Protecting our water and world

Our Climate Change Adaptation Report for 2015-2020

Contents

Introduction from Sarah Bentley, our CEO

Across Thames Water, we have an important responsibility to make sure there's always enough clean water for our customers, communities and the environment to thrive - both today and in the future. The impact of climate change and increasing population size puts huge strain on our precious water resources.

Our world is rapidly changing. New climate records are continually being set and the devastating effects are evident. The ten warmest years on record have all occurred since 2002 and for the first year in recorded history 2020 had temperature, rain, and sunshine rankings in the top ten. More recently, we've seen the heart-breaking effects of extreme rainfall leading to homes and livelihoods being flooded in parts of London and the Thames Valley.

We're currently underway with our business turnaround plan and one of our core areas of focus is to shape the future, as I care about leaving a positive legacy for future generations. We're developing our Vision for 2050, including being prepared and resilient when it comes to climate change.

We look at climate change in two ways – firstly what we can do to prevent it and secondly how we can adapt to its effects, so we can continue to deliver life's essential service.

Prevention

Reducing the impact of climate change is not new to our business. It's been an area of focus in our operations since the 1930s when we started creating our own power from poo. Since 1990, we've reduced our operational carbon emissions by nearly 70%. Our next stop is net carbon zero and we've committed to getting there by 2030.

We have a real opportunity to change the way energy is created and used in the UK too, making us an important player in energy transition.

Adaptation

We're already seeing the effects of climate change and need to increase our resilience for the future. To do this, we're focused on activities such as reducing our leakage and working with customers to reduce the amount of water they use.

We're also committed to working in close partnership with the lead local flood authorities, Environment Agency, Highways Agency and others to take a joint approach to flood risk management.

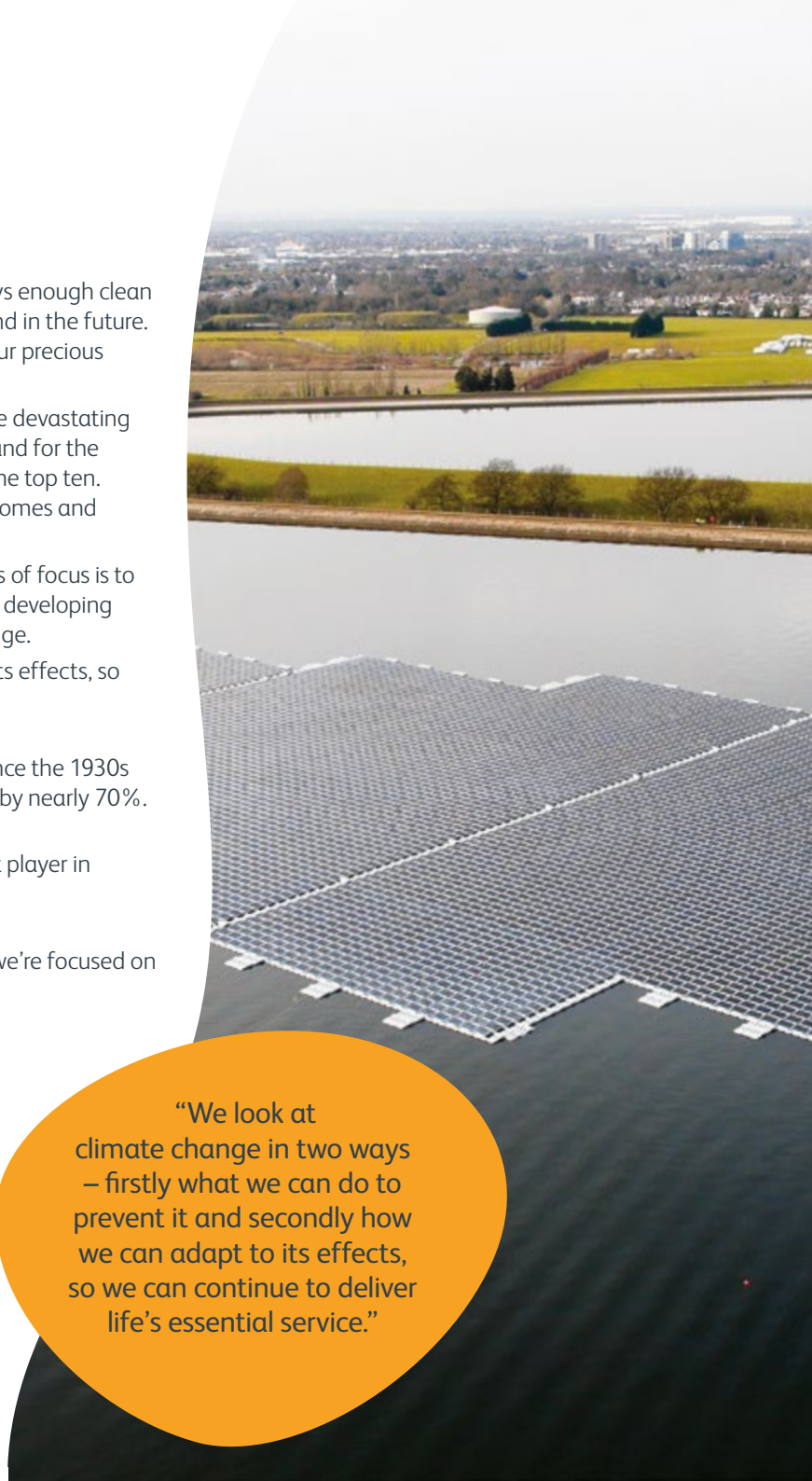
Making a difference

You can find out more on what we're doing to tackle climate change and how we're responding to the threat of increasingly turbulent weather patterns throughout this report.

Reducing the impact of climate change is one of my core focus areas. I'm looking forward to working together with customers, stakeholders and key organisations to ensure we are driving positive change in this critical area.

Sarah Bentley

Sarah Bentley
Chief Executive Officer



"We look at climate change in two ways – firstly what we can do to prevent it and secondly how we can adapt to its effects, so we can continue to deliver life's essential service."

Our overview

Delivering life's essential service

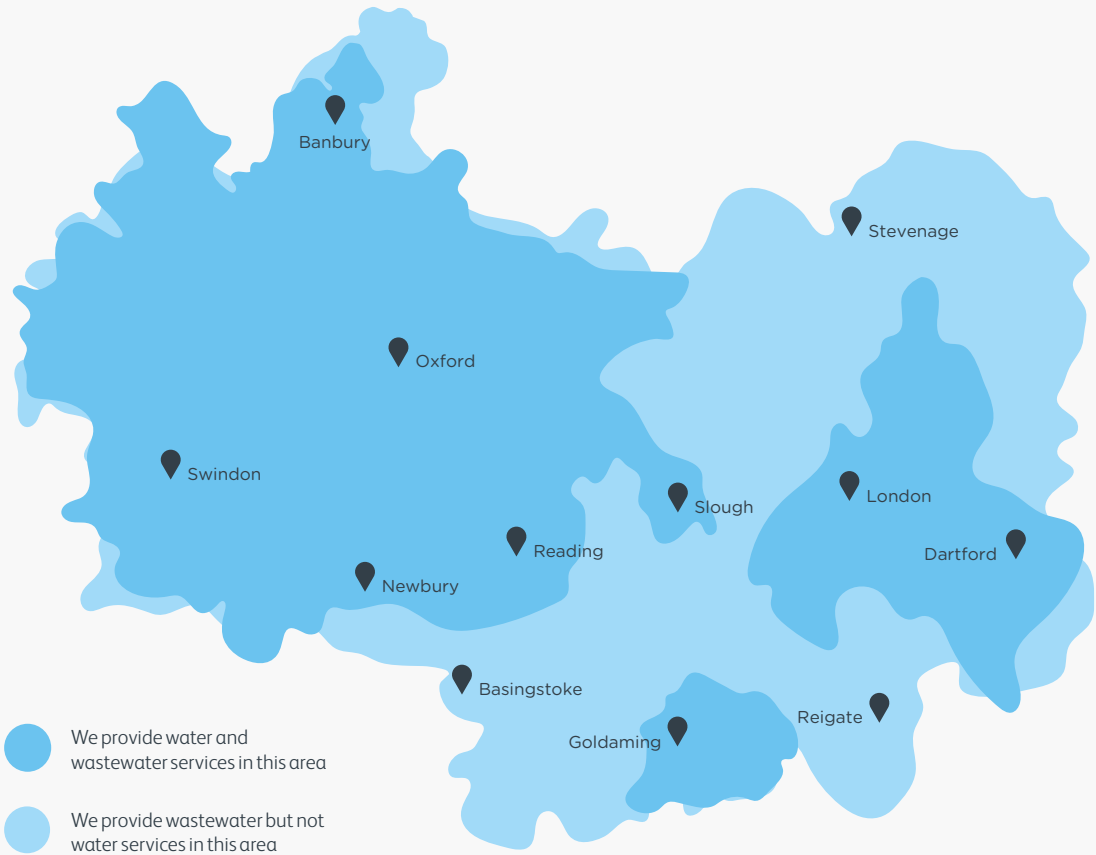
We serve customers in an area that follows the River Thames and stretches from Gloucestershire to Essex, covering countryside, villages, towns and our capital city.

Providing clean water to the communities we serve, while protecting this precious resource and the environment for the future drives everything we do.

Water is a vital part of all our lives – it keeps us healthy and hydrated, it helps nature thrive and it connects us.

Every day, we serve over 10 million customers with high-quality drinking water and remove wastewater for 15 million people. We treat wastewater at one of our 354 sewage treatment works before returning it safely back to the environment. In 2020-21 we renewably generated 23% of our electricity needs which was used to power our operations, reduce greenhouse gas emissions and reduce energy costs.

We couldn't do any of this without the planet's natural water cycle. Our world provides the water and resources we all rely on. And it's our world, and the vibrant communities within it, that inspire us to keep improving and changing things for the better.



Thames Water in numbers

We supply **2.6 billion** litres of high-quality drinking water every day

We maintain **85,000** miles of pipes to provide our essential services

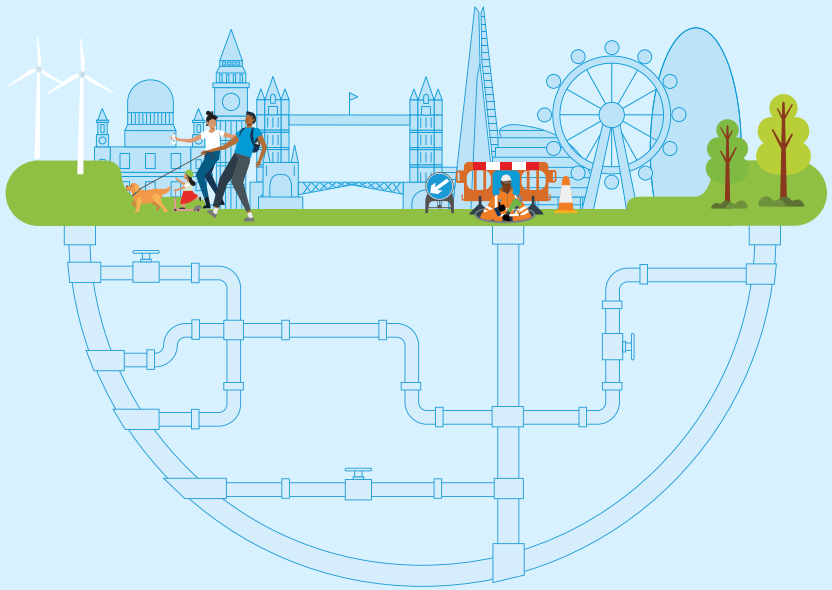
We have a **three-star** Environmental Performance Assessment rating

We generate **311 GWh** of renewable electricity

We collect and treat **4.7 billion** litres of wastewater every day

Our Purpose

To deliver life's essential service, so our customers, communities and the environment can thrive



Protecting the environment – at the heart of our Purpose

We're dedicated to our Purpose – to deliver life's essential service so our customers, communities and the environment can thrive. Protecting the planet we share sits at the core of that Purpose.

Living our Purpose means that every day, we commit to keeping taps flowing and toilets flushing, while caring for our customers and the world around us.

We've set a clear direction for the future to ensure we can realise our Purpose every day. This includes:

- Providing resilient, safe and affordable water and wastewater services for current and future generations
- Protecting our natural environment, maintain clean rivers, and build a sustainable ecosystem
- Delivering best-in-class customer service, support those who need it most, and act in the long-term interests of our customers, communities and the environment

Our commitment to becoming a Purpose-led business is championed by our Board. Our directors actively consider how any decision will impact society and the environment alongside shareholders.

We're determined to be a force for good and that means listening to fresh thinking and working collaboratively with our communities and stakeholders to find innovative and sustainable solutions to our challenges – including those that climate change brings.

Committing to change

Climate change is one of the biggest challenges we face. More frequent and intense weather events across the globe will impact our business and the service we provide to customers over the coming years.

The ten warmest years on record have all occurred since 2002 and 2020 was the first year in recorded history to have temperature, rain, and sunshine rankings in the top ten.

As part of our plans for 2020-2025, we've engaged with over one million customers to understand their needs. They're trusting us to plan ahead for the challenges that could affect them in the future, whether that's changing weather patterns or increasing demand. So, we've put climate change at the heart of our planning, not just for the next five years but to the end of the century.

This commitment is a vital part of delivering life's essential service.

To protect our world and water supply for the future, we need to transform the way we create and use energy. And, as we face the challenges of a growing population and unpredictable weather, we're pushing ourselves to spread the word about water, encouraging our customers to save water and educating future generations about the importance of the water cycle.

Changing weather patterns will affect the amount of water we have to use, reducing London's available supplies by around 180 million litres a day by 2085.

In this update, we'll:

1. Describe our challenges, as well as how we're responding to them and embedding responses in our plans
2. Update you on our progress towards becoming a climate resilient business

Our world in weather

2010

April: Start of two-year drought

November to December: Severe winter weather with very low temperatures and significant snowfalls

2011

April: Unusually warm spring and a persistent lack of rainfall

2012

March: End of the equal driest two-year period on record since 1910

April to July: Wettest spring/summer on record since 1766

November: One of the wettest weeks in the last 50 years

2013

March to April: Severe winter weather with very low temperatures and significant snowfalls

July: Temperatures exceed 28°C on eight days

2014

January to February: 12 major storms cause widespread damage

2015

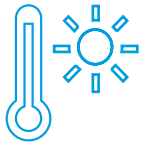
July: One-day heatwave with high temperatures across South East England (36.7°C at Heathrow)

2016

September: Heatwave, torrential downpours and flash flooding in South East England, with UK's hottest September temperature (34.4°C) since 1911

2017

June: Temperatures exceed 28°C across parts of England (34.5°C at Heathrow)



2018

February to March: Severe winter weather with very low temperatures and significant snowfalls (Beast from the East)

June to August: Warmest summer since 2006, driest since 2003 and sunniest since 1995

2019

July: Hottest temperature on record (38.7°C in Cambridge)

38.7°C

2020

February: Wettest on record since 1862

August: Heatwave in South East England

October: UK wettest day on record (Storm Alex)

Our approach to climate change

Developing a forward-thinking plan

The turbulent weather patterns we've experienced over recent years have tested the resilience of our services. It's one of our biggest challenges – but it offers a great opportunity to do things differently.

Although it remains uncertain how severe the impacts of climate change will be, our approach to tackling it is clear. We're adapting our business to meet challenges and play our part in mitigating them. This approach is a cornerstone of our commitment to becoming more sustainable.

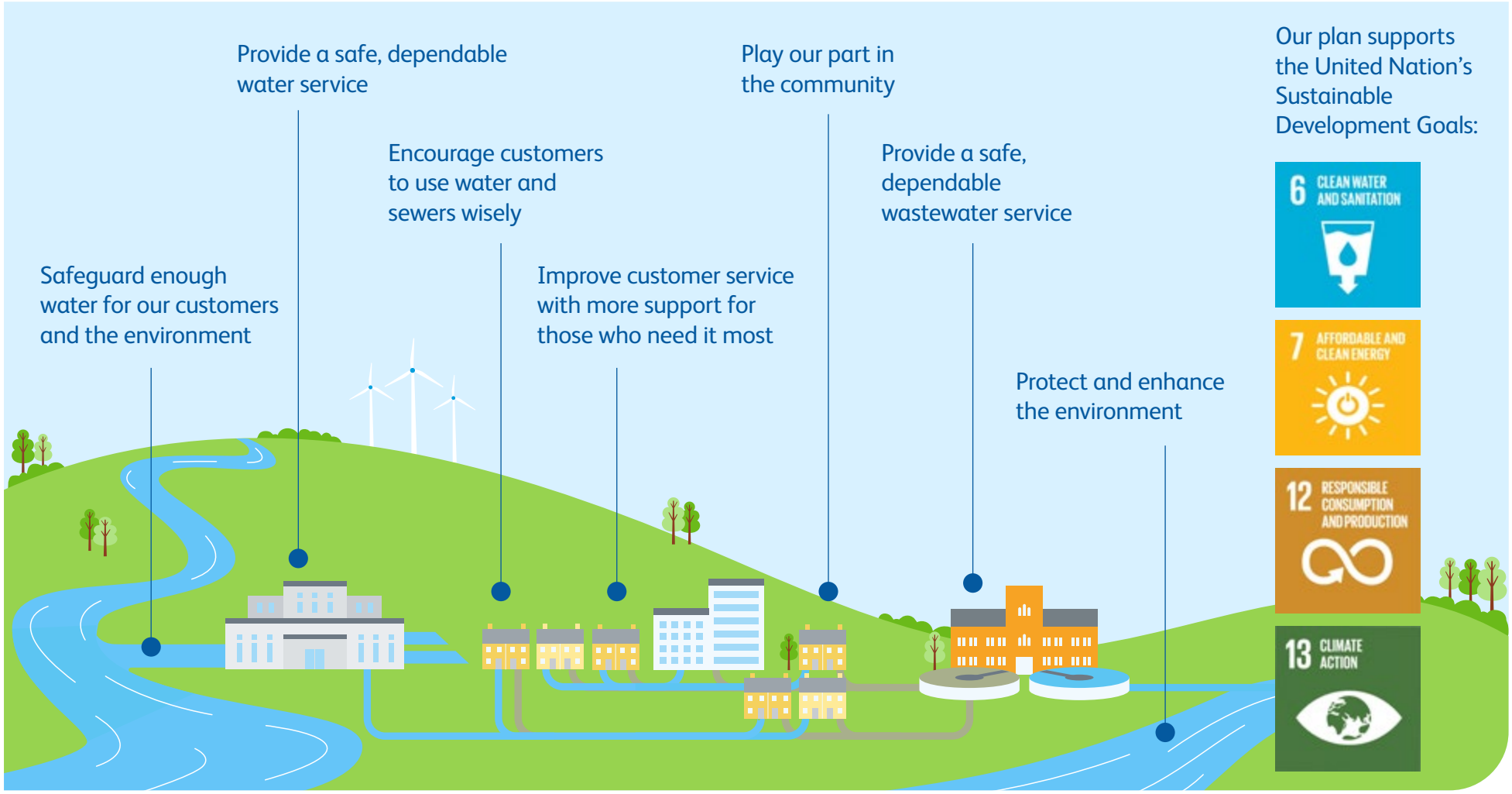
While reviewing the potential impact of climate change on our business, we've identified themes tying together key issues: too much, too little or the wrong kind of water. To address this we're refreshing our 25-year-plus plans for both water resource management and drainage and wastewater management that explicitly take climate change and its uncertainty into account.

During the planning stage for our 2020-2025 Business Plan, we gathered insights from over one million customers to understand their expectations of our water and wastewater services. We've used this feedback to shape a plan that puts customers and communities at the heart of everything we do.

In March 2018, we faced the Beast from the East, the UK's most significant cold spell since 2010, quickly followed by the joint-hottest summer on record.

A snapshot of our plan

Over the past 10 years, we've taken action to improve our climate resilience – but there's still much more to do. We want to:



Predicting the unpredictable

There's always more we can do to improve our operational resilience. At a minimum, we must maintain an acceptable level of service for customers and protect the environment in reasonable conditions. But to go above and beyond and evolve for the future, we need an effective response and recovery plan for when things go wrong. We also need to be able to apply any lessons learnt from previous extreme weather events.

In the ten years since our first Adaptation Reporting Power (ARP) update to the Government, a multi-year drought, record-breaking temperatures, extreme wet weather and the Beast from the East have all challenged our ability to serve customers. While not weather-related, the Covid-19 pandemic has also challenged our resilience.

We're developing a robust incident management process and structure that operates 24 hours a day, 365 days a year. It identifies potential incidents, so we can respond quickly and intervene as soon as possible to mitigate risks and minimise disruption to our customers.

We review every incident to understand its root cause and consider any operational and strategic learnings as part of our continuous improvement process. If longer-term strategic interventions are required, we feed this into our other business planning processes, such as water resource and drainage management planning.

In a 1 in 1,000 year river flooding event, around 75% of our above ground assets would continue to operate for our customers.

Reducing the impact of flooding on customers

Flooding from river water (fluvial) or surface water (pluvial) has the potential to affect delivery of the essential service for our customers. It's a complex issue, with responsibility shared across a range of organisations.

Many of our water and wastewater treatment works are located close to rivers so we can abstract water to turn into drinking water and return treated effluent easily. While this makes practical sense for current and historical operational efficiency, it does increase the potential risk of flooding from our rivers. There's also a risk of flooding from surface water and groundwater.

Over the past five years, we've taken steps to reduce the risk of flooding during extreme weather events, such as installing flood doors, raising the height of electrical panels and the purchase of temporary flood defences to protect critical buildings. We've also carefully assessed flood risks to understand how many of our above ground assets would be affected by flooding events then prioritised responses in those areas.

Our latest assessment

Return period flood event	River flooding (% of our assets at risk)	Surface water (% of our assets at risk)
1 in 10 year	17 %	21 %
1 in 200 year (with no future climate change allowance)	23 %	46 %
1 in 200 year (with a future climate change allowance)	26 %	48 %
1 in 1,000 year	26 %	57 %

Protecting customer service

Between 2015 and 2020, we reduced the risk of flooding that would have impacted our activities at wastewater sites serving a population equivalent of 1,569,343 customers – a huge step forwards. We also improved flooding resilience to future extreme rainfall events at clean water sites providing a total of 755 Ml/d of water service.

Our infrastructure resilience

We used the four Rs from the Cabinet Office's Infrastructure Resilience Components (2011) to inform our approach to our site upgrades.

Measures taken

Resistance

- Installing flood walls around site perimeters and individual assets
- Installing flood doors and air vent covers
- Waterproofing buildings
- Using demountable flood barriers at sites without permanent flood resilience measures

Reliability

- Raising electrical panels
- Maintaining communications and telemetry equipment during incidents

Redundancy

- Re-zoning water supplies to keep customers' taps flowing

Response and recovery

- Creating Flood Emergency Response Plans at high-risk sites to detail the actions our teams should take, including which critical assets to protect and where safe access routes are
- Providing potable water and removing foul water using tankers

Examples of our resistance measures on-site

Mitigating risks

Aligning our approach

Since our last update in 2016 we've updated our climate change risk assessment to better inform our corporate risk management framework, which helps internal stakeholders understand our climate change risks and the impact they could have on our operations. We're actively consulting key stakeholders as we embed this across the business.

Our corporate risk management process is aligned with the Risk Management International Standard ISO 31000. Our framework covers all types of risks that could impact the achievement of our purpose and strategic objectives, including (but not limited to) climate change.
We regularly update on our risk position through our Annual Report and Sustainability Report.

We categorise each identified risk as strategic, operational, compliance or financial and align it to one of our principal risks within these categories. Each principal risk is sponsored by a member of our Executive team, and we assess the financial impact of key risk events and scenarios each year through our long term viability statement.

Our aim is to manage risk effectively and in line with our risk appetite, which reflects the fact it's not always possible to reduce risk to zero. We make every effort to maximise potential opportunities, minimise the adverse effects of risk and increase our ability to effectively deliver value to our customers, people, communities, environment, stakeholders and shareholders.

We've reviewed and updated our climate change risk assessment, originally prepared for the first reporting period in 2011 (ARP1) and revised for the second reporting period in 2016 (ARP2), for our ARP's third reporting period (ARP3).

Thames Water's combined Annual Report and Sustainability Report 2020-21

Summary of our principal risks for 2020-21

Principal Risk	Risk Trend
Strategic	
1. Environmental protection and climate change	↑
2. Political, regulatory, legislative, and societal changes	→
3. Maintaining the trust and confidence of stakeholders	→
4. Business planning and delivering transformational change	→
Operational	
5. Supply of enough 'wholesome' water	→
6. Collection, treatment and recycling of wastewater	→
7. Physical and cyber security	→
8. Information and operational technology	→
9. Customer service	→
10. People	↓
11. Health, safety and wellbeing	→
12. Supply chain management	→
13. Understanding our assets	NEW
Compliance	
14. Legal and regulatory compliance	↑
Financial	
15. Financing our business	→

Risk trend key

↑ Increasing

→ Stable

↓ Decreasing

Our ARP1 and ARP2 risk assessment

Likelihood	Consequence					
			1	2	3	
1		1	2	3		
2		2	4	6		
3		3	6	9		

Our revised ARP3 risk assessment

Likelihood						
5	5	10	15	20	25	
4	4	8	12	16	20	
3	3	6	9	12	15	
2	2	4	6	8	10	
1	1	2	3	4	5	
	1	2	3	4	5	
	Impact					

Adjusting our risk bands

We've taken steps so that our climate change risk assessment better informs our corporate risk management framework. For more information see our 2020-21 Annual Report and Sustainability report.

Although the three-point likelihood and impact scoring divisions in our ARP1 and ARP2 climate change risk assessment partially aligned with our latest corporate risk assessment matrix, we've now increased the number of divisions of likelihood (probability) and impact (consequence) from three to five (one being remote/negligible, and five being almost certain/major). We've also undertaken a backwards compatibility assessment with ARP1 and ARP2 risk scores to allow for future comparison.

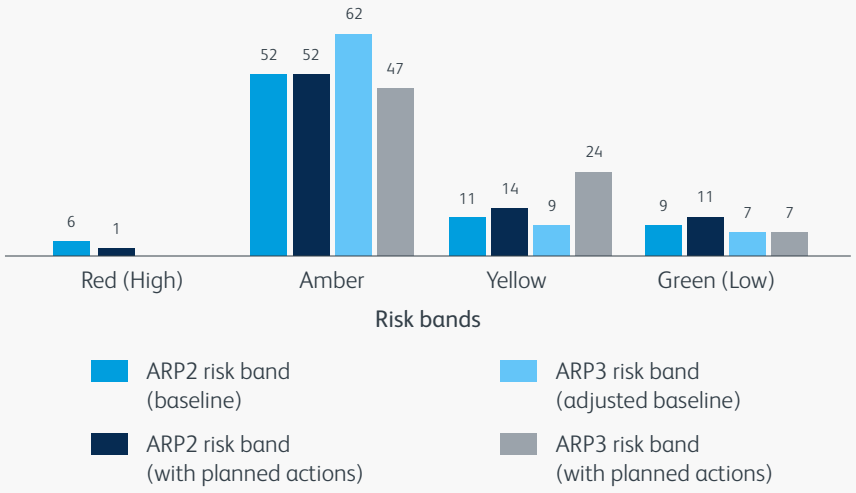
This approach will inform clearer, more consistent consideration of current risks at a corporate level. We assign each risk a score between one and 25 using the green, yellow, amber and red thresholds in the table below. As we make progress, risks in the amber and red bands will shift towards the green and yellow bands.

Risk priority band	Risk band lower threshold	Risk band upper threshold	Current operational risk	Action status
Green	1	4	Low	Monitored / no action required
Yellow	5	7.5	Low/medium	Sufficient action plan in place
Amber	8	12	Medium	Improved action plan required
Red	15	25	High	No action plan in place / incomplete risk understanding

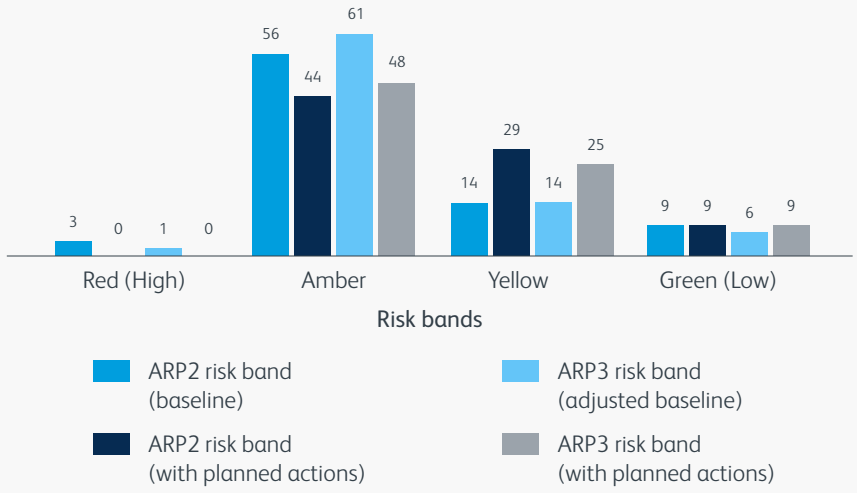
Understanding our risks

We have used our new banding system to review our water and wastewater risks. The graphs below compare the number of risks in each priority band for ARP2 and ARP3 using a baseline scenario as well as a scenario taking planned actions into account.

Number of water risks by priority band



Number of waste risks by priority band



In ARP2, there were no red water risks and only one red waste risk (direct asset flooding) with no action plan in place. Once our planned ARP3 actions are in place, there should be no red risks.

However, the number of amber water and waste risks has now increased from ARP2. This is due to:

- Six water risks and three waste risks shifting down from red as a result of our ARP2 actions
- Green and yellow risks shifting up to amber as a result of the updated risk assessment for ARP3

We will use the information from our climate change risk assessment to inform our understanding of actions we could take to tackle the amber risks. We're also committed to using our 'watching brief' approach for green and yellow risks. We'll monitor these periodically and promote or relegate them if their risk profile changes.

Looking ahead

By aligning our climate change risk assessment method with our corporate risk management framework, we've improved its definition and level of detail, while making sure it's still compatible with previous ARP reporting rounds. Our latest risk review allows us to focus on implementing actions that address key risks while continuing to monitor those considered low priority.

We have also considered the water sector risks identified by the UK Government and the Department for Environment, Food and Rural Affairs (Defra).

The UK's second national Climate Change Risk Assessment (CCRA) in 2017 represented the Government's assessment of the threats and opportunities we face from climate change. These challenges included significant flood risks, extended periods of high temperatures and heatwaves, water shortages, impacts on biodiversity and natural ecosystems, risks to domestic and international food production and trade, and risks from new and emerging pests and diseases.

We will consider the information included in the UK's third Climate Change Risk Assessment published on 16th June 2021 in our future planning.

Find out more about how we're adapting to these risks.

Keeping water flowing

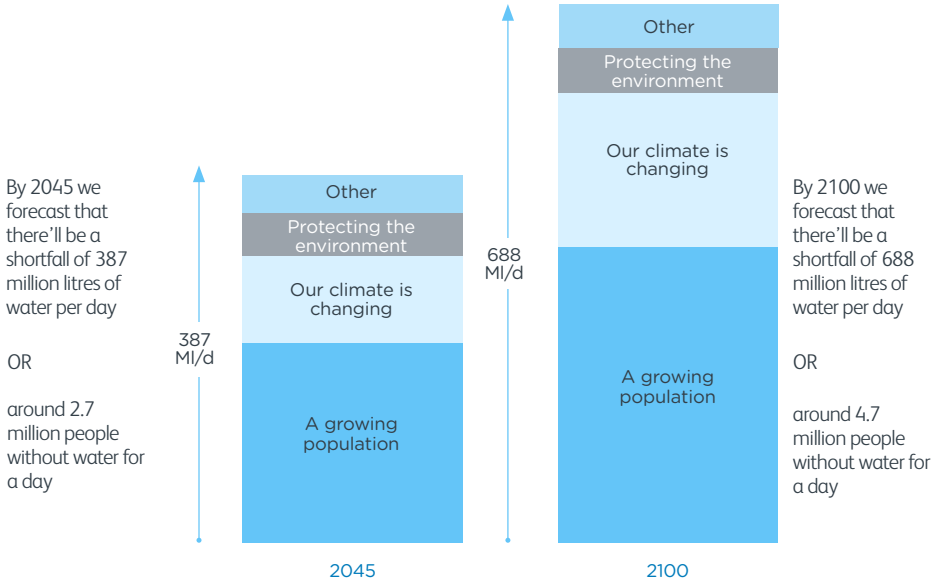
Understanding our challenges

Most people think of the UK as a rainy place, but the south east of England is actually one of the United Kingdom's driest regions. London gets less rainfall than Rome, Dallas and even Sydney!

Our changing weather patterns will reduce available supplies in London by around 180 million litres a day by 2085. While we need to take water from rivers and groundwater aquifers to provide high-quality drinking water to our customers, we also need to leave enough in the environment to protect the health of our rivers and wildlife.

Demand for water is likely to rise even further as our climate changes and population grows. Unless we act now, we forecast a substantial shortfall between the amount of water we have and the amount we need for the future.

Our predictions for the future



We forecast there'll be just under 2 million more people in our area by 2045 – the equivalent of Birmingham moving in. This will increase to approximately 3.6 million more people by 2100.

Building our Water Resources Management Plan

Since publishing our ARP2 in 2016, we've developed our Water Resources Management Plan 2020-2100 (WRMP19), which was approved by the Secretary of State for Environment, Food and Rural Affairs in March 2020.

This sets out the actions we'll take to deliver a secure, sustainable supply of water for our customers in London and the Thames Valley over the next 80 years – an essential service for everyday life, the wellbeing of the environment and economic growth. It goes beyond the 25-year minimum statutory planning period to provide resilience for current and future generations, meeting our customers' needs until the end of the century. This approach reflects the expectations of customers and stakeholders.

Developed in accordance with the Water Resources Planning Guideline, our Water Resources Management Plan (WRMP) also meets the more recent guidance set out in the Government's Strategic Policy Statement; Defra's Guiding Principles; and the National Infrastructure Commission's 'Preparing for a drier future' assessment.

We review our WRMP every five years to make sure we're delivering for our customers, protecting the world around us and explicitly taking the projected impact of climate change into account. Read or download our WRMP19 here.

Every day, we supply our customers with around 2.6 billion litres of drinking water – enough to fill 1,000 Olympic sized swimming pools.

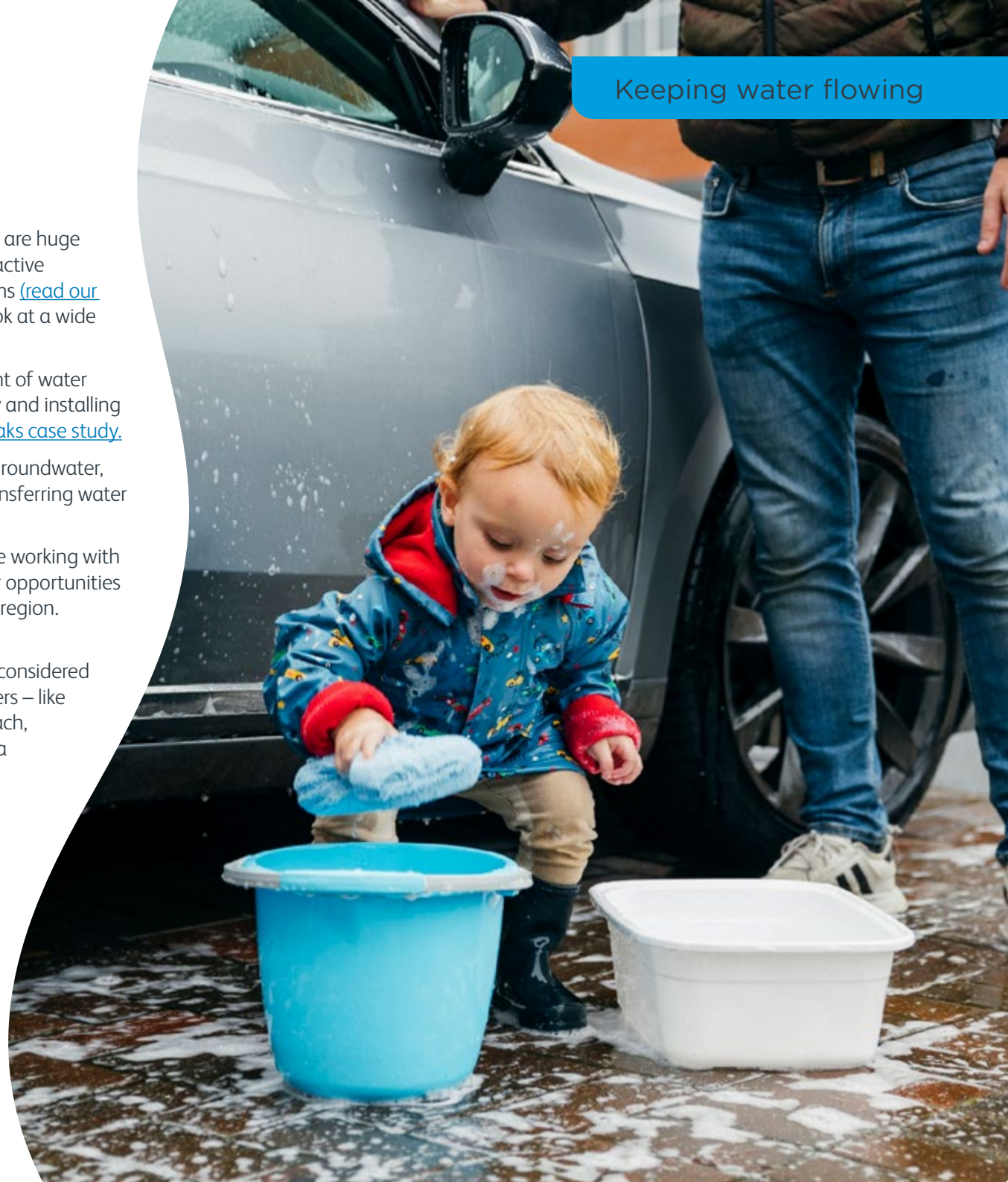
Considering climate change

The consequences of not planning ahead for climate change are huge – for society, the economy and the environment. To take proactive steps to make sure there's enough water for future generations (read our managing supply and demand case study), we decided to look at a wide range of options to plug the shortfall:

- Making the most of what we have by reducing the amount of water lost through leaks in our pipes, promoting water efficiency and installing smart meters in customers' homes. Read our detecting leaks case study.
- Finding new ways to boost our supplies such as sourcing groundwater, reusing treated wastewater from our treatment works, transferring water from other areas and storing more water

Through the Water Resources South East (WRSE) group, we're working with water companies across the south east of England to look for opportunities to share water and plan resilient water supplies for the whole region. Read our WRSE case study.

We know things will change over the next 80 years, so we've considered a range of possible futures, some more challenging than others – like more people living in our area than we predicted. This approach, called adaptive planning, means we're flexible and ready for a broad range of potential outcomes in the future. By looking ahead to 2100, we can lay the best foundation for future generations. You can find out more about this in Appendix U of our WRMP19.



Engaging with our stakeholders

We followed a careful process to develop a robust Water Resource Management Plan that aligns with Government guidelines and regulatory requirements.

Our Water Resource Management Plan framework

Our plan addresses the challenges we face, including climate change, and provides the best value for our customers and the environment.

Improving pipes

We'll invest in our network of over 31,000km of pipes, some of which are more than 100 years old. We currently lose around 23% of water through leaks and so between 2020 and 2025, we'll use smart technology to replace over 700km of water mains – enough to go around the M25 almost four times – and reduce leakage by 20%. By 2050, we plan to reduce leakage by at least 50% in comparison to the level in 2018.

Installing smart meters

By 2025, we'll install almost 700,000 more smart water meters. These will give us essential information about where water goes, helping our teams tackle leakage and our customers reduce how much water they use. By 2035, we're aiming to install smart meters on the connections to all properties in our region.

Reducing water use

We'll help our customers reduce their water use by providing free water-saving devices and tailored advice. By 2025, we'll complete a further 125,000 Smarter Home and Smarter Business Visits, providing advice and practical support to encourage the efficient use of water. We'll continue to work with schools, local communities, businesses and councils to reduce water use sustainably.

Boosting water supplies

By 2030, we'll introduce several innovative schemes, including a new aquifer storage and recovery scheme, wastewater reuse and a water transfer scheme. After 2030, we'll continue to develop new water sources, such as transferring more water into our region from the Midlands and the North West and increasing water storage through developing a new reservoir.

Protecting the environment

We'll reduce the amount of water we're allowed to take from rivers and underground sources. By 2025, we'll reduce our licensed abstraction by 18 million litres per day from the River Cray and River Chess catchments. And we're aiming to stop all abstractions that adversely affect vulnerable chalk streams and other watercourses by 2050.

Boosting drought resilience

Delivering on our WRMP19 will provide a 1-in-200-year resilience to drought. This is a significant improvement from the 1-in-100-year level of protection in our statutory Drought Plan, which sets out the actions we'd take to maintain essential supplies of water and protect the environment in a drought situation.

Looking ahead

In March 2020, the Environment Agency published a national framework which looks at the country's need for water as whole – not just the water needed to supply homes and businesses but also the water needed for industry, agriculture and the environment. It considers the long-term challenges facing all water-using sectors and forecasts the need for water both nationally and regionally. Most importantly, it sets the focus for planning future water supplies at a regional level, looking beyond individual water company boundaries.

To make the best use of water and boost our supplies, we used this as well as our WRMP19 to build a five-year investment plan that will take us from 2020 until 2025. We'll continue exploring our options to find new sources of water for the future and provide a progress update as part of our annual review.

Through Water Resources South East, we're working very closely with the five other water companies in south east England to develop a multi-sector, regional resilience plan, which will cover climate change and the latest UK Climate Projections (UKCP18). This plan will be the foundation of our next Water Resources Management Plan (WRMP24), which we'll publish for consultation in 2022. We'll continue working with stakeholders and customers as we shape our water future.

Managing wastewater

Understanding our challenges

Long-term planning for wastewater and drainage is a challenge, as it involves pulling together a large number of smaller systems that are inherently very focused on local issues. This means we don't always have the flexibility to develop region-wide solutions.

The requirement for us to discharge the flow we treat back into the environment is fixed, as it provides a critical contribution to the health of our rivers. It isn't as easy as just moving flow around, as this could affect our communities and environments elsewhere.

While long-term planning for wastewater across our region isn't currently a statutory requirement, we're tackling these challenges with our regional Drainage and Wastewater Management Plan (DWMP). As responsibility for wastewater management is widespread, we're collaborating with multiple stakeholders to set out how we'll manage it more effectively in the future.

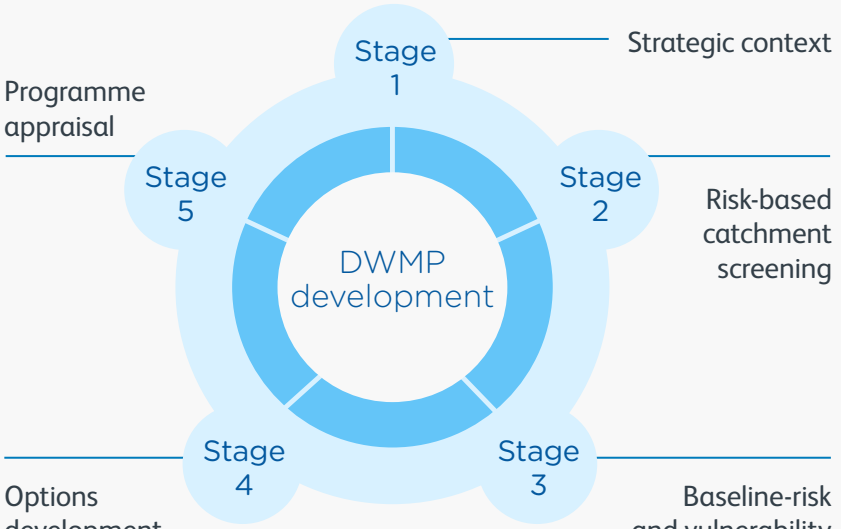
This is the first time we'll produce a long-term plan for our wastewater business as a whole. Between 2014 and 2019, we consulted on a long-term view for wastewater in London, known as London 2100: The Case for Change. London was the focus due to its dense population and diverse environment, which posed a huge challenge for long-term planning. We've now built on these insights to develop plans for our regional DWMP.

We'll review our DWMP on a five-year basis to match our price review process. Our first DWMP will be ready for consultation in the summer of 2022, with final publication in March 2023.

Building our Drainage and Wastewater Management Plan (DWMP)

In 2019, we actively supported the development of a national drainage and wastewater framework by regulators and industry bodies including Ofwat, Defra, Water UK, the Environment Agency, Welsh Government, Natural Resources Wales, ADEPT, Consumer Council for Water (CCW) and Blueprint for Water. Our Head of Environmental Engagement, has been involved from the start, setting the scope for DWMPs across the industry as co-chair of the framework's steering group.

Our DWMP will eventually deliver a strategic action plan for the next 25 years. Working through the five stages of the framework helps us understand the long-term pressures affecting our region and their impact on our service, customers and the environment. We also use three planning periods (2025-30, 2025-35 and 2025-50) to assess the potential impact of each risk, explore how they might progress and determine which areas to invest in. Find out more.



Considering climate change

For our first DWMP, we're prioritising the pressures the industry believes will have the greatest impact on drainage and wastewater services and that can be forecast using nationally agreed data. These are climate change, population growth and urban creep.

Over the next 25 years and beyond, changing weather patterns will create major challenges for our wastewater services, increasing the risk of flooding and reducing the efficiency of our wastewater treatment works and drainage assets. This may also affect sewer flows, water quality, ground conditions, the sensitivity of receiving watercourses and the demand for sludge recycling. We aim to systematically address these challenges by working with our stakeholders and ecosystems to deliver resilient services.

We've used UK Climate Projections (UKCP09, UKCP18 and various emission scenarios), UK Water Industry Research (UKWIR) reports and methods and the DWMP Framework to guide how best to obtain, interpret and use climate change data in our DWMP.

This matches the approach to our existing Water Resource Management Plan, which has been through several more planning cycles and iterations.

In 2020, we modelled the impact of climate change on our network and assets for a number of time periods 2030, 2035 and 2050. Some will be more challenging than others – for example, increasing rainfall will likely need long-term interventions at a local level.

As climate change is a significant driver in decreasing water supplies and increasing sewer flooding, we plan to develop nature-based solutions that support the outcomes of both our DWMP and WRMP.

Engaging with our stakeholders

We can't create our DWMP alone. That's why we're working with organisations and groups that have a shared responsibility or interest in drainage, flooding and environmental protection to develop the most comprehensive, sustainable and collaborative DWMP we can.

Informed by the industry-agreed framework and existing planning boundaries/groups within our region, we're engaging with our stakeholders across three levels:

Level 1

Region-wide forums

Including the Environment Agency, National Infrastructure Commission, London councils and Transport for London, who cover the whole of the Thames Water region.

Level 2

Catchment partnership and Thames Regional Flood and Coastal Committee sub-committees (TRFCC)

Our 27 Catchment partnerships and 13 TRFCCs

Level 3

Local level engagement

Including local organisations, interest groups and the general public, for example through our attendance at flood forums.

Making progress with our DWMP

So far, we've engaged with stakeholders to complete the first three stages of our DWMP framework. We're working with our stakeholders to deliver at Stage 4: Optioneering, and we'll publicly consult on our plan in 2022.

1 Scope and context

Through consultation with our stakeholders we agreed 12 planning objectives for the first cycle of our DWMP: reducing internal sewer flooding, reducing external sewer flooding, reducing the risk of sewer flooding in a 1 in 50 year storm, preventing sewer collapses, reducing pollution incidents, reducing misconnections, reducing surface water run-off, ensuring sewage works compliance, ensuring dry weather flow compliance, improving storm overflow performance, enhancing wellbeing and achieving net zero emissions.

2 Initial catchment screening

We presented the outcomes of our Risk-Based Catchment Screening (RBCS) to our stakeholders through existing forums. You can view these on our public portal. A total of 382 catchments went through to the next stage for catchment risk analysis, accounting for 99% of the population we serve.

3 Catchment risk analysis

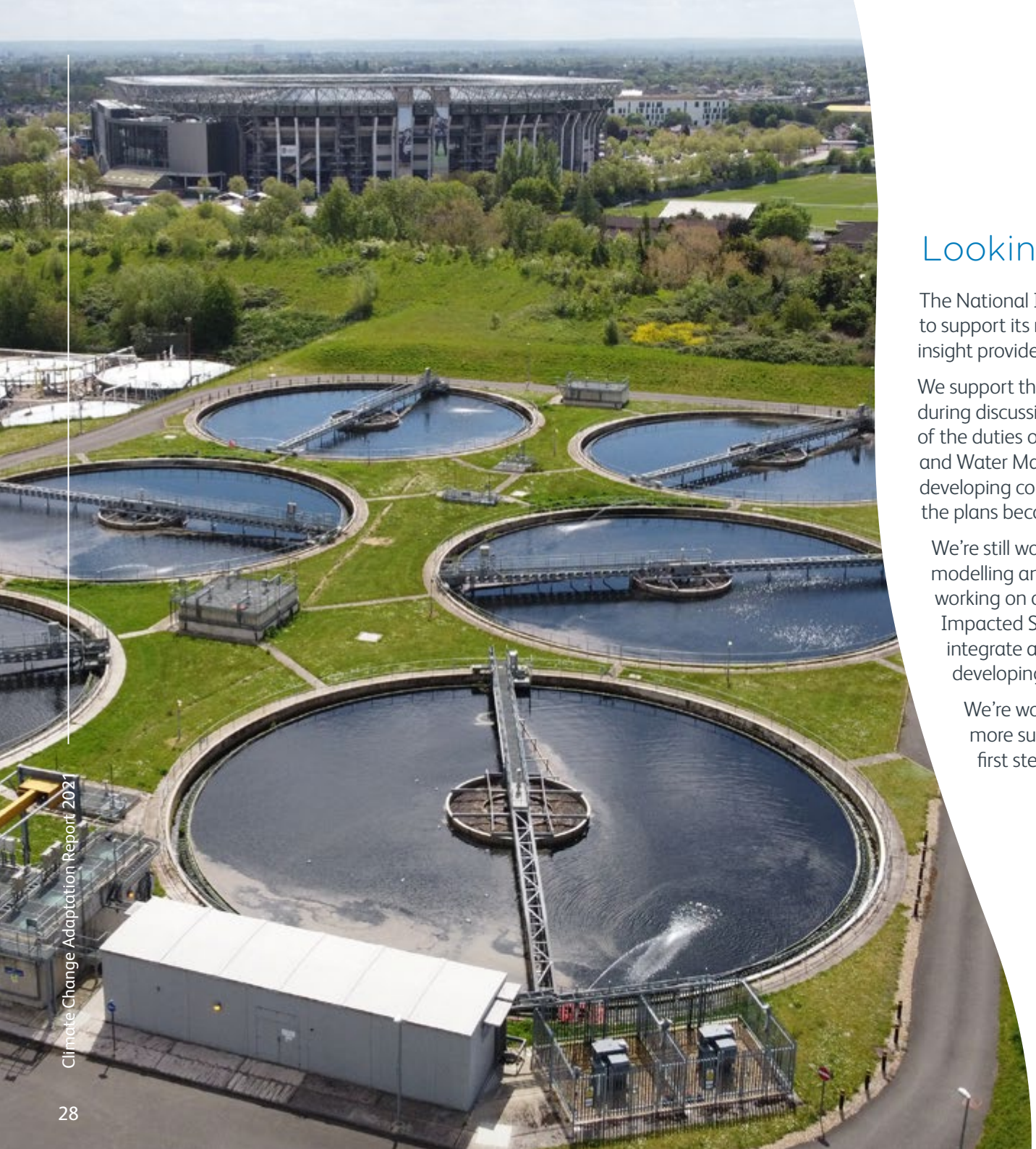
To present the outcomes of our Baseline Risk and Vulnerability Assessment (BRAVA), we carried out 70 virtual workshops in line with coronavirus restrictions and asked stakeholders from Lead Local Flood Authorities (LLFAs), Catchment Partnerships and the Environment Agency for their feedback.

We used this information to update our catchment maps and prioritise catchments to take forward to Stage 4.

4 Optioneering

We've worked with Atkins to map out this process during 2021.

Because of the level of technical detail, we'll be using online webinars, tailored workshops and technical drop-ins to engage stakeholders. We'll continue seeking support from Thames Flood Advisors to keep LLFAs up to speed through 2021.



Looking ahead

The National Infrastructure Commission is using this first round of DWMPs to support its resilience planning work, and we're building on the powerful insight provided by our London 2100 research on regional mega-trends.

We support the statement made by Minister Rebecca Powell in Parliament during discussions on the Environment Act, committing to the expansion of the duties of the Risk Management Authorities (RMAs) under the Flood and Water Management Act 2010. This would be a great step towards developing collaborative and partnership-led DWMPs and could lead to the plans becoming a statutory requirement in the future.

We're still working to align our DWMP and WRMP's climate change modelling and stakeholder engagement wherever possible. We're also working on our Surface Water Management Plans and our Groundwater Impacted Sewerage System Plans separately. Our long-term aim is to integrate all these plans within the next 25 years. In the meantime, our developing understanding of DWMP will inform our PR24 planning.

We're working to make the future of wastewater more streamlined, more sustainable and partnership-led, and our DWMP is the first step.

Looking ahead – in action

We're committed to becoming more climate resilient, managing the unavoidable impacts of climate change and reducing our net operational emissions to zero.

Over the next five to ten years, we'll work to further reduce leakage, update our long-term water resources plans and produce our first Drainage and Wastewater Management Plan. Below are some of our key goals.

Carbon

We'll generate 517 GWh/year of renewable energy by 2025

By 2030, we'll have net zero operational carbon emissions
read our next stop, net zero case study

Wastewater

Disconnect 65 Ha more land from mains drainage using sustainable drainage systems read our sustainable drainage in action case study

Ensure the Thames Tideway Tunnel is ready to convey flows to Beckton

Deliver 757 green WINEP schemes

Complete our Drainage and Wastewater Management Plan to replace current drainage strategy frameworks

Trial next generation 'digital sewer level monitors' to help pinpoint emerging problems before they become serious blockages.

Leakage

Replace 700 km water mains

Install almost 700,000 smart meters in London

Reduce leakage by 101 Ml/d to a level of 493 Ml/d

Continue to publicly report leakage performance

Water Resources

Make water efficiency savings of 15.5 Ml/d

Give customers monthly rainfall and reservoir level updates

Maintain our Security of Supply Index (SOSI) at 100%

Continue the Abstraction Incentive Mechanism (AIM) at 5 locations

Improve our resilience to a 1 in 200 year drought by 2030

Continue working with Water Resources South East on regional water resource plan read our WRSE case study

Looking ahead – in action
continued

Environmental, Social Governance (ESG)

Be fully aligned with Task Force on Climate-related Financial Disclosures requirements by 2022

Continue to positively manage our activities to access green and finance opportunities

Produce an ESG statement on our performance over the past 5 years

Engage with customers and stakeholders on our plans for PR24 and our vision for 2050

Plans

Update our Drought Plan with new information, challenges, and targets, including resilience to a 1 in 200 years drought event

Produce Water Resource Management Plan

Produce Drainage and Wastewater Management Plan

Customers

Have 300,000 customers on social tariffs by 2025

Have 410,000 customers on Priority Services Register by 2025

Performance Commitments

Deliver 3 catchments through our smarter water catchments programme
read our smarter water catchments case study

Increase Biodiversity Net Gain by 5% at 253 of our sites

Undertake a natural capital assessment of all our landholdings

What have we done?

Between our last Climate Change Adaptation update in 2016 and 2020, we've made progress across a wide range of areas to improve our climate resilience. This includes: reducing leakage, long-term water and wastewater planning including climate change, reducing flood risk and innovating how we deliver customer service to increase resilience. Below are some of the key things we've done.

Carbon

Self generated and used 1362 GWh of renewable electricity in AMP6

305 GWh of renewable electricity self generated and used in 2019/20

Announced net zero operational emissions by 2030 ambition read our next stop net zero case study

Wastewater

Disconnected 21 Ha of land from mains drainage using sustainable drainage systems

Completed £700 million Lee Tunnel project – to prevent 16 million tonnes of untreated sewage entering the River Lee each year read our sustainable drainage in action case study

Developed 26 local drainage strategies

Carried out 5 sewage catchment studies

Invested in technological capability of our Wastewater Management Centre read our real-time visualisation – wastewater case study

Leakage

Installed over 400,000 smart meters – contributing to >33 Ml/d leakage reduction in 2019/20

Installed 27,000 acoustic loggers helped detect over 65 Ml/d of leakage in 2019/20

Replaced 527 km of water mains

Reduced leakage by 47 Ml/d to 595 Ml/d since 2016

Provided 6841 free customers leak repairs

Created a public report on monthly leakage performance

Developed our 'What DMA' approach read our detecting leaks case study

Water Resources

Reduced water consumption by 34.42 Ml/d by providing water efficiency devices to customers

Kept customers updated on rainfall and reservoir levels

Maintained Security of Supply Index (SOSI) of 100%

Implemented Abstraction Incentive Mechanism (AIM) at 5 locations – reducing abstraction from environmentally sensitive sources.

Current level 4 drought protection – equivalent to a 1 in 100 year drought

Working with Water Resources South East to develop regional water resource understanding

What have we done?
continued

Environmental Improvements

Helped develop and signed the CISL Catchment Declaration

Improved or protected 10 water bodies through catchment management

Created over 150,000 m^2 of wetland

ESG

Issued a £705 million Green Bond download our Green Bond Impact Report 2019/20 here

Engaged with over 120,000 students on water issues through our school's education programme

Published an Environmental, Social Governance (ESG) statement on our performance over the past 5 years

Engaged more than 1 million customers in the development of our 2020-25 business plan

Plans

Produced Drought Plan for the steps we'll take in a drought read or download our Drought Plan

Agreed Water Resource Management Plan read or download our WRMP19

Began development of integrated Drainage and Wastewater Management Plan

Customer

150,000 customers on social tariffs

Over 80,000 customers on Priority Services Register

Flooding

Water sites providing 755 MLd of service made more resilient to extreme rainfall events.

Wastewater sites serving a 1,569,343 population equivalent made more resilient to extreme rainfall events.

Assessed our resilience to a 1 in 1,000 pluvial flooding event

Case studies

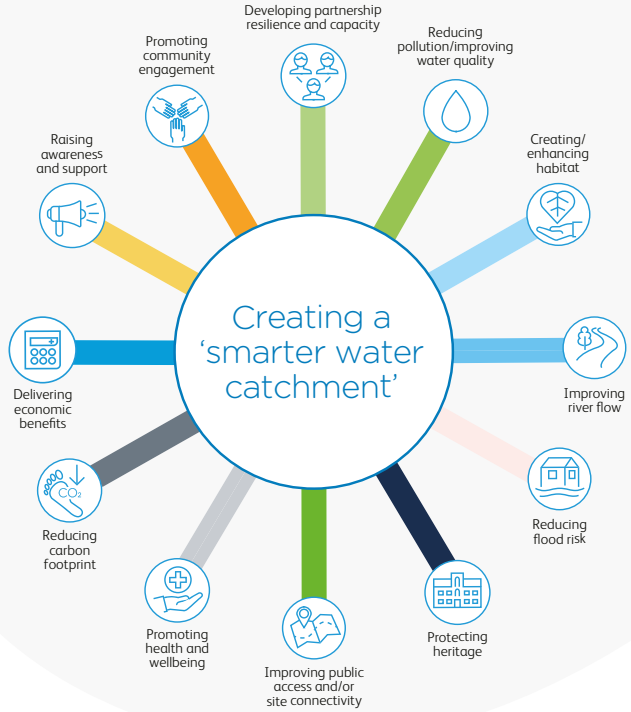
Smarter water catchments

The background

Catchment management can offer better value and greater benefits than more traditional hard engineered solutions. However, it's usually restricted to an individual organisation working to address a single issue, such as pesticide run-off from agricultural land into local rivers.

We believe we can achieve more by taking a systems-based view of the environment, collectively addressing multiple challenges, including climate change, and co-delivering solutions that make the most of opportunities on an even bigger scale.

This is the basis of our 'smarter water catchments' initiative. We're putting this approach into practice to understand how we can achieve key benefits while working in a more holistic way.



Our response

Water is more precious than ever as we face climate change, population growth and changes in consumer behaviours. Add in more extreme weather events, ongoing urbanisation and a fundamental shift in our land-use patterns, and it becomes even harder to manage this resource.

Challenges around our ageing infrastructure and, in some cases, the outdated designs of our wastewater systems, combined with the public misconception of what can safely go down drains, can lead to unwanted pollution incidents.

By 2045, we estimate there'll be an extra two million people living in the Thames region. We'll need to find new ways to meet their growing expectations for clean, green and blue spaces to enjoy.

The water quality of our rivers is fundamental, not just for our customers but for the habitats and biodiversity of species that depend on them. We must take action to share the value of water and work with upstream and downstream users across our region to protect our river catchments for the future.

Our approach

The purpose of our smarter water catchment approach is to:

- Understand and value our environment
- Set a precedent for future ways of working
- Create stronger partnerships with stakeholders
- Inform PR24 investment and decision-making
- Quantify additional benefits
- Understand the contribution to public value

Over the next four years we're investing £9 million to trial initiatives in three catchment within our region.

We're collaborating with our partners and communities to find and co-deliver innovative solutions to the environmental challenges we all face. In many cases, this will lead to activities that also meet the individual priorities of the organisations involved. We're identifying opportunities in three trial catchments across our headwaters, floodplains and rural communities through to our urban areas.

Over the next four years we'll be investing over £9 million to trial this initiative in three catchments within our region: River Chess, Crane Valley and the Evenlode. This is the seed funding we need to set up new and improved governance frameworks, financial models and delivery roadmaps to ensure we meet our objectives.

We've worked closely with over 67 organisations to determine a vision for each catchment and to co-create and co-deliver a plan for the next 10 years. We've published these plans on our website.

Working with Water Resources South East

The background

Water Resources South East (WRSE) is an alliance of Thames Water and the other five water companies that cover the south east region of England, originally set up in 1996. Its aim is to secure the water supply for future generations through a collaborative, regional approach to managing water resources.

WRSE also benefits from the input of Advisory Members, namely its regulators, such as the Environment Agency and Ofwat, while representatives from Defra also attend its meetings.

Securing future water supplies requires greater collaboration among regional water companies and other sectors, regulators and stakeholders across the UK.

WRSE's ambition

WRSE has five simple ambitions for water resources and water use in the south east of England:

- Everyone understands where water comes from – so they play their part in using less than they do now
- A prosperous economy with enough water available to support the future needs of businesses and industries
- To use only sustainable sources of water so people and nature can thrive
- Making any new water resources accessible and valued public amenities
- A smart and more flexible network with minimal leakage and the ability to adapt to different circumstances in the future

Developing a Regional Resilience Plan

Central to WRSE's activities is the development of a regional resilience plan for all users of water in the south east of England. This plan will be used as a blueprint for water supply investment by each water company in the region including Thames Water to ensure that we can provide an affordable, resilient and sustainable water supply that delivers for the public, industry and the natural environment for years to come.

Given the scale of the challenges we face, including climate change and population growth, securing a sustainable future supply of water requires a more collaborative response between the region's water companies and other national players. It needs to go beyond reducing leaks and encouraging more efficient water use.

Delivering the plan

Our joint vision with WRSE is to produce a multi-sector regional resilience plan for the south east of England. The resilience plan will go beyond public water supplies and considers the water needs and challenges of other sectors, such as agriculture. And it will have people, the environment and growth at its centre.

The plan will inform decisions on the strategic interventions, including infrastructure, demand management and catchment measures, which will make the South East more resilient to a wide range of future shocks and stresses so customers, businesses, industry and the natural environment have the water they need to prosper.

Importantly, the WRSE plan will link to other regions in the UK so that we contribute to the bigger national picture on resilience and drive greater collaboration and innovation.

For more information please visit the WRSE web site: wrse.org.uk/

Managing supply and demand

The background

Since our last ARP report, we've significantly improved our understanding of and capability to monitor our operational systems. This means we can better predict and manage the performance challenges associated with providing water to our customers 24 hours a day.

We've developed a tool to allow us to visualise, at the system level, our supply, demand and storage position.

Data – Insight - Action

Providing customers with clean water requires three key elements to be in balance:

- Supply: Being able to supply enough water from our water treatment works
- Demand: Understanding customer demand both forecast and actual
- Storage: How much treated water we have available to supply customers

Historically we've had a good understanding of individual components of our water supply situation, but we did not have good understanding at the regional level. We've applied systems thinking to our approach of managing supply, demand and storage across 49 component hydraulic systems.

We have developed a Supply Demand System Risk (SDSR) tool, which allows us to use existing data to visualise our supply, demand and storage position at the system level and use almost real-time actions to make sure our customers are always in supply.

Supply

The tool provides almost real-time updates on supply capability to identify any emerging issues and mitigate the consequences of any supply interruptions. It also allows us to make more informed operational decisions using actual and forecast supply data.

Demand

Demand forecasts were previously only recorded once a day, but the tool now provides near real time updates. The SDSR tool provides an overview of each of the 49 hydraulic systems across London and the Thames Valley to identify where expected demand is changing. The tool also generates automatic email alerts where demand forecasts are exceeded in three consecutive 15-minute periods in the same hydraulic system which ensures issues are flagged and responded to.

Storage

The storage component of the tool provides storage information at either the whole system or component system level. The tool updates every 15 minutes to provide near real-time data that can be used by operators in conjunction with supply and demand data to minimise the impact of supply interruptions on customers.

Time to impact tool

This allows us to undertake 'what if' analysis to determine impacts on storage capability. This is useful when, for example, there's an interruption to supply or to determine how long before a reservoir reaches its critical storage level or time to impact.

Headroom tracker

This component of the tool allows users to view historic, current and forecast levels of system 'headroom' to determine the expected availability of water at a regional area level. The tool uses our demand forecaster which is based on weather predictions and historical observed demands.

We work out headroom by subtracting demand from reliable supply levels to give a figure in megalitres. This helps us identify issues and develop plans, such as transfers, to deal with any potential storage issues or supply interruptions.

Outcome

Using existing data, we are able to take almost real time actions to ensure our customers are always in supply. The tool we've developed allows us to visualise our Supply, Demand and storage position at a systems level across London and the Thames Valley.

Detecting leaks

30% more leaks are found with acoustic logger data.

The background

Reducing leakage is one of our biggest challenges. So, identifying and repairing leaks is an important adaptation response, helping delay the need for major new water resource development and improve resilience including the impacts of climate change.

Since our last ARP report, we've significantly improved our understanding of and ability to monitor our operational systems. This helps us better predict and manage performance challenges, including weather, leakage and bursts. This played an important part in meeting our end of AMP6 leakage target.

The challenge

The identification and repair of leaks plays an important role in how we'll meet our challenging leakage target. We have over 300 Leakage Technicians, who are responsible for the detection of leaks. On average, we identify and repair around 1,000 leaks per week across around 1,700 District Meter Areas (DMA).

Despite the amount of investment and resource we were directing at leakage, we were still missing our leakage target and needed to approach finding and detecting leaks in a different way. One of our responses was to develop an App called 'Where DMA' to help improve the efficiency and effectiveness of our Technicians in finding leaks which then in turn improves the speed at which they can be repaired.

Where DMA

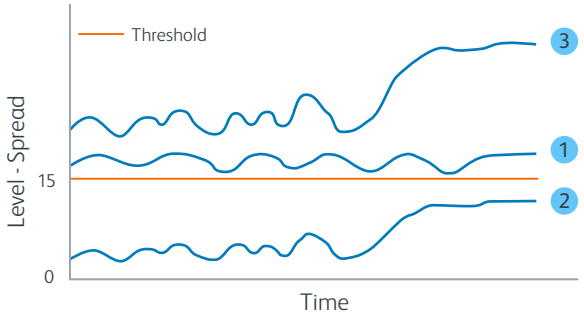
The app uses a combination of data science and a machine learning algorithm to analyse 20 years of existing data across over 12 factors – including: pipe age, pipe material, soil type, location, junctions – to identify those pipes more likely to leak. It then prioritises them from red – the highest risk-level – through amber, yellow and then to green – the lowest risk. The app then directs our technicians towards the areas of the DMA where the leakiest pipes are likely to be located. We've seen a 14 to 28% improvement in our technicians' productivity when they use the App.

Using data loggers to detect leakage

Historically, we used thresholds on our acoustic loggers to indicate we had a leak requiring investigation, however, this approach often either missed leaks or alarmed when there was no leak (see line 1).

Our new dynamic approach uses data from almost 26,000 acoustic data loggers and analyses changes in data from what is considered 'normal' for a specific location and any change would trigger a leak investigation (e.g. lines 2 and 3). This has improved detection by over 30%.

As shown in the diagram, under the previous approach, line 1 would have triggered an alarm and an unnecessary investigation because it is above a threshold. With our new approach, we can now identify a potential leak (line 2) when the background signal increases from its normal level even though it is still below the threshold previously used. Similarly, line 3 would have previously been considered a leak only because the background signal was above the threshold point, however, the tool can detect a leak with more confidence because there is a material change in the signal.



Taking care of water

The background

Most people think of the UK as a rainy place, but the South East of England is actually one of our driest regions. London gets less annual rainfall than either Rome, Dallas and even Sydney!

While we need to take water from rivers and groundwater aquifers to supply high-quality drinking water to our customers, we also need to leave enough in the environment to protect the health of our waterways and wildlife.

However, we can care for the water we already have by working together to save it where we can.

In 2021 we reached the milestone of installing our 500,000th smart meter as part of the biggest smart water meter programme in the UK.

The challenge

It's estimated that an extra 2.1 million people are due to move into our region over the next 25 years. This, combined with climate change, means that, without action, we face a potential shortfall of 350 million litres of water a day, between the amount available and the amount needed, by 2045.

Smart meters and Smarter Home Visits

Some of the ways we're addressing this potential shortfall is through our progressive metering and Smarter Home Visit (SHV) programmes. Smart meters and SHVs give our customers greater control over their water use and bills. They also enable us to understand where there's high consumption, so we can help those customers with water efficiency tips. They also help us find leaks.

Smart meter data and thousands of home visits each month have shown that a small number of big water users were disproportionately influencing average consumption data. After an SHV where we retrofitted water saving devices and fixed leaks for free, these high-consuming customers saved significantly more water than they did with our previous water efficiency approaches.

The WEE App

We've developed an industry leading Water Efficiency Engagement app – the 'WEE app'. It enables our in-home advisers to not only give personalised water savings reports, but also help customers in vulnerable circumstances sign up to our Priority Services Register, receive independent affordability assistance and the industry's first Greenredeem incentive scheme, which rewards customers for saving water, in real time.

Smart data

As the first UK water company to roll out a large-scale smart meter programme, we've now developed new analytics capabilities, enhanced performance commitments and converted data to insight – then into on-the-ground action.

Smart data lets us quickly and accurately identify high-use households and external and internal leaks. And we've developed visual dashboards, which monitor water savings delivered by our SHVs and allow us to track usage and leakage savings benefits. The recent addition of high-use alert emails helps flag customers with above-average water consumption and gives them immediate practical advice, helping them save water and money.

What might previously have taken up to a year can now be fixed in days.

Covid-19 and 'virtual visits'

In addition, the data from the meters has been central in helping us identify exactly where water's being used, reduce leakage and meet the unprecedented demand for water during the Covid-19 pandemic. Despite the challenges of the pandemic, we've continued to support our customers by setting up the sector's first and largest virtual water efficiency 'visit', using video/phone calls with customers.

Seeing the benefit

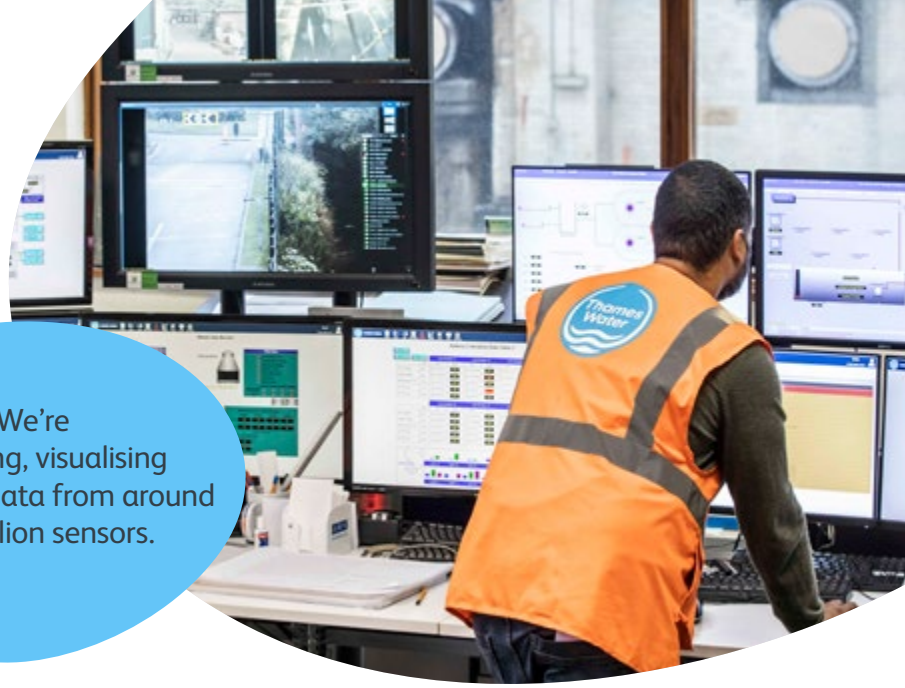
Benefits of our smarter water efficiency approach have included:

- Increasing the average savings per household from 36 litres per day to >80 litres per day – a 122% increase
- Delivering nearly 5,000 SHVs and 7,905 new virtual water efficiency visits during lockdowns, saving an average of 58 litres per day per household
- Helping to mitigate the increase in household water use associated with significantly higher household consumption during the pandemic

Visualising wastewater in real-time

The background

We're investing heavily in the technological capability of our Wastewater Management Centre (WWMC), where we manage our Wastewater networks. We've upgraded the centre to include our Central Geographical Information Systems (GIS) Room and to serve as the central repository for storing and managing the data from around 2.2 million sensors.



We're collecting, visualising and using data from around 2.2 million sensors.

Getting ahead of incidents

Our Central GIS Room contains sophisticated IT hardware, used to assimilate and visualise the data collected by sensors in real-time. This level of GIS capability allows the 'blending' of incomplete datasets to maximise the value of this enhanced monitoring programme.

Ultimately, the system will allow us to better understand where the stresses are in our networks and how these systems change over time. Climate change is the potential root cause of a number of the pressures the business faces, and this improved monitoring system will help us manage its impacts in a similar manner.

Geographical systems

A key step-change in our approach to monitoring was the decision to combine hundreds of individual wastewater assets into just 78 systems, based on catchment geography. For each of the 78 systems, we will be able to integrate management of pollution, flooding and customer service.

Intelligence Hub

Since our last ARP update in 2016, we've enhanced the capability of the WWMC by setting up an 'Intelligence Hub' (or iHub) which links the WWMC to our 'SCADA' (Supervisory Control and Data Acquisition) systems. The iHub helps us make sure we're collecting validated operational data that can be used for investment planning and storing it consistently across our business. This data collection will continue through the AMP7 investment period to prepare for PR24, ensuring we're planning investment with a much-improved level of understanding of weather and climate impacts.

Benefits of a systems approach

Our 'systems approach' will offer multiple benefits including:

- Early detection of issues – enabling response teams to be rapidly mobilised and provide timely intervention
- Enhanced monitoring – helping manage energy, carbon and cost
- Tailoring chemical usage demands to meet the specific requirements of individual sewage treatment works – reducing overall chemical use and reducing our impact on the environment

Sustainable drainage in action

SuDS solutions at Battersea's Nine Elms removed over 18 Hectares of surface water drainage from our sewers.

The background

In response to the large, high-profile "Nine Elms Partnership" project, which worked to transform an entire district of Vauxhall, South London, we've installed an ambitious and innovative sustainable drainage system (SuDS). It eases pressure on the sewerage system by stopping rainwater from entering it.

The challenge

This area, previously occupied by industrial and large commercial premises, was served by Victorian 'combined sewers', which receive both rainwater and foul water. The development work of the Nine Elms project, would put additional demands on the sewer network, which already faced extra pressure from climate change. So we decided to deliver an ambitious SuDS project to reduce the pressure on the combined sewer network and free up space.

Instead of running into the combined sewer network, rainwater that falls on the area between Vauxhall and Battersea Power Station is now channelled into large underground pipes and then flows into the Thames.

By working closely with project stakeholders, we were also able to provide an improved public amenity and enhanced biodiversity across the site.

Working with others

The project required close collaboration between Thames Water and the Nine Elms Partnership, which is made up of Lambeth and Wandsworth councils, the Greater London Authority and developers Ballymore, as well as occupants of the site including Royal Mail, the US and Dutch embassies and the Environment Agency.

We worked hard to minimise impacts on stakeholders – for example, the Royal Mail depot in Westminster needed to remain open, so we used tunnelling while we were working in that area instead of open trenches. We also worked closely with the site developers to minimise any impact on their construction works.

Reducing carbon

Through the careful choice of construction materials, we were able to reduce the embodied carbon of the project by 35,000 tonnes, compared to our original plan. This reduction was partly achieved through the reuse and recycling of 6,000m^3 of material.

Delivering towards Twenty 4 Twenty

Between 2015 and 2020, we invested around £20m into delivering sustainable drainage surfaces – such as rain gardens, swales and permeable paving – and removed at least 20 hectares (about 30 football pitches) of hard, impermeable surfaces. This has helped to reduce the risk of sewer flooding and pollution after heavy rainfall. The scheme at Battersea's Nine Elms delivered 18 hectares of our Twenty 4 Twenty goal.

Future SuDS planning

Working with the Greater London Authority we've helped support the creation of a SuDS planning tool to help identify the areas of Greater London at the highest risk of sewer flooding and pollution events, based on current sewer capacity levels. We're working with lead local flooding authorities, stakeholders and charities to identify areas where interventions are needed and to identify efficient opportunities for implementation.

Through the development of the SuDS planning tool, we've also been able to identify suitable partnership projects with third parties to support the London Sustainable Drainage Action Plan.

Preparing for cold weather

The extreme weather events we've experienced over the past ten years are consistent with the types of event we expect to see in the future due to climate change.

The background

In early 2018, a severe cold snap proved challenging for our customers and the businesses we serve. Despite our usual winter preparations, the sustained period of freezing temperatures followed by a rapid thaw had an unprecedented impact. It increased not only the number of bursts across our own network but also across our customers' pipes, leading to a rapid increase in demand beyond our predictions. As a result, approximately 75,000 of our customers suffered low pressure or went without water.

Although the impact was less severe outside London, and we worked around the clock to resolve all the issues we faced, we failed to protect our customers from the cold weather.

Our response

We knew we needed to consult with as many people as possible to develop a robust plan that would deliver real benefits to customers if a similar incident were to occur in the future. Here's how we responded to the challenge.

External engagement

- We engaged with water companies who performed well in the crisis (United Utilities and Affinity Water) as well as the wider water industry to identify ways to share best practice
- We participated in sessions held by Water UK with the aim of working more collaboratively across the industry
- We collaborated with the Customer Challenge Group (CCG) to obtain their input on the real impact on customers
- We consulted an external assurer with over 30 years' experience in the utility sector, including 24 years' experience of crisis management planning and operation within the energy sector

Customer feedback

- We conducted research to understand and learn from our customers' views on what happened
- We reviewed feedback from our customers, including surveys and complaints
- We analysed our research to inform our 2020-25 Business Plan
- We commissioned additional research to find out how we can generally improve 'no water' incidents for customers

Internal engagement

- We held internal workshops to consolidate our planned improvements and agree further initiatives for each of the issues Ofwat identified in their report
- We developed a roadmap of necessary actions, helping us to track our progress and assure delivery

Testing our response

- We practised our revised Gold and Silver command incident structure approach
- We successfully tested some of our new practices during the 2019 heatwave and high demand period, including sending proactive SMS communications to those customers at risk of a supply shortage and delivering bottled water to people in vulnerable circumstances
- We continue to learn from real-life events to continually improve our response

Understanding a 2°C warmer world

The background

The Paris Agreement aims to keep this century's global temperature rise well below 2°C higher than pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C.

The earth has already warmed by around 1°C since pre-industrial times. Beyond 2°C of warming the potential consequences rise sharply. A range of scenarios are typically used to assess future risks and opportunities related to climate change.

Our Water Resource Management Planning incorporates scenarios in which there's warming of 3°C and greater by the end of century.

Predicted scenarios

Average summer temperatures in the South East are projected to increase by 3 to 4°C relative to the 1981-2000 baseline period by the end of the century. For precipitation the changes are less certain, but the south of the country is projected to experience wetter winters and drier summers. It's also generally agreed that climate change will increase the variability of weather – meaning we'll see more extreme events, such as heat waves, floods and droughts and they'll be of greater magnitude.

Planning ahead

Our current strategic Water Resource Management Plans, consider the availability of water for supply based on the previous UKCP09 climate change projections (UKCP18 was not available for the current WRMP but will be used in WRMP24, the next round of planning). As part of this process we already consider the impact of climate change on supply to the mid-2080s using the medium emissions scenario.

Under this scenario, London warms 3°C by the 2080s and summer temperatures increase by 2 to 6.4°C relative to a 1961-1990 baseline. We've also considered increases in heavy rainfall and flood risks to London under a range of scenarios and are prepared for warming of 3°C and above.

Working with uncertainty

We're planning, and have responses, for at least a 2°C world – for example, our Water Resource Management Planning incorporates the use of scenarios of 3°C and greater warming by the end of century.

While we're actively managing current and future risks, there'll always be some residual risks related to extreme events and the possibility of warming beyond 4°C. We're developing an "adaptive pathways" approach, so adaptation activities can be accelerated if the pace of climate change is greater than projected.

Adaptive pathways are frameworks that map an array of interventions to a changing world and enable routes or 'pathways' to be established based on socioeconomic and environmental data. The pathways are dynamic, changing with feedback from appropriate monitoring data.

Next stop, net zero

The background

In 2019, we made an important pledge to reduce our operational net carbon emissions to zero by 2030 – a full 20 years ahead of the UK government's target and the global Paris Pledge.

Although extremely challenging, we're already making progress to achieve this goal. But we don't want to stop at net zero – we're committed to going beyond this by 2040 and working to become a net negative organisation for the future.

Since 1990, our operational emissions have reduced by 578 $ktCO_2e$, while the number of customers we serve has gone up by 4.3 million.

Where are we?

We've been working to tackle our carbon emissions for many years, and we've already made significant progress. Since 1990, our operational emissions have fallen from 845 $ktCO_2e$ to 268 $ktCO_2e$, despite our serving an additional 4.3 million customers.

We've already worked through the easiest options to reduce our carbon emissions, so to reach net zero, we need to explore new solutions and embrace new technology. This will involve greater levels of innovation and collaboration than we've ever had before. We've created a Net Zero Carbon Taskforce made up of experts from across our business who are exploring potential options and developing a comprehensive plan for emissions reduction.

Our route map

We've developed a route map which covers the areas in which we'll actively work to reduce our operational carbon emissions to drive us forward for the future:

- Reduce – Design and operate our assets so they emit as few carbon emissions as possible
- Decarbonise – Provide the same capabilities using lower carbon technologies
- Create a net negative future – Grow our export of renewable energy products and procure renewable energy when we can't decarbonise our supplies
- Sequester and offset – Consider carbon offsets, carbon capture and storage, and carbon sequestration opportunities

What are we doing?

Our in-depth plan includes a range of green initiatives, ranging from renewable energy generation and fossil fuel substitution to energy recovery, energy efficiency and vehicle decarbonisation. Examples include:

- Increasing our use of biogas to replace fossil fuels on our sites. We're also looking to convert it into biomethane so that we can export it to the gas grid as a fuel for vehicles and alternative to natural gas
- Developing innovative plans to recover heat from our sewage and final effluent. This includes working with Kingston Council to heat over 2,000 homes from a new state-of-the-art energy centre at our Hogsmill Sewage Treatment Works
- Engaging with our supply chain so that we can understand how they're measuring and reducing their own carbon footprint and look for new opportunities to improve our own
- Using adaptive pathways. These are frameworks that map an array of interventions to a changing world and enable routes or 'pathways' to be established based on socioeconomic and environmental data. The pathways are dynamic, changing with feedback from appropriate monitoring data

Looking forward

We've created this route map so that we can understand the scale of the challenge and work together to identify opportunities to move towards net zero.

We understand it won't be an easy road, and we can't achieve it on our own. To overcome the net zero challenge, we'll need to successfully work with all our partners, stakeholders and regulators to unlock brand-new solutions.

In addition to all this, we're actively exploring how we can reduce the amount of embodied carbon associated with the delivery of our capital projects.

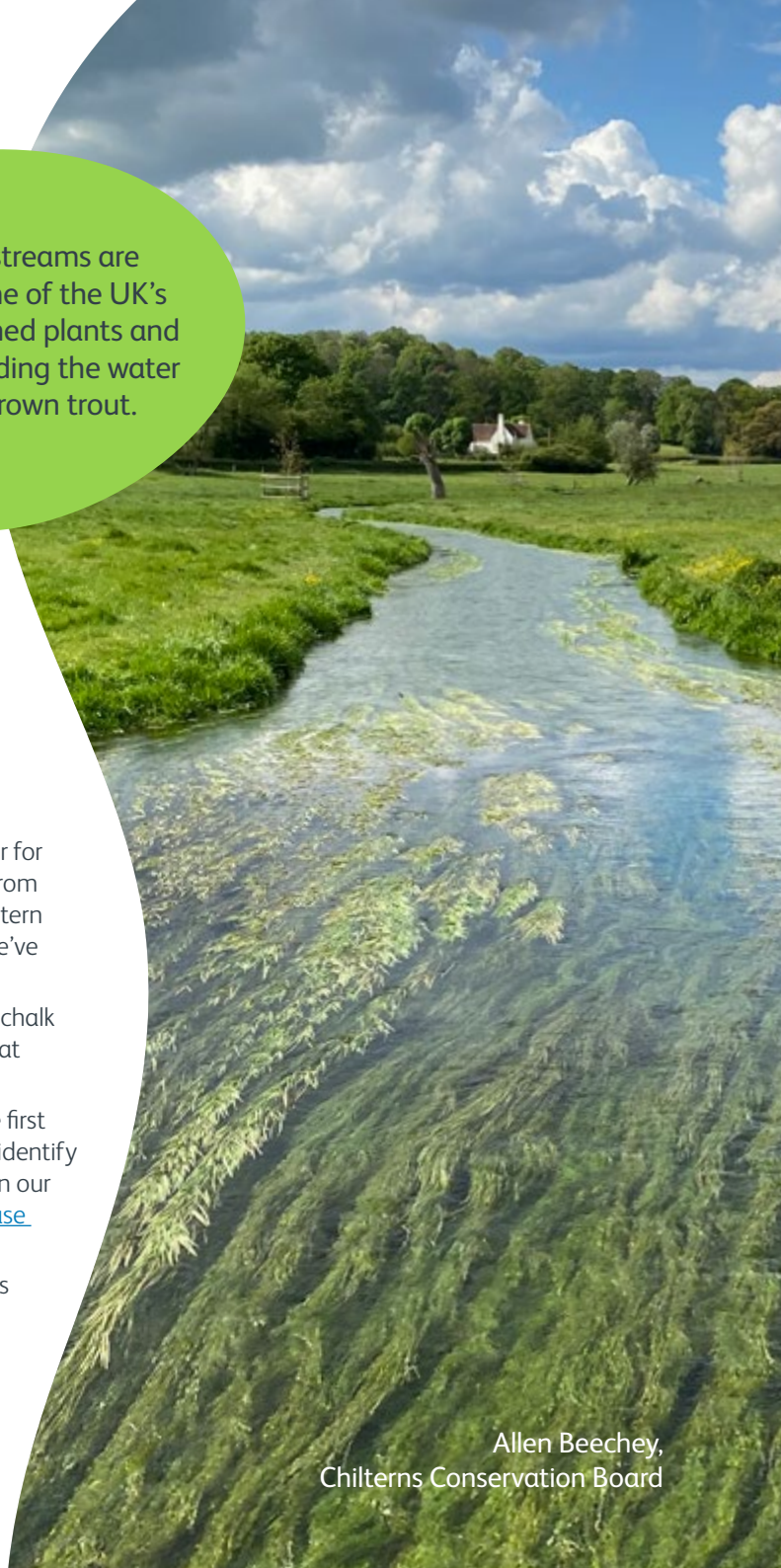
Protecting chalk streams

The background

Clean, clear and rich in minerals, chalk streams offer the perfect environment for wildlife to thrive. The Chilterns is home to nine of these rare rivers – but the area's demand for water is also some of the highest in the country. This is just one of the reasons why the UK's chalk streams are currently under threat.

In October 2020, we and three other water companies announced our plans to invest millions of pounds in protecting chalk streams all over the UK. We've committed to reducing the amount of water we take from these vulnerable watercourses as well as reducing the risk of pollution that could harm their fragile environments. Taking action now will help our waterways adapt to the impact of climate change.

Our chalk streams are home to some of the UK's most threatened plants and animals, including the water vole and brown trout.



Allen Beechey, Chilterns Conservation Board

Our commitment

Restoring and protecting chalk streams is a huge team effort, which is why we're working with the Government, regulators, public bodies, environmental non-governmental organisations, and local communities to make change happen. We've already made good progress and have ambitious plans for the future, including:

- Achieving a 39% increase in capacity at Chesham sewage works by 2023 so that we can store and treat more wastewater and reduce the need for discharges to the River Chess
- Increasing the capacity at Berkhamstead sewage works
- Reducing phosphorous levels at Chesham and Berkhamstead sewage works
- Preventing groundwater infiltration and surface water infiltration in our sewer network to reduce the likelihood of the network being overwhelmed or excess flows entering waterways from Combined Sewer Overflows (CSOs)
- Stopping all abstraction from Hawridge on the River Chess by the end of 2024
- Investing £40 million in an alternative source of water for the 12,000 customers who currently get their water from Hawridge, reducing overall abstractions from the Chiltern chalk streams by 80% compared to 1990 (to date, we've already reduced abstraction by 63%)
- Working with Affinity Water to establish a new set of chalk stream health metrics so that we can understand what 'good' looks like for a chalk stream
- Growing our smarter water catchment initiative – the first project in the UK to go beyond the water industry to identify all the different pressures including climate change on our rivers and work with partners to address them. See case study on page 34
- Collaborating with key groups, such as the River Chess Association, to assess the benefits of addressing multiple challenges together, eg. finding solutions to promote biodiversity, prevent flooding and improve access to blue/green spaces

Protecting biodiversity

Over 92% of the sites we assessed were classed as being very low to medium sensitivity to climate change.

The background

Our climate is changing, and it's having a profound impact on the animals and plants living in the natural environment.

For example, many species are now found further north and some have colonised large parts of the UK from continental Europe, including Invasive Non-native Species (INNS), such as Japanese knotweed.

Climate change and biodiversity

As our climate changes, habitats are likely to evolve, and we'll need to find ways to accommodate any impacts. Whatever changes there may be, we'll still need to manage our sites effectively and deliver high levels of customer service.

We draw on significant natural resources and operate large network assets, such as reservoirs and water treatment works, which are likely to be sensitive to changes in climate. We'll need to manage our network and assets to meet changing demands, such as population growth alongside managing the impacts on our network.

We own and operate in numerous designated status sites, including Sites of Special Scientific Interest (SSSI) and Sites of Biodiversity Interest (SBI). These are regulated and many receive designated status due to the presence of a particular species and/or habitat and therefore must be managed carefully.

We've explored the climate sensitivity of biodiversity across more than 250 of our sites, covering an area of around 4,000 hectares. Over 92% of the sites assessed were classed as being very low to medium sensitivity to climate change.

In the future, these species and/or habitats may move or change with climate, and this will bring new challenges with respect to how we maintain compliance in the future. It also raises new questions – for example, how might regulations need to evolve?

Invasive species

Invasive species are already a challenge for us and can cause issues with water abstraction, water treatment, water distribution and wastewater discharge and have significant financial implications. Climate change is likely to further exacerbate these issues by increasing the scale and type of suitable habitat for invasive species. This may cause more impacts and increase the vulnerability of ecosystems to invasive species. It presents both an uncertain operational challenge and a challenge for maintaining existing sites, including the habitats and species contained within them.

We're working with several partners to raise awareness of the problems associated with invasive species, including the development of 'heat maps' that identify areas at most risk. A Working Group on invasive species has been set up, and, in collaboration with the Environment Agency, we've produced a series of posters and information booklets for operational staff to use and a platform for reporting and managing INNS on our sites.

Biodiversity Net Gain

By 2025, we're planning to deliver Biodiversity Net Gain at 253 of the sites assessed in our climate change sensitivity study.

The area of land to be improved by this biodiversity programme is c.4,000 hectares – about two and a half times the size of Heathrow Airport. We'll achieve this by improving the condition of existing habitats through changes in management regimes of grassland. We'll also create new habitats with improved connectivity, such as wetlands, woodlands and hedgerows.

Understanding natural capital

We've undertaken a natural capital assessment for all our landholdings.

The background

The natural capital concept describes the natural environment surrounding us as a valuable resource or range of assets that all society depends upon.

Natural capital is the sum of our ecosystems, species, freshwater, land, soils, minerals, air and seas. These natural capital stocks provide us with valuable goods and services, called "ecosystem services", which include food, clean air and water, wildlife, energy, wood, recreation and protection from hazards.

Importantly, natural capital is underpinned by biodiversity, which is essential for the sustainable provision of ecosystem services and healthy natural capital assets.

Taking a natural capital approach

If managed sustainably, natural capital can provide a continuous flow of ecosystem services that benefit human wellbeing. So, it's important to understand how to positively manage natural capital, to protect wildlife and to secure the many benefits people receive from it.

Understanding our natural capital stocks

Water companies are fundamentally dependent on a healthy natural environment. We abstract water to supply clean, safe drinking water, and we treat wastewater and safely return it to the environment. Therefore, it's important that we consider the ecosystem services and wider benefits that are provided by the natural environment to help us achieve this.

Assessing the quantity, quality and performance of the natural environment that we own and manage provides valuable insights into how our land contributes to biodiversity, people's wellbeing and wider society, which can help inform our business decision-making into the future.

We've undertaken an assessment of 100% of our landholdings to help us understand what natural capital stocks we have, their location and condition, and what services and benefits are being provided.

What we found

We own around 6,500 hectares of land made up of small- to medium-sized sites including water and wastewater treatment works, recreational sites and nature reserves. In our assessment, we've identified key habitats such as grasslands (which cover 36% of our landholdings), rivers, lakes, reservoirs (33%), urban (13%), woodland (7%) and cropland (5%). Over 50% of our landholdings have some sort of environmental designation.

These habitats provide a wide range of ecosystem services and benefits, the most significant being water supply, sense of place, aesthetic and significant biodiversity value. Other services include flood regulation, erosion protection, pollination and pest control.

Our assessment shows how our estate provides a great deal to people's wellbeing, beyond our core business activities of supplying households and businesses with water and wastewater services, adding significant value to our local communities and wider society.

Looking forward

We are exploring how we can use the insight from our natural capital assessment to inform our future business decisions.

Natural capital baseline			
Asset attribute	Indicator	Hectares	Percent
Extent	Total assessment area (Assessment scope)	6,504	100%
Coverage	Habitat area	5,711	88%
	Non-habitat area	793	12%

Appendix

Our Defra risk assessment

CCRA 2017 risk	Relevance to water sector	Likelihood of risk to water sector	Impact on customer service	Risk understanding	Progress since 2015	Actions (AMP 2020-25)	Metrics/reporting
In1: Risks of cascading failures from interdependent infrastructure networks	Medium	Low	Low-medium	Moderate	Took a systems approach to allow the consequences of individual system component failure to be quantified in terms of impacts on customer service. Used real-time data and technological advances to improve our ability to predict individual system component failures in advance, continually increasing our understanding of the 'interconnectivity' of related systems. Developed and implemented an enhanced incident management arrangements response with clear, defined roles and responsibilities. Continuously improved through training and reviews. Implemented an Emergency planning function. Established and strengthened relationship within conjunction with local resilience forums through enhanced engagement and involvement in planning activities. Increased capacity to self-generate renewable energy.	Invest in systems monitoring to improve predictive capability and understanding of the consequences of failure within interdependent systems. Increase self-generated renewable energy to 517 GWh. Invest circa £31 million to make 47 key power-dependent sites resilient to power disturbances or interruptions of over three hours from distribution network operators. Continue developing operational plans, Business Continuity Plans and relationships. Working towards increased exercising to build confidence and response. Competency model under development.	Power resilience PR19TMS_ DWS01 reporting Renewable energy produced PR19TMS_EWS03 Annual SEMD Audit and report
In2: Risks to infrastructure services from river, surface water and groundwater flooding	High	Medium	Medium	Moderate	Delivered flooding resilience measures at priority water and wastewater treatment works. Invested more than £2 million to improve availability of temporary flood defense products and auxiliary equipment. Completed five sewer catchment studies and developing more than 30 local drainage strategies. Improved system monitoring and predictive capability to allow for asset optimisation and ability to provide potable supplies to customers from multiple treatment works. Reviewed impact of flooding risk related to possible impact on customer service. Developed and implemented enhanced incident management arrangements with clear, defined roles and responsibilities. Continuously improved through training and reviews. Implemented an Emergency planning function. Established and strengthened relationship with local resilience forums through enhanced engagement and involvement in planning activities. Enhanced adverse weather process including increased staff / changed work mix / more comms. Updated EA annually as part of Section 18 reporting.	Invest £211 million in AMP7 to improve overall resilience, including £31 million to improve the power resilience of water and wastewater services. Continue to invest in systems monitoring to further improve predictive capability. Continue developing operational plans, Business Continuity Plans and relationships. Working towards increased exercising to build confidence and response. Competency model under development.	Power resilience PR19TMS_ DWS01 Annual returns related to Section 18 of the Flood and Water Management Act 2010 Annual SEMD Audit and report

CCRA 2017 risk	Relevance to water sector	Likelihood of risk to water sector	Impact on customer service	Risk understanding	Progress since 2015	Actions (AMP 2020-25)	Metrics/reporting
In3: Risks to infrastructure services from coastal flooding and erosion	Low	Negligible	Negligible	Good	Our region connects to the sea via the Thames Estuary. We rely on the Environment Agency to maintain 0.1% Annual Exceedance Probability protection to London.	Watching brief.	No metric
In4: Risks of sewer and surface water flooding due to heavy rainfall	High	High	High	Good	Improved network monitoring, root cause analysis, data analytics and adverse weather modelling to improve our ability to predict incidences of sewer and surface water flooding in advance. Disconnected circa 21ha of impermeable area from its combined sewer system using SuDS. Supported UKWIR studies for modelling the impacts of climate change on sewage networks. Undertook London 2100 plan to look at future wastewater needs and challenges. Developed and implemented enhanced incident management arrangements with clear, defined roles and responsibilities. Continuously improved through training and reviews. Implemented an Emergency planning function. Established and strengthened relationship with local resilience forums through enhanced engagement and involvement in planning activities. Enhanced adverse weather process including increased staff / changed work mix / more comms.	Produce DWMP. Continue to invest in systems monitoring to further improve predictive capability. Disconnect 65 hectares of surface area from the combined sewer system or attenuate through SuDs by 2024-25 Deliver performance commitments on internal sewer flooding; risk of sewer flooding in a storm; sewer collapses; and clearance of sewer blockages. Support delivery of Thames Tideway Tunnel. Continue developing operational plans, Business Continuity Plans and relationships. Working towards increased exercising to build confidence and response. Competency model under development.	Surface water management PR19TMS_DS02 Internal sewer flooding PR19TMS_CS03 Clearance of blockages PR19TMS_CS04 DWMP Sewer collapses PR19TMS_CS02 Internal sewer flooding PR19TMS_CS03 Risk of sewer flooding in a storm PR19TMS_DS01 Annual SEMD Audit and report
In5: Risks to bridges and pipelines from high river flows and bank erosion	Low	Low	Low	Moderate	Enhanced network monitoring to improve our ability to understand the status of our pipeline systems in real time and predict failures in advance.	Achieve performance commitments on sewer collapses. Participate in the Water Industry National Environment Programme, which will help enhance watercourses and improve bank stability.	Sewer collapses PR19TMS_CS02 WINEP Delivery PR19TMS_NEP01

CCRA 2017 risk	Relevance to water sector	Likelihood of risk to water sector	Impact on customer service	Risk understanding	Progress since 2015	Actions (AMP 2020-25)	Metrics/reporting
In8: Risks to subterranean and surface infrastructure from subsidence	Low	Low	Low	Low	Risk tolerated.	Watching brief.	No metric
In9: Risks to public water supplies from drought and low river flows	High	Medium	High	Good	Completed WRMP including explicit climate change actions. Published Drought Plan describing how and when we respond to droughts/reduced water supplies under current climate assumptions. Began publishing monthly updates on leakage performance. Published reservoir levels and rainfall figures. Supported development of Water Resources South East (WRSE) Strategy. Undertook out Stochastic Drought Modelling. Improved network monitoring to allow for asset optimisation and ability to provide potable supplies to customers from multiple treatment works. Developed enhanced leakage reduction programme, including the new 'Which DMA' and 'Where in the DMA' digital tools. Delivered best leakage performance for over 30 years, with a 95Ml/d reduction in reported leakage in 2019-20. Implemented water efficiency and water use reduction programme, outperforming our target by 123% in 2019-20. Researched the effective use of probabilistic climate change projections in water resources planning (e.g. the MARIUS Project). Collaborated with University of Oxford to explore drought management planning in the face of climate uncertainty. Developed Supply Demand playbooks and enhanced Incident Management arrangements .	Reduce leakage by 20.4% on a three-year average basis. Publish monthly updates on leakage performance. Publish reservoir levels and rainfall figures. Ensure all customers have a resilience to a 1-in-200-year drought, on average, over 25 years by 2030. Achieve performance commitments on water supply interruptions; leakage; per capita consumption; mains repairs; unplanned outage; risk of severe restrictions in a drought; properties at risk of low mains pressure; responding to major trunk mains bursts; Security of Supply Index (SoSI); and installing new smart meters. Continue research and adaptive actions to address how climate change can impact water quality in reservoirs. Publish new Drought Plan accommodating updated information from the latest WRMP assumptions, including climate change. Carry out more detailed water resources management and environmental impact assessments in future drought plans that explicitly consider the future impacts of climate change. Continue supporting Water Resources South East (WRSE) Strategy.	Risk of severe restrictions in a drought PR19TMS_DW01 Leakage PR19TMS_BW04 Security of supply index (SoSI) PR19TMS_DW02 Installing new smart meters in London PR19TMS_M01 Annual SEMD Audit and report

CCRA 2017 risk	Relevance to water sector	Likelihood of risk to water sector	Impact on customer service	Risk understanding	Progress since 2015	Actions (AMP 2020-25)	Metrics/reporting
In14: Potential benefits to water, transport, digital and energy infrastructure from reduced frequency of extreme cold events	High	Low	High	Good	Combining data and learning from the 2018 freeze-thaw event with the smart metering programme to allow weather models to better predict mains and customer-side pipe leakage during extreme cold weather events. Enhanced leakage reduction programme, including the new 'Where DMA' digital tool. Delivered best leakage performance for over 30 years, with a 95Ml/d reduction in reported leakage in 2019-20. Developed and implemented enhanced incident management arrangements with clear, defined roles and responsibilities. Continuously improved through training and reviews. Implemented an Emergency planning function. Established and strengthened relationship with local resilience forums through enhanced engagement and involvement in planning activities. Adverse weather process enhanced including increased staff / change work mix / more comms.	Achieve performance commitments on water supply interruptions, leakage, mains repairs, responding to major trunk mains bursts and installing new smart meters. Continue developing operational plans, Business Continuity Plans and relationships. Working towards increased exercising to build confidence and response. Competency model under development.	Leakage PR19TMS_BW04 Security of supply index (SoSI) PR19TMS_DW02 Water supply interruptions PR19TMS_BW03 Responding to major trunk mains bursts PR19TMS_BW11 Mains repairs PR19TMS_BW01 Installing new smart meters in London PR19TMS_M01

This edition of our Climate Change Adaptation Report was published in November 2021 and covers the period 2015 to 2020. This is the third submission we've made to the Department for the Environment, Food and Rural Affairs (Defra) under the Adaptation Reporting Power (ARP) of the UK Climate Change Act (2008). We'll include climate change adaptation updates in our Annual Report, Annual Performance Report and Sustainability Report and on our website.

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