



# Water 2050: A White Paper



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2 Challenges, opportunities and gaps between now and 2050: our priorities for change

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6 The way forward: working together to deliver change

# Executive Summary

**Water is essential for life, nature, jobs, and development. But our management of it needs to change if we are to deliver more for the environment and meet the threat of climate change.**

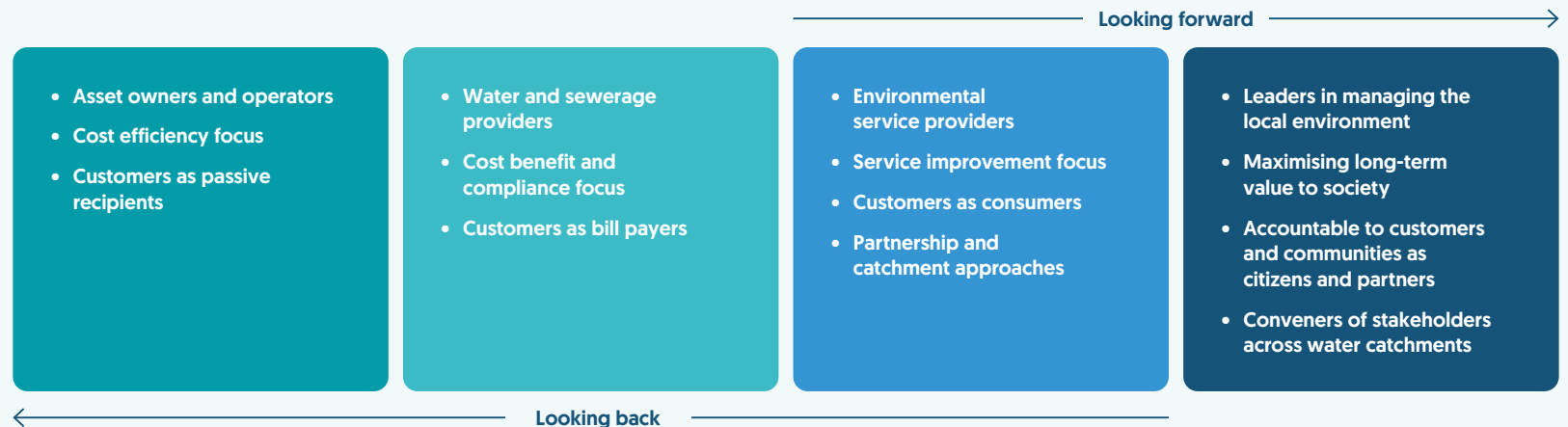
Our customers expect us to deliver more environmental impact and be ready to deal with the consequences of climate change. As water companies, **we have a clear purpose: to protect public health, improve the environment, unlock economic growth, and act as a responsible leader at the heart of England’s regions, today and in the future.** It is our responsibility to ensure that we can deliver our purpose both today and in the future.

While the latest science<sup>1</sup> indicates that climate change will lead to increased frequency of droughts and other extreme weather events, our customers will expect us to continue to improve our services. They also expect us to play our part in reducing carbon emissions, and water quality impacts, and in reversing the decline in biodiversity that is threatening the prosperity of current and future generations.<sup>2</sup> These challenges are amplified by the expected increase in the UK population and an ageing asset base, designed primarily to fulfil our duties towards public health rather than improving wider ecosystems. We are therefore facing an unprecedented threat to our ability to deliver our purpose.

**In response to this threat, we have developed this White Paper to set out our positive ambition for the future of the water sector in England and outline urgent priority areas for change that we need to work on in collaboration with others.** If we fail to act now, current and future generations are at risk of paying more than they need to for services that fail to match their expectations, and could be faced with water acting as a constraint rather than an enabler of future growth and productivity.

To rise to the challenge, **our Vision** is that: **By 2050, we will be globally recognised as an environmental leader, stewarding the improvement of rivers and seas, acting on the climate emergency and protecting customers’ long-term interests.** To achieve our Vision, we will need to get the fundamentals right while continuing to transform our role in society (see below). Achieving our sector Vision is also a vehicle for the Government’s own ambitions in a number of areas including the target for Net Zero carbon emissions, its 25 Year Environment Plan (25YEP) and it will support the need to ensure no communities are left behind.

1. IPCC, Climate Change 2021 – The Physical Science Basics  
2. The Economics of Biodiversity: The Dasgupta Review Headline Messages, 2021



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Water companies' regional focus means that we are experts in our environment, well-connected with other local stakeholders and have a funding mechanism that can enable private investment to deliver the improvements required across those regions. To achieve our Vision however, and deliver our purpose now and in the future, **we have identified two priority areas for urgent change:**

1. **Delivering more environmental impact more efficiently** — we need to ensure that every £1 of investment delivers maximum environmental impact. While the current approach to environmental regulation delivered significant benefits in the past, it is not fit for purpose for the future as it is fragmented, prescriptive, output-focused and not systems-based. It ultimately leads to inefficient investments with less benefit for nature. We urgently need to implement Outcome-Based Environmental Regulation (OBER) as this will unlock innovation, enabling us to deliver more environmental improvements for less bill impact.
2. **Protecting long-term customer interests through the right investments at the right time** — as asset lives in the water sector span multiple generations, we need to make decisions today — in the context of much greater uncertainty — that affect generations in the future. Our current ways of planning as a sector lack a thorough, joint and consistent understanding of best value and risk. They are also prone to a focus on backward-looking assessments against a future that is different and uncertain and where society's expectations are changing. This means that we cannot be confident that the right investment decisions are being made at the right time.

We therefore need to develop and agree clear long-term resilience standards, a common risk framework and forward-looking approaches to assessing investment needs that can ultimately lead to a single adaptive plan for each water company. This will ensure that current and future generations of customers receive the service levels they expect with the least bill impact.

**The changes proposed in this White Paper will allow investments to achieve far more.** The changes will therefore support the long-term affordability of water bills. Given the size of the future challenge, we also need to consider the way we charge for water services to ensure that they are affordable and acceptable today and in the future. While our focus is on the water sector in England, we expect the areas for change that we have identified to have some relevance for other jurisdictions as we are facing common challenges.

This White Paper sets out our positive ambition for the future of the water sector in England and outlines urgent priority areas for change. However no individual organisation can achieve this alone and **we will need to work collaboratively with many stakeholders, both within and beyond the water sector, recognising our shared responsibility** to achieve the outcomes customers and wider society require today and in the future. **To achieve these changes for the benefit of current and future generations of customers we need to act now.** Failing to act now risks hitting tipping-points from which it will be much more costly for society to return.

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An aerial photograph of a large dam structure extending into a deep blue body of water. The dam is a long, narrow concrete wall with a road on top. The water is turbulent, with white foam from the dam's spillways. A large, semi-transparent, stylized number '1' is overlaid on the right side of the image, partially covering the dam and the water. The number is white with a teal shadow.

# 1 Introduction

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# Who we are and why we have developed this White Paper

**Water UK has developed this White Paper on behalf of 16 water companies that operate in England.**

**Collectively, we serve over 55 million people and over 2.5 million businesses in England, supporting around 180,000 jobs across the whole supply chain, at a cost of around £1 per customer per day.**

We have developed this White Paper because our customers and communities face enormous challenges over the next 30 years, with the climate and biodiversity emergency the most profound. It threatens every aspect of the water sector.

## This White Paper describes:

- **Future challenges, opportunities and gaps and the priority areas for change (Section 2)**
- **Our Vision for 2050 (Section 3)**
- **Why and what we need to change: Delivering more environmental impact more efficiently (Section 4)**
- **Why and what we need to change: Protecting long-term customer interests through the right investments at the right time (Section 5)**
- **How we will make the change happen (Section 6)**

While this White Paper has been developed on behalf of water companies that operate in England, we expect the areas for change that we have identified to have some relevance for other jurisdictions as we are facing common challenges.

## Our Purpose



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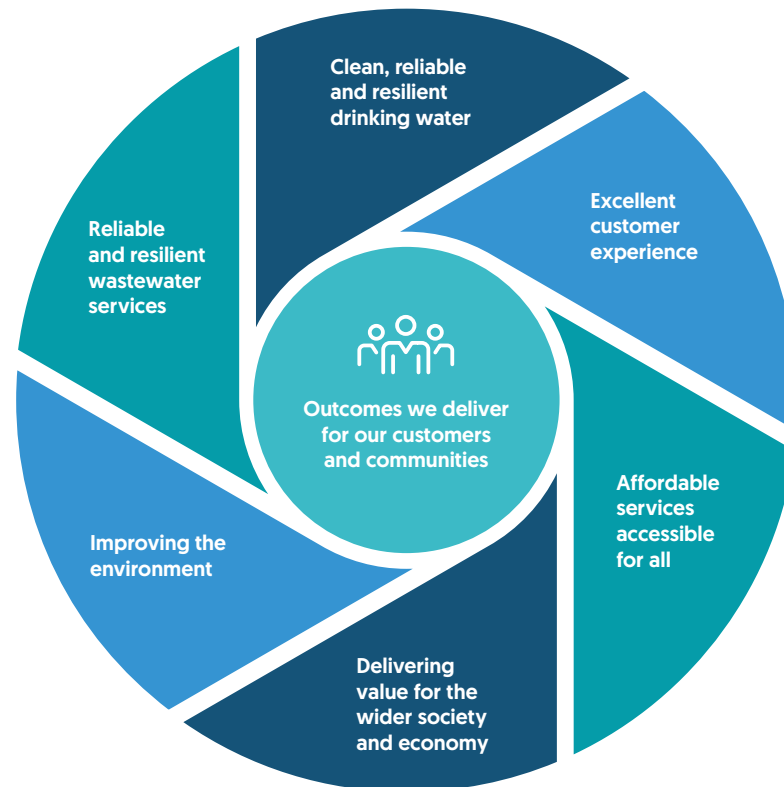
# Our White Paper is built on a clear purpose

**We have a clear purpose that is grounded in continuous community and stakeholder engagement.**

We do more than provide high quality, affordable and efficient water and wastewater to customers:

**Our purpose is to protect public health, improve the environment, unlock environmental growth, and act as a responsible leader at the heart of England's regions, today and in the future.**

**Our purpose is underpinned by the following outcomes**



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## **2** Challenges, opportunities and gaps between now and 2050: our priorities for change

# We face enormous challenges to our purpose over the next 30 years

## We have identified the 5 key challenges to our purpose between now and 2050.

This is based on a wider range of inputs, including experts from every water company in England and responses from stakeholders to a discussion paper we issued in March 2021, which was a public consultation on building an ambitious, long-term Vision for the water sector in England.<sup>1</sup>

“  
**The most profound and urgent risk facing the water sector, and society at large, is the climate emergency.”**

“  
**The biggest existential threats ever to face mankind: climate change, water as a scarce resource, and biodiversity”**

“  
**The public increasingly expects that environmental quality will always be good enough to support the activities they want to do such a river swimming, fishing, river walking, as well as to support wildlife. If it isn't, they expect something to be done”**



1. Developing a 2050 Vision for the Water Sector, [www.water.org.uk/2050-vision-for-the-water-sector/](http://www.water.org.uk/2050-vision-for-the-water-sector/)



# We need to meet increasing consumer, community and societal expectations

## Water customers are expecting us to improve the environment in various ways

*“While our current bill payers place the highest priority on drinking water quality and reliability, our future bill payers place more importance on protecting the environment, meeting future challenges such as climate change and supporting low income customers.”*

United Utilities, Customer Priorities Research, Nov 2021

*Working with others to improve ecological quality has been promoted by Anglian Water’s customers to become one of the company’s four long-term priorities.*

Anglian Water customer research, 2017

*Research for Water Resources South East showed 85% of customers thought companies should go beyond minimum government regulations and protect more of the environment.*

WRSE, 2020

*Bristol Water’s Youth Board explained that the environmental and social credentials of companies were important to their generation and were a key differentiating factor between businesses.*

Bristol Water Youth Board, 2020

*“People increasingly expect companies in all sectors to behave ethically and consider their broader impacts”*

Ofwat, PR24 and Beyond

## Wider societal trends point towards consumers that are more aware, ethical and connected and less patient

Consumer expectations are rising and priorities are changing, driven by advances in technology, standards and societal change:



### More aware and ethical

- Consumers are increasingly holding companies to account on their environmental performance, including their carbon footprint, use of electric vehicles, air travel, and single-use plastics.
- Gen Z “want brands to be transparent, to know what is in their food, what country their clothes were made in, how employees are treated, what company profits are being put towards”.
- Linked to consumer expectations on transparency and ethical standards, there is a general debate on private ownership of essential services and, post-Grenfell, the efficacy and priorities of independent regulation, that covers a range of sectors such as rail, post, water, public transport, prisons, etc..



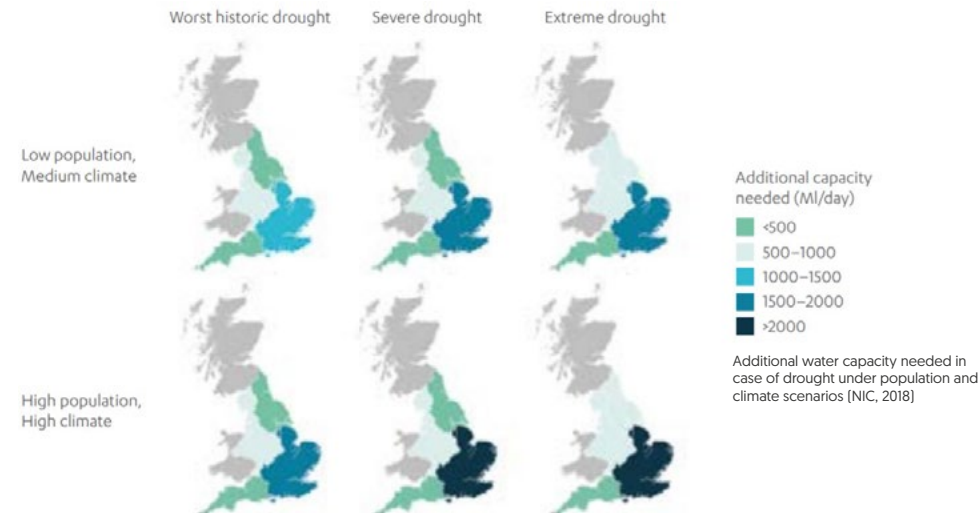
### More connected and less patient

- Consumers expect seamless processes and intuitive interactions and the rise in real time information means they are becoming less willing to wait. Tablets, smart phones, social media and chatbots have transformed how companies engage with customers.
- Over the next 30 years, we will see more technological advancements including 5G (and beyond), the Internet of Things, Virtual Reality, Augmented Reality, and 3D printers. All of these are likely to increase convenience and ease.

# The climate emergency presents an extreme challenge. We face increased drought risk between now and 2050...

The latest IPCC report estimates that temperatures are rising faster than expected and that 1.5°C warming will be reached sooner than expected, by mid-2030s. With this comes:

- **Increased frequency, severity and duration of droughts** due to the climate emergency and population growth – the IPCC estimates that extreme weather events between 5.6 times and 13.9 times more likely with 1.5°C warming
- Total water supply is forecast to decrease by 7% by 2045 as a result of the climate emergency and limits to sustainable abstraction.
- Between 2020-2050, we are twice as likely to have a year with water restrictions due to droughts in England when compared to the 1997-2004 time period.
- The chance of a serious drought between now and 2050 that results in water deficits and requires supply restrictions is between 1-in-7 and 1-in-4.
- Without action, the risk of not having enough water to satisfy our customers' demand is very real.



National Audit Office, Water supply and demand management, 2020  
IPCC, Climate Change 2021 – The Physical Science Basics

Committee on Climate Change, CCRA2: Updated projections of water availability for the UK, 2015  
National Infrastructure Commission, Preparing for a drier future: England's water infrastructure needs, 2018

Up to  
**+4,000 M/l day**  
extra needed

Extra capacity of litres of water per day needed in England from 2025 to 2050 (NIC, 2018).

**2 droughts**  
every 10 years

Frequency of an intense agricultural ecological drought event occurring in 10 year period is 2 times with 1.5°C warming, and to 2.4-4 times with 2-4°C warming (IPCC, 2021).

**-8% to -22%**

Change in supply-demand balances in 2050 compared to 2015 in England. This is based on medium to high assumptions for climate change and population growth and assuming no additional action is taken (CCC, 2015).

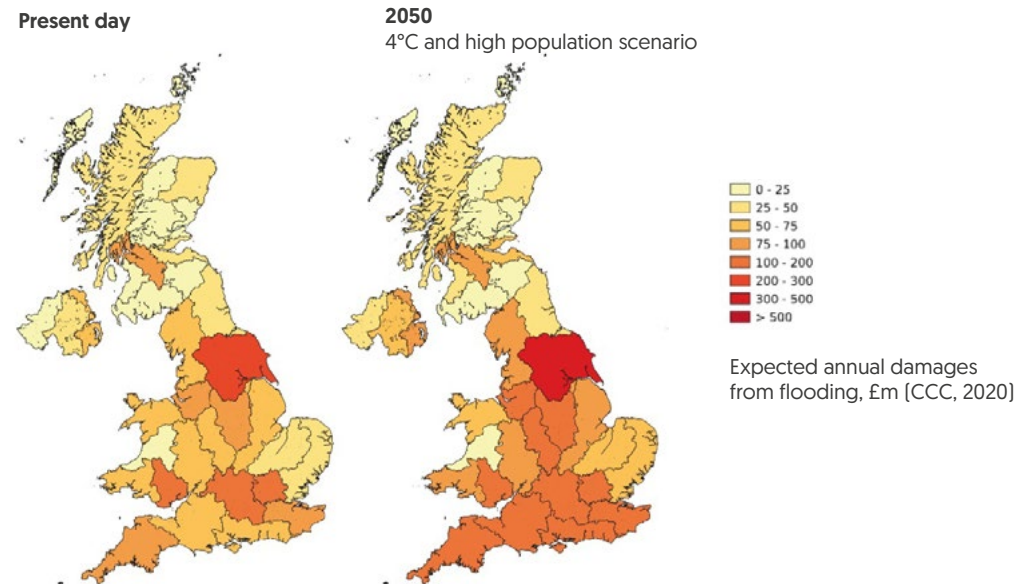


Without action customers and communities will be faced with longer and more frequent water restrictions.

## ...we also face increased flood risk, pollution and extreme weather events

In England, water companies are just one of the authorities that have a role to play in reducing flood risk, alongside the Environment Agency, Internal Drainage Boards, and local authorities, so working in partnership will become even more important in the future when:

- Flood risk is increasing due to more intense winter rainfall and summer storms.
- Urban areas will experience more flash flooding in the future.
- Expected annual damages due to floods are forecast to increase from £1.4bn in 2020 to between £1.7bn - £2.1bn by 2050. On average, the more socially vulnerable are exposed to a greater flood risk.
- Increased flood risk will increase the risk of reduced service levels as it leads to:
  - Increased risk of sewer flooding
  - Risk of reduced raw water quality and increased complexity of treating drinking water
  - Negative impacts on biodiversity such as increased soil loss and movement of invasive non-native species as well as movement of chlorides from the coast into freshwaters



Committee on Climate Change, Third UK Climate Change Risk Assessment [CCRA3] Future flood risk, 2020  
Natural Environment Research Council, Water Climate Change Impacts Report Card, 2016

IPCC, Climate Change 2021 – The Physical Science Basics

**£300m - £700m  
p.a.**

Increase in expected annual damages due to floods by 2050 [CCC,2020]. Water companies are one of the authorities that have a role in reducing flood risk.

**Heavy rain 1.7x  
more likely and  
more intense**

With 2°C warming, heavy precipitation over land is 1.7 times more likely to occur and will be 14% wetter, in comparison with pre-warming levels (1850-1900), and 2.7x more likely and 32% wetter with 4°C warming. IPCC, 2021.



Without action customers and communities will be faced with increased risk of sewer flooding and biodiversity loss.

# A New Operating Environment

Playing our part in meeting the UK's emissions reductions targets under the UK's legally binding Net Zero 2050 commitment is a key challenge. The Government's Net Zero strategy places the water sector in a new operating environment where carbon impacts are a key factor that will drive changes to the energy systems we rely on and the operational processes we operate. Emissions will become an increasingly important consideration alongside other investment objectives.






To maintain high levels of performance during the transition to a low carbon economy companies must be enabled to make the requisite investment decisions, drive emissions reductions, and play their part in achieving the 6th Carbon Budget.

## Key challenges include:

- **Wastewater treatment** is essential to protecting the water quality of our rivers but it is responsible for around two thirds of the water sector's overall emissions. Reducing emissions from treating wastewater (process emissions) will require changing technologies, updating assets, or capturing emissions at c 6,000 sites across the UK. Greater focus on investment in research and development would allow the sector to identify the most economically advantageous ways of achieving these reductions.
- **Scaling up** from successful pilots in areas where solutions have been proven, such as nature-based solutions.
- **Maximising biogas production** to ensure this sustainable resource is put to work in the energy grid, allowing others in the economy to move away from fossil fuels, and allowing water customers to benefit from energy exports that balance the rising costs of fuels.



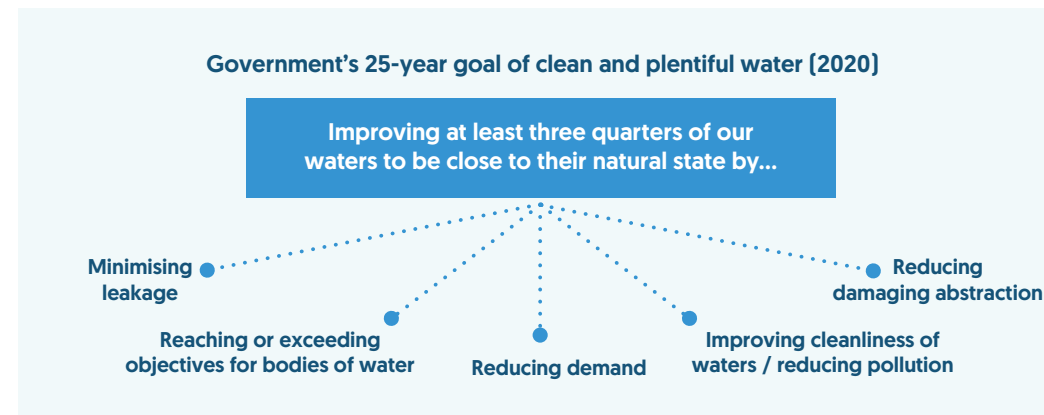
# Summary of climate emergency impacts

Risks to resilience <sup>1</sup>	Currently		By 2050
 Annual mean temperature	8.8°C	Up to 33% higher	<b>9.1°C to 11.7°C</b>
 Probability of heatwaves	10% to 25%	Up to 5x as likely	<b>50%</b>
 People in significant flood risk areas	1.4m	Up to 70% higher	<b>2.1m to 2.8m</b>
 Supply / demand balance	+1.4bn litres/day	Up to 4.4bn l/d lower	<b>-1.1bn litres/day to -3.0bn litres/day</b>
 Agricultural land classified as poor quality (drought impact)	2%	Up to 40%pts higher	<b>25% to 43%</b>

# We need to deliver a step-change in environmental improvement

We need to deliver substantial improvements to our natural assets, which will already be under significant pressures from the climate emergency and population growth.

- The government’s 25-year Environment Plan (25YEP) for England provides a clear direction of travel for environmental improvements. Its ambition is to help achieve “the first generation to leave our environment in a better state than we found it” and to “help the natural world regain and retain good health” (Defra, 2018).
- This includes:
  - moving from 15% to 75% of rivers close to their natural state
  - restoring 75% of the UK’s one million hectares of terrestrial and freshwater protected sites to favourable condition securing their wildlife value for the long-term
  - Increasing woodland in England in line with Defra’s aspiration of 12% cover by 2060.
- This means that investment in natural assets is just as important as investment in physical assets.
- Like reducing flood risk, we have a big role to play in helping to achieve these ambitions, but we are only responsible for around one-third of water quality issues in rivers, which means other authorities and sectors also need to play their part.
- This challenge is made even harder due to the extra pressure on the environment brought about by the climate emergency and population growth.



International Water Association, Water Utility Pathways in a Circular Economy, 2016  
Defra, A Green Future: Our 25 Year Plan to Improve the Environment, 2018



## Understanding the circular economy is key to improving the environment

As a recycled resource, the water sector’s contribution to the circular economy can be significant. Reduced leakage, increased reuse and lower energy consumption can help close the loop between catchments and customers.



Without action customers and communities will be missing out on the benefits of having an improved environment.

# We are at a tipping point to address these challenges

## Temperatures are rising faster than expected

### Key messages from the latest Report from the Intergovernmental Panel on Climate Change (2021):

- Temperatures rising faster than expected, 1.5°C expected to be reached by mid-2030s, and 1.5°C 40% likely to be temporarily reached in next 5 years.
- 1.5°C will go beyond many tipping points, including loss of Arctic sea ice, die-offs of coral reefs and thawing of methane-rich sea ice.
- Extreme weather events between 5.6 times and 13.9 times more likely with 1.5°C warming

## The climate emergency and biodiversity are linked

*Biodiversity hotspots located around the world will each face unique challenges in Climatic Impact Drivers (CID) changes. Heat, drought and length of dry season, wildfire weather, sea surface temperature and deoxygenation are relevant drivers to terrestrial and freshwater ecosystems and have marked increasing trends.*

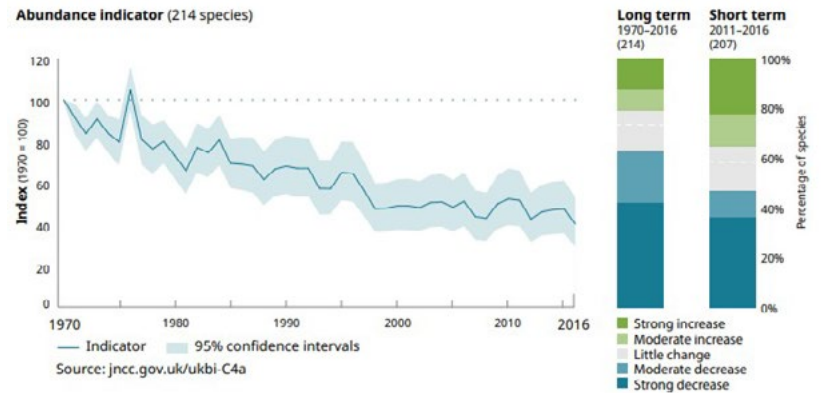
IPCC: [Climate Change 2021: The Physical Science Basics](#)

Biodiversity acts to regulate the state of our planet, including the cycles of carbon, nitrogen, oxygen, carbon dioxide and water - if too much biodiversity is lost we risk triggering a tipping point in our climate and seas.

## Temperatures are rising faster than expected

While climate tipping points are global in nature, biodiversity tipping points can be much more localised, permanently shifting local ecosystems into different states. Some biodiversity loss may be irreversible.

### UK Biodiversity Indicator: Change in the relative abundance of UK priority species, 1970 to 2016



Source: UK State of Nature report, <https://nbn.org.uk/wp-content/uploads/2019/09/State-of-Nature-2019-UK-full-report.pdf>

**15 percent of UK species are threatened with extinction. Of the G7 countries, the UK has the lowest level of biodiversity remaining. At a minimum, the UK has failed to meet 14 of the 19 Aichi biodiversity targets, the global nature goals the UK committed to meet by 2020.**

House of Commons Environmental Audit Committee. [Biodiversity in the UK: Bloom or bust? \(2021\)](#)

# Population growth and demographic changes will amplify the impacts of the climate emergency

The UK population is forecast to grow from 67m in 2020 to 75m – 79m in 2050, further increasing pressure on the supply and demand balance and our infrastructure:

- Growth is forecast to be highest in the South East of England, with projected growth between 19% - 25% by 2050 but the issues will affect all regions. There is also increased uncertainty around the distribution of population growth as a result of COVID-19.
- Average household size is also decreasing, resulting in many more connections to the network.
- The population is ageing as well: In 2018, 18% of residents were 65+ years old, but this share will rise to 24% by 2043.

This presents a number of challenges:

- The extra demand will place extra pressure on our water resources, asset health and the environment which will already be under pressure from the climate emergency. For instance, a larger population will result in an increase in the use of detergents which will result in higher levels of phosphorus entering rivers and lakes.
- Our relationships with customers will also need to adapt to cater for an ageing population.

“

*Three factors in particular are likely to increase water scarcity in the coming years: an increase in population and the number of households, a reduction in available water due to climate change, and regulatory restrictions on abstracting water from already over-stretched sources.”*

EA — Water Ambition Evidence Synthesis — Towards a Sustainable Water Management System for England

**+13% to +18%**

Increase in overall UK population from 2020 to 2050 (CCC, 2020)

**+19% to 25%**

Increase in South East population from 2020 to 2050 (CCC, 2020)

**2.7**

Average household size in the UK by 2040, down from 2.85 today



Without action customers and communities will be faced with longer and more frequent water restrictions, poorer network performance and biodiversity loss



# The other challenges are amplified by the need to future proof asset health & skills

## Future-proofing our physical infrastructure

- Our legacy assets are ageing and were designed primarily to meet the public health challenges of previous generations, not the wider expectations and needs of current and future generations and a changing planet.
- The approach to asset replacement over the past 30 years does not meet the future challenges, particularly in the context of:
  - the need to deal with climate change now and for future generations
  - increased customer expectations of service and amenity levels
  - the need to improve the health of our local ecosystems
  - changing water demand patterns

### Take our underground assets as an example:

- Many of our water mains and sewers were first built in the 19th century. Only 0.2% of sewers and 0.6% of water mains are replaced annually. At this rate, it would take 500 years to renew our sewers, and 167 years to renew our water mains.<sup>1</sup> Renewal rates will have to increase to 1.3% for mains and 1.2% for sewers for performance simply to stand still.<sup>1</sup>
- We have found innovative ways of achieving higher levels of performance from these assets, but this can only go so far. Ultimately we will need to increase our renewal rates as without this by 2050 service will deteriorate significantly, including:
  - the number of water main bursts will increase by 20%
  - the number of interruptions to water supplies will increase by 25%
  - flooding and pollution from sewers will increase by 6%.<sup>1</sup>

On top of this, we need to consider how the performance of these networks need to change to meet increased expectations of our customers and society and the changing demands on them from climate change (e.g. the use of sewer overflows).

<sup>1</sup> UKWIR, Long Term Investment in Infrastructure, 2017

## Future-proofing our skills and talent

**We are faced with three challenges:**

1 Our workforce is ageing — we need to continue to attract the best minds to the sector and transfer our knowhow and experience to the next generation.

2 We will need a different skill mix going forward to respond to future challenges — for example, we need to bring in new skills that will become increasingly important in future such as machine learning and big data.

3 We need our workforce to be more diverse and inclusive so that it represents the population that we serve.

**25%**

Increase in supply interruptions if asset replacement rates are not increased. (UKWIR, 2017)

**350,000km**

Km of water mains in the UK that will begin to fail more often. (UKWIR, 2017)

**625,000km**

Km of sewers in the UK that will begin to fail more often. (UKWIR, 2017)

# Opportunities: Innovation will play a key role in helping us meet these challenges

## We have the opportunity to transform our ways of working:

- We have a long history of innovation, stretching back over 400 years, from the world's first city-level water transfer project in 1613 to the invention of the activated sludge process in 1914.
- We are proud of our innovative history and will continue to innovate to deliver positive outcomes for our customers and the environment, as set out in our 2050 Water Innovation Strategy.
- The key to this will be to promote collaboration with others, both within the water sector and beyond and to foster a culture where innovation thrives. Given that the climate emergency is impacting on virtually every sector, collaboration with other sectors is especially important.
- There are many opportunities for us to grow:
  - Open data and using new technologies, approaches and ways of working
  - Improve sector-wide collaboration and co-ordination
  - Work more closely with universities so that academic research can help us meet our challenges
  - Increase the speed of innovation from ideation to implementation
  - Create a streamlined and effective point of access to water sector innovation for external partners nationally and globally
  - Develop regulatory frameworks to enable innovation
  - Create a culture where people are willing to take risks to innovate
  - Turn ideas into commercial products
  - Learning from others within and outside the sector

## Big data, AI, machine learning and digital twins

- We have vast amounts of data, covering everything from the real-time condition of underground assets to customer sentiment on social media posts.
- With advancements in big data, AI and machine learning, we will be able to unlock valuable insights from this data to help optimise operations and investment, and manage risk. Imagine being able to predict the next mains burst

### Using open data to improve services and generate wider value Northumbrian Water

In 2019, the Cabinet Office announced that a National Underground Assets Register (NUAR) would be piloted in North East England and London with estimated benefits of £4bn a year. The NUAR was born at Northumbrian Water's Innovation Festival in 2018 whose objective was to bring together infrastructure providers and Ordnance Survey to explore how asset data could be combined on a single platform.

Northumbrian Water also opened up datasets associated with its sewage pumping stations (SPS). By collaborating with a diverse range of capabilities they were able to identify a pattern in pumping station flows that could act as a lead indicator for potential future failures. Northumbrian Water experienced a reduction in pollution originating from SPS's of over 70%, and the open data initiative was identified as a key contributor to this improvement.

# Working together to meet these challenges

Comparing the scale of each of the challenges, climate change and the biodiversity crisis have the biggest impact on our ability to deliver our purpose. This is because they are unprecedented in their scale and they threaten our ability to deliver reliable services.

While we could simply look to increase investment in the environment and resilience, our priority is to find a way for the sector to deliver more environmental value and the right level of resilience in a way that minimises bill impacts.

Our twin priorities are therefore focused on:

- Delivering more environmental value more efficiently and
- Protecting long-term customer interests through the right investments at the right time

Given the size of the future challenge, we also need to consider the way we charge for water services to ensure that they are affordable and acceptable today and in the future.

Challenge	Impact on ability to deliver purpose
Customer expectations	Medium
Climate change mitigation and adaptation	High
Biodiversity crisis	High
Population growth	Medium
Future-proofing assets and skills	Medium

What challenges will have the biggest impact on our ability to deliver our purpose and outcomes?



## Priority areas for change



Delivering more environmental impact more efficiently



Protecting long-term customer interests through the right investments at the right time



Without any changes in these areas, customers, communities and the economy will face significantly higher risk of experiencing:

- Restrictions on water use
- More sewer flooding
- Reduced water quality (e.g. boil water notices)
- Deteriorating ecological status of rivers and environment
- Biodiversity loss
- Supply interruptions

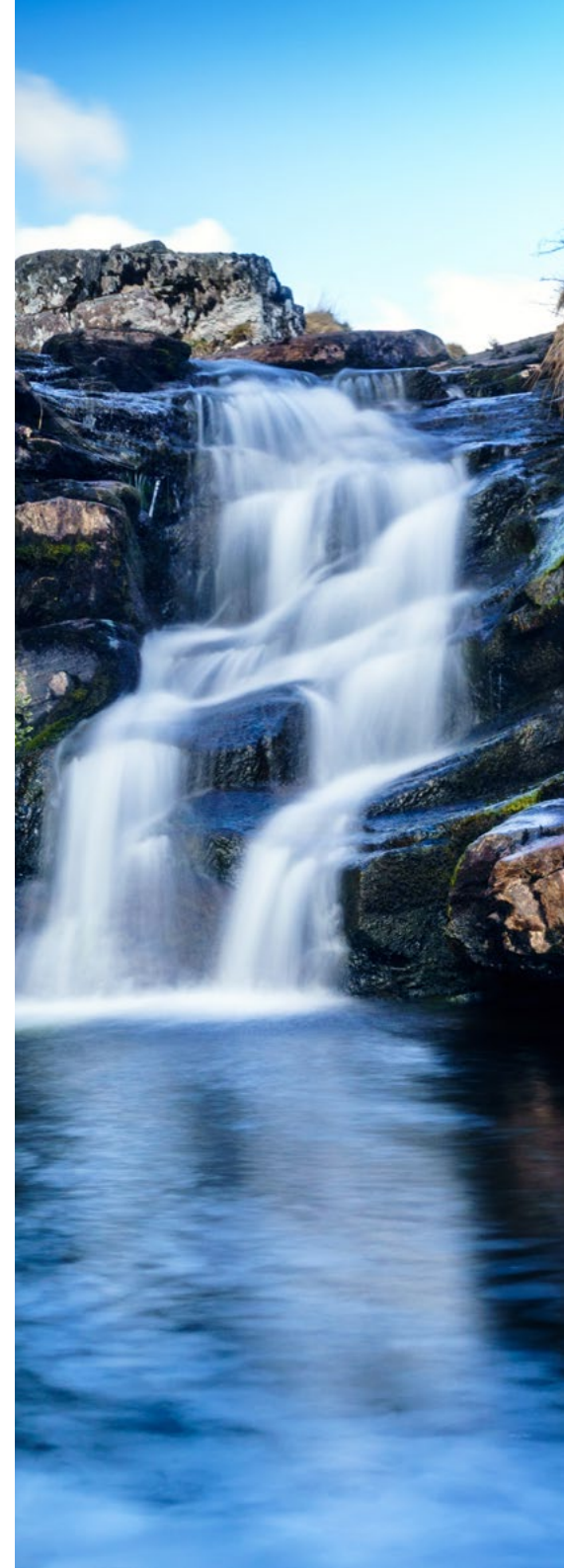
Or customers and communities will be paying more to avoid these consequences.

# Focusing our combined efforts on these twin priorities will be essential for us to deliver our purpose today and in the future

Our twin priorities for change reinforce each other — failures in service will have a direct impact on the environment as well as on customers.

Focusing on these priorities will also help:

- Safeguard the high quality of our potable water supplies, keeping them resilient to climate impacts and supporting public health.
- Ensure that the sector meets these unprecedented challenges in the most efficient and therefore most affordable way for our customers.
- Enable the sector to deliver wider value to society and the economy across all regions.
- Enhance the engagement of water customers and communities with their local water environment and their willingness to actively participate in the solutions to the challenges.



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## 3 Our Vision for 2050

## Our Vision responds to these priorities

### OUR VISION

By 2050, we will be globally recognised as an environmental leader, stewarding the improvement of rivers and seas, acting on the climate emergency and protecting customers' long-term interests.



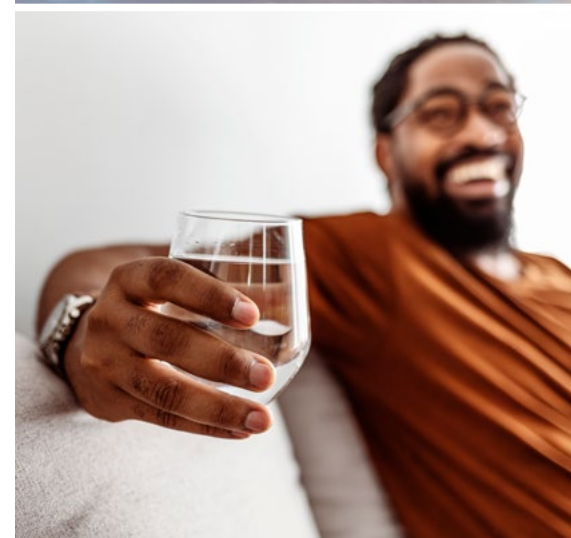
*It is incumbent on every part of the water industry to play its part to mitigate and adapt to the impact of climate change on the environment and the sustainability of the water supply”*

[2050 discussion document feedback](#)

**Achieving our Vision will ensure we continue to deliver on our purpose in an affordable way despite the challenging external environment.** This will help protect our customers and communities from the consequences of the climate change emergency and the biodiversity crisis, whilst ensuring resilient and sustainable services, and lower bill impacts in the longer term.

**Achieving our Vision can be a vehicle for the government's ambitions in a number of areas and protect the long-term interests of citizens and communities.** This includes the target for Net Zero carbon emissions, the 25 Year Environment Plan [25YEP] and the need to ensure no communities are left behind (levelling-up).

To overcome the challenges and achieve the Vision, water companies, the supply chain, government, regulators, customers and communities need to come together to accelerate the rate of positive change.



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# To achieve our Vision, we will need to get the fundamentals right while also continuing to transform our role in society

## The role of the water company has changed significantly over the past 30 years.

Customers used to be viewed as passive recipients of water and wastewater services, and companies used to focus narrowly on their own assets.

Now, we are proud protectors of the environment, with a responsibility much wider than our own assets. We collaborate with an increasing number of partners, and customers and communities are active participants in the sector. We have improved faster in some areas than others, but looking forward, in achieving our Vision, we will ensure that in addition to getting the basics right, we are focused on maximising long-term value for society across all parts of our business.

Our Vision and the changes we need to make are not dependent on any specific industry structure. Changes to environmental regulation could encourage integration across different providers of environmental services in the long-run but this would be a consequence not a pre-requisite. We are uniquely placed to play the role we set out in this White Paper because:

**The water sector has a long-term role in society**

**We are experts in our local environment**

**We are well-connected with stakeholders, other sectors and NGOs**

**We have a funding mechanism that can enable private investment to deliver the improvements required across all regions - £160 billion invested since the 1990s**

Looking forward →

- Asset owners and operators
- Cost efficiency focus
- Customers as passive recipients

- Water and sewerage providers
- Cost benefit and compliance focus
- Customers as bill payers

- Environmental service providers
- Service improvement focus
- Customers as consumers
- Partnership and catchment approaches

- Leaders in managing the local environment
- Maximising long-term value to society
- Accountable to customers and communities as citizens and partners
- Conveners of stakeholders across water catchments

← Looking back

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## **4** Why and what we need to change: Delivering more environmental impact more efficiently





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# Stepping back: Protecting our natural environment requires environmental regulation to address market failures

**In the current regulatory period (2020-2025), water companies are spending £5bn on improvements to the environment via the WINEP<sup>1</sup> that is focused on improving catchments.**

A catchment is the geographical area of land through which water from any form of precipitation drains into a body of water – this can be a river or groundwater. Water is abstracted from catchments for various purposes including public water supply and industrial use and pollutants enter catchments as a result of discharge (from sewerage companies or industry) and as a result of run-off (e.g. from farmland or roads). In addition, the public uses rivers for a range of leisure activities such as fishing, boating and swimming.

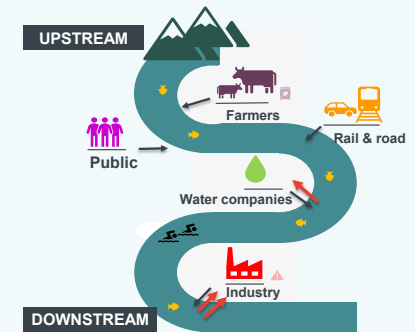
Environmental regulation is critical to protect our catchments, improve the environment, and ultimately deliver better outcomes for consumers. Without government intervention rivers would be over-abstracted and over-polluted as the social cost of abstraction and pollution are not aligned with the private costs (which is a classic externality problem).

The additional issue with catchments is that there are many different environmental externalities that interact. This creates a level of complexity that needs careful policy design.

Environmental regulation is an important tool for managing river catchments as they are subject to a number of market failures.

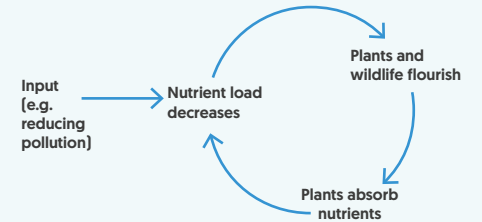
### 1. Common Pool Resources

It is very difficult to limit access to them; but their supply is fixed, meaning they can be depleted over time. This is why catchments are prone to market failure and why intervention is needed in the first place. Different sectors use catchments in different ways and we need to take a holistic approach to environmental regulation.



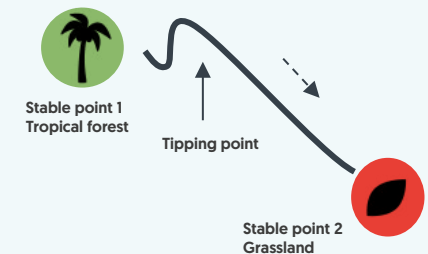
### 2. Feedback loops

These can be positive (virtuous cycles) or negative (vicious cycles). A holistic approach can help accelerate the virtuous cycle and put the environment in a position where it can self-recover.



### 3. Tipping points

The environment can tolerate a degree of harm, but beyond a certain point it quickly deteriorates and it becomes significantly harder to restore.



1. Water Industry National Environment Programme

# The current approach to environmental regulation is not fit for purpose

The current approach to environmental regulation delivered good value when there were “low hanging fruit” such as substantial reductions in point source pollution at low costs or reducing specific abstractions which caused clear environmental harm. Today the approach is no longer fit for purpose because it is:

## Fragmented and sends different signals to different sectors

- Many sectors impact on the environment but are subject to very different types of regulation and incentives. In water, we have the WINEP that covers all environmental improvements including stricter discharge consents and reducing abstraction. There is no equivalent scheme in other sectors. While there are new schemes aimed at biodiversity improvements such as Environmental Land Management (ELM) and Biodiversity Net Gain (BNG), they are only available to some sectors even though others can deliver the same outcomes.
- This sends different signals about the social costs and benefits of the environment to different sectors. This is not in line with the ‘polluter pays’ principle which is one of the key principles set out in the Environment Act.
- Each sector (and their end customers) should be paying for the true social costs of the goods and services being produced.

## Prescriptive and output focused

- The current WINEP is made up of more than 11,000 individual output requirements for water companies to deliver, and is set to cost £5 billion over the period 2020-2025. Many of the outputs are demonstrably not optimal, and the same outcome could be achieved more efficiently.
- The WINEP also obliges the water sector to carry out the improvements itself even though engagement with other sectors could achieve the same outcomes at a lower cost and with greater benefits.

## Not systems-based

- This means that environmental trade-offs are not transparent and not reflected appropriately
- Through the WINEP, water companies have been required to invest heavily in physical assets to improve water quality, even when it is not efficient to do so, and perversely, many of these asset-based solutions are energy intensive adding to their carbon footprint.
- The current approach runs the risk of creating additional negative externalities and misses the opportunity to create virtuous circles, e.g. as a result of nature-based solutions.

Government’s recent WINEP reform taskforce has been a useful step in the right direction but has not gone far enough in moving away from prescriptive outputs, delivering in partnership or encouraging systems-based thinking. The consequences of the current approach are that we do not deliver environmental improvements in a way that maximises benefits and minimises costs to society.

# And financial incentives and culture & skills contribute to a focus on traditional solutions

## The focus on traditional solutions is reinforced by:

### Financial incentives skewed towards traditional solutions

- The current approach to economic regulation means the cost of traditional capital-intensive solutions is recovered with some certainty through the Regulated Capital Value (RCV) over a period of time. In contrast, nature-based solutions will provide broader environmental benefits require mainly opex, and their cash-flow profile is therefore more even over the life of the solution. Cost recovery beyond the current regulatory period is less certain for companies as repeated costs such as opex are benchmarked at each price control making these solutions less attractive in an internal cost benefit analysis. This potential issue has been acknowledged by Ofwat in its PR24 and beyond document.
- Innovative solutions have a different risk profile compared to traditional solutions as we need to build up a track record of experience. If the overall risk and reward balance is based on traditional solutions, there is a case for reviewing the balance to ensure it appropriately incentivises innovative solutions.

### Culture and skills across industry largely focused on traditional solutions

- The culture and skills in the industry need to move away from focusing on traditional solutions towards finding new and innovative ways that provide best value from a holistic systems-based point of view. This runs the risk of creating a vicious circle that incentivises traditional thinking and therefore prevents the transition to a broader set of skills and expertise.
- Related to this is the need for the water sector to represent a wider set of perspectives in its workforce. Currently, the water sector has a less diverse workforce when compared to all other sectors, e.g. only 4% of the workforce identifies as BAME compared to 15% across all sectors and 20% of the workforce is female compared to 47% of all sectors. This means that the workforce does not necessarily represent the different perspectives that we need to be outward-focused and innovative.

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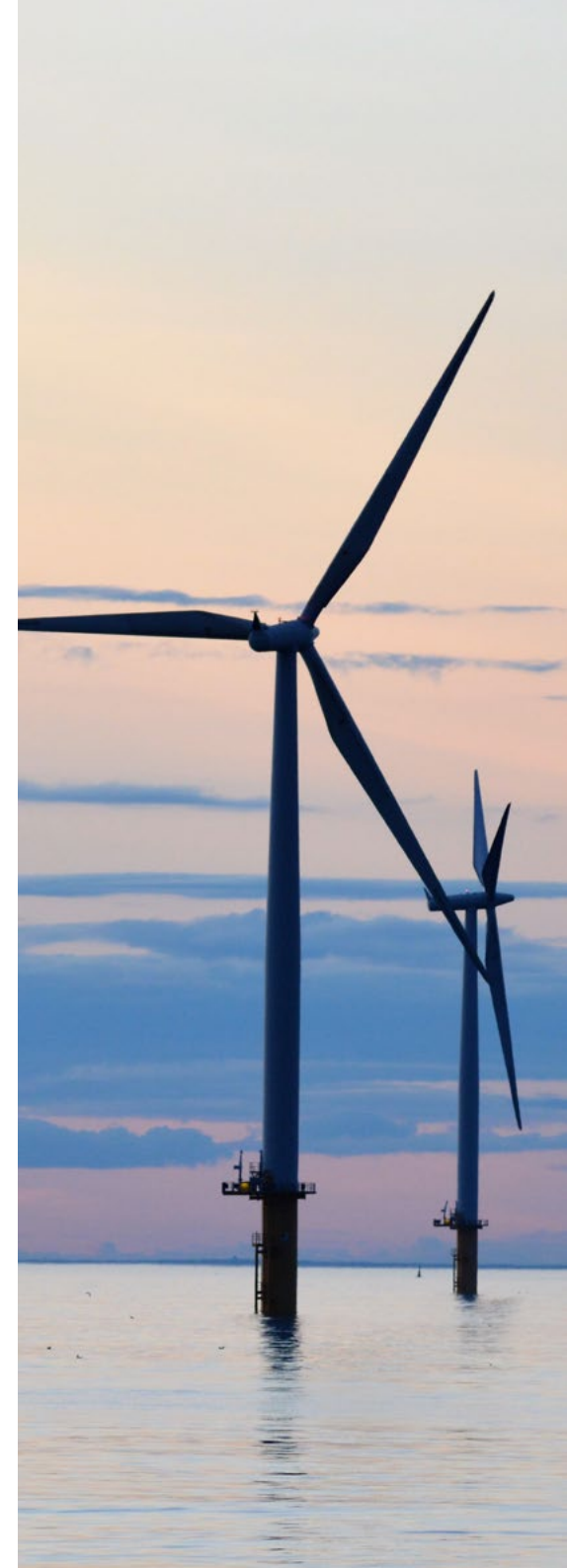
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## Action on Net Zero brings significant co-benefits that alleviate other challenges

The changes needed to deliver net zero also support other priorities, producing efficiencies and synergies that help the sector meet increasing expectations. For example:

- **Increasing operational resilience by deploying renewables** — solar and wind generation, coupled with battery storage makes our sites more resilient when power grids fail, meaning water customers remain in supply, and grid operators can focus their attention on other priorities such as asset health. Deploying more of these systems would also protect customers from energy price shocks, as more of the sector's power would come from our own sources, reducing the link with fossil fuel pricing.
- **Reducing chemical dependency through new technologies** — deploying alternate treatment technologies would allow the sector to retire some of the high-carbon and chemical-dependent technologies used to treat water. This would help decouple the sector from overseas supply chains which can be disrupted by fuel prices, political changes, and times of low global security.
- **Harnessing nature for biodiversity** — nature-based solutions such as peatland restoration and wetlands, not only reduce our carbon footprint, they also provide vital habitats for nature, alleviate the biodiversity crisis and provide opportunities for public recreation that enhance national wellbeing.
- **Reducing demand** — reducing demand, especially in times of drought, can avoid the need to tanker water to support local networks, cutting vehicle emissions, and avoid the need to source water in already stressed areas.
- **Utilising by-products** — carbon reduction technologies, such as advanced anaerobic digestion, already help turn wastes into products that support sustainable practices in other sectors, and widening this to other aspects of the industry can help the UK decarbonise, and generate revenues that offset the burden on customer bills.

**But we need regulation to recognise and incentivise these co-benefits sufficiently if we are to realise their maximum potential.**



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## Case studies that illustrate the problem and benefits from solving the problem

### Case Study

#### Wessex Water's experience at Poole Harbour

Wessex Water was obliged to reduce nitrate pollution at Poole Harbour by investing in a carbon-intensive treatment process, with an estimated cost of £31,000 per tonne of nitrogen removed. However, Wessex has shown that it could achieve the same outcome by delivering a **nature-based solution in partnership with farmers**, at a cost of £9,000 per tonne of nitrogen removed – i.e. **71% cheaper and also with biodiversity benefits** instead of more carbon emissions. But despite this, Wessex was ultimately still obliged to invest in the costlier carbon-intensive solution.

### Case Study

#### Anglian Water: The opportunities offered by nature-based solutions and barriers to their implementation

Anglian Water worked with the EA and the Norfolk Rivers Trust to explore solutions that would maximise wider value whilst delivering a reduced level of ammonia and phosphorus discharge from its water recycling centre at Ingoldisthorpe. Rather than focusing only on traditional solutions such as membrane bioreactors technology or pumping flows to neighbouring areas, which would have been more expensive, it invested in a nitrifying sand filter along with four new connected wetlands to further improve water quality and enhance the natural capital of the local environment. This innovative approach allowed Anglian to deliver against its water quality commitments,

avoid carbon and chemical intensive solutions that run counter to national net-zero ambitions and deliver biodiversity gains. Early results show that water quality has improved beyond expectation and that wildlife thrives in the newly created natural environment.

Whilst Anglian was able to successfully deliver this pilot, the transition to more widespread use of nature-based solutions faces several barriers. **Prescriptive regulatory requirements (in this instance to line treat the constructed wetland) can increase both the carbon and financial cost of wetland schemes** and risks pushing water companies back towards lower-value solutions. Moving to outcome based regulation would focus on the best way to deliver overall outcomes rather than specifying specific inputs, allowing natural capital and carbon benefits to be maximised at minimal environmental risk. **Outcome based regulation would facilitate more cross-sector collaboration and this would also accelerate widespread use nature-based solutions** e.g. the ability to work in partnership with landowners and top up money farmers are already receiving to fund better land management. Finally, **there is a challenge for water companies themselves to ensure that their culture and systems are set up to identify and enable new and partnership-style solutions** e.g. redesigning procurement systems to contract with smaller, local level organisations rather than national engineering firms.

### International precedent

#### *An integrated network approach to flooding resilience\**

##### Amsterdam

In response to several severe rainfall events in the Netherlands, Waternet (the water supplier for Amsterdam) established Amsterdam Rainproof. The project established a collaborative network of organisations and citizens who work together to increase the city's resilience to extreme rainfall on a small and large scale.

The Amsterdam Rainproof project promotes an outcome rather than outputs based approach, identifying where improvements in other sectors could achieve the same outcome at lower cost and greater benefit to society. The project also promotes Amsterdam's circular economy goals, finding opportunities to reuse excess rainfall e.g. the Hemelswater: Code Blond beer is brewed using rainwater from roofs of Amsterdam.

To date over 50 physical rainproof projects have been implemented.

\*<https://iwa-network.org/city/amsterdam/>

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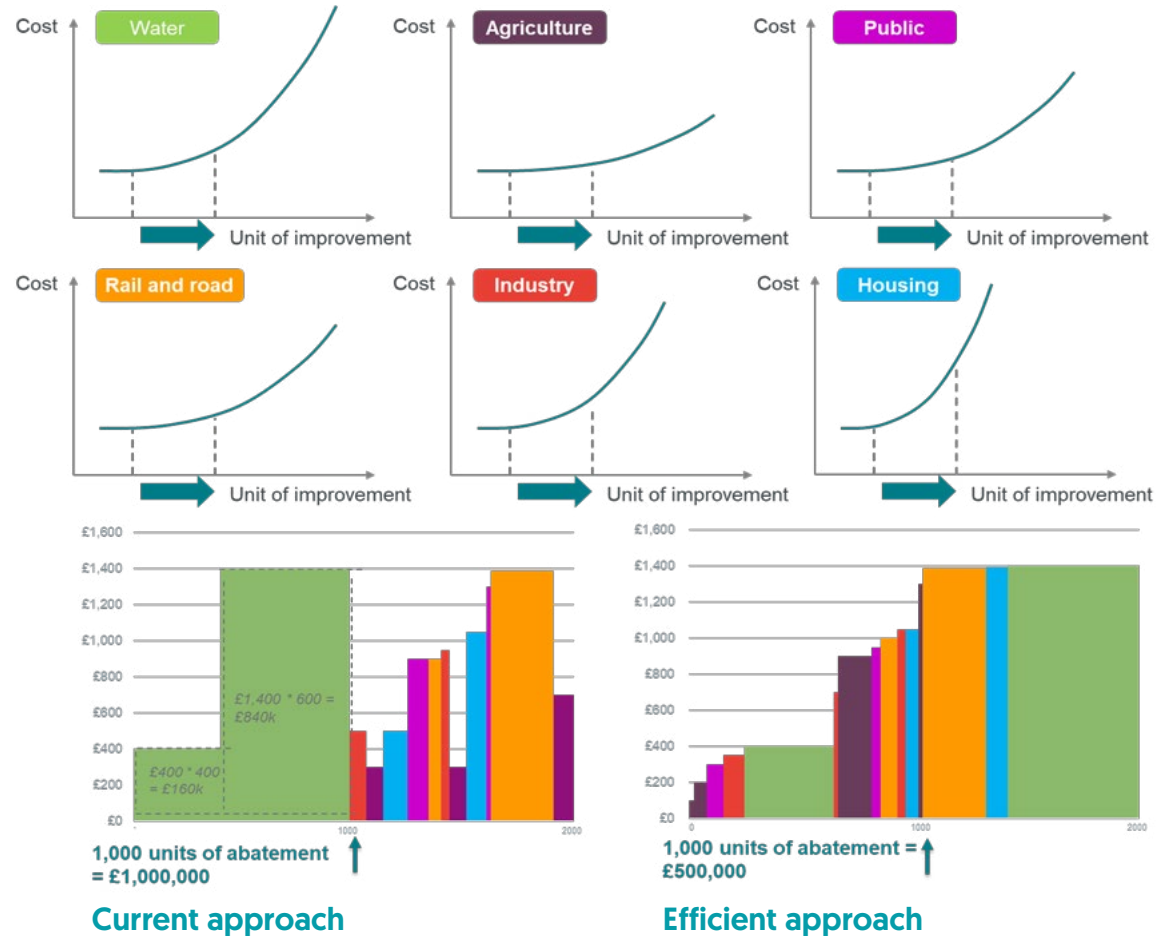
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# The case for change: the current approach to environmental regulation of catchments is inefficient



Each sector is faced with its own cost curve for improving the environment. The current approach to environmental regulation is inefficient as it does not incentivise all sectors to implement the best value solution first but instead leads to an arbitrary mix of solutions.

The picture to the left illustrates that the consequence for society is less environmental improvement at higher costs.

This problem is exacerbated when policies are only aimed at one environmental measure (e.g. phosphate). In this case, the solution to reduce phosphate may create other negative environmental impacts that are not reflected.

We therefore need an approach that is efficient from a holistic point of view.

# We need to work together to implement outcome-based environmental regulation (OBER) and change our culture and skills

## How do we deliver more environmental impact, with more benefit for nature from each pound of investment?

### 1. Implement outcome-based environmental regulation (OBER):

- Long-term outcome targets linked to the 25YEP set for England as a whole covering all key aspects of the environment – including carbon. This will ensure that the water sector targets contribute directly to the 25YEP ideally as part of a National Plan for Rivers<sup>1</sup> and other water bodies (Action 1 in our 21st Century Rivers Plan<sup>1</sup>).
- Targets and milestones apportioned to catchments, fundamentally reshaping the scope of the WINEP. Water companies should receive their fair share of the targets without delay so we can start making our contribution to the 25YEP.
- Companies allowed to meet targets by delivering outcomes in partnership with others, including customers and communities and other sectors. This will ensure that the best value solutions are implemented and allow innovation to flourish. This is key for unlocking efficiencies.
- Economic regulation provides appropriate risk and reward balance and level playing field between traditional and nature-based solutions. This will ensure that there are no financial barriers to innovative solutions.
- OBER monitoring framework supported by additional steps to provide open and live data (e.g. discharges). This is essential for trust and confidence in OBER and identify how OBER has facilitated innovation.

### 2. Change skills profile and culture so:

- Water companies, regulators, NGOs, etc. have world-class green skills to identify, develop, and implement innovative solutions.
- Everyone is focused on outcomes, innovative approaches and partnerships.
- This will ensure that OBER delivers maximum benefits to customers and communities as we have the right skill base and mindset to develop, trial and implement innovative solutions.

Ideally this would be underpinned by protection in law such as a new single “Rivers Act” (Action 2 in 21st Century Rivers Plan).

This would be enabled with “Local Empowerment” (Action 3 in 21st Century Rivers Plan).

This would support accountability on the basis of a data-driven approach (Action 4 in 21st Century Rivers Plan)

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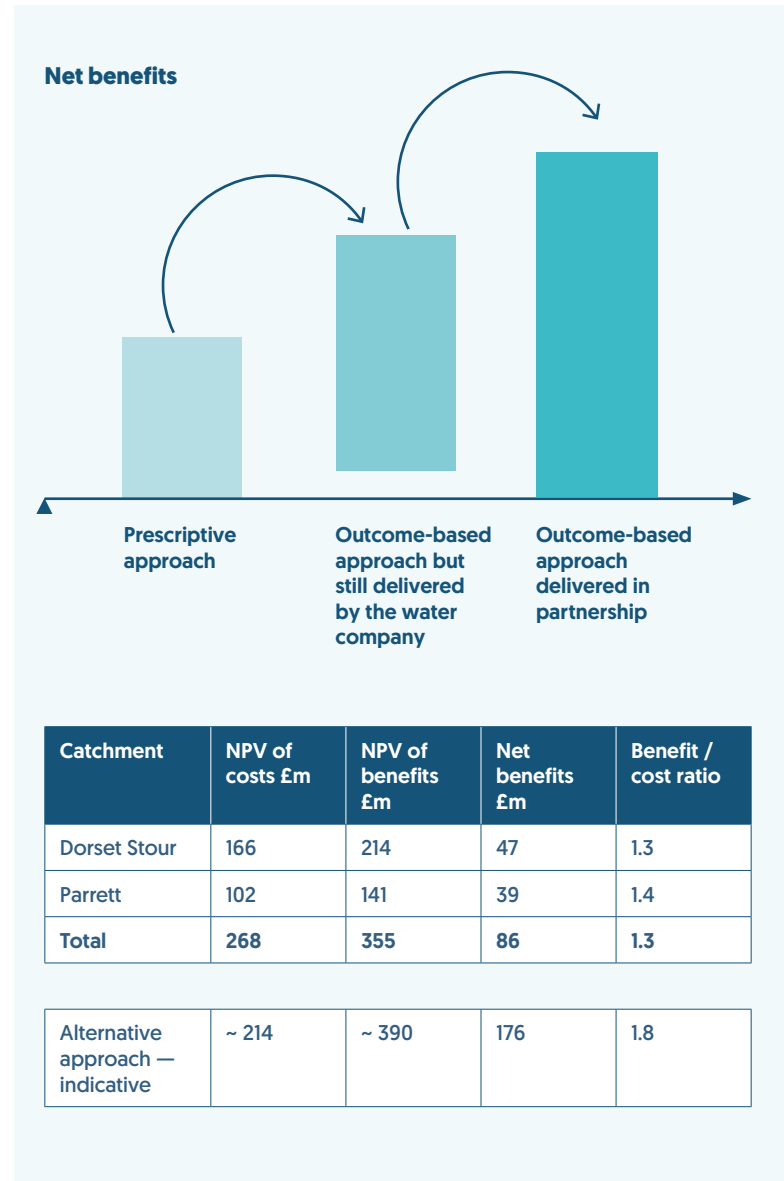
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# While it is difficult to estimate the costs and benefits of reform...

## Approach 1: Bottom up estimate based on Wessex Water's experience

- Estimating the potential cost savings of outcome-based environmental regulation is challenging, as it difficult to observe the cost curves of other sectors to deliver environmental improvements. However, there are various case studies that highlight the inefficiency of the current approach to environmental regulation.
- Through the WINEP, Wessex was initially obliged to reduce discharges at a small number of treatment works. However, it was able to demonstrate that by reducing discharges by a smaller amount at a greater number of sites, it could achieve the same outcome but for **£54 million less (c20% less)**, and with around **£35 million of extra benefits (c10% more)**. The EA accepted this analysis and allowed Wessex to deliver its alternative approach.
- To get an overall sense of the benefits, these figures can be scaled up to England as a whole. Wessex's area of operation covers around 8% of England. Scaling up these figures – which assumes that other companies would be able to achieve similar cost savings and greater benefits through an improved approach to the WINEP – would imply:
  - a total cost saving for England of around £700 million for the period 2020-25, equal to around £6 per household per annum. Assuming the same cost saving per annum, this equates to cumulative cost savings of **£2.7 billion out to 2050** in net present value (NPV) terms.
  - extra benefits of **£1.7 billion in NPV terms** out to 2050.
- However, it is worth noting that Wessex's proposed approach still involved Wessex carrying out the improvements itself. Further cost savings and greater benefits could have been possible if it were able to deliver the improvements in partnership with others. Therefore, the figures above really only capture the impact of partially moving away from a prescriptive approach and not the full benefits of outcome-based environmental regulation
- This estimate is clearly only based on extrapolation of one example and therefore the figures should not be viewed as a robust estimate of the overall benefit. Instead they provide an illustration of the magnitude of potential benefits. Further work is needed to assess the costs and benefits in detail.





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# ...the potential magnitude could amount to billions out to 2050

## Approach 2: Top down analysis

- According to Indepen, across all sectors in England, over £13 billion is spent on improving catchments each year:
  - Direct - Spending with a primary aim of protecting and improve England’s water and land environment. Indepen estimates spending on this to be £7.7 billion per annum.
  - Indirect – Spending in a catchment to manage water for the benefit of society (for example, drainage, flood risk and water supply). Indepen estimates spending on this to be £5.7 billion per annum.
- Given the inefficiencies of the current approach to environmental regulation, it is not unreasonable to believe that with outcome-based environmental regulation, the 25YEP could be met for billions of pounds less and with significantly greater environmental benefits than under the current approach.
- First, not all of the £13 billion figure would be on incremental activity which could be suitable for delivery through partnerships. Part of it would relate to operating and maintaining existing assets. For instance, of the EA’s budget on flood risk management, around 65% is spent on ‘capital’ which “is money that is spent on investment and things that will create growth in the future” which could be suitable for delivery through partnerships instead. Similarly, for water companies, around 18% of expenditure is spent on ‘enhancement’ which includes spending on new assets some of which could alternatively be delivered through partnerships instead.
- Making a high-level assumption that 40% of this £13 billion figure relates to incremental activity which could be delivered in partnership with others, and assuming a relatively conservative 10% cost saving on that amount, equates to potential cost savings of £520 million per annum, or £22 per household in England each year.
- Assuming the same cost saving per annum, this implies cumulative savings of around **£10 billion in NPV terms**.
- As this estimate is clearly based on a number of high level assumptions, it should not be viewed as a robust estimate of the overall benefits. Instead, it provides a high level indication of the potential magnitude of the benefits. Further work is needed to assess the costs and benefits in detail.

### Academic literature on cost savings from delivery through market-based approaches

Cost reduction	Market Scheme
15%–90%	Sulphur dioxide allowance trading in the US
40%–47%	NOx trading in the US
43%	South Coast Air Quality Management District

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## Case Study

### Yorkshire Water: Partnership working to deliver greater flood resilience

The Hull area is at particular risk from extreme flooding and is one of the most vulnerable areas to climate change. Traditional solutions to expand the capacity of Hull’s sewer system would cost around £1.8bn for consumers.

Yorkshire Water worked with the EA and local government to explore alternative holistic solutions that combine grey and natural flood management solutions (blue-green solutions). It identified four ‘hot spot’ areas where blue-green interventions could deliver flood resilience at a lower cost to consumers, along with delivering co-benefits for the environment via biodiversity improvements and an amenity value within the local economy.

Blue-Green solution cost (£m)	Traditional solution cost (£m)
50.5	72.1

By working together with local partners, Yorkshire Water was able to develop a non-traditional solution that delivers against both the levelling-up and environmental agenda which would not be the case using a traditional solution.

Yorkshire Water faced a number of barriers to partnership driven solutions. Separation of flooding responsibilities across different bodies ignores the interdependent nature of flooding and obtaining regulatory approval for holistic solutions is perceived to be difficult due to uncertainty around the treatment of wider social benefits.

**Removing regulatory and other barriers to partnership working will reduce the risk that traditional siloed solutions remain the default option and can be expected to allow solutions that maximise public value to be identified and pursued.**

## Case Study

### United Utilities: Enabling the best value schemes to proceed

United Utilities (UU) needs to meet a new phosphate permit at a rural water recycling centre and prevent storm spills from the site. In this particularly difficult location UU worked to understand how nature-based solutions could support the delivery of this while also benefitting other ecosystem services. Two non-traditional options were developed to treat storm spills rather than prevent them, a storm treatment reed bed and an Integrated Constructed Wetland (ICW).

The reed bed was the lowest cost option and also a relatively more proven approach. The benefits case however is significantly better for the ICW as it provides a more natural habitat which created better biodiversity as well as an amenity for local people to access. The location of the site next to a public right of way opened up an opportunity to maximise this value. The use of nature-based solutions therefore allowed a viable solution to be developed for this site at a significantly reduced cost to the traditional solution although at greater cost than the reed bed.

Solution	Construction (£m)	Natural capital value (£m)
Traditional	1.000	-
Reed bed	0.255	+£0.163
Constructed Wetland	0.340	+£1.800

UU has decided to progress the ICW option, facilitated by a bespoke incentive arrangement with the economic regulator to deliver natural capital value that offsets the additional costs and risk to UU associated with the ICW approach.

**A move to outcome-based environmental regulation would systemise a more holistic assessment of wider environmental benefits across water company investment decisions so that these opportunities to deliver wider value are identified and proceed as a matter of course.**

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## Case Study

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### South East Water: Taking a long-term view to environmental planning

South East Water recognised that making a lasting change to the environment takes time, and that no one organisation can do it alone. It has therefore taken the bold step to develop its own 25 year plan for the environment, co-creating a long-term environmental strategy to enhance environmental resilience in the short and long-term. It worked together with more than 200 customers, stakeholders and employees to identify the greatest challenges and key strategic themes for the strategy. This included environmental NGOs, local and national government representatives, large land owners, industrial water users, housing developers, highways authorities, independent expert groups, and representatives for other water users. Furthermore, the strategy explicitly recognises that we need to consider wider environmental impacts, taking a more holistic view to ensure the best possible outcome for the environment.

This plan will exceed the statutory obligations and planning cycles such as the WINEP, Water Resources Management Plan, and dry weather plan - showing an appetite for companies to work with stakeholders to deliver more integrated long-term plans. These would be facilitated by greater commonality in the existing planning frameworks' objectives and greater clarity and consistency on how to interpret and implement a best-value approach across them.

## Case Study

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### Anglian Water: Slug-it out campaign — Changing the culture and skills base within water companies

Anglian faced the challenge of metaldehyde, a soluble compound commonly used by farmers as a pesticide against slugs and snails. Rather than installing traditional treatment solutions to ensure water quality, which would have cost the region £595m to build, with an additional £17m annual operating cost, it piloted a programme to work with 225 farmers to use alternative chemical slug controls at a cost of £3.5m. The campaign has been highly successful, delivering a 96% reduction in metaldehyde levels across the region and farmers have proactively stopped using metaldehyde in other areas.

A key factor to the success was that **Anglian Water developed a team of skilled agricultural experts to engage with farmers**, helping to broker relationships and ensure productive ongoing engagement. **The success of this pilot shows how that if the industry is to grasp fully the opportunities of outcome-based environmental regulation, companies will need to develop new ways of working in partnership with others and acquire and develop new skills** to identify the opportunities for different solutions.

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### South West Water — Working with communities to identify and deliver wider environmental benefits

South West Water engaged with a community action group Water Watch to identify the multiple sources of bacterial pollution impacting on the quality of the bathing water at Combe Martin beach, including dog faeces and farm run-off into the River UMBER.

From this they identified that planting more native trees in the catchment will help improve water quality in the River UMBER and at Combe Martin beach by intercepting peak flows of rainfall in the valley and improving soil health. Approximately 4 hectares of trees and 130 metres of hedgerow at seven locations will be planted across the catchment after local landowners volunteered to get involved. These catchment actions complement South West Water's ongoing work to improve the wastewater drainage systems in the area and will have additional positive impacts for biodiversity and carbon.

Outcome-based environmental regulation will result in a step-change in the scale and scope of these types of opportunities by providing additional incentives for collaboration between communities, landowners and water companies to look at environmental improvements in a holistic way. It will encourage them to identify and then deliver innovative approaches that have greater long-term environmental benefit for every pound of investment.

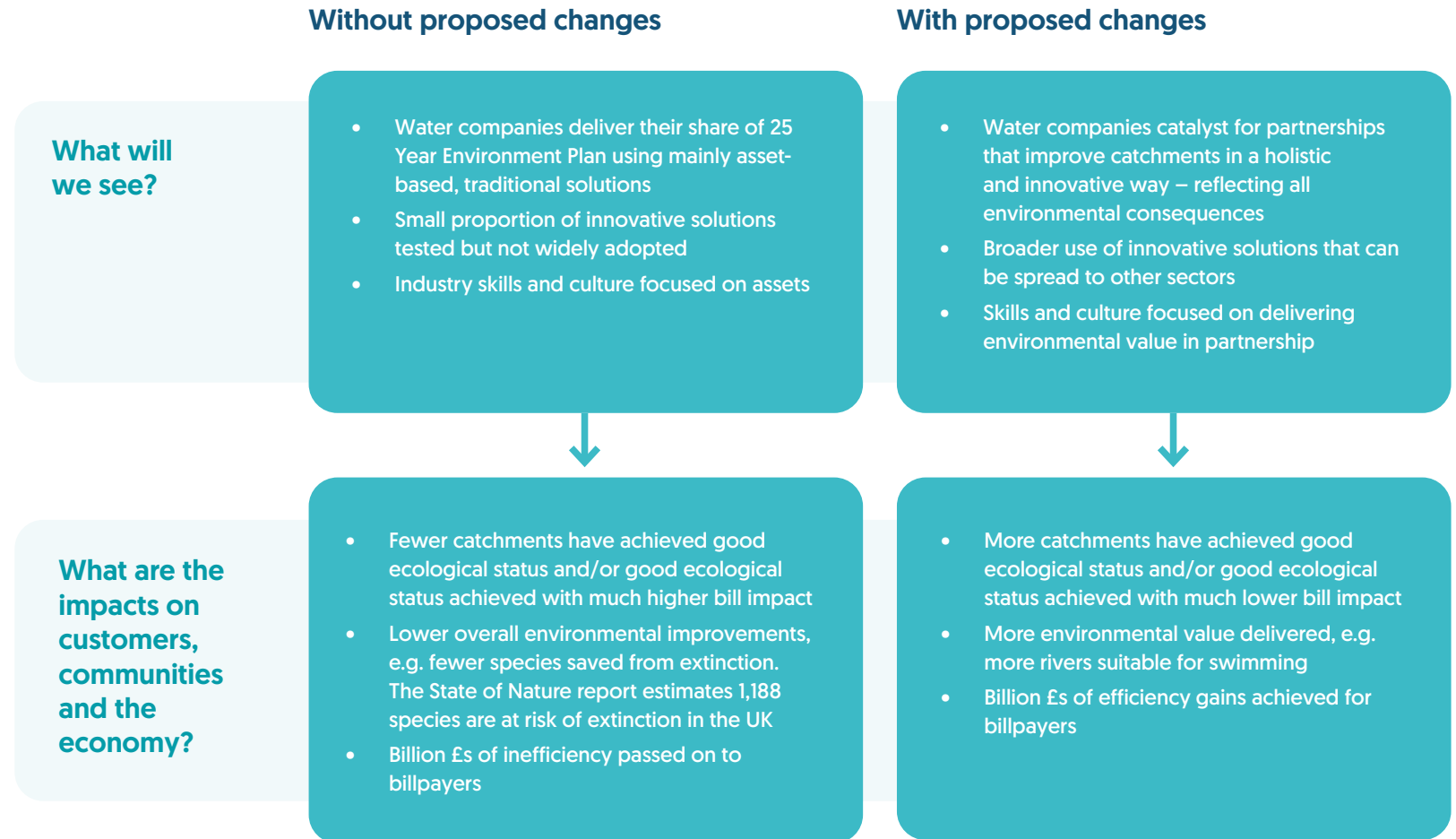
## Case Study

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### Southern Water: Enhancing the natural environment to reduce overflow spills — a win-win solution

Southern Water is focusing on addressing the challenge of storm overflows in a number of catchments across its region, including the Sandown catchment on the Isle of Wight that has high amenity and ecological value. By scrutinising the pathways and sources of rainwater and runoff to the sewerage system there it has identified that approximately 80% of the additional hydraulic load that is causing overflows to spill is coming from roofs and roads. Preliminary analysis shows that reducing a proportion not all of this runoff will significantly reduce storm overflow spills. Most excitingly this reduction can be achieved using upstream nature-based solutions that are low-carbon, enhance biodiversity and add further amenity and ecological value to the area. This is therefore a win-win in environmental terms and Southern Water is currently establishing the partnership to drive this forward.

# Looking back from 2050, what would we see?



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## **5** Why and what we need to change: Protecting long-term customer interests through the right investments at the right time

# Stepping back: Making the right decisions for current and future generations is a complex challenge



# The current approach to making investment decisions is not fit for purpose

The current approach to making investment decisions is appropriate when the sector is in a “steady state”. However, in the context of the climate and biodiversity emergency, the approach is no longer fit for purpose because it is:

## Not based on a thorough joint understanding of uncertainty around climate change, technological change, and preferences of future generations

- The current approach is largely based on individual decisions by different regulators and companies on how much risk we are prepared to take without an overall framework. This means we cannot be confident that our planning and investment decision processes always lead to decisions that are aligned with current and future customers’ preferences.
- We do not have the right conversations about risk. Long-term planning for the water sector is an exercise in managing uncertainty and currently planning and decision making processes are not based on a thorough joint understanding of uncertainty around climate change, technological change, and preferences of future generations.

## Based on backwards looking assessments

- The assessment of costs is largely based on historical costs – this is appropriate in a “steady state” but not fit for purpose when faced with an inflection point in the external environment as a result of climate change and the ambitions of the 25YEP.
- Backward-looking assessments also runs the risk of favouring tried and tested solutions over innovative solutions.

## Lacks an integrated approach

- The current approach reflects multiple planning guidelines for different parts of the business that can have different objectives. This can create inefficient planning processes.
- Most of the planning guidance now reflects “best value” approaches but there is a lack of clarity on how to interpret and implement this approach. Most decisions are based on a mix of customer valuations and wider societal values without any clear consideration of future generations’ preferences or capturing the risk of tipping points. We currently do not have a holistic assessment of all of the impacts for each potential scheme.

**As a result, we cannot be confident that the current approach will enable us to make the right decisions for current and future generations.**



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# Ensuring no regrets investment for 2050 and beyond

## Making the right decisions

The UK Net Zero Strategy provides a high-level approach to meeting the Net Zero 2050 target, but it is currently absent the detail needed for all stakeholders to plan their own pathways. Clarity and confidence in the strategic direction are essential for sound sector-level planning and to finding the most advantageous approach for society as a whole. Defra's role in supporting the water sector to meet the Government's Net Zero target is an important catalyst for future collaboration and coordination on more detailed policy objectives.

Our Net Zero 2030 Routemap identified the importance of PR24 for enabling the sector's transition to net zero. Process emissions in particular is an area where significant emissions reductions have been identified by Government, and significant research and innovation will be needed.

The water sector is also pivotal in the net zero ambitions of other sectors. Recognition and analysis of the interdependencies by regulators would allow sectors to progress faster, and ensure investments do not conflict or supersede those in elsewhere in the system.



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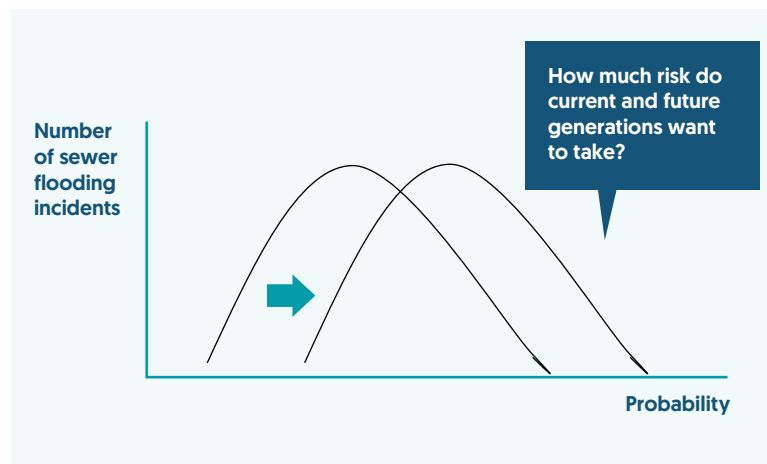
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# The current approach to planning and making investment decisions is not fit for purpose

## Not selecting the level of risk that reflects preferences of current and future generations

The climate emergency is changing the likelihood of extreme events and service interruptions such as drought or extreme rainfall. Without action, customers and society would experience lower service levels. As a result, resilience has been one of the major investment themes. However, we currently do not have a systematic approach to analysing and deciding on the level of risk current and future generations want to take. The current approach is often ad hoc, e.g. risk is considered when looking at individual investment options. This risks leading to decisions that are not optimal so we either take too much or too little risk and do not invest at the right time.

In addition, when relying on historical data for assessing the costs of addressing future challenges, there is a risk of not allowing the right level of investment at the right time to deliver the society's risk preferences over the long-run.



## Not selecting projects on the basis of best overall value

When faced with the decision of whether to propose or allow a project to go ahead, a holistic cost benefit analysis can inform which projects are optimal from a societal point of view. The problem is that is not straightforward to assess and include all relevant impacts. The table below provides an illustrative example of two options that could address the same problem. When reflecting customer preferences today, option 2 is optimal as it has a higher benefit cost ratio. But if environmental impacts are included, both options are equally worthwhile. If we include consideration of tipping points, option 1 becomes more cost-beneficial than option 2. The problem with the current approach is that we do not always have a comprehensive analysis of the impacts and we then do not always make consistent and coherent decisions on the basis of the impacts. The risk is that we select options or projects that are not optimal – this means ultimately society will pay more for less improvement.

	Option 1	Option 2
BCR <sup>1</sup> (Customer preferences today)	1.2	2.2
BCR (with environmental impact)	1.5	1.5
BCR (with environmental tipping point)	2	1

1. Benefit / cost ratio

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## Case Study

### Thames Water: How fixed regulatory timescales can hinder the adoption of solutions which deliver wider benefits

Thames Water has identified that it might have been possible to develop a more integrated approach to the water quality and flooding issues associated with the Roundmoor Ditch, a chalk stream in its region that is strongly influenced by a discharge from Slough Water Recycling Centre.

The regulatory timescale associated with the requirements to upgrade Slough WRC meant that a potential alternative solution which maximises the environmental and community benefits could not be fully pursued, as the complex issues associated with a more integrated approach could not be resolved in sufficient time for the company to avoid financial penalties for non delivery of the scheme.

Thames currently therefore expects to need to pursue an option which is likely to be more costly and increase the carbon footprint of the site. It will only partially address the operational and community issues associated with the Roundmoor Ditch and fails to make use of the potential opportunity afforded by this upgrade to restore local watercourses and deliver local environmental improvement.

## Case Study

### South East Water: PROWATER Identifying tipping points in the local environment

South East Water is taking part in the European PROWATER project which aims to facilitate greater use of ecosystem-based adaptation solutions (EbA) to build resilience against climate change. Not only are nature-based solutions less carbon and chemical intensive than traditional solutions, they also deliver environmental benefits via soil protection and biodiversity. These solutions also provide climate change resilience, allowing us to understand how specific habitats can capture more rain and transfer it to groundwater, improving effective rainfall while protecting the quality of raw water.

However, the current regulatory system is not considered to facilitate cross-sector collaborative nature-based solutions, and the key objective of the PROWATER project is to develop a long-term incentive scheme and common toolbox for assessment of co-benefits for EbA solutions.

To illustrate this point, the project has developed a geographic information tool to identify key areas where a change land use change could act as a tipping point for the local environment, deteriorating soil health, water quality and quantity, and biodiversity loss. However, even once these high risk areas are identified, water companies do not have the powers to ensure land is managed in a way to deliver natural solutions, requiring multi-sector collaboration to effect change. Environmental regulation around land-use though is fragmented across segments and often input or output focused, making it difficult for multiple stakeholders to work together to take corrective action.

## International precedent

### *Cloudburst: Delivering societal value alongside flooding resilience\**

#### Copenhagen

Copenhagen is experiencing more frequent major rainfall events and rising levels of damage due to climate change. To address this challenge, it carried out a reassessment of the overall economics of flood resilience mitigations, choosing between traditional sewer solutions and a combined blue/green solution. The combined solution consists of a network of parks that act as reservoirs when required, connected by streets that channel water to the harbour.

To decide between these options, the city carried out a socio-economic assessment which recognised the additional benefits of a combined solution which included urban space improvements, new job creation, and the value of piloting a proof of concept that could be applied in other cities, all while preparing the city for a 100-year rainfall event.

The city ultimately went with the blue/green solution, with the mayor for technology and the environment stating that “we could build more sewers, but that would be expensive and Copenhageners would get little benefit out of it. Instead we opted for a green and blue solution”.\*\*

DKK billions	Traditional sewer solution	Combined solution
Net benefit	-4	5

\* <https://climate-adapt.eea.europa.eu/metadata/publications/economics-of-cloudburst-and-stormwater-management-in-copenhagen/11258638>

\*\* <https://www.politico.eu/article/copenhagen-warming-climate-flooding/>

# We need to work together to change our approach to investment planning and decision making

## How do we protect long-term customer interests through the right investments at the right time?

### 1. Resilience standards and a common risk framework:

- Defined and agreed clear long-term resilience of service standards alongside a common understanding of risk and who is best placed to bear that risk
- A sector-wide view of operational resilience that can identify and take steps to mitigate systemic vulnerabilities to low probability, high impact events – for instance, the sudden inability of the UK to source a critical chemical.
- All sector planning decision frameworks to be focused on best value, allowing the most beneficial, innovative improvements to be taken forward where they have wider benefits to society

### 2. Forward-looking approach to investment decisions:

- Investment decisions and cost assessment should always be made and funded based on forward-looking approaches to assessing costs, value and risk of existing and new assets
- Short-term company targets transformed into milestones consistent with a best value approach towards achieving long-term standards, enabling innovative solutions that may require longer-term horizons.

### 3. A single joined-up long-term adaptive plan

- Integration of multiple existing plans into a single, joined-up, long-term adaptive plan for each company (including the WINEP, WRMP, DWMP, RBMP) and closer collaboration with other sectors
- This plan will form the basis of 5-year revenue allowances and service milestones, framed within 25-year and 50-year horizons
- This would enable a better decision making on affordability in the context of the long-term



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# Case studies that illustrate the benefits of the proposed changes

## Top down analysis

The National Infrastructure Commission’s (NIC) recent study of England’s future water needs points towards the need for increased investment in resilience to protect customers from drought risk.<sup>1</sup> Based on the highest risk scenario – high population growth and high climate impacts – the costs of maintaining the current level of resilience in response to a drought emergency could reach c£40 billion by 2050, while proactively investing in long-term resilience may only cost c£21 billion.

On flood resilience, the Third UK Climate Change Risk Assessment discusses flood risk in terms of expected annual damages to residential and non-residential properties, in addition to indirect damages. Under current levels of adaptation and planning, expected damages from flooding could rise to c£2 billion annually by 2050, an increase of 60% relative to current levels under the high risk scenario of a 4°C rise in global temperatures and high population growth.

Over the course to 2050, the studies above indicate that more joined-up, long-term and adaptive planning may help save up to £35 billion, or £80 per household per annum<sup>2</sup> in relation to adverse resilience outcomes around droughts and flooding.



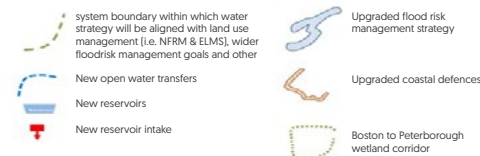
1. National Infrastructure Commission, Preparing for a Drier Future, 2018  
 2. Committee on Climate Change, Third UK Climate Change Risk Assessment (CCRA3) Future flood risk, 2020

## Case study

### Anglian Water: Future Fens – Taking an integrated and holistic approach to long-term planning

The Fens is the most exposed area of the UK to climate change. This low-lying region is on the frontline of rising sea levels and at the foot of major river catchments. Traditional solutions to the Fens’ challenges would see reservoirs, transport links, biodiversity restoration and flood prevention considered in silos, an expensive approach delivering limited benefits. By contrast, Future Fens: Integrated Adaption (FF: IA) is multi-agency collaboration led by Anglian Water, Water Resources East and the Environment Agency in partnership with Royal Haskoning DHV, the Dutch Delta Commission, local MPs and authorities and many regional partners to bring together many different sectors, organisations and people into one integrated, holistic approach to help solve the problems we all face together.

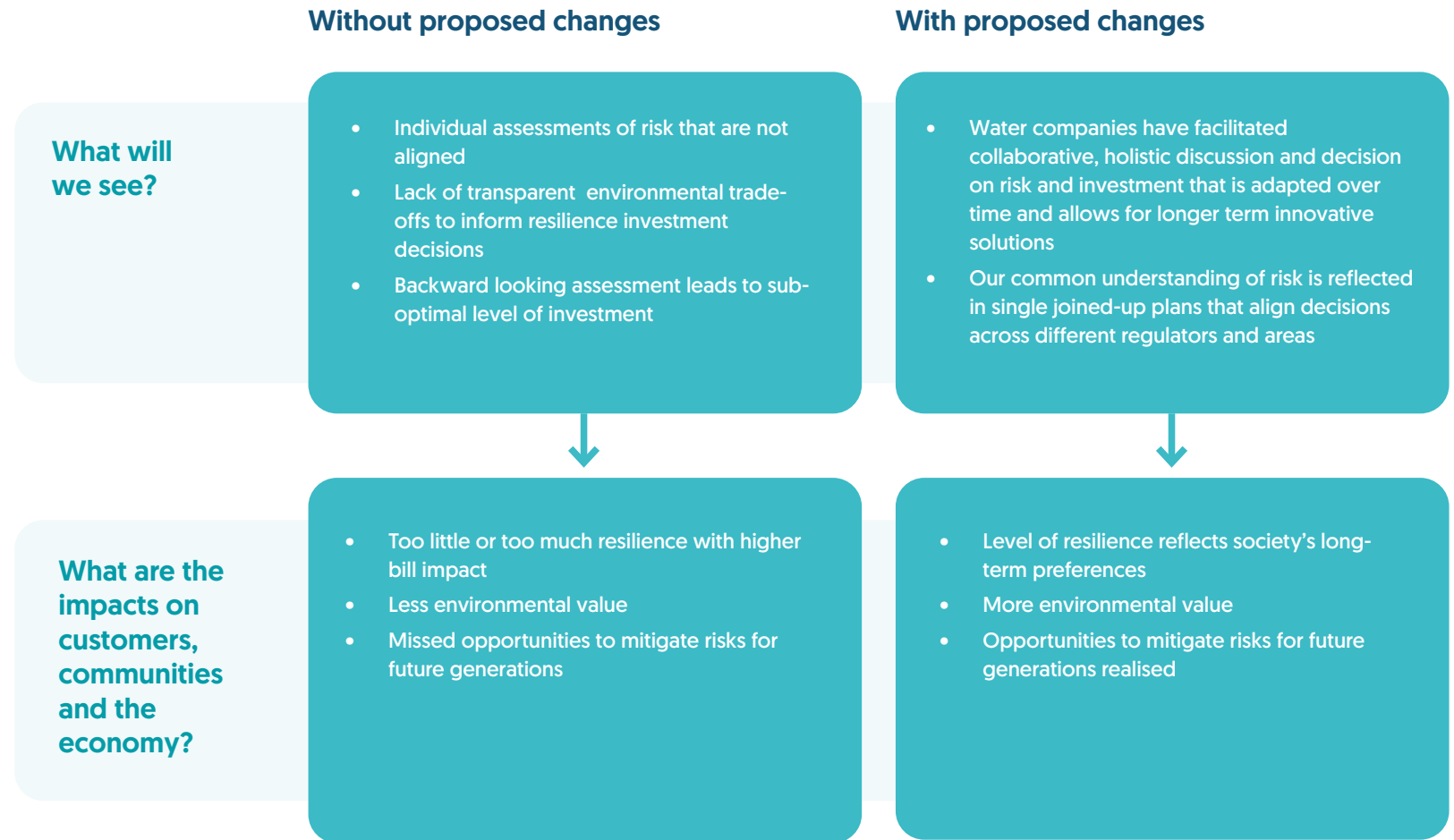
The new water management approach created by this partnership will be one solution addressing many of the environmental, economic and social challenges faced by the Fens. By integrating all elements of water usage, we can ensure the most effective storage and use of water resources, building resilience into the long-term. Flood risk



management of major rivers, including upgraded coastal defences, barriers and barrages will protect growth areas and enable key local infrastructure projects, while new open water channels will enable growth in biodiversity, tourism and navigation. New multi-sector reservoirs (including a 60 billion litre capacity resource) will provide additional water supply resilience for water companies, farmers and the food industry, and improve the water environment. This programme enables the Fens to take control of its own destiny; adapting and becoming climate resilient. It has the potential to unlock wider benefits for the region and for the country such as: more productive agriculture, long-term food security, increased biodiversity, climate resilient infrastructure, a supply of sustainable housing, thriving places and renewed local pride. It will bring tangible social benefits to an area where social mobility has been limited (with youth unemployment a particular challenge), and where livelihoods are at further risk from climate change. It also provides an opportunity to build on inclusion and diversity work led by Anglian Water and others in the region.



# Looking back from 2050, what would we see?



# 6 The way forward: working together to deliver change



# Summary of our proposals for change

To overcome the challenges and to achieve our Vision, water companies, the supply chain, government, regulators, customers and communities must all come together to accelerate the rate of positive change.

## Delivering more environmental value, more efficiently

- 1. Outcome-based environmental regulation OBER:**
  - Long-term outcome targets linked to the 25YEP set for England as a whole covering all key aspects of the environment – including carbon. This will ensure that the water sector targets contribute directly to the 25YEP ideally as part of a National Plan for Rivers<sup>1</sup> and other water bodies. Ideally this would be underpinned by protection in law such as a new, single “Rivers Act”.<sup>1</sup>
  - Targets and milestones apportioned to catchments, fundamentally reshaping the scope of the WINEP. Water companies should receive their fair share of the targets without delay so we can start making our contribution to the 25YEP.
  - Companies allowed to meet targets by delivering outcomes in partnership with others, including customers and communities and other sectors (consistent with local empowerment.<sup>1</sup> This will ensure that the best value solutions are implemented and allow innovation to flourish. This is key for unlocking efficiencies.
  - Economic regulation provides appropriate risk and reward balance and a level playing field between traditional and NBS. This will ensure that there are no financial barriers to innovative solutions.
  - OBER monitoring framework supported by new measures that provide open and live data (e.g. discharges). This is essential for trust and confidence in OBER and identify how OBER has facilitated innovation.
- 2. Change skills profile and culture so:**
  - Water companies, regulators, NGOs, etc. have world-class green skills to identify, develop, and implement innovative solutions
  - Everyone is focused on outcomes, innovative approaches and partnerships
  - This will ensure that OBER delivers maximum benefits to customers and communities as we have the right skill base and mindset to develop, trial and implement innovative solutions.

## Protecting long-term customer interests through the right investments at the right time

- 1. Resilience standards and a common risk framework:**
  - All sector planning decision frameworks to be focused on best value, allowing the most beneficial improvements to be taken forward where they have wider benefits to society.
  - A sector-wide view of operational resilience that can identify and take steps to mitigate systemic vulnerabilities to low probability, high impact events – for instance, the sudden inability of the UK to source a critical chemical.
  - Defined and agreed clear long-term service resilience standards alongside a common understanding of risk
- 2. Forward-looking approach to investment decisions:**
  - Investment decisions should always be made and funded based on forward-looking approaches to assessing costs, value and risk rather than focusing on historical data.
  - Short-term company targets need to be transformed into milestones consistent with a best value approach towards achieving long-term standards, enabling innovative solutions that may require longer-term horizons.
- 3. A single joined-up long-term adaptive plan**
  - Integration of multiple existing plans into a single, joined-up, long-term adaptive plan for each company (including the WINEP, WRMP, DWMP, RBMP) and closer collaboration with other sectors. This plan will form the basis of 5-year revenue allowances and service milestones, framed within 25-year and 50-year horizons.



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## Industry case study: 21st Century Rivers – Promoting Collaboration and Reform to Prioritise Healthy Rivers

Water UK’s recent document 21st Century Rivers asks everyone — from river users and customer groups, to environmental NGOs, to work with the water companies on a new collaborative approach that responds to the challenges of climate change, increased customer expectation and the realisation that substantial investments driven by environmental regulation are not producing the outcomes that society expects.

With other industries shown by the EA to be responsible for three-quarters of the reasons for harm in rivers and the use of storm overflows responsible for just 4%, a National Plan for Rivers will help prioritise investment across sectors and identify the policy changes required.

The 21st Century Rivers ‘Ten actions for change’ therefore provide an example of the collaborative, cross-sector approach that is needed to rise to the challenges of the future. One of the key actions is for a National Plan for Rivers to be developed and governed by a National Plan Steering Group. The 21st Century Rivers Actions are aligned with the key changes articulated in this White Paper with the aim of “delivering more environmental value more efficiently”. Outcome-based environmental

regulation (OBER) will enable water companies up to innovate and invest in the outcomes that really matter for the environment. This is likely to be achieved by working with others who impact on the health of the river and will also identify opportunities to improve other environmental outcomes such as biodiversity and avoid negative externalities such as additional carbon emissions. This will enable companies to deliver the most environmental value at the least cost.

This White Paper calls for changes that would lead water companies to produce a single and integrated long-term plan, grounded in local needs and a common understanding of risk. These plans will place the future health of our rivers alongside other key priorities such as achieving net zero and the need to secure the resilience of our water and wastewater services to customers in the face of climate change and its impact on our ageing asset base. A National Plan for Rivers will both inform and be informed by companies’ own integrated long-term plans. The outcome will be a transparent set of expectations for improvements to the river that will enable us to invest in the right things at the right time.



The 21st Century Rivers Actions are aligned with the key changes articulated in this White Paper with the aim of “delivering more environmental value more efficiently”.



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## Together we need to build a shared endeavour to rise to the challenges of the future

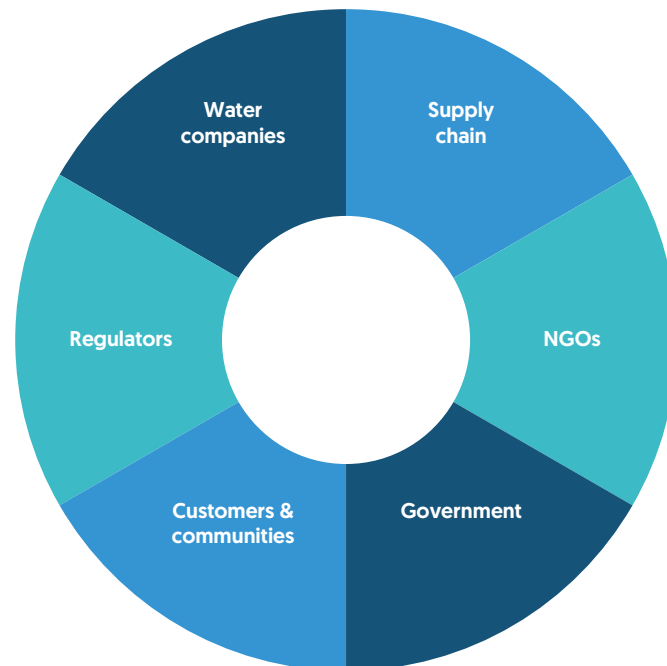
On behalf of the water companies in England, Water UK will bring together a wider range of stakeholders to drive collaborative change.

We need to work together to implement the changes that will enable us to deliver our Vision.

We understand that short-term priorities often take precedent but the challenges are so great that we cannot afford delay.

**We therefore commit to driving these changes forward by:**

- Establishing a White Paper Steering Group to facilitate ongoing strategic dialogue with all stakeholders on how much progress we have made against the priority areas for change discussed in this White Paper;
- Together with our stakeholders we will integrate, accelerate and boost existing work programmes to deliver the changes we need; and
- When faced with short-term challenges or regulatory cycles we will ensure that we do not lose sight of the priority changes.



# We need to change now to meet society's future needs in the face of a changing planet

