resilience in the round.

Principle 7: Board assurance and sign-off

Our Plan has been through a robust board assurance process.

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Anglian Water

14A. A SYSTEMS APPROACH TO RESILIENCE SHOCKS AND STRESSES

RESPONSIBLE BUSINESS OF THE YEAR 2017
BUSINESS IN THE COMMUNITY

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2015

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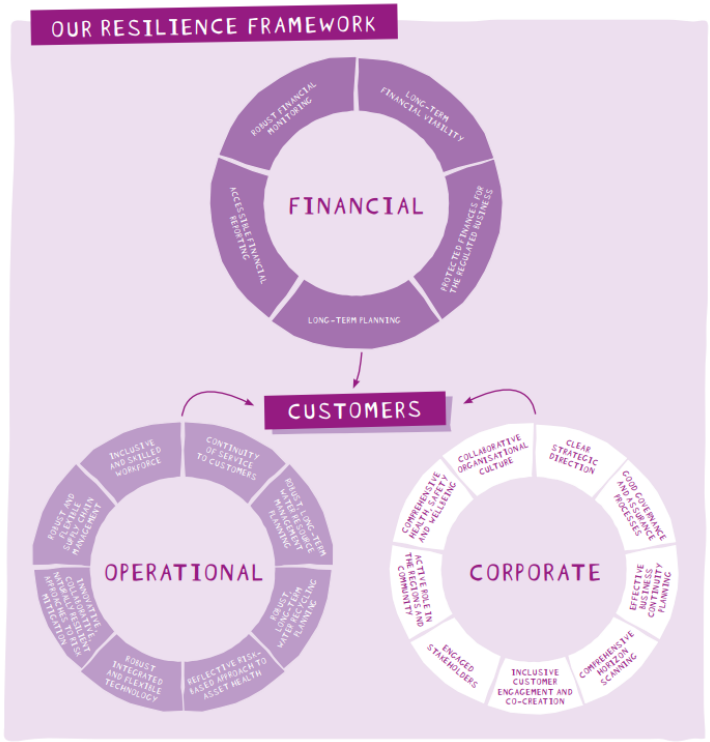
A SYSTEMS APPROACH TO RESILIENCE

SEPTEMBER 2018

CONTENTS

1. INTRODUCTION: RESILIENCE AT ANGLIAN WATER



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1. INTRODUCTION: A SYSTEMS APPROACH TO RESILIENCE

Our definition of resilience

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'Resilience in the Round' expanded on three resilience themes:

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Our resilience framework

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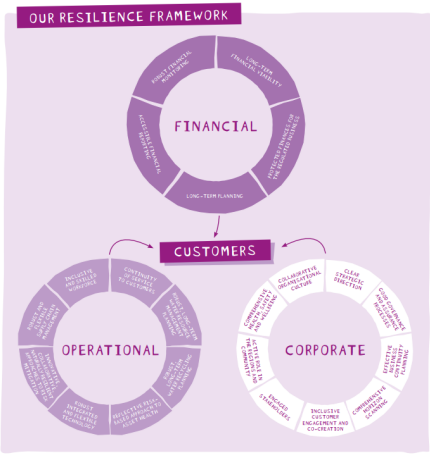


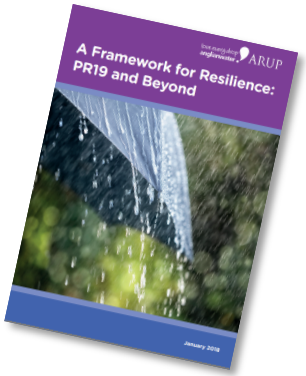
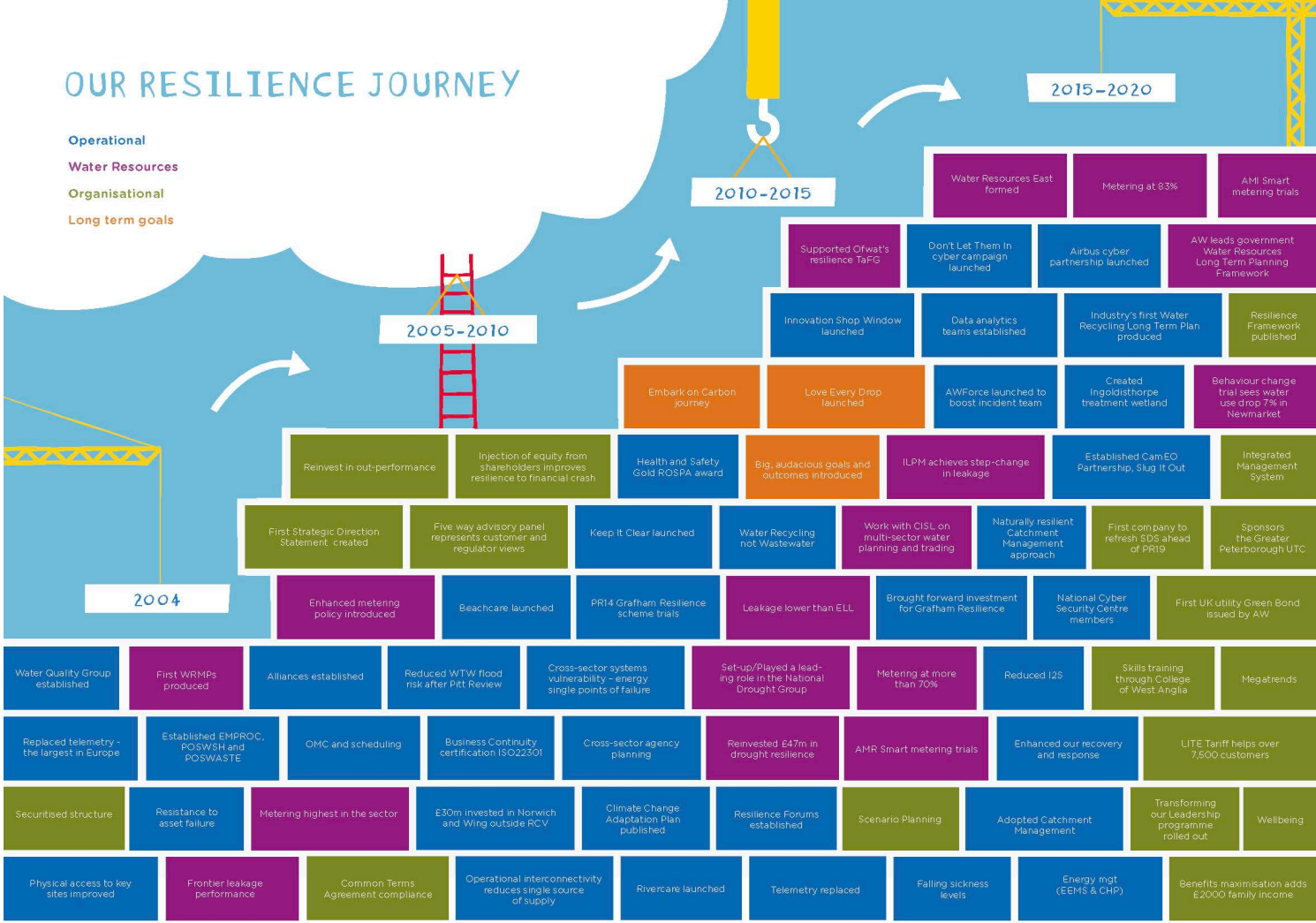


Figure 1: Our Resilience in the Round Framework

BUILDING RESILIENCE:

We've been on a resilience journey for a long time, increasing resilience in the round at every step.



2. A SYSTEMS APPROACH TO RESILIENCE

OUR 'ALL HAZARDS' APPROACH TO MANAGEMENT SYSTEMS

Our management systems help to ensure that we meet our customer commitments and deliver our outcomes for customers and the environment (see figure 2).

We take an all hazards approach to our management systems.

We are committed to delivering excellent drinking water and preventing pollution by enhancing the quality of the water we treat and return to the environment. As part of this we comply with relevant legislation, regulation and the standards of:

- Quality- ISO 9001
- Environment- ISO 14001
- Asset Management- ISO55001/PAS 55
- Business Continuity- ISO 22301
- Health and Safety- OHSAS 18001
- MCERTS (self monitoring of effluent flow)
- Anti Bribery - ISO 37001
- Carbon Management in Infrastructure - PAS2080

These management system standards share the same core structure and use common system clauses bringing consistency and compatibility between standards.

LR (Lloyds Register) assess these core set of requirements across our functions and activities, reducing business impact, expanding our view of resilience and maximising the output value of any findings.

We are currently in the process of implementing the following standards:

- Customer Vulnerability- BS18477
- Information Security Management- ISO 27001
- Occupational Health and Safety- ISO 45001
- Personnel Certification- ISO17024

We aim to ensure we have a robust and flexible approach to management of shocks and stresses. We constantly review available management system standards to enable us to provide our customers and stakeholders with the best possible levels of assurance.

All of the documents and associated activities within our management system framework policy and our standards are subject to a risk based audit through both our internal audit programme and our third party verification via LR.

Our Top Tier Risk Register is regularly reviewed by the Anglian Water Services Board and reflects emerging risk as well as current risk. The review challenges our level of controls and our risk appetite to ensure we understand our position and resilience to the risks.

We also carry out a forward look at Management Board and with the Anglian Water Services Board to ensure any mega trends are understood and taken in to account when we review our Risk Register. We have used third party advice from Oliver Wyman and PWC to help ensure a global long term view is taken in to account. The mega trends identified are detailed in section 3.

We also undertake an external annual SEMD (Security and Emergencies Direction) audit including Critical National Infrastructure. This audit is subject to third party verification and assurance undertaken by Jacobs.

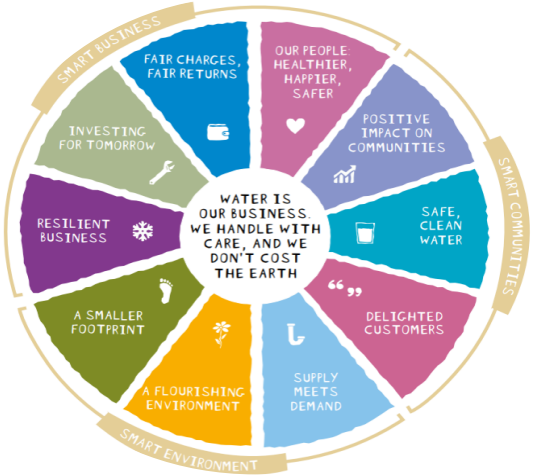


Figure 2: Our ten customer outcomes

2. A SYSTEMS APPROACH TO RESILIENCE

RESILIENCE GOVERNANCE

We are committed to high standards of corporate governance. We published the Anglian Water Services 2014 Corporate Governance Code in December 2013 in response to the governance proposals put forward by Ofwat. Our 2014 Code was updated to reflect changes in the UK Corporate Governance Code with effect from 1 April 2015. The Company Secretary keeps compliance with the Code under review and any changes recommended are subject to approval by the Board.

We have a clearly defined framework of roles, responsibilities and delegated authorities is in place which is designed to support the delivery of each outcome. The Board has a formal governance matrix which sets out the matters that are specifically reserved for its decision, through ensuring it exercises control over appropriate strategic, financial, operational and regulatory issues. Matters delegated to management are set out in a Scheme of Delegation.

The roles of the Chairman and Chief Executive Officer are separate, with their roles and responsibilities clearly divided. A document clearly sets out the respective responsibilities and a separate document sets out the role and duties of the Senior Independent Non-Executive Director. These documents can be found on our website.

Independent non-executive directors (INEDs) are (by definition) independent from management and are therefore well placed to ensure that decisions of the Board are taken objectively. Under the Companies Act all directors are required to exercise independent judgment and to have regard (amongst other matters) to the impact of decisions on a range of stakeholders (including customers) and to the likely consequences of any decision in the long term. INEDs have been the single largest group on the AWS Board since 2015. However, in August 2018, following the retirement of two of our executive directors, INEDs became the majority of Board members. All Board committees (including the Remuneration Committee) are comprised solely of non-executive directors. It follows that non-executive directors play a key role in ensuring that Management is not incentivised to take a short term view. In addition, as part of our securitisation arrangements, no dividend can be paid by AWS unless two INEDs are satisfied that the viability of the business is assured. This viability is tested by reference to a series of financial covenants which are assessed on a forward looking basis.

Our Top Tier Risk Register is regularly reviewed by the Anglian Water Services Board and reflects emerging risk as well as current risk. The review challenges our level of controls and our risk appetite to ensure we understand our position and resilience to the risks.

Below the Anglian Water Services Board, risks are considered in further levels of detail by the Management Board, Business Unit Senior Leadership Teams and down through the structure to individual teams. Risks are also actively managed by other relevant governance groups including:

- Strategic Priorities Board – chaired by the CEO and attended by a majority of Directors to actively manage resource allocations to address risks and ensure delivery of outcomes and performance commitments.
- The Resilience Steering Group – chaired by the CEO and made up of Directors and other senior managers, this group is responsible for resilience issues and providing strategic direction and tactical intervention in relation to business resilience and management system issues, including security, emergency planning, business continuity, and training and exercising activities of operational sites, offices, Anglian Water Services employees, third party contractors and suppliers working on behalf of Anglian Water. The group meets monthly.
- Finance, Treasury and Energy Steering Group – chaired by the Chief Financial Officer, which meets monthly to review the cash position of the business, current funding requirements and market risks. The group also considers energy prices and hedging strategies.
- Climate Change Steering Group – chaired by the Regulation Director, which assesses the latest climate change science, potential impacts on our business, mitigation and adaptation strategies, as well as processes for ensuring climate change impacts are taken into account in day-today investment and operating decisions.
- Fire Risk Steering Group – chaired by Director of Water Services, meets regularly to ensure consistency of application of hazard evaluation and installation of appropriate detection and suppression schemes. We are also working with a leading fire authority to achieve a consistent and robust fire risk assessment process for business-wide application.
- Information Governance Forum – chaired by the Group Legal Director, reviews how we protect data and reviews progress against the GDPR legislation.
- Leakage Steering Group – chaired by Director of Water Services Group and attended by Directors and senior managers, meets monthly to assess current performance and actions required to ensure resources are available to meet leakage targets.
- Water Quality Group – chaired by Group Head of Risk and Resilience, and attended by the CEO, operations Directors and senior managers , meeting weekly to review operational events and risks to ensure action is taken on a timely basis. The group also ensures that lessons are learnt from events and processes updated where needed. Lessons are also actively sought from other companies' events.

2. A SYSTEMS APPROACH TO RESILIENCE

INTEGRATED MANAGEMENT SYSTEMS

Our Integrated Management System unifies our management system processes into a complete framework, enabling us to work as a single unit with unified objectives.

The management system standards which support this framework share the same core structure and uses common system clauses, terms and definitions, bringing consistency and compatibility between standards.

The key components of this approach are:

- Guiding Principles for business resilience and Emergency Management Procedures (EMPROC)
- Policy and Standards for Water Supply Hygiene (POSWSH)
- Policies, standards and procedures for water recycling (POSWASTE)
- Operations Security Manual

Figure 3: the core of our integrated management systems.

EMPROC
EMPROC is a collection of structured 'Emergency Management Procedures' which ensure we are sufficiently prepared to respond and recover from any level of impact, event or incident.

Above these is a policy document 'Guiding Principles for Business Resilience' which acts as strategic guidance, ensuring the implementation of SEMD and the Civil Contingencies Act.

All EMPROC Procedures are reviewed on an annual basis.

EMPROC contains procedures for the creation, review and updating of comprehensive response and recovery plans for assets and temporary equipment.

EMPROC covers all facets of the business ensuring resilience is integrated throughout all areas of our operations.

POSWSH
POSWSH policy and standards are clearly defined with responsibilities detailed within the supporting procedures to maintain water supply hygiene.

The policy, standards and procedures are regularly reviewed to ensure current best practice and industry learning is embedded within the business. Policy and standards are currently reviewed on an annual basis and are approved by the Policy Advisory Group (PAG) of which the terms of reference require a quorum for approval of any updates and changes to the documents.

POSWH procedures are reviewed every 2 years currently and progress against that review process is monitored at the monthly POSWH update meeting. A member of the Water Quality management team is responsible for each POSWH section.

POSWASTE
We have policies, standards and procedures for water recycling (POSWASTES), which is reviewed at the Water Recycling Interlocking Group, the procedures are currently reviewed every two years and progress of the review process is monitored at the meeting.

Associated Work Instructions all have a document sponsor from the water recycling management team and require a minimum quorum for review and approval.

Operations Security Manual
The Operations Security Manual contains Policies and Procedures which are embedded within POSWSH, POSWASTE and EMPROC. These define the way in which the business should operate to avoid security being compromised and detail the minimum standards of security required. In the event of a security breach they provide the guidance and instructions to be followed to mitigate further risk, investigate the security incident and provide the legal evidence which may be required.
They are comprised of guidance from the Department of Environment, Food and Rural Affairs (DEFRA) and the Centre for the Protection of National Infrastructure (CPNI). These assist with maintaining our compliance with the Security & Emergency Measures Direction 1998.

The procedures are reviewed every 3 years by the Security Team with the support of relevant business unit members to ensure they are in alignment with current guidelines and practices.

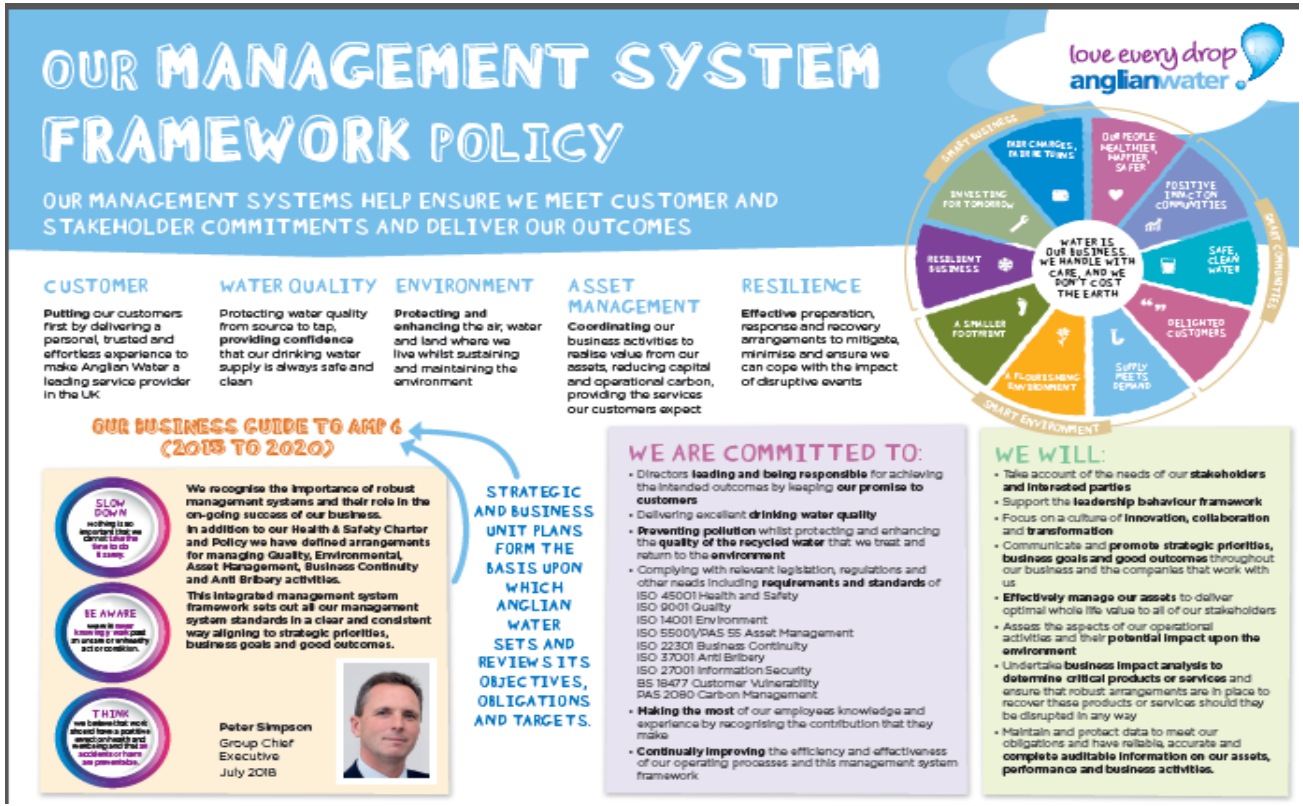
Key benefits to this integrated approach are:

- aligned policy and management system objectives
- improved risk management and integration
- optimised use of business resources
- enhanced customer satisfaction through successful delivery of service expectations
- efficiencies gained from third party assessment process; by assessing against a core set of requirements across AW functions and activities, we reduce business impact, minimise disruption and maximise value for money
- full alignment with AW strategic priorities, business goals and outcomes.

Our Integrated Management System Framework is illustrated on the next page.

A critical part of resilient thinking is to have an integrated approach across all systems. LRQA are our certification body and with their support we have developed a leading Integrated Management System Framework across the business. This framework approach, illustrated on the following page, now enables us to "bolt on" with ease any new and emerging standards we choose for example Customer Vulnerability (BS18477) which we are currently working towards. We were the first water company to be certified by LRQA to the business continuity standard (ISO22301).

INTEGRATED MANAGEMENT SYSTEMS FRAMEWORK



Gary Reed, Lloyd's Register Business Development Manager:

"Anglian Water Services Limited have made significant progress in the integration of their management systems, utilising the Annex SL ten-clause High Level Structure to good effect. This has enabled the business to take on new standards and integrate them into the management framework, with minimum disruption, and duplication.

"From the eighteen months that I have worked with the business, It has been clear that the driver to achieve this level of integration was value for the business, as opposed to collecting certificates.

"This is a refreshing approach, and will lead to enhanced performance and risk mitigation, which is of great value to both Anglian Water Services Limited, and Lloyds Register Group, in certifying their portfolio of approvals."

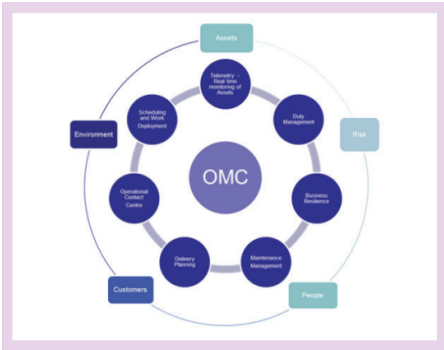
2. A SYSTEMS APPROACH TO OPERATIONAL RESILIENCE

Operational Management Centre

A key element of our ability to deliver resilient services is the effectiveness of our Operational Management Centre.
Our Operational Management Centre (OMC) provides 24/7 management of our operations throughout our region and across the water cycle. It is a key capability for managing risk, customer experience and driving efficiency. We set it up in 2006 to have a single 24/7 view of our operations and to provide an umbrella under which to manage operational risk. We have had an extensive telemetry system for decades, the largest in Europe, which we refreshed in AMP5. It has allowed us to target maintenance based on asset condition and performance.

Some of the benefits it gives us include:

- all Operational workflow is in one centre
- we monitor 750,000 separate telemetry points on Water and Water Recycling Assets
- we manage 1 million separate customer contacts and jobs per year on our Network and Assets
- all work is remotely dispatched to field technicians and tracked and captured on corporate data systems
- the OMC is staffed 24/7 with Senior Operation Managers
- enhanced understanding of asset performance and development of enhanced proactive maintenance strategies
- a dedicated insight and Data Scientist Team.



Business continuity

Business Continuity is a critical theme in our resilience thinking. We carry out a detailed Business Impact analysis to ensure team and personal resilience in all of our activities.

As part of our Business Continuity Planning we have both internal and externally sourced Work Place Recovery centres. We run regular exercises and system checks to ensure we can continue to operate.

Assurance

We have an Audit Committee whose principal role is to examine any matters relating to the financial affairs of the Company and to provide effective oversight and governance of the Company's internal control and risk management processes. Internal Audit supports the Audit Committee in evaluating the design and effectiveness of internal controls and risk mitigation strategies implemented by management.

The Audit Committee oversees the relationship with our external auditors, Deloitte, and monitors their independence and objectivity as well as considering the effectiveness of the audit process.

Lloyds Register (LR) provide external third party assessment and certification services. This assessment covers all management system standards that the business has committed to comply with. This external assessment goes beyond compliance and provides independent assurance and value adding recommendations for continual improvement.

Key business standards currently include health and safety, business resilience, quality, environmental, anti-bribery, asset and carbon management. These management system standards share the same core structure and use common system clauses bringing consistency and compatibility between standards. LR assesses these core set of requirements across AWS functions and activities, reducing business impact, expanding our view of resilience and maximising output value of any findings. We appoint a third party firm, Jacobs, to act as our assurance provider for annual and PR19 non-financial data. The appointment was made in conjunction with our Customer Engagement Forum, which can independently requisition its own reviews or audits of our data, procedures, policies or processes. Third party audits form part of the assurance necessary for our continued certification to ISO9001 and ISO22301. Ofwat's Company Monitoring Framework provides an incentive to ensure our published data is reliable and reported in a transparent and accessible way.

2. A SYSTEMS APPROACH TO FINANCIAL RESILIENCE

Long Term Financial Viability

As a long term business that provides essential services; works within very long (decades plus) planning cycles; has very long lived assets; and with long term investors, we take our long term financial viability extremely seriously. We have put in place a number of systems and checks to ensure our financial resilience and to monitor it.

The securitised structure of the business enhances our financial resilience by imposing a rigorous governance framework which requires continuous monitoring of our financial performance by senior management, and provides an additional layer of control over how we transact with our suppliers, business partners and bond holders. Any dividend payments are subject to stringent covenant constraints as part of our securitisation agreement.

Our covenants include forward-looking compliance statements. Two INED's and two Executive Directors confirm compliance on a forward looking basis.
We have a 25 year corporate financial model that is linked to our Strategic Direction Statement

We have maintained stable credit ratings and enjoy open dialogue with the rating agencies.

Reporting

We publish a Long Term Viability Statement: embracing the five year best practice corporate code methodology.

We have led the sector in producing integrated annual reports. We publish a comprehensive report on activities in the preceding year. This gives all stakeholders information about our activities and financial performance following International Financial Reporting Standards.

Our consolidated accounts provide information on the performance of parent and other group companies.

Financing

We have a long term investor base formed of pension funds.

Re-financing concentration risk is managed by having access to diversified sources of finance and no more than 50% debt maturing in any 5 year period, and 20% in any 2 year period.

We have also diversified our sources of funding with the issue of the first Green Bond in sustainable finance in the UK Water sector.

Protected Finances for the Regulated Business

Our finances are restricted to use by the regulated business. There are strict covenants that prevent diversification into non-regulated activities: we also ensure strict cash management; Certain conditions have to be met prior to dividend payments being made.

Robust Financial Monitoring

We consider stringent covenant tests required under our securitised structure to provide comfort to our bondholders that our business is viable to the end of the current period and beyond.

The Board reviews financial reports showing variance to budget and prior year each month. Significant variances are highlighted and explained.

The external auditor reports its findings to the Audit Committee in May and November annually. In addition, our internal audit function carry out a range of assurance assignments over the course of the year based on a plan agreed with the Audit Committee. Internal audit reports are rated on the basis of the risks identified and remedial actions assigned to management as appropriate, with internal audit continuously monitoring progress against the agreed actions.

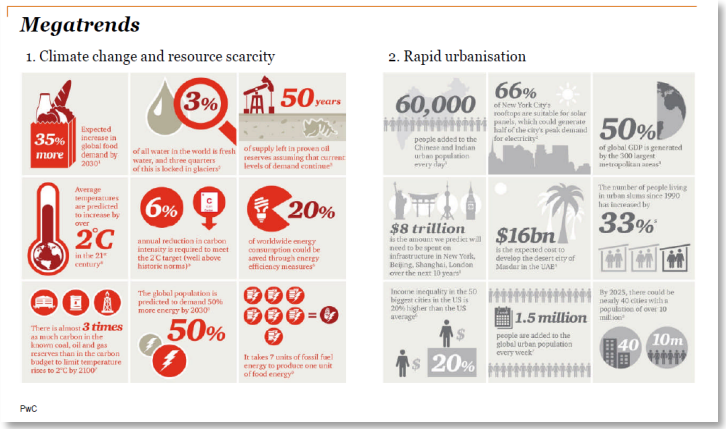
A regular monthly steering group meeting that involves senior members of the finance and wider regulation team checks progress through the year.

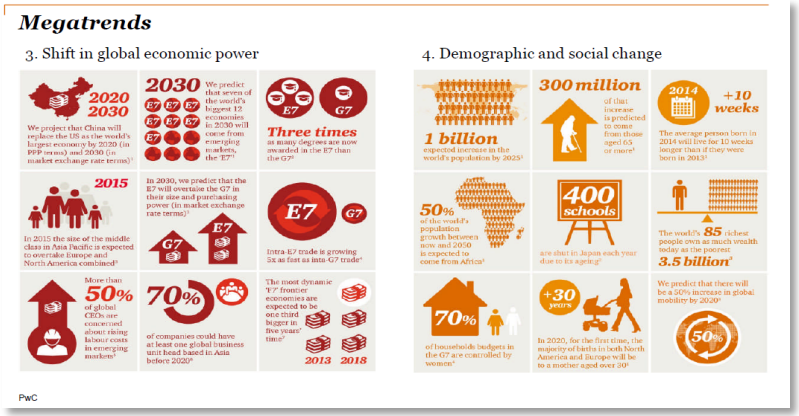
We have regular review meetings with the leading Rating agencies. This involves detailed discussion on financial sensitivities, scenarios including stress tests around macroeconomic and financial risks.

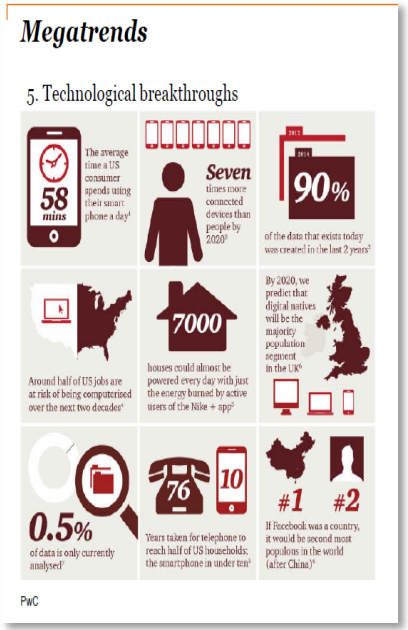
Financial controls are monitored on a monthly basis with around 30 employees responding to some 130 key control questions via a control monitoring tool. This is supplemented by an annual process coordinated by internal audit.

Our scenario analysis and financial viability statement can be found in the "Balancing, Risk & Reward" section of our PR19 Business Plan narrative.

ENGAGEMENT WITH PWC TO HELP WITH LONG TERM RESILIENCE PLANNING







3. IDENTIFYING AND PRIORITISING SHOCKS AND STRESSES

In order to build our resilience we have considered mega trends (see page 11) and identified the shocks and stresses that may impact our business. We have defined these as:

Shocks	Disruptive events, which impact the ability to provide a high quality service. In the water industry, acute shocks include sudden events such as floods, fires or cyber attacks.
Stresses	Chronic conditions which weaken the function of the organisation or system long-term. Examples highlighted in particular by Ofwat include population growth and climate change. Stresses are also often felt as shocks when they reach a tipping point.

A long list of these shocks and stresses has been identified and is set out on pages 13 to 16.

We have also mapped both our shocks and stresses together, based on level of control and the relevance of the risk to our business, shown in Figure 4.

Shocks are shown in purple and stresses in blue. Those in the top right quarter of this graph are a particular focus of investment. However for those shocks and stresses where we have less control, we aim to work with our stakeholder and customers to reduce and mitigate residual risks.

The mitigation strategies we have formulated to deal with these shocks and stresses are detailed in the following pages.

These are split by operational security, operational infrastructure, operational technology, operational resilience, operational environmental, corporate, political, legal/regulatory, social, economic, people and financial.

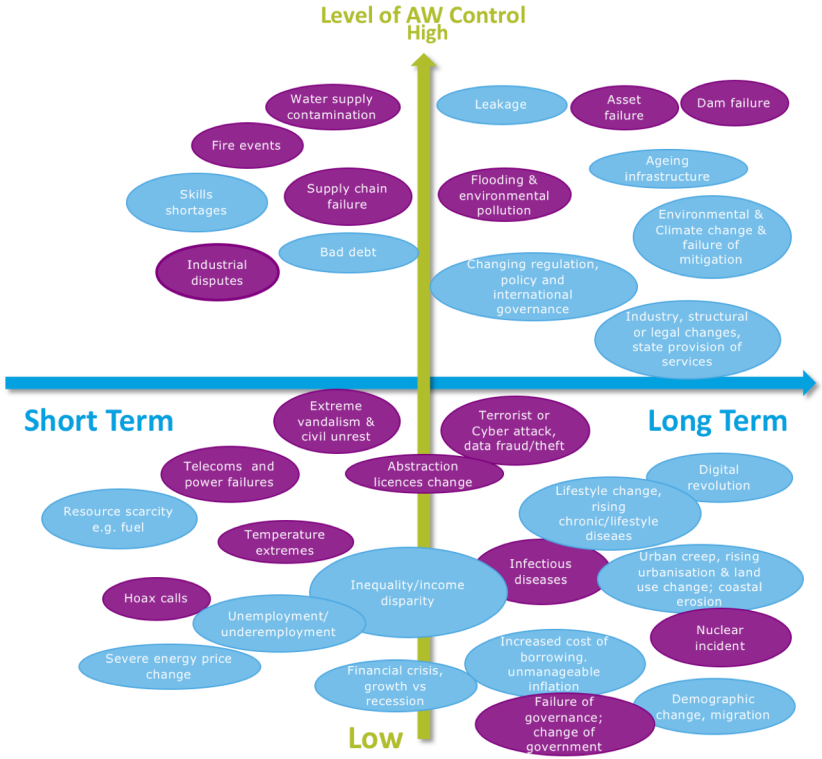


Figure 4: one of our methods for shock and stress mapping

3. IDENTIFYING AND PRIORITISING SHOCKS AND STRESSES

AN ALL HAZARDS APPROACH: SHOCKS THAT MAY IMPACT ANGLIAN WATER

Operational security			
Terrorist attack	Individuals or non-state groups with political or religious goals that successfully inflict large-scale human or material damage. This is defined under the Terrorism Act 2000 for the UK.	**Extreme vandalism**	Major malicious (or wilful) defacement of destruction of private or public property. This may include trespassing, damage to assets or theft of materials.
Civil unrest	Major social movements or protests (e.g. street riots, social unrest, etc.) that disrupt political or social stability, negatively impacting populations and economic activity.	**Hoax calls**	A call made to deceive for malicious or humorous reasons. This maybe by criminals directed at customers, reducing trust in water companies, causing resource to be diverted to address fake issues.
Cyber attacks	Large-scale cyber attacks or malware causing large economic damages, geopolitical tensions or widespread loss of trust in the internet.	**Data fraud/theft**	Wrongful exploitation of private or official data that takes place on an unprecedented scale.
Operational Infrastructure			
Asset failure	A sudden, unexpected loss in the service provided by an asset. This may have a knock on effect on the service of other parts of the network.	**Dam failure**	Dam breaches, failures, or collapses have the potential to cause massive possible destruction to communities and the environment and as such are defined as installations containing dangerous forces in international law. Causes may include extreme events, lack of maintenance or poor design.
Fire events	Fires in assets or wildfire can cause major disruption and impact on the ability to provide critical services. They may have other knock-on impacts like wildfire impacting water quality.	**Supply chain failure**	Many companies are reliant on global supply chains, with some materials limited to specific suppliers. Global resource scarcity or disruptions to supply chains may prevent critical products or services reaching their required designations.
Power outages	Unexpected loss of energy supply caused by an issue on site, from extreme events, causing an issue for continuation of services.	**Power cut**	Unexpected loss of energy supply caused by an external network issue, from extreme events, causing an issue for continuation of services.
Operational technology			
Telecommunication failure	Outage of critical information infrastructure (e.g. internet, satellites, etc.) and networks, causing widespread disruption.		
Operational resilience			
Water supply contamination	Where there is contamination of a drinking water source. This may include chemical, metal, drugs, or microbiological contaminants and may be incidental or malicious.	**Nuclear incident**	An event where radiation source has led to significant consequences to people, the environment or the facility (defined by the International Atomic Energy Agency). They may be in hospitals, nuclear facilities or in transport of radioactive material.
Temperature extremes	Major property, infrastructure and/or environmental damage as well as loss of human life caused by extreme temperatures.	**Flooding**	Major property, infrastructure and/or environmental damage as well as loss of human life caused by extreme weather events which cause flooding.
Infectious diseases	Bacteria, viruses, parasites or fungi that cause uncontrolled spread of infectious diseases (for instance as a result of resistance to antibiotics, antivirals and other treatments) leading to widespread fatalities and economic disruption.	**Industrial disputes**	A dispute between employees and employers, which may lead to disruption in the continuation of service. E.g. Union organised strikes.

3. IDENTIFYING AND PRIORITISING SHOCKS AND STRESSES

AN ALL HAZARDS APPROACH: SHOCKS THAT MAY IMPACT ANGLIAN WATER

Operational environmental			
Environmental pollution/ Invasive species	Deterioration in the quality of air, soil and water from ambient concentrations of pollutants and other activities and processes. In the case of water, this includes emerging contaminants, such as human pharmaceuticals and hormones, nano materials and recreational drugs.	**Failure of climate change mitigation & adaptation**	The failure of governments and businesses to enforce or enact effective measures to mitigate climate change, protect populations and help businesses impacted by climate change to adapt
Political, legal or regulatory			
State collapse or crisis	State collapse of geopolitical importance due to internal violence, regional or global instability, military coup, civil conflict, failed states, etc. (e.g. civil conflict, military coup, failed states).	**Failure of regional, national or global governance & planning**	Inability of regional or global institutions to resolve issues of economic, geopolitical or environmental importance.
Abstraction licences change	A change in legal abstraction allowances causing less water to be allowed to be taken from water sources.		
Economic			
Severe energy price change	Significant energy price increases or decreases that place further economic pressures on highly energy-dependent industries and consumers.		

3. IDENTIFYING SHOCKS AND STRESSES

AN ALL HAZARDS APPROACH: STRESSES THAT MAY IMPACT ANGLIAN WATER

Operational Infrastructure	
Ageing infrastructure	Failure to adequately invest in, upgrade and/or secure infrastructure networks (e.g. energy, transportation and communications), leading to pressure or a breakdown with system-wide implications.
Leakage	Loss of treated water through faulty or ageing infrastructure. Knock on impacts include wasted water, reduced pipe pressure, and supply issues.
Operational Environmental	
Environmental change inc. invasive species	Changes in habitats, ecosystems and biodiversity from pollution, habitat destruction and climate change. This includes invasive alien species arriving and outperforming and replacing the native species.
Climate change (inc. drought and sea level rise)	Change of climate, which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, in addition to natural climate variability.
Coastal erosion	Increasing coastal erosion is likely in part due to increased sea levels, causing damage to infrastructure.
Urban creep	Rising number of people living in urban areas resulting in physical growth of cities.
Rising urbanisation	Urbanisation concentrates populations, potentially making them more vulnerable to the effects of natural disasters, disease and deliberate acts of violence.
Land use change	Changes in the use of land. This could be from changes in agriculture, land management or urban creep.
Political, legal or regulatory	
State provision of services	Governments may become less able to provide critical services, meaning other organisations may have to take over this role.
Legal structures	Legal changes in frameworks or obligations may occur that transfers responsibilities or enables processes. This may include legal duties like abstraction licenses or biodiversity duties.
Changing regulation, policy and international governance	Changing landscape of local, regional or global policy, legislation and regulation.
Change of Government	Change in the controlling party of the UK following a general election.
Regulatory changes	Change in regulation in response to questions about trust and legitimacy.
Brexit	The unknown impact of Britain's decision to leave the EU.
Corporate	
Digital revolution	Intended or unintended adverse consequences of technological advances such as artificial intelligence, geo-engineering and synthetic biology causing human, environmental and economic damage.

3. IDENTIFYING SHOCKS AND STRESSES

AN ALL HAZARDS APPROACH: STRESSES THAT MAY IMPACT ANGLIAN WATER

Social	
Demographic change	Global population growth is predicted, the location of these population is expected to change. This also includes ageing populations in developed and developing countries driven by declining fertility and decrease of middle-and old-age mortality.
Migration	Large-scale movement of people voluntarily or involuntary induced by conflict, disasters, environmental social or economic reasons.
Lifestyle change	Changes in the way people live, causing a change in the resources used and expectations of services provision.
Inequality and increasing income disparity	Increasing socioeconomic gap between rich and poor in major countries or regions.
Rising chronic and lifestyle diseases	Increasing rates of non-communicable diseases, also known as "chronic diseases", leading to rising costs of long-term treatment and threatening recent societal gains in life expectancy and quality.
People	
Shortage of skilled labour	A shortage of unknown or emerging specialist skills required for the continued running of businesses, systems and services.
Skills shortages	A shortage of known specialist skills required for the continued running of businesses, systems and services.
Unemployment and underemployment	A sustained high level of unemployment or underutilisation of the productive capacity of the employed population.
Economic	
Structural change	Change in the basic way a market or economy functions, caused by a variety of factors, such as globalisation, labour changes or resource variability.
Macro industry change	Economic changes causing changes in the sectors of the economy. For example a shift from primary and secondary sectors (extraction of raw materials and manufacturing) to tertiary sector (service sector).
Resource scarcity(inc. fuel)	Reduction in resources availability, locally, regionally or globally, this may include water, energy, fuel, chemicals or any finite physical resource.
Financial	
Growth vs recession	Significant growth or decline in the activity across an economy lasting at least a few months. This recession may be seen negative economic growth.
Financial crisis	The loss in the nominal value of financial assets. For example asset bubbles where unsustainably overpriced assets such as commodities, housing, shares, etc. in a major economy or region.
Unmanageable inflation	Unmanageable increases in the general price levels of goods and services in key economies.
Bad debt	Debt which cannot be recovered, often linked to the debtor being insolvent. Risk of bad debt is often linked to the strength of the wider economy.
Increased cost of borrowing	Increased interest rates causing increased financial burdens on individuals and organisations.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL SECURITY

We have a clear strategy for how we manage and mitigate the challenges of operational security. The three key challenges are physical, personnel and cyber.

Our works, pipes and pumps are part of the UK's national infrastructure and are needed to help run the country and deliver essential services.

Some of that infrastructure is considered 'critical' because of the serious effect on the economy and on people's lives if it were to be damaged or lost. Cyber attack poses a large and increasing threat to critical infrastructure across the world. We have a significant and award winning programme to minimise the risk and impact of a cyber attack. An important part of this programme has been about internal personnel resilience to cyber attacks.

Our Resilience Steering Group meets to review current security threats and monitor our theft reduction programme. The group also keeps abreast of where risks are emerging and reviews our mitigation against these. Matters of civil unrest or hoax calls would also be part of this mitigation review.

We work closely with Category 1 responders and specifically Counter Terrorism Security Advisors (CTSAs) to keep a finger on the pulse of any emerging risks and to use their knowledge to measure and improve our resilience in this area.

The Information Governance Forum also reviews how we protect data and reviews progress against the new GDPR legislation.

Figure 5: Our award winning Cyber Programme


SECURITY NEWSLETTER

Issue 003 – March 2018

Parks and Conservation — Protecting our crowded places

The Security Team joined staff at the recent Parks and Conservation Annual Team Meeting to deliver several training packages aimed at improving our response to a range of security incidents.

A police Counter Terrorism Awareness Advisor delivered a **Project Griffin** briefing, providing practical advice to mitigate the threat from terrorism. This complimented scenarios based security training, which challenged the group to think about how we can protect our crowded places and operational sites from criminals and terrorists.

Risk and Resilience Team certified as SEMD compliant

Auditors recognised the dedication and commitment from staff right across the organisation, during last months ex-

SUSPICIOUS BEHAVIOUR!

ADDITIONAL SUPPORT AVAILABLE ;

- Physical Security Advice
- Counter Terrorism Advice
- Covert Operations
- Mobile CCTV
- Fly Tipping
- Security Surveys
- Training & Exercises

Please don't hesitate to contact the Security Team for more help and advice.

Figure 6: A snapshot of one of our security newsletters

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL SECURITY

Mitigation of physical security challenges

Our Security Manual and EMPROC set out processes and practices to help our resilience against terrorist attack and extreme vandalism. We also ensure we comply with SEMD requirements and the associated Advice Notes. We have physical hardening of buildings and critical processes, we have an extensive training and exercise programme and have carried out awareness workshops across critical teams.

Terrorist attack
Individuals or non-state groups with political or religious goals that successfully inflict large-scale human or material damage. This is defined under the Terrorism Act 2000 for the UK.

- We ensure DEFRA security threat information is communicated and acted upon via reporting up to Resilience Steering Group.
- We work with CTSA's (Counter Terrorist Security Advisors) and CPNI provide support, analysis and intelligence to ensure that we are prepared to respond to any increase in risk.
- We have invested to meet the requirements of SEMD and the associated Advisory Notes. We have ensured these requirements are contained within our minimum asset standards to ensure future assets also comply.
- Our critical assets and teams have business continuity plans in place which are externally audited and certified to ISO 22301.
- We have also put in place workplace recovery provision for our major offices in the event of a disruption. Our response arrangements are regularly tested and exercised.
- We are audited annually against the requirements of the Security Emergency Measures Direction (1998), and an approved SEMD programme of capital works is in place to ensure we meet security requirements.
- The Business Resilience Security Manager works closely with our Human Resources team to identify any roles where new employees may require security screening or checks are undertaken e.g. those working at critical national infrastructure sites or undertaking activities which allow them access to sensitive personal information.
- We have a heightened security procedure and process ensuring relevant staff will be alerted and measures such as extra "manning" and vigilance across our key sites.

Extreme vandalism
Major malicious (or wilful) defacement of destruction of private or public property. This may include trespassing, damage to assets or theft of materials.

- Our Security and Emergencies Advisor role has a specific portfolio role for theft reduction and reports to our Resilience Steering Group on the success of this targeted approach.
- We have CCTV at a large percentage of our sites particularly key water sites to both deter and track intruders.
- We use SmartWater to deter theft but also to help track and recover after theft. We also use them to monitor trends in both types of theft/vandalism and geographical location so we can alert operational managers.
- A range of anti-theft activities are in place including covert operations in vulnerable or repeat target areas. We maintain close working relationships with local police services throughout our region supporting intelligence sharing. We have been targeting Theft Reduction across our assets and have made significant reductions and built heavily on site resilience.
- Regular reports are shared with internal stakeholders including trend reporting.
- SEMD programme of capital works for AMP6 on going to install equipment in accordance with DEFRA security requirements.
- A rolling programme is in place for the application of Smartwater to key operational installations.
- We have Drinking Water Safety Plans in place supported by our emergency response arrangements which are audited and externally certified to ISO22301: Societal security: Business Continuity.
- DEFRA security threat information is communicated and acted upon.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL SECURITY

Mitigation of personnel security challenges

Civil unrest

Major social movements or protests (e.g. street riots, social unrest, etc.) that disrupt political or social stability, negatively impacting populations and economic activity.

- Our incident response process addresses a wide range of threats and events.
- We ensure our "field" employees are briefed if there are any areas to avoid or circumstances which required a change to their routine duties.
- Our sampling staff have detailed briefings of how to deal with any local disruptions or areas where the risk of entry may be of concern.
- Our events team and recreation teams all have "counter terrorism" awareness training and are briefed ahead of any large events
- We have a heightened security procedure and process ensuring relevant staff will be alerted and measures such as extra "manning" and vigilance across our key sites.

Hoax Calls

A call made to deceive for malicious or humorous reasons. This maybe by criminals directed at customers, reducing trust in water companies, or may to be water companies, causing resource use to address fake issues.

- We work with a range of stakeholders including local police forces and local resilience forums to cascade information and educate our customers so that they can recognise bogus callers.
- We have processes in place to allow for verification of our employees' identity. We have undertaken a campaign through our Bogus caller information leaflet, shown in Figure 7.
- We also brief call centre staff to ensure any unusual calls are reported and escalated, these are then reported to the Police if appropriate, Defra and where applicable to the cyber security team.
- We train and exercise with our Facilities Management provider to ensure we are well practised and can respond to such incidents.
- We participate in Warning and Informing groups within Local Resilience Forums to disseminate key messages.
- We work with agencies, partners and customers to ensure our processes for verification of employee identity are understood to try and prevent bogus callers and improve the resilience of our customers.

Figure 7: Our Bogus caller information leaflet

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL SECURITY

Mitigation of cyber security challenges

Cyber attacks
Large-scale cyber attacks or malware causing large economic damages, geopolitical tensions or widespread loss of trust in the internet.

Data fraud/theft
Wrongful exploitation of private or official data that takes place on an unprecedented scale.

- The physical security process and practices links with our cyber protection programme which seeks to make us more resilient to cyber attacks and data fraud/theft.
- An overarching and holistic security strategy has been defined and approved by RSG. This describes the direction of travel for all elements of security including cyber and includes alignment of Cyber, Personnel and Physical security as well as future certification against a recognised framework for management of cyber risk (ISO27001).
- The cyber security team has expanded in remit and resources to address a broader set of risks; this includes the appointment of a Chief Information Security Officer and re-focusing of the different risks between Information Technology and Operational Technology across the AW group.
- Key governance and controls are in place to monitor and identify threats from incoming attacks. Detective and preventative technical controls have been implemented to reduce likelihood of attacks being successful.
- In addition to enhancing technical controls an ongoing awareness and education campaign continues to modify employees' behaviours towards cyber risk, with regular checks to test people's understanding . Additional vetting of new employees and an extension to our supplier risk assessment has been implemented to support our security improvements.
- A managed outsourced security service has been contracted and has significantly matured. This has included the implementation of critical security technologies. These technical controls have improved detection and prevention response as well as enabling faster response to incidents.
- Threat Intelligence services have been introduced to proactively respond to new threats and to ensure that services are protected from known attacks more quickly.
- Our IT infrastructure has been tested against cyber attack, and changes made to existing systems have been reviewed for impact on security architecture.
- The Phishme monitoring tool provides measurement of employee understanding and awareness of attack issues.
- Training and development continues to be a key focus within the cyber team with investment in ISO27001, GICSP, SEC+ and CCSP all being completed in 2018 and further investment planned for 2018/19 and beyond.
- Cyber playbooks have been developed that identify the top 10 most likely incident types for both Information Technology and Operational Technology assets and for each scenario a set of actions have been designed and trained to the Incident response teams to minimise the impact of future cyber events.
- A significant investment programme has been undertaken in respect of the new General Data Protection Regulation. This has involved a comprehensive review and update of all relevant policies, identification and assessment of data collection and processing activities, embedding privacy by design into new projects and data processing activities and a review of new technologies needed to support ongoing compliance with the regulation.
- The SAP Cyber security team manages our activities around the assessment of access rights and privileges within the SAP system. Their work includes detailed reviews of risks concerning data security and fraud and we have focussed on tightly controlling all access provisioning for all users in order to minimise the risk of fraud. The work of the team is externally audited in detail, over several months each year

Strategy for the Management of Cyber Security

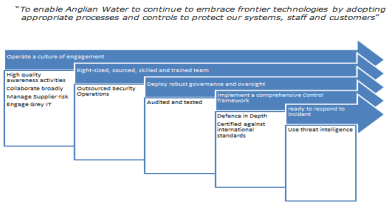


Figure 8: (above) our cyber security strategy (below) Our cyber security campaign to raise awareness with out staff.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL INFRASTRUCTURE

Mitigation of operational infrastructure challenges

Asset Failure
An sudden, unexpected loss in the service provided by an asset. This may have a knock on effect on the service of other parts of the network.

Dam Failure
Dam breaches, failures, or collapses have the potential to cause massive possible destruction to communities and the environment and as such are defined as installations containing dangerous forces in international law. Causes may include extreme events, lack of maintenance or poor design

Ageing infrastructure
Failure to adequately invest in, upgrade and/or secure infrastructure networks (e.g. energy, transportation and communications), leading to pressure or a breakdown with system-wide implications.

- Our incident management processes support response to asset failure; response and recovery plans are produced by supply system and critical assets identifying contingencies in place should sites or assets fail.
- Governance supporting processes when designing, implementing or modifying Supply Systems ensure that resilience is given adequate consideration and that supply resilience mitigation schemes are well managed.
- A significant part of our investment programme is targeted at maintaining Asset Health and ensuring our infrastructure is resilient for the future. We have reliability and criticality models for all of our asset inventory which are used to identify and prioritise investment requirement to maintain asset health and serviceability to customers.

A few examples are detailed below :

- Schemes are being completed during AMP6 at Grafham and Wing WTWs providing additional capacity or improving the resilience of these sites. Additionally, several smaller scale schemes are being delivered to provide additional resilience where schemes initiated due to water quality or maintenance are taking place. To mitigate the risk of flooding at critical sites, capital solutions are being delivered across three alliances (IMW, IOS and IMR).
- All of our dams are maintained and inspected in accordance with the requirements of the Reservoirs Act and specific investment is ring-fenced for this activity.
- We have established a dedicated Restoration team working across the business to enable supply restoration activities before repair and ensuring that all planned work considers restoration techniques to minimise interruptions.
- In order to reduce the risk of failure, routine maintenance programmes are carried out to monitor the condition of our assets and replace where required.
- Pump Replacement - activities aimed at reducing the number of pumps out of service and the mean time to replace / repair. Targeting below 5% pumps out and a 10 day level of service for all replacements.
- Pumping Station Serviceability visits - Planned teams in Maintenance carry out a programme of serviceability visits on our pumping stations with frequency dependent on risk based assessment.
- Planned Preventative Maintenance for sewer jetting and wet well cleaning - 5469 km of sewers jetted according to risk-based programme and 518 wet well cleans. Partnership funding - capital contributions made to third-party schemes which deliver cost beneficial flooding benefits to our customers.
- We have developed a predictive analytics model to identify high risk sewers which are then included in our CCTV survey and remedial works programme.
- To mitigate the risk of pollutions, our 'Pollution Watch' campaign targets communications for the general public and river users to contact us in the event of potential pollution. This increases our self-reporting and improves reactive response times to potential incidents. A Pollutions app is also now in use to support technicians to collect data during incident management.
- High risk pumping stations have been identified and a programme put in place targeting risk reduction at these assets. Maintenance resources have also been increased to carry out planned work.
- To reduce the impact on the network of customer behaviour we also promote our Keep it Clear campaign, a programme of activity to drive behavioural change in disposal of fats, oils and greases and unflushables into the sewerage network to reduce blockages.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL INFRASTRUCTURE

Mitigation of operational infrastructure challenges

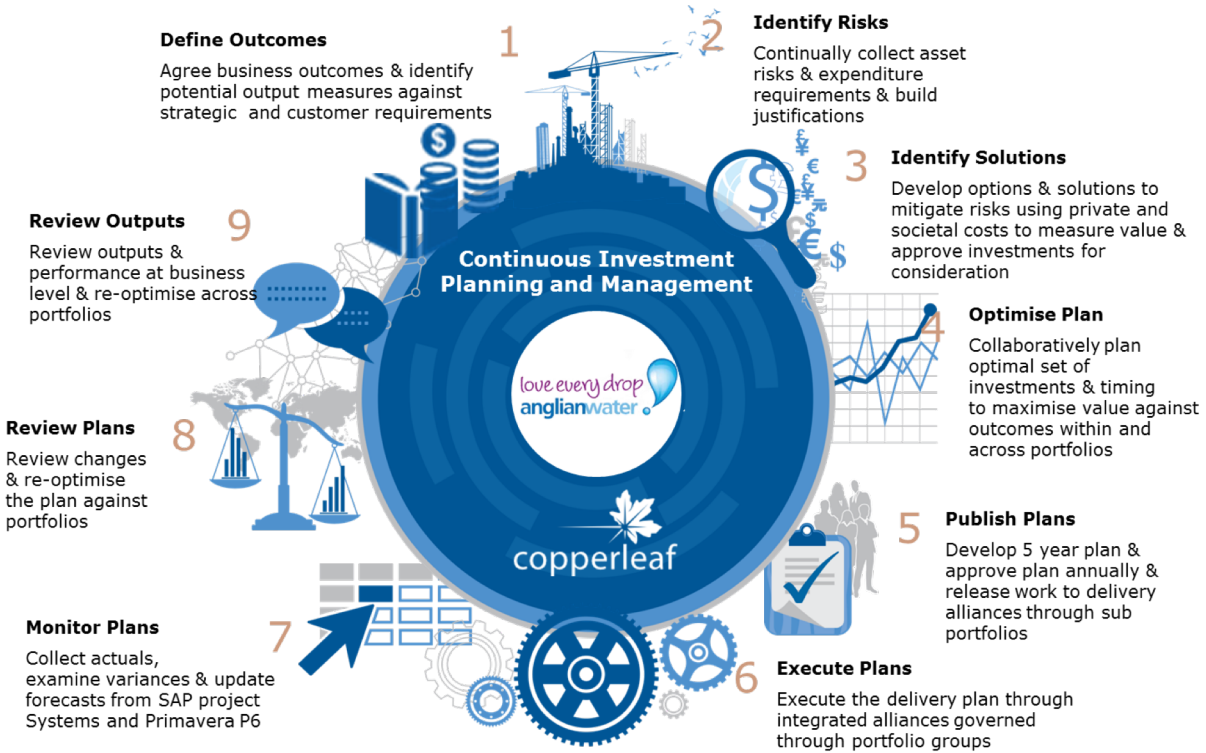


Figure 9. Our asset management systems approach

CASE STUDIES - SYSTEM RESILIENCE

BENEFITS FROM THE NORWICH RESILIENCE SCHEME

Early 2010 saw the commissioning of the Norwich resilience scheme. As our first major standalone resilience scheme, the concept was developed in 2005 to provide resilience under average demand conditions should the full output of the Norwich Heigham Water Treatment Work (WTW) fail (72% of required supply for 200,000 population).

The investment of £16.5M delivered a new raw water mains, a new 24 Ml/d Water Treatment works plus trunk main connections from the East Hills WTW to the Norwich water ring main.

The solution included a full automation configuration which enables remote control of WTW output and full pressure control. This has been designed to allow optimisation of all the available groundwater assets should Heigham output be catastrophically lost due to a resilience event such as fire or flood.

The scheme and its operation was underpinned by a regular and full maintenance and testing regime.

The East Hills scheme is designed to be able to ramp up instantly (unlike a more complex solution such as an RO/membrane plant requiring run up time) and the East Hills WTW output can be controlled remotely from Operational Management Centre. It can meet demand by ramping up from its baseline output of 2 to 3 Ml/d to the maximum output of circa 24 Ml/D in short timeframes.

This resilience scheme was used during the 2018 Freeze/thaw event when demand rose in the Norwich Supply from 53.63Ml/d to 73.65Ml/d over the period of 4 to 6 March 2018. The East Hills WTW was used to pick up the majority of this increase with its flows rising from 2.57Ml/d on 3 March to 12.26Ml/d on 5 March and 13.79Ml/d on 6 March.

Without this resilience capability, the ability of the Heigham WTW to meet this increased demand in such a short timescale would have been questionable. This event showed the value of our resilience investment.

BENEFITS FROM THE GRAFHAM RESILIENCE SCHEMES

Grafham Water Treatment Works (WTW) serves 829,000 people. A resilience event causing a prolonged network outage would rapidly affect 75% of this population – representing a significant risk.

To provide Network resilience, our AMP5 Business Plan included a scheme for the construction of a new storage reservoir and major network resilience scheme, with a new water main from Hannington Reservoir to Grafham WTW.

Our AMP6 Business Plan included completion of this scheme and an additional scheme to secure the power supply to Grafham; Grafham was one of only two water treatment works at the time without sufficient onsite backup generation.

In preparation for our AMP6 Business case for the Power resilience scheme the latest best practice in resilience planning was followed to understand the need and evaluate options.

In doing this we listened to our customers and worked closely with Ofgem, National Grid and the Distribution Network Operators (DNOs).

For the network resilience scheme, instead of a new main we saved cost and carbon by adapting and using an existing asset (which had originally been designed for single directional flow) . This resulted in avoiding the need to construct a 36km pipeline. This innovative and ground-breaking approach created an enhanced network with a bi-directional asset and allowed large potable water transfer between supply zones.

This scheme was the first of its kind, globally, to use flow reversal philosophy on the existing asset to ensure resilience in the Grafham system.

We received external validation through recognised and prestigious awards, for example the Capital Project Management Award at the Utility Week Awards where the judges called it a "fantastic exemplar for the industry" using technical innovation to deliver outstanding results while driving massive reductions in cost. It also won the prestigious Carbon Reduction Project of the Year in the British Construction Industry Awards.

CASE STUDY – KEEP IT CLEAR

Keep it Clear delivers bespoke awareness interventions in response to pipe and pump blockages which can cause customers to experience inconvenience, internal flooding and pollution to the environment.

Keep it Clear works across our network including operating at **24 key locations. It delivers 30% average blockage reduction rising to 52% in areas where the campaign runs for more than a year.**

- **10 formal partnerships** with community organisations in **17 areas.**
- **Doorstep visits** trial in high risk areas - 84% reduction in actual blockages.
- **Food serving establishments** (FSE) - reactive advisory visits as well as new trial in Peterborough of pro-active visits to 600 + premises.
- **Partnerships** with major retailers and manufacturers, local authorities and NGOs leading to influential change.
    - **New livery** (right) in partnership with Marine Conservation Society's 'Monsters' campaign.
    - **100,000** conversations with women and in schools discussing sanitary item disposal,
    - **500** community events attended and **35,000** children and adults engaged in collaborative arts and performance project.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL INFRASTRUCTURE

Mitigation of operational infrastructure challenges

Fire events
Fires in assets or wildfire can cause major disruption and impact on the ability to provide critical services. They may have other knock-on impacts like wildfire impacting water quality.

- Our policies and procedures define all aspects of fire risk control and related processes, and governance includes routine review of system effectiveness, performance monitoring and consideration of process improvement.
- Hot work safe systems include permits, security of the area, fire risk management, equipment maintenance and specific training. Permits are monitored and work areas subject to inspection by managers.
- The Fire Risk Steering Group, chaired by the Director of Water Services, meets regularly to ensure consistency of application of hazard evaluation and installation of appropriate detection and suppression schemes. We are also working with a leading fire authority to achieve a consistent and robust fire risk assessment process for business-wide application.
- Thermography maintenance and electrical testing programmes are embedded across the business.
- Fire safety plans and risk assessments are completed for all premises, monitored and reviewed on a regular basis.
- Evacuation plans are in place for all sites with major office sites supported by offsite dispersal plans.
- All staff receive fire safety training at a level appropriate to their role and are briefed on evacuation procedures during site inductions.
- Those who have a specific role in an emergency receive appropriate and specific training, and regular evacuation drills are carried out, supported by a programme of exercises to test evacuation and dispersal at main offices.
- We also have insurance to cover financial losses arising from loss through fire.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL INFRASTRUCTURE

Mitigation of operational infrastructure challenges

Supply Chain Failure
Many companies are reliant on global supply chains, with some materials limited to specific suppliers. Global resource scarcity or disruptions to supply chains may prevent critical products or services reaching their required designations.

- As part of our EU compliant strategic sourcing process, suppliers are assessed in terms of their business resilience and this also includes assessment of criticality to our organisation in relation to the goods and services supplied to us including the upstream supply chain. Where suppliers are identified as medium or high risk against our documented supplier business resilience assessment procedure, they are required to provide details of resilience and continuity arrangements as part of the tender process. If successful in being awarded a framework these are reviewed on a regular basis as part of active framework management and mitigation plans are put in place, some of which are contractually obligated.
- Dependant on the size of the contract, we will seek differing levels of financial resilience measured through creditworthiness, e.g. for our principle electricity contract we require a credit rating from the main credit rating agencies of A1.
- We have portfolio managers in place for all key spend areas. Core to portfolio management is the development and management of their supplier relationships and building an in-depth knowledge of their portfolio's supply chain. In identified areas of critical spend such as chemicals, there is at least one additional colleague with knowledge of the supply chain and suppliers.
- Where global supply chains are involved or suppliers have been identified as a business resilience risk within our frameworks, we work to understand the potential bottlenecks, risks and opportunities within those supply chains to ensure that mitigation plans are in place and ownership is clear to all parties.
- One mitigation where global supply chain criticality is highlighted is to contract with multiple suppliers for key goods and chemicals which allows us to ensure that we maintain deliveries for our sites. However, we acknowledge that this is only the first level of the supply chain and that bottlenecks and risks can be further up the supply chain. Long term relationships are key to transparency through the entire upstream supply chain.
- Across our Integrated Supply Chain team we have decades of experience balanced across the portfolios of spend. This stability within the team supports and maintains the strong, collaborative and proactive relationships with our key and critical suppliers. For strategic portfolios category plans are developed to ensure the in-depth knowledge of the supply chain is captured.
- As part of active framework management, where appropriate, a robust audit programme is in place, particularly for example with the chemical portfolio to ensure we maintain an understanding of our Supply Chain's resilience to disruptions, scarcity of supply and impact of Brexit.
- We regularly review our policies to ensure water treatment chemical supply resilience is sufficient, including input from the operational teams.
- Any contingencies in place are outlined in the Process Recovery Plans and detail if suppliers can or should be able to support critical activities.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL INFRASTRUCTURE

Mitigation of operational infrastructure challenges

Leakage
Loss of treated water through faulty or ageing infrastructure. Knock on impacts include wasted water, reduced pipe pressure, and supply issues.

Strategy

- Leakage is one of our key priorities as a business and a clear priority for our customers. Our Water Resources Management Planning identifies that demand management is key to offset the pressure of future growth in our region and maintain resilient future supplies to our customers. Our demand management plan includes leakage, smart metering (allowing us to identify customer side leakage and plumbing losses) and promoting water efficiency and customer behavioural change. Leakage reduction has always been a key part of managing demand and is one of our customers highest priorities as they see it as an 'emblematic' issue.

Governance

- We have clear governance and control processes in place to monitor leakage performance and gain assurance of achievement of target this includes our Leakage Board where performance is reviewed monthly by relevant Directors.
- Our annual water balance is fully audited by Jacobs as part of leakage data verification process.
- Leakage targets are set on a 3 year rolling average, with recovery plans in place should the target be in jeopardy.

Optimised Water Networks

- In a water stressed area with significant anticipated future growth, leakage is and will remain a key priority for us. As the frontier performer in the UK water industry we continue to explore and adopt innovative approaches to prevention and detection of leaks. Rather than being solely reliant on traditional leak detection and repair techniques we have a multi AMP overarching leakage and optimisation strategy, focussed on establishing our long term goal of a calm and controlled network across the whole of the region. As part of this we have a pressure calming programme to reduce leakage, reduce pressure transients and prevent mains bursts.
- We also have our Smart Water Systems programme looking at the use of new technology to identify and mitigate leakage faster and promote solutions to maximise the life of our assets. We utilise our industry leading Shop Window area to develop and prove the benefits of emergent technological advances such as near real time predictive modelling, acoustic noise logging, drones and satellite imagery and analytics before wider utilisation across our region.
- We actively collaborate across the industry, all parts of the business and our wider supply chain to develop innovative new solutions to drive frontier performance in leakage management. Through participation in national and international forums we share our experiences and best practice approaches.

Data

- As we have evolved our leakage strategy, data fusion and analytics play increasingly key roles in our leakage process. We have invested extensively in flow and pressure monitoring across our network. This is fully integrated into our Telemetry system which interfaces with our bespoke leakage management system, Integrated Leakage and Pressure Management (ILPM). ILPM integrates all of our corporate systems, providing a visualisation platform for all relevant information.
- ILPM manages the whole leakage process, from effective targeting of high areas of leakage, deployment of field resources and resolution. This also provides near real time system performance reporting and is used to provide accurate and timely performance reporting to governance forums.
- In readiness for achieving our AMP6 targets a predictive forecast model was developed in collaboration with Cranfield University, providing a prediction of volume and areas where burst water mains are likely to be observed based on environmental data science modelling of weather, soil, and infrastructure variables. This allows us to proactively predict likely work volumes and manage our repair team resources to best effect. We are continuing to develop and refine this forecasting model.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL INFRASTRUCTURE, LEAKAGE

CASE STUDY – SMART WATER SYSTEMS

We have established a dedicated project team to deliver leakage savings through exploiting the benefits of new technologies. The project team work collaboratively with key technology suppliers (such as Claval and I2O) developing new innovative processes in areas such as:

- Pressure transient identification and mitigation
- Sensoring of the network through pressure and fixed correlating noise loggers
- Near real time modelling
- Dynamic DMA operation.

As part of our overall leakage and optimisation strategy they proactively identify and prevent failure, maintain customer supplies and reduce leakage.

Peterborough Network Optimisation

The Peterborough network optimisation project involved optimising 42 separate fed closed DMAs across the city through strategic pressure management utilising intelligent control valves allowing remote control of the full network. Since commissioning the first
phase in 2015 a further 5 phases have been completed.
Aside from creating greater resilience to customers through multiple supplies the following benefits have been realised;

- Distribution input reduced by 8.26 Ml/d
- Leakage reduced by 4.35 Ml/d
- 44% reduction in burst mains
- Reduced operating costs

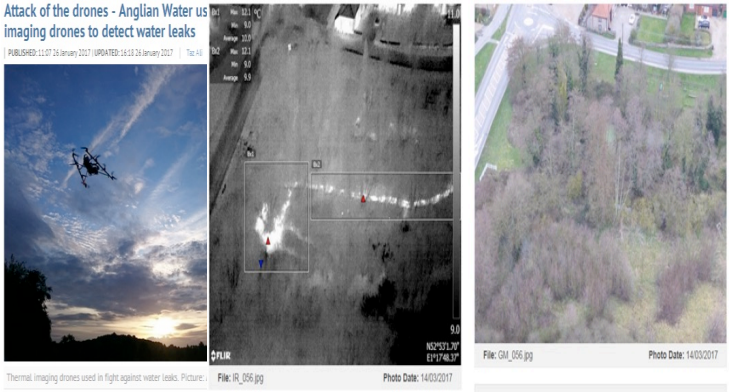
CASE STUDY – USE OF DRONES TO PINPOINT LEAKAGE

In this historically high leakage area we approached the challenge differently.

We knew that there was a leak in the overgrowth highlighted above but knew that there were Health and Safety as well as logistical challenges to overcome.

In order to identify the source of the leak we flew a drone with thermal imaging to help pinpoint the location.

By using this technique we were able to surgically identify and fix the leak instead of undertaking more costly solutions like a complete service renewal



4. MITIGATION OF SHOCKS AND STRESSES

MITIGATION OF OPERATIONAL INFRASTRUCTURE CHALLENGES

CASE STUDY – ENHANCED METERING, SMART METERING

Enhanced metering

Domestic metering is key to maintaining a resilient supply demand balance by reducing customer demand and incentivising water efficiency. Under our enhanced metering scheme we fit the meter compulsorily, then provide customers with information on whether they will be better off being charged on a meter and give them support through our water efficiency programmes to save water, energy and money. We then give the customer the option of switching to measured charges.

In AMP6 enhanced metering is installing water meters in water stressed areas. We aim to install 53,534 meters in Fenland, Norwich, the Broads and Ruthamford South WRZs (Water Resource Zones) as well as Norfolk Rural, North Norfolk Coast, March and Ely. This programme aims to have 53.534 meters fitted in AMP6, resulting in 90% of all Anglian Water customers having a meter and 84% paying measured charges by the end of the AMP.

Smart Metering

In our pilot Shop Window area of Newmarket and our follow up rollout in Norwich we have been proving the benefits that come from the installation of smart domestic meters in providing usage information for customers, identifying customer side leakage and plumbing losses.

AMP 7 we will install smart meters across the region to enable a step change in customer communications, the use of behavioural economics techniques, and supporting our water efficiency initiatives. The programme also has significant benefits for optimising our networks and supporting the delivery of our leakage strategy

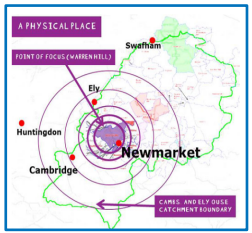
CASE STUDY – SHOP WINDOW

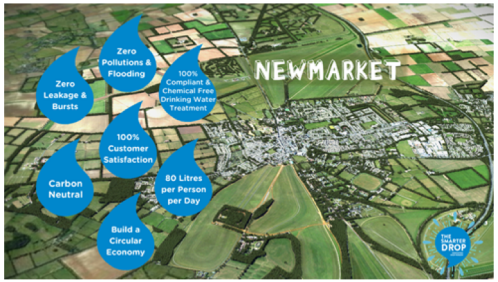
shop window

Our Shop Window innovation hub, located in the Suffolk town of Newmarket, is helping us to answer some of the biggest challenges facing our industry. By focussing innovation activities in a single catchment and working in collaboration with our employees, customers, supply chain and communities, we are accelerating our learning and building the microcosm of a future water company, today.

We are always looking to continuously move closer to achieving our aspirational goals. As we continue to focus our attention in these ways, technological development and its affordability will play a role in how close we can get to achieving these. They will continue to provide a clear direction for our business and inspire our people and partners about what can be achieved.

The Shop Window is a long-term initiative aiming to deliver benefits to our customers and our business over AMP7, AMP 8 and beyond – a microcosm of our business in 30 years time. As we build this microcosm we will take the learning from successes and failures in order to deliver benefits to our customer and our business by rolling them across our region. We have achieved this success to date by growing the Shop Window and intend to continue it this way through AMP7.





3. MITIGATION OF SHOCKS AND STRESSES

MITIGATION OF OPERATIONAL INFRASTRUCTURE CHALLENGES

"What is really impressive is how everything is interconnected"

"The most impressive thing was how Anglian is engaging and motivating real people."

SHOP WINDOW FEEDBACK

shop window

"Anglian Water's Smarter Drop campaign is an extremely rewarding and interesting experience."

Emma Bailey, Newmarket Customer

"I thought the Shop Window was a fantastic concept which really brought innovative thinking into tangible action, through mutually beneficial, collaborative partnerships."

"This is exactly the sort of ambition that we want to see from water companies"

John Russell – OFWAT Senior Director, Strategy and Planning

THE SMARTER DROP

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL INFRASTRUCTURE

Mitigation of operational infrastructure challenges

Power outages/ power cuts
Unexpected loss of energy supply caused by an external network issue, from extreme events, causing a issue for continuation of services.

As with many other sectors we are reliant on power to operate both our process assets but also those which distribute water and our major office sites. Investment in back up generation and the associated fuel stocks has been critical in developing our resilience to power outages both internally and via our Distribution Network Operators (DNOs).

Our Energy Team also invests significant time and effort to secure resilient power supplies and monitor the effectiveness of our generators. We work closely with the DNOs and National Grid and exercise power outages at a regional level through our Multi Agency Support Group and at a National level through Water UK and the LRF Chairs Forum.
We are one of the largest energy users in the east of England. This is a big cost to us as well as having an adverse effect on the environment through the resulting greenhouse gas emissions. This is why we put the Energy Initiative in place which focuses on saving both energy costs and energy usage. Examples of how we ensure resilience to power outages/cuts are detailed below:

- Power failures and their impact are monitored and reported on a monthly basis.
- National Grid's latest report indicates supply margins are improving in part thanks to instruments such as the Capacity Market in which Anglian Water participates.
- Through collaboration with the Business Resilience Team, Energy Team, Operational teams & external stakeholders (e.g. Distribution Network Operators) our electricity supply resilience plans are being developed. The Head of Carbon and Energy is responsible for provision of information progress and status.
- Incident management and recovery plans are in place including availability of generator and fuel supplies; joint response and recovery plans with Distribution Network Operators.
- Critical assets are protected by standby generation and dual power feeds. Schemes to improve power resilience at our critical water treatments works (Grafham and Wing) are in progress and due to be completed this year. Funding has also been secured to improve the power resilience for some of out office buildings e.g. Enterprise House replacing the existing generator with 2 sets capable of running all equipment in the building for 10 days. This will improve the resilience of this site in addition to our Work Place Recovery Centre which provides critical operational and customer services.
- Risk of power failure is fully considered as part of procurement resilience planning criteria, including collaborative work with Distribution Network Operators to identify overlaps and potential process gaps. Significant mitigation is provided by back-up diesel generators and multiple supplies to critical assets.
- The Energy Team continually reviews and assesses this risk and provides the Resilience Steering Group reports in line with data and intelligence received including Government reports.
- A winter action plan has been developed in response to increased risk of voltage reductions and rota disconnections.
- Anglian Water is one of the founding members of Multiagency Support Group for the East of England (MASG). As part of this group, regional power outage scenarios have been exercised to identify the interdependencies between power and telecoms and the impact of our business.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL TECHNOLOGY

Mitigation of operational technology challenges

Telecommunications failure/Loss of Telemetry
Outage of critical information infrastructure (e.g. internet, satellites, etc.) and networks, causing widespread disruption.

- We have invested in world leading telemetry systems such as IRIS and ILPM providing operational insight to our Operational Management Centre and in the field. Our telemetry systems use a number of communications links including IDSN lines, UHF radio signals , mobile networks and microwave links to transmit information to IRIS.
- Our 24/7 Tactical Operations team continually monitors information from our telemetry system and can initiate processes to run critical operational sites manually if required, or to prioritise and manage 'milk round' visits to critical sites should widespread failure of IT or mobile networks occur.
- Scanning equipment is regularly calibrated to ensure that readings are accurate.
- IS and telephony incidents are managed through the CapGemini Major Incident Management process and escalated to our IS incident management team through set triggers. Alerts are sent through email and text message to employees giving updates to provide information and updates.
- Telecoms circuits supplying our major offices are resilient and our contact centre call management system is hosted in data centres certificated to ISO27001 (information security), and our internal telecoms infrastructure supporting contact centres is hosted in secure environments protected by generator backup and UPS. Should any failures occur calls can be routed direct to contact centre agents, and this is further protected by PSTN landline telephones for 24/7 roles in case of local network failure.
- Additional resources are in place to be able to answer customer queries via our webchat channel and social media networks.
- In the event that our major offices are affected but the wider network remains online, we have pre-allocated seating for critical teams at internal and external Workplace Recovery Centres and dispersal to these sites is regularly tested.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL RESILIENCE

Mitigation of operational resilience challenges

Water supply contamination
Where there in contamination of a drinking water source. This may include chemical, metal, drugs, or microbiological contaminants and may be incidental or malicious.

Nuclear incident
A event where radiation source has led to significant consequences to people, the environment or the facility (defined by the International Atomic Energy Agency).

- We have a mature Drinking Water Safety Planning approach which meets regulatory requirements, underpinned by our extremely robust Policies and Standards for Water Supply Hygiene (POSWSH). These ensure that we manage water quality from source, through our water treatment works and water storage points and our network of pipes into customers' premises.
- We have a significant AMP6 Capital Maintenance and Quality Enhancement programme to ensure that we maintain and improve our drinking water quality.
- Regular audits are carried out both internally and externally. Water Services processes are externally assessed annually by LRQA to ISO 9001 Quality Management and ISO 22301 Business Continuity management system standards. UKAS audits our laboratory as part of ISO 17025. A comprehensive internal audit programme is signed off each year by the Director of Water Services and his senior leadership team, and is delivered by members of the Water Quality and the Risk and Systems Teams.
- In addition, our senior manager-led Water Services Compliance Monitoring Group and Water Quality and Environmental Compliance Group regularly review performance against key water quality parameters. Our Board of Directors also regularly review key targets and quality standards.
- Numerous sub-groups track progress with key water quality programmes of work, for example monthly Storage Point Delivery Group and weekly senior manager-led conference calls track the progress of external and internal water storage point inspection programmes, an area where we have seen significant improvement in performance.
- We also ensure that operational and scientific employees are trained and assessed as competent. Our industry-leading Licence to Operate programme sets benchmarks and expectations for competency and is being further enhanced by a drive towards professional registration such as Chartership through professional bodies such as the Institute of Water.
- Following some potentially serious incidents resulting from the quality of chemicals obtained from third party suppliers, as part of the 2017/18 Water Quality Internal Audit Programme all suppliers of potable water treatment chemicals were audited. Audits were conducted in collaboration with the Water Quality team, Integrated Supply Chain, Risk and Systems and LRQA. Generally good compliance was witnessed, with corrective actions successfully progressed to closure. The output from these audits is being used to inform the future internal audit programme.
- We carry out gap analysis of other water companies' post-incident reports to ensure key lessons learnt from significant water supply events are embedded into the our business.
- We engage with Nuclear power plants in our region both directly and via the Local Resilience Forums to ensure there are agreed plans in place for a response to a nuclear event or incident.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL RESILIENCE

Mitigation of operational resilience challenges

Our standard emergency procedures are supported by a business-wide approach to severe weather, outlining a stepped response for weather hazards including snow and ice, storms and gales, heatwave and summer demand, and flooding.
The Severe Weather Matrix provides a tool to implement these procedures and coordinate the business response to manage demand and meet the needs of customers whilst recovering critical people, processes and assets affected by these hazards.

Temperature extremes
Major property, infrastructure and/or environmental damage as well as loss of human life caused by extreme temperatures.
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- Regular workshops are held with critical teams to understand and identify supply sites which may be at higher risk of summer demand issues.
- Review of all severe weather plans & supporting materials on an annual basis.
- High Demand Planning sessions with operations at the start and end of each summer period.
- Winter awareness campaign is launched annually to promote resilience for all staff including free tyre checks and provide hints and tips.
- Our Drought Plan documents processes to maintain supplies during periods of low rainfall, Including options to reduce demand through additional leakage management, water efficiency campaigns and, where appropriate, Level of Service 1 and 2 restrictions. In addition, the drought plan includes operational supply side options developed to increase resilience, including trading options with other water companies.

Nuclear incident
A event where radiation source has led to significant consequences to people, the environment or the facility (defined by the International Atomic Energy Agency).

- Severe Weather Matrix contains a flooding section with directions for the business in flooding events, with supporting Severe Weather Plan.
- Our sites are assessed for flood risk.
- Where required flood emergency response plans (FERP) are produced.
- FERPs are regularly exercised to ensure that staff on site are able to quickly respond in the event of flooding.
- Mobile Flood Barrier held with a team trained to deploy to anywhere in the region.
- User of the Environment Agencies 'Targeted Flood Warnings' system to monitor assets real time flood warnings.

Figure 9: (top) Our severe weather matrix for management. (bottom) our EMPROC Matrix

FREEZE THAW CASE STUDY

The 2018 Freeze-Thaw event put significant strain on infrastructure across the UK. In the water sector the rapidity of the thaw following an extended freeze caused unavoidable problems with burst mains and leaks from customer pipes and company networks. The combination of freeze and rapid thaw also caused substantial ground movements and resultant mains bursts, particularly in the Fens.

Our emergency response and incident management meant that 99.6% of our customers experienced no impact from this event (a small number of customers in the Fens and on the Norfolk coast were affected with short duration interruptions). Our success in minimising the impact on customers stemmed from a number of factors, including:

- Putting innovation at the heart of what we do: ensuring optimal use of our Dashboard Information System, Telemetry System (IRIS), and our leading Integrated Pressure and Leakage Management System (ILPM), which drove our operational response and ensured we targeted our resources to the areas of greatest need.
- Our industry-leading position on leakage. This means we lose less water from our networks, and so are better placed to cope with spikes in demand that flow from an event like this.
- Our resilience approach, based on ISO22301.
- Our customer-centric approach of 'restore, repair, recharge' to focus first on meeting customer needs rather than fault repairs.
- The quality of our customer and stakeholder communications, both proactive and reactive, across all channels to try to reach the widest range possible.
- The collaborative approach we have pioneered with our unique alliance model which saw us quickly deploy 119 gangs and over 400 people to address problems.
- Investment in resilience schemes, which has reduced the numbers of customers dependent on a single source of supply. This gave us more options to minimise customer impacts.

Figure 1 : Our technician responding to customers during the freeze thaw event

We initiated our incident response before the event to ensure we were prepared. Our incident rooms and incident teams worked 24/7 for 10 consecutive days to respond and recover from this event. An Incident Director was also appointed throughout to ensure strong leadership and direction.

Our operational teams alongside our Anglian Water Force volunteers worked tirelessly in challenging situations to ensure we could minimise any disruption to water supplies and provide excellent customer service.

All of these were combined with strong preparation across the company, to ready ourselves operationally, ensure proactive communications with customers, and execute our resilience planning systems.

All of the above work is in place to ensure we are able to quickly and effectively respond to incidents and events, **ensuring our services are resilient and our customers are unaffected in all but the most serious incidents**.

But it all comes back to PREPARE, PREPARE THEN ESCALATE – THINK FAST, THINK BIG

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL RESILIENCE

Mitigation of operational resilience challenges

Infectious diseases

Bacteria, viruses, parasites or fungi that cause uncontrolled spread of infectious diseases (for instance as a result of resistance to antibiotics, antivirals and other treatments) leading to widespread fatalities and economic disruption.

- Our business impact analysis programme identifies critical business activities and the manpower resource supporting their delivery. Core staffing requirements and contingencies for critical resources are identified and documented in team process recovery plans.
- This is supported by our Reduced Manpower matrix outlining a proportionate and scalable response to manpower reduction across the business.
- We have also worked with Alliance partners to develop a database identifying manpower resources available during incidents, supported by our training and exercising programme.
- To minimise the impact of seasonal influenza, awareness programmes are delivered by Occupational Health and influenza vaccination vouchers are made available to prioritised groups of staff.
- The Resilience Steering Group regularly meets to review performance and progress towards targets.

Industrial disputes

A dispute between employees and employers, which may lead to disruption in the continuation of service. E.g. Union organised strikes.

- Positive employee relations and minimising disputes with the three recognised unions by regular dialogue.
- Regular meetings are in place with full time officers of all three unions.
- A programme of workshops is also under way to develop a framework within which to manage industrial relations risk including dispute avoidance procedures.
- Contingency plans for protecting services are in place and regularly reviewed; these involve redeployment of existing staff/managers, and the use of external contractors to cover essential work. These plans are reviewed as necessary in advance of any negotiation which could conceivably lead to industrial action.
- Regular engagement takes place between Business Resilience and Employee Relations to ensure plans are in place and that these are current.

Figure 10: Our Reduced Manpower Matrix.

3. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL ENVIRONMENTAL

Mitigation of operational environmental challenges

Environmental pollution
Deterioration in the quality of air, soil and water from ambient concentrations of pollutants and other activities and processes. In the case of water, this includes emerging contaminants, such as human pharmaceuticals and hormones, nanomaterials and recreational drugs.

- Anglian Water is already susceptible to a deterioration in the quality of water available for drinking water purposes. Increasing levels of nitrate in raw water have been monitored for many years and action is taken to blend or invest in treatment processes to ensure that drinking water meets all of the necessary standards.
- More recently metaldehyde (used by farmers to kill slugs) has been an increasing risk. We have been at the forefront of understanding and developing approaches to mitigating the risk – in particular through our Slug It Out campaigns. We have also been working with Defra on the introduction of a targeted ban to mitigate the risk where voluntary measures are not sufficient. Where necessary we have also implemented treatment processes so that all drinking water standards are met.
- Emerging contaminants, such as pharmaceuticals and hormones have been subject to a number of pilots that we have actively participated in over recent years. We continue to monitor potential impacts and take part in developing research programmes.
- Nanomaterials are likewise being studied to understand potential impacts on drinking water quality.
- We are also conscious of the impact of our own operations on the wider environment and Anglian Water has set a goal of no pollutions. To achieve this a number of mitigants are in place:
    - All pollution incidents, the associated response, mitigation and preventative actions are reported to and monitored by senior management. We have a wide programme of activities to reduce pollution incidents and improve our understanding of their causes. This includes:
    - Spending of around £6 million in the last financial year on planned preventative maintenance to reduce blockages and consequent pollutions.
    - A priority, 'blue light' or fast response for areas with historical pollution risk and/or significant environmental sensitivity.
    - Investment in new technology for remote monitoring of discharges. This has been installed at key points on the network, both inland and coastal. More than 800 locations are now monitored around the clock.
    - Continuing to develop our systems to achieve real-time monitoring and reporting of pollution incidents and to provide a one-stop shop for pollution information, including a reporting app to improve the quality and consistency of information from the field.
    - Aligning our internal processes and procedures to meet changes to Environment Agency guidance.
    - Extension of our 'pollution watch' campaign targeted at the public and river users to encourage earlier engagement with resolution of any potential incident.
    - Investment in flow monitoring on rising mains and smart pump control across 250 high priority pumping stations
    - Making a step change in pollution management by attempting to predict where incidents could occur in our network, with proactive inspections of high-risk assets.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL ENVIRONMENTAL

Mitigation of operational environmental challenges

Environmental change inc. invasive species
Changes in habitats, ecosystems and biodiversity from pollution, habitat destruction and climate change. This includes invasive alien species arriving and outperforming and replacing the native species.

Invasive species are a risk to our ability to move water to where it is needed and is a key consideration in developing new options in our WRMP, in particular in assessing the ability to import water from other regions.

The potential impact is assessed as part of our option appraisal process.

We are also conscious of the potential impact of our wider activities in spreading non-native species. We have produced an invasive and non-native species and biosecurity information booklet to share knowledge on what invasive species are and how they cause impacts to Anglian Water and the wider economic, societal and environmental impacts.

Our Biodiversity team helps to manage some of these issues by:

- Actively managing some of the land we're responsible for to maintain its conservation value and address invasive species.
- Working with colleagues and contractors to influence the management of other land for wildlife.
- Making staff aware of the problem of invasive species and providing guidance on what to do when we find them.
- Working with others in the industry and beyond to understand (e.g. through research) the pressures on our region's environment and working in partnership to get better outcomes, e.g. Water for Wildlife, RiverCare and BeachCare.

INTRODUCTION

The impact of invasive non-native species is increasing around the globe. Closer to home they have caused problems for us at Anglian Water, the regional economy and our environment.

This guidebook introduces you to what invasive non-native species are, why they matter and what we can do to protect our staff, assets and processes. In doing so we'll protect ourselves from the threat of prosecution and play our part in protecting the environment.

If you want advice on invasive non-native species or other biodiversity matters, please contact **biodiversity@anglianwater.co.uk**

WHAT ARE INVASIVE NON-NATIVE SPECIES?

NON-NATIVE PLANTS AND ANIMALS ARE THOSE THAT HAVE BEEN TRANSPORTED FROM THEIR NATIVE RANGE TO A NEW REGION WITH THE ASSISTANCE OF HUMANS, FOR EXAMPLE THROUGH ACTIVITIES SUCH AS TRANSPORT, TRADE AND RECREATION.

Many of these species are not adapted to the environments they find themselves in and don't survive. Of those that do, the majority do not cause problems. However, a significant minority cause harm and these are termed invasive non-native species. An invasive non-native species is one that has a negative environmental, economic or societal impact.

From: Field Guide to Invasive Plants and Animals in Britain, Bloomsbury 2015.

WHAT IMPACTS DO INVASIVE NON-NATIVE SPECIES HAVE?

The impacts these species have are many and varied. Here are a few examples:

Societal impacts
Some species, such as Giant hogweed, are poisonous or cause dermatitis if touched. Floating pennywort can grow so thickly across waterways that it prevents navigation by boats or fishing by anglers.

Economic impacts
Japanese knotweed and Tree of heaven grow so vigorously they can cause significant harm to infrastructure. Deer and Grey squirrel can cause significant damage to forestry.

Environmental impacts
Invasive non-native species can outcompete or predate native species. For example American mink is one of the major causes of decline in Water vole. Invasive non-native species can also introduce disease. The decline of Red squirrel is partly due to the squirrel pox that was introduced with Grey squirrels.

Find out more about the impacts of invasive non-native species on Anglian Water in the species descriptions later in this booklet.

2 ANGLIAN WATER BIOSECURITY GUIDE

ANGLIAN WATER BIOSECURITY GUIDE 3

Figure 11: An excerpt of our invasive species information booklet

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL ENVIRONMENTAL

Mitigation of operational environmental challenges

Failure of climate change mitigation and adaptation
The failure of governments and businesses to enforce or enact effective measures to mitigate climate change, protect populations and help businesses impacted by climate change to adapt

Climate change (inc. drought and sea level rise)
Change of climate, which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, in addition to natural climate variability.

Coastal erosion
Increasing coastal erosion is likely in part due to increased sea levels, causing damage to infrastructure.

Water crisis and the failure of climate-change mitigation and adaptation remain amongst the top risks in The Global Risks Report 2018 published by the World Economic Forum. These global risks align closely with our local risks. Our region is low lying, with a long coastline and low rainfall. Hotter, drier weather can cause water scarcity and drought. We also expect climate change to mean more intense rainfall and rising sea levels, meaning a bigger risk of flooding. The development of our business plan has been based on the application of the latest UK Climate Projections (UKCP09) - the leading source of climate information for the UK and its regions. The next version of the UK Climate Projections (UKCP18) will be published later this year and these will be used to inform the delivery of our business plan.

- The success of climate change mitigation and adaptation depends on leadership and collaboration. As such we are working nationally and internationally with government, policy makers and others to raise the ambition on climate change. For example we are founding members of the Corporate Leaders Group on Climate Change who are an international group of companies from a range of industries committed to limit global temperature rise to well below 2°C. We are also members of the Green Construction Board, a consultative forum for government and the UK design, construction, property and infrastructure industry who have been successful at reducing carbon, reducing cost and increasing value. In response to the global and local mitigation needs we have set ourselves a long term goal of being carbon neutral by 2050. In line with this goal, by the end of AMP7 our target is to reduce net carbon emissions by 48% against our 2010 baseline. Our track record in reducing carbon gives us the confidence that we will achieve this goal. For example, we remain certified to CEMARS GOLD (ISO-14064) and are one of only 28 UK companies to deliver seven years of continual emissions reduction against this standard.
- Climate change is a constant theme on the Board's agenda and leadership on climate change adaptation continues to be provided by our Climate Change Steering Group working alongside our Resilience Steering Group. The risk and steps we are taking to adapt to climate change are laid out more fully in our Adaptation Report that is published in response to the Climate Change Act 2008. We will publish our next Adaptation Report between 2019-2021 in line with the timescales of the third-round of the Adaptation Reporting Power (ARP). Responding to climate change also forms a vital part of our Strategic Direction Statement which sets out the risks and objectives for the whole business over the 25 years from 2020 to 2045. This long term strategy is guided by the things our customers have told us are important to them including the need to protect their service and the environment in the face of disruptive events and climate change. National risk assessments support our experience and understanding of the risks.
- The Committee on Climate Change's Adaptation Sub-Committee 'UK Climate Change Risk Assessment 2017 Evidence Report' identified flooding risk to infrastructure, including sewers as one of the highest priorities. Our long term strategy for Waste Water Networks Plus also supports the objective to meet growth, climate change and resilience needs in a sustainable way. In AMP7 community flood risk management will replace our previous flooding programme which focused on delivering traditional 1:30 standards of protection to customers at risk of flooding from hydraulically overloaded systems. Our planned level of spend on these traditional solutions in AMP7 has reduced as we increase investment in sustainable, long term surface water strategies and increased partnership working. For an example of our partnership work on flooding, see our case study of Clacton-on-Sea coastal defences . These strategies are expected to improve the affordability of delivering protection to a standard of 1:30 plus climate change to currently unfunded schemes over the next 25 years whilst offering improved levels of service in the short term. This will be achieved by managing storm flows within the wider catchment and therefore reducing the residual storage required.

Continued on next page...

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL ENVIRONMENTAL

Mitigation of operational environmental challenges

Failure of climate change mitigation and adaptation
The failure of governments and businesses to enforce or enact effective measures to mitigate climate change, protect populations and help businesses impacted by climate change to adapt

Climate change (inc. drought and sea level rise)
Change of climate, which is attributed directly or indirectly to human activity, that alters the composition of the global atmosphere, in addition to natural climate variability.

Coastal erosion
Increasing coastal erosion is likely in part due to increased sea levels, causing damage to infrastructure.

Continued from previous page

- The 'UK Climate Change Risk Assessment 2017 Evidence Report' also identifies the risk of shortages in water supply as a priority area where more action is needed. As part of our leadership of Water Resources East and as part of our Water Resource Management Plan process, we undertook a climate change vulnerability assessment to confirm the impact of climate change on the amount of water we have available for supply. We closely followed the Environment Agency's new guidance for completing this assessment, which states that companies must take account of the fact that the climate has changed and will continue to change, encouraging companies to take account of climate change that has already happened as quickly as possible. The adoption of this new approach has driven a step reduction in the amount of water available from our sources which are impacted by climate change. Our Drought Plan also details the operational response to drought triggers being hit and is supported by summer demand activities taking place each year.

- In July 2018 the Department for Environment, Food & Rural Affairs published The National Adaptation Programme and the third strategy for climate adaptation reporting. This report sets out what government and others will be doing over the next 5 years to be ready for the challenges of climate change. Our business plan supports the key actions identified in that report. Our business systems and our business plan also include other wide-ranging interventions that will improve our climate resilience. For example, we already experience extreme weather which impacts the operation of our assets. As such we have effective extreme weather processes and tools and are investing to increase the connectivity and resilience of our water networks.

A case study, on the next page, sets out our actions to protect Clacton-on-Sea from the threat of coastal erosion.

CASE STUDY

CLACTON-ON-SEA COASTAL DEFENCES – BUILDING RESILIENCE THROUGH WORKING COLLABORATIVELY

When we asked our customers about how to best respond to the challenges of disruptive events and increasingly severe weather, we heard that they wanted us to take preventative action, engage in long-term planning to build resilience and work in partnership with others.

Supported by the increased flexibility of Totex funding, that is the approach we are taking for flood alleviation projects across our region. It is a move supported by our independent CEF, where it delivers value for money for customers.

A good example is Clacton-on-Sea where costal erosion threatens the sewer network. This includes a 2.8m diameter strategic sewer that runs along the coast relying on the coastal defences to protect it. If this was to fail it would cause sewer flooding to any properties still standing, as well as pollution to the environment and bathing waters popular with tourists.

Tendring District Council is responsible for the defences and had received 70% of the £37m needed to enhance them from Defra. However contributions from other partners were still needed to secure the full funding, so they approached us for support.

Our assessment showed it would cost £27.4m to redesign and relocate sections of the strategic sewer. Such work would also cause significant disruption to for the local community.

Contributing £3m to the council's partnership scheme as an alternative way of achieving the same outcomes was therefore a clear benefit for customers, saving over £23m.

It also supports an important resilience scheme with wider benefits for the community, businesses and future of tourism in Clacton-on-Sea.

4. MITIGATION OF SHOCKS AND STRESSES

OPERATIONAL ENVIRONMENTAL

Mitigation of operational environmental challenges

Urban creep
Rising number of people living in urban areas resulting in physical growth of cities.

Rising urbanisation
Urbanisation concentrates populations, potentially making them more vulnerable to the effects of natural disasters, disease and deliberate acts of violence

Land use change
Changes in the use of land. This could be from changes in agriculture, land management or urban creep.

- We have identified growth as one of the key challenges facing our business over the next 25 years and beyond. One of the four key themes in our 25 year Strategic Direction Statement is to "Enable Sustainable Economic and Housing Growth in the UK's fastest growing region".
- Both our 25 year Water Resources Management Plan and Long Term Water Recycling Plan include the latest forecasts of population growth over the next 25 years, with detailed spatial plans developed to ensure that we are able to plan for and meet the future needs of our growing region. The investment needs to sustain future growth are included in our investment plans. Strategic Business Plan assumptions are regularly reviewed to ensure they are up to date with current growth predictions.
- We have created a Market Insight Team to better understand growth in our region so we can build the right infrastructure, at the right time, in the right location. Market Insight intelligence has to be at the forefront of our function to support growth. The team will develop and enable geo-spatial understanding of growth and investment. This is a step change in how we have historically approached growth and moves Development Services from site-reacting to catchment-delivering.
- We work closely with Local Authorities and Developers to understand the phasing of potential new developments, build rates and phase projections so that infrastructure is built to support development during each phase of developments. As part of the early engagement with developers we have enlarged our Growth Management function to build relationships and look for ways to promote developer self-build options.
- To ensure that we are able to support growth needs on a timely basis, we are planning and designing schemes in AMP6, ready for AMP7 start. There are a number of particularly major new developments (5,000 houses or more) that are expected to come on stream in AMP7, including Waterbeach, Biggleswade and Great Haddon; early engagement with stakeholders on identifying and managing risks associated with these sites is crucial.
- Ensuring that future schemes are sustainable and able to adapt to changing needs has driven us to working in partnership with other bodies including Lead Local Flood Authorities and Local Authorities; we are looking at sustainable drainage options wherever possible as well as traditional construction. This includes our innovative approach to "Make Rain Happy", which will involve the planting of a million tress over the next 25 years. We are also working with land and housing developers on Green Water - 'A Greener, Cheaper Water' to promote the re-use of rain water for toilet flushing and gardening.
- Our plan for rolling out smart meters over the next ten years will enable us to reduce current demand and provide the water needed by a growing population. We are also working with Defra, Waterwise and other companies, to develop a water standard, similar to the energy efficiency standard, that can be used by white goods manufacturers and trade associations to help customers make the best choices to help them save water, supporting messages from our Drop 20 campaign.
- Our catchment-based work, including through our sponsorship of the CamElyOuse catchment (CamEO) enables us to work across sectors to understand and mitigate the impacts of changes of land use. Our learning from this catchment will help us to manage risks across our region. Water Resources East will also be instrumental in aiding our understanding and management of changes in land use.
- Potential changes in land use are also a potential risk to our ability to dispose of nutribio (bioresources) to land – we keep this risk under regular review and have sought to mitigate the risk by ensuring that our product is of the highest quality. The development of BAS (Biosolids Assurance Scheme) is a key risk mitigant, and benefits the industry as a whole by providing a dependable quality standard trusted by farmers.

4. MITIGATION OF SHOCKS AND STRESSES

POLITICAL, LEGAL OR REGULATORY

Mitigation of political, legal or regulatory challenges

State collapse or crisis
State collapse of geopolitical importance due to internal violence, regional or global instability, military coup, civil conflict, failed states, etc. (e.g. civil conflict, military coup, failed states).

Failure of regional, national or global governance and planning
Inability of regional or global institutions to resolve issues of economic, geopolitical or environmental importance

State provision of services
Governments may become less able to provide critical services, meaning other organisations may have to take over this role.

Abstraction licences change
A change in legal abstraction allowances causing less water to be allowed to be taken from water sources.

Legal structures
Legal changes in frameworks or obligations may occur that transfers responsibilities or enables processes. This may include legal duties like abstraction licenses or biodiversity duties.

Changing regulation, policy and international governance
Changing landscape of local, regional or global policy, legislation and regulation.

A collapse of the State and its ability to govern is considered a remote risk and outside the control of Anglian Water. Nevertheless, key to mitigating such a risk is the robustness of our financial controls and liquid cash available to run our operations for at least twelve months. Other elements of our plan include mitigations to deal with the risk of people being unavailable, fuel being in short supply, a breakdown in telecommunications – all of which might be an outcome from a collapse of the state.

Changes in legal structures and our obligations are nothing new and we have a good track record of working with Government and regulators to inform direction of travel to help shape their plans and to implement policy changes. For example, we continue to be actively involved in the development of market reform across our industry - we have been extensively involved at all levels of the Non-household Market Programme to support the design and development of the retail market. We took the strategic decision to legally separate our Non-Household Business and to create a Wholesale Service Centre (WSC) within our Wholesale Services business unit that provides a single point of contact for all non-household retailers into Anglian Water Services, ensuring fair treatment for all retailers and compliance with market codes.

There is a particular heightened risk at the moment with the potential for re-nationalisation in the event of a change in government, together with the current regulatory actions in response to a debate about legitimacy and trust. These risks, as well as the potential impacts on the business from Brexit, are considered separately on the next page.

4. MITIGATION OF SHOCKS AND STRESSES

POLITICAL, LEGAL OR REGULATORY

Mitigation of political, legal or regulatory challenges

Change of Government
Change in the controlling party of the UK following a general election

Regulatory Changes
Change in regulation in response to questions about trust and legitimacy

Brexit
The unknown impact of Britain's decision to leave the EU.

Anglian Water has no control over the risk of a change of government and has little ability to directly influence the philosophical disposition of the current labour leadership towards re-nationalisation of privatised services.

Anglian Water's approach to mitigating this risk and responding to the expectations of the Government and Ofwat to the need for action to secure trust and legitimacy is to:

- Listen to our customers and others to understand expectations and to take action quickly. For example, in response to Ofwat's challenges in the spring of 2018, we immediately:
    - Improved the transparency and clarity of our financial structures by removing our Cayman Islands subsidiary and repaying an inter-company loan to simplify the presentation of in our accounts (particularly around real dividends). These actions have been completed.
    - Placing public interest at the heart of the business - working with Ofwat on proposals to ensure we can be held to account for acting in the public interest
    - Changing the composition of the Anglian Water Services Board so that Independent Non-Executive Directors are in the majority, and not just the largest group
    - Making an additional investment commitment to 2020 - investing an extra £65m in resilience schemes not included in the company's original plan. This will improve the region's ability to deal with drought and flooding and will be paid for through a reduction in dividends to shareholders.
    - Reducing dividends and borrowings through to 2025 - resulting in a significant reduction in the company's level of debt and gearing
- Always aim to deliver a brilliant service for customers. The ability to promote a positive image depends upon the continual delivery of quality and critical service across the entire business. A recent example of this being our response to the 'Beast from the East' in which, during a period of heavy stress on the water network, only a limited number of our customers were affected. When nationally the response from some water companies was brought into question, our planning, response and customer communication was singled out for praise by the Water Minister.
- Be a responsible business – Anglian Water was BITC's Responsible Business of the Year in 2017.
- To innovate and be seen as leading internationally as well as nationally – Anglian Water has been recognised as a Leading Utility of the World.

The potential impacts of Brexit have been discussed at the AWS Board since the referendum with a detailed Brexit matrix being kept up to date and reviewed by the Board. Key potential impacts include:

- stress on the supply chain and the impact of worsening exchange rates; we are exploring sourcing opportunities outside of the EU and constantly reviewing fluctuations in commodity process and where possible locking in long terms agreements to pass on the exchange rate risk.
- loss of access to secure and lower cost EIB financing; Anglian Water was the first public utility to issue Green Bonds as a new source of finance on terms not dissimilar to those offered by the European Investment Bank
- loss of access to people and skills from European countries; our involvement in the regional skills agenda continues to grow, through the Greater Peterborough University Technical College, College of West Anglia and our own Community Education Team, as we seek to address the skills gap with home-grown talent. Additionally, our graduate and apprenticeship programme continue to grow to meet the skills challenge.

We also see some opportunities arising from Brexit, in particular with the replacement of the Common Agricultural Payments with a new approach that incentivises farmers to change farming practices that would benefit the environment and protect our water sources. We have been working with environmental groups and Defra on the future of CAP reform.

4. MITIGATION OF SHOCKS AND STRESSES

TECHNOLOGICAL CHANGE

Mitigation technological challenges

Digital revolution
Intended or unintended adverse consequences of technological advances such as artificial intelligence, geo-engineering and synthetic biology causing human, environmental and economic damage.

We see Digital Revolution as an opportunity for the business; our challenge is to stay abreast of the rapidly changing pace, innovation and application of technological advances. Through our Digital Transformation programme and other business initiatives we are:

- Working with Global Technology partners who are at the forefront of technology applications
- Working with key academic organisations to monitor innovative technologies
- Ensuring we link with key forums in order to keep abreast of emerging trends and to grow our digital network. We look outside of the water industry to learn from companies who are further along their digital transformation journey or who are inherently digital-first and bring this learning back to our own company.
- Investing in our technology platform to ensure we can exploit opportunities, such as process robotics, machine learning, data analytics and AI
- Building a digital capability with our people, both internal and externally. This includes our partner ecosystem, which in turn includes a number of academic organisations to ensure our people keep abreast of cutting edge capabilities and to help develop a talent pipeline.
- Developing easy access to relevant information and data; this is critical to future performance in our business. Future investment in our technology platform is premised on improving performance.

As our customers experience greater digital capability they will expect us to provide digital services that meet their expectations. Smart metering will be a key element of being able to meet these expectations.

Developers also expect to interact digitally with us - we have already delivered pioneering digital services.

4. MITIGATION OF SHOCKS AND STRESSES

SOCIAL

Mitigation of social challenges

Demographic change *Global population growth is predicted, the location of these population is expected to change. This also includes ageing populations in developed and developing countries driven by declining fertility and decrease of middle- and old-age mortality.*	***Migration*** *Large-scale movement of people voluntarily or involuntary induced by conflict, disasters, environmental social or economic reasons.*	**Lifestyle change** *Changes in the way people live, causing a change in the resources used and expectations of services provision.*	***Inequality and increasing income disparity*** *Increasing socioeconomic gap between rich and poor in major countries or regions.*	**Rising chronic and lifestyle diseases** *Increasing rates of non-communicable diseases, also known as "chronic diseases", leading to rising costs of long-term treatment and threatening recent societal gains in life expectancy and quality.*

The potential impact on our services of a growing population and the effects of migration are dealt with as part of our 25-year long term planning of water resources and water recycling. These are dealt with extensively in our plan.

We are aware of the risk and impact of an ageing population and a rise in customers with vulnerabilities as a result of chronic and lifestyle diseases. We also recognise that some customers struggle to afford their water bills. The section of our plan "Customer bills, affordability and supporting customers in vulnerable circumstances" sets out our analysis of the challenges and our plans for ensuring that all customers, whatever their circumstances, get the services they need.

As well as impacting on our customers, rising chronic and lifestyle diseases have the potential to impact on our workforce. The health and safety of our people and our partners is a key priority. We are committed to looking after our employees' safety and also believe that work should have a positive impact on their health & wellbeing. The Management Board reviews health and safety performance and associated actions monthly, immediately reporting any significant incidents to the Board. Performance is also monitored through our OHSAS 18001 accredited Safe and Well Management System, with six monthly external reviews by LRQA as well as through our internal audit program. In addition:

- Our management systems track near misses and actions from audits, inspections, and accident/incident investigations as well as providing access to current policies and procedures and safe systems of work. Throughout the business we have a series of health, safety & Wellbeing Networks that report into the Director-led Company Health, Safety & Wellbeing Network, so that best practice is shared & any issues or concerns can be effectively managed.
- Underpinning our approach to health and safety is LIFE, which focuses on health, safety and wellbeing and our vision of happier, healthier and safer employees. LIFE is about moving from a traditional compliance based approach to a culture where we take responsibility for our health, safety & wellbeing and that of our colleagues. It will create a culture of care and concern where we look out for each other and make the right choices. This is a long term commitment, to date we have run numerous health & wellbeing campaigns focusing on the happier & healthier pillars of LIFE, which includes mental and physical health. We have also held LIFE sessions where over 3000 people, including Alliance personnel, have attended focusing on the safer element.
- We launched a three year health, safety & wellbeing plan which has been developed with stakeholders across the business, initiatives from outside the business such as Water UK and the HSE and our own H&S information ensuring we are focusing on current and relevant areas and potential high risks. Performance and progress will be monitored at Management Board.

Diversity and Inclusion is also essential for our people to thrive and we have established a cross-business programme which focuses on ensuring the way we operate the business is fully inclusive irrespective or gender, ethnicity, age or many other factors. This is working towards ensuring we attract a workforce with greater diversity and representative of the community we serve.

4. MITIGATION OF SHOCKS AND STRESSES

PEOPLE

Mitigation of people challenges

Shortage of skilled labour
A shortage of unknown or emerging specialist skills required for the continued running of businesses, systems and services.

Skills shortages
A shortage of known specialist skills required for the continued running of businesses, systems and services.

Unemployment or underemployment
A sustained high level of unemployment or underutilisation of the productive capacity of the employed population.

Our succession-planning processes are fully embedded, with rigorous analysis to check the quality and depth of succession pipelines for key posts. We look 10 years ahead, identifying and developing candidates for these posts, with external market mapping used where appropriate.

Extensive development programmes are in place, building future talent at graduate, middle and senior management levels, and we continue to invest in career development support for graduates and apprentices to maximise retention and progression. There is also a Diversity Action Plan in place to keep the promotion and retention rate of talented female managers under review.
Senior managers, key skills and talent are covered by Long-Term Incentive Plan (LTIP) schemes, retention bonuses and non-financial retention arrangements, including active development plans. Executive management carries out regular and formal reviews of our succession-planning process and talent pipelines, using external advisors where appropriate.
Pensions freedoms and the publicity around them may mean that more experienced members of staff with specialist knowledge may consider early or partial retirement. A proactive approach to identifying those staff has been taken, and succession plans are well advanced to mitigate any impact that this may have.

We have very mature recruitment, training and reward packages throughout all levels of the business to ensure staff retention; some of these are detailed below:

- Established In-house skills and training capability - whilst partnering with national training organisations for technical skills, water industry and company specific skills are trained by our in-house training team. This allows us to develop tailored skills training programmes and fully incorporate company specific procedures.
- Licence to operate (LTO) defines skill requirements for operational roles, and the objective is to deliver a highly competent workforce by ensuring that people are assessed and developed on their technical competence and their ability to apply their skills and knowledge, through training and assessment through a series of Operational Qualifications. This route ensures a consistent level of assessment across different roles, which has already been mapped to Competent Operator Scheme standards. The modular nature of the C&G LTO programme also allows for training needs to be addressed very specifically ensuring that employees can continue to work in the areas where they are competent whilst receiving support for additional development. By providing a cross company training standard skills can be easily transferred providing resilience to staffing changes.
- Extensive, industry-leading apprentice programmes across a range of Business Areas (Water, Water Recycling, Maintenance, Groundwater Engineering, Telemetry and Vehicles). Long-term investment in apprentice skills to meet demographic changes within the business. Contracts with apprentice providers is well-established and a strategic approach to maximising Apprentice Levy funding is in place. Collaboration with University Technical Colleges to ensure future flow of essential skills into the business.
- Graduate programme Annual recruitment of high quality graduates to a 2 year development programme. High retention rates and successful careers.
- Boost Benefits – an online benefits platform which brings together all employee benefits in one single place. This makes it easy for employees to understand the total value of all their benefits and enables them to make personal selections to suit their individual needs, therefore driving higher employee engagement and retention.
- Transforming Our Leadership (TOL) programme - externally recognised and award winning leadership development programme for senior and front-line mangers to create a common leadership language and practice.
- CPD for key staff - offered for all staff as appropriate for their roles. Funding provided for membership of one professional body for each employee if required. Programmes to support Chartered status across a wider range of career paths. Planning for skills gaps at an individual level is also identified through our Performance Development Review process that sets individual objectives, behavioural frameworks and measures the person in both. Development plans form an integral part of the person's PDR to support and challenge them.
- Glass door award winners of the Best UK Company to work for as voted by employees 2017 along with best UK CEO Award.

4. MITIGATION OF SHOCKS AND STRESSES

ECONOMIC AND PEOPLE

Mitigation of economic challenges

Structural change *Change in the basic way a market or economy functions, caused by a variety of factors, such as globalisation, labour changes or resource variability.*	**Macro industry change** *Economic changes causing changes in the sectors of the economy. For example a shift from primary and secondary sectors (extraction of raw materials and manufacturing) to tertiary sector (service sector).*	**Resource scarcity (inc. fuel)** *Reduction in resources availability, locally, regionally or globally, this may include water, energy, fuel, chemicals or any finite physical resource.*
Structural changes to the water sector, either by government or the economic regulator are dealt with under the heading political risks. Wider structural changes in other sectors but which could impact on our business are considered as part of other risks and are covered elsewhere: for example, changes in labour markets, changes affecting key suppliers, changes as a consequence of Brexit and changes in the availability of financing.		• We have robust supply chain agreements in place. For example, the treatment of water relies upon the secure supply of chemicals to set quality standards which is managed through a multisource framework of suppliers. • We have a Management of Fuel Disruption procedure linked to the National Fuel Plan. • We ensure an adequate level of stored fuel for generators particularly at our key sites. • We work closely with Local Resilience Forums and Category 1 responders to ensure we have plans in place.

4. MITIGATION OF SHOCKS AND STRESSES

ECONOMIC

Mitigation economic challenges

Severe energy price change
Significant energy price increases or decreases that place further economic pressures on highly energy-dependent industries and consumers.

- We have a comprehensive Energy Procurement Policy in place, overseen at Executive Director level at the Finance, Treasury and Energy Policy Group (FTEPG).
- The Policy is reviewed annually and is signed off at Board level. It clearly defines the parameters within which wholesale energy purchases can be made and by whom and it sets a timeframe for making purchases such that budgets and affordability can be protected. Wholesale purchases can be accelerated or delayed depending upon market conditions.
- FTEPG meets monthly and is updated on the state of forward energy markets and hedge levels on a weekly and ad-hoc basis by Treasury staff. Wholesale prices are obtained from consultants, suppliers and other market participants such as relationship banks.
- FTEPG has formulated the wholesale power hedging strategy for AMP7 and keeps it under constant review.
- We procure our energy contracts well ahead of delivery. We are in the final stages of awarding our next large, half-hourly metered electricity contract which offers more flexibility in how our wholesale power can be purchased. It also allows us to fix the supplier's costs of servicing the contract for five years.
- Non-commodity costs, which are mostly regulated costs, such as taxes, levies and delivery network costs, cannot be hedged in the same way as wholesale energy. Instead we actively seek to minimise these and reduce our overall exposure to volatile energy costs through our Energy Programme
- Our comprehensive Energy Programme includes such initiatives as:
    - energy efficiency of pumps, motors, lighting and heating and efficiency of whole operational delivery and collection systems
    - self generation and self supply of renewable energy from biogas fired CHP, wind and solar
    - on-site storage of electricity, especially that generated by renewables, obtaining savings and generating revenue
    - Demand and Supply Response (DSR) initiatives which both avoid charges and generate revenue through running standby generators and turning demand down.

4. MITIGATION OF SHOCKS AND STRESSES

FINANCIAL

Mitigation of financial challenges

Growth vs recession *Significant growth or decline in the activity across an economy lasting at least a few months. This recession may be seen negative economic growth.*	***Financial crisis*** *The loss in the nominal value of financial assets. For example asset bubbles where unsustainably overpriced assets such as commodities, housing, shares, etc. in a major economy or region.*	***Unmanageable inflation*** *Unmanageable increases in the general price levels of goods and services in key economies.*	**Bad debt** *Debt which can not be recovered, often linked to the debtor is insolvent. Risk of bad debt is often linked to the strength of the wider economy.*	**Increased cost of borrowing** *Increased interest rates causing increased financial burdens on individuals and organisations.*

This group of risks all have a financial impact on the business; some in the longer term. Our financial viability statement, covered our business plan details an extensive range of scenarios that cover all of the above potential risks. We are financeable, with mitigating actions identified, even in extreme scenarios. Our financial resilience has been tested by Arup in its maturity assessment, and we score in the top two categories across all areas of financial resilience.

Scenario planning occurs, as a matter of course, twice a year and similarly tests a significant number of downside scenarios. These include lower inflation, costs shocks, interest rate rises, regulatory risks and Group related risks which may impact on the regulated business.

AWS' track record of performance along with our securitised financing structure has helped protect the business during recent financial uncertainty. During the Global Financial Crisis in 2008, availability of debt was severely restricted and various many organisations faced difficulty in raising new or refinancing their existing debt; whereas Anglian Water Services' credit rating remained "stable" and well within the investment grade during that period. In 2009, when the UK economy experienced deflation for the first time in over 500 years, our shareholders injected equity and our Ratings were unaffected by the deflation.

Managing the continuing risk of bad debt is mitigated with sector leading initiatives such as County Court Judgements, Credit Data sharing and close working with credit agencies. Customers who are struggling with affording their bills will be helped through initiatives set out in our plan.

A large part of embedded debt is at fixed rates and not at risk from changes in interest rates. Any rise in interest rate risk is also mitigated to a significant extent as PR19 allows for debt indexation, so rising debt costs will be covered in line with a market index. The timing gap between any interest rate increase and recovery through customer bills will be managed as a business risk, so that customers are not exploited.


LOVE EVERY DROP.
PUT WATER AT
THE HEART
OF A WHOLE NEW
WAY OF LIVING.
SMART COMMUNITIES
SMART BUSINESS
SMART ENVIRONMENT

Anglian Water

14B. ANGLIAN WATER PR19 RESILIENCE ASSESSMENT UPDATE

RESPONSIBLE BUSINESS OF THE YEAR 2017
BUSINESS IN THE COMMUNITY

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2015

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Anglian Water PR19 Resilience Assessment update

Version 4 | ISSUE
21st August 2018

ARUP

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Contents

1. Introduction

Purpose

This document is an update to the original assessment report completed in December 2017. This report has been produced to act as an independent review of Anglian Water's current and planned activities, and how these relate to the current understanding of resilience – with particular reference to Ofwat's recent guidance on 'resilience in the round'.

The findings are intended to help to inform the company's resilience plans for the benefit of it customers.

The update has been updated at this time in order to support and provide evidence to support Anglian Water's PR19 business plan submission.

Background and approach

The original assessment was undertaken between the end of August and mid-October 2017, and supported by a resilience steering group, comprising key individuals from within Anglian Water, who provided input and feedback throughout the process.

Since our original review, Anglian Water has been working on its implementation strategy to determine what will be in its PR19 Business Plan, based on a range of technical, commercial and customer performance criteria. Our original 2017 report was developed in order to inform the development of the business plan. This update takes into account additional information provided by Anglian Water in June-August 2018 as PR19 plans were being finalised.

This updated assessment has been based on five key sources of information:

1) A meeting with senior representatives from IT, finance, business continuity and wastewater services
2) A review of information collated by the business resilience manager relating to each of the sub-themes
3) Publicly available reports, such as the Strategic Direction Statement (SDS), the Annual Reports etc.
4) Meetings with the executive Director for Growth and Resilience and other senior representatives
5) Additional information provided by Anglian Water.

Since the original assessment for Anglian Water, Arup has undertaken resilience maturity assessments for six other water companies. Additional rigour to our benchmarking has also been applied to reflect this knowledge gained.

Structure

The remainder of this report is structured as follows:

- Section 2. introduces resilience concepts, our methodology and an assessment framework.
- Section 3. presents our maturity assessment approach
- Section 4 presents the findings from the assessment; the strengths and opportunities for Anglian Water's resilience performance, now and into the future.
- Section 5. sets out conclusions and recommended next steps.

2. Towards a definition of resilience

2.1 Resilience background

What do we mean by resilience?

Overview

Resilience reflects the overall 'capacity of individuals, communities, institutions, businesses and systems to survive, adapt and thrive no matter what kinds of chronic stresses or acute shocks they experience' (adapted from Rockefeller Foundation, 2013)

In the 21st century, pressures that happen at scale − such as climate change, disease pandemics, economic fluctuations, and terrorism − pose new challenges (Arup, 2013). Risk is increasingly unpredictable due to the complexity and interdependencies between systems and the uncertainty associated with many hazards – notably climate change.

Risk assessments and mitigation continue to play an important role in responding to business challenges. However, in order to create truly resilient organisations in the face of growing uncertainty, this will be need to be supplemented with a broader consideration of resilient systems. Hollnagel (2014) describes a Safety-II approach, providing a focus on success, and how systems function when 'things go right', as well as risk which focuses on when 'things go wrong'.

Cabinet Office Guidance

The Civil Contingencies Act (2004) sets an important framing for resilience in the UK. The Cabinet Office (2011) describes Infrastructure resilience as "the ability of assets and networks to anticipate, absorb, adapt to and recover from disruption". Resilience is secured through a combination of the principal components shown in Figure 3:

- Resistance: Concerns direct physical protection, e.g. the erection of flood defences;
- Reliability: The capability of infrastructure to maintain operations under a range of conditions, e.g. electrical cabling is able to operate in extremes of heat and cold;
- Redundancy: The adaptability of an asset or network, e.g. the installation of back–up data centres; and
- Response and Recovery: An organisation's ability to respond to and recover from disruption.

Figure 1: Infrastructure Resilience Components (Cabinet Office, 2011)

These four components align with the seven characteristics of resilience described by the CRI.

Ofwat guidance

> *'Resilience is the ability to cope with, and recover from, disruption and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future.'*
>
> Ofwat's definition of resilience

Ofwat has published guidance on resilience in its PR19 consultation document (*Ofwat, Delivering Water 2020: Consulting on our methodology for the 2019 price review*). This includes the concept of 'Resilience in the Round' shown in Figure 3 (right), which recommends that customers should be the focus of the business and 3 themes of resilience should be considered:

- **Corporate resilience**: the ability of an organisation's governance, accountability and assurance processes to help avoid, cope with, and recover from, disruption; and to anticipate trends and variability in its business operations.
- **Financial resilience:** an organisation's ability to avoid, cope with, and recover from, disruption to its finances.
- **Operational resilience:** the ability of an organisation's infrastructure, and the skills to run that infrastructure, to avoid, cope with, and recover from, disruption in its ability to provide critical services to customers.

In addition, Ofwat published a report *Resilience in the Round* (Ofwat, 2017). Ofwat's report advises 'Resilience in the Round' should be at the core of how companies approach the resilience challenge, but they should create their own approach to resilience planning.

Ofwat has provided an illustration of what resilience might look like which includes subjects such as systems thinking, an environmental foundation, customers at the heart of resilience, smart approaches to resilience, and monitoring and measuring resilience. It is worth noting that Anglian Water appear as examples of resilience that other companies should follow including the 'Keep it Clear' campaign, and the 'Slug it Out' initiative.

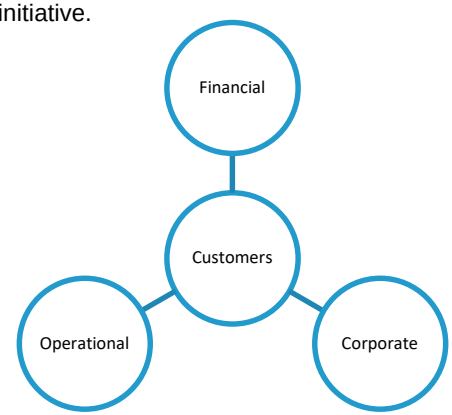


Figure 2: Resilience in the Round from Ofwat, Delivering Water 2020

2. Towards a definition of resilience
2.2 Shocks and stresses

The Ofwat guidance is directing water companies to be resilient to short-term shocks and long-term stresses. Table 1 sets out a range of shocks and stresses that we have identified that may be relevant to Anglian Water. This list has not been updated since the original assessment report. However, we understand that Anglian has used this list to consider how these align with previously identified risks and to consider the mitigations in place.

Stresses

In the Strategic Direction Statement 2020-2045, Anglian Water has identified the challenges to its business from long term stresses. These are population change, environmental protection and the impacts of climate change which will be acutely felt in its area, including sea level rise and increased water stress. Further horizon scanning and scenario development has also identified stresses for Anglian.

Shocks

Anglian Water identify and manage shorter-term shocks, through the Strategic Business Risk Map (the AWS Corporate Risk Register). Anglian Water takes an all risks approach, mapping risks from the National Risk Register, to understand the potential impact on its business.

The business risks identified are wide-ranging and include potential cyber attacks, legal risks, toxic gas leaks.

Uncertainty

As much as an organisation can review and assess both short and long-term risks, it is widely accepted that within today's dynamic environment, these shocks and stresses are increasing in frequency and diversity, requiring successful businesses to adapt their operations beyond risk management of likely and understood shocks.

The Ofwat guidance recognises that resilience as well as risk management is needed to overcome short-term disruptive shocks and chronic long term stresses, especially when these are uncertain and unknown. Therefore, the characteristics of the organisation, as well as the mitigation plans it has in place, are important in developing resilience.

Table 1: The shocks and stresses identified for Anglian Water

Shocks		Stresses	
Disruptive events, which impact the ability to provide a high quality service. In the water industry, acute shocks include sudden events such as floods, fires or cyber attacks.		Chronic conditions which weaken the function of the organisation or system long-term. Examples highlighted in particular by Ofwat include population growth and climate change. Stresses are also often felt as shocks when they reach a tipping point.	
Terrorist attack	Failure of climate change mitigation and adaptation	Demographic change	Land use change
Civil unrest	Temperature extremes	Urban creep	Coastal erosion
Extreme vandalism	Infectious diseases	Migration	Environmental change inc. invasive species
Hoax calls	Environmental pollution	Skills shortages	Inequality and increasing income disparity
Cyber attacks	Fire events	Unemployment and underemployment	Growth vs recession
Power outages	Nuclear incident	Lifestyle change	Financial crisis
Asset failure	Flooding	Rising chronic and lifestyle diseases	Unmanageable inflation
Telecommunication failure	Severe energy price change	Shortage of skilled labour	Bad debt
Data fraud/ theft	State collapse or crisis	Rising urbanisation	Resource scarcity (inc. fuel)
Dam failure	Industrial disputes	Leakage	Increased cost of borrowing
Power cuts	Supply chain failure	Ageing infrastructure	Structural change
False positive alarms	Abstraction licences change	Digital revolution	Macro industry change
Water supply contamination	Failure of regional, national or global governance and planning	Climate change (inc. drought and sea level rise)	Changing regulation, policy and international governance
		State provision of services	Legal structures

3. Our resilience framework and approach

A resilient water company for customers and the environment

A scoping study provided the underpinning theory for our approach for a resilience framework, which considers what a well-functioning system will look like, comprising corporate, financial and operational resilience.

This framework is designed to enable Anglian Water to think about short-term management of risks, alongside longer-term trends and lower likelihood risks. The framework is designed to help Anglian Water to become a truly resilient water company for the benefit of its customers and the environment.

Minor amendments have been made to the framework since the initial assessment, enabling a more robust assessment, particularly in comparing maturity across companies.

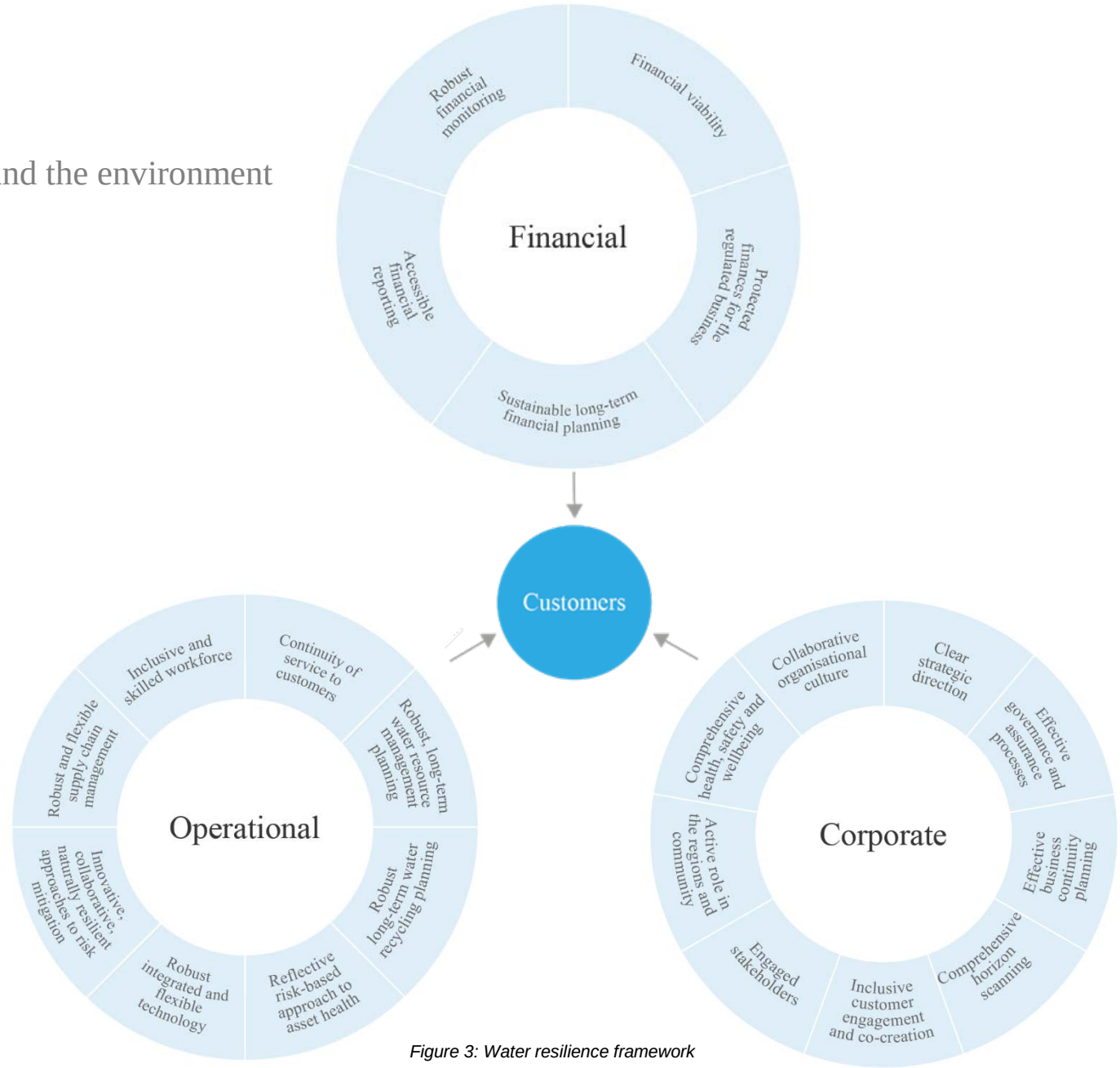


Figure 3: Water resilience framework

Resilience framework: Financial

An organisation's ability to avoid, cope with, and recover from, disruption to its finances

Table 2: The financial resilience sub-themes within the resilience framework

Sub-theme	Description
Financial viability	The Directors review the long-term viability of the company as an extension of their business planning process, and by their actions retain a strong investment grade rating for the company (ideally Standard & Poor (S&P) equivalent >= 'BBB+' Stable Outlook). To do this the company: • has financial systems to accurately project planned Opex, Maintenance and Capex expenditure in each AMP • has access to sufficient additional liquidity (cash or access to cash) in the event of unforeseen events or failures • publicly reports in accounts look-forward rolling financial viability statements for at least five years based on long-term scanning spanning at least two AMPs, regularly stress testing the company to meaningful shocks (e.g. impact of change in inflation, major waste water event, terrorism/ cybersecurity incident, failure to accurately predict Opex costs and future Capex costs, etc.), including the Ofwat July 2018 stress tests • to accommodate stress tests and scenario analysis (e.g. the Ofwat July 2018 stress tests) has determined appropriate gearing levels and appropriate use of instruments such as inflation-linked debt • has appropriate insurance policies and cover.
Protected finances for the regulated business	The company has appropriate measures for ring fencing finances for regulated activities to protect the interests of customers. Where the company has non-regulated activities, these are managed appropriately so they do not risk the financing of regulated activities. The company maintains flexibility to finance regulated company activities in the event of shocks to the group finances, evidenced by results from stress tests, spare cash reserves, liquidity, etc.
Sustainable long-term financial planning	The company is looking forward 25+ years, with investment and expenditure plans linked to the strategic direction of the company. These are regularly reviewed and tested. Base operating and maintenance expenditure together with any additional enhancement or replacement expenditure to meet customer and regulatory requirements have been identified on a year-by-year basis in the short to medium term and AMP-by-AMP basis for the longer term. The company has an excellent understanding of the current and future predicted condition and performance of all its assets. Horizon scanning for future trends informs new investment.
Accessible financial reporting	Financial reporting is appropriately tailored for the needs of investors, other stakeholders, and interested water customers. The company publicly reports its financial and annual performance (via the annual reports and APRs) using customer focused language. Customer billing information provides sufficient information to enable customers to understand major areas of expenditure and impacts, such as leakage reduction. Corporate, financing and tax structures are transparent and easy to understand.
Robust financial monitoring	The company has appropriate measures to monitor and confirm the company's long-term viability, which goes beyond AMP cycles to track trends in maintenance programmes, climate change and demographic changes, etc. These measures are supplemented by regular sensitivity tests and scenario testing. Such information is recorded and reported routinely at Board level, with clear criteria for when material divergences from expected plans need to be discussed and actioned.

Resilience framework: Corporate

The ability of an organisation's governance, accountability and assurance processes to help avoid, cope with, and recover from, disruption; and to anticipate trends and variability in its business operations.

Table 3: The corporate resilience sub-themes within the resilience framework

Sub-theme	Description
Clear strategic direction	The company has a clear aim and strategy which is well communicated and is recognised by all, both internally and externally. All plans and decisions are based on how they will work towards this strategy.
Effective governance and assurance processes	The company has reliable and well disseminated processes, roles, governance and reporting covering all aspects of the business. There is a clear process for assurance, approval and board sign-off.
Effective business continuity planning	The company has a risk-based approach to resilience planning linked to the National Risk Register and the likely impact on service to customers. A set of response plans are in place to prepare for, respond to and recover from potential impacts. Plans are regularly trained and exercised, with everyone in the company knowing their roles and responsibilities. All critical assets have emergency plans and all critical teams will be able to recover to minimise impact on service. Approaches will follow best practice, e.g. ISO 22301 and the Business Continuity Institute Good Practice Guideline 2018.
Comprehensive horizon scanning	Plans, strategies and actions are all based on the outcome of comprehensive and robust horizon scanning which takes into account future shocks and stresses that may impact areas of the business. Horizon scanning is regularly reviewed.
Inclusive customer engagement and co-creation	The company has a clear two-way dialogue with customers to ensure that customers are included and to improve transparency, cooperation and collaboration on current performance and future direction for the business. Customer policy and practices are established to meet the needs of customers in vulnerable circumstances. The company aims to establish trust, confidence and legitimacy.
Engaged stakeholders	The company plans, manages and undertakes regular and clear communications with stakeholder groups and organisations. Collaboration is determined through multi-agency participation with tangible outputs that improve the resilience to customers and the business.
Active role in the regions and community	The company undertakes activities which have wider benefits to the communities that are served allowing them to grow and develop through enabling sustainable growth, both at a regional and local level demonstrating corporate citizenship in the process. The company is establishing goals to meet the carbon challenge contributing to their global and local impacts.
Comprehensive health, safety and wellbeing	The company has reliable and robust plans for health, safety and well-being which will make significant and measurable improvements to the lives of the workforce. There is a strong health and safety culture, where behaviours are over and above what is required.
Collaborative and adaptive organisational culture	A notable organisational culture that puts collaboration and change at the heart of all they do. This is apparent in the values, policies, plans and working practices of all employees who understand the fundamental roles they play in the service value chain.; working together across boundaries in the service of the customer and community. Empowered and engaged staff, with the capability, capacity and mandate to learn and adapt to events and change, is evident in the short, medium and long-term management of the operation; not simply one-off innovations and in response to major 'events'. The organisational approach to collaboration aligns with ISO044.

Resilience framework: Operational

The ability of an organisation's infrastructure, and the skills to run that infrastructure, to avoid, cope with and recover from, disruption in its performance

Table 4: The operational resilience sub-themes within the resilience framework

Sub-theme	Description
Continuity of service to customers	Company operations focus on providing a continuity of service to customers and avoiding critical service failures, such as supply interruptions and internal sewer flooding. It takes into account the different needs of customers, particularly those who are vulnerable. Service interruptions only occur in the most unforeseeable situations. Asset condition and criticality is understood and all critical aspects of the network have redundancy built in. Mechanisms to regularly review and update all plans are in place.
Robust long-term water resource management planning	Water resource management planning and drought planning has been undertaken for the long-term and integrated into business planning to ensure that the company can meet their supply obligations and facilitate sustainable growth. Plans are produced collaboratively with the EA and regional planning groups to ensure best value for customers with respect to cross-company, regional and national supply options. The approach looks at a full range of hazards based on a robust evidence base. Water resource management planning looks 80 years into the future and develops adaptive pathways for delivering in the long-term.
Flexible, long-term water recycling planning	The company has undertaken drainage and water recycling planning for the long-term enabling sustainable growth in the region without impacting existing customers. Wastewater plans are developed with stakeholders and integrated into their business plans. Plans are published and shared. They focus on critical service failures such as internal sewer flooding and pollution incidents. Best practice from the 21st Century Drainage programme is followed.
Reflective risk-based approach to asset health	The company has undertaken a comprehensive assessment of asset health and asset risk, including long-term low-likelihood risks, having detailed and accurate information on the state of all assets, the way they are configured and the way they are operated. Focus is on criticality, protecting customers and the natural environment from exposure to known risks, and reducing vulnerability to future uncertainties. There is a region wide asset strategy which is adaptive, regularly reviewed and considers changing requirements in the long-term (25 years). They follow best practice for asset management, e.g. ISO 55000.
Innovative, collaborative, naturally-resilient approaches to risk mitigation	There is a robust approach to considering a wide range of options to risk mitigation. Approaches are collaborative, innovative and embrace technological change and the role of the natural environment. A system-wide approach is taken. Collaboration is integrated into business plans, working with customers, other companies, and wider stakeholders to deliver solutions. Approaches considered include encouraging customers behavioural change through smart customer engagement, and use of smart technologies to improve asset performance, customer information, leakage management and water efficiency, natural solutions, such as catchment management to improve raw water quality, and blue-green infrastructure to manage storm water and reduce flooding and pollution incidents. Catchment solutions are considered across the whole catchment, integrating water and wastewater needs.
Robust and flexible supply chain management	The company considers the impact of energy, resource and skills supply chains on their operations and ensure diverse and competitive supply chains that deliver the best outcomes for their customers. Supply chain needs are considered in the long-term, based on horizon scanning. Collaborative relationships are developed with the supply chain, to avoid boom and bust cycles. The company also considers the flexibility of their supply chains, particularly during shock events. Internal processes are in place to keep this under review, sharing knowledge and developing solutions with others. The supply chain is considered as a network. The company also considers how they can effectively utilise options beyond their boundaries to mitigate their risks, e.g. use of water trading and bio resource trading markets.
Inclusive and skilled workforce	The company has identified the capabilities and skills required to deliver outcomes for customers in the long-term, based on robust horizon scanning. Robust people plans have been developed to fill any current or emerging gaps to support these business needs, identifying recruitment, training and development, knowledge management, succession planning and increasing diversity. The company works across the water industry and utility sector to address these skills gaps. The company is seen as the first choice for highly skilled individuals, and valued employees recognise it as a great place to work. The company encourages diversity through a range of programmes, such as employee network groups and leadership role models.
Robust, integrated and flexible technology	Technology is used intelligently to deliver real operational and strategic gains. Data-driven decisions are the norm, using both real-time data to adapt and respond, as well as using data for robust long-term decisions. Systems are integrated, including operational technology and information technology systems. Interoperability and integration with systems in other sectors has been considered. Cyber security is paramount, with redundancy built into systems, and processes in place to continually review and improve this. People are at the centre of how technology is designed and implemented, both customers and staff.

3. Our resilience framework and approach

Resilience assessment

The approach to maturity assessment is based on a desk top review of additional evidence submitted by Anglian Water between June and August 2018. It should be noted, however, that this is not necessarily a full picture of resilience at Anglian Water.

The results are presented using scores from 1 to 5 against each sub-theme, as defined in Table 3.

Deliberately we have not attempted to prioritise any of the three resilience groups (financial, corporate and operational resilience) above others, nor weight the individual sub-components of the groups. This helps to recognise the interdependencies across the components, i.e. failing on one of the sub-components can mean a whole company is not resilient.

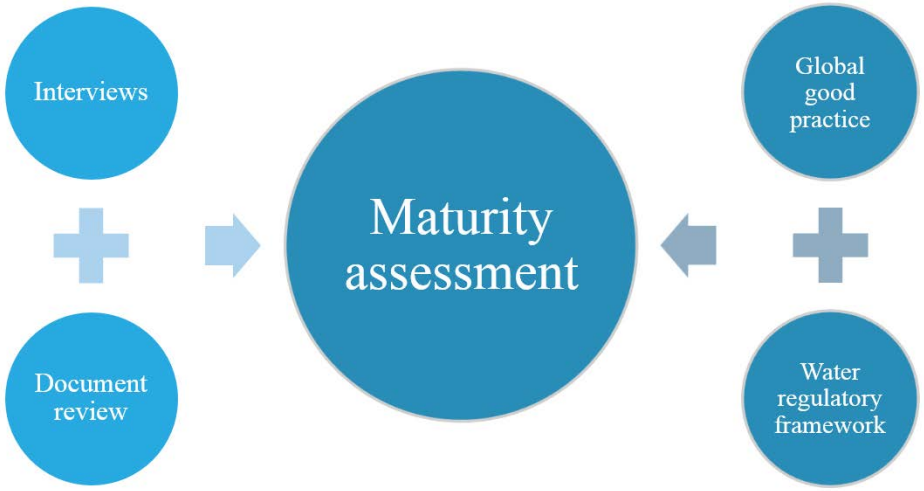
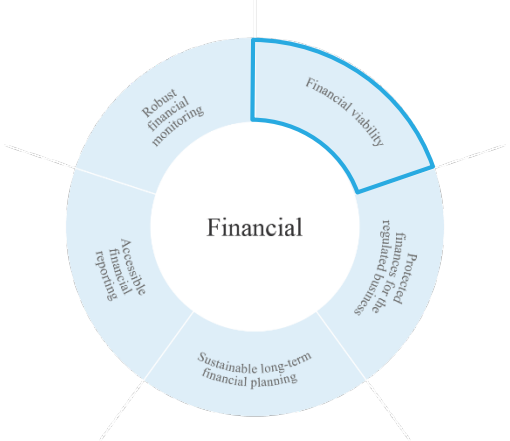


Figure 4: Maturity assessment approach

Table 5: Definition of the maturity assessment scoring scale

Level 5: Leading	The company has a best practice approach to this goal with cutting edge actions and responses currently in progress. There is significant horizon scanning for future changes and clear methods to including these within plans and strategies. Regular reviews and updates are part of business as usual.
Level 4: Response actioned	The company has created a response and actions to meet this goal which is being applied in practice across the company. The company is focused on proactive actions to prevent issues before they arise.
Level 3: Response developed	The company set a clear goal around this and has developed a response. This response has yet to be widely actioned, though some pilots may have been undertaken.
Level 2: Aware	The company is aware of the need for this goal but has not yet been formally adopted into process, plans, strategies and operational activities. There has been very limited response to these gaps. In general the company reacts only to issues that arise as they arise
Level 1: Unaware	The company has not determined this as a goal. There are significant gaps in understanding, processes, plans, strategies and operational activities to achieve this goal.

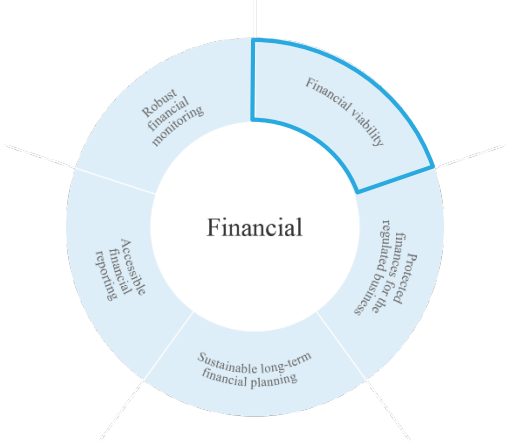


4. Maturity assessment

Financial viability

Description of what leading looks like	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The Directors review the long-term viability of the company as an extension of their business planning process, and by their actions retain a strong investment grade rating for the company (ideally Standard & Poor (S&P) equivalent >= 'BBB+' Stable Outlook). To do this the company: 1. has financial systems to accurately project planned Opex, Maintenance and Capex expenditure in each AMP 2. has access to sufficient additional liquidity (cash or access to cash) in the event of unforeseen events or failures 3. publicly reports in accounts look-forward rolling financial viability statements for at least five years based on long-term scanning spanning at least two AMPs, regularly stress testing the company to meaningful shocks (e.g. impact of change in inflation, major waste water event, terrorism/ cybersecurity incident, failure to accurately predict Opex costs and future Capex costs, etc.), including the Ofwat July 2018 stress tests 4. to accommodate stress tests and scenario analysis (e.g. the Ofwat July 2018 stress tests) has determined appropriate gearing levels and appropriate use of instruments such as inflation-linked debt 5. has appropriate insurance policies and cover			Current and Ongoing Activities Planned for AMP7 and beyond		

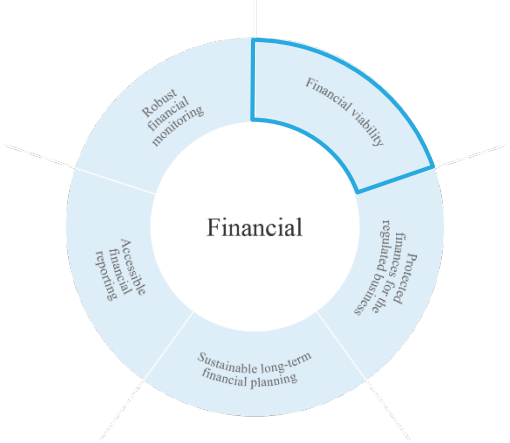
	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, the business regards long-term viability of the company as key. This is supported by the owners of Anglian Water who are institutional investors (such as pension companies) and infrastructure funds whose investment focus is long-term stable returns. The company also has mature systems, which were established approximately 15 years ago, to understand risks and value in decision making. Ofwat is concerned by high levels of gearing in water companies, and as part of PR19 requires companies with gearing levels above 70% to propose "*outperformance sharing mechanisms that allow customers to share in the returns equity investors achieve from high gearing*". This announcement and other earlier Ofwat announcements prompted Moody's, the credit rating agency, in late May 2018 to place four highly geared water companies on negative outlook. Anglian Water has the second highest gearing ratio of the combined water and wastewater companies, at 78.5% in 2017/18. Moody's has changed Anglian Water's credit rating from 'Baa1' Stable (S&P equivalent 'BBB+') to 'Baa1' Negative Outlook indicating it could fall to Baa2 (S&P equivalent 'BBB') if Anglian Water "*has insufficient financial flexibility to accommodate the expected reduction in allowed returns at PR19, including additional sharing mechanisms.*"



3. Approach and maturity assessment

Financial viability

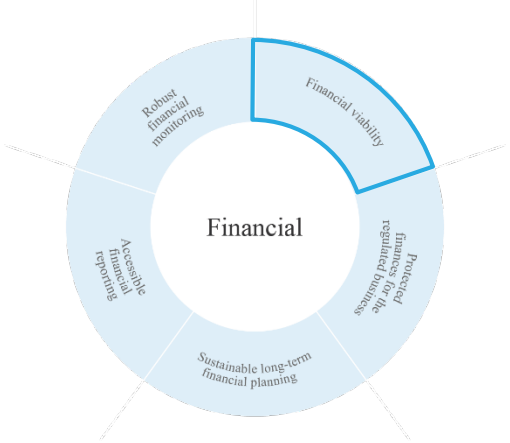
	Maturity Assessment
Current and Ongoing Activities	Each of the criteria is assessed in more detail: 1. The company has financial systems to project planned Opex, Maintenance and Capex expenditure for the next 25 years, explained in the **Sustainable long-term financial planning** section. It has low-, medium- and high-cost expenditure models for AMP8, AMP9, AMP10 and AMP11 that include enhanced capital expenditure and Botex for different investment needs (again see **Sustainable long-term financial planning** section for more information). 2. Like a number of other water companies, Anglian Water has a Whole Business Securitisation (WBS) structure which imposes criteria to always have at least 12 months of working capital. At the end of March 2018 the company had liquidity of £1,277m (comprising £287m of cash and £990m of undrawn committed finance). 3. In 2016/17 Anglian Water increased its long term viability analysis to five years, and again publically reported a five-year rolling Long Term Viability Statement (LTVS) in 2017/18 – meeting Ofwat's stipulated five year minimum LTVS. To prepare the LTVS the company has run a number of stress tests to confirm the company would remain viable. Its Annual Report highlights that stress tests are run for: • key operational risks - water sector reform and changes in legislation, defined benefit pension changes, regional growth, long term supply of water, varying demand, pollution incidents, failure to deliver all the AMP6 plans, different ODI outcomes in AMP7, Brexit, customer relations, health and safety, staff talent and succession, cyber security and maintaining water quality. For all risks potential mitigation measures are considered; and • financial risks, e.g. potential impact of credit rating agency downgrades, fines, cost of debt increases and lower than expected inflation outcomes. Against each of the risks Anglian Water ascribes an equivalent financial (£m) impact. Historically, none of three major shocks that have affected the company in the last 20 years have costed the company more than £30m individually, (e.g. an AMP3 event in Marham, cryptosporidium being identified in Pitsford Water Treatment Works in AMP4, and a third dry winter (drought conditions) in AMP5). Therefore, Anglian Water has run an AMP7 stress test analysis of an additional £60m capex shock that cannot be mitigated using insurance it holds – i.e. if two of the major events in the last 20 years happen again in AMP7. The company is able to accommodate this with a combination of increasing its gearing rate and reducing profits available for dividend distribution. Additionally, in July 2018 Ofwat confirmed that as part of water companies' financial viability and resilience tests they want companies to run various stress tests, including a challenging, downside combined scenario of a year-on-year 10% underperformance on Totex and retail expenditure, a year-on-year ODI penalty of a Rate of Return on Equity (RoRE) decrease of 1.5%, and a financial penalty of 1% of revenue in one year. AWL also ran their own combined scenario of two major events happening in AMP7 (total cost of £60m), CPI inflation being 1% lower than anticipated, and two years of 1% RoRE reductions. Thus, in total six stress tests (10% Totex overspend, ODI penalty of 3% of RoRE in a year, CPI inflation 1% lower than anticipated, bad debtors 5% higher, financing costs 2% higher for all new debt, and a penalty of 3% of appointed revenues in one year) and two scenarios (Ofwat combined scenario and AWL combined scenario of two major incidents costing £60m with inflation 1% lower in each year and an ODI penalty of 1% RORE year 2 and 3) were run. The stress test of an ODI penalty of 3% RoRE and the Ofwat combined scenario created issues that cannot be met by adjusting gearing or reducing dividends



4. Maturity assessment

Financial viability

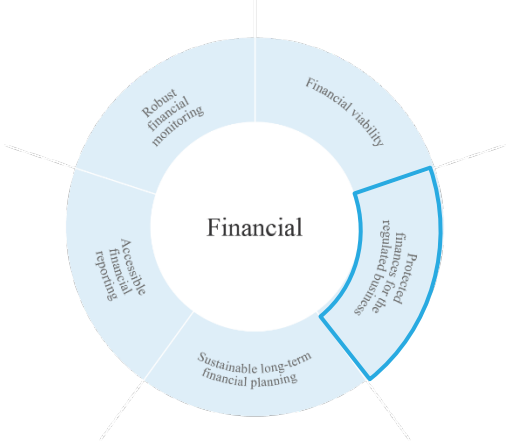
	Maturity Assessment
Current and Ongoing Activities	alone. If these two cases could not be met through insurance, other levers include: • Making a call on shareholders to inject money to reduce debt (which then reduces interest payments). Like most other water companies, Anglian Water is a private company so it is arguably easier to approach shareholders for further injections. In AMP5 shareholders injected a small amount of equity to avoid a potential lock up of WBS dividend payments, and in AMP6 shareholders agreed to forego dividends of £165m to reinvest in water resilience. Further, in response to Ofwat concerns over high gearing rates Anglian Water has recently announced its intention not to make dividend payments for the next seven years unless the company exceeds its ODI metrics. This means its gearing will reduce from c.78.5% to c.77% by the end of AMP7; For a short period adjusting investment in other parts of the business, for instance reducing the proactive maintenance Opex spend in a year by £10m can increase the interest cover ratio by 0.15 which would be sufficient to avoid a covenant breach in the year of the 3% RoRE reduction; and • looking for wider options to reduce debt repayments, e.g. restructuring debt, entering into derivative contracts or switching to more index-linked debt (which decreases nominal interest payments in earlier years). To reduce exposure Anglian Water is also making progress cutting its defined pension scheme deficit, which has fallen from £80m in 2016/17 to £47m in 2017/18. As a strength, Anglian Water's performance against some of the Outcome Delivery Incentives (ODIs) it sets has historically been good. For instance, Anglian Water is one of three companies that agreed an in-AMP6 ODI test, and has been awarded an additional £2.5m (2012 prices). As a further plus, the company has stated that although it reports a five-year LTVS it could formally report longer, acknowledging the further into the future one looks the higher the uncertainty. 6. Mention has already been made of Anglian Water's plans to reduce its gearing. Anglian Water carefully monitors future repayment dates for debt, and has a policy of ensuring no more than 50% of debt matures in any five year period, and 20% in any two year period. Its 2017/18 Annual Performance Report states that index-linked debt is c.58% of all debt, higher than the 2016-17 water and wastewater company (WaSC) industry average of c.46%. 7. To further reduce risks the company has a comprehensive insurance cover, including insurance for (a) all risks property damage/ business interruption, (b) employer's liability, (c) public/ products, pollution, financial loss, professional loss and legionella liability, (d) pollution and remediation environmental liabilities, (e) terrorism, (f) water resilience liability (e.g. accidental contamination or malicious tampering with water supplies), (g) commercial crime, (h) motor vehicles, (i) personal accident/ travel liabilities, (j) directors and officers liability, and (k) pension trustee issues. **Overall a score of (4) is given as:** • **Whilst the company is one of the more highly geared water companies (and therefore has less headroom to increase its debt), with its gearing at 78.5% it is still able to borrow an extra £500m before reaching a WBS lock-up on its gearing levels (85%);** • **It is performing well against its ODI targets, indicating that the company well prepared to respond effectively to shocks and stresses. For example, in**



4. Maturity assessment

Financial viability

	Maturity Assessment
Current and Ongoing Activities	**March 2018 it was praised by the Water Minister for its pre-planning for Storm Emma that resulted in very few incidents;** • **Its March 2018 announcement about lowering 2018 and future dividend payments to reinvest for future investment is welcomed as a way to reducing gearing. Being a private company owned by a few global asset management companies and investment funds, announcing reductions in dividends for a number of years is arguably easier than for listed companies.** Internally the company also runs stress tests for 10+ years, and under the scenarios modelled the company remains viable. Thus, Anglian Water may also want to consider reporting longer LTVSs as some other water companies are now.
Planned for AMP7 and beyond	**In AMP 7 and beyond if Anglian Water carries on reducing its gearing and being proactive it will retain a score of 4 (Response Actioned).**

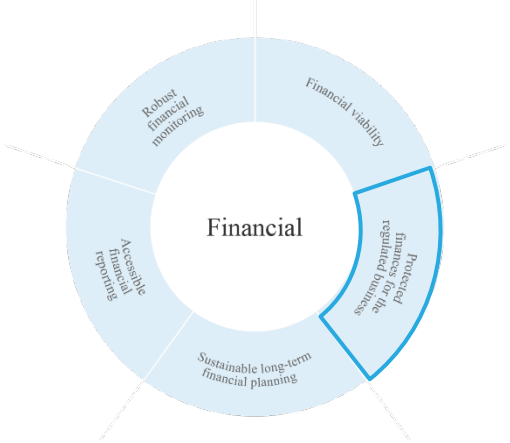


3. Approach and maturity assessment

Protected finances for the regulated business

Description of what leading looks like	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company is an exemplar in ring-fencing finances for regulated activities to protect the interests of customers. Where the company has non-regulated activities these are managed appropriately so they do not risk the regulated activities. Therefore, in the event that the company suffers a series of shocks to its finances, there will be enough flexibility to keep the core of the regulated company operating, evidenced by results from stress tests, spare cash reserves, liquidity, etc.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Anglian Water's regulated turnover in 2017/18 was £1,249m, which represents c.93% of the total Anglian Water Group Ltd.'s turnover (£1,338m). The remaining 7% comes from the non-regulated Anglian Venture Holdings Ltd., which is described on the Anglian Water Venture Holdings website as "*the investment and management vehicle responsible for the Anglian Water Group's commercial businesses across the UK and Ireland, with over £100m invested to date. These businesses have a combined turnover in excess of £500 million and offer customers a wealth of expertise in the water industry and infrastructure related sectors…..*" It has a staffing complement of around 450 employees. Anglian Venture Holdings Ltd.'s three main subsidiaries are: • Anglian Water Business (National) Ltd, which is the licensed retail business arm of the Group and is the dominant subsidiary. It operates with a profit margin after tax of c.3%. Anglian Water Business (National) Ltd. is branded as Wave Utilities which is a 50:50 Joint Venture between Anglian Water and Northumbrian Water (https://www.wave-utilities.co.uk/). To reduce the risk of business clients defaulting on the payments they owe Wave Utilities, Wave Utilities requires its clients to pay their bills in advance unless they can provide a strong company guarantee or parent company guarantee. Additionally, Wave Utilities has in place insurance, which further mitigates risks to regulated wholesale business companies (whether that be Anglian Water Ltd, Northumbrian Water or any other water company) of Wave Utilities failing to pay money owed to the wholesale business water company; • Celtic Anglian Water Ltd. is an Irish company that operates wastewater and water assets on behalf of private companies. In March 2017 it had turnover of €34.6m and net assets of c.€9.3m; and • Alpheus Environmental Ltd is a UK company which, like Celtic Anglian Water, operates other UK companies' water and wastewater infrastructure. In March 2017 it had turnover of £10m and net assets of £1.8m. **The risk of Anglian Water Group Ltd.'s 7% of non-regulated turnover scores a 4 (Response Actioned). This is for three main reasons: (a) the Anglian Water Group owns 50% of Wave Utilities, meaning it has greater oversight of the company compared to wholesale business water companies selling their water to**



4. Maturity assessment

Protected finances for the regulated business

	Maturity Assessment
Current and Ongoing Activities	**standalone water business companies, (b) there is insurance to mitigate the risk of Wave Utilities going bankrupt, and (c) all the non-regulated business activities are comparatively asset light, employee heavy, meaning it would be easier to reduce costs and minimise expenses in the event of a downturn in Wave Utilities' performance.**
Planned for AMP7 and beyond	**Given no significant change to in structures is planned, we expect Anglian Water to continue to score 4 (response actioned) in the future.**

4. Maturity assessment

Sustainable long-term financial planning

Description of what leading looks like	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company is looking forward 25+ years, with expenditure plans linked to the strategic direction of the Board. These are regularly reviewed. Base operating and maintenance expenditure together with any additional enhancement expenditure to meet customer and regulatory requirements have been identified on a year-by-year or AMP by AMP basis. The company has an excellent understanding of the current and future predicted condition and performance of all its assets. Horizon scanning for future trends informs new investment.	Current and Ongoing Activities Planned for AMP7 and beyond				

Maturity Assessment

Current and Ongoing Activities

From workshops and interviews conducted as part of this assessment the company is continuing to improve its understanding of work to enable smarter investment. For example, its Strategic Direction Statement (SDS) (2020-2045) has an aim of 'investing for tomorrow' which includes proactive maintenance strategies, alliancing strategies and innovation, based on future challenges identified.

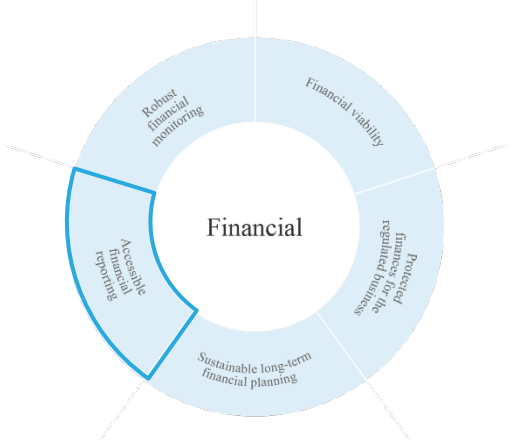
To meet the SDS the company has identified the additional works that will need to be undertaken to meet the SDS, estimated the costs of these activities on an AMP by AMP basis and prepared low, medium and high scenarios over the next 25 years. The following table splits out the main components of this plan.

	Operational	Maintenance	Customer enhancements	Supply Demand	Quality	
Water	✓	• Base maintenance • Smart infrastructure • Asset deterioration • Leakage actions • Smart meter replacements	• Standby generators • Leakage actions • Fire risks • Low pressure actions • Smart metering • Interruptions	• New strategic reservoir • Single supply resilience • Small scale single supply • Capacity for third dry winter • Sustainability reductions • Growth	• Metaldehyde • Nitrate • Nickel/ other • Catchment management	• Water resources • SEMD • Lead
Wastewater	✓	• Base maintenance • Smart infrastructure • Asset deterioration • Private sewers • Private pump stations	• Coastal enhancements • Domestic flooding • Odour management • Partnership funding • Pollution control	• Growth projects	• Urban Waste Water Treatment Directive • Ground Water Directive • Water Framework Directive • Coastal Waters • First Time Sewerage	• Chemical treatment • Combined Sewer Overflow strategy • Sludge • No deterioration planning • Flow compliance

4. Maturity assessment

Sustainable long-term financial planning

	Maturity Assessment
Current and Ongoing Activities	Long-term planning also feeds through to Anglian Water's draft Water Resources Management Plan 2019, which is also used to determine future expenditure requirements. As set out in **reflective risk-based approach to asset health,** Anglian Water has a good understanding of asset condition and criticality. It uses the Copperleaf system to assess the location, age and asset condition of most assets, either using inspections or where inspections have not taken place using computer algorithms to estimate their asset condition. The company's expenditure on replacing/ refurbishing assets is less than 1.2% of the Gross Modern Equivalent Asset Value (GMEAV), which would be the replacement cost if the average age of assets is c.80 years. However, this is for two reasons: • operationally the company does not see a current need to increase the replacement rates given the condition of its assets; • its asset management innovation in ways to extend the economic life of assets (e.g. by pumping water at lower pressures) or to repair/ replace assets much more cheaply (e.g. only replacing parts of pipes, not the full length of pipes; running new pipework within existing pipes or structural relining – all of which avoid trenching costs). Its asset optimisation approaches mean it was the first company in the UK to achieve an ISO55000 (International Standards for Asset Management) quality mark. **Expenditure plans are all contained in a single system, including for the long-term. Anglian Water therefore scores 4, putting the company in the upper quartile of water companies for its approaches.**
Planned for AMP7 and beyond	During AMP7 the company will be using its Copperleaf system to understand the condition of its remaining assets (i.e. more of its adopted private sewers). Cognisant of climate change, and other long-term stresses, as set out in its SDS and dWRMP, we expect the company to continue to invest new and existing assets with this long-term mindset. **We expect Anglian Water to continue to achieve a score of 4 (Response Actioned) with prospects to become a 5 (Leading) as it moves to having costed plans to be being resilient for 1 in 500-year droughts.**

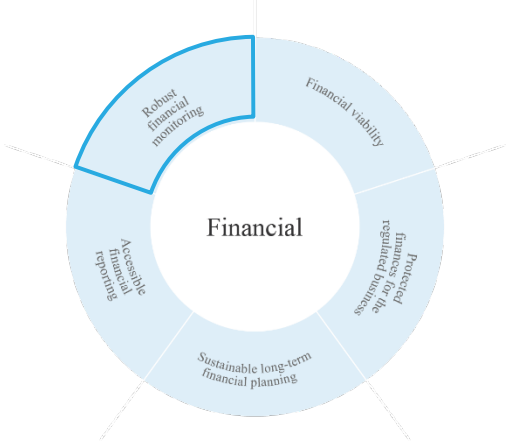


4. Maturity assessment

Accessible financial reporting

Description of what leading looks like	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
Financial reports need to be tailored for two types of audiences – the investor and the interested water customer. For the interested water customer in order to be transparent and inclusive the company publicly reports its financial and annual performance (via the annual reports and APRs) using customer focused language. In bills it also shows easy to understand visuals showing where customers water bills go, and how it minimises leakages, outages and sewerage leakages. Financing, company and tax structures are easy to understand.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, Anglian Water's Annual Reports and Annual Performance Reports are presented in a clear and understandable format. Additionally, public reporting on ODIs is provided in non-technical language on Anglian Water's website, and updated regularly. In Ofwat's November 2017 review of Anglian Water, Ofwat reported that "*there is clear evidence that the company's reporting is transparent and accessible to customers and other stakeholders …..*" For investors additional information is provided, for every example every six months Anglian Water produces a report that captures all relevant financial information. In order to improve transparency, on 5th June 2018 Anglian Water closed its dormant Cayman Islands company and has repaid an intercompany loan of £1.6bn, thereby making it easier for customers to see the exact dividend payments that are being made to its shareholders. Anglian Water employs external parties undertake data assurance, and in November 2017 Ofwat suggests that "*the publication of an easily accessible statement or report from …. external reviewer*" would provide further reassurance. Anglian Water has incorporated this suggestion into its latest 2017/18 Annual Performance Report, including a letter from Deloitte who analysed the many of the financial metrics included in the Annual Performance Report and a summary from Halcrow who provided assurance of the technical sections of the Annual Performance Report. **A score of 4 (response actioned) is awarded. To move to leading in the sector Anglian needs to carry on presenting clear Annual Reports, Annual Performance Reports and communications with customers, and work with customers to demonstrate that this information is presented in the clearest format for them, co-creating any improvements.**
Planned for AMP7 and beyond	This assessment understands that Anglian Water will continue to report publically in the format they currently use, and is improving its understanding and engagement with the public as outlined in the draft Customer Engagement Strategy Booklet. **We therefore expect Anglian Water will continue to score level 4.**

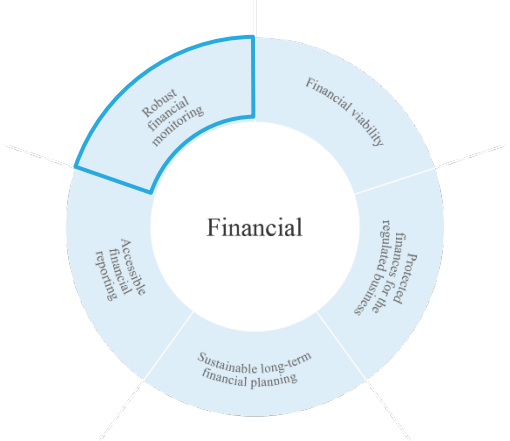


4. Maturity assessment

Robust financial monitoring

Description of what leading looks like	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
In order to provide continual checks and balances that the company is continuing to support its long term viability, the company undertakes regular monitoring to track trends in opex, leakages, refurbishment of assets, investment, climate impact, demographics, etc. This is supplemented by regular sensitivity tests and scenario testing. Such information is then recorded and reported routinely at Board level, with material divergences from expenditure plans discussed and actioned.			Current and Ongoing Activities		
			Planned for AMP7 and beyond		

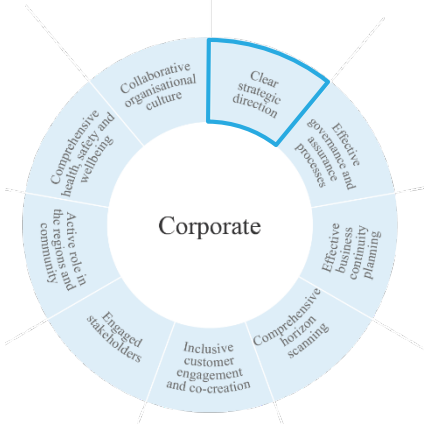
	Maturity Assessment
Current and Ongoing Activities	Anglian Water has many systems for robust financial monitoring including: • Every month a detailed report including performance against the financial plan and against the ODI indicators is discussed in depth in a Management Board meeting. This board meeting includes senior members of the finance and water regulation team. Differences, particularly underperformance against the plan, are marked with a Green, Amber (issue, but should resolve itself or already being resolved) and Red Flag system. To provide all the necessary information involves around 30 employees responding to about 130 control questions. As the Board meets so regularly even comparatively small differences (e.g. £1m) are picked up; • A high-level dashboard version of this Management Board report is then discussed at the Main Board meeting; • The monthly performance reports are also shared with the Strategic Priorities Board which flexes investments in response to changing needs and trends; • Every six months the company reports its performance to its bond investors via Investor Reports that provide an additional level of scrutiny; • Every six months to fit into the timetable for reporting to its bondholders stress testing is performed against pre-determined metrics, and any operational risks that are identified that are more extreme than some of the standard sensitivities (e.g. a 10% totex overrun) are highlighted. However, in between the six monthly formal submission matters are closely monitored; • As with all large water companies the credit rating agencies provide an external view of the finances of the company. The company regularly liaises with them; • As with all other water companies the financial results and the LTVS in the Annual Report are audited. Additionally assurance of the Annual Performance Report is carried out. As part of the annual comparison of water companies financial resilience Ofwat decided in November 2017 to retain Anglian Water's assurance status as 'targeted'. In coming to their decision, Ofwat raised minor concerns with Anglian Water's Financial Monitoring Framework, noting a number of small errors in reporting financial derivatives and presenting information about dividends. These have been addressed. **Therefore, overall, like the majority of other water companies, Anglian Water achieves a score of 4 (Response Actioned).**



4. Maturity assessment

Robust financial monitoring

	Maturity Assessment
Planned for AMP7 and beyond	We understand Anglian Water is enhancing its financial systems to develop integrated reporting of capital and operational costs. The company is also considering consolidating their governance and assurance process into one area. **Whilst these changes are to be commended, we expect that Anglian Water will continue to score 4 (Response Developed).**



4. Maturity assessment

Clear strategic direction

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has a clear aim and strategy which is well communicated and is recognised by all, both internally and externally. All plans and decisions are based on how they will work towards this strategy.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Anglian Water has taken its 'Love Every Drop' campaign and translated this into a core business strategy, defining its corporate identity with this widely understood concept. This strategy is supported by 12 specific goals to improve the business, and underpins numerous initiatives such as 'Keep It Clear' and 'Drop 20' which are an important part of the presence the company has in the communities it serves. The 12 goals are reviewed and updated regularly to reflect internal progress as well as any change in external circumstances. Anglian Water has a Strategic Direction Statement (SDS) that describes the direction of the business over a 25-year period, and identifies four long-term ambitions to help guide the company's planning; focused on resilience to risks of drought and flooding, enabling sustainable economic and housing growth, carbon neutrality by 2050 and improving ecological quality. The 12 business goals from the Love Every Drop strategy are included and referenced in the SDS, which supersedes a number of previous strategies and demonstrates a clear strategy and integrated thinking. The updated SDS has been published and communicated internally and externally. It underpins other strategies including: CXTP, Asset & Operations, People etc. The SDS also adopts a resilience framework to consider resilience in the round (including operational, financial and corporate resilience). Anglian Water is one of the few companies to have updated its SDS in advance of PR19, and this demonstrates a clear commitment to long-term planning. The PR14 customer outcomes have been refreshed in the recently published SDS, which provides a long-term strategy to 2045. The SDS sets out strategies to deliver each outcome and identifies challenges that will affect it. The outcomes are also linked to the UN Sustainable Development Goals. Building on longer-term objectives in its SDS, Anglian Water have set out their priorities for AMP7, which are customer, leakage, and efficiency [C]. These priorities, as well as the vision and principles developed for the SDS, will feed into the AMP7 operating model. **The updated SDS provides clarity regarding the company's strategic direction, removing some of the previous ambiguity that resulted from having a number of strategy documents. We consider that Anglian Water currently has a developed and implemented a response to its strategic direction.**
Planned for AMP7 and beyond	**As noted above, the updated SDS provides clarity regarding the company's strategic direction. We expect that this will be implemented in AMP7 to demonstrate its potential to be a leading approach.**

4. Maturity assessment

Effective governance and assurance processes

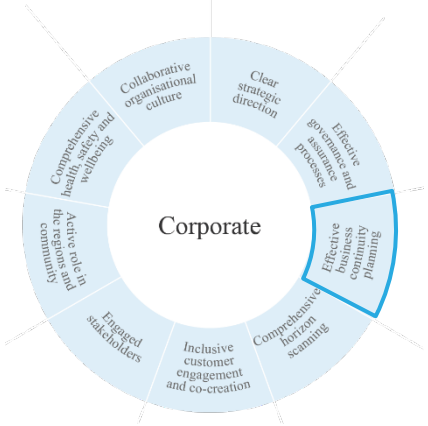
Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has reliable and well disseminated processes, roles, governance and reporting covering all aspects of the business. There is a clear process for assurance, approval and board sign-off.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	This assessment understands that Anglian Water has a clear process for governance and assurance. This includes a Scheme of Delegation, to ensure correct process and reporting, and includes regulation, finance, strategy and management, and policies and the 2014 Corporate Governance Code details business roles, reporting, transparency, governance. Targets for the business (both financial and non-financial) are set annually and aligned to the five-year strategic delivery plan. The business produces a 'performance book' which is updated on a monthly basis and shows actual performance to date, forecasted performance for the year and a comparison to both the target and the prior year. The most significant metrics are summarised on a page at the start, and a dashboard is shared with the AWS board, with the full report presented to the management board. The focus for these reviews is early identification of trends or issues so that timely corrective action can be taken. Anglian Water has several key business standards for management systems, and they share the same structure and use common system clauses to ensure consistency and compatibility. An independent auditor (LRQA) are employed to assess these core set of requirements across the business' functions and activities. Anglian Water's Integrated Management System (IMS) unifies its management system processes into a complete framework, unifying the objectives of the organisation and optimising use of resources as well as enabling better governance and assurance across the business. Anglian Water has an Audit Committee, whose principal role is to examine any matters relating to the financial affairs of the company and provide effective oversight and governance of the company's internal control and risk management processes. Anglian Water are certified and independently audited to ISO9001. In addition, Anglian Water's Customer Engagement Forum has the ability to requisition its own reviews or audits of Anglian Water's data, procedures, policies or processes. Anglian Water also have a sustainability and resilience sub-group of the customer challenge group, which acts as an independent advisory group. The chair of this group is Craig Bennett, Chief Executive of Friends of the Earth. Anglian Water are also sponsoring a project run by Sustainability First on developing capacity and understanding of what public interest looks like in utilities across energy and water ('New-Pin'). Anglian Water's policies and standards for water supply hygiene (POSWSH) are clearly defined alongside responsibilities for supporting them. POSWHS standards are approved by the Policy Advisory Group (PAG), and reviewed on an annual basis, and the procedures are reviewed every two years. Progress against the review process is monitored at a monthly POSWHS update meeting.

4. Maturity assessment

Effective governance and assurance processes

	Maturity Assessment
Current and Ongoing Activities	Assurance is provided by external challenge of governance by third parties, including non-executive Board directors. The Board membership has a majority o independent non-executive directors (INEDs), and some of the committees are specifically comprised of solely INEDs, in order to ensure that management is not incentivised to take a short-term view. As part of Anglian Water's securitisation arrangements, no dividends can be paid unless at least two INEDs are satisfied that the viability of the business is assured. The company also has a policy in place to ensure that the roles of the Chairman and Chief Executive Officer are kept separate, with responsibilities clearly divided and documented. There are six different Alliance boards. There is clear process to deal with risk like a Market Reform Group exists to deal with opening of retail market and management of legal risks (bribery, data protection, env. protection) undertaken through appropriate policies, awareness and training. The company has an established annual business planning cycle which is signed off by the Board. No changes are planned. In Ofwat's Company Monitoring Framework 2017 Anglian 'exceeded expectations' for charges engagement partly due to detailed information in Board Assurance Statements and received a 'meets expectations' for board leadership, transparency and governance for meeting Ofwat's principles but with reporting being highlighted as a week area. It also found the Board has also provided a suitably signed off Risk and Compliance Statement and suitable process to meet these obligations. The Strategic Priorities Board (SPB) provides internal regulation within Anglian Water. Its purpose includes monitoring and review of business performance, delivery of ODIs and performance commitments and delivery of obligations. The SPB is separate from the operational business and overseen by the Chief Executive. It sets longer term strategic priorities based on longer term risks, rather than reacting to short term pressures. The SPB has delegated powers to allocate investment or change plans. Environmental and drinking water compliance is assured through a senior review group (WQECG – Water Quality & Environmental Compliance Group) which includes the CEO as well as Directors of Water and Water Recycling, Heads of Water Quality and Environmental Quality, the Head of Asset Planning and senior members of Legal and Media teams. Weekly meetings of the WQECG include a review of significant drinking water, environmental and media issues from the previous week to understand and assess the impact on customers and the company's reputation with regulators, as well as briefings on quality compliance, strategic quality risks and lessons learned. Assurance of covenants linked to raising of debt is carried out through members of the board and senior management taking responsibility for owning covenants in each business area, and reporting compliance on a monthly basis, with any potential issues raised at a monthly Financing, Treasury and Energy Policy Group (FTEPG). This process is managed by the Group Treasury, who also hold annual reviews with each of the covenant owners. **Anglian Water has clearly demonstrated its response to governance and assurance is actioned and embedded. An executive director with specific responsibility for resilience, challenge from the CCG specifically on resilience and a Strategic Priorities Board to consider longer-term challenges all point to a leading approach within the industry.**
Planned for AMP7 and beyond	Anglian Water plans to submit its PR19 Business Plan on before 3 September 2018. The plan will have full Board Assurance. **We expect Anglian Water's to continue to learn and evolve its approach to governance and assurance planned for AMP7 and beyond to retain this leading position.**

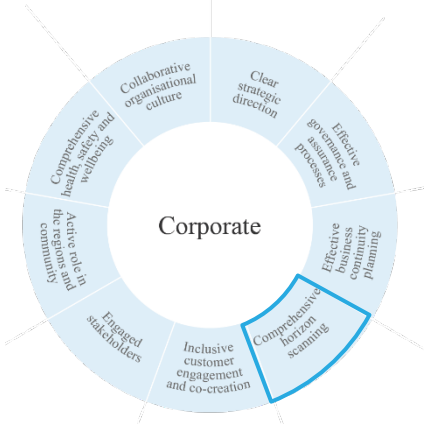


4. Maturity assessment

Effective business continuity planning

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has a risk-based approach to resilience planning linked to the National Risk Register and the likely impact on service to customers. A set of response plans are in place to prepare for, respond to and recover from potential impacts. Plans are regularly trained and exercised, with everyone in the company knowing their roles and responsibilities. All critical assets have emergency plans and all critical teams will be able to recover to minimise impact on service. Approaches will follow best practice, e.g. ISO 22301 and the Business Continuity Institute Good Practice Guideline 2018.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Currently, Anglian Water has a Business Continuity Management System certificated by a third party (Lloyds Register Quality Assurance) for compliance with International Standard BS ISO 22301:2012, and are the only water company in the UK with this standard. The company has mapped its critical activities as part of its business impact analysis and process recovery plan programmes. When testing these plans during exercise programmes, critical teams are included to validate their plans and ensure that the business co-ordinates an effective response and makes the best use of resources during an incident. The business has robust precautions in place for cyber security threats. We also understand that megatrends and risks are considered at board level, in the audit committee, and an external audit is undertaken annually. A risk register has also been created across the business which considers health & safety risks, National Risk Register, regulatory & policy risks, business delivery risks, financial risks, business compliance risks, legal compliance risks against the risk score and trend against outcomes, and use a JCAD system to manage risk with a 20 year time horizon. Anglian Water also take an active role in Government- and Cabinet Office events around security, emergency planning and business continuity activities. On cyber security, Anglian Water review technical designs to ensure there are no single points of failure, which ensures its technical solutions are resilience and can maintain continuity, as well as providing assurance that the processes in place are providing good levels of protection. Anglian Water has a Security Operations Centre which provides 24/7 analysis of threats and attacks. Robust management of cyber security controls such as parching or anti-virus reduces the likelihood of outages, which reducing the risks of business continuity issues. **Compared to other examples of water company approaches to business continuity planning, Anglian is demonstrating leading practice including obtaining third party assurance through ISO certification.**
Planned for AMP7 and beyond	**In AMP7 and beyond, Anglian will maintain its industry leading position if it continues to improve alongside national and international best practice and set the standards for the UK water industry.**



4. Maturity assessment

Comprehensive horizon scanning

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
Plans, strategies and actions are all based on the outcome of comprehensive and robust horizon scanning which takes into account future shocks and stresses that may impact areas of the business. Horizon scanning is regularly reviewed.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	This assessment understands that risks are currently managed with a 20 year horizon and the Management Board considers megatrends. Climate change adaptation planning and National Risk Register and 'all hazards' assessments are cross referenced with business unit and strategic risk registers to ensure there are no gaps in coverage. Horizon scanning has provided input into a range of long-term plans; evidence was originally collected to inform the 2007 Strategic Direction Statement (SDS). In 2012, in support of PR14, Outsights was appointed to develop long-term scenarios and in 2016, Oliver Wyman was appointed to develop a revised set of scenarios, working with the Board. Anglian Water has also sought third party expert input on horizon scanning from PWC. Long-term challenges were reviewed as part of the 2017 SDS refresh. Horizon scanning has also been undertaken in relation to specific topics. For example, In 2011 and 2015, climate change adaptation report were published. However, there remains an opportunity for Anglian Water to improve understanding across the business and between teams; sharing the outputs from these horizon scanning activities to inform an even greater number of plans, strategies and actions. **Anglian Water has developed its approach towards horizon scanning to some degree, and used this to inform key plans and strategies. There is further scope to engage across the organisation on horizon scanning – both to get input and to communicate findings and thinking to ensure all of its business areas are taking future trends and scenarios into consideration when planning and making decisions, and so a score of 3 is given.**
Planned for AMP7 and beyond	With Regulation changing to Regulation and Strategic Direction Anglian Water is strengthening its capability in the area by the joining of regulation, corporate affairs and asset management. It has also committed to review and update our scenario planning on a 4-5 year cycle, and it is likely this will be done on a more regularly on a topic specific approach. **Anglian Water has committed to ongoing review and update of its scenario planning and horizon scanning activity, and so scores a "response actioned" level 4 into the future.**

4. Maturity assessment

Inclusive customer engagement and co-creation

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has a clear two-way dialogue with customers to ensure that customers are included and to improve transparency, cooperation and collaboration on current performance and future direction for the business. Customer policy and practices are established to meet the needs of customers in vulnerable circumstances. The company aims to establish trust, confidence and legitimacy.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, Anglian Water has an inclusive customer engagement strategy, underpinned by the recent 'Anglian Water Engagement Strategy Booklet 2017' which was co-created with domestic and commercial customers. This document demonstrates a good understanding of perspectives of different customers, how they should be engaged and what Anglian Water's gaps are in current engagement: for example that resilience can bring benefits in the short-term as well as the long-term, and incorporates financial and corporate elements as well as the more direct operational. Anglian Water has undertaken customer segmentation, developed a resilience co-creation report, set up an online community which opens up a two way dialogue with customers and has a new question every week to direct customers to the most useful topics to discuss, undertake regular talks and presentations and community groups around its supply area. For example, Anglian Water has carried out customer perception surveys via its online community, Love Every Drop, to understand their experiences of sewage network rehabilitation. This activity enabled the company to understand and minimise frustrations in relation to rehabilitation works thereby increasing customer buy-in to company plans and practices and providing evidence of customer priorities and concerns to be considered in future projects. Customer engagement focuses on ideas in the next AMPs so looks five to 10 years in the future. Anglian Water has engaged with 500,000 customers at PR19, compared to 50,000 at PR14. This engagement has allowed an better understanding of the best engagement methods (including value exchange and including short term benefits for the short term). Anglian Water has launched a collaborative learning programme via a series of guides including on community regeneration and innovation. These focus on working closely with communities to drive systemic change and co-create a shared vision. There are also Community Ambassadors who run talks to seek the views of organisations that have an interest e.g. customers, communities, housing developers, retailers, manufacturers and government. Anglian Water has developed a leading collaborative approach with JCP Ltd which allows co-creation involving partners, the business and customers A regular synthesis of customer views is compiled by an independent consultant from the results of the customer engagement that Anglian Water carries out – this has been updated every month during PR19 business planning, and will continue to be updated at less frequent intervals going forwards. Anglian Water has carried out work with two suppliers – Community Research and Accent – to start to define its new response to customers that may find themselves in vulnerable circumstances. Through this, Anglian Water has identified that it has more to do in this space, and a step change is planned in AMP7 to move from 30,000 to 300,000 customers on the Priority Services Register.

4. Maturity assessment

Inclusive customer engagement and co-creation

	Maturity Assessment
Current and Ongoing Activities	With a mandate to make recommendations to enhance customer influence within the decision making processes of the company, Anglian Water's Customer Board also meets bi-annually. The Board is responsible for reviewing and challenging strategies from a customer perspective, providing feedback on developing customer experience plans and channels, and ensure these are representative of Anglian Water's customer base. In day-to-day contact and communication, Anglian Water can point to metrics that demonstrate good practice. For example, in the Ofwat Service Incentive Mechanism (SIM) with a 2017/18 score of 88 (one of three companies nationally to score this) compared with an industry average of 84. There is also work being undertaken to prepare customers for extreme events through joint media campaigns. The "Keep Your Pipes Cosy" campaign was commended by Ofwat as part of the 2018 freeze-thaw review, Out in the Cold. Anglian Water was praised or its approach to communication with customers and stakeholders, through a range of media. **Anglian Water has a clearly developed response towards customer engagement, and two-way dialogue allows co-creation of solutions and ensures the company are investing in the right areas according to customers' needs. Its inclusive approach is epitomised by the co-creation of its customer engagement strategy and extensive engagement for PR19, which helps to demonstrate a leading approach.**
Planned for AMP7 and beyond	The Engagement Strategy Booklet 2017 states that the business aims to shift to be more customer led. Following the success of the PR19 online community Anglian Water has made a decision to make this a permanent feature of its customer engagement strategy, demonstrating an ongoing commitment to a two-way dialogue with customers. Anglian Water has committed to a step change in its approach to customers in vulnerable circumstances in AMP7, highlighted through a ten-fold increase in Anglian Water will need to continue to evolve and innovate to retain its leading approach to customer engagement into AMP7. **The fact that Anglian Water will be engaging with customers on all aspects of the business, and embedding its good practice from PR19 business planning engagement into ongoing customer engagement activity, means we expect them to further demonstrate inclusive customer engagement and co-creation in AMP7 and beyond, building trust and resilience.**

4. Maturity assessment

Engaged stakeholders

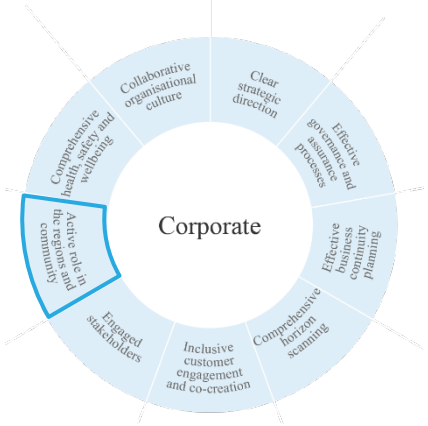
Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company plans, manages and undertakes regular and clear communications with stakeholder groups and organisations. Collaboration is determined through multi-agency participation with tangible outputs that improve the resilience to customers and the business.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Anglian Water has an active stakeholder network, which is maintained across multiple areas of interest including technical, political, operational and environmental. Lobbying and engagement work includes updating stakeholders regularly both face-to-face and through topic-specific bulletins. Anglian Water has established a leading communication and engagement strategy 'Love Every Drop'. This strategy lead to Anglian Water to be awarded 'Responsible Business of the Year 2017' by the Business in the Community Responsible Business Awards. Anglian Water has produced a business resilience leaflet for the Local Resilience Forum, and has emergency planners so stakeholders know what Anglian Water's response to an event will be to enable easier emergency planning. When dealing with extreme events stakeholders, like Local Authorities and partners, are engaged for multi-agency plans and joint campaigns through a number of exercises and events. This was observed by Ofwat in the 2018 Freeze-thaw event. Anglian Water has also carried out projects in partnership with others, including on flood defences and Water Resources East. Anglian Water is a member of CBI and the regional Chambers of Commerce, as well as a number of issue- and industry-specific groups such as CIPR, IoW, UKWIR etc. The business takes an active role in Government- and Cabinet Office organised events on risk and resilience issues, and maintains regular dialogue with regional elected officials, both in response to specific issues and more generally on issues of corporate significance. Effectiveness of Anglian Water's multiple internal communications channels for the dissemination of information is periodically reviewed. The business is part of a Multi Agency Support Group (MASG) to help share and collaborate both during business as usual, for example by maintaining a site on 'Resilience Direct' for sharing information, as well as during large scale events – for which exercises are regularly planned, based on the National Risk Register and with the involvement of all agencies and all category responders. The company is also part of the Water Sector Risk Group, sharing approaches to risk management and seeking best practice, including by involving experts from the private sector. Anglian Water is also part of several Water UK groups for sharing best practice, collaborating to review and influence changes in legislation and working with regulators and agencies to improve sectoral resilience. The company has a unique partnership with Allia and Opportunity Peterborough through the Water Innovation Network (WIN), which provides local SMEs with an opportunity to collaborate with Anglian Water and showcase innovative products and services. The network is free to join and has over 900 members. **Anglian Water's stakeholder management and engagement has helped deliver some clear results for the company and the region, and demonstrates an actioned response to building resilience in this category.**

4. Maturity assessment

Engaged stakeholders

	Maturity Assessment
Planned for AMP7 and beyond	The 2017 Strategic Direction Statement commits Anglian Water to continue to deepen and extend its collaboration with partners across the region. We have seen evidence that Anglian Water is looking to undertake further communication and partnership working on catchment management initiatives, and fluvial, pluvial and coastal flooding schemes in future AMPs, including through established business to business initiatives such as Water Resources East, and the LEP (Local Enterprise Partnership). Through the AMP6 and PR19 process Anglian Water has established open channels with customers including twitter, and online communities. It is expected that these will continue as channels in AMP7 and beyond. **There are no significant changes planned for Anglian Water's stakeholder engagement strategies in AMP7 and beyond, so we expect its score will remain as a Level 4.**



4. Maturity assessment

Active role in the regions and community

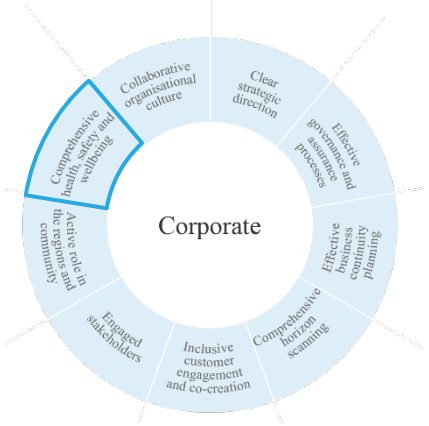
Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company undertakes activities which have wider benefits to the communities that are served allowing them to grow and develop through enabling sustainable growth, both at a regional and local level demonstrating corporate citizenship in the process. The company is establishing goals to meet the carbon challenge contributing to their global and local impacts.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Currently, Anglian Water has a number of initiatives which demonstrate a desire to have a positive role in the community. These include the Anglian Water Community Education Team, three Education Centres, a community outreach programme and the employee volunteering scheme 'Love to Help'. The Community Education programme encourages behavioural change by developing students' knowledge about the key issues facing local areas including growth, climate change, and the need for sustainable water management – and through this it also raises aspirations and provides an awareness of career pathways, developing local talent pools and encouraging social mobility. There is also a Community Ambassador Programme which enables customers to feed into the PR19 strategy, focusing on key issues in the region. Anglian Water partners with local groups such as the Women's' Institute and Adult Social Care Great Yarmouth. There are some examples of Anglian Water taking a leading role in a community. For example, its work on community regeneration in Wisbech; Anglian Water has worked with partners to introduce new Further Education courses and develop a vision for a new garden town, with over 10,000 new homes. In order to share their experience with others, Anglian Water has produced a guide for other public, private and third sector organisations, aiming to demonstrate the potential to achieve mutual goals through strong leadership, innovation and collaboration, with both business partners and communities. Anglian Water will take the learning from some individual parts of this programme to apply in other geographies (e.g. Hartlepool college). Anglian Water has set targets to 2030 for reduction in capital carbon emissions, and for 2020 for reduction in operational emissions. It is on track to meet these targets. In addition, it has set an ambitious target, in line with the aims of the Paris Agreement, to become a carbon neutral business by 2050. Anglian Water aims to lead by example on this front; for example it was founding member of the Prince of Wales's Corporate Leaders' Group (CLG) for Climate Change, and was Business in the Community's Responsible Business of the year for 2016/17. **Currently, Anglian Water has developed and has some actioned responses to maintaining an active role in the regions and community, in particular focusing on education and engaging with young people. There is an opportunity to set out a more comprehensive plan to learn from experience in Wisbech and elsewhere. The company's carbon reduction ambition is leading and there is further work to do to deliver against this ambition. The company scores a Level 3 in this section based on the evidence we have seen.**

4. Maturity assessment

Active role in the regions and community

	Maturity Assessment
Planned for AMP7 and beyond	In AMP7 and beyond, the long term strategy Strategic Direction Statement (2020-2045) has the outcome 'Caring for communities' including goals for contributing to the community by facilitating population and regional economic growth, as well as being a good neighbour. It has also set the leading ambition to become carbon neutral by 2050, demonstrating a response that will be actioned in the future. Anglian Water seems to have a good understanding of how to engage with its communities and the need to take a leading and active role at times. However, there could be more detail on the pathway Anglian will follow to achieve the goals identified in the SDS: How will specific activities contribute to regional growth? What community needs will be addressed, how will these needs be identified? **Anglian Water's incorporation of caring for communities and zero carbon commitment in its long term strategic direction statement indicates that its response will be further developed and actioned in AMP7 and beyond.**



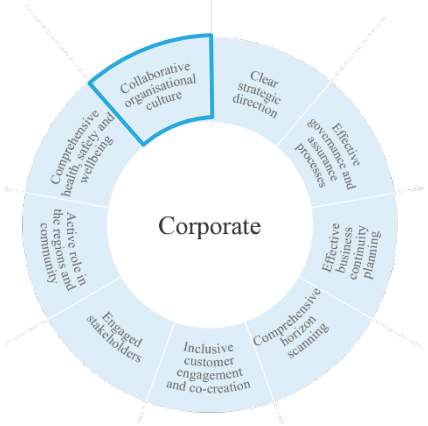
4. Maturity assessment

Comprehensive health, safety and wellbeing

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has reliable and robust plans for health, safety and well-being which will make significant and measurable improvements to the lives of the workforce. There is a strong health and safety culture, where behaviours are over and above what is required.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Currently, there is a company-wide occupational health and safety management system which is compliant with the International health and safety assessment specification OHSAS18001:2007. There are various wellbeing initiatives including 'Personal Resilience in the Workplace', information pack to help first line managers to support the health and wellbeing of their team, and 'Living in an Injury Free Environment' (LIFE) which has pillars on Healthier, Happier, Safer Environment, as well as employee 'Health MOTs', debt advice and online access to advice. Anglian Water provides healthcare cover for all, but maintains flexibility by allowing employees the option to reduce their cover and select other wellbeing benefits should they feel these can enhance their wellbeing. Anglian Water has been recognised by external awards; both as a business and through individual members of staff, with the company being awarded 'Responsible Business of the year' award for its Employee Assistance Programme, and one employee receiving an 'Employee Wellbeing Visionary' award from the Reward and Employee Benefit Association. **Anglian Water has a well developed and actioned response towards Health, Safety and Wellbeing, and this has been recognised by a number of external awards. To demonstrate leading practice, we would expect to see clear processes for developing and reviewing indicators and associated controls for specific health, safety and wellbeing issues relevant to its business.**
Planned for AMP7 and beyond	For AMP7 and beyond, it appears that the business is going in the right direction through various wellbeing events and campaigns are planned up to 2020, detailed in 2020 Plan for Wellbeing. e.g. hygiene. It is currently unclear how progress and success of these wellbeing events will be measured. Anglian Water regularly undertake surveys which are independent to the business, the most recent was completed in June 2017. Action plans from this 'Love to Listen' survey are being developed and signed off in November 2017. **There are no significant changes to Health, Safety and Wellbeing processes in AMP7 and beyond, therefore the scoring is not expected to change in the future based on evidence seen to date.**

*https://www.glassdoor.co.uk/Award/Best-Places-to-Work-UK-LST_KQ0,22.htm

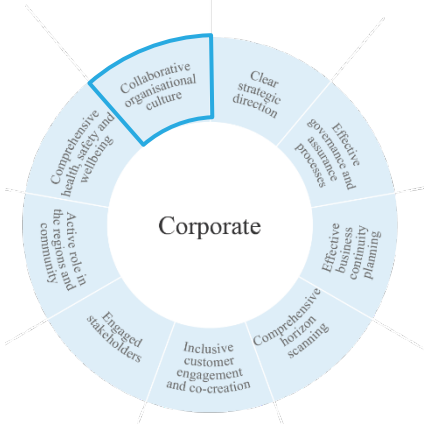


4. Maturity assessment

Collaborative organisational culture

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
A notable organisational culture that puts collaboration and change at the heart of all they do. This is apparent in the values, policies, plans and working practices of all employees who understand the fundamental roles they play in the service value chain.; working together across boundaries in the service of the customer and community. Empowered and engaged staff, with the capability, capacity and mandate to learn and adapt to events and change, is evident in the short, medium and long-term management of the operation; not simply one-off innovations and in response to major 'events'. The organisational approach to collaboration aligns with ISO044.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Anglian Water's 'Love Every Drop' vision and strategy promotes a number 'principles' and strategic pillars; where collaboration, innovation and transformation agility are explicitly noted. These capabilities also underpin Anglian Water's People Strategy where a focus on growing a culture that supports agility, flexibility, and 'time to think' is prized and enabled by an organisation redesign with greater 'horizontal' (versus vertical / hierarchical) working will enable more dynamic working and collaboration. Change starts with an awareness of what needs to be different, a desired future and mindful consideration / managing people through it. The 'Where are we' sections in both the organisation and People Strategy documents demonstrate a refreshing awareness of Anglian Water's current state including capability gaps, the aspirational 'where next' and the impacts. For example Anglian Water notes that it has 'well developed alliances with capital partners and customers but silos exist within the organisation which reduce knowledge sharing'. The process for creating these strategies has been notably collaborative; engaging across staff; partner / supply chain and customers to inform direction. There are also encouraging signs that collaboration and change is happening in pockets. For example, better collaboration between Ops, Delivery Teams and Asset Management has delivered fully prioritised programmes of work which reach decision milestones more quickly and with reduced expenditure. In 2018, an organisational restructure is underway, and the business has built up its transformation and change capability in order to deliver this change. Anglian Water's "Shop Window" innovation programme is further evidence of organisation's cultural approach to adaptation and change, embracing new technologies and approaches. It provides a real-world location where collaboration across business, supply chain and all those engaged in the water cycle value chain can unlock synergies between new technologies and different ways of working; accelerating learning. There are a number of examples of a collaborative approach with partners. For example, multi-agency, multi-county collaboration in Emergency Planning enables best practice sharing and lessons learnt. The Water Innovation Network (WIN) is a unique partnership between Anglian Water, Allia and Opportunity Peterborough which provides SMEs within the East Anglia region an opportunity to collaborate with Anglian Water, showcasing their innovative products and services to help Anglian Water meet its objectives; providing a potential market for new businesses.



4. Maturity assessment

Collaborative organisational culture

	Maturity Assessment
Current and Ongoing Activities	Although Anglian Water has clear evidence of how it successfully galvanises staff and partners during incidents, it is aware more needs to be done to create a collaborative and adaptive culture that addresses long term change systemically (not only in a crisis). Significant investment in Directors, Band 4s and Front Line Managers (FLMs) is focused on creating a connected and common language across leadership. A multi-agency collaboration programme is in place to train staff and test plans relating to resilience and incident management. Staff perceptions of the working environment at Anglian Water is evidenced by the fact the company was ranked in second place on Glassdoor.com's 'Best companies to work for'* for 2018. There appears to be various levels of understanding, engagement and communication of what resilience is, and what it means to Anglian Water as a whole as well as different teams and business areas. There seems to be limited communication between teams of their view of resilience and the ways they are working on it, however there does appear to be good understanding at high level, and appetite to improve this throughout the business. **Anglian Water is assessed to be at level 3, as through its People Strategy there are clear plans in place to deliver greater agility, flexibility and collaboration throughout the organisation.**
Planned for AMP7 and beyond	In AMP7 and beyond, Anglian Water has identified what it defines as 'The Right Culture' in The People Strategy. This identifies a number of aims to address what has been identified as current issues with the organisational culture, including more collaborative ways of working, and greater self reliance and equality rather than paternalism. There is also an emphasis on the move to digital focused workforce and organisation, but no mention of the natural environment and very limited reference to customers. The August 2017 draft of the People Strategy reviewed as part of this assessment did not include measures of success, so there is an opportunity to further strengthen delivery plans to achieve the level 4 awarded here. **Anglian Water scores a level 4 for future, reflecting evidence of plans to implement its People Strategy, achieving agility, flexibility and collaboration throughout the organisation.**

4. Maturity assessment

Continuity of service to customers

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
Company operations focus on providing a continuity of service to customers and avoiding critical service failures, such as supply interruptions and internal sewer flooding. It takes into account the different needs of customers, particularly those who are vulnerable. Service interruptions only occur in the most unforeseeable situations. Asset condition and criticality is understood and all critical aspects of the network have redundancy built in. Mechanisms to regularly review and update all plans are in place.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Anglian Water's certification to ISO 9001, ISO 22301, ISO55001 and PAS55 is a fundamental part of ensuring the quality of its continuity of service to customers. Anglian ensures resilience of services to customers through duality and redundancy of water supply, with a dedicated programme in place to reduce the number of customers that rely on a single source of supply. This programme has achieved a reduction in customers on single sources of supply from 43% to 24.7%, and this will continue to reduce through network improvements, extension and alternative treatment options as well as additional investment for 'daisy chaining' particularly vulnerable areas in rural Norfolk. As part of Anglian Water's Capital Delivery and Commissioning process, and through its @One Alliance, it provides resources for testing new assets for the first time to ensure reliability and performance prior to handover to the end user. The @One Alliance is fully integrated into delivery teams to ensure input is provided from the start of design through to handover. The Capital Delivery also takes responsibility for training Operational colleagues on new assets; and on large or complex capital projects the business often chooses to embed operational staff members into the capital delivery team to ensure maximum understanding of any new processes prior to handover. In terms of ensuring continuity of service to customers, Anglian Water has clear processes in place for this. For planned work and interruptions, the approval process requires a risk assessment to be undertaken and an impact plan forms part of this risk assessment if there is a risk to service or water quality. The impact plan requires step-by-step assessment and quantification of risk with control and mitigation measures, and provision of contingency in some cases. There is a clear approval process required including approval from local supply and network managers and scientist, and final approval by the OMC tactical ops team. A suite of dedicated 'interruption to supply' (I2S) programmes was undertaken in AMP6, improving the time taken to restore supply, and undertaking risk assessments and priority improvements to risk reduction measures such as comms links, generator sockets, mobile generators, PRVs, tower bypasses, remote reset capabilities for pumps and other small scale resilience opportunities. Anglian Water's emergency equipment provision supports its compliance with the Security and Emergency Measures Direction (SEMD) and minimises potential impact on customers, as well as building resilience around preventing supply interruptions. A range of equipment including bowsers, tankers, and bottled water stocks is maintained to provide alternative supplies during events. Internal and third party audits of SEMD requirements inform the company's Annual Compliance Statement provided to Defra.

4. Maturity assessment

Continuity of service to customers

	Maturity Assessment
Current and Ongoing Activities	Anglian Water uses a structured suite of 'Emergency Management Procedures' (EMPROCs) to ensure it is sufficiently prepared to respond and recover from any level of impact event or incident. The procedures are subject to planned and on-going testing and exercising. Anglian also has comprehensive response and recovery plans for assets and temporary equipment. Anglian Water has produced a business resilience document, including management of warning and information which contains external communication methods, and through planning with the Local Resilience Forum, and responding with incident support managers, has effective plans and responses in place for engaging customers during incidents and emergency events. The business is part of a Water Sector group whose members actively support each other during incidents and events, principally through sharing alternative supplies but also enables sharing of specific expertise etc. Anglian Water has mutual aid arrangements in place as part of this. Anglian Water is also part of a Water UK group ('Watercare register') to review and ensure maximum benefit to customer service. The register is used during incidents and events to tailor its response for priority services customers and those with specific needs. Anglian Water has deployed an Integrated Remote Intelligence Service (IRIS) system, a top end telemetry system that brings together real time information from the assets and allows the control room to manage issues from the centre. It also uses business intelligence systems to integrate the real time information with IT information to inform strategic tactical and operational decision making, to enable continuity of service to customers. Anglian Water is extending it to develop real time modelling for wastewater and water networks. During the freeze thaw event in March 2018, Anglian Water minimised the impacts to customers with 99.6% of customers experiencing no impacts. Investment in information systems including IRIS and the Integrated Pressure and Leakage Management System (ILPM) enabled Anglian Water to target resources to address areas of greatest need. Their alliance model enable them to deploy response teams to address problems. Implementation of resilience schemes has reduced the number of customers dependent on a single source of supply and provided more options to minimise customer impacts from the event. **Anglian Water has demonstrated that it has a clear programme to continue to deliver continuity of service to customers, as evidenced, for example through the freeze thaw incident in March 2018. Its IRIS system is one of the features that demonstrates leading performance in this area.**
Planned for AMP7 and beyond	In AMP7 Anglian Water are planning to have real time analytics of water and waste services from their control room. The control room will be able to communicate to relevant teams when a disruption occurs. **We would expect Anglian Water to continue to deliver its approach under this theme. It will need to continue to review performance and learn from others to continue to deliver leading performance in this area.**

4. Maturity assessment

Robust long-term water resource management planning

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
Water resource management planning and drought planning has been undertaken for the long-term and integrated into business planning to ensure that the company can meet their supply obligations and facilitate sustainable growth. Plans are produced collaboratively with the EA and regional planning groups to ensure best value for customers with respect to cross-company, regional and national supply options. The approach looks at a full range of hazards based on a robust evidence base. Water resource management planning looks beyond the statutory 25 years into the future and develops adaptive pathways for delivering in the long-term.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, Anglian Water has some responses developed and some in action to ensure water resource management planning is robust. Anglian is an active member of Water Resources East, working with other water companies, the Environment Agency, Natural England and other stakeholders to develop a strategic water resource plan for the east of England. Anglian Water played a key role on the steering group for the Water UK Water Resources long-term planning framework, the development of which has significantly improved the water industry's understanding of the severity of recorded droughts and those that might be reasonably expected in the future. The outputs have informed investment decisions to build resilience of upstream water resources during periods of low water availability. Anglian Water has recently published its draft 2019 WRMP for consultation, which outlines the future challenges and provides a principal planning scenario covering the trends where there is greater certainty around the impact, and a further 'adaptive planning scenario' which gives an indication of the potential impact that some less certain future scenarios may have, for example sustainability reductions in AMP8 and possible future exports. The document has been informed by extensive customer engagement, and key outputs from the multi-sector Water Resources East (WRE) initiative. However, as noted by Ofwat, there are parts where alignment with WRE is not as strong as it could be. The strategy sets out a number of principles and preferred programme for both demand-side and supply-side solutions, and includes assessment of water trading opportunities to improve regional resilience. It also summarises the results of the latest Anglian Water climate change vulnerability assessment. Anglian Water already engage with regional activity on water resources management by trading (both importing and exporting) approximately 140Ml/d of potable water with neighbouring water companies, and Anglian Water continues to evaluate trading opportunities as part of its WRMP and drought planning processes. Some of this trading is designed specifically to improve resilience against drought events and major outages. Anglian Water looks at a planning period of the statutory planning period of 25 years.

4. Maturity assessment

Robust long-term water resource management planning

	Maturity Assessment
Current and Ongoing Activities	Anglian Water has undertaken planning beyond the statutory planning period of 25 years in collaboration with other companies through the Water Resources East partnership. The Water Resources East (WRE) resource management strategy was officially launched to the public on 9th July 2018, and demonstrates a collaborative, long-term approach, considering a range of shocks and stresses. We understand that this work has been central to informing Anglian Water's own plan. However, there is a further opportunity to communicate this relationship within Anglian Water's own plan. WRE aims to develop shared vision planning and robust decision making by facilitating collaboration between neighbouring water companies. The group is built on principles of circular and systems-thinking, and intends to pioneer a new approach to managing water resources, and will be investigating innovative solutions with potential for the region, such as desalination, industrial water recycling, transfer networks for water trading, uniting flood control and water supply, natural infrastructure and solutions for effective demand management. **Anglian Water has demonstrated a good level of response in its long-term water resource management planning, both in its technical appraisal and in its collaborative approach in the region with WRE and nationally with WaterUK. Its decision making has followed best practice of adopting a twin-track approach and considering adaptive pathways. To demonstrate leading practice, Anglian Water will need to demonstrate more clearly the link to the WRE strategy with its longer-term horizon, and integration of a wider range of shocks and stresses in its scenario testing.**
Planned for AMP7 and beyond	In AMP7 and beyond, Anglian has a number of strategic goals relating to water resource management, and, importantly, some plans to achieve those goals. The Strategic Direction Statement 2020–2045 includes the outcome 'resilient services' which includes strategies on resilience to drought and 'supply meets demand' with a strategy on long-term adaptive planning. There is a goal of 80 litres per person per day and 100% compliant and clean water. The SDS also includes a strategy on demand management and reduced leakage, and the goal of zero leakage and bursts. Within this is a plan to improve monitoring on raw and treatment mains networks, and address leakages on the water supply network and drive down leakage by a further 20mgl, including through innovative approaches to controlling pressures. Anglian Water is currently reviewing and revising its Drought Plan; expected to be published in 2020. This plan will consider options to reduce demand as well as supply-side options, including trading with other water companies. The 2020 Drought Plan update will refer to increased levels of resilience under future severe droughts. **With its leading role in regional and national water resource management planning, we expect this to translate more clearly into its own plans in the future and thus have awarded a level 5, leading, for AMP7 and beyond.**

4. Maturity assessment

Flexible, long-term water recycling planning

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has undertaken drainage and water recycling planning for the long-term enabling sustainable growth in the region without impacting existing customers. Wastewater plans are developed with stakeholders and integrated into their business plans. Plans are published and shared. They focus on critical service failures such as internal sewer flooding and pollution incidents. Best practice from the 21st Century Drainage programme is followed.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, Anglian Water has a clear response actioned to ensure robust long-term wastewater planning. A significant developing response is the Water Recycling Long Term Plan (WRLTP); the first of this type of plan in the industry. Anglian Water's plan has been prepared and a draft published for public consultation in May 2018. This plan sets out a clear, comprehensive process for assessing the investment needs over the next 25 years using a risk-based approach to determine supply-demand deficit according to local growth plans. The six strategic aims of the WRLTP are integrated into Anglian Water's SDS. The Long Term Surface Water Management Strategy outlines some goals and proposals for collaborating with partners to implement tree planting and innovative initiatives such as reverse auctions for community projects. By using spatial growth forecasts alongside climate change projections, spending can be prioritised towards sites with the highest deficit and confidence of growth occurring. Infra- and non-infra are aligned and assessed using the same principles, and using key indicators and dynamic asset monitoring to review and update plans and continually improve understanding of system resilience. Alongside this informed investment planning, Anglian Water also ring-fence some funding for emerging investment, where growth sites are not currently included in local plans. Anglian Water have adopted a collaborative planning approach which combines business and delivery planning. Sewer inspection and rehabilitation was the pilot scheme for this approach. The outcomes included benefits across three work streams – PR19, ama and Whitebooks – and will be included in future planning in those areas. Anglian Water has a suite of policies, standards and procedures for water recycling (POSWASTES), which is reviewed at the Water Recycling Interlocking Group, the procedures are currently reviewed every two years and progress of the review process is monitored at the meeting. Associated Work Instructions all have a document sponsor from the water recycling management team and require a minimum quorum for review and approval. **Anglian Water has now developed and actioned a robust plan for its long-term water recycling approach. As the plan is delivered, we would expect Anglian Water to quickly demonstrate leading practice in the future, and we expect the company will rapidly become more resilient in this area.**

4. Maturity assessment

Flexible, long-term water recycling planning

	Maturity Assessment
Planned for AMP7 and beyond	Anglian Water's Water Recycling Long Term Plan (WRLTP) is expected to be adopted, shared with partners, and delivered. If Anglian do this, it will demonstrate a leading industry response. In AMP7 and beyond, Anglian Water has a number of strategic goals for long term wastewater planning, and now has a robust and deliverable plan to achieve these goals through a clear, risk-based approach. In developing future plans, Anglian Water has identified a desire to incorporate more integrated thinking, e.g. catchment-wide approaches and initiatives, and to address aging infrastructure obsolescence, considering serviceability and investing for the future of Anglian and its customers. The Strategic Direction Statement 2020–2045 includes outcomes that apply to pollution and flooding such as Resilient services (strategies include resilience to flooding), supply meets demand (sewerage management and water recycling process plans). The statement also pledges to invest in SuDs where feasible to prevent pollution, and has a goal of zero pollution and flooding. The Surface Water Management Strategy takes a longer term view to value and a consideration of wider benefits for investing proactively in reducing unwanted flows to water recycling centres and delivering environmental benefits. **Based on these developments, we expect Anglian Water to become a leading example for approaching long term water recycling planning and delivery in the industry.**

4. Maturity assessment

Reflective risk-based approach to asset health

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has undertaken a comprehensive assessment of asset health and asset risk, including long-term low-likelihood risks, having detailed and accurate information on the state of all assets, the way they are configured and the way they are operated. Focus is on criticality, protecting customers and the natural environment from exposure to known risks, and reducing vulnerability to future uncertainties. There is a region wide asset strategy which is adaptive, regularly reviewed and considers changing requirements in the long-term (25 years). They follow best practice for asset management, e.g. ISO 55000.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, Anglian Water has comprehensive responses and long term plans developed to ensure the health of most of its digital and physical assets now and into the future. Anglian Water understands the health of its assets through a risk based approach which includes asset serviceability action plans, an asset level risk portal for monitoring and reporting, and modelling of the impact of asset failure on customer service. This is linked to over 100 service measures which have established private and societal costs. Anglian Water is certified to ISO 55001. Anglian Water has recently developed a Totex based Asset and Operation strategy to consider the full lifetime of assets, and use predictive performance analytics to enable proactive interventions to limit impacts on service. Anglian Water has a data management system with asset information which is used to support decision making. Anglian Water's approach to asset health is based on the Integrated Remote Intelligence Service (IRIS) system, a top end telemetry system that brings together real time information from the assets and allows the control room to manage issues from the centre. Anglian Water has deployed field devices and asset health checks to monitor the health of their assets. It also uses business intelligence systems to integrate the real time information with IT information to inform strategic tactical and operational decision making. Part of the IRIS system is an Asset Management Framework, which includes a system of risk-based alarms and alert. Deterioration of all assets is modelled. Anglian Water has three asset registers; a geospatial database with the network of assets; a works management system (SAP); and the telemetry asset register. There is ongoing work to bring the telemetry assets into SAP, a process to digitise their assets using GIS with a common naming conventions to integrate with other systems, such as SAP. There is also a plan to migrate to SAP HANA. Anglian Water has adopted C55, a decision analytics tool which enables them to determine where to invest based on customer outcomes. During AMP6, Anglian Water has invested a significant amount into capital maintenance and quality enhancement programmes to drive improvements. This assessment has identified that comprehensive dam break analysis has only been completed for 25% of Anglian Water's dams. For the remaining 75% there has been some qualitative assessment but Anglian are potentially 'unaware' of the risks posed by these.

4. Maturity assessment

Reflective risk-based approach to asset health

	Maturity Assessment
Current and Ongoing Activities	Security of physical assets is implemented and increased where required e.g. intruder alarms, improving security of buildings with toxic materials and manholes. For key water treatment assets that are 'too critical to fail' Anglian Water has implemented HAZOP style approach to identify single points of failure, addressing critical situations where no alternative supply exists, and developing mitigation measures for these risks. Anglian Water has a mature drinking water safety planning approach, underpinned by the POSWSH documentation for all quality critical processes, to ensure that it manages water quality from source to tap. Anglian Water is particularly good at response and recovery, evidenced by management plans for asset resilience and the Incident escalation matrix which provides structured, effective response to increasingly significant incidents impacting service delivery or environmental pollution. This assessment has seen Anglian Water's existing Cyber Security Management Strategy, and identified that Anglian has good processes for managing current and short-term risk, and recognise this is a challenging area due to speed of change and evolution of threats. **Anglian Water has a clear suite of ongoing actions to understand and improve asset health, and therefore scores a level 4.**
Planned for AMP7 and beyond	For AMP7 and beyond, Anglian Water's Strategic Direction Statement 2020–2045 has the outcome of 'resilient services' with a strategy to improve cyber security and smart infrastructure. This and the existing Cyber Security Management Strategy show Anglian recognise the importance of cyber security and the fast evolving threats. The strategy identifies its aim to consider physical, cyber and personnel security jointly, and demonstrates awareness of longer term risks, including how to provide cyber security to operational assets in IoT, and a strategy that is able to adapt to rapid short term changes in technology. There are also clear next steps identified for the dam break analysis to improve understanding and mitigation of current physical risks. The Digital transformation programme will allow the development of a smart infrastructure and monitoring programme, and there is a project underway to review the current IT systems used for sampling with a view to replacing the existing systems with new ones that are fully integrated into existing corporate systems. This is aspirational and is a multi-AMP strategy. In July 2018, Anglian Water business leaders participated in a workshop to develop the vision and plan for a 'digital twin' of the strategic network. A digital twin is a 3D representation of assets with live and historic data. It will address some of the current limitations for IRIS including difficulty with extracting and importing data, reporting and maintenance. **These improvements and clear next steps will help Anglian Water improve its resilience in terms of systems for monitoring and maintaining asset health, and the development of digital twins, in particular, is expected to demonstrate an industry leading approach.**

4. Maturity assessment

Robust integrated and flexible technology

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
Technology is used intelligently to deliver real operational and strategic gains. Data-driven decisions are the norm, using both real-time data to adapt and respond, as well as using data for robust long-term decisions. Systems are integrated, including operational technology and information technology systems. Interoperability and integration with systems in other sectors has been considered. Cyber security is paramount, with redundancy built into systems, and processes in place to continually review and improve this. People are at the centre of how technology is designed and implemented, both customers and staff.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Anglian Water has invested in world leading telemetry systems such as IRIS and ILPM providing operational insight to its Operational Management Centre and in the field. Centralised scheduling and deployment direct to workforce allows risks to be prioritised dynamically. Anglian Water's extensive telemetry system is itself an indication that previously the company has been a leader in innovating and implementing new technology to meet its changing needs. This assessment has seen no evidence of Anglian Water undertaking routine reflective assessments and iterative updates to make use of the value of the information which this telemetry system offers. Field based staff have access to real time asset performance and risk information. Anglian Water is also investing extensively in smart networks, with the aim of providing a far greater understanding of the operation of its networks and service risks to its customers. Predictive performance analytics enable proactive interventions and risk management. Anglian Water has adopted C55, a decision analytics tool which enables them to determine where to invest based on customer outcomes. Other asset information management tools used by Anglian Water are SAP and GIS. Based of evidence collected as part of this assessment operational technology (OT) and information technology (IT) systems are currently kept separately deliberately to manage the security risk. This is partially due to the difference in the maturity of the security measures in place between the OT and IT systems. IT security has had heavy investment over the past five years and continues to developed at this rate. The OT security maturity is low as the currently lack of asset connectivity means the impact of a security break is lower than that of the breach of IT systems. For both IT and OT, the cyber security team provide controls and assurance to maintain the business' resilience towards cyber attacks and ensure the risk of outages is kept to a minimum. The cyber security team also liaise with the National Cyber Security Centre (NCSC) with regards to significant security events, and participate in the joint industry-government venture CiSP (Cyber Security Information Sharing Partnership). As noted in Reflective risk-based approach to asset health sub-theme assets have Cyber Security Management Strategy which manages risk. Current research on risk assessments for OT is currently being developed. Some of the data sets and systems used have little integration or capacity for interoperability, making decision making based on data is more difficult. There is a programme for improving end user experience which refreshes the user interface, mobility and applications. There have been pilot roll outs of new technology and apps, such as operational apps, tablets in the field, using form rather than website apps, and augmented reality.

4. Maturity assessment

Robust integrated and flexible technology

	Maturity Assessment
Current and Ongoing Activities	The totex-based approach that Anglian Water has recently developed for managing its assets and operations takes a forward-looking view of the technological changes that could drive the industry in the future. By taking a systems thinking approach the company is enabling full optimisation of its asset base as well as adopting collaborative planning to build resilience across the business. Anglian Water has two alliances that are focussed on IT. Through this structure they have the ability to take on new technology and innovate through the supply chain. The @one alliance and the IoS alliance create 3D CAD drawings, point clouds and complete drone surveys however the information associated with these is not currently imported into Anglian Water's master data systems as the datasets are large. Anglian Water recognise the potential benefits from using these datasets to inform maintenance tasks, investment cases and reduce the amount of site visits and surveys. **Anglian Water has demonstrated a good understanding of the technology it requires to maximise its business resilience, and has a good level of understanding of the system-level view and what is required to support this. It recognises that there is work to be done to develop its response in a number of areas including in responding to regulatory changes and integration of IT and OT. However, with its leading telemetry systems and approach to cyber security, overall, we consider Anglian Water to be leading in this area compared to industry peers.**
Planned for AMP7 and beyond	For AMP7 and beyond there are plans for significant investments and fundamental redesign of systems particularly significant changes for OT security. These plans are to connect a series of currently stand-alone assets into an OT network. There are also plans for and integration of OT and IT Systems, but security maturity levels must be in a similar state before this can be undertaken. There are plans to incorporate Industrial Internet of Things (IIoT) and Internet of Things (IoT) into systems providing an increased capacity for data analytics, automation, and AI based control. In July 2018, Anglian Water business leaders participated in a workshop to develop the vision and plan for a 'digital twin' of the strategic network. A digital twin is a 3D representation of assets with live and historic data. It will address some of the current limitations for IRIS including difficulty with extracting and importing data, reporting and maintenance. **The substantial changes planned for AMP7 and beyond are likely to significantly improve Anglian Water's resilience in its integration of technology and readiness for new technological advancements. We expect to see a step-change once these plans are delivered, and it is likely that Anglian Water can retain its leading performance in this area in the future.**

4. Maturity assessment

Innovative, collaborative, naturally-resilient approaches to risk mitigation

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
There is a robust approach to considering a wide range of options to risk mitigation. Approaches are collaborative, innovative and embrace technological change and the role of the natural environment. A system-wide approach is taken. Collaboration is integrated into business plans, working with customers, other companies, and wider stakeholders to deliver solutions. Approaches considered include encouraging customers behavioural change through smart customer engagement, and use of smart technologies to improve asset performance, customer information, leakage management and water efficiency, natural solutions, such as catchment management to improve raw water quality, and blue-green infrastructure to manage storm water and reduce flooding and pollution incidents. Catchment solutions are considered across the whole catchment, integrating water and wastewater needs.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Anglian Water is working with other organisations including the Environment Agency as a partner in achieving flood resilience and environmental outcomes collaboratively. Anglian Water also has its own pilot catchment management initiatives including 'slug it out'. This involved working collaboratively with farmers in a voluntary trial to reduce the amount of metaldehyde entering the water system, on a small scale this was an innovative catchment approach to avoid the costly treatment systems required to remove metaldehyde from drinking water. Following the pilot program, Anglian Water has recommended a targeted ban on agricultural (and domestic) use of metaldehyde in high-risk areas in order to tackle the issue at source. Another example of strategic, catchment scale approaches being taken is the creation of the Ingoldisthorpe Wetland, funded by Anglian Water and created in partnership with Norfolk Rivers Trust and the Environment Agency, which acts as a natural treatment plant for over one million litres of water each day as well as providing a home for wildlife, and providing an overall more beneficial solution than the traditional option which would have been to pump the effluent away to another centre at a financial and environmental cost. These initiatives show Anglian Water has the potential to be leading on natural solutions in this area, and the company identifies the importance of and challenges facing the natural environment in many of its publications. Anglian Water has developed a plan for the integration of the six capitals into their ways of working, and is planning to set up a partnership group on natural capital; Natural Capital East. This approach has been approved by the board and implementation will begin imminently. **Anglian Water's response is developed and actioned in some areas of its business, but there are a number of areas where different approaches are still being piloted. Overall Anglian Water's score for this section remains as 'response developed' for current and ongoing activities.**

4. Maturity assessment

Innovative, collaborative, naturally-resilient approaches to risk mitigation

	Maturity Assessment
Planned for AMP7 and beyond	In AMP7 and beyond, Anglian Water has identified plans to continue working in partnership with WRE for water resource planning throughout the century, the EA, Regional Flood and Coast Committees, local authorities, and communities (e.g. through the Make Rain Happy campaign) on flood resilience and surface water management. There are plans through the Community Flooding Programme to model and where appropriate implement SuDS solutions to flood risk. Following the 'slug it out' campaign, interviews and workshops have identified possible plans to extend this to a bigger strategy to improve water quality through advice, best **p**ractice, and financial incentives. There is senior level endorsement of the idea of natural capital and catchment solutions, and a drive from the specialists to embed these solutions more broadly across the organisation in the future. The company is keen to develop and embed the 'Six Natural Capitals' approach to decision making at every scale; and sees this as a potential UK first and a key way to ensure its BAU decision making, reporting and collaboration is carried out in the most sustainable way and measured with appropriate indicators, keeping a broad range of issues in mind. There are plans to sett up 'Natural Capital East' – a potential partnership group along similar lines to Water Resources East. There is a plan to improve intelligence of networks, including balancing flows by increasing the storage capacity of current wastewater network. Improved scenario testing could inform greater understanding of interdependencies of pressures and the integrated elements of Anglian Water's water and wastewater operations and services, and the natural water environment on which they depend. There are plans in PR19 to increase the amount of investment in partnership funding, building on effective schemes and addressing an increase in requests from partners for this type of collaborative approach. Anglian Water is also developing its data and information strategy which is currently in draft form but shows a commitment to make better use of monitoring and telemetry data, improve information quality and accessibility, and a roadmap for how to achieve these outcomes. There are plans for more intelligent networks and improving the 'reflective' element by making monitoring and modelling more integrated, automated and regular. As part of the PR19 planning, there is an aim to increase smart metering coverage, up to 95% over AMP7 and AMP8; this will improve understanding and ability to pinpoint leakage. The Information Charter, and a number of strategies developed to implement it, outline a number of current challenges and aspirations for where Anglian Water want to increase interconnectivity and integration of data, improve business intelligence, shift to a 'mobile first' operational culture, and ultimately improve the quality and availability of data and information. The charter and strategies are a plan for the future, and show an understanding and commitment to the importance of information, however they don't demonstrate how Anglian Water currently identify and introduce new technology. **Anglian Water has a number of plans in place to continue to improve its approach in this area in the future, which we expect will progress its response towards becoming fully actioned. To be considered leading in this area of resilience, the company would need to be at a stage of consistently developing and delivering catchment-wide solutions integrating both water supply and water recycling needs.**

4. Maturity assessment

Robust and flexible supply chain management

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company considers the impact of energy, resource and skills supply chains on their operations and ensure diverse and competitive supply chains that deliver the best outcomes for their customers. Supply chain needs are considered in the long-term, based on horizon scanning. Collaborative relationships are developed with the supply chain, to avoid boom and bust cycles. The company also considers the flexibility of their supply chains, particularly during shock events. Internal processes are in place to keep this under review, sharing knowledge and developing solutions with others. The supply chain is considered as a network. The company also considers how they can effectively utilise options beyond their boundaries to mitigate their risks, e.g. use of water trading and bio resource trading markets.	Current and Ongoing Activities Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, Anglian Water works with partners and suppliers to understand and improve its own resilience through reviews and questionnaires. The supply chain is perceived to be robust for direct operational requirements including key equipment, fuel and chemicals by having dual providers or sources for most materials. Anglian Water has also established programmes to secure duality of potable water supply for 76% of customers and plan to get this close to 100%. There is some lack of integration and understanding between teams working on emergency management, energy, demand and supply chain and how these are interlinked. Anglian Water acknowledges that it deals with complex supply chains so to a certain extent will always have unknown unknowns. Anglian Water has water trading arrangements in place with Affinity Water and Severn Trent Water, providing additional resilience of supply. Anglian Water has improved resilience of its power supply as all power and communications are ‘dualled’ and by generating112GWh (of the total energy demand of 710GWh/year). There are also commissioning of sludge treatment centres at Pyewipe, Colchester, Basildon and Cliff Quay in Ipswich, and plans to install solar arrays on sites: the first five were commissioned and installed this year and there is a target to increase solar capacity by 30GW this AMP. The opportunity for energy storage combined with maximising renewable energy is under review. Forward hedging of energy purchasing alongside close collaboration with power distribution companies to understand system resilience has also contributed to Anglian Water’s supply chain management and resilience. Anglian Water has alliances with a broad range of capabilities, including long-term arrangements with tier 1 partners and integration of teams, which allows it to allocate work on a ‘best for task’ basis. This includes the only IT and IS alliances in the industry, and longer-term partnership to build trust and share risk and

4. Maturity assessment

Robust and flexible supply chain management

	Maturity Assessment
Current and Ongoing Activities	resilience reward more effectively. This has also built resilience for busy times and peak periods, and the arrangements also enable resilience by allowing work to be transferred between alliances if the scope or complexity changes during the initiation stage. The arrangement of these alliances was tested and proven successful by the recent freeze-thaw event in March 2018. **Anglian Water's demonstration of its supply chain resilience and management shows it has a leading response. In particular, its integrated and collaborative approach to developing alliances for the long-term stands out as an exceptional approach.**
Planned for AMP7 and beyond	For AMP7 and beyond, Anglian Water's Strategic Direction Statement 2020–2045 includes the outcome 'resilient services' which includes a strategy on supply chain considering availability of products long term. In the renewable energy supply programme, it is targeting another 30GW solar capacity next AMP. There was a recognition in interviews conducted as part of this assessment that improving the understanding of short term resilience, and integration of understanding and investment relating to long term supply chain resilience across teams within Anglian and partners was an important next step. Having developed new IT alliances in AMP6, we expect Anglian Water to continue to review and update its approach and culture with regards to its supply chain. **We expect Anglian Water to be able to maintain its leading approach.**

4. Maturity assessment

Inclusive and skilled workforce

Maturity Summary	1 Unaware	2 Aware	3 Response developed	4 Response actioned	5 Leading
The company has identified the capabilities and skills required to deliver outcomes for customers in the long-term, based on robust horizon scanning. Robust people plans have been developed to fill any current or emerging gaps to support these business needs, identifying recruitment, training and development, knowledge management, succession planning and increasing diversity. The company works across the water industry and utility sector to address these skills gaps. The company is seen as the first choice for highly skilled individuals, and valued employees recognise it as a great place to work. The company encourages diversity through a range of programmes, such as employee network groups and leadership role models.	Current and Ongoing Activities				
	Planned for AMP7 and beyond				

	Maturity Assessment
Current and Ongoing Activities	Based on evidence seen as part of this assessment, Anglian Water has identified gaps and responses for ensuring its workforce has the right skills, including internal training, scenario exercises for extreme events, and an understanding of what the gaps and issues it faces are. Anglian Water partner with national training organisations for technical skills, and water industry and company specific skills are developed by an in-house training team allowing the company to develop tailored skills training programmes including company specific procedures. Under development is a Employee Strategy which will define the skills and capabilities required. Anglian Water already has a 'Licence to Operate' system which clearly defines skill requirements for operational roles, and includes training and assessment for technical competence through a series of Operational Qualifications. Process safety training is delivered to selected employees through third partners to ensure that employees understanding of health and safety is not limited to occupational safety but also encompasses an understanding of how to recognise and prevent process safety events. Continuous professional development (CPD) is offered to all staff as appropriate for individual roles, and funding is provided for membership of one professional body for each employee if required. Anglian Water has programmes to support chartership across a wide range of career paths. LEAN skills development is in place for upskilling the workforce with techniques for driving efficiency and service improvement. The company also has an external accreditation programme for experienced practitioners. Anglian Water carries out a formal review of succession and talent across the organisation, and plans are reviewed twice a year at a minimum, at business unit leadership team and at board level. Risk of flight is noted for succession to Director candidates, and roles critical to Anglian Water's operations all have succession plans. To support the development of a steady pipeline of future engineers, the company has developed strong connections with universities and arrangements with colleges in the region. Anglian Water with Lane 4 has just developed the 'Transforming our Leadership' programme which equips management and leaders with the skills, capabilities and tools to manage the company. Anglian Water has multiple initiatives in place to ensure it can respond effectively to incidents and extreme events, including a Reduced Manpower Matrix, Resilience Guide for staff, and incident support managers deployed in an incident to liaise with customers.

4. Maturity assessment

Inclusive and skilled workforce

	Maturity Assessment
Current and Ongoing Activities	Anglian Water has a good apprentice programme set up to meet its future workforce needs, however it was acknowledged in interviews that this primarily incorporates training in skills needed now, not comprehensively developing skills needed in the future such as programming and data analytics. Alongside the apprentice programme Anglian Water has a graduate scheme, with annual recruitment of high quality graduates to a 2-year development programme which has high rates of retention. The company has an online benefits platform making it easy for employees to understand the total value of their benefits and make personal selections to suit individual needs. Anglian Water are winners of the 'Best UK company to work for' as voted by glassdoor.com reviewers (current and ex-employees) in 2017, and the CEO has also won an award for 'Best UK CEO'. Anglian Water's bi-annual employee survey 'Love to Listen' carried out independently by IBM is benchmarked externally, allowing the company to understand where it sits against other leading UK employers. Anglian Water also has a changing workforce model, with alliance partners talking on more work and responsibility for delivering Anglian Water's services, there is a question to be addressed about if it will continue to need the same skills in house. In terms of diversity and inclusion, the company has targeted apprenticeship programmes and monitored graduate programmes to support a greater female workforce inclusion within the company and to promote equal opportunities. As set out in the 2017 gender pay gap report, 74% of employees are male. Work has been done also to promote and support BME (Black and Minority Ethnic) and LGBT (Lesbian, Gay, Bisexual and Transgender) groups), with a Diversity and Inclusion working group set up to focus on ensuring that the way the business is operated is fully inclusive irrespective of gender, ethnicity, age or many other factors. **Anglian Water has actioned a good approach across parts of the criteria for this category, including recruitment and retention of staff, independent verification of staff satisfaction and a number of awards – however there is work to be done to develop the company's diversity approach and more robust horizon scanning to incorporate possible future shocks and stresses and consider how the company can prepare its systems and processes for the workforce to ensure resilience in this area. As result, with the People Strategy and diversity and inclusion working group, we have given a score of 3.**
Planned for AMP7 and beyond	For AMP7 and beyond, Anglian Water has identified the upcoming skills gap as one third of its workforce retire in the next decade, and in the Strategic Direction Statement 2020-2045, identify the contribution it can make to communities in closing this gap along with other partners such as academic institutions. In the draft People Strategy, there are more detailed gaps and plans to address these in the future. The results from the 'Love to Listen' survey are also being analysed and converted into action plans. There are plans on diversity outlined in the 2017 gender pay gap report. In addition, the following areas were identified as room for improvement during workshops and interviews: addressing the issue of knowledge retirement with an aging workforce, management of company knowledge through the development of a strategy to build a knowledge sharing approach, moving to digital focused workforce and dealing with the rate of changes in technology development and improving collaboration to reduced duplication of effort. **If Anglian Water takes action on these areas, we would expect its resilience and score on having an inclusive and skilled workforce to improve accordingly. To become leading, the company would need to demonstrate that it has carried out robust and broad thinking around horizon scanning for workforce issues in the future, and must have implemented a number of actions to ensure the workforce ranks highly in diversity, inclusivity and satisfaction.**

5. Conclusions and next steps

Results of the assessment: current score

Figure 5, presented here, outlines the results of the assessment of Anglian Water's current performance. Over the following pages, the strengths and opportunity areas that have been identified within each of the three themes are explored in more detail.

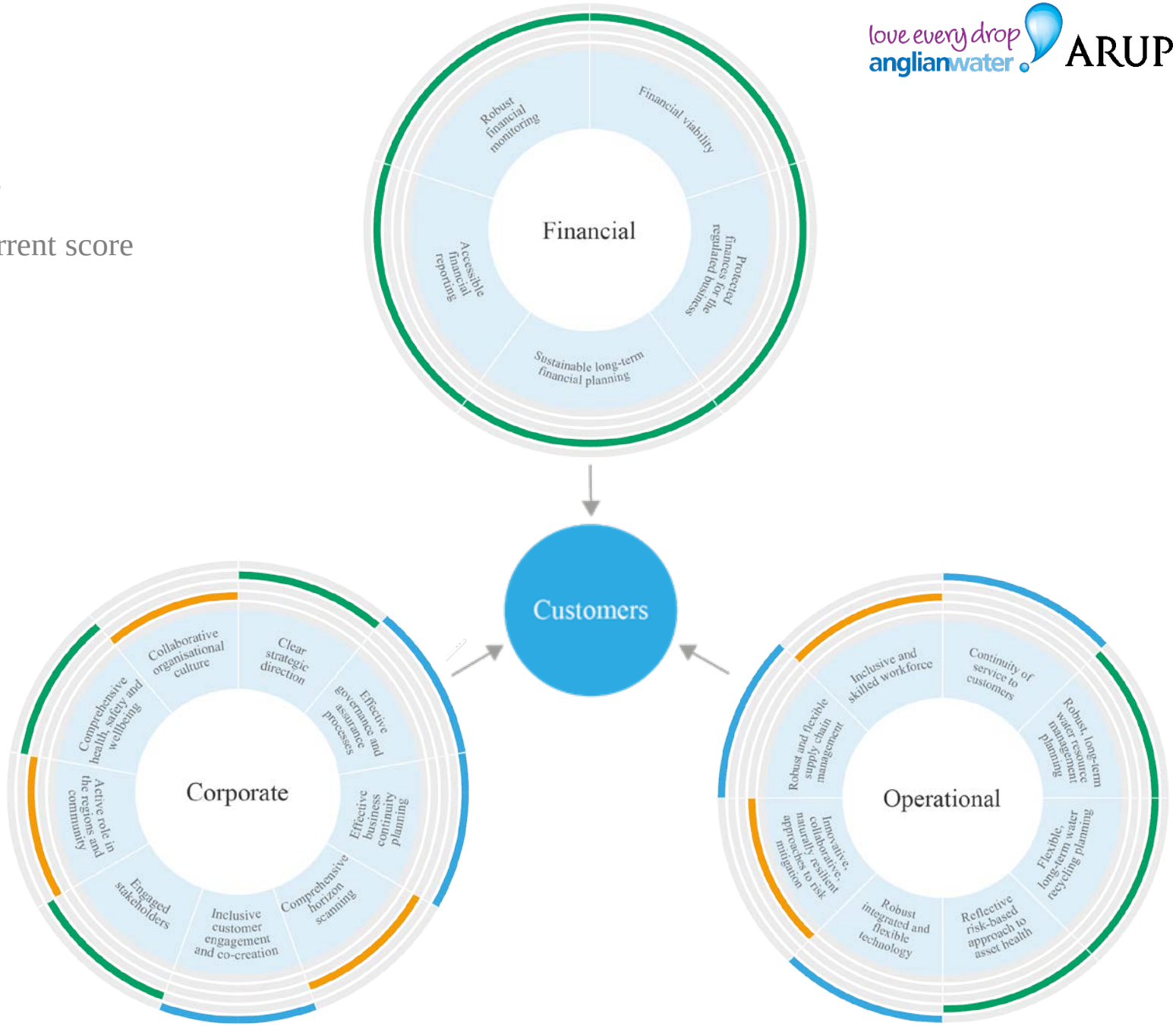


Figure 5: The results of the assessment of current performance illustrated on the Anglian Water resilience framework

5. Conclusions and next steps

Results of the assessment: future score

Figure 5, presented here, outlines the results of the assessment of Anglian Water's AMP7 and beyond performance. Over the following pages, the strengths and opportunity areas that have been identified within each of the three themes are explored in more detail.

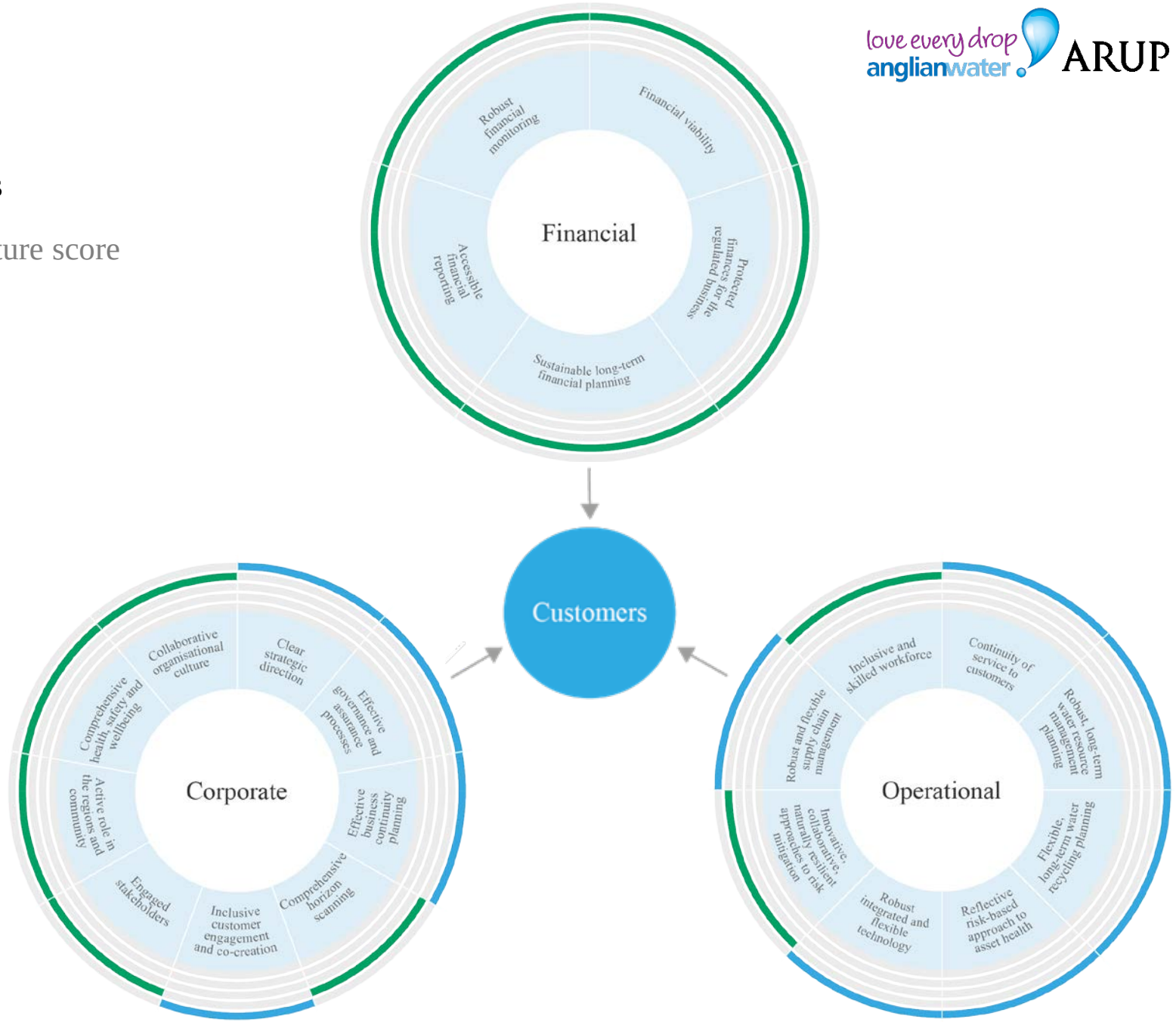


Figure 6: The results of the assessment of future performance illustrated on the Anglian Water resilience framework

5. Conclusions and next steps

Identified strengths and opportunity areas

Financial

Strengths

Plans to reduce gearing in AMP7 to assist responding to major stress events

The reduction in gearing will improve the financial resilience of the company, and respond to Ofwat concerns over highly geared companies.

Noted by Moody's, the credit rating agency, as having 'strong' performance

With a proactive maintenance regime, being joint first on SIM scores for 2017/18, and obtaining ODI outperformance payments is evidence Anglian Water is more ready to respond to unexpected shocks than some other water companies (reducing financial impacts and downsides).

First water company with Cayman Island finance to repatriate funds to the UK

This was announced in June 2018, improving transparency.

Accessible financial reporting

Proactively responding to Ofwat concerns in their November 2017 assessment.

Sustainable long-term financial planning

The company already has high-level expenditure plans for AMP8, AMP9, AMP10 and AMP11. Apart from some of the private sewers it has adopted, it understands the condition of all its assets, enabling more robust financial planning which mitigates the risk of in-AMP problems arising.

What leading could look like

Operating with higher interest cover ratios

Many of the more highly geared water companies are more curtailed in responding to shocks by interest cover ratio tests (the ratio of profits before interest payments to interest payments) than by gearing limits. Having greater headroom on interest cover ratios would offer the company more options to accommodate major shocks and stresses before having to make calls on shareholders, flex expenditure plans or restructure debt.

Consider reporting longer Long Term Viability Statements

Some companies are now reporting for 10+ years. As Anglian Water prepares more detailed AMP8 cost estimates longer term viability statements may be possible.

Continue to improve sustainable long-term financial planning

Complete the asset survey of the remaining adopted private sewer networks and start to plan how 1 in 500-year droughts could be accommodated. Further, Anglian Water's resilience thinking does not seem to appear to include a holistic view of costs which incorporates natural capital.

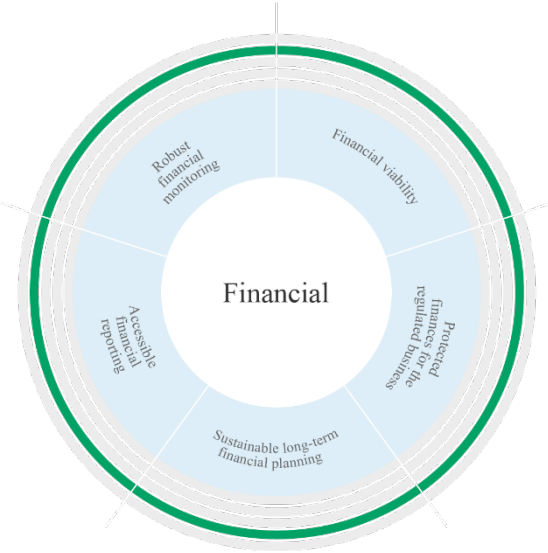


Figure 7: current score – financial resilience

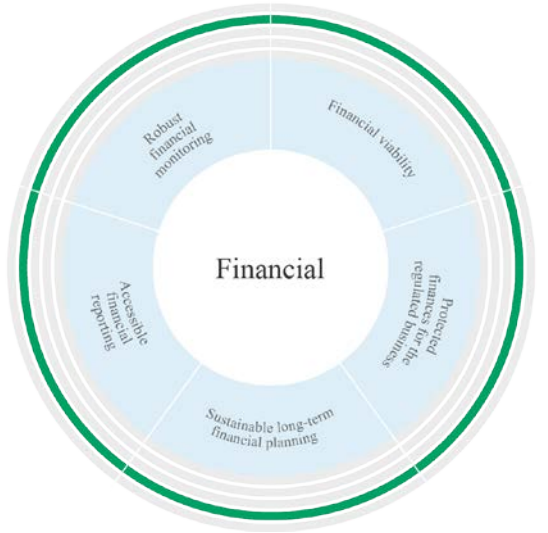


Figure 8: future score – financial resilience

5. Conclusions and next steps

Identified strengths and opportunity areas

Corporate

Strengths

Excellent risk management culture.

Principles of risks and value embedded across the organisation and in decision making. Anglian Water also has good response and recovery plans to deal with extreme events, including collaborating with others and keeping customers informed.

Robust business continuity management.

Planning and management for business continuity appears to be robust and comprehensive. This is aided by a clear governance system and effective scanning of organisational risks.

Governance and assurance for resilience

As one of the few companies with resilience in the job title of an executive director, challenge on resilience from a sustainability and resilience sub-group of the CCG, and a long-term perspective integrated through the Strategic Priorities Board, Anglian Water has demonstrated a leading approach to governance.

Inclusive customer engagement.

Anglian Water's approach to co-creating its customer engagement programme with its customers emphasizes its inclusive customer-led approach.

What leading could look like

Co-ordinating long term planning and short-term actions.

In some areas such as supply chain management, there are good practices in place for consideration of long term risk and resilience, but an understanding that these need to be better incorporated into short term action.

Consolidating perspectives on risk and resilience.

Operational resilience is being considered by many teams, however there are cases where their understanding varies.

Some are taking Cabinet Office guidance, others the Resilience in the Round report. Resilience is a way to consider unknown unknowns and uncertainty, so does beyond risk mitigation. This needs clear communication and a consistent message across the organisation.

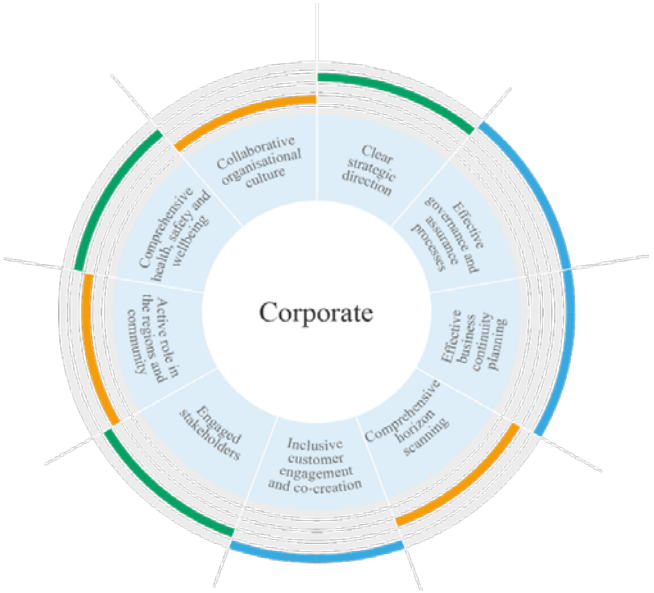


Figure 9: current score – corporate resilience

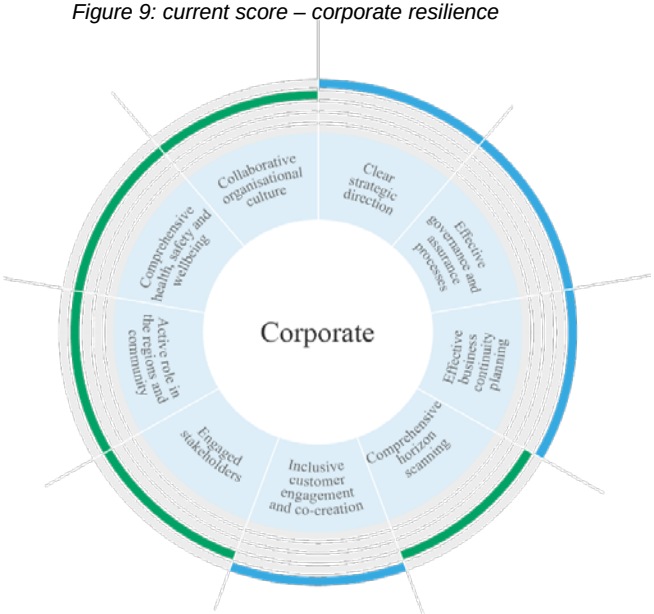


Figure 10: future score – corporate resilience

5. Conclusions and next steps

Identified strengths and opportunity areas

Operational

Strengths

Effective supply chain management.

Look long term at risks to supply chain, good a communicating issues to look at future changes, and working with suppliers. Long-term alliance partnerships help to build trust and share risk and resilience reward.

Harnessing the value of the telemetry network.

Anglian Water has a world-leading telemetry network and is using this data to inform short and longer-term decision-making.

What leading could look like

Resilient water resources.

Anglian Water has duality and redundancy on a significant portion of its water supply network. There is good example of partnership working to address future challenges through Water Resources East (WRE), but a good opportunity for Anglian Water to look further into the future to address future pressures.

Using the evidence base for catchment solutions.

Anglian Water has demonstrated industry leadership on both catchment solution and treatment option of metaldehyde. Now it has an excellent evidence base to inform decision next AMP, and influencing regulation and industry. As a result, catchment solutions and natural capital are endorsed and understood as offering potential Totex and wider benefits, but are not yet part of business as usual.

Embracing diversity and inclusion.

Evidence suggests that a more inclusive organisation is a more resilient one. In order to strengthen diversity of thought, and learning from different perspectives, Anglian Water still has work to do to become a more diverse and inclusive organisation. With the establishment of the diversity and inclusion working group, this is underway.

Figure 11: current score – operational resilience

Figure 12: future score – operational resilience

5. Conclusions and next steps

Next steps

Based the work undertaken to date, the next stage could see two areas for further work:

1. A more detailed assessment framework and KPIs. The approach to date has seen the development of a qualitative assessment process. This could be supplemented with quantitative measures, to develop a more in depth and robust approach, which might be required for investment decision-making, and more continual monitoring of performance.
2. The development of a 'Resilience Action Plan' which identifies and prioritises initiatives to would build on the strengths and opportunity areas highlighted in this assessment. This could comprise actions for AMP7, as well as longer-term initiatives. The Plan should be integrated, meaning that ideally, initiatives would support multiple benefits across different shocks, stresses and elements of the resilience framework.

Sources

Annual Performance Report 2017/18

Annual Report 2017/18

Anglian Water perspective

Collaborative Planning

Corporate governance: Feedback from Love Every Drop online community

Corporate strategy and narrative development

Customer feedback on Sewerage Rehabilitation- Customer Perceptions;

Decision Making for Sustainability: The 6 Capitals Approach

How Anglian Water responded to the 2018 freeze-thaw event

Getting fit for AMP7

Ingoldisthorpe Wetland case study

Innovation in Anglian Water

Metaldehyde key themes

New Models for Collaborate Working: Guide to Community Regeneration in Wisbech

New Models for Collaborative Working: A Guide to Innovation from our Shop Window

Oliver Wyman - 0180802 Horizon Scanning

New Models for Collaborative Working: Water Resources East - A Guide for Innovative, Multi-sector, Regional Resource Planning

Responsible business - Annual Integrated Report 2018

Strategic Direction Statement 2020-2045

Strategic Priorities Board Terms of Reference

Water Resources East – A Guide for innovative, multi-sector, regional water resource planning

WRMP Strategic Pipeline – Digital Asset

Important notice and disclaimer

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Findings are time-sensitive and relevant only to current conditions at the time of writing. We will not be under any obligation to update the report to address changes in facts or circumstances that occur after the date of our report that might materially affect the contents of the report or any of the conclusions set forth therein.

For further information

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love every drop anglianwater

ARUP

Appendix 5

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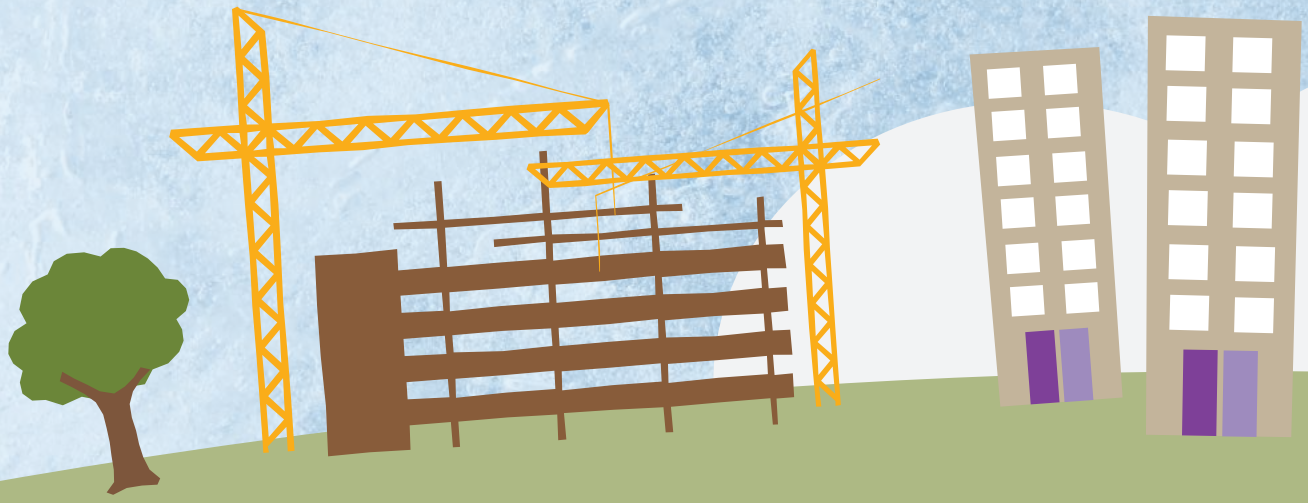
How Anglian Water responded to the 2018 Freeze/Thaw Event



RESPONSIBLE BUSINESS OF THE YEAR 2017
BUSINESS IN THE COMMUNITY

THE QUEEN'S AWARDS FOR ENTERPRISE: SUSTAINABLE DEVELOPMENT 2015

Executive Summary

The 2018 Freeze-Thaw event put significant strain on infrastructure across the UK. In the water sector the rapidity of the thaw following an extended freeze caused unavoidable problems with burst mains and leaks from customer pipes and company networks. The bad weather occurred across the UK: the East of England's exposure was similar to the rest of the country. Indeed, the combination of freeze and rapid thaw caused substantial ground movements and resultant mains bursts, a more significant issue in our region (particularly the Fens) than elsewhere.

However, our actions ensured that customer impacts were minimised. Almost no business customers were significantly affected (so cross-infrastructure effects were eliminated), and only 163 homes were off water for more than 12 hours, mainly in the Cromer area. Over 99.6% of our customers experienced no impact from this event. Where problems did occur they were quickly rectified. Other business priorities continued to be progressed during the event.

Our success in minimising the impact on customers stemmed from a number of factors, including:

- Putting innovation at the heart of what we do: from the work of our Insight and Data Science team and our dashboard information system, which drove our operational response and ensured we targeted our resources to address areas of greatest need, to how we work differently with our supply chain and our customers, to investments in our Integrated Remote Intelligence Service (IRIS) system, including our leading Integrated Pressure and Leakage Management System (ILPM), co-developed with Schneider, to our enhanced telemetry, condition monitoring and modelling and information systems (See sections B,C & F);
- Our industry-leading position on leakage. This means we lose less water from our networks, and so are better placed to cope with spikes in demand that flow from an event like this (Section C);
- Our resilience approach, based on ISO22301, which we have now taken further with Arup in our Resilience Framework, which we used to test the resilience of the company and its partnerships (Sections E, H and I) ;
- Our customer-centric approach of 'restore, repair, recharge' to focus first on meeting customer needs (including redeploying water recycling assets) rather than fault repairs (Sections E,F & G);
- The collaborative approach we have pioneered with our supply chain: our unique alliancing model saw us quickly deploy 119 gangs and over 400 people to address problems (Section F);
- The quality of our customer and stakeholder communications, both proactive and reactive, across all channels to try to reach the widest range possible (Section G);
- Investment in resilience schemes, which has reduced the numbers of customers dependent on a single source of supply, gave us more options to minimise customer impacts in this event. This was combined with strong preparation across the company for this event, to ready ourselves operationally and to ensure proactive communications with customers before the event occurred. We executed our resilience planning systems and incident room approach, before the incident (to ensure we were ready) and during, and showed strong leadership throughout, with a Director heading our response, 24 hours a day.
- Finally, we would praise the resilience and skills of our frontline operational teams, drawn from across Anglian Water, our alliance partners, and our Anglian Work Force volunteers, all of whom worked tirelessly to avert impacts on customers in very challenging conditions.

Table of contents

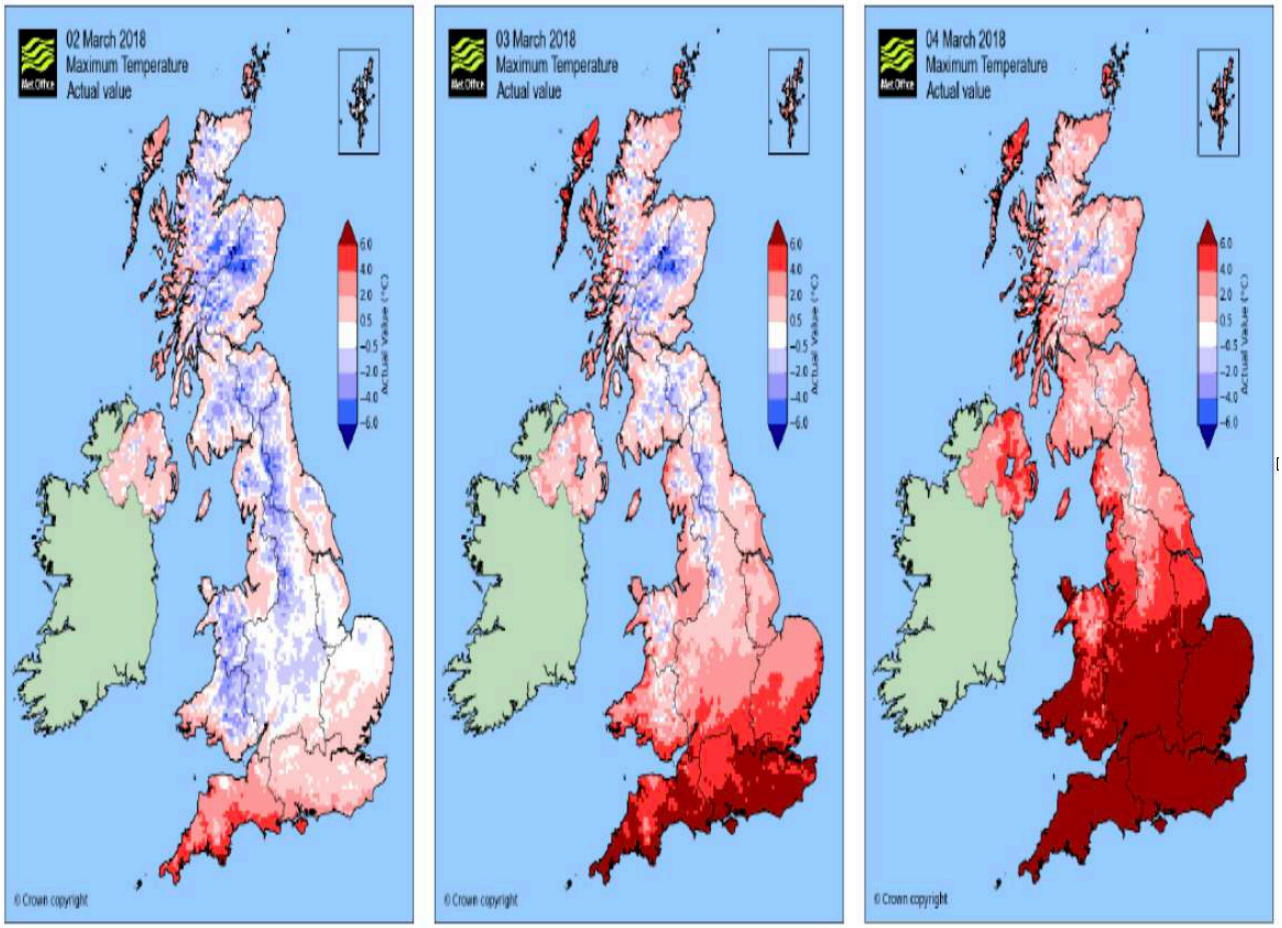
SECTION A: WHY THERE ARE PROBLEMS WITH FREEZE/THAW EVENTS

Weather conditions

We have reviewed information from the Met Office to understand whether there was a differential impact on our region compared to other parts of the UK. This analysis shows that, whilst there was some variance in the specific weather being experienced in different regions, the key parameters of the level of freeze and rapidity of thaw were very similar across the UK.

In essence, the evidence shows that we faced the same difficulties as other companies, the weather conditions were just as bad and the impact on us in terms of soil temperature changes, bursts and leaks just as significant. Indeed as we note below, the position is actually worse for our region given the impact of such events on ground movements in soil types that predominate in the East of England and which contribute to mains bursts and leaks.

The Met Office data shows that our region showed some of the greatest negative temperature anomalies during the freeze event. This was then followed by a very rapid thaw, which affected all regions to the south of the Humber. Within the Anglian Water Region, the Met Office data shows that the 4 day temperature swing of 13.3 degrees Centigrade was the greatest since January 1993. Measured soil temperatures reacted in a similar way, with soil temperatures in the east of England responding in an equivalent way to those in the south of England.



SECTION B: WHY MAINS BURSTS AND LEAKS HAPPEN IN OUR REGION DURING A FREEZE-THAW EVENT

What does the research tell us?

Anglian Water has for some time sought to better understand the phenomenon of ground movement, affected by temperature and levels of precipitation and the consequential impacts on leaks and mains bursts. We therefore undertook some industry-leading research with Cranfield University to:

- Understand exactly how extreme weather impacts AW assets;
- Prove the AW region due to its topography and associated soil types is more vulnerable to ground movement as a result of weather extremes (the shrink-swell effect);
- Build a dynamic model with predictive capability to plan for the impacts of the shrink-swell effect on AW assets.

The research with Cranfield concluded that the Anglian Water region does have high susceptibility to burst mains.

This is as a direct result of significant areas of our region being vulnerable to ground movement, a key factor in weather-related burst mains (known as the shrink/swell effect – see appendix for detail).

Our ability to understand the impacts of weather extremes, and which mains are at greater risk of failure because they are located within soil types more vulnerable to ground movement, now allows us to plan more effectively in terms of anticipating the effects of severe weather.

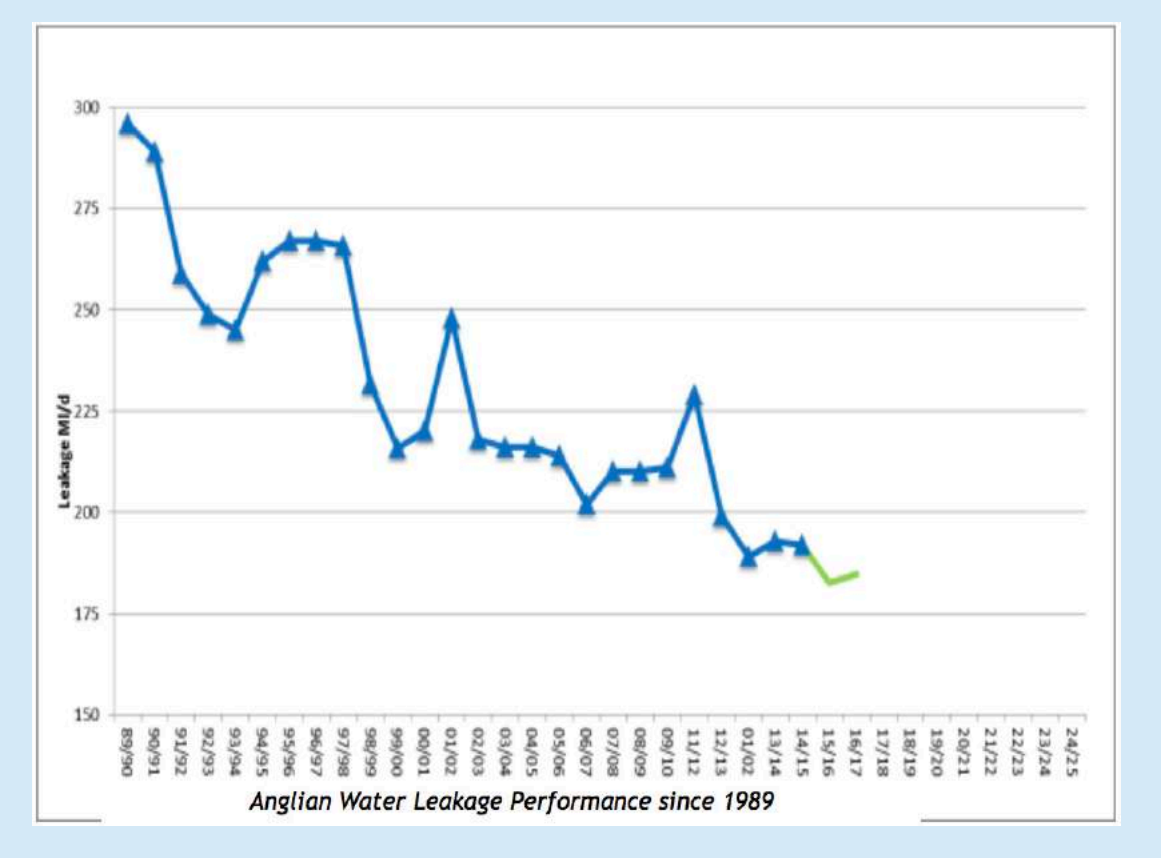
The investment we made in this work gave us a key operational advantage during the freeze-thaw event, and we are continuing to build on this through the development of the next generation WISPA 2 model in preparation for AMP 7.

SECTION C: INDUSTRY-LEADING LEAKAGE PERFORMANCE PROVIDES RESILIENCE TO INCIDENTS

Leakage performance

During the drought of 2011-12, which came just after the severe winter of 2010-11, we took the decision invest more in leakage reduction to take us below our Sustainable Economic Level of Leakage (SELL) of 211 Ml/d. We invested in improving our repair run times and we in-sourced our leakage detection teams to ensure stability of the work force which resulted in an 17 Ml/d (8%) reduction in leakage by the last year of AMP5 compared with the AMP4 average. In AMP6 we are continuing our leakage reductions targeting 172 Ml/d by 2020, which will represent a 20 Ml/d reduction (10%) from the position at the start of the AMP. Anglian Water's investors made the decision to forward fund the required investment to deliver the reduction. The costs will only be recouped if we continue to hit our glide path for reward under our ODI mechanism.

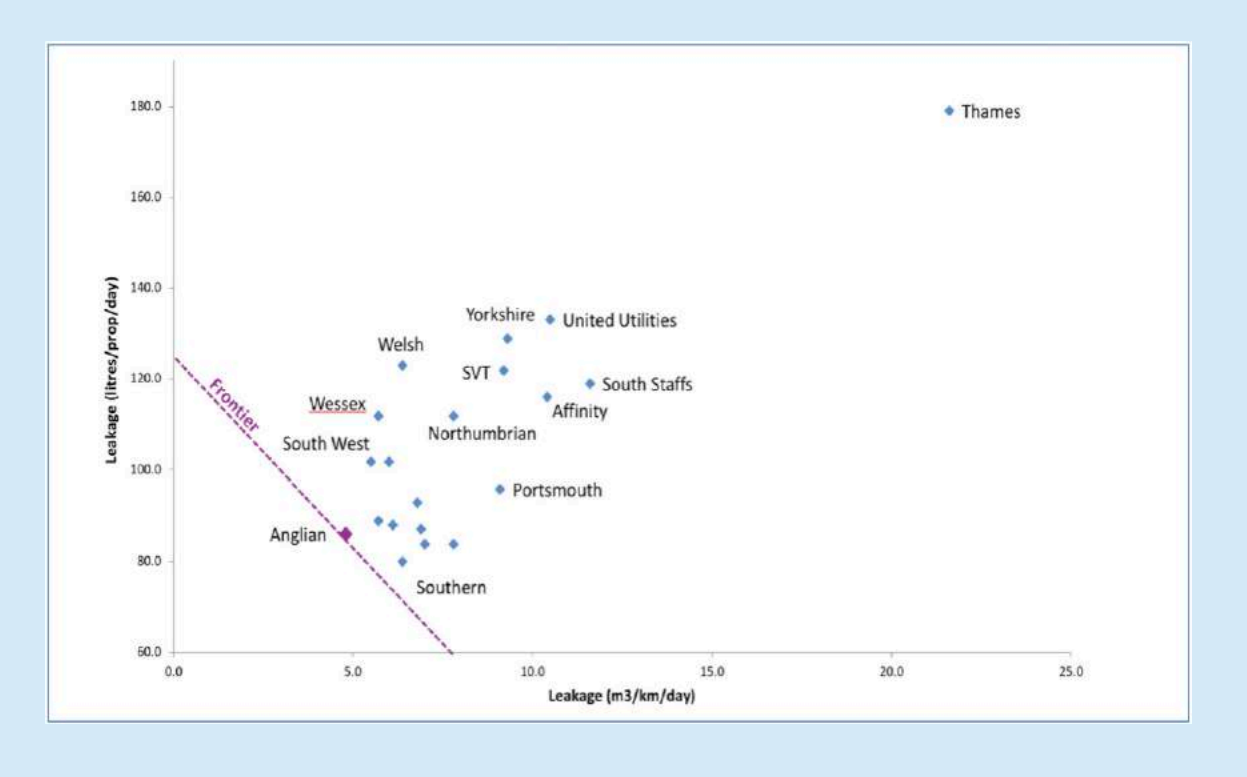
The graphs below shows our leakage performance since the industry was privatised in 1989 and data from Discover Water showing our industry leakage performance in 2016-17. Critically, this strong leakage performance gives us a far stronger starting point at the beginning of an incident like this. In the 2010-11 freeze, more reservoir levels were close to critical. By March 2018, our treated reservoir levels were far higher and gave us more "in the bank" to deal with the peak in demand that resulted from the weather event. Had our starting leakage level being higher in March 18 then the peak in DI would also have been higher.



In the last 2 years we have continued reducing leakage and in 2016-17 reported a figure of 185 Ml/d, representing a 7 Ml/d drop since the start of the AMP. This is frontier performance. Leakage is now 26 Ml/d (12%) lower than in the year before 10/11 which is one of the factors why we did not experience widespread loss of supply the March 2018 freeze/thaw event. In the last year of AMP4 16% of mains bursts were identified by our proactive leak detection teams. In the first three years of AMP6 we now find 29% of mains bursts through proactive detection.
Additional measures in development include the following:

- Near-Live" GIS access for NTs via tablets - incorporating Valve Control : The concept in development is a mobile solution that is updated wirelessly so that Technicians have the confidence to always use it to locate valves and to record both what had been altered and how long it was likely to stay altered (including permanently)
- Near Real-Time Modelling : The concept in development is a system which would have flagged all pressures downstream of a burst. After repair the system would identify if all pressures downstream had returned to normal. Together with the ability to generate an elevation map this would have pinpointed potential air locks. Also, throughout the extreme weather event technicians were constantly updating spread sheets for storage points across the company, trying to predict which were falling "significantly" to allow us to carry out predictive analysis and anticipate potential events. Near Real-Time modelling would significantly enhance our capability in this area.

Despite the inevitable short-term spike in leakage caused by this event, we have recovered quickly and the event has not deflected from our downward glidepath towards meeting our ambitious goals for leakage reduction, and our specific targets for the end of the AMP.



SECTION D: MINIMAL IMPACTS ON CUSTOMERS

Over 99.6% of our households saw no material service reduction impacts from this event.

Contact Centre Resilience

Calls into our Operational Contact centre were double their normal levels, and peaked at 500% of normal levels on Sunday 4th March. This was the busiest Sunday for contact on record but we managed these volumes effectively by preparing in advance and then switching contact agents from Billing and Metering teams into Operational contact. Through this and the use of our Anglian Water Force Resilience teams we were able to triple the size of our Operational contact centre. This meant speed of contact for our customers on traditional and digital channels remained at good levels despite the much increased demand. During this period calls to our customers were answered on average in around a minute.

Incident Room

Our incident room opened on Weds 28th February, in order to ensure we were prepared for the events to come and after defined triggers (temperatures not greater than zero degrees Celsius for two days, and lowland snow deposits of >10cm) had been met. The incident room initiated the following actions:

- Enhanced monitoring of key storage points, pressure, flow and leakage in our network
- Increasing levels of field, alliance, contact centre, alarm monitoring teams
- Scenario modelling
- Increasing holding of alternative and bottled water supplies and engagement of bottled water suppliers to increase stock across the region by 150% (usual baseline stock is 100 pallets and increased to 248 pallets of bottled water)
- Liaison with Partner agencies
- Setting up of alternative supplies hub
- Proactive communication to customers about ensuring private pipework is adequately lagged.
- Proactive communication regarding 'Watercare Register'
- Postponing planned activity on our network and treatment works
- We actively participated in Local Resilience Forum teleconferences, Tactical Co-ordination Groups and Strategic Co-ordination Groups across 10 counties; a total of 61 teleconferences across the period.

Targeted contacts with retailers and specific customers

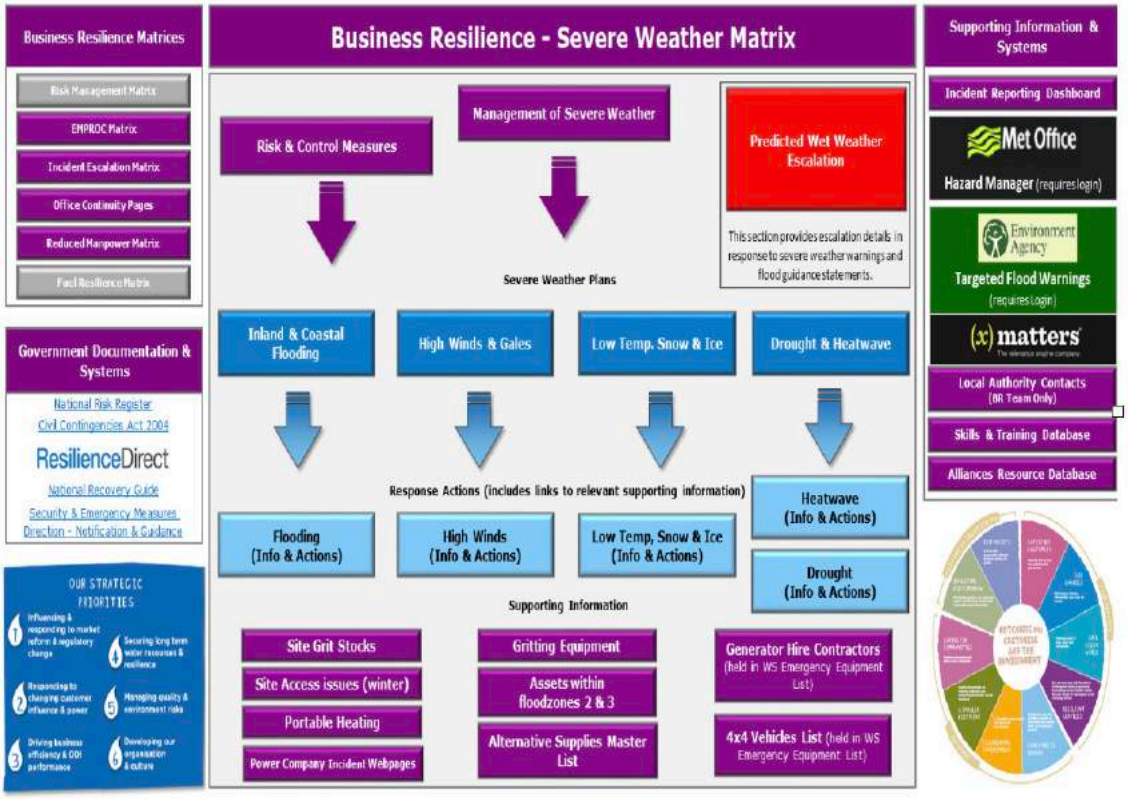
We set up information conference calls with our retail customers throughout the event, recognising the sensitivity of our non-household (NHH) customer base. Feedback from our Retailer customers was extremely positive. Only a handful of NHH customers suffered material interruptions to supply over this period, with only seven customers suffering an interruption of more than 12 hours and no NHH customer suffering an interruption to supply of greater than 24 hours.

Between 28th February and 7th March, 163 customers had a supply interruption of greater than 12 hours, nearly all in the Cromer area. The maximum interruption was 30.75 hours for 4 properties. We prioritised vulnerable customers and delivered bottled water to all affected customers (346 packs in total) and put in place contingency arrangements with local hotels and laundries should the situation have continued. No formal complaints were received and the Parish Council confirmed that it was not seen as a big issue.

SECTION E: HOW WE MINIMISED THE IMPACT ON OUR CUSTOMERS

Business Continuity

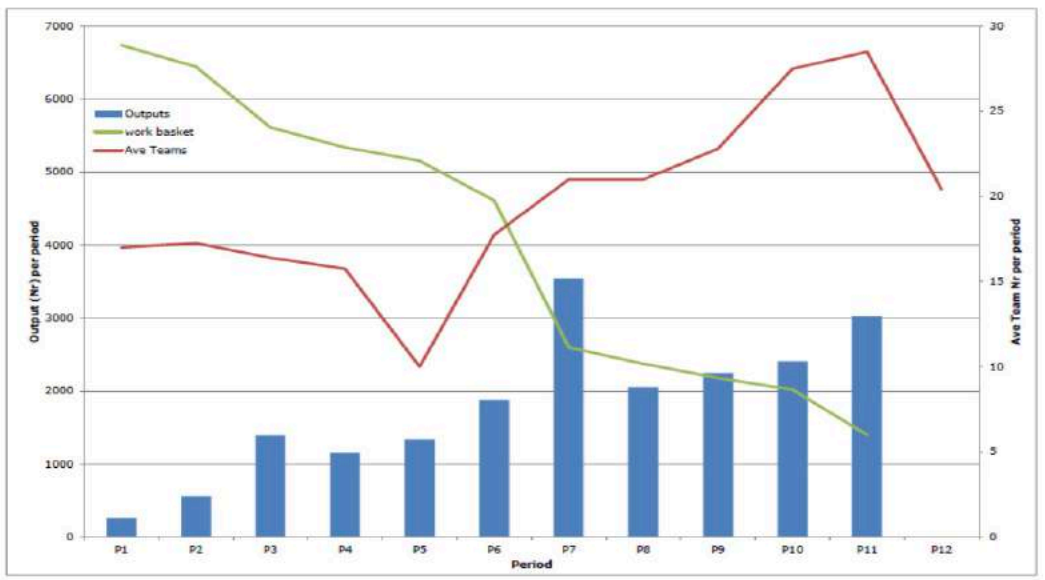
Our business continuity arrangements are certified to ISO22301 standard. We were the first water utility to achieve this. We have documented policies and procedures for management of severe weather events. These are based on principles of preparedness, response and recovery. Defined triggers escalate our business on to a level of heightened readiness. We regularly exercise our readiness to respond to these events, including with external partners.



Together with this, we believe that our Anglian Water Force, a network of trained experts within our core business and alliance teams, together with our ability to deploy information and analytics in an agile way, provides an extra layer of resilience in our ability to respond to incidents. Overall 763 employees and Alliance partners form part of our Anglian Water Force.

Proactive management of planned work backlogs on our Network before the event

As can be seen from the graph below, during the period up to the freeze thaw event we increased our level of activity on planned work. We were able to utilise the flexibility of our alliancing business model to target resources appropriately during the period before the event. This ensured that backlogs were low in advance of the event that we knew was coming and provided additional resilience.



Increased activity on planned work before the event

We take a dynamic approach to balancing resource levels between reactive and planned work. The drop-off in planned teams in P12 shows the teams who were sent across to assist with reactive work during the burst outbreak. Our business as usual operation is headed by a 24/7 Senior Operations Manager leading a team providing operational and service oversight across our business through our Operational Management Centre.

Benefitting from investment to reduce interruptions to supply

Over recent years we have made significant investments in restoration and a massive step change in moving away from our previous approach of 'repair first' towards our new order of priority of 'restore, repair, recharge'. When supplies are interrupted through a burst or other problem, our priority is to restore that supply, rather than immediately fixing the cause. This "customer first" approach has seen big reductions in the amount of time people are left without water.

This change has been achieved by working with our field teams to co-create new ways of working. Our teams are focused on customer needs: every customer counts, and every second counts, and actions are prioritised accordingly. The new restoration team was introduced in 2015. Now all 21 restoration technicians are trained to drive the water tankers in our newly expanded fleet and to use a variety of equipment and techniques, including temporary overland pipes to keep people supplied. These techniques can keep a number of homes supplied indefinitely during an incident.

The water services teams work closely with other parts of the business to tackle the causes of interruptions, and the effective management of these events when they occur, is vital. The reactive approach is led and managed by the Tactical Operations team. These efforts also complement the pressure management and other proactive work to prevent problems happening in the first place.

During the period from the 4th March to the 9th March, our Restoration team worked a total of 1083 hours maintaining supplies to our customers whilst our repair teams worked on fixing leaks and bursts on our Network.

Case Study, benefits from the Norwich Resilience Scheme

Early 2010 saw the commissioning of the Norwich resilience scheme. The concept was developed in 2005 to provide resilience under average demand conditions should the full output of the Norwich Heigham WTW fail (72% of required supply for 200,000 population). The investment of £16.5M delivered a new raw water mains, a new 24 Ml/d Water Treatment works plus trunk main connections from the East Hills WTW to the Norwich water ring main. The solution included a full automation configuration which enables remote control of WTW output and full pressure control. This has been designed to allow optimisation of all the available groundwater assets should Heigham output be catastrophically lost due to a resilience event such as fire or flood.

The scheme and its operation was unpinned by a regular and full maintenance and testing regime and has in the 8 years since commissioning only been required to operate in anger for a continuous period of 5 to 7 days due to the Heigham WTW suffering a water quality challenge due to raw water conditions.

The East Hills scheme is designed to be able to ramp up instantly (unlike a more complex solution such a RO/membrane plant requiring run up time) and the East Hills WTW output can be driven remotely by our central OMC by remote control . It can meet demand by ramping up from its baseline output of 2 to 3 Ml/d to the maximum output of circa 24 Ml/D in short timeframes.

When demand rose in the Norwich Supply from 53.63Ml/d to 73.65Ml/d over the period of 4th to 6th March , the East Hill WTW was used to pick up the majority of this increase with its flows rising from 2.57Ml/d on 3rd March to 12.26Ml/d on 5th and 13.79Ml/d on 6th March. Without this resilience capability, the ability of the Heigham WTW to meet this increased demand in such a short timescale would have been questionable. This event showed the value of our resilience investment

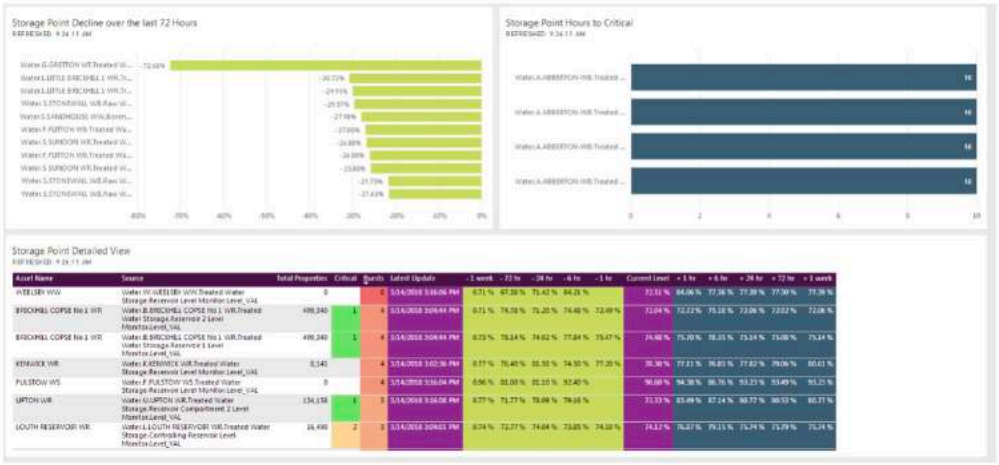
Making best use of data

The team use the largest telemetry system in western Europe, with over 750,000 separate points monitored, sophisticated modelling, mapping and analytical tools to ensure a seamless service is maintained to our 6 million customers. Our investment in our Integrated Remote Intelligence Service (IRIS) system, and our leading Integrated Pressure and Leakage Management System (ILPM), co-developed with Schneider gives us high quality information which our data scientists can then use to allow us to target our actions to minimise customer impacts. This is backed up by dedicated field teams whose primary aim is to restore supplies to our customers following an interruption.

Investment in our information capabilities to exploit current technologies and to build a business wide analytics community of practice has enabled us to undertake analysis in an agile way, using expertise from across the business to inform decisions. During the freeze-thaw event, this enabled us to:

- Analyse our current customer issues at scale to identify potentially vulnerable customers and respond accordingly;
- Identify high risk areas using geospatial tools that account for topography /contour height;
- Keep customers informed of our plans and prioritise workloads.

Our dashboard mapping incoming customer contact allows our teams' quick and visual access to emerging issues. We have created a single dashboard view, which provides a single risk dashboard on critical storage point levels, storage points in decline, and hours until those storage points become critical. This allowed for proactive intervention before situations become critical.



Key strategies that were put in place included targeting leakage teams to critical zones, and increasing works output to ensure demand was met and rezoning supplies to affected areas.

Case Study: Supporting neighbouring companies

Resilience and integration of our networks has been a long-term objective for Anglian Water. In the south-west of our region we have an integrated network that allows us to balance supplies and improves resilience in our network. Whilst we saw an increase in demand in this area we did not experience any significant issues which would have negatively affected our customers.

However we were called to support a neighbouring company (Affinity Water) by providing additional supplies to their normal demand. By utilising our integrated network we were able to move supplies from the north of the region to the south to provide this support.

We also partially commissioned our Grafham resilience scheme (a significant resilience project) on 27th February which provided additionally flexibility and allowed us to prioritise supplies to Affinity water whilst still maintaining secure supplies to our customers.

In addition to this we were in the middle of planned work with one of our clarifier units out of service for cleaning and repair. This reduces our works output by 45 Ml/d. This work had been part of our routine planned work programme that had been planned 6 months previously in conjunction with Affinity.

In response to the need to support Affinity, we accelerated the completion of this work. Working with our Main Works Alliance and framework partners we completed the remaining work, scheduled to take 3 weeks, within 3 days. This involved additional resources all parties working 18 hour days.

We maintained regular liaison between our operational control rooms and Affinity's to ensure all customers were supported regardless of the providing water company.

[1]See Appendix for further examples

SECTION F: A SPEEDY AND FLEXIBLE RESPONSE, HELPED BY OUR ALLIANCING MODEL

We are increasingly seeing the benefits of our alliancing approach in improving our customer experience, our ability to respond quickly and decisively to network incidents and our ability to manage our financial performance.

The freeze-thaw event presented us with some big challenges but also gave us an opportunity to learn about how we can respond with our alliances when under extreme pressure.

Our alliancing models provide long term platforms that allow the delivery partners and extended supply chain to align to, have influence over, gain satisfaction from and be rewarded for achievement of our business goals, SIM and ODI requirements, daily challenges and major incidents.

Through these alliancing models, strong relationships have formed between us and our delivery partners. From Chief Executives to front line operational staff there is a unity and collaborative nature that has developed allowing all parties to take a longer term view of resource requirements, security, stability and commitment required to deliver.

Critically, this models looks beyond the immediate work requirements and stretches for the full period the AMP cycle. Success is measured by total collaborative accomplishment not by individual achievement.

The alliancing model within the Integrated Maintenance and Repair (IMR) alliance was revised in 2017 with a view to ensuring it provided a sustainable and equitable platform for all parties. The alliance model now reflects a position whereby it recognises that resource availability and stability is at its core. There are circa 89 teams of dedicated resources that are dedicated to delivering the mixed basket of work activity across both reactive and planned environments. This provides the IMR with the flexibility of resource it needs to be able to proactively manoeuvre between short-term peaks of reactive work whilst balancing the whole efficiency and productiveness of it resources through the utilisation of a planned work book.

The alliance has also recognised that its success in achieving SIM and ODI delivery requires a flexible and skilled resource base. That it is informed by previous work trends, weather impacts and network challenges, that it looks forward to provide insight and a non-complacent view of how it will robustly manage the network and structure itself for long term benefit and issue mitigation. Working in this way has allowed the alliances to have teams and the mechanisms in place to deploy to the most “in need” areas with immediate effect.

The alliance and its resource needs are aligned to a view of the network condition and potential impacts over a 10+year period. This long-term view that means it is not susceptible to the short-term “boom and bust management” which is often associated with operating in a reactive maintenance and repair arena, and which is challenging to manage under traditional contractual, commercial and operating models.

Additionally we are operating pan-Alliance working methodologies that allow us to recognise where there is an opportunity to have a more joined up and aligned workforce. An example would be the sharing of resources across the IMR and the Integrated Metering and Developer Services Alliance (IMDS). Through the linkages that exist at all levels of these two alliance, the same supply

chain delivery partners, aligned management teams, joint working groups etc there has been the creation of a flexible and multi skilled resource base, each team with capability to deliver the specific needs of each delivery route whilst providing the right training and development of key resources to enable the movement across alliance and geographic boundaries.

Further the alliancing models have also enabled the active deployment of assets, plant and equipment sharing across the entire water network.

Specifically in response to the recent network incident we had the Integrated Main Works (@ one) alliance providing support to our IMR Water colleagues. We had the Integrated Supply Chain function operating out of our Thorpe Wood House site supporting the OMC Incident Room on Alternative Supplies. We had IMR Water Recycling alliance providing additional traffic management to the IMR Water alliance. We had Integrated Operational Services alliance supporting maintenance of existing Traffic Management on planned works that had to be put on hold for a week.

In total, through the alliancing delivery models, rapid access to some 400 plus people were available to Anglian Water to provide support on the ground across all areas of the network and operation to proactively manage our response to the significant issues created by the bout of bad weather.

Further to the direct support enabled by the alliancing models and to help manage large operational incidents the creation of an Anglian Water Force (AWF) incident community has been established.

This is a way in which we recognise that although large operational incidents do not happen often, we can be proactive and plan our approach to them. We have a wide pool of some 350 volunteers who we can call upon when needed to help us address issues and provide support across our geography and operations.

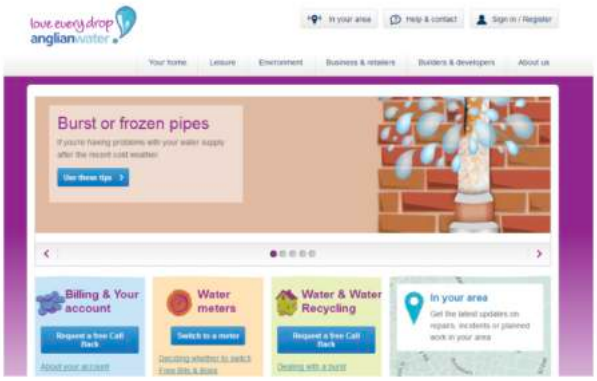
SECTION G: HOW WE COMMUNICATED WITH CUSTOMERS

Before and during the event we communicated across a wide range of channels with customers to ensure we were doing all we could to help them avoid problems in the first place, and explain what we would do to alleviate any issues that did emerge.

Anglian Water's Keep Your Pipes Cosy campaign

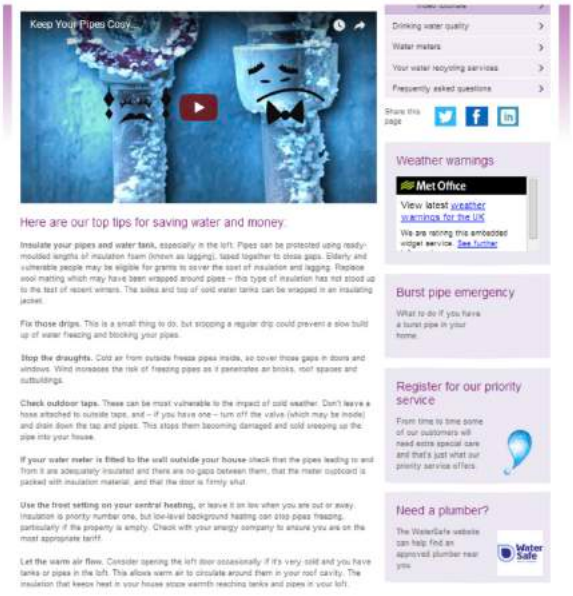
Ahead of any freezing weather conditions each winter we reactivate our Keep your Pipes Cosy (KYPC) campaign via, media, web and social. This is a campaign strand that has run for several years, with notably significant success when distribution of the story is timed to respond to national weather warnings.

Multiple communications assets with a lifespan of several years have been developed since this campaign's inception. Targeting and appropriate localisation keep these assets fresh each year.



A link to cold weather advice appears on the Anglian Water homepage, while a unique short URL - anglianwater.co.uk/winter – takes customers directly to information on protecting their pipes from cold weather. Further advice is signposted at various stages throughout the customer journey.

Online content is supported by printed collateral, also available for download.



Detailed advice is published on our website, including links to weather warnings, emergency contacts, priority service support, Watersafe accredited plumbers, and how-to videos.

The twin objectives of the campaign are to attract customer attention in the context of what else they may be hearing and seeing in relation to cold weather, and to inform them about how to prepare. How-to videos and creative animations are at its heart.

Engagement with traditional media

Ahead of the freeze which swept the UK in late February, we reactivated this campaign. We issued our Keep Pipes Cosy press release to regional media, radio and TV, offering advice to customers about what action to take ahead of the cold snap to protect homes from burst pipes and flooding.

While initial release on the 26 Feb had a limited amount of pick up, our advice had been lodged with newsrooms, stakeholders and opinion formers. Once the snow began to fall and freeze the following week (and customer contact volumes increased) we reissued the release, with additional guidance for customers should they find their pipes had already frozen.

We proactively contacted all major local radio stations, (BBC and commercial) offering live interviews or pre-recorded advice for their broadcasts.

Every local BBC radio station, and all major local commercial stations, booked interview slots in with us between the 1 and 2 March. While some carried interviews as a feature in daytime programming, others ran it as content in news bulletins.

Channels which ran the story were:

- BBC Radio Cambridgeshire, Lincolnshire, Norfolk, Northampton, Suffolk
- Lincs FM
- Eastern Daily Press
- BBC Look East
- Grimsby Telegraph
- Heart Radio

All of this messaging was consistent with information published to our "In Your Area" website. The thaw of the following week (and operational challenges in other water companies) created a further wave of interest from the media. With such limited customer impact in the Anglian region, our contribution to media debate was largely around:

- explaining why a rapid thaw can causes pipes to burst, and the difference between our infrastructure and domestic plumbing
- offering reassurance to customers that our network was coping well with the conditions and was being monitored closely by our engineers
- encouraging them to report any leaks to our Leakline
- Encouraging the use of Watersafe accredited plumbers

'Beast from the East II'

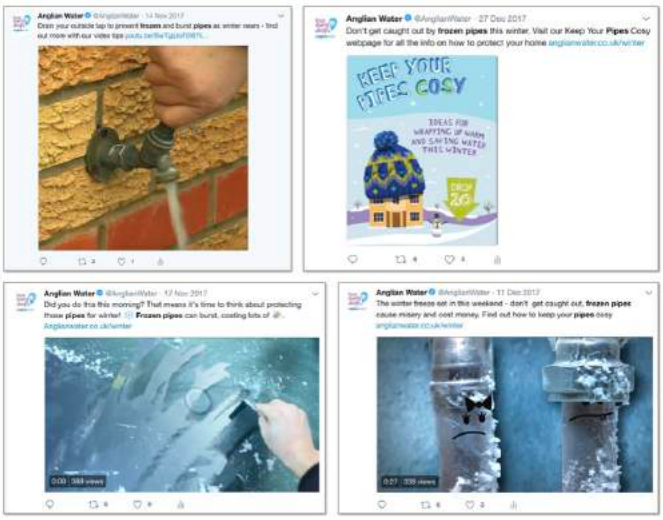
Despite the forecast for the second cold snap being less ferocious than the first, we proactively contacted all regional radio stations again, ahead of the 17 March forecast for further snow and ice. BBC Radio Northampton, BBC Radio Lincolnshire and BBC Radio Norfolk ran the piece again. We also reissued the advice as part of our fortnightly supplement in the East Anglian Daily Times, one of the most widely-read regional newspapers in our area, covering Suffolk along with parts of Norfolk and Essex.

Customer engagement on social media
Anglian Water's social media channels are consistently the most 'followed' or 'liked' in the industry, with correspondingly leading levels of engagement.

Facebook post v's engagement statistics comparing UK water companies, 16/03 – 23/03, showing comparative 'BAU' levels of engagement

Page		Total Page Likes	From Last Week	Posts This Week	Engagement This Week
YOU 1	Anglian Water - Love Ev...	19.7K	▲ 2%	9	3.7K
2	Scottish Water	17.2K	▲ 3.4%	58	1.9K
3	Yorkshire Water	16K	▲ 3.2%	10	919
4	Dwr Cymru Welsh Water	15.7K	▲ 33.8%	35	11.9K
5	Severn Trent	9.4K	▲ 14.9%	35	2.9K
6	Thames Water	8.4K	▲ 11.7%	91	5.6K
7	United Utilities	7.3K	▲ 1.8%	34	666
8	Wessex Water	5.1K	▲ 0.6%	9	329
9	Southern Water	3.5K	▲ 38.3%	44	3.3K
10	South East Water UK	1.9K	▲ 46.5%	125	2.7K
11	Affinity Water	1.5K	▲ 3.2%	4	128
12	Northumbrian Water	767	0%	0	0

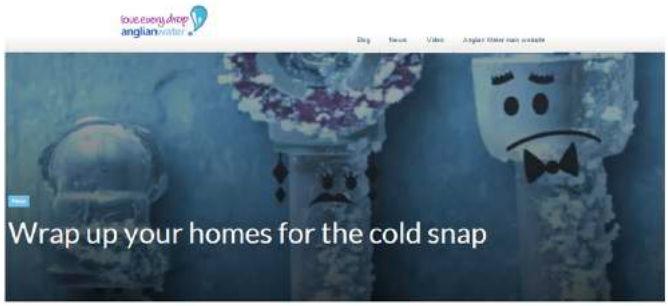
Using campaign collateral, we are able to target customers directly, using our well-established social media channels.

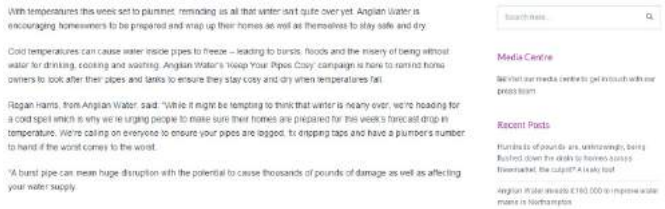


Examples of previous cold weather engagement using Twitter, December 2017

With the cold weather predicted in late February and early March, we again pushed the message out, echoing the messaging of our media release. This was published to our media site on 26 Feb.

The Anglian Water media site provides a central location for all published content, such as press releases, blogs and videos.
This story can be found here: https://media.anglianwater.co.uk/wrap-up-your-homes-for-the-cold-snap/




With temperatures this week set to plummet, reminding us all that winter isn't quite over yet, Anglian Water is encouraging homeowners to be prepared and wrap up their homes as well as themselves to stay safe and dry.

Cold temperatures can cause water inside pipes to freeze – leading to bursts, floods and the misery of being without water for drinking, cooking and washing. Anglian Water's 'Keep Your Pipes Cosy' campaign is here to remind home owners to look after their pipes and tanks to ensure they stay cosy and dry when temperatures fall.

Regan Harris, from Anglian Water, said: "While it might be tempting to think that winter is nearly over, we're heading for a cold spell which is why we're urging people to make sure their homes are prepared for this week's forecast drop in temperature. We're calling on everyone to ensure your pipes are lagged, fix dripping taps and have a plumber's number to hand if the worst comes to the worst.

"A burst pipe can mean huge disruption with the potential to cause thousands of pounds of damage as well as affecting your water supply.

Media Centre

Recent Posts

Social media traffic began to steadily rise from the start of the week commencing Feb 26. As the temperature thawed and customers started to report leaks and water issues in their properties, contact peaked on late Sunday March 3 and throughout Monday March 4, before returning to normal levels on Wednesday.

During this period we received 2,668 messages and comments on Twitter and Facebook from 1,134 accounts. Of these 553 were customers requiring assistance, information or advice and they all received an individual response from our digital customer services team.

This was the highest level of traffic we have ever received on our social media channels. To ensure we were able to cope with demand we moved shifts to extend our hours of coverage, increased

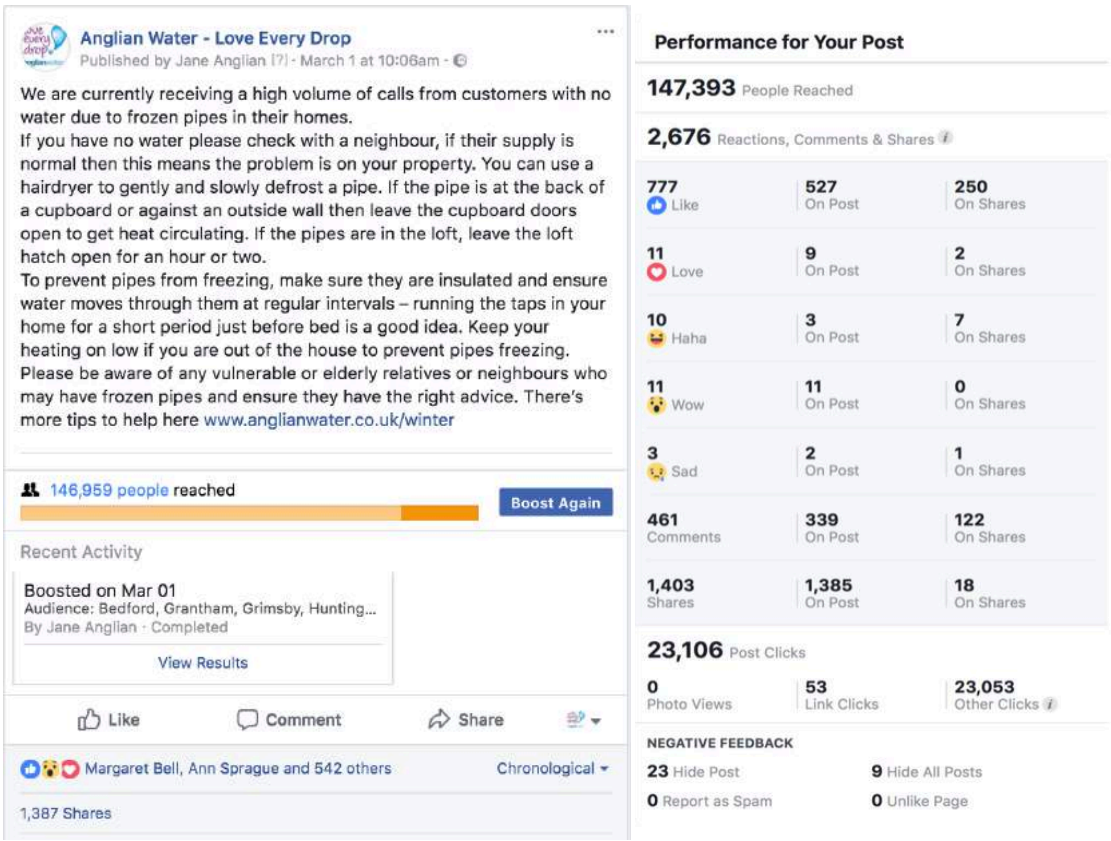
the number of available seats on our customer service platform by 20, and made preparations to bring in extra staff from other areas of the company to help respond individually to customers online. Ultimately, we were able to deal with demand from within the dedicated team.

Our proactive messages on social media were given over to updates and advice for customers as well as images of our staff out working to keep customers informed and reassured.

We posted 11 Facebook updates during this period: a mixture of general posts for all affected customers, and targeted posts on specific localised issues only visible to those in the affected geographic areas.

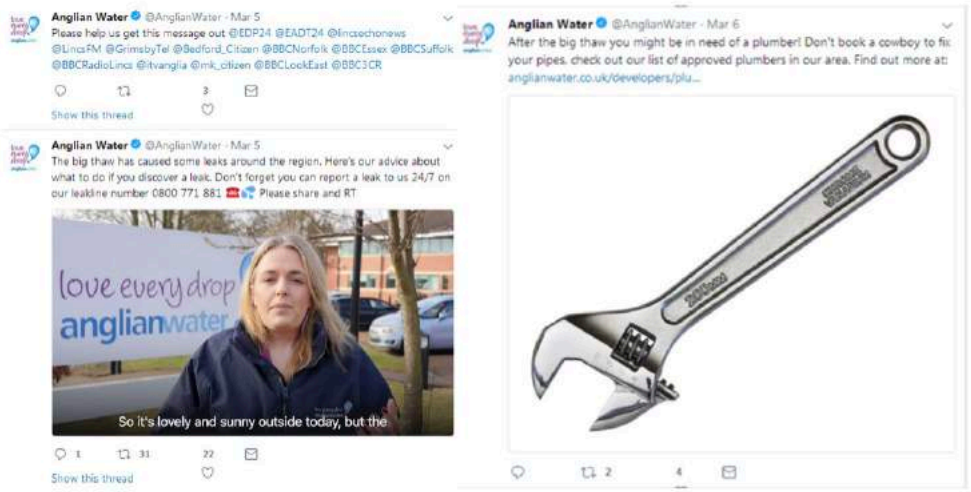
Our total combined reach on these posts was around 250,000, with 40,000 people engaging (eg liking, commenting, sharing, clicking on links or watching videos).

The post with the highest reach was posted on March 1, reaching almost 150,000 people, receiving 2,600 likes, comments and shares and was clicked on 23,000 times.

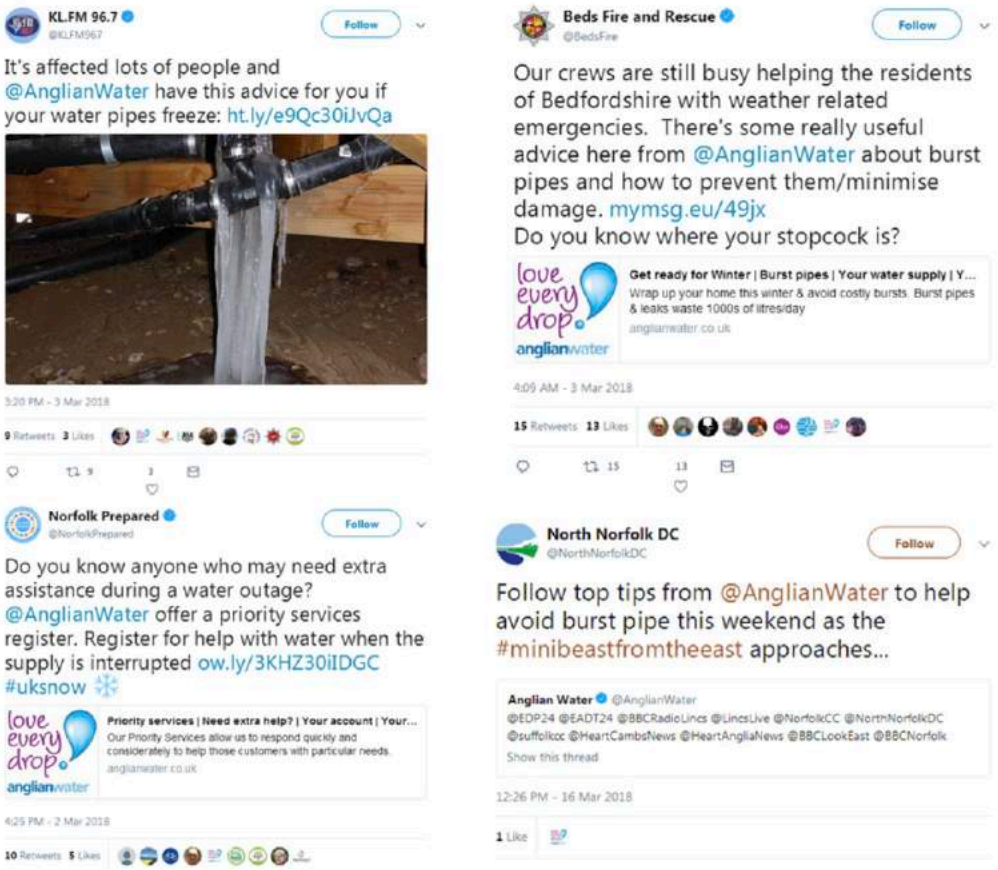


To contextualise the situation we shared images of work being carried out on the front line. This follows our tried and tested strategy of lifting the lid on the work we do, turning front line colleagues into advocates and ambassadors, showing that the whole business is working in service the customer. Customer responses were typically very supportive.

Similar content was posted on Twitter. Our tweets over this period received more than 240,000 impressions.



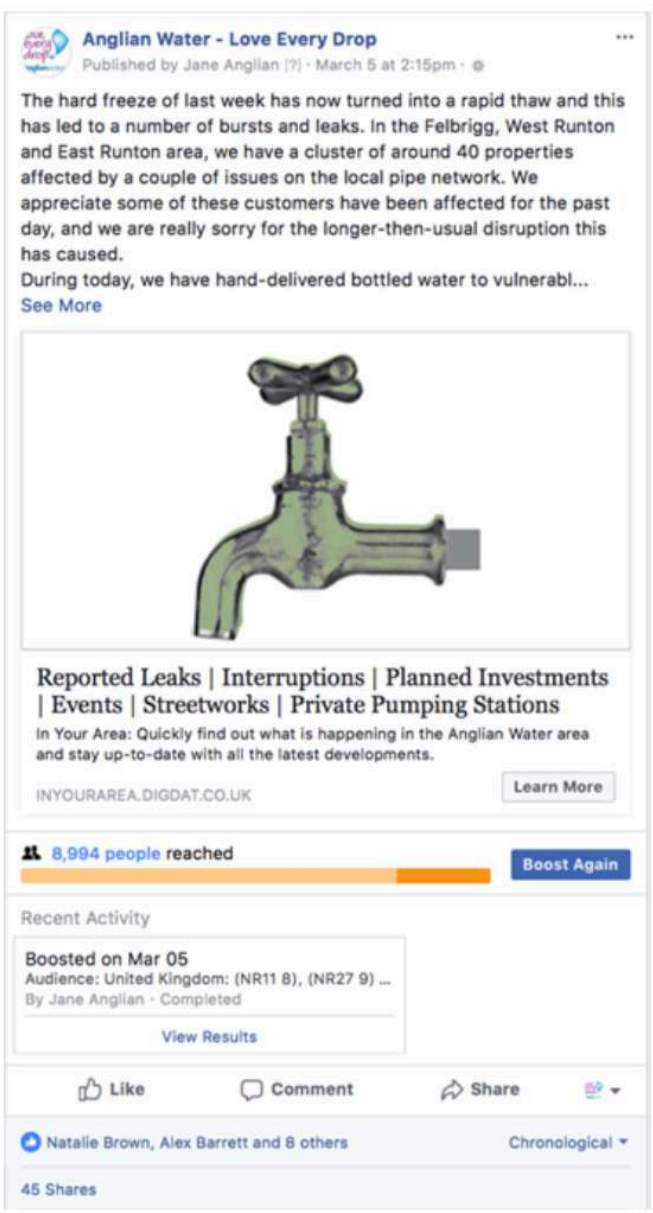
As we have built up a large Twitter following as a result of regular and relevant updates targeted at specific communities, our message was reiterated by a large number of independent voices. For instance:

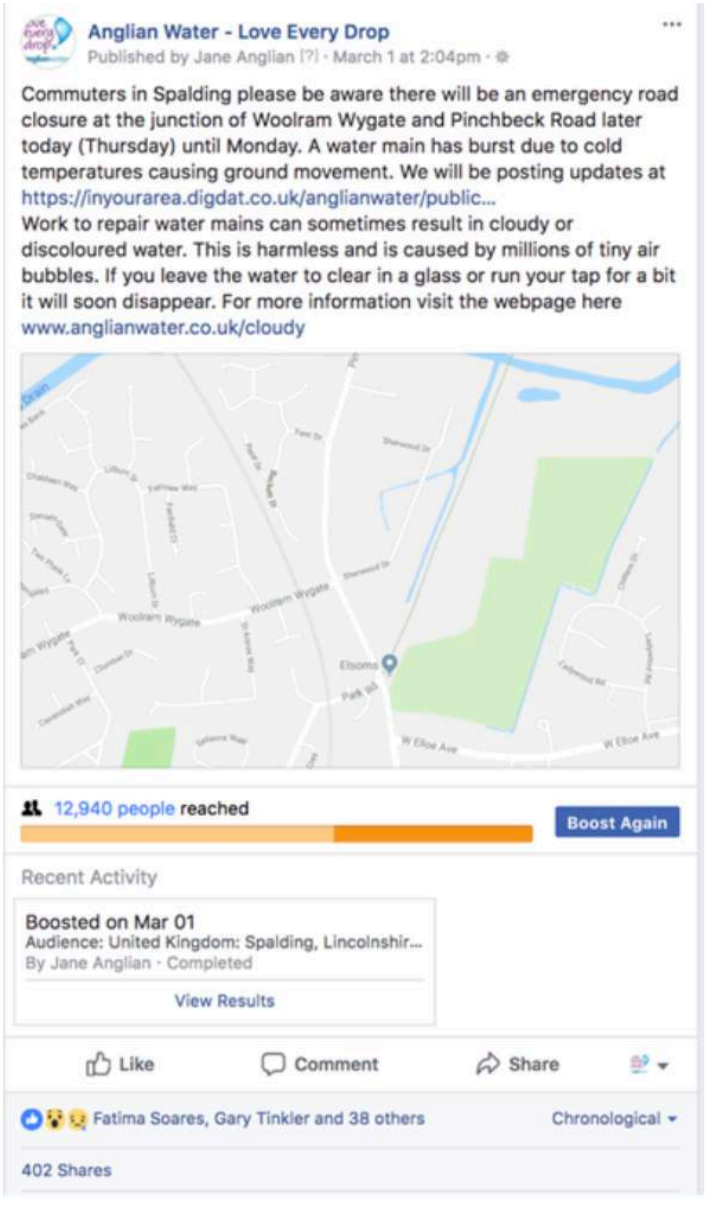


On the following days, posts contained videos from staff giving advice on how to deal with burst pipes in the home, how to contact an approved plumber, and how to inform us of leaks.

As these posts were 'boosted' they reached a larger number of people than they would otherwise (organically) have done. Again, they were fronted by regular staff, emphasising the focus of the whole business being on the customer.

During this period we also posted a number of targeted messages (dark posts) to specific locations, reaching communities affected by bursts, roadworks or potential cloudy water following a repair.





SECTION H: DELIVERING ON OTHER BUSINESS PRIORITIES DURING THE EVENT

Despite the huge pressure and significant additional demand on resources at all levels within the business from the freeze thaw event, Anglian Water was nonetheless able to demonstrate its resilience in the round by continuing to deliver other priorities.

For example, the event coincided with the City Conference, which necessitated immediate and detailed follow-up work with our investors and Board. This included arranging and preparing for two short notice additional Board meetings. In turn this allowed us to make a series of major announcements about changes to our financial structures and governance in early March which responded to the challenges that were set out from Government and Ofwat around transparency and legitimacy of the sector as a whole.

Also in the midst of the weather event, we were concluding sensitive negotiations with national Trades Unions on changes to our pension scheme, and continued with a major Customer Engagement Forum session, an important element of our preparations for the PR19 business plan. Colleagues were able to cover for those otherwise engaged with manning the incident room for example.

Similarly, whilst coping with significant pressures from the severe weather, our water recycling operations were able to continue to operate (albeit with some constraints) and we redeployed assets from the water recycling side of the business to help deal with the more immediate pressures being faced on the water side of the business.

SECTION I: OUR RESILIENCE FRAMEWORK

Anglian Water has developed its approach to resilience over many years. In 2017, we appointed Arup to assist us in bringing together our various resilience streams in to a coherent framework, which we published alongside our refreshed Strategic Direction Statement.

The framework builds on Arup's resilient cities approach, Cabinet Office guidance, and Ofwat's guidance in the PR19 methodology and "resilience in the round" thinking. The framework has then been tested against the key shocks, stresses and risks that Anglian Water may face to ensure that the framework, and our implementation of it, will deliver a resilient business and continuity of services for customers and the environment.

We have used the framework to assess our maturity and to identify any gaps, where we could make improvements to further increase resilience. Arup will carry out an independent maturity assessment as part of our PR19 business planning process.

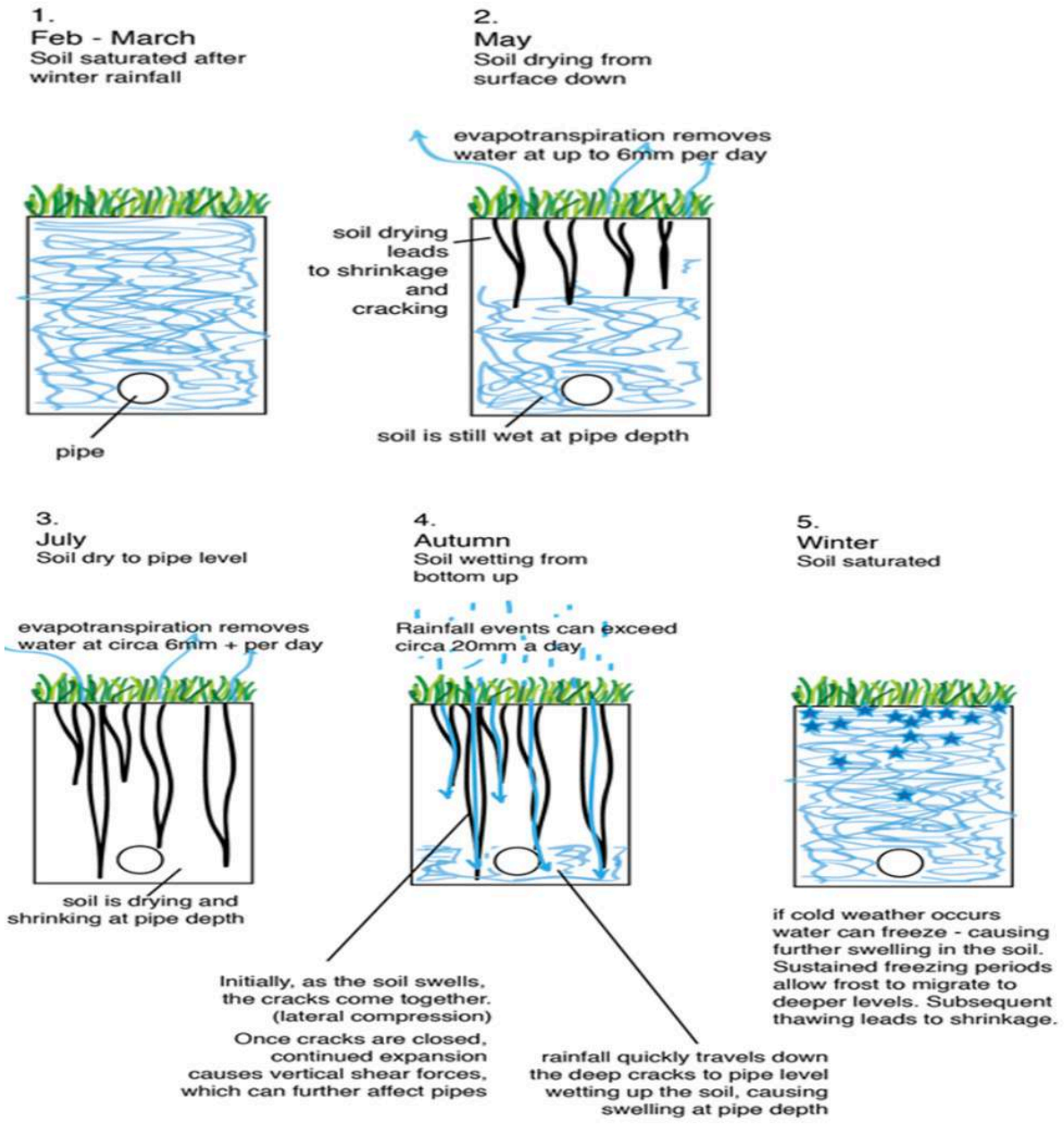
A key part of our approach to being a resilient organisation is learning from others – one such example of recent learning was of direct relevance to our ability to cope with the recent freeze/thaw event. One of the key learning points that we took from the United Utilities' crypto event last year was the importance of having a readily available workforce that we could deploy in managing customer contact, helping vulnerable customers and deploying alternative water; we have set up AWF (Anglian Water Force) - a widespread network of Anglian Water employees that can be readily deployed across the region to talk to customers and assist them as needed.

[2] http://www.anglianwater.co.uk/_assets/media/55189_AW_Long_Term_Strategy_single_pages.pdf

APPENDICES

Section B

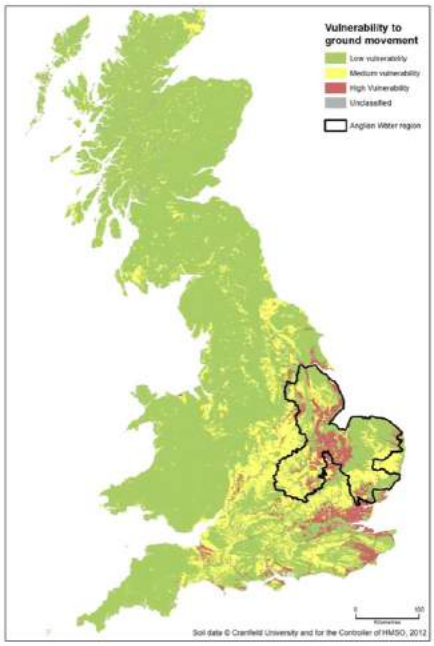
Extremes of weather, either cold or dry have a significant impact on ground movement, which then exerts forces onto mains and increases the likelihood of failure. This stems from the process outlined in the diagrams below taking place.



By assessing the shrink/swell effect and its relationship with burst main levels, we better understand the root causes of this phenomenon, which is directly impacted by soil type and climatic conditions.

Soil Types

- The AW region has a high vulnerability to ground movement due to being made up largely of clay and sandy soil types;
- Ground movement can take place as a result of extremes in weather;
- The presence of frost in soil can cause excessive expansion;
- Sudden thaw or a heat wave can cause excessive contraction / expansion (the shrink / swell effect);
- Persistent cold or hot temperatures causes the ground to expand and contract far more abruptly than in normal conditions.



Climatic Conditions

Soil Moisture Deficit (SMD) – is the amount of water needed to bring the soil moisture content back to field capacity, which is the amount of water the soil can hold against gravity. As SMD changes, the soil expands (saturation / low SMD) and contracts (drying / high SMD). This, in conjunction with temperature and average rainfall, directly impacts burst mains.

Average Rainfall – has a direct impact on SMD in conjunction with temperature. In the summer, even with rainfall, SMD tends to be high due to average temperatures being higher and causing moisture in the ground to evaporate and the ground to shrink. In the Winter, when average temperatures are lower, the ground tends to become saturated causing it to swell.

Average temperature directly impacts SMD. At higher temperatures, moisture in the ground evaporates, causing it to shrink. During Winter where temperatures are much lower and SMD tends to be lower due to the ground being saturated, the ground will swell. Moreover, in very low temperatures where the ground freezes, further swelling can occur. Once temperatures begin to rise and the ground starts to thaw, contraction/shrinking begin to occur.

These factors and their inter-relationships cause significant forces to be applied to mains due to expansion and contraction in ground movement. This causes the Anglian Water region to be more susceptible to higher levels of mains bursts during weather extremes such as experienced in December 2010 and March 2018.

Effects of extreme weather: December 2010 & March 2018

In both December 2010 & March 2018 a large increase in bursts was experienced due to weather extremes. Low Soil Moisture Deficit coupled with sustained low temperatures, and freezing conditions caused significant ground movement. The initial ‘freeze’ phase in both these instances, caused ground movement through swelling, followed by a ‘thaw’ resulting in shrinkage. In both instances, the thawing resulted in a significant increase in burst water mains.

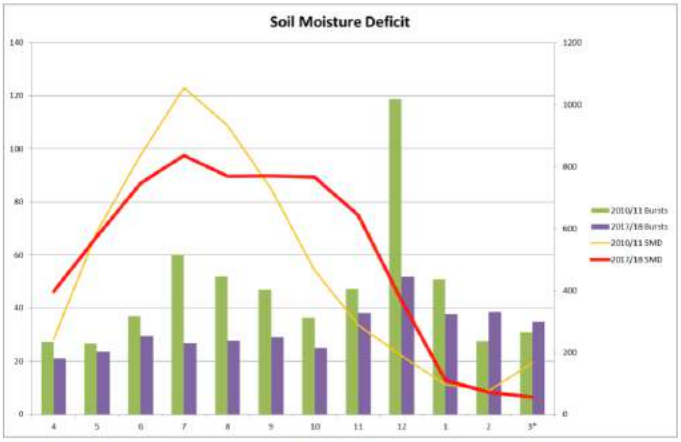
The graphs below are indicative of the interdependencies which exist between SMD, Average Rainfall and Temperature. In March 2018, the same climatic conditions can be observed – rainfall levels causing soil saturation in January and February 2018. This resulted in a downward trend in

Soil Moisture Deficit to very low levels. Freezing minimum temperatures during February with an average of <0°C caused further ground movement due to freezing. This continued into the first week of March 2018 however, it can be observed from the table below that as of the 4th March 2018 the variance in daily temperature between minimum and maximum increased until 10th March 2018 daily temperatures started to get warmer. The consequential thawing from 4th March 2018, experienced within the Anglian region, will have resulted in significant shrinkage and ground movement which resulted in a heightened level of burst mains.

Temperature Levels 1 March to 13 March 2018

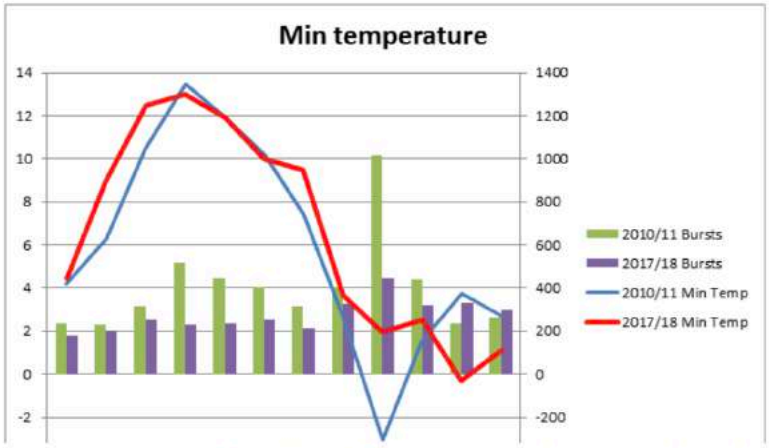
Date	Min Temp °C	Max Temp °C
01/03/2018	-5.868421053	-0.715789474
02/03/2018	-4.010526316	0.321052632
03/03/2018	-2.057894737	3.394736842
04/03/2018	0.057894737	7.342105263
05/03/2018	2.026315789	10.11578947
06/03/2018	4.305263158	8.905263158
07/03/2018	1.068421053	9.526315789
08/03/2018	1.284210526	8.431578947
09/03/2018	-0.310526316	10.67368421
10/03/2018	4.036842105	13.36315789
11/03/2018	4.010526316	11.34736842
12/03/2018	6.105263158	8.189473684
13/03/2018	3.884210526	10.45789474
Grand Total	**1.117813765**	**7.796356275**

Soil Moisture Deficit



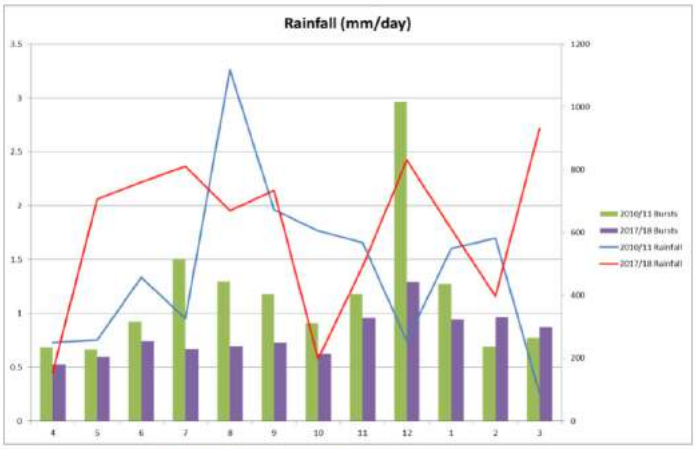
Soil Moisture Deficit (SMD) for 2010/11 and 2017/18 plotted against bursts

Minimum Temperature



Average Min Temperature (°C) for 2010/11 and 2017/18 plotted against bursts

Rainfall



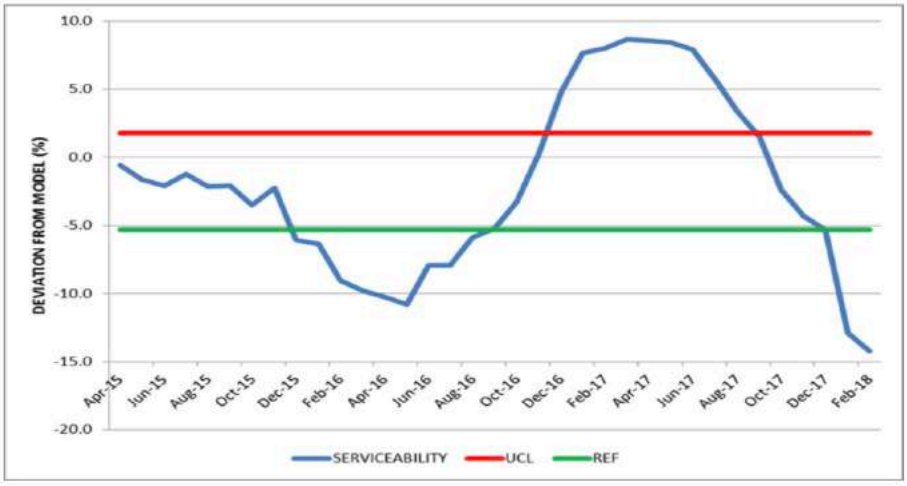
Rainfall for 2010/11 and 2017/18 plotted against bursts

Use of dynamic modelling to improve predictions and preparedness

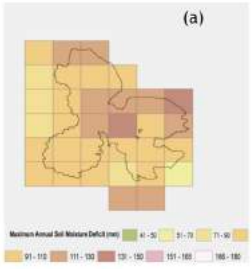
Using the research findings produced in collaboration with Cranfield University, a dynamic model was built and has been running since 2014. The model, known as WISPA (Water Infrastructure Serviceability Performance Assessment) uses our expert knowledge on the impacts of climatic conditions on water mains to predict how many burst mains are likely to occur as a result of the weather and the effects it has on the shrink/swell of soil types in our region. Our Serviceability Performance is then tracked against the model prediction by comparing the number of reactive burst mains we actually have.

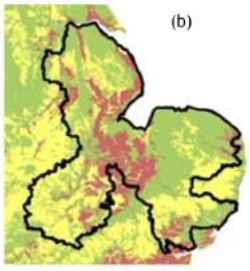
The model runs weekly predictions and is reported on monthly. This model was approved by Ofwat for AMP6 to measure Water Infrastructure Serviceability performance. By predicting how many bursts are expected to occur as a result of weather conditions, Anglian Water is expected to remain below a +1.8% tolerance of the model prediction for number of bursts. Performance below this Upper Control Limit is recognised as 'Green' Serviceability status by OFWAT.

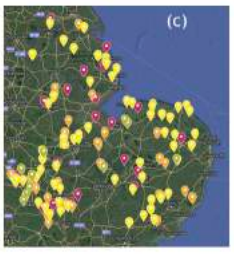
Between the 1st March and 8th March we recorded 245 reactive bursts. Whilst Anglian Water saw an increase in the number of burst mains as a result of the extreme weather in March 2018, Serviceability Performance is still forecast to be 'Green' status at the end of the financial year. Anglian Water is currently forecasting a year end position of -14.2% lower than the model prediction for 2017/18.

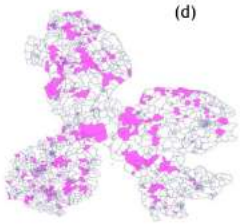


Whilst used as a tool to report regulatory performance, WISPA is also used as a decision-support tool within both capital investment and operationally. By mapping SMD (a) and vulnerable soil types (b), alongside historic burst history by area, main type, age and condition, we use this data to inform our prioritisation of capital investment.









The correlation can be seen with image (c) which geographically plots capital investment and (d) which shows pressure-managed areas which have been invested in to reduce leakage and bursts.

This is because we use WISPA and our detailed understanding of the impact climatic conditions have on ground movement and therefore burst mains as a decision-support tool within our investment planning. Ground movement and the understanding we have on areas of our water network which are susceptible to shrink/swell is used with root cause analysis undertaken during the promotion of capital investment and to ensure the correct totex solution is promoted and invested in.

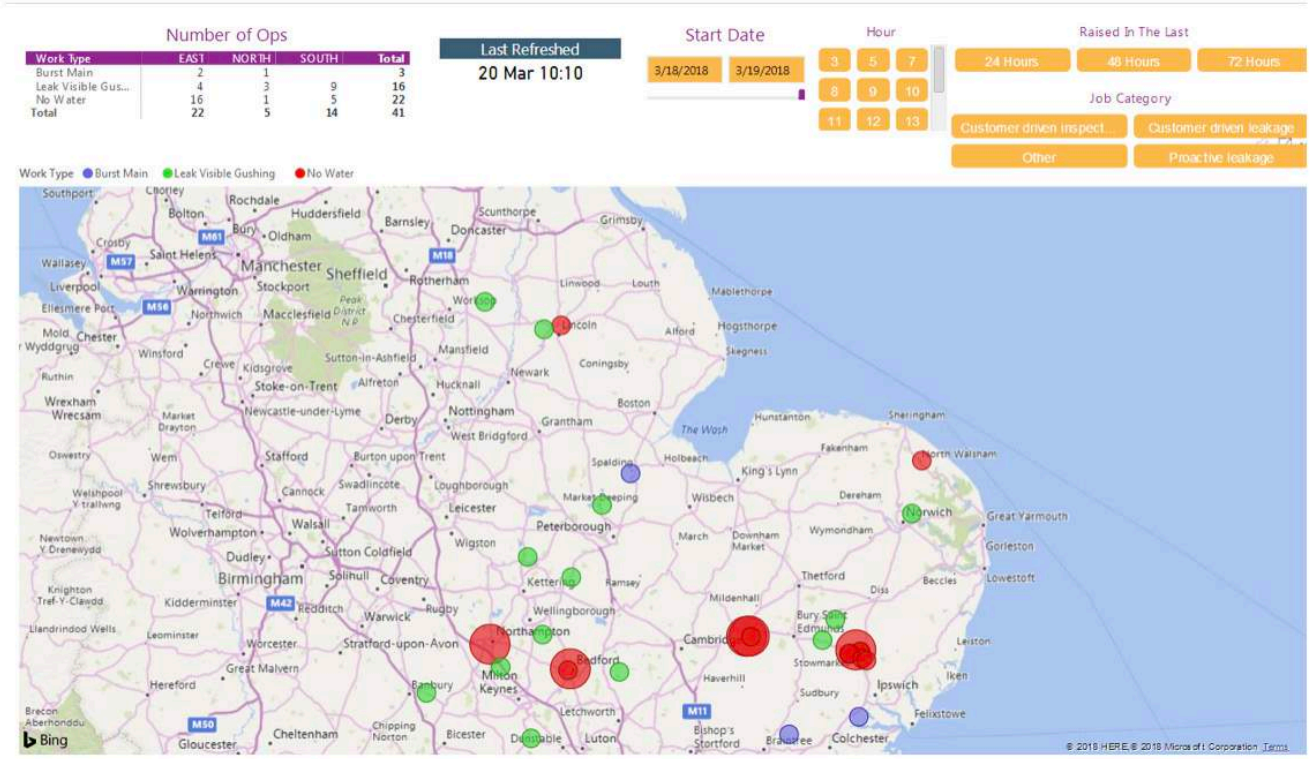
- c.60km of small diameter AC mains replacement in soils with high susceptibility to weather related ground movement resulting in bursts. Targeted investment in PVC, CI and AC mains replacement in areas where burst rates exceed WISPA predictions

- £17m of additional mains replacement was promoted in Year 3 of AMP6 in areas susceptible to mains failures due to climatic conditions
- Pressure management and optimisation schemes targeted in areas with greatest benefit (leakage and bursts) including Peterborough, Bury St Edmunds, Ely – all areas susceptible to significant ground movement. Since 2010, reduction of 564 bursts and 14.5 MLD leakage in pressure managed zones
- Noise Logging – Programme of fixed noise loggers planned to start this year in areas with high leakage and burst rates to detect leaks earlier. Results will also feed into investment planning to reduce burst rates in future.

SECTION D

Making best use of data: Our dashboard mapping tools

Below are examples of our dashboard mapping tools that were at the heart of our operational response.



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