UK

2050 WATER INNOVATION STRATEGY

DRAFT

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THE WATER SECTOR'S VISION

To create open collaboration opportunities across the water sector to drive **transformational change through innovation** that delivers greater value for customers and the environment.

WHAT THIS STRATEGY IS:

- Owned by water companies across the UK on behalf of the wider sector.
- Built on current work and understanding in the sector and beyond.
- Focused on the societal challenges that innovation in the water sector can help to solve, through providing short, medium and long-term outcomes for the sector.
- A call to innovate to existing and new partners who can co-create innovative solutions.

WHAT THIS STRATEGY IS NOT:

- A detailed delivery plan with a list of solutions the water sector want to implement.
- Fixed. It will continue to be evolved and developed.
- Intended to replace existing innovation activity carried out by individual companies.
- A delivery plan for the Ofwat innovation fund.
- A delivery plan for a Centre of Excellence.

EXECUTIVE SUMMARY

The world is changing faster than ever before. We face a climate crisis, an ecological emergency and now, COVID-19.

None of us are alone in the water sector in experiencing the impacts of these global challenges. With an ageing asset base and an urgent need to decarbonise, our sector must make some big decisions in the next few years that will shape the future of water in the UK.

With great uncertainty comes the need for change, and it is this need for change which will drive transformational innovation; 'necessity is the mother of invention'.

We have come together as water companies in the UK to develop this strategy. Our track record in innovation stretches back over 400 years. From the world's first city-level water transfer project, completed in 1613 and still one of London's main water resources, to the invention of the activated sludge process in 1914 – arguably no country can match the extent or influence of our pedigree in pinpointing visionary solutions to water-related problems.

SURVEY

Please help us to shape this draft strategy and its delivery by filling out this survey – click here

United as a coherent alliance of 19 water companies, we write this strategy with a common purpose of driving transformational change in our sector through collaborative innovation. And we know that we cannot deliver this change alone. This strategy is a call to action for you to join us on this journey.

In the strategy, we set out how we will start to deliver transformative innovation through our key **principles** which define how we will work together. We describe the delivery of a **'Centre of Excellence'**, which will support us in delivering these. This will support shared access to skills, resources, knowledge, data, and support us in creating a collaborative innovation culture.

Our strategy also defines the ends; a number of key **themes**, which describe our environmental, social and economic ambitions, and which we know are important to our customers. For each theme, we have set ambitions that the sector will aspire to, and work towards, in the short, medium and long term, to 2050. These are our ambitions, rather than targets, and will guide us collectively in delivering challenge-led innovation.

CALL TO ACTION

This is an opportune moment to shape the future of water in the UK but we can only achieve this through collective action – everyone has a role to play. Current and future partners will be central to shaping, and collaborating to deliver transformative innovation in the sector. There is also a pressing need to work with government and other decision makers to support innovation for growth and for good, directing innovation to society's most important problems, and shaping the application of new ideas and technologies in a way that benefits as many people as possible. While by itself, this strategy cannot achieve these things, we hope it will be the catalyst for change.

INTRODUCTION & CONTEXT

Water is the essential ingredient to human life and a healthy natural environment. The water sector in the UK needs to rapidly adapt to our changing world.

UNDERSTANDING THE WATER SECTOR

We, the UK water industry, have come together to develop this strategy for innovation on behalf of the wider sector and our customers. This strategy is unique as it is a national strategy developed by a cohort of water companies in open and transparent engagement with regulators and other stakeholders.

This strategy has been developed jointly by 19 companies across the UK, facilitated by UK Water Industry Research (UKWIR) and supported by Water UK, on behalf of the wider water sector.

The water sector includes everyone involved in using and providing water and wastewater services across the whole water cycle, from customers, other users like industry and farming, water companies, regulators, the supply chain to wider stakeholders. The boundaries of the sector are deliberately blurred, recognising the opportunity for new entrants.

UNDERSTANDING INNOVATION AND ITS VALUE

We want this strategy to stimulate transformational change and achieve the best value for customers, the environment and wider society in the long term. This means systemically rethinking innovation practices, culture and enablers in the water sector.

Innovation can be described as the 'the development, implementation, and exploitation of a novel idea, service, scheme, system, process or formula'. This means that innovation extends well beyond new technology.

Innovation extends from research and a better understanding of our challenges, through to testing new ideas quickly, failing fast, iterating and importantly, spreading and scaling what works, so that we achieve maximum benefit.

We have an opportunity to address society's most important problems through innovation, and to shape the application of new ideas and technologies in a way that benefits as many people as possible. Delivering this change for good also present enormous opportunities for innovative businesses, big and small, to market their goods, knowledge and services both at home and overseas.

APPROACH TO DEVELOPING THIS STRATEGY

This draft strategy has been developed by representatives from across 19 water companies, with the close co-operation with Ofwat, facilitated by UKWIR and Arup on behalf of the wider sector.

Building on the engagement undertaken to develop the UKWIR big questions, and ongoing engagement with customers and stakeholders by partners across the sector, we have carried out engagement specifically to inform the development of this strategy with groups representing the supply chain, academia, funding bodies, other sectors, regulators and more. This has been coupled with a review of good practice from elsewhere, of societal drivers, and in particular of the UKWIR big questions and the associated routemaps.

Engagement has been supplemented by additional input crowd-sourced from experts across all of the water companies.

This approach allows the strategy to focus on meeting the needs of the stakeholders by identifying and focusing on key drivers and challenges which significantly impact that way we work now and the service we will be able to provide in the future. It also recognises the role that the water sector might play in wider societal drivers, taking a systems view of these challenges. For example, considering the water, food, energy nexus.

We recognise that the engagement undertaken to date is just the start of our co-creation journey, and we will continue to engage widely to understand how we can work together to achieve the ambitions set out in this strategy.

Collaborative innovation will support the water sector in meeting ambitions for customers; improving social and environmental value in the long term.

INTRODUCTION & CONTEXT

UNDERSTANDING THE LANDSCAPE

Global Water Intelligence estimates that meeting the UN Sustainable Development Goals for water and sanitation between 2018 and 2030 will cost **$1,785 billion** for rehabilitation and **$4,056 billion** for new infrastructure. Activity on this scale will require significant innovation and forward thinking.

There are also huge opportunities for water innovation in the fields of energy, design, manufacturing, data science, food security, and resilience. Cross-sector collaboration to address some of these opportunities will create substantial benefits including carbon emission (which we use here as shorthand for greenhouse gas emissions) reduction cost savings and secure agricultural production.

The water sector's innovation journey

Innovation has been essential to the UK water sector for many years as it provides significant opportunities to provide customer benefits.

There are standout cases of effective and collaborative innovation which reflect the sector's capacity to co-deliver innovation. Demonstrating this are examples from the water companies of:

- Closely working with supply chains and undertaking joint innovation sprints with third parties;
- Joint innovation events across companies and with third parties which facilitate knowledge transfer;
- Joint projects with stakeholders through initiatives like catchment partnerships;
- Customer engagement initiatives to encourage the community to be involved with innovation;
- Networks to support joint working such as through Water UK and UKWIR among others.

Ofwat

£200 million

Ofwat additional funding available for innovation

The regulatory environment

Investment in innovation in the water sector is set in part by the regulatory environment, which is different between the countries within this strategy. To date the sector has often invested in incremental innovation, driven by the need to deliver on regulatory business plans and meet statutory obligations within financial constraints. We believe adaption of the regulatory environment is key to supporting transformational innovation.

In England and Wales, the economic regulator, Ofwat, sees innovation as "crucial for meeting challenges in a cost-effective and sustainable way". It recognises that there are currently untapped opportunities for the industry to work together. To support this Ofwat has made up to £200 million of additional funding available for innovation in addition to existing innovation investment funded by customers. Scottish Government has established a Hydro Nation strategy, developing the 'water economy', where water resources are developed so as to bring the maximum benefit to the Scottish economy, underpinned by a statutory duty. The Utility Regulator in Northern Ireland is supportive of NI Water's Innovation Initiatives set in context against the underinvestment challenges.

Economic regulation is one of the three regulatory pillars, alongside environmental and drinking water quality regulation. There are further opportunities for policy and regulatory reform.

We have many proven strengths including a world class science base and considerable expertise in devising and disseminating innovations that can address key water-related challenges worldwide.

Market opportunity

To win a bigger share of the global water market and position the UK as a global leader in water innovation, we have a strong foundation to build on. We have many proven strengths including a world class science base and considerable expertise in devising and disseminating innovations that can address key water-related challenges worldwide. We also have a proud pedigree in research and innovation, funding a considerable amount of water research and innovation through our Research Councils and having established a number of centres of excellence in universities and elsewhere. Our strong supply chain has distinctive strengths, offering specialist technology providers and world class capabilities in the supply of tailored and integrated consultancy services, and our water companies are well regarded internationally, providing some of the cleanest drinking water in the world. Indeed, our track record in managing, and maximising the value of, ageing water infrastructure is just one area where we are well positioned to secure a dominant global role.

The water innovation ecosystem

Innovation is a complex, non-linear process, so the complexity of the water innovation ecosystem is perhaps no surprise.

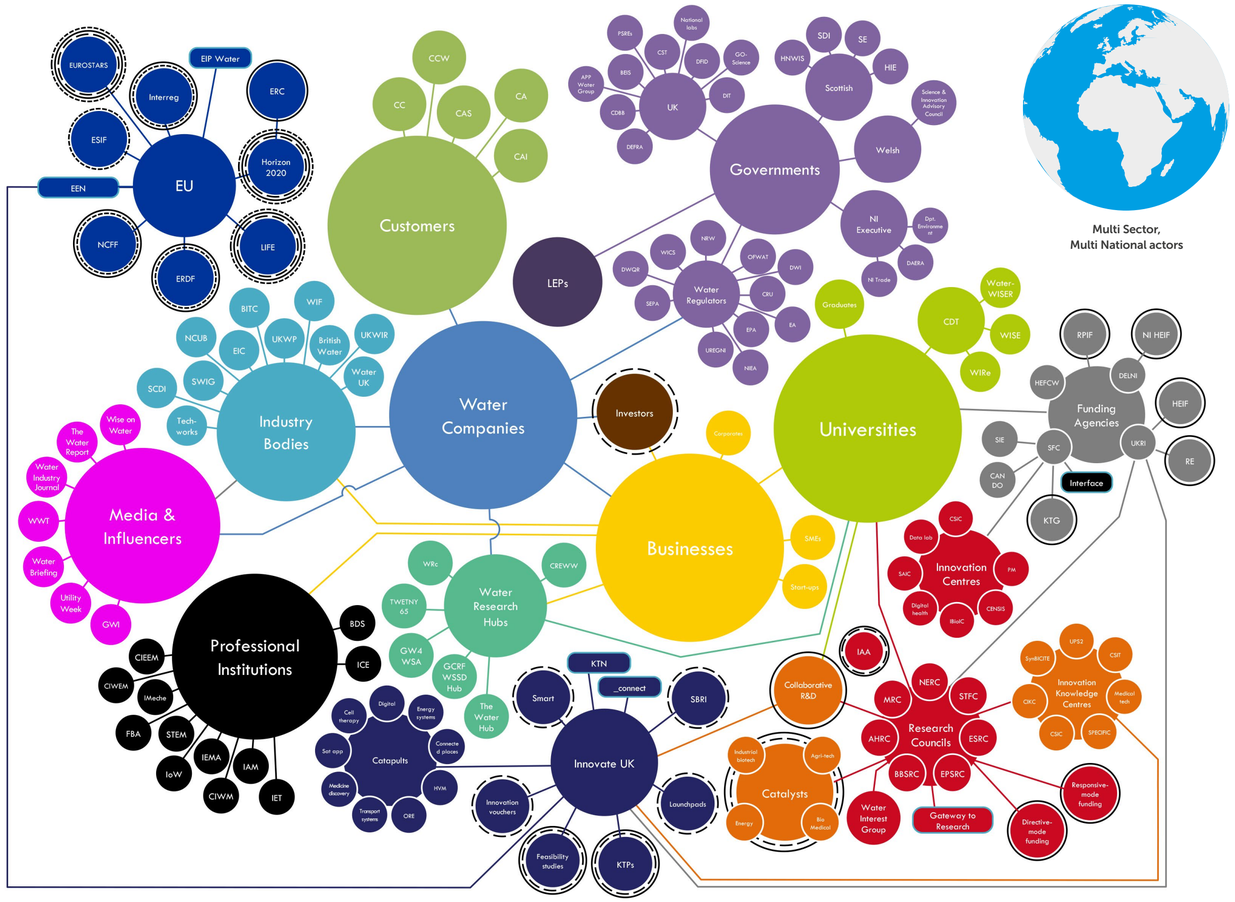
In order to lay the foundation for collaborative innovation, we have started to map the key actors that play a role in water innovation activity across the UK. We recognise this landscape is constantly changing – by identifying the gaps, establishing relationships between different actors, and continuing to develop our collective understanding over time, we hope to make it easier for people to collaborate with, and innovate within, the water sector. We also recognise that cross-sector collaboration will be central to addressing some of society's biggest challenges and we will continue to explore where those opportunities exist.

From carrying out research and developing innovative technologies, through to driving behavioural change and implementing policy frameworks, everyone has their part to play in innovation. The Massachusetts Institute of Technology, which contributes to one of the world's most dynamic and successful economies based on innovation, identifies a number of components for successful innovation ecosystems.

A strong base of research intensive universities is important and there needs to be a sufficient number of entrepreneurs with the right skills and culture to spin-out, start and scale up innovative firms. A strong group of corporates undertaking innovation and supporting and advising smaller firms is necessary. The availability of risk capital and the engagement of investors, who provide mentoring and advice, as well as finance, to entrepreneurs is also a major factor. Government has an important role to play in creating the right policy frameworks, infrastructure, and data.

We recognise the importance of customers in our ecosystem and that the opportunity to co-create to deliver maximum value is huge.

All of these actors need to work together to ensure there is the right engagement and support across the system to create a successful ecosystem that is more than the sum of its constituent parts.



KEY — — Funding for business ——— Funding for academic & research organisations - - - - - Funding for other ⬭ Network brokerage tool

Note: This is an attempt to capture the major actors that play a role in water innovation in the UK. Due to the complexity of the landscape there will inevitably be information missing. The 'UK Research and Innovation Landscape' from The Dowling Review of Business-University Research Collaborations (2015) was used to form elements of this map.

INTRODUCTION & CONTEXT

TRENDS, OPPORTUNITIES AND STRENGTHS FOR THE WATER SECTOR

This strategy provides a joint approach to use innovation to allow us to embrace opportunities and prepare for future drivers of change by building on our strengths.

Strengths to build on

The UK has many proven strengths, including a world class science base and considerable expertise in creating, developing and disseminating innovations that can address key water-related challenges worldwide.

We have the ambition and the support of our regulators to look for new ways to work. We can use current networks, partnerships, and experience of funding to build the resources needed to implement innovation. By recognising our strengths we can build on these to achieve sector-wide change.

Drivers to prepare for

Global trends such as population growth and climate change are forcing water companies and the wider sector to adapt and invest significantly in water supply and wastewater treatment.

We have created our themes, which are the topics we want to focus our innovation on, to prepare the sector for these drivers.

Opportunities to grow

There are key areas we need to address to take the opportunity to achieve our transformational innovation aims and support the sector to become recognised globally for water innovation.

In the UK there are lots of examples of water companies successfully collaborating regionally, nationally and globally. With the right enabling infrastructure, there is a significant opportunity to do even more in this space.

Improving integration between Government, regulators and water companies to provide a single gateway for innovation will support effective collaboration across the sector. We believe that improving risk tolerance in the sector, learning from others and using data and technology are key tools to achieving this.

We have developed our principles, which illustrate how we will innovate, to support us in taking advantage of these opportunities.

Building the enabling infrastructure will support us in delivering our principles; we have described this as a Centre of Excellence. This in itself will not bring about the transformation we want to see, but it will provide a catalyst for change and a means of achieving that change through collective action.

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OUR STRATEGY

Our vision for this innovation strategy

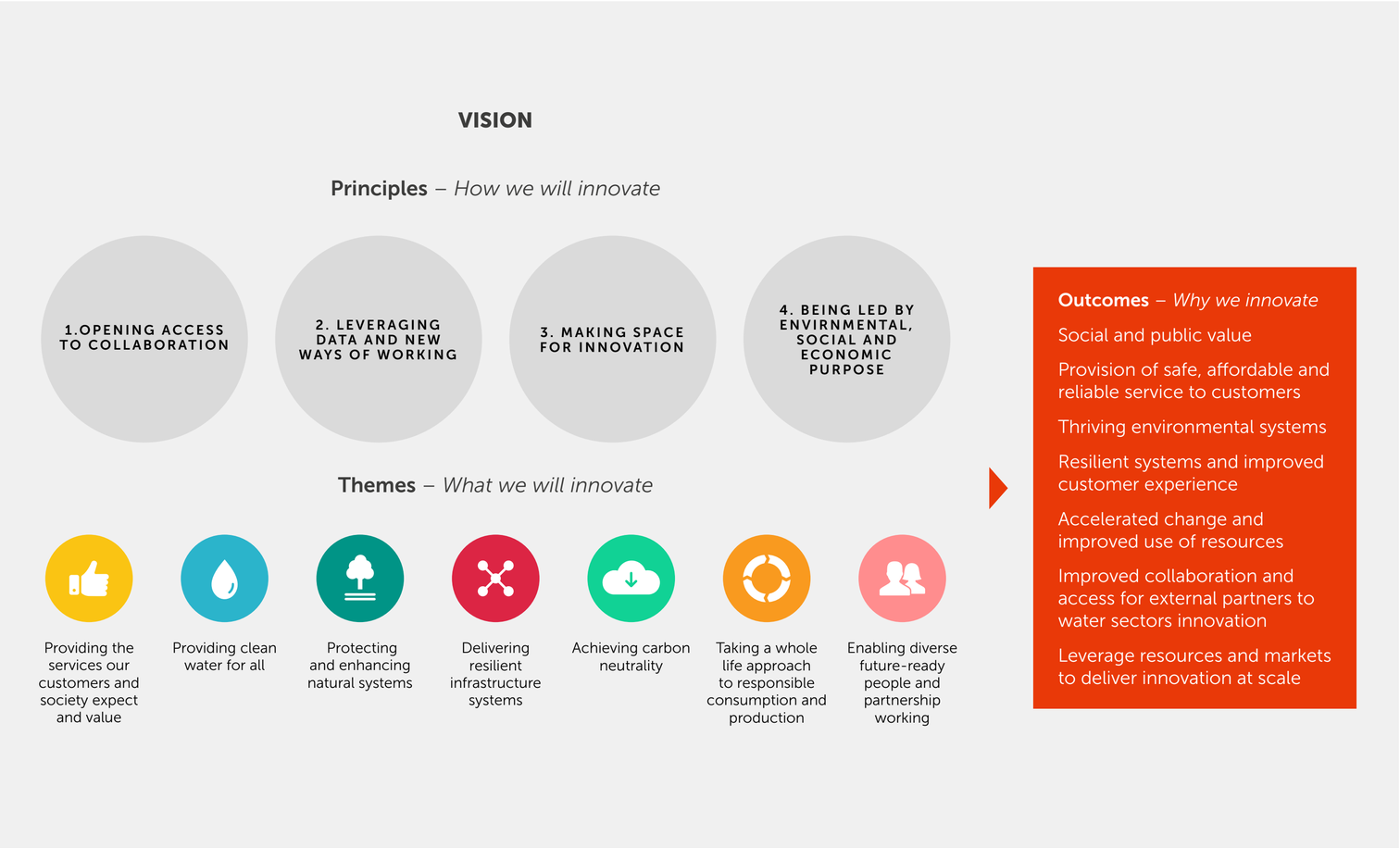
To create open collaboration opportunities across the water sector to drive transformational change through innovation that delivers greater value for customers and the environment.

This vision sets out our aim for innovation in the water sector. This vision is supported by:

Four principles which are ways of working, detailing how we plan to innovate. These are cross-cutting changes that are required to inform and guide all of our innovation activity to take opportunities to grow and further enhance strengths highlighted on the previous page.

Seven themes which are the topics we have identified to support us in delivering innovation that is led by environmental, social and economic purpose. This will support us in responding to the drivers highlighted on the previous page, and the issues that are important to our customers.

Our vision, principles and themes are designed to support us in delivering the outcomes that we have identified.



OUR PRINCIPLES

These principles are the key ways of working we believe will be essential to innovate as a sector. Our principles illustrate how we will innovate and are the enablers to implementing our strategy.

Opening access to collaboration

We will enable water companies, supply chains, stakeholders, regulators, SMEs, start-ups, academia, the public and other innovators to co-create and co-deliver innovation initiatives.

We will create a joined up, transparent approach which leverages the full potential of the community rather than individual organisations.

Leveraging data and new ways of working

We will ensure that we open data and share knowledge and technology to avoid duplication. We will create change at pace, seeking to transform the sector.

We will develop new technologies from early technology levels through to full deployment and share knowledge to secure maximum value.

Making space for innovation culture

We want to develop a shared water sector culture of innovation which supports everyone in the water sector to innovate, adapt and learn.

This requires appropriate resources including access to funding, skills, and time for innovation to create the virtual and physical space required innovate in a controlled regulatory environment. We will work with others to gain new skills and leverage wider funding opportunities for the sector.

Being led by environmental, social and economic purpose

We recognise that the innovation that we create and implement has a clear purpose to contribute to addressing water sector challenges. We will implement the optimal value solutions to build trust and deliver public value through a sustainable water industry.

We will look to create genuine environmental and social benefit in the long-term by prioritising innovation that will unlock long-term sustainability and resilience improvements.

Our themes will support us in defining this purpose.

More detail on how we aim to deliver these principles are detailed in our 'Strategy to Implementation' section. Our proposed **Centre of Excellence will be critical to this.**

OUR THEMES

To provide focus and encourage accelerated change we have identified seven themes. These are the topics we have identified as our focuses for innovation to respond to our future drivers and the long-term priorities of our customers.

These themes are opportunities for innovation both for the water sector and for other wider sectors across global geographies to inspire and encourage diverse collaboration.

We have set out key questions for each theme to provide a tangible focus for innovation in the UK.

When developing these themes, we used the UN Sustainable Development Goals, for global applicability. We used the UKWIR Big Questions, which are underlined in the following section, English water companies' Public Interest Commitments, and national policy to identify the key topics for the UK water sector to address.

Full mapping of these themes is set out in Appendix 1.

These themes overlap and are inherently interconnected. Therefore, they are not designed to be considered in isolation. For example, there are opportunities for nature based solutions at a catchment level that could support delivery against all of themes.

We also recognise the need for innovation and new ideas to be encouraged without structure, and these themes are not designed to stifle new ideas or create additional processes, but rather to provide focus and common ambition as we work together with new partners.

In the following section we have set out more of the detail behind each themes, including:

- Key questions to focus our innovation work.
- The current baseline to detail where we are now.
- The enablers of innovation.
- The outcomes to be achieved in the short, medium and long term.

We have also included some case studies from other sectors showing our ambition to learn from new partners and sectors.

These themes are designed as long term guides for innovation, rather than as specific programmes of projects. We recognise that others will have ideas and solutions that will support us in addressing the questions under these themes.

PROVIDING THE SERVICES OUR CUSTOMERS AND SOCIETY EXPECT AND VALUE

PROVIDING CLEAN WATER FOR ALL

PROTECTING AND ENHANCING NATURAL SYSTEMS

DELIVERING RESILIENT INFRASTRUCTURE SYSTEMS

ACHIEVING CARBON NEUTRALITY

TAKING A WHOLE LIFE APPROACH TO RESPONSIBLE CONSUMPTION AND PRODUCTION

ENABLING DIVERSE FUTURE-READY PEOPLE AND PARTNERSHIP WORKING

PROVIDING THE SERVICES OUR CUSTOMERS AND SOCIETY EXPECT AND VALUE

We need to innovate to build customers' trust and deliver transformational customer service.

KEY QUESTIONS

How do we build customer trust and confidence in the face of future uncertainty?

How do we enhance affordability, accessibility and protect vulnerable customers?

How do we achieve zero customers in water poverty by 2030?

How do we improve transparency?

The water sector provides essential water and wastewater services to households and businesses. However, enabling customers to interact with this service effectively, whether for payments, problem solving, or emergency support, requires a tailored, accessible and reliable customer service.

Now more than ever, customers need to be able to engage with us through platforms and mechanisms that are accessible to them and that take account of additional support requirements, especially for vulnerable customers. Looking ahead, we understand that both the need and expectation of a smarter and more flexible level of customer service will become commonplace – especially when comparing the efficacy of the water sector to sectors and organisations that lead in excellence of customer service.

As a sector, we must be able to respond to the needs of our customers efficiently, through multiple channels and in a way that builds trust and strong relationships through a shared understanding and mutual level of communication.

Current baseline

Across the sector, water poverty research to date has reviewed measures for water poverty, causes of water poverty, current interventions, consequences of prolonged water poverty and lessons learnt from other sectors in comparable economies for best practice.

Further research and innovation is required to truly understand what customers expect from us now and in the future and the mechanisms that will enable us to deliver against those expectations at a national scale.

KEY ENABLERS TO DELIVERING THIS THEME

We need new enablers and ways of working to address these key questions which include:

- Creating an open two way dialogue with customers
- Having one voice of the water sector
- Developing an understanding of the true value of water among customers
- Creating national benchmarks for data sharing and collaboration
- Ensuring all IT systems are agile and have inter-operability and use appropriate third party and internal data
- Sharing broader environment benefits with customers
- Improving customer engagement processes
- Cross utility partnerships

PETA JAKARTA – CREATING CROWD-SOURCED FLOOD MAPPING

Piloting an innovative approach to citizen engagement in Indonesia, the Peta Jakarta project in 2014/15 used real-time social media engagement to generate crowd-sourced disaster maps in a period of monsoon flooding. (Holderness and Turpin, 2015). Based on the success of this pilot, this project has been expanded, called Peta Bencana, to the greater Jakarta region.

Innovative use of social media for disaster response and citizen protection

The project enables Jakarta's citizens to report the locations of flood events using the social media network Twitter. This real-time, citizen driven data collection supported:

Accurate and publicly accessible real-time mapping of flood conditions

Cross-validation of formal flood reports data sources with live data

Creation of information for flood assessment, targeted response, and management in real-time

The study demonstrated the value and utility of social media as an urban method for crowd sourcing situational information to support decision-making and response coordination in the face of extreme weather conditions. (Holderness and Turpin, 2015).

Relevance to UK Water sector

This project illustrates the potential to crowd source data and to bring the community to centre of projects. This is a step change from a more traditional approach of having customer and community engagement as a one way broadcast rather than a two-way dialogue and process of co-creation.

PROVIDING THE SERVICES OUR CUSTOMERS AND SOCIETY EXPECT AND VALUE

We need to innovate to build customers' trust and deliver transformational customer service.

	SHORT TERM TOWARDS 2025	MEDIUM TERM TOWARDS 2035	LONG TERM TOWARDS 2050
How do we build customer trust and confidence in the face of future uncertainty?	Our communications reflect the needs of our customers and are efficient and effective (especially in an emergency) • E.g. through communication platforms like 'How to' service of online videos, video calling, automated and smart payment mechanisms There is sector-wide clarity on the common behaviours, wants and needs of customers • E.g. through ethnographic and universal research approaches to help understand the cultural and social drivers of customer needs, expectations and behaviours Customer data is protected and managed • E.g. through solutions such as blockchain Our approach to customer service is developed with customers and is in line with best practice from other sectors who lead on customer experience	All our customers have an excellent customer experience from our service provision on top of delivering our regulatory service requirements	Customers are part of the journey: co-creating with customers to build customer trust and their willingness to contribute to achieving common goals
How do we enhance affordability, accessibility and protect vulnerable customers?	Customer service is flexible and reflects the needs of all customers inclusively • E.g. by using multiple platforms and engagement approaches Vulnerable customer support is continuously improving by learning from best practice in other sectors Improved customer experience and accessibility has been achieved through exploring new approaches • E.g. innovative tariff structures and joined up, cross sector billing Improved use and modelling of customer data allows us to better predict vulnerability, debt and other service issues	All decision-making considers optimisation of social capital (as part of introducing wider capitals beyond financial return into decision frameworks) Collaboration with public sector, private sector and customers has led to a better understanding of the role and remit of water companies in supporting the delivery of public benefit such as environmental purpose and regional connectivity	Communities of customers are supported by the water sector to collaboratively support vulnerable customers, especially during an emergency or supply interruption
How do we achieve zero customers in water poverty by 2030?	The water sector has a shared understanding of water poverty (that considers future regional and external drivers) and a strategy to appropriately measure and overcome it The social value of supporting households experiencing water poverty is understood Best practice water poverty interventions, appropriate for the context, are implemented	There are no customers in water poverty. Tariff structures reflect ability to pay and provide improved affordability support to customers experiencing water poverty and those struggling to pay Customers consider water and wastewater services to deliver good value for money	
How do we improve transparency?	Decision making processes are transparent so that our customers can better understand how we make decisions regarding things such as network investments, emergency response, engagement and pricing Engagement spreads to all water users, not just bill payers to improve the visibility of the sector, enabling greater understanding of our work	The amount and type of data we openly share with customers is reviewed regularly and aligned to improve transparency in areas that customers identify as important. • E.g. improved data sharing about live network conditions as an information source for customers	We share our progress and data openly, and in a way that is meaningful to our customers

PROVIDING CLEAN WATER FOR ALL

We need to provide a reliable, quality service to our customers

KEY QUESTIONS

How do we achieve 100% compliance with drinking water standards (at point of use) by 2050?

How do we achieve zero interruptions to water supplies by 2050?

How do we achieve zero harm from emerging contaminants and lead?

How do we provide enough water for all?

We believe that it is essential that when our customers turn on the tap they have a reliable, good quality water that they trust is safe to drink.

Water quality includes taste, odour and appearance. When there is an issue with water reliability, quality or safety it is a significant public health concern and erodes trust in our service.

There has been a shift in customer expectations in recent years, with customers becoming increasingly intolerant of water supply interruptions especially during extreme events like the Beast from the East in 2018 which impacted thousands of our customers.

Current baseline

There has been significant work across the water sector to improve the quality and reliability of our clean water supply in the past decade. Water quality in the UK is consistently ranked among the best in the world where compliance with water quality standards typically exceeds 99.9%. However, we do know that our raw water supplies are subject to contamination, through events in catchments and from other contaminants such lead and metaldehyde (an active ingredient in slug pellets). We also know that our traditional approaches to treatment of our raw water uses significant amounts of energy and chemicals.

Water supply is becoming increasingly more reliable, but external drivers, such as climate change could put this at risk. We know that lengthy interruptions are mostly causes by the failure of large pipes that are the single source of supply to a community.

We still need to do more work to address taste, odour and discolouration issues. We also need new methods to identify and address emerging contaminants. We also need to ensure that we improve the resilience of our supply systems and protect our vital water supply assets effectively.

Water resource partnerships have recently been formed and collaboration is being developed in the sector to respond to the challenges of long-term water resource needs.

KEY ENABLERS TO DELIVERING THIS THEME

We need new enablers and ways of working to address these key questions which include:

- Developing regulatory and organisational processes which enable the timely deployment of innovative approaches for clean water treatment
- Creating trust and an open dialogue with customers to create a shared understanding of the value of safe, clean water beyond price
- Opening access to improved, low cost methods for monitoring, modelling and treating water
- Developing and implementing partnership approaches on a catchment scale

RECYCLING INNOVATION FOR SECURITY OF SUPPLY BY WATER CORPORATION, WESTERN AUSTRALIA (WA)

Australia's water supply is facing mounting threats from increased periods of drought due to climate change. In response to this challenge, the state-owned Water Corporation (the principal supplier of water, wastewater and drainage services in WA) is leading an innovation programme to develop novel approach for scalable water recycling and supply resilience (WC, a. 2020).

A water recycling innovation hub

Water Corporation launched an innovation hub on the grounds of its Subiaco wastewater treatment plant, the Water Research and Innovation Precinct. The Subiaco innovation hub is a collaborative space that is focussed on accelerating projects that deliver novel and innovative approaches to wastewater treatment and resource recovery technologies. The hub partners with global technology providers, research institutions and local industry representatives to create mechanisms of delivering a reliant, resilient and safe water supply now and for future generations (WC, a. 2020).

By driving innovation in water recycling, Water Corporation is freeing up WA's rainwater supply for drinking water purposes. By 2030, the Water Corporation aims for 30% of water used in WA to be recycled for use in agriculture, industry, households and maintenance of natural systems.

Relevance to UK Water sector

This project demonstrates how innovation, collaboration and technology acceleration can be used by the water sector to increase the security of drinking water supply and improve the health of groundwater sources. It also shows the role of innovation in improving climate resilience in a vulnerable environment.

PROVIDING CLEAN WATER FOR ALL

We need to provide a reliable, quality service to our customers

	SHORT TERM TOWARDS 2025	MEDIUM TERM TOWARDS 2035	LONG TERM TOWARDS 2050
How do we achieve 100% compliance with drinking water standards (at point of use) by 2050?	The sector has a shared understanding of the impact of water quality on human health Low impact water treatment methods have been developed for large scale roll out • E.g. through feasibility and business case development for emerging and proven water quality technologies Methods to detect sources of drinking water taste, odour and appearance issues in 'live' environments have been developed. Raw water quality has been improved at a catchment level	All customers are satisfied with the taste, odour and appearance of their drinking water Roles and responsibilities associated with water quality are clear among all stakeholders (including customers). All play their part in sector-wide consistent compliance with water quality standards All piped systems are innovatively managed to maintain impeccable drinking water quality at point of use while extending their life. Low impact strategies are implemented when replacement is required	Zero chemical, low energy and low impact treatment processes are rolled out at scale across the sector
How do we achieve zero interruptions to water supplies by 2050?	The condition of water assets is well understood • E.g. through technologies for improved and non-invasive asset condition monitoring, repair and maintenance in 'live' environments Water assets are managed effectively • E.g. through best practice, asset optimisation and network risk assessments The potential for alternative service delivery models has been explored with regulators • E.g. for de-centralised supply	Potential interruption risks are identified across systems enabling timely responses to prevent issues before they occur providing our customers with a more reliable service • E.g. through reliable customer service and real-time engagement • E.g. through improved modelling and sensing of our network all water treatment and supply chains are efficient and effective	There are zero interruptions to customer water supply across the UK
How do we achieve zero harm from emerging contaminants and lead?	The impact on water safety and water quality of emerging pathogens, viruses and emerging contaminants is well understood and reflected in our approach to management • E.g. the impact of climate change on the spread of viruses and pathogens	The quality of raw water has no negative impact on the natural environmental	Emerging contaminants such as pesticides, pharmaceuticals and invasive species are dealt with effectively using innovative and efficient management and control methods
How do we provide enough water for all?	The sector as a whole understands the long term future water demands from all sectors in the UK and has clear processes to share water where required • E.g. through multi-sector adaptive planning for UK water resources to understand future demand and identify the impacts of future trends like climate change	All water supply risks are known and addressed where possible through close partnerships between everyone within the water sector and other water users such as industry	Water supply is drought resilient and there is enough water for all customers across the UK

PROTECTING AND ENHANCING NATURAL SYSTEMS

We need to develop, protect and enhance our environment, both above and below water, to build resilience to degradation and environmental changes

KEY QUESTIONS

How will we deliver an environmentally sustainable wastewater service that meets customer and regulator expectations by 2050?

How do we halve freshwater abstractions in a sustainable way by 2050?

How do we achieve zero uncontrolled discharges from sewers by 2050?

How do we achieve zero harm from plastics via our operations and activities by 2050?

How do we develop, protect and enhance our natural environment ensuring resilience against current and future challenges, including natural solutions?

The condition of our natural systems is fundamental to the ability of the water sector to provide water and wastewater services. We understand that our interaction with natural resources has a direct impact on their quality and longevity. We also recognise the contribution of industries (including our own) to the deterioration of natural systems through pollution, unsustainable extraction of resources, ecosystem degradation and significant non-renewable energy consumption.

Current baseline

The reliance of the water sector on natural systems means that appropriate management of our natural systems has always been at the forefront of thinking. Particularly in recent years as knowledge of the fragility of our resources and their resilience against the changing climate has become more prominent, protection and enhancement of the environment has become a priority for many of our customers.

In the sector to date, research and progress in this area has been mainly focussed on treatment and compliance frameworks for environmental protection. Research and pilot projects have also been conducted regarding customer engagement, innovative land use for co-benefits and delivering local solutions for local problems. Similarly, a number of water companies have fully integrated consideration of natural and social capital into their decision making processes. This includes the six capitals approach which equally values financial, manufactures, intellectual, human, social and natural capital.

In the early stages of delivery are catchment level solutions for operational sustainability and environmental resilience. However, for widespread success, further progress needs to be made in the sector's ability to effectively collaborate with wider stakeholders and enablers.

KEY ENABLERS TO DELIVERING THIS THEME

We need new enablers and ways of working to address these key questions which include:

- Developing effective frameworks and business models for collaboration with wider stakeholders, environmental regulators and beneficiaries that outlines potential funding mechanisms and the total value of natural solutions
- Creating and implementing a multi-capital holistic approach to decision making which can be adopted across the sector
- Evolving a regulatory framework which fosters innovation, collaboration and delivery of long term solutions which considers net environmental impact (carbon, biodiversity and water quality)
- Engaging with customers to raise awareness of their ability to contribute and the value of their collaboration in delivering environmental outcomes

NATURAL CAPITAL DECISION MAKING AND SUPPLY CHAIN INNOVATION AT UNILEVER

Unilever, a multinational consumer goods company, draws many of the raw materials needed for its products from nature. This has encouraged the company to take significant steps to ensure that natural and social capital are at the heart of their decision making processes at all levels.

Decision making tools consider the natural capital across the lifecycle of their products and assets through the 'Natural Capital Project'. Investment optioneering also integrates carbon pricing in anticipation of emerging carbon taxes (Unilever, 2020).

Supply chain influence and innovation

Unilever also works with the supply chain to protect and enhance natural systems.

In 2010 Unilever developed a 'sustainable agriculture code' which is followed by its suppliers around the world (Unilever, 2020). The code addresses: use of agrochemicals and fuels, soil and nutrient management, water and energy consumption, biodiversity, waste, human and animal welfare and skills development to improve local economies (Unilever, 2010).

Unilever also works to protect the natural systems upon which is relies through innovation in areas such as: sustainable sourcing, waste, water use, operational efficiency and carbon emissions.

Relevance to UK Water sector

Unilever's work demonstrates how organisations that rely heavily on natural resources can innovate in their decision making and leverage their supply chain influence to realise social, environmental and economic benefits for themselves and others.

PROTECTING AND ENHANCING NATURAL SYSTEMS

We need to develop, protect and enhance our environment, both above and below water, to build resilience to degradation and environmental changes

	SHORT TERM TOWARDS 2025	MEDIUM TERM TOWARDS 2035	LONG TERM TOWARDS 2050
How will we deliver an environmentally sustainable wastewater service that meets customer and regulator expectations by 2050?	Wastewater treatment across the sector effectively balances headroom, cost, and risk with environmental outcomes Wastewater treatment have been developed to improve effectiveness and cost efficiency across the network • E.g. through the development of opportunities to decentralise wastewater treatment where appropriate	Wastewater treatment is effective and cost efficient across the network	No deterioration in water bodies and net positive natural and social capital is achieved each year
How do we halve freshwater abstractions in a sustainable way by 2050?	All water companies actively engage and collaborate with household and non-household customers for environmental protection and enhancement through significant behaviour and consumption change	Losses from water treatment and supply systems are minimal across the UK water sector	The sector has halved fresh water abstractions without impacting service provision
How do we achieve zero uncontrolled discharges from sewers by 2050?	Proactive and effective customer engagement helps us keep undesirable content out of our sewers	There are proactive interventions across the network as a whole to minimise uncontrolled discharges even in the face of emerging challenges • E.g. through effective monitoring, incident response and maintenance programmes	We control the content of our sewers at source and there are no pollution events
How do we achieve zero harm from plastics via our operations and activities by 2050?	The sources of plastics and nanoparticles in water supply networks are known and there is an informed approach to removal and prevention	Across the sector there are treatment processes which can effectively remove harmful plastics The sector has actively minimised the impact of plastics in the environment from operations	The entry of harmful plastics into our products and water cycle is effectively controlled at source Any effects of the plastics in our biosolids are quantified and have no negative impact on soil health
How do we develop, protect and enhance our natural environment ensuring resilience against current and future challenges, including natural solutions?	The impacts of climate and extreme conditions on water and wastewater services are understood and reflected in our management and planning processes The water sector has a shared future vision for holistic air, land and water management There are effective methods to identify catchment level conditions, risk and opportunities to enhance our natural systems • E.g. through dynamic data collection mechanisms (such as earth observation) and sensor technologies Improved holistic decision making and valuation frameworks help us to invest in work that will provide the greatest public benefits There is sector-wide understanding of implementable solutions for household, network and catchment scale sustainable interventions	Natural infrastructure and nature based solutions are core to our work • E.g. within our built infrastructure, for low impact treatment, water temperature control, minimisation of sediments and pollution, regulation of storm water runoff and flood risk management • E.g. through large scale implementation of sustainable urban drainage	The sector managers and operates multi-functional assets that deliver net positive natural and social capital at an acceptable cost to customers Natural solutions for environmental protection, enhancement and sustainable operation are delivered collaboratively with wider environmental stakeholders and customers

DELIVERING RESILIENT INFRASTRUCTURE SYSTEMS

We need to prepare our systems to be resilient to future challenges and unknowns

KEY QUESTIONS

How do we develop resilient systems and assets to deal with known and unknown future challenges?

What is the true cost of maintaining assets and how do we get this better reflected in the decision-making process?

Risk in the water sector is increasingly unpredictable due to the complexity and interdependencies between systems and the uncertainty associated with many hazards. Risk assessments and mitigation continue to play an important role in responding to business challenges.

However, resilience as well as risk management is needed to overcome short-term disruptive shocks, such as flooding, and chronic long-term stresses, such as aging assets. Resilience is especially essential to prepare our systems for uncertain frequency or unknown future shocks and stresses. Resilience has become increasingly central to water companies service delivery, with regulators such as Ofwat requiring water companies to consider resilience as part of their business plans.

In 2017 Ofwat defined resilience as 'the ability to cope with, and recover from, disruption and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future.'

Within this dynamic environment it is essential that we innovate to adapt our operations to deal with these shocks and stresses. It is also vital that we innovate to build on the recovery from extreme events to build transformative innovation solutions to ensure our sector thrives in the future.

Current baseline

As water companies, we have worked to identify and understand our baseline resilience and some of the wider resilience issues. Further work is still needed to develop this preliminary work into implementable solutions which incorporates systems thinking into the delivery of our service; through our assets, service, processes and finances.

We will build on the existing resilience frameworks and asset management processes that exist within companies already to develop sector wide innovative approaches. This will consider data collection, investment decision making and building resilient assets and introducing new technologies into our asset base.

KEY ENABLERS TO DELIVERING THIS THEME

We need new enablers and ways of working to address these key questions which include:

- Collecting, sharing and using reliable data to allow decision making over multiple timeframes and systems
- Creating an open dialogue with regulators to develop a long-term plan for maintenance and prepare our assets and networks for the future
- Developing a regulatory model that enables and encourages long term investment

INNOVATION FOR RESILIENCE IN THE ENERGY SECTOR BY NATIONAL GRID

National Grid, the electricity transmission and gas distribution company, must adapt rapidly to the changing energy sector. Energy demand is expected to increase and 65% of electricity could be being generated locally by 2050 (National Grid, 2018). Therefore optimisation of performance and infrastructure resilience are key areas of innovation (ENA, 2020).

Innovation projects to build resilience

Distributed ReStart is a project run by National Grid ESO, the electricity systems operator, and Scottish Power Energy Networks. It explores how distributed energy resources (DER) can be used to restore power in the event of a total or partial blackout of the national electricity transmission system (ENA, 2020).

The 'Virtual Site Acceptance Testing & Training' scheme run by National Grid Electricity Transmission aims to develop and demonstrate the first phase of a digital substation through the development of a platform, simulation and modelling of interoperability (ENA, 2020). This research will establish:

- The feasibility and implementation costs for scalable deployment of digital substations
- A common specification for data models, engineering process, commissioning and testing.

Relevance to UK Water sector

We want to learn from the rapid pace of innovation this national infrastructure network has established to improve infrastructure resilience and performance.

DELIVERING RESILIENT INFRASTRUCTURE SYSTEMS

We need to prepare our systems to be resilient to future challenges and unknowns

	SHORT TERM TOWARDS 2025	MEDIUM TERM TOWARDS 2035	LONG TERM TOWARDS 2050
How do we develop resilient systems and assets to deal with known and unknown future challenges?	Effective, low cost and low carbon approaches to flood risk management have been implemented • E.g. nature based solutions for flood risk management are implemented in all appropriate circumstances The sector is able to monitor infrastructure asset health and performance • E.g. through roll out of low cost sensors and communications Networks are considered to be reliable and interruptions are effectively managed • E.g. through implementing advanced pressure management across all water distribution networks The sector has robust modelling and a shared understanding of what the future may look like that informs our planning and processes • E.g. 'What does a 4^0C world mean for the UK water sector?' Interoperability of systems is designed across the sector so that all systems and devices can work together and exchange data appropriately • E.g. through sector-wide approved open data and interoperability standards There is a sector-wide approach to valuing for decision making which focuses on wider resilience value rather than purely economic value • E.g. through developing a robust evidence base demonstrating the efficacy and value of nature based solutions as an alternative to grey engineered solutions The sector has effective and cost efficient methods to understanding the condition of assets and networks which informs decision making and procurement • E.g. through the development of feasibility, cost, benefits and barriers for use of robotics and other pipeline condition assessment technologies Regulatory frameworks support the implementing of resilient infrastructure through ongoing open dialogues with regulators	The sector can detect and address asset failure rapidly • E.g. through real time methods to detect the true causes of key asset failure and deterioration The sector rolls out key reliability initiatives at scale across all systems • E.g. through implementing cost effective systems to refurbish potable water storage tanks There is a sector-wide approach to valuing solutions which provide wider resilience value rather than purely economic value • E.g. through developing a robust evidence base demonstrating the efficacy and value of nature based solutions as an alternative to grey engineered solutions The sector as a whole makes decisions based on best resilience value and regulatory frameworks support investing in resilience in the long-term Resilient asset ownership and operation is achieved • E.g. through implementation of novel business and ownership model	There are no service or supply incidents and disruptions The sector uses a systems approach to designing and maintaining our assets and networks to build sector wide resilience The sector uses shared adaptive models to understand the impact of changing demographics and climate change on the efficacy and resilience of our assets
What is the true cost of maintaining assets and how do we get this better reflected in the decision-making process?	The interconnectivity of systems and risk across the industry's national asset base is understood Data is actively collected that will inform evidence based decision making There is a cross-sector approach to effectively assess portfolios of regimes for optimised outcomes	The sector has implemented processes and initiatives which prevent cascading failures, improving reliability for our customers and improving the value of our service The interactions between the water sectors' systems and risks and those of other sectors and systems are understood	Our portfolio of lifecycle regimes balance value, risk and long-term costs of asset ownership The regulatory regime supports the long-term resilience of water Robust methods to understand and predict how assets deteriorate or fail are used to inform our assessment of consequences, risks and our approach to risk mitigation Long-term strategic decisions in the sector are with confidence using a framework that considers social and natural capital, future scenarios and the national asset base

ACHIEVING CARBON NEUTRALITY

We need to play our part in limiting global temperature rise to under 1.5^{0}C

KEY QUESTIONS

How do we remove more carbon than we emit by 2050?

How do we work with together with customers, our staff and our supply chain to achieve carbon neutrality across the value chain?

There has been an estimated 1^{0}C warming above pre-industrial levels caused by human activities. This has already impacted both human and natural systems and caused more extreme weather events including increased flooding, extreme drought and reducing biodiversity. We need urgent action to reduce carbon emissions to limit global temperature rise to below 1.5^{0}C to prevent further catastrophic impacts.

We are clear that we need to respond to this in the long term by implementing carbon mitigation measures to reduce the causes of climate change, through reducing carbon emissions and improving carbon sinks. Therefore we will enable the decarbonisation of our systems including energy, transport, processes and procurement and improve carbon sinks through land use management and carbon capture. We know that reducing carbon emissions is a society-wide need therefore we will also encourage our customers to reduce their carbon emissions.

Current baseline

The water sector has a good understanding of the carbon challenge we face with respect to significantly reducing our emissions and our contribution to climate change. Indeed, many companies have set ambitious individual timebound targets relating to reducing the carbon impact of their operations. Furthermore, WaterUK is delivering a net zero carbon route map for the water sector focussing on operational emissions. However, this work is not supported in all cases by a programme to monitor and reduce them in alignment with targets.

Looking forward, our ability to achieve carbon neutrality as a sector will be strongly supported by a robust and consistent approach to data collection, analytics, scenario modelling and monitoring of emissions. It is important to note that while some companies have made commitments with respect to their operational carbon emissions, tackling embodied and value chain carbon emissions remain significant challenges for the industry that need to be considered. It is understood that many of the tools for proper quantification, monitoring and management of carbon emissions already exist. However, innovation and progress are required to ensure that evidence-based consideration of carbon is integrated into our decision-making processes across the board.

KEY ENABLERS TO DELIVERING THIS THEME

We need new enablers and ways of working to address these key questions which include:

- Developing a regulatory framework that drives investment to reduce carbon ahead of government targets
- Updating codes and standards, including engineering and health and safety, and procurement regulations to facilitate innovation around carbon management
- Developing a framework or guidance for carbon offsetting to enable funding to be directed towards management activities such as peatland restoration for balancing residual emissions
- Developing a consistent 'net zero' definition, terminology, and sector ambitions and route map
- Accelerating the implementation of emerging low carbon technologies
- Exploring partnership opportunities with stakeholders such as wildlife and woodland trusts, catchment management groups, private landowners and the supply chain

CARBON NEUTRALITY AT ACCIONA

ACCIONA, a firm which develops and manages infrastructure and renewable energy around the world, "considers the fight against climate change, and the effects it causes, to be a strategic priority." (ACCIONA, 2018).

The company have achieved carbon neutrality each year since 2017 through a combination of renewable energy generation, efficiency interventions, robust carbon pricing in decision making and offsetting residual emissions through Certified Emissions Reduction schemes.

The role of innovation in decarbonisation

ACCIONA invest ~3% of annual revenue back into collaborative and operational innovation with a focus on maximising operational efficiency and pioneering new, sustainable business models. Collaborative innovation is delivered through start-up accelerators, innovation challenges and a digital innovation hub.

Each year their progress unlocks ~€30m of operational savings and enables them to deliver low carbon infrastructure for clients whilst achieving carbon neutrality as a company (ACCIONA, 2018).

Relevance to UK Water sector

ACCIONA's work demonstrates how investment in innovation enables implementation of asset upgrades and extensions based on the principles of circular economy, develop low carbon value chains and rapid integration of emerging technologies into their procurement streams.

ACHIEVING CARBON NEUTRALITY

We need to play our part in limiting global temperature rise to under 1.5⁰C

	SHORT TERM TOWARDS 2025	MEDIUM TERM TOWARDS 2035	LONG TERM TOWARDS 2050
How do we remove more carbon than we emit by 2050?	The sector has a joined up approach to quantifying and reducing operational (scope 1 and 2) greenhouse gas emissions' Process emissions from across the sector are better quantified and where possible, reduced: • E.g. through monitoring and potentially modifying treatment regimes • E.g. through developing real time management for raw water abstraction and water distribution Carbon capture and storage opportunities have been explored • E.g. through testing the feasibility of non-land-based carbon capture and storage The water sector is transitioning to sustainable transport The sector has rolled out energy efficiency and carbon energy and heat initiatives • E.g. through rolling out low energy treatment technologies and mechanisms, optimising heat options and implementing renewable electricity generation Carbon storage and scalable sequestration has been developed • E.g. through soil improvement programmes using water process residuals; or wetland, marine algae and peatland restoration • E.g. through the development of a land carbon sequestration tool and low carbon farming guidance	The English water sector has achieved net zero emissions for operational emissions in 2030 • E.g. through prevention, optimisation or capture of water company emissions and engagement with the supply chain The sector has a joined up approach to quantifying and reducing greenhouse gas emissions from water and wastewater treatment processes for scope 1 and 2 emissions The water sector has transitioned to sustainable transport The sector is a significant contributor to wider decarbonisation through the production and export of low carbon energy generation • E.g. through renewable energy, hydrogen and energy from waste fuel sources Carbon storage and scalable sequestration has been rolled out across the sector The sector is collaborating with environmental stakeholders to collectively deliver against net zero targets ' There is consistent accounting of operational greenhouse gas emissions which is linked to investment opportunities E.g. through developing certified emission reduction methodologies to attract carbon offset project funding	The whole UK water sector has achieved operational and value chain carbon neutrality through water and wastewater processes • E.g. through minimised emissions in materials, consumables, products and services and developing credible offsets The sector has decarbonised all energy and transport • E.g. through avoidance, efficiency and alternatives to fossil fuels Carbon sequestration non-land-based carbon storage has been implemented across the sector as a whole
How do we work with together with customers, our staff and our supply chain to achieve carbon neutrality across the value chain?	The sector works with customers to reduce demand • E.g. through promotion of the service's associated carbon footprint The sector has a clear understanding of embodied and value chain carbon for the sector • E.g. through quantification and measurements of all emissions Procurement and supply chain emissions have reduced • E.g. through individual company procurement strategies and policies to prioritise low carbon decision making that includes carbon cost considerations and criteria	Emissions have reduced linked to reductions in customer demand Decarbonisation has been enabled across our value chains through working with communities. • E.g. through sustainable procurement or enhanced carbon sequestration practices	Stakeholders and customers are central to the sector's approach to carbon neutrality The whole UK water sector has achieved operational and value chain carbon neutrality through water and wastewater processes • E.g. through minimised emissions in materials, consumables, products and services and developing credible offsets

TAKING A WHOLE LIFE APPROACH TO RESPONSIBLE CONSUMPTION AND PRODUCTION

We need to transform our processes and the way we work to deal with resource scarcity

KEY QUESTIONS

How do we maximise recovery of useful resources and achieve zero waste by 2050?

How will we achieve zero leakage in a sustainable way by 2050?

How do we increase the perceived value of water to sustainably reduce water consumption?

Sustainable and responsible consumption and production is essential for the sector as many of the resources we rely on are finite and in critical condition. Drivers, like climate change, are set to put further strain our water supplies through more frequent and extreme events.

Therefore we need to improve the way we use resources, including water, energy and materials. We need to move away from the current linear model of consumption to a regenerative, circular approach to maximise the recovery of useful resources, minimise resource use, design out waste and pollution and get the best value out of all our resources.

Water is a precious resource that should be treated as such, moving from our current 'take-use-discharge' approach to a 'restorative by design' approach. Tackling leakage is vital to our approach to responsible consumption as it directly impacts amount of water abstracted rivers and aquifers.

To achieve responsible consumption and production, it is important that we consider the lifecycle of our activities and assets. This allows identification of inefficiencies, opportunities for savings and resource recovery value chains.

Current baseline

On maximising resource recovery, research to date has been focussed on developing low-cost recycling routes for organic wastes as a source of energy. This has enabled a preliminary understanding of the value of waste recycling as an additional value chain for the water sector.

However, further work is needed to help deliver a significant step change in efficiency and sustainable consumption and production in the water sector.

In general household water consumption has been reducing over the past few years across the UK, though fluctuations are seen throughout the year. Technologies such as smart-meters have been deployed which reduce water use by about 30 litres per person per day (Waterwise, 2017). Leakage has reduced by 40% since 1997. Work is still required to address the loss 20% of drinking water through leakages from homes, businesses and water company pipes (UKWIR, 2018).

KEY ENABLERS TO DELIVERING THIS THEME

We need new enablers and ways of working to address these key questions which include:

- Flexibility in the regulatory frameworks to enable circular economy principles to be applied across organisations and the wider sector
- Building customer acceptance of metering and valuing water as a scarce resource
- Developing low cost metering and insight on usage patterns for domestic customers
- Enforcement of regulation and incentives to ensure more conservative use of water and encourage grey water use
- Engaging our customers so that they feel truly part of the water cycle and understand their role in reducing leakage
- Developing markets and value chains for raw materials
- Creating methods to evaluate the scale of consumption and production over the lifecycle of assets

CIRCULAR ECONOMY AT GSK

GSK researches, develops and manufactures pharmaceutical medicines, vaccines and consumer healthcare products. Recognising the social, environmental and economic benefits of resource efficiency and sustainable consumption, GSK work to integrate principles of circular economy and resource recovery into their value chains. This extends to their procurement, production and internal processes.

A company-wide approach to resource recycling and efficiency

In 2010, GSK sent 17,200 tonnes of waste to landfill. Recognising the damage of creating this level of waste, they set a target to achieve zero waste to landfill at all of their sites by 2020. Since setting this ambitious target, GSK has adjusted its thinking to consider waste as a valuable resource. Some examples of resource recovery being integrated into their production processes include:

- Composting egg waste from flu vaccine manufacturing
- Recycling packaging waste into the material mix for waterproof flooring
- Generating green gas from food waste
- Re-using refrigerated packaging from distribution of vaccines in insulation materials for construction projects

Relevance to UK Water sector

GSK's work demonstrates how integrating principles of circular economy and resource recovery into supply chains and operational activities can lead to significant savings and additional value streams.

TAKING A WHOLE LIFE APPROACH TO RESPONSIBLE CONSUMPTION AND PRODUCTION

We need to transform our processes and the way we work to deal with resource scarcity

	SHORT TERM TOWARDS 2025	MEDIUM TERM TOWARDS 2035	LONG TERM TOWARDS 2050
How do we maximise recovery of useful resources and achieve zero waste?	There is a shared understanding across the water sector on the opportunities for implementing a shared circular economy approach • E.g. through a lifecycle assessment of consumption and production associated with delivering core responsibilities, identifying opportunities for resource efficiency, and identifying highest value resources The sector has shared approaches to designing out waste and pollution from service provision to reduce impact on the natural environment • E.g. through the creation of methods for efficient and effective recovery of resources from wastewater process including resources like phosphorus, nitrogen, plastics, precious metals, grit, methane and nitrous oxide The sector focuses on keeping products and materials in use to optimise resource yields and resource extraction (including water, energy and chemicals) • E.g. through developing regulatory processes and business models around resource recovery • E.g. through developing processes for extracting biofuels from sludge and heat from sewers	Decision making, planning, and regulatory guidance are driven by whole life assessments of assets and processes to achieve social environmental and economic capital gain for society to provide the best service for customers • E.g. through updated resources use and recycling approaches • E.g. through collaborating with end-users to develop markets for recovered materials and with customers, policy makers and regulators to remove regulatory and public perception barriers Waste and pollution is designed out across the sector, through rolling out circular economy approaches to water and wastewater systems to optimise the amount of energy, minerals, and chemicals used in operation of water and wastewater systems Operational energy consumption and waste production is minimised and resource recovery is maximised • E.g. through applying circular economy principles and deploying technologies to enable all waste streams recycled and resources recovered with the most cost efficiency Ownership and responsibility for resources management is clear and all play a partnership role in driving resource efficiency	The economic and regulatory frameworks have been updated to effectively support and incentivise resource recovery and reuse in the water sector The sector produces zero avoidable waste The sector as a whole keeps products and minerals in use: • Water treatment processes use recycled water to provide different water quality for different purposes • Wastewater treatment have become resource factories, energy generators and used water refineries
How will we achieve zero leakage in a sustainable way?	The English and Welsh sector has achieved a 17% reduction in leakage over the last five years Leakage detection is rapid and allows for rapid cost effective repair • E.g. through deploying monitoring technology The sector understands how water assets age and has methods to predict future leakage and burst rates for different types of pipes • E.g. through processes to identify how deterioration of pipes and joints evolves into leakage • E.g. through techniques for tracing non-metallic pipelines The scale of background leakage is understood The sector understands how customer behaviour impacts leakage rates	The sector has achieved a 66% reduction in leakage All new leaks are found quickly after they break out All new pipework is leak free New leaks on existing networks are minimised	Zero leakage is achieved and quantified Background leakage is eliminated Repairs are quick and economic with minimal disruption
How do we increase the perceived value of water to sustainably reduce water consumption?	Water efficiency measures have been developed to create behaviour change for household, retail and non-household use • E.g. through combining behaviour change engagement and campaigns with other sector efficiency programmes • E.g. through development and deployment of low cost rainwater and grey water recycling for domestic non-potable re-use National water efficiency targets have been created and progress is monitored	Sector wide behaviour change programmes and interventions have been rolled out at a national scale to develop a water-saving culture reducing consumptive and non-consumptive uses of water	Household, retail and non-household customers understand the value of water and have minimised water consumption • E.g. through water neutral developments and realising the potential value of offsetting to improve water efficiency in existing properties

ENABLING DIVERSE FUTURE-READY PEOPLE AND PARTNERSHIP WORKING

We need to ensure we have the culture, skills and partnerships to innovate to prepare for future change

KEY QUESTIONS

How do we build a shared innovation culture across the water sector to improve customer experience?

How do we enable improved collaboration between water companies, regulators, supply chains, SMEs, start-ups, academia, customers and other innovators?

How do we ensure that our staff have the skills to prepare for and address emerging challenges in an ever changing world?

How do we ensure that the regulatory framework incentivises efficient delivery of the right outcomes for customers and the environment?

The world is a rapidly changing place and the water sector needs a culture which is adaptive and agile to respond to major challenges, changing trends and expectations. We recognise the importance of having people who are empowered and have the skills to create new innovative ideas, develop and implement them. Working with new partners and sectors allows us to learn new skills and ways of working to support this.

Current baseline

Currently innovation in the water sector is mainly focused within companies, with each water company taking a different approach to innovation development, investment and delivery. There are some collaboration networks which support sector wide collaboration between water companies (examples include Water UK and UKWIR. There are significant opportunities to create a sector wide shared innovation culture.

Often partnerships are highly contractual and the speed and flexibility of procurement systems can present problems. For example, inflexible procurement can make long payment periods which can hamper collaboration with SMEs who need to manage their cash flow. This lack of flexibility can stifle innovation.

There is a perception in the water sector that the relationship between regulators and water companies is highly hierarchical. Regulators often require evidence of short-term return on investments which makes it difficult to implement truly transformational innovation projects. Many in the water sector would welcome more open two-way dialogue between regulators and water companies. Water companies horizon scan for future short and medium-term skills development needs and opportunities, though longer-term sector wide planning could be improved.

There is an opportunity for further sector wide understanding of these issues and more communication across organisations. We recognise that there are a range of future trends, such as an ageing workforce or technological advances that reflect the need or opportunity to change the future model of work.

KEY ENABLERS TO DELIVERING THIS THEME

We need new enablers and ways of working to address these key questions which include:

- Trust as a foundation for equal partnerships across the industry, with other sectors and with our customers and community
- Working with partners and regulators to enable innovation to provide multi-generational best value from lowest cost, rather than needing benefits to be realised in a short timeframe
- Adapting the workforce bringing new skills, such as social scientists, and upskilling the operational workforce to support the businesses to adapt
- Embedding new ways of working to develop innovation, such as development sprints, and communicate and share the outcomes of this work and good practice
- Using open data and compatible digital infrastructure across the industry, supply chains, other innovators and customers
- Measuring of value wider than purely economic value considering whole-life social environmental costs, value and solutions which are supported by our regulators, legislation and policy makers
- A policy review of water policy and regulation to restructure incentives to transform the sector

INNOVATION DISTRICTS

The innovation district model was developed by the Massachusetts Institute of Technology (MIT) to deliver innovation through place-based entrepreneurial ecosystems. It works to join innovators with a university or research centre, capital investment, corporate acceleration and government or regulatory support.

The UK Autodrive project

Reflecting the MIT innovation model, the UK Autodrive project in Milton Keynes was a government supported scheme to test and develop connected and driverless cars. The project was supported by industry partners and an industry testing centre before trials moved to live city environments in Coventry and Milton Keynes (UK Autodrive, 2020).

The trials demonstrated how connected and autonomous vehicles (CAVs) could be integrated into real-world city scale urban environments to support stakeholders and decision makers to implement CAV schemes.

Relevance to UK Water sector

'Innovation districts' demonstrate to the water sector how a hub of excellence can be a catalyst for inclusive economic growth by:

- Providing leadership for high skilled, focussed teams
- Creating geographical areas of excellence and technical innovation
- Building cross-sector collaborative networks to deliver shared goals
- Supporting real-world test beds for emerging technologies and innovations to be trialled in live environments

ENABLING DIVERSE FUTURE-READY PEOPLE AND PARTNERSHIP WORKING

We need to ensure we have the culture, skills and partnerships to innovate to prepare for future change

	SHORT TERM TOWARDS 2025	MEDIUM TERM TOWARDS 2035	LONG TERM TOWARDS 2050
How do we build a shared innovation culture across the water sector to improve customer experience?	Staff across the industry are empowered; they create, develop and implement innovation • E.g. through rolling out employee engagement strategies and reward strategies which promote innovation The sector has clear guidance on good water company capabilities, rewards, which can be used to deliver a nationwide level of service • E.g. through a clear framework for flexible working	The UK has a sector wide innovation mindset • E.g. through organisational design, social networks, skills, culture and promotion of successful innovation Long-term partnerships are built around trust, without barriers to collaborative endeavour	Our organisations are structured to ensure that we have the best talent, the right workforce numbers for the best cost New business models and partnerships are implemented which have arisen out of and enable innovation
How do we enable improved collaboration between water companies, regulators, supply chains, SMEs, start-ups, academia, customers and other innovators?	Collaboration and co-creation are key criteria for innovation undertaken in the sector • E.g. through sharing ideas, findings and solutions between water companies, other sectors and interested groups Partners work together to create mature, functional and trusting relationships between parties • E.g. through an effective framework to support collaboration with a wide range of stakeholders which addresses collaboration issues such as intellectual property	Public, private and third sectors work together with communities and individuals to innovate and reduce the risk of harm to our customers and environment	Collaboration between a range of innovators is central to all of our innovation work
How do we ensure that our staff have the skills to prepare for and address emerging challenges in an ever changing world?	Training, upskilling, resource sharing, and employment development programmes are based on best practice to support the creation of a future ready workforce • E.g. through development programmes to ensure that innovation skills and wider supporting skills, such as collaboration, digital, product develop and customer research, are key industry skill-sets	The sector has a shared understanding of where future skills gaps could emerge and sector wide plans and training programmes to address any gaps identified	The sector can upskill, attract and retain the best people with the right skills to provide public value
How do we ensure that the regulatory framework incentivises efficient delivery of the right outcomes for customers and the environment?	Decisions are made based on new approaches to value wider social and environmental long term benefits • E.g. multi capitals assessment	Regulators measure and incentive service based on value wider social and environmental long-term benefits rather than short-term economic returns	Regulators have adapted regulatory frameworks to enable innovation, co-delivery and co-production and also share regulatory risk

FROM STRATEGY TO IMPLEMENTATION

Phased Implementation

We recognise that achieving the short, medium and long-term objectives of our strategy will require an agile, phased implementation plan. In the short term, we will accelerate innovation activity around the industry's biggest challenges, as set out under each of our themes to deliver tangible benefits to society and the environment over the next five years. In parallel, we will lay the foundation for delivering transformation through innovation in the medium and long term by developing the enabling infrastructure and relationships needed to address multi-sector, multi-national challenges.

Enabling Innovation

Transformative change requires enabling infrastructure. In the UK, we already have most of the ingredients needed to do innovation, but it is largely fragmented and not joined up. The enabling infrastructure we put in place to implement our strategy will therefore focus on connecting, coordinating and leveraging what already exists.

In the supporting document, Enabling Innovation, we describe what we think is required to implement our strategy, which is framed around our proposal for a Centre of Excellence.

Centre of Excellence

The Centre of Excellence is an evolution of the concept that has been referred to by Ofwat in recent publications. After exploring various options for what this could be (which are described in the Enabling Innovation document in Appendix 3), we have determined that a virtually integrated innovation centre would best serve the needs of the sector while providing a vehicle for delivering our strategy. We have used the term "Centre of Excellence", but this is not necessarily a single centre or entity, but rather the virtual integration of systems with the power to connect, integrate and enhance existing innovation activity and facilities across the sector. It would serve as a focal point for water innovation and, with no geographic boundaries, would provide open and equal access to all. In contrast to a physical centre, it is relatively cost-effective and aligns with our strategic needs for phased implementation. Further details are provided overleaf.

Section 2 describes some of the issues regularly cited as restricting the innovation capability of our sector, including: lack of alignment between research and sector needs; the speed of innovation from ideation to exploitation; the need for greater integration of industry activity; the need for strengthened branding of water capability for international markets; and better understanding and utilisation of national testing, validation and demonstration facilities.

In addressing these issues and in line with the principles of our strategy, the Centre of Excellence will:

- Provide **access to skills and capability** (supporting principles 1, 3, 4) including: test and demonstration facilities; academic expertise and research programmes; business and start-up support; and strategic advice (e.g. regulator one-stop shops).
- Promote **collaboration and knowledge sharing** (supporting principles 1, 2, 3, 4) by: providing a single gateway for innovators; promoting access to project and funding opportunities; creating forums for sector collaboration; and developing a platform for knowledge dissemination.
- Provide access to **open and shared data** (supporting principles 2, 3, 4). We will commit to working together to develop common approaches to trialling and data.
- Support our **people and** promote a **culture** of innovation (supporting principles 1, 3, 4) by: providing access to skills and training; promoting diversity of thought through openness and collaboration; and providing opportunities for community outreach and engagement.

Catalyst for change

This is an opportune moment to shape the future of water in the UK but we can only achieve this through collective action – everyone has a role to play. All of our stakeholders will be central to shaping, and collaborating to deliver transformative innovation in the sector. There is also pressing need to work with government and other decision makers to support innovation for growth and for good, directing innovation to society's most important problems, and shaping the application of new ideas and technologies in a way that benefits as many people as possible. While by itself, the Centre of Excellence cannot achieve these things, we hope it will provide the catalyst for change.

Centre of Excellence

Overview

Develop enabling infrastructure to facilitate innovation activity; focus on accelerating innovation around the industry's grand challenges (UKWIR Big Questions); and define the commercial and governance model for enabling activity.

HERE & NOW

1 3 4

Access to skills & capability

Improve access to: testing and demonstration facilities, business and start-up support (e.g. incubators, accelerators, business coaching); academic expertise and research programmes; and strategic advice (e.g. regulator one-stop-shops).

1 2 3 4

Collaboration & knowledge sharing

Increase visibility of project and funding opportunities – calls for innovation, funding and grants, proposals portal; develop a common approach to knowledge sharing and dissemination; provide a single gateway for innovators; and create appropriate sector forums for inclusive stakeholder engagement.

2 3 4

Open and shared data

Define and map data contributors, data users, decision makers and funders in the context of the water sector; identify areas where sharing data between water companies is beneficial; develop common data standards for the water sector; develop mechanisms for opening and sharing data.

1 3 4

People & culture

Work with communities to define public value; provide access to skills and training opportunities; empower and enable bottom-up innovation; engage with schools to promote water innovation; recognise and celebrate successful innovation.

LOOKING AHEAD

Overview

Develop strategic partnerships for cross-sector collaboration; focus on medium and long-term challenges that go beyond the regulatory cycle and may require multi-sector, multi-national collaboration.

1 3 4

Access to skills & capability

Continually review and assess skills and capability requirements in line with delivering our innovation strategy; identify synergies with skills and capability in other sectors.

1 2 3 4

Collaboration & knowledge sharing

Develop cross-sector relationships, specifically with the digital, energy, infrastructure and agriculture sectors which are the fastest growing areas of concern relating to water management.

2 3 4

Open and shared data

Establish data governance trust framework; engage government (e.g. CDBB) and other sectors on opportunities to share data for multidisciplinary challenges.

1 3 4

People & culture

Leverage innovation culture to attract and promote diversity of thought in the sector; demonstrate innovation credentials to influence government and the perception of water; develop the next generation of researchers; do what is necessary 'to appeal'.

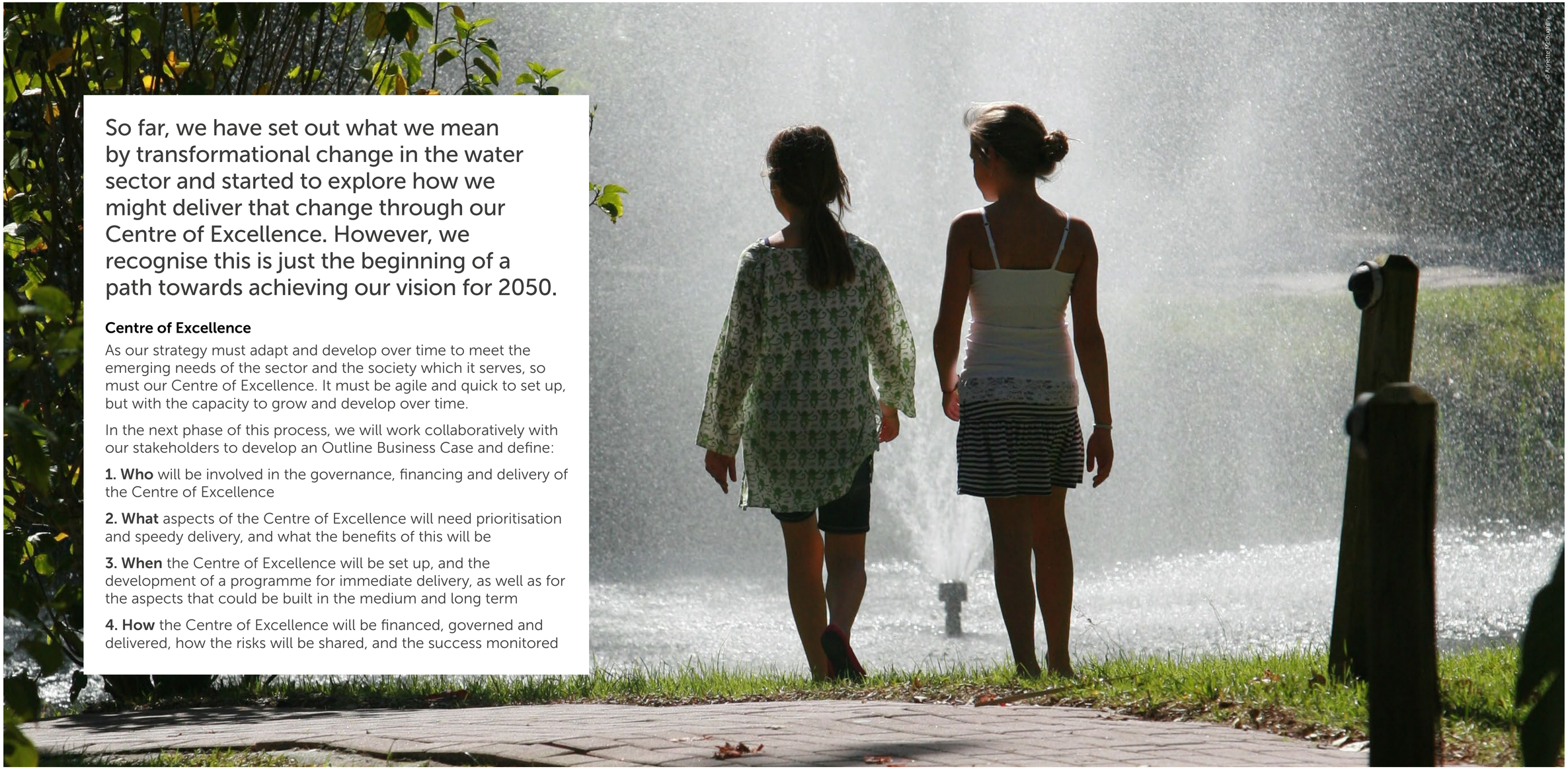
STRATEGY PRINCIPLES

1 Opening access to collaboration

2 Leveraging data and new ways of working

3 Making space for innovation culture

4 Being led by environmental, social and economic purpose



So far, we have set out what we mean by transformational change in the water sector and started to explore how we might deliver that change through our Centre of Excellence. However, we recognise this is just the beginning of a path towards achieving our vision for 2050.

Centre of Excellence

As our strategy must adapt and develop over time to meet the emerging needs of the sector and the society which it serves, so must our Centre of Excellence. It must be agile and quick to set up, but with the capacity to grow and develop over time.

In the next phase of this process, we will work collaboratively with our stakeholders to develop an Outline Business Case and define:

1. **Who** will be involved in the governance, financing and delivery of the Centre of Excellence
2. **What** aspects of the Centre of Excellence will need prioritisation and speedy delivery, and what the benefits of this will be
3. **When** the Centre of Excellence will be set up, and the development of a programme for immediate delivery, as well as for the aspects that could be built in the medium and long term
4. **How** the Centre of Excellence will be financed, governed and delivered, how the risks will be shared, and the success monitored

CONTINUOUS EVOLUTION

It is critical that our strategy is able to adapt and develop over time in order to reflect the emerging needs and priorities of the sector and the society which it serves. Through sound monitoring processes and measuring impact, we will be able to learn from our experiences and improve our approach over time.

Monitoring and review

Following the incorporation of wider stakeholder consultation and feedback in the coming months, we will publish our UK 2050 water innovation strategy in the early autumn. The strategy will be reviewed annually and updated in 2022 at which stage we will check with you, our stakeholders, that the principles and innovation themes are the right ones.

Stress testing

We have developed a three element process for stress testing our strategy. These elements set out a test for this strategy, tests for deliverability and tests for acceleration. More detail is set out in Appendix 2.

We will continue to develop quantitative and qualitative metrics to monitor progress and create a feedback loop that supports our annual review and biennial update.

We will create and implement a process with appropriate governance to provide independence to our stress testing.

Measuring success

We recognise that success comes in many forms. Changing the culture of innovation, building trust with our stakeholders and changing the perception of our sector, while all difficult to quantify, will be key indicators of success in the long term. Accelerating the speed and efficiency of innovation from ideation to adoption is central to our strategy and we will look at various ways to measure this (e.g. speed of decision-making, amount of shared and open data). The successful realisation of our strategy should also lead to a growth in the number of jobs and SMEs active in our sector, and increase our collective share of the global water market. In the next stage of this process, we will listen to our stakeholders on what success will look like and explore different frameworks for measuring innovation success.

CALL TO ACTION

We want you, as our stakeholders to be central to shaping, and collaborating to deliver, transformative innovation in the water sector.

This strategy has the aim of galvanising our stakeholders across the sector and beyond to come together in a focused effort to co-develop an approach that is inclusive, accessible and transformative for all.

In the next phase of this process, we will engage in a range of ways to provide everyone with a voice in shaping our Innovation Strategy as it develops, and in how we deliver it.

We will listen, we will collaborate, and we will co-develop.

We want you to join us and play your part in delivering transformational change through innovation.

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APPENDIX 1

Mapping the themes against the UKWIR Big Questions and the SDGs

We have mapped our themes, and the outcomes within these themes, against the SDGs and UKWIR big questions, as shown in the diagram below. We have also mapped them against the Public Interest Commitments, the 25 Year Environment Plan, the Water Strategy for Wales and the Sustainable Water long term strategy for Northern Ireland.

Themes	UKWIR big question that links to this theme	Additional key questions within themes	SDGs
Providing the services our customers and society expect and value	How do we achieve zero customers in water poverty by 2030?	How do we build customer trust and confidence in the face of future uncertainty? How do we enhance accessibility and protect vulnerable customers? How do we improve transparency?	1 NO POVERTY 2 ZERO HUNGER 3 GOOD HEALTH AND WELL-BEING 8 DECENT WORK AND ECONOMIC GROWTH 17 PARTNERSHIPS FOR THE GOALS
Providing clean water for all	How do we achieve 100% compliance with drinking water standards (at point of use) by 2050? How do we achieve zero interruptions to water supplies by 2050?	How do we achieve zero harm from emerging contaminates and lead? How do we provide enough water for all?	6 CLEAN WATER AND SANITATION 17 PARTNERSHIPS FOR THE GOALS
Protecting and enhancing natural systems	How do we halve freshwater abstractions in a sustainable way by 2050? How will we deliver an environmentally sustainable wastewater service that meets customer and regulator expectations by 2050? How do we achieve zero uncontrolled discharges from sewers by 2050? How do we achieve zero harm from plastics via our operations and activities?	How do we develop, protect and enhance our natural environment ensuring resilience against current and future challenges, including natural solutions?	14 LIFE BELOW WATER 15 LIFE ON LAND 17 PARTNERSHIPS FOR THE GOALS
Delivering resilient infrastructure systems	What is the true cost of maintaining assets and how do we get this better reflected in the regulatory decision-making process?	How do we develop resilient systems and assets to deal with known and unknown future challenges?	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 11 SUSTAINABLE CITIES AND COMMUNITIES 13 CLIMATE ACTION 17 PARTNERSHIPS FOR THE GOALS
Achieving carbon neutrality	How do we remove more carbon than we emit by 2050?	How do we work with people and the environment to achieve carbon neutrality?	7 AFFORDABLE AND CLEAN ENERGY 11 SUSTAINABLE CITIES AND COMMUNITIES 13 CLIMATE ACTION 17 PARTNERSHIPS FOR THE GOALS
Taking a whole life approach to responsible consumption and production	How will we achieve zero leakage in a sustainable way by 2050? How do we maximise recovery of useful resources and achieve zero waste by 2050?	How do we increase the perceived value of water to sustainably reduce water consumption?	7 AFFORDABLE AND CLEAN ENERGY 11 SUSTAINABLE CITIES AND COMMUNITIES 12 RESPONSIBLE CONSUMPTION AND PRODUCTION 17 PARTNERSHIPS FOR THE GOALS
Enabling diverse future-ready people and partnership working	How do we ensure that the regulatory framework incentivises efficient delivery of the right outcomes for customers and the environment?	How do we build a shared innovation culture across the water sector? How do we enable improved collaboration between water companies, regulators, supply chains, SMEs, start-ups, academia and other innovators? How do we ensure that our staff have the skills to prepare for and address emerging challenges in an ever-changing world?	4 QUALITY EDUCATION 5 GENDER EQUALITY 8 DECENT WORK AND ECONOMIC GROWTH 17 PARTNERSHIPS FOR THE GOALS 10 REDUCED INEQUALITIES 16 PEACE, JUSTICE AND STRONG INSTITUTIONS 17 PARTNERSHIPS FOR THE GOALS

APPENDIX 2

Stress testing our ongoing innovation approach

We have developed a three element approach to stress testing which creates a framework to measure progress over time. These three elements are:

- Testing the strategy
- Testing deliverability
- Testing acceleration

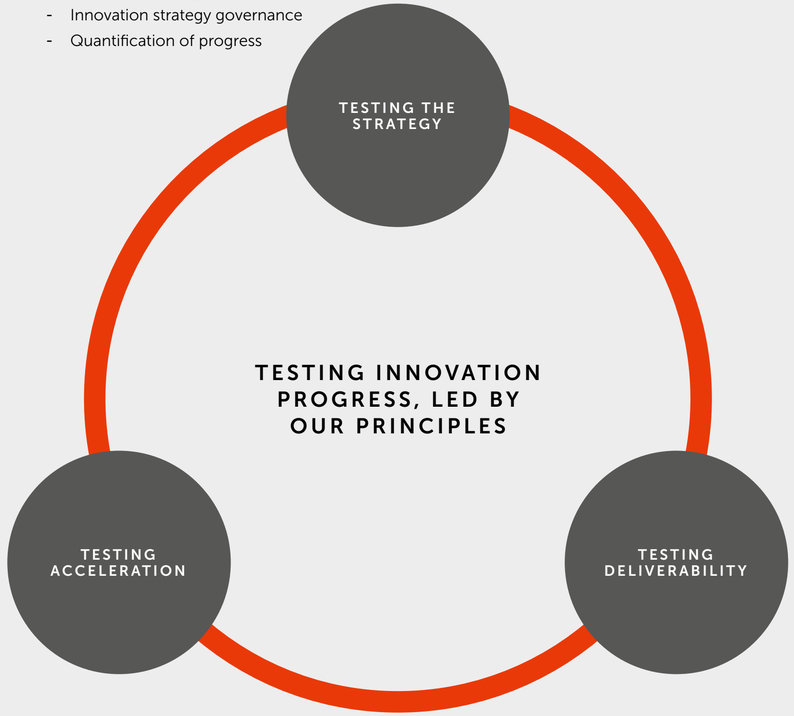
This process will continue to develop quantitative and qualitative metrics to monitor progress and impact.

Recognising that the strategy must make innovation open to all, we will be inviting our stakeholders to participate in the process of testing the strategy and developing what success looks like in the forthcoming consultation.

Importantly, we will ensure that there is a feedback loop in place to support the periodic review and update of the strategy. We plan to develop a framework that is owned by the water industry and provides a method to easily measure progress and which is supported by appropriate assurance processes.

This element tests:

- Innovation strategy scope
- Strategy language and audience
- Awareness of the policy and regulatory environment
- Innovation strategy structure and content
- Innovation strategy delivery
- Innovation strategy governance
- Quantification of progress



This element tests if the enabling infrastructure proposed in the strategy provides additionality and accelerates the pace of innovation.

This testing builds on the current innovation landscape to enable and accelerate the delivery of the desired outcomes.

This element tests if mechanisms exist to deliver this strategy through:

- Capture, triage and prioritisation of ideas against transparent criteria
- Processes for initiating projects, including funding, procurement and frameworks for collaborative working
- Delivery models that enable rapid testing and iteration of new ideas, failing fast, and capturing and disseminating knowledge
- Processes for implementation and roll-out

APPENDIX 3

2050 Water Innovation Strategy evidence base

Enabling Innovation

UK
2050 Water Innovation Strategy evidence base
- Enabling Innovation

DRAFT

SECTION 01

Introduction

The development of our UK 2050 water sector innovation strategy has highlighted the need for the sector to undertake new activities to enable innovation. This report describes the enabling infrastructure needed to deliver our shared vision for transformative change, including our proposals for a Centre of Excellence.

The Centre of Excellence is an evolution of the concept that is referred to in Ofwat's innovation consultation documents. This paper explores options for what this could comprise, but essentially we describe the enabling infrastructure that will provide a vehicle for delivering our strategy. We define some of the key features and elements within the Centre of Excellence and set out a series of recommended next steps for its design, development and implementation.

In our joint innovation strategy, we set out the following principles:

1. Opening access to collaboration.
2. Leveraging data and new ways of working.
3. Making space for innovation culture.
4. Being led by environmental, social and economic purpose.

In line with these principles, the Centre of Excellence will:

- Provide **access to skills and capability** (supporting principles 1, 3, 4) including: test and demonstration facilities; academic expertise and research programmes; business and start-up support; and strategic advice (e.g. regulator one-stop shops).
- Promote **collaboration and knowledge sharing** (supporting principles 1, 2, 3, 4) by: providing a single gateway for innovators; promoting access to project and funding opportunities; creating forums for sector collaboration; and developing a platform for knowledge dissemination.
- Provide access to **open and shared data** (supporting principles 2, 3, 4). We will develop common approaches to trialling and data.
- Support our **people and** promote a **culture** of innovation (supporting principles 1, 3, 4) by: providing access to skills and training; promoting diversity of thought through openness and collaboration; and providing opportunities for community outreach and engagement.

SECTION 02

Strategic Case

Transformational change requires enabling infrastructure.
Our solution, the Centre of Excellence.

In this section, we begin to set out a strategic case for the Centre of Excellence. We look at what is driving change in the sector, we define the benefits that delivering change will bring, and we explain how the Centre of Excellence could bring about that change, for social and economic good.

What are the drivers of change?

Population growth, urbanisation, climate change and ageing infrastructure are forcing nations, governments and organisations to rethink their approaches to water, and to invest significantly in managing their water and wastewater infrastructure to ensure it is fit for the future.

International and national policy

Policy is a key driver of change. The 2030 Agenda for Sustainable Development, adopted by all Untied Nation Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries – developed and developing – in a global partnership.

The UK Industrial Strategy, 2017, sets out a long term plan that aims to boost productivity throughout the UK and become the world's most innovative economy, improving earning power and upgrading the UK's infrastructure. It frames the need for innovation to address key future challenges by capturing the value of innovation through technology. The National Infrastructure Assessment sets out a clear, long term plan for the upgrades required to UK's economic infrastructure to 2050.

There are numerous national policies and legislation, which set wellbeing and environmental outcomes. The 25 Year Environment Plan sets out a long-term approach to protect and enhance England's environment.

The Environment Strategy for Scotland sets a framework to bring together Scotland's existing environmental strategies and Climate Change (Scotland) Act 2009, to improve the environment and citizens' well-being. The long-term water strategy for Northern Ireland presents a framework to achieve a sustainable water sector in the country.

The Water Strategy for Wales aims to improve the resilience of their national water system and The Environment Wales Act 2016 aims to support the country in meeting the demands on natural resources.

The Well-being of Future Generations Act 2015, places a duty on public bodies to improve the social, economic, environmental and cultural well-being of Wales.

Regulation

In England and Wales, the economic regulator, Ofwat, sees innovation as "crucial for meeting challenges in a cost-effective and sustainable way". It recognises that there are untapped opportunities for the industry to work together, and has made up to £200 million of additional funding available for innovation in addition to existing innovation investment funded by customers.

Scottish Government has established a Hydro Nation strategy, developing the 'water economy', where water resources are developed so as to bring the maximum benefit to the Scottish economy, underpinned by a statutory duty.

The Utility Regulator in Northern Ireland is supportive of NI Water's Innovation Initiatives set in context against the underinvestment challenges. These are particularly in wastewater where competition for innovation funds has to be carefully managed within the overall regulatory funding determination.

What is the opportunity?

We have an opportunity to address society's most important problems through innovation, and to shape the application of new ideas and technologies in a way that benefits as many people as possible. Delivering this change for good also present enormous opportunities for innovative businesses, big and small, to market their goods, knowledge and services both at home and overseas.

Global Water Intelligence estimates that meeting the Sustainable Development Goals for water and sanitation between 2018 and 2030 will cost $1,785 billion for rehabilitation and $4,056 billion for new infrastructure.

To win a bigger share of the global water market and position the UK as a global leader in water innovation, we have a strong foundation to build on. We have many proven strengths including a world class science base and considerable expertise in devising and disseminating innovations that can address key water-related challenges worldwide. We also have a proud pedigree in research and innovation, funding a considerable amount of water research and innovation through our Research Councils and having established a number of centres of excellence in universities and elsewhere. Our strong supply chain has distinctive strengths, offering specialist technology providers and world class capabilities in the supply of tailored and integrated consultancy services, and our water companies are well-regarded internationally, providing some of the cleanest drinking water in the world. Indeed, our track record in managing, and maximising the value of, ageing water infrastructure is just one area where we are well positioned to secure a dominant global role.

There are also huge opportunities for water innovation in the fields of energy, food security, and resilience. Cross-sector collaboration to address some of these opportunities will create substantial benefits including carbon reduction, cost savings and secure agricultural production.

How would the Centre of Excellence help?

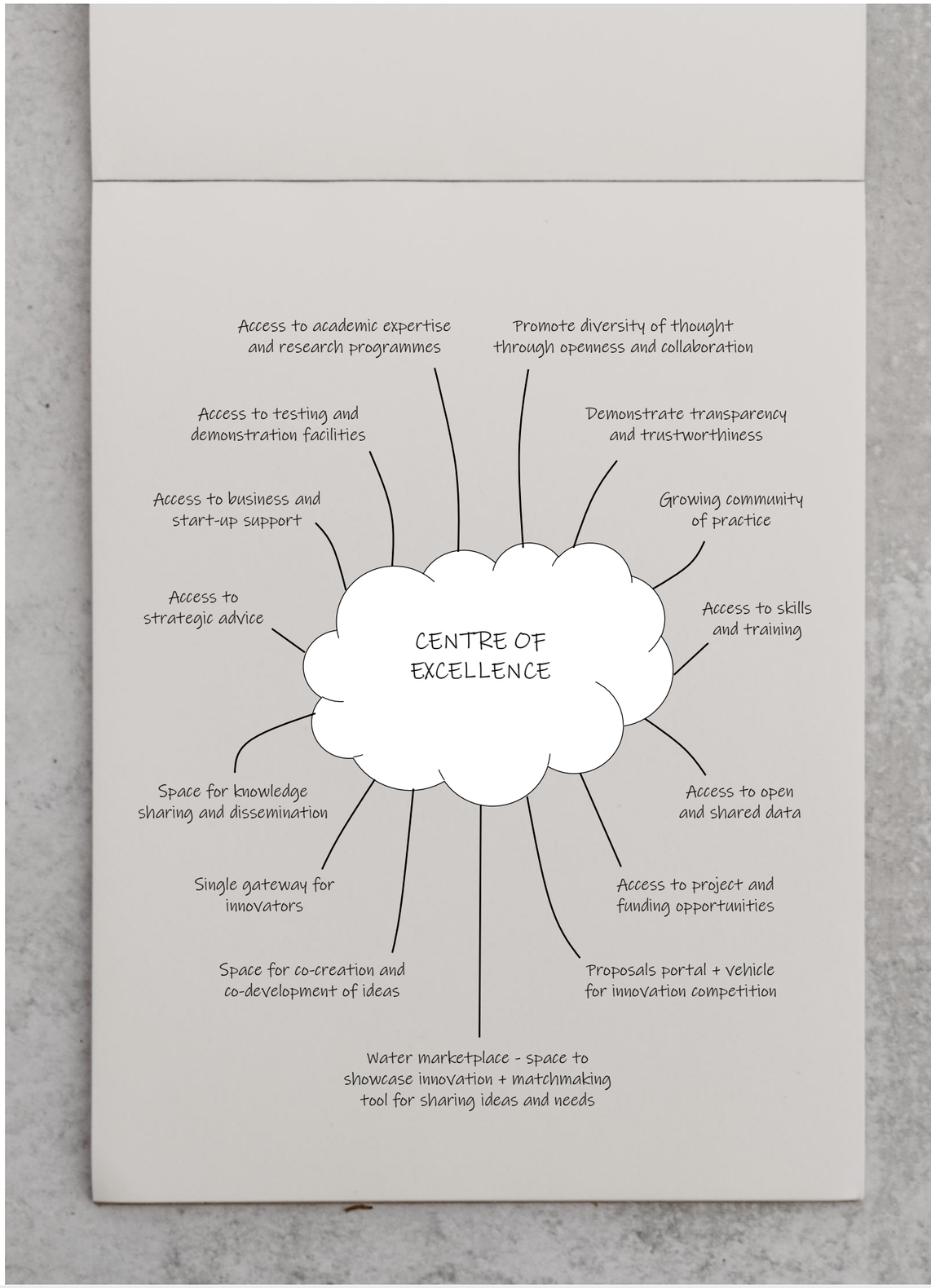
Some of the issues regularly cited as restricting the innovation capability of our sector include:

1. Lack of alignment between research and sector needs.
2. Speed of innovation from ideation to exploitation.
3. Need for greater integration of industry activity.
4. Better understanding and utilisation of national testing, validation and demonstration facilities.
5. Need for strengthened branding of water capability for international markets.
6. No overarching research or innovation strategy for water.

Some of these issues highlighted above will require collective action by our sector, including policy makers and government bodies. Building the enabling infrastructure in itself will not bring about the transformation we want to see, but it will provide a catalyst for change and a means of achieving that change through collective action. The Centre of Excellence will:

- Provide access to skills and capability including: test and demonstration facilities; academic expertise and research programmes; business and start-up support; and strategic advice.
- Promote a culture of innovation by: providing access to skills and training; promoting diversity of thought through openness and collaboration; and providing opportunities for community outreach and engagement.
- Promote collaboration and knowledge sharing by: providing a single gateway for innovators; promoting access to project and funding opportunities; creating forums for sector collaboration; and developing a platform for knowledge dissemination.
- Provide access to open and shared data.

Building on existing collaboration between our water companies at a regional, national and international scale will be central to achieving success.



The Process

In order to provide best value for customers, the environment and the economy, we have considered a range of options, looked at examples from around the world, and started consulting with key stakeholders to understand the sector's views.

This section briefly describes the process that we went through to arrive at our preferred option.

1

Research

We talked to our stakeholders to understand their views. We also researched examples and case studies from around the world to learn about what works and what doesn't. We categorised these and looked at their features to better understand what we need to enable transformative innovation in our sector.

CATEGORY
- Physical
- Virtual
- Hybrid

FEATURES
- Provides access to skills and capability
- Promotes collaboration and knowledge sharing
- Provides access to open and shared data
- Promotes a culture of innovation

2

Options development

Based on our research, we developed four options for consideration and analysis:

Option A	Option B	Option C	Option D
Do minimum	Physical centre	Hybrid ce ntre	Virtually integrated centre

3

Options analysis

We assessed each option against how well they could deliver a number of key elements while fulfilling the criteria set out below. Further information about the assessment process is described in the options analysis section.

Value to customer – Does it provide value for bill paying customers?
Principles – Does it align with the principles of our innovation strategy?
Inclusivity – Is it accessible and inclusive to all?
Cost and funding – Are setup and/or operational costs feasible?
Sustainability – Is it a sustainable model?
Timescales – Are the timescales for setup and delivery feasible?

4

Preferred option

Based on our analysis, we decided on a preferred option and started to map out what needs to happen next in terms of design, development and delivery. We highlighted some of the activity needed 'here & now' and set out a series of recommended next steps.

Here & Now
Next Steps

Stakeholder views

We asked our stakeholders what they thought about the need to drive transformational innovation in the water sector. From customers and supply chain groups through to academia and government bodies, we spoke to a broad range of organisations and individuals and their feedback has shaped our early thinking on what the Centre of Excellence should be. Central to this…

The Centre of Excellence must be inclusive, accessible and transformative for all.

We heard…

"Innovators don't know where to go or who to talk to get their innovations into the market."

"There is already a wealth of research, testing and demonstration facilities spread across the UK, we need to make best use of what already exists."

"Sharing data would help the water industry address common challenges, optimise the supply chain, benchmark success, and demonstrate trustworthiness."

"Improving the visibility of projects and opportunities across the sector will help to drive innovation in the right areas."

"The water sector must do anything to appeal."

We will…

Create a single gateway for innovators, a space where they can showcase their ideas, have their voice heard, and directly access the industry.

Improve the visibility of, and ease of access to research, testing and demonstration facilities across the UK. Not only that, we will provide access to other skills and capability including: academic expertise and research programmes; business and start-up support; and strategic advice for businesses.

Identify areas where sharing data between water companies is beneficial and develop mechanisms for opening and sharing data.

Increase the visibility of project and funding opportunities through the Centre of Excellence. This will include information about calls for innovation, funding and grants, as a proposals portal for submitting applications for the innovation competition.

Promote a culture of innovation in the water sector through openness and collaboration, which fosters diversity of thought and attracts creative minds.

Case studies

LIS-Water

Description

The Lisbon International Centre for Water (LIS-Water) is a proposed non-profit centre of excellence that, once fully established, will focus on public policies, regulation and management of water services and resources. The centre aims to improve water services and enable a healthier, better society. LIS-Water aims to respond to global water challenges (as recognised by the SDGs) by operating across five core work streams: research and innovation; education, training and capacity building; reflection and strategic advice; support and industry start-ups; communication and social participation.

Relevance to Centre of Excellence

Some of the elements of LIS-Water are pertinent to what the Centre of Excellence is trying to achieve. This case study also highlights the importance of establishing a strong business case and commercial model for the Centre of Excellence; LIS-Water, which was heavily reliant on EU grants, failed to secure funding for its final phase of development.

- *Physical*
- *Virtual*
- *Hybrid*

- *Provides access to skills and capability*
- *Promotes collaboration and knowledge sharing*
- *Provides access to open and shared data*
- *Promotes a culture of innovation*

"Providing the right guidance for innovators through the process of ideation to exploitation is key to success"

Living Labs

Description

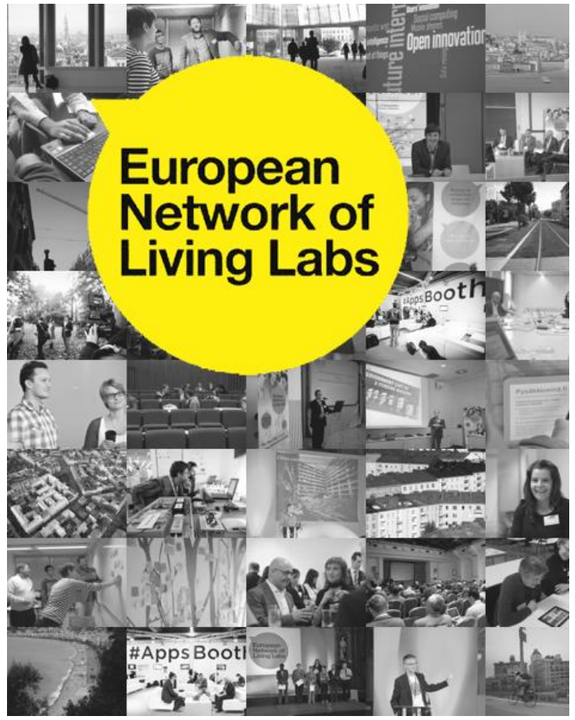
Living Labs (LLs) are user-centred, open innovation ecosystems based on a systematic user co-creation approach, which integrate research and innovation processes in real life communities and settings. They are both practice-driven organisations that facilitate open, collaborative innovation, as well as real-life environments where innovation can be tested and developed. LLs operate as intermediaries among citizens, research organisations, companies, cities and regions for joint value co-creation, rapid prototyping or validation to scale up innovation and businesses.

Relevance to Centre of Excellence

There is a clear need for researchers and developers to test new water technologies and processes in facilities that represent realistic deployment situations, and providing access to do so will be a key part of the Centre of Excellence. LLs approach to co-creation, rapid prototyping and scaling-up is something we should learn from and emulate by leveraging access to places, assets and expertise that already exist in the sector.

- *Physical*
- *Virtual*
- *Hybrid*

- *Provides access to skills and capability*
- *Promotes collaboration and knowledge sharing*
- *Provides access to open and shared data*
- *Promotes a culture of innovation*



CATAPULT

"The Catapult Network can provide opportunities for cross sector collaboration and, while geographically focussed, the centres could support a disaggregated innovation model for the water sector"

The Catapult Network

Description

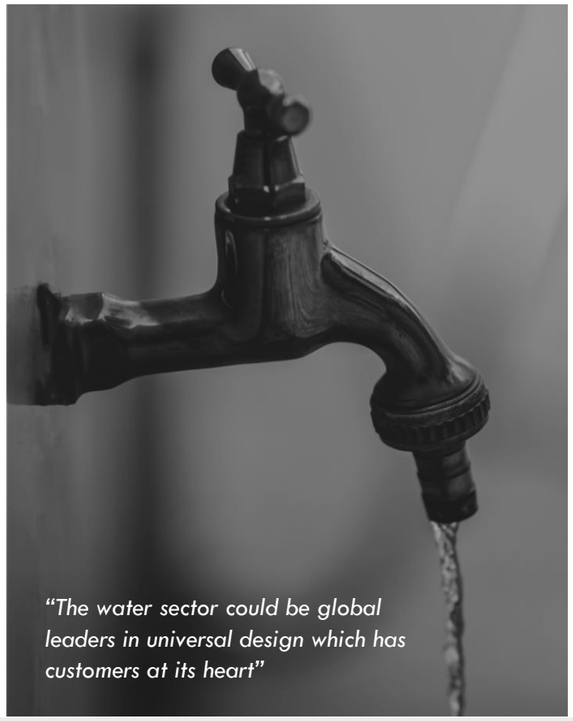
The Catapults are a network of world-leading technology centres designed to transform the UK's capability for innovation in areas of strength and drive innovation to promote productivity and economic growth. They are a series of physical centres where businesses, scientists, technical specialists and engineers work side by side on late-stage research and development – transforming high potential ideas into new products and services and accelerating adoption to generate economic growth.

Relevance to Centre of Excellence

Ideas for a water catapult have been discussed in the past, but have faced reluctance due to their physical presence. Leveraging existing catapults that are relevant to water innovation (e.g. Digital, High Value Manufacturing) should be a key part of enabling innovation in the sector by providing access to physical spaces. We should also adopt positive aspects of the catapults model – not-for-profit, independent, neutral convener – which have been proven to promote collaborative innovation.

- *Physical*
- *Virtual*
- *Hybrid*

- *Provides access to skills and capability*
- *Promotes collaboration and knowledge sharing*
- *Provides access to open and shared data*
- *Promotes a culture of innovation*



"The water sector could be global leaders in universal design which has customers at its heart"

Centre for Excellence in Universal Design

Description

The Ireland-based Centre for Excellence in Universal Design (CEUD) is dedicated to enabling and promoting the design of environments and communities that can be accessed, used and understood by everyone. To deliver their vision of accessible environments for all, the CEUD: contributes to the development of standards that enable and encourage universal design; develops and delivers universal design courses; and promotes awareness and consideration of universal design principles across multiple sectors.

Relevance to Centre of Excellence

This case study was highlighted by the Consumer Council for Water, the voice of water users in England and Wales, as an area in which the water sector could become global leaders on. With end users at its heart, the CEUD and indeed the concept of universal design is something that should be deeply embedded in our Centre of Excellence.

- *Physical*
- *Virtual*
- *Hybrid*

- *Provides access to skills and capability*
- *Promotes collaboration and knowledge sharing*
- *Provides access to open and shared data*
- *Promotes a culture of innovation*

Case studies

Data

Description

Many businesses are embracing the sharing of data, and are seeing tangible benefits for their organisations and across their entire sectors. Research by the Open Data Institute (ODI) demonstrates that data sharing can: encourage innovation; optimise supply chains; address common challenges across a sector; improve market reach; benchmark success and get new insights; help comply with regulation; and demonstrate trustworthiness. ODI research shows how sharing data can positively impact the bottom line and there are already a number of examples of open data approaches in sectors such as physical activity, banking and pharmaceuticals.

Relevance to Centre of Excellence

Providing access to open and shared data will be central to both the Centre of Excellence and the delivery of our joint innovation strategy. We will need to: define data contributors, data users, decision makers and funders in the context of the water sector; identify areas where sharing data between water companies is beneficial; develop common data standards for the water sector; and develop mechanisms for opening and sharing data. The lessons learned from other sectors will be key to this.

"Sharing data will help the water industry address common challenges, optimise the supply chain, benchmark success, and demonstrate trustworthiness."

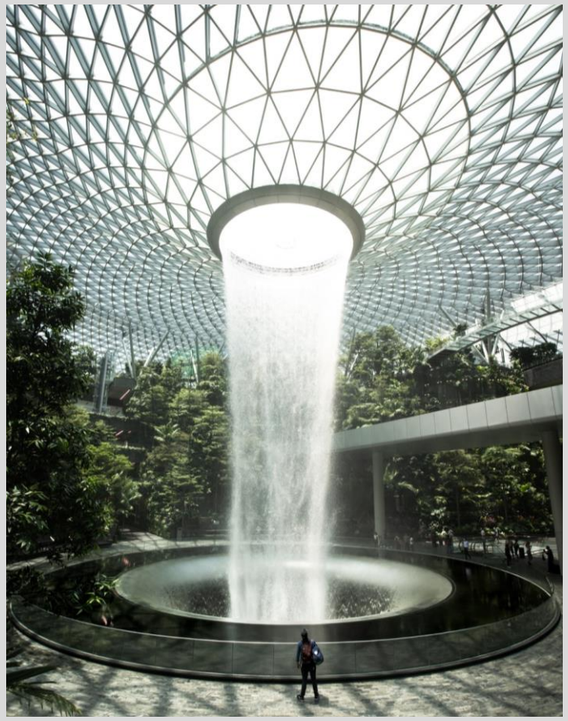
Promoting a culture of innovation

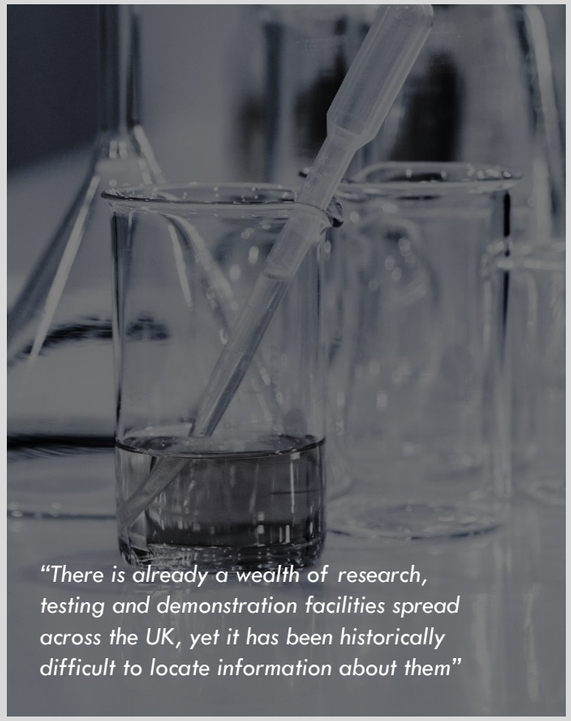
Description

Internationally, there are a number of places highly-regarded for their approach to water innovation (e.g. Singapore, Netherlands, Israel, Milwaukee). From focusing on country-specific water challenges through to developing pragmatic approaches to IP, each example is different but they are all characterised by strong central governance, a not-for-profit set-up and a long-term commitment from Government. Meanwhile in the UK, policy reform and incentive mechanisms profoundly changed the culture of innovation in the energy sector and has driven a transition towards renewable energy over the last decade.

Relevance to Centre of Excellence

These case studies highlight that, while there are things we can learn and in some cases adopt, producing a Centre of Excellence in itself will not deliver transformational change, unless it is accompanied by a wider cultural shift in the sector. There is a pressing need to work with government and other decision makers to support innovation for growth and for good, directing innovation to society's most important problems, and shaping the application of new ideas and technologies in a way that benefits as many people as possible. Innovation policies must be smarter (in the way they use evidence, experimentation and data), more inclusive (in the way they benefit, involve and listen to the public) and fit for the future (in the way they anticipate and exploit new global trends in technology and innovation).





"There is already a wealth of research, testing and demonstration facilities spread across the UK, yet it has been historically difficult to locate information about them"

Access to skills & capability

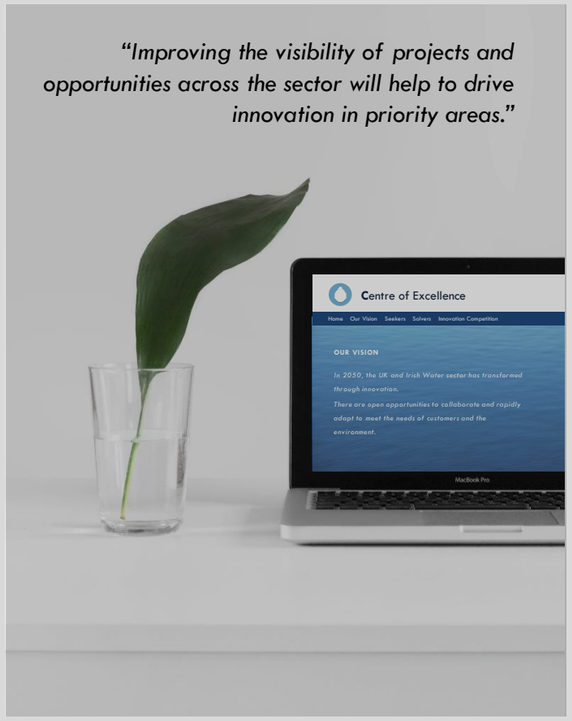
Description

There are a number of existing initiatives that promote access to testing and demonstration facilities both nationally and internationally. The UK Water Partnership (UKWP) test facilities register provides access to over 100 testing and demonstration facilities across the UK, helping technology researchers and developers to easily search for and identify facilities that best meet their needs and to contact the owners and operators for access. The Water Test Network (WTN) is a transnational network of testing facilities that comprises 14 operational scale demonstration sites across North-West Europe, which SMEs can use to test, demonstrate and develop new products for the water sector.

Relevance to Centre of Excellence

There is already a wealth of research and testing facilities spread across the UK, yet it has been historically difficult to locate information about such facilities. Recent initiatives including the development of the UKWP's test facilities register has made a start, but there is an opportunity to do much more. The Centre of Excellence should seek to connect, develop and improve existing tools like these to leverage existing assets and promote access to a range of skills and capability within the sector – not just test facilities.

"Improving the visibility of projects and opportunities across the sector will help to drive innovation in priority areas."



Collaboration & knowledge sharing

Description

There are a number of virtual platforms that support open and collaborative innovation. PlanBox is an online platform that brings together innovation ecosystems to virtually collaborate on the best ideas. It recently acquired IdeaConnection, a Canadian firm that connects 'seekers' to 'solvers' in science and engineering. With an 80% success rate, their team of experts support solution development and are awarded on a pay-for-success basis. Another example is the Energy Innovation Centre (EIC), a not-for-profit organisation that brings together industry and innovators in the energy sector. It operates a shared virtual platform to provide an open environment for collaborative innovation and, since 2008, has worked with over 7,000 innovators, published over 130 calls for innovative solutions to industry problems with 85% of innovation calls resulting in sourcing implementable solutions for industry partners.

Relevance to Centre of Excellence

Providing a single gateway for innovators to engage with the water sector will be central to the Centre of Excellence. In doing so, we can learn and draw from those who already do it well. We recognise the Centre of Excellence will be more than just a marketplace, and that in developing a suitable model we may need to adopt a modular approach that enables us to add different elements while maintaining a focus on the end user.

Options analysis

Based on our research, we developed four different options for review and analysis. We assessed these against how well they could deliver a number of key elements while fulfilling the criteria set out below.

This analysis was a collaborative exercise that was undertaken by a collective group of water companies and key stakeholders within the sector. However, we recognise that its qualitative nature may be subject to opinion and we welcome the views of stakeholders on our initial assessment.

Options

DO MINIMUM
Adopt a common approach to testing and trialling on the basis that all results are shared and disseminated.

PHYSICAL CENTRE
Create a physical centre that focuses on the merits of concentrating innovation activity in one central location.

HYBRID CENTRE
Create a physical centre with a strong virtual presence that provides a single gateway for innovators and promotes access to connect existing innovation activity.

VIRTUALLY INTEGRATED CENTRE
Create a virtually integrated centre focused on leveraging existing assets and capability within the sector.

Elements

Access to skills & capability
Does it provide access to skills and capability including: testing and demonstration facilities; academic expertise and research programmes; business and start-up support; and strategic advice?

People & culture
Does it provide access to skills and training, promote diversity of thought through openness and collaboration, and provide opportunities for community outreach and engagement?

Collaboration & knowledge sharing
Does it provide: a single gateway for innovators; access to project and funding opportunities; forums for sector collaboration; and appropriate means for knowledge dissemination?

Data
Does it provide access to open and shared data or have the functionality to do so?

Criteria

Value to customer
Does it provide value for bill paying customers?

Principles
Does it align with the principles of our innovation strategy and provide a vehicle for delivery?

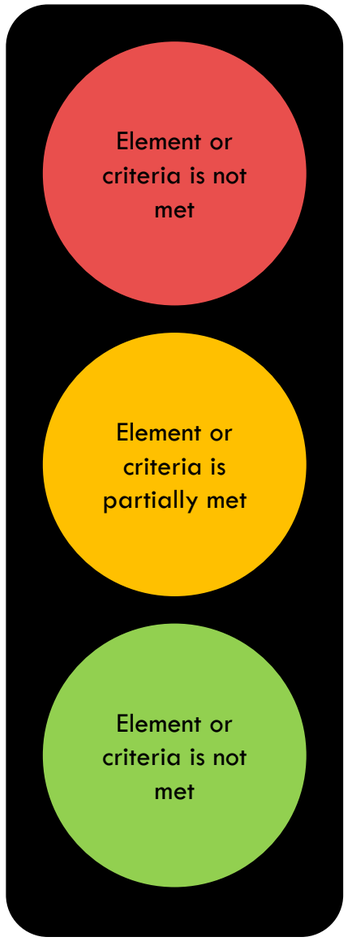
Inclusivity
Is it accessible and inclusive to all?

Cost and funding
Are set-up and operational costs feasible?

Sustain-ability
Is it a sustainable model?

Timescales
Are the timescales for set-up and delivery feasible?

Assessment



Option A.

Do Minimum

Option A would involve doing the bare minimum to improve or develop the existing innovation landscape. This option is based on the premise that what already exists is sufficient and that any centralisation or coordination of innovation activity would create disproportionate bureaucracy that would not lead to any additional benefits for the sector. The only significant change that Option A would involve is in the way that innovation is trialled. Water companies would agree a common approach for undertaking trials on the basis that the results are shared and disseminated via an existing forum.

STRENGTHS

- Low capital and operational costs.
- Relatively short anticipated timescales.
- Promotes knowledge sharing and access to shared data.

WEAKNESSES

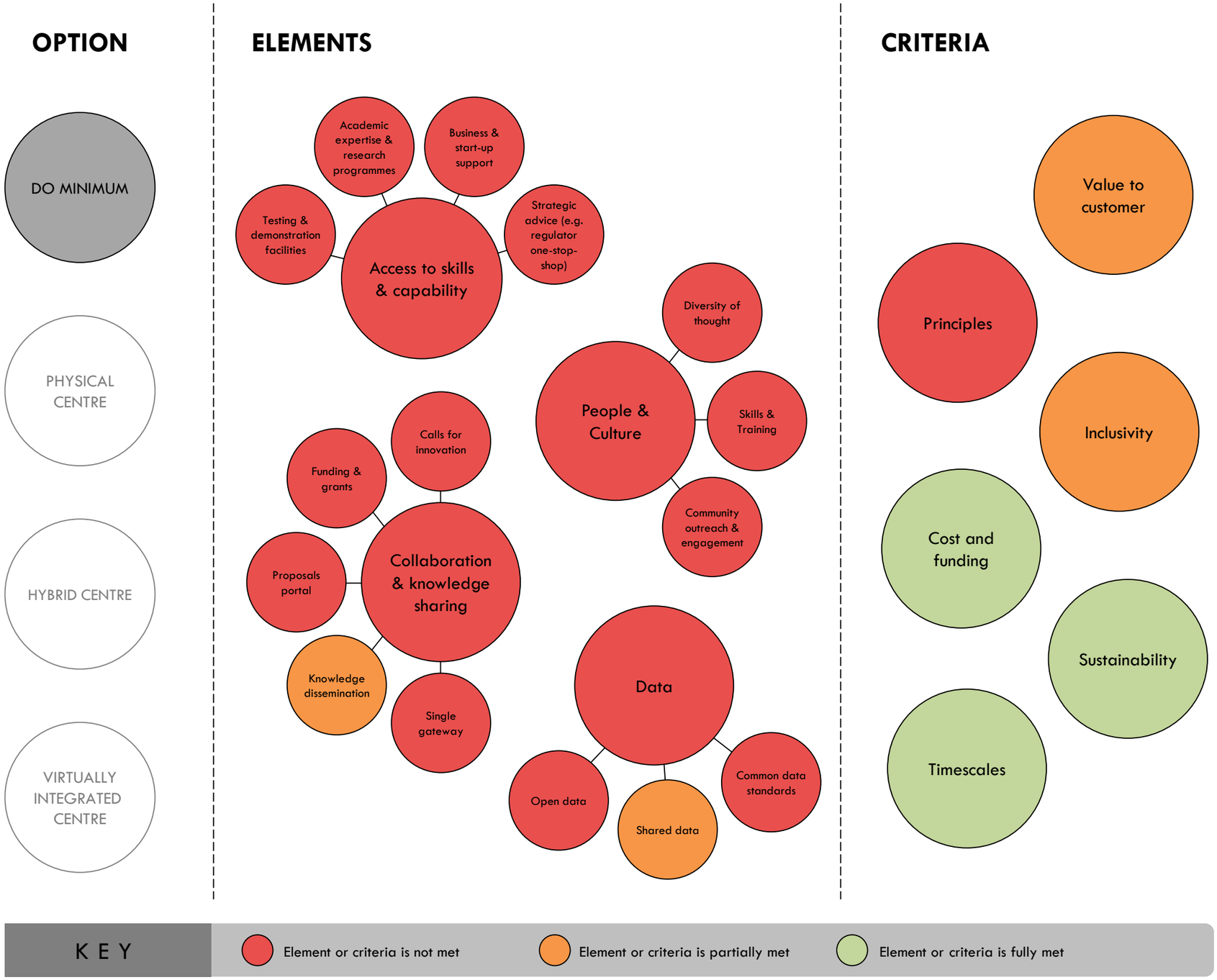
- Limits inclusivity and openness to innovation.
- Does not improve access to skills and capability.
- Does not promote cultural change.
- Does not fully align with the principles of our joint innovation strategy nor does it provide a sufficient vehicle for delivering the strategy.

OPPORTUNITIES

- Streamline existing activity for the benefit of innovators and water companies.
- Realign existing forums to make more efficient.

THREATS

- Negative perception of the water sector.
- Inability to deliver joint innovation strategy.



Option B.

Physical Centre

Option B would involve creating a physical innovation centre that focuses on the merits of concentrating innovation activity in one central location. This model is commonly seen in other sectors and could work well if effectively governed and administered. Alongside the physical centre, this option would involve water companies working together to develop common approaches to trialling and data.

STRENGTHS

- Focal point for innovation in the water sector.
- Provides access to skills and capability, promotes a culture of innovation and enables collaboration and knowledge sharing.
- Provides a physical space for enabling infrastructure (e.g. data centre).

WEAKNESSES

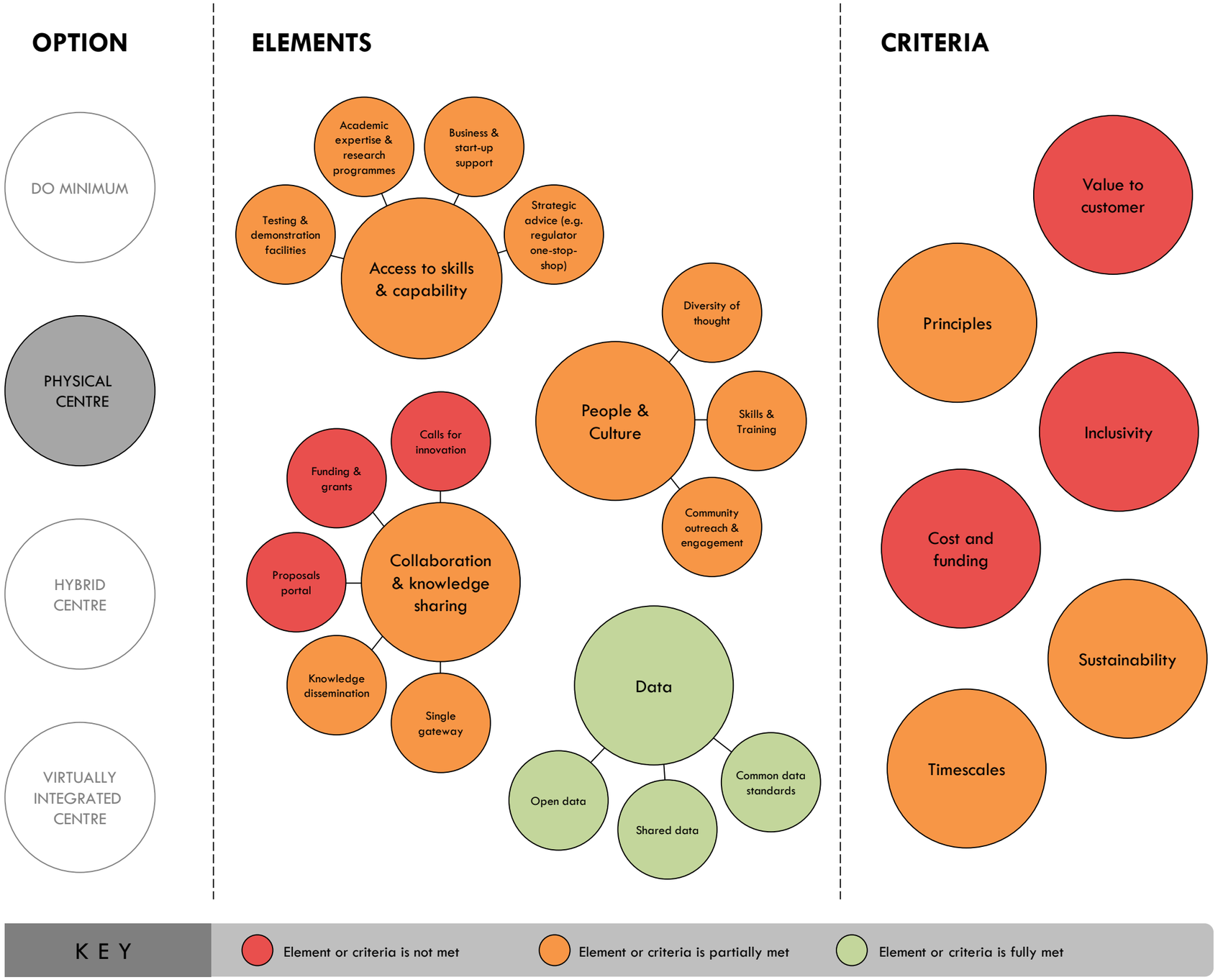
- Exclusive by nature due to geographic location.
- High capital and operational costs.
- Potentially long timescales.

OPPORTUNITIES

- Opportunities for revenue streams.

THREATS

- Could inhibit sector engagement due to geographic location.
- Cost and timescales for development could be prohibitive.
- Reliant on effective, independent governance and administration.



Option C.

Hybrid Centre

Option C would involve creating an innovation centre that has both a physical and virtual presence. A physical space would bring with it all the benefits of Option B, while a virtual platform that serves as a gateway for innovators would address some of the issues around openness and accessibility. Together with a hybrid innovation centre, this option would involve water companies working together to develop common approaches to trialling and data, which could be stored and/or shared via the virtual platform.

STRENGTHS

- Open and accessible.
- Focal point for innovation in the water sector.
- Provides access to skills and capability, promotes a culture of innovation and enables collaboration and knowledge sharing.

WEAKNESSES

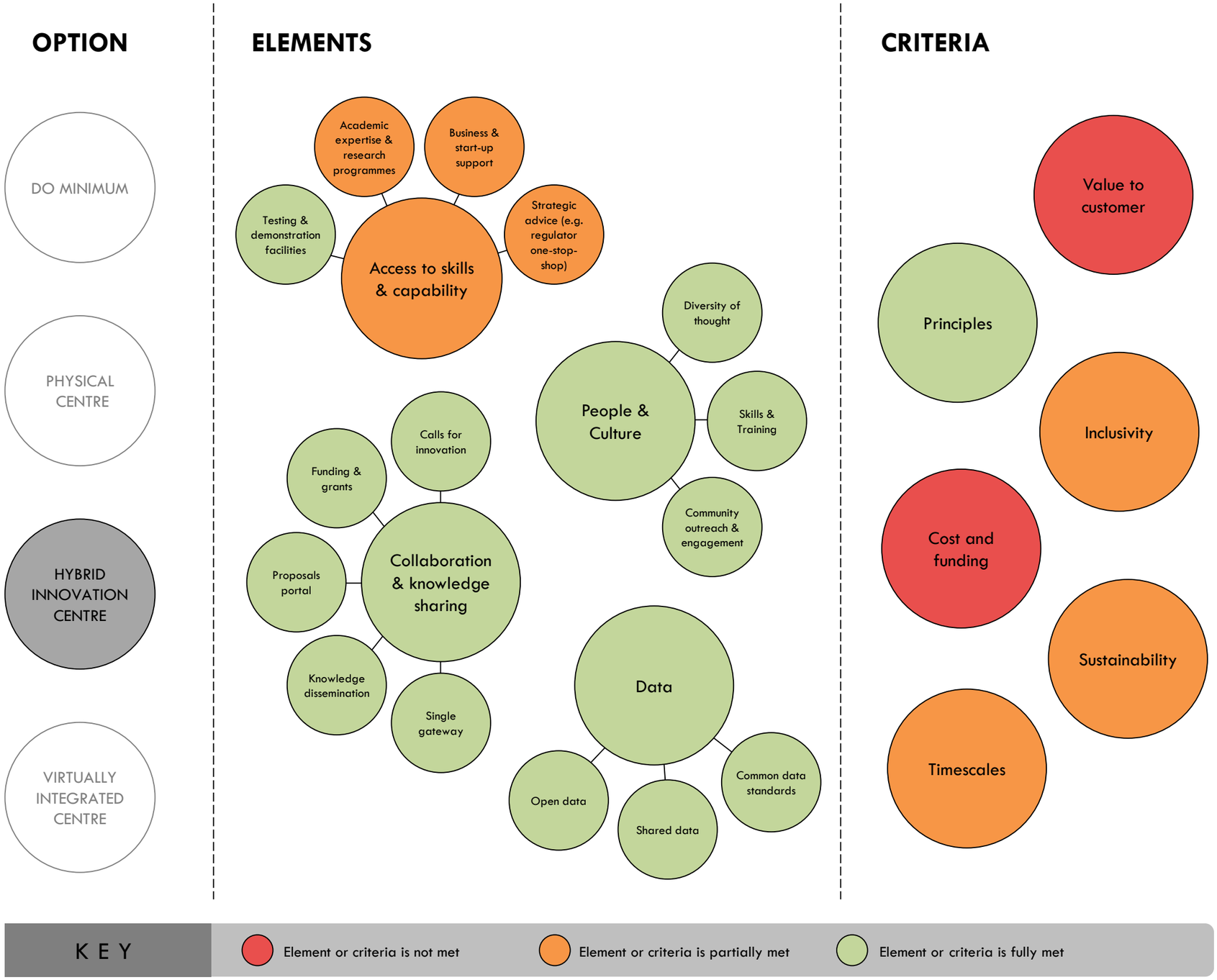
- Physical centre is exclusive by nature due to geographic location.
- High capital and operational costs.
- Potentially long timescales.

OPPORTUNITIES

- Vehicle for delivering innovation competition.
- Opportunities for revenue streams.

THREATS

- Could inhibit sector engagement due to geographic location.
- Cost and timescales for development could be prohibitive.
- Reliant on effective, independent governance and administration.



Option D.

Virtually Integrated Centre

Option D would involve developing a virtually integrated innovation centre. A web-based, over-arching entity that has the power to connect, integrate and enhance existing innovation activity across the sector. Amongst other things, it would act as a single entry point for innovators, promote access to skills and capability and provide a platform for collaboration and knowledge sharing. Alongside the centre, this option would involve water companies working together to develop common approaches to trialling and data, which could be stored and/or shared via the virtual platform.

STRENGTHS

- Open and accessible to all.
- Focal point for innovation in the water sector.
- Suitable for phased implementation.
- Provides access to skills and capability, promotes a culture of innovation and enables collaboration and knowledge sharing.
- Could be established relatively quickly.
- Comparatively low cost.

WEAKNESSES

- Lacks the benefits of face-to-face collaboration and co-creation.

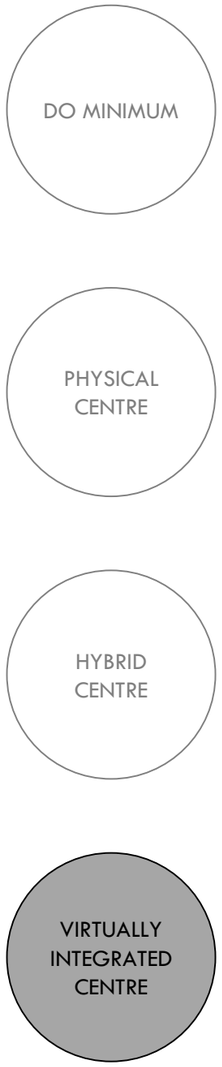
OPPORTUNITIES

- Vehicle for delivering innovation competition.
- Opportunity to become self-governing over time.
- Opportunity for revenue streams.
- Opportunity to add additional capability over time.

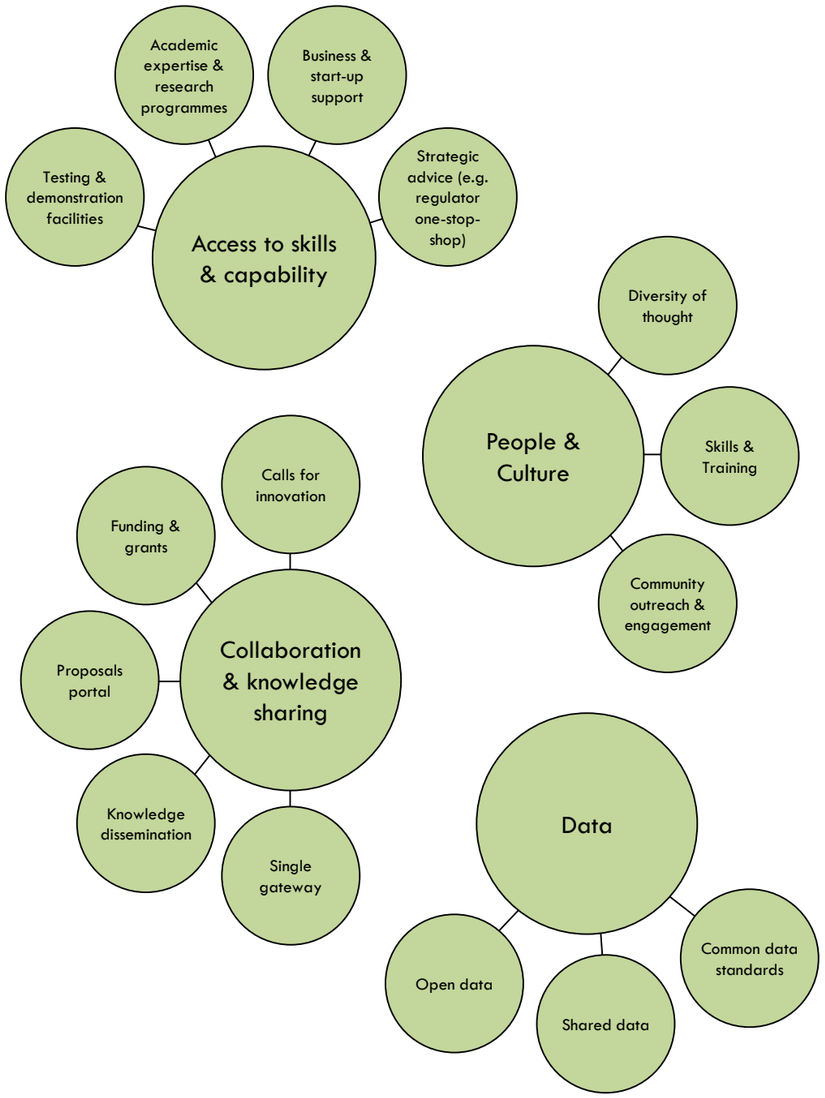
THREATS

- Reliant on effective, independent governance and administration.
- Partnering specifications could be complex.

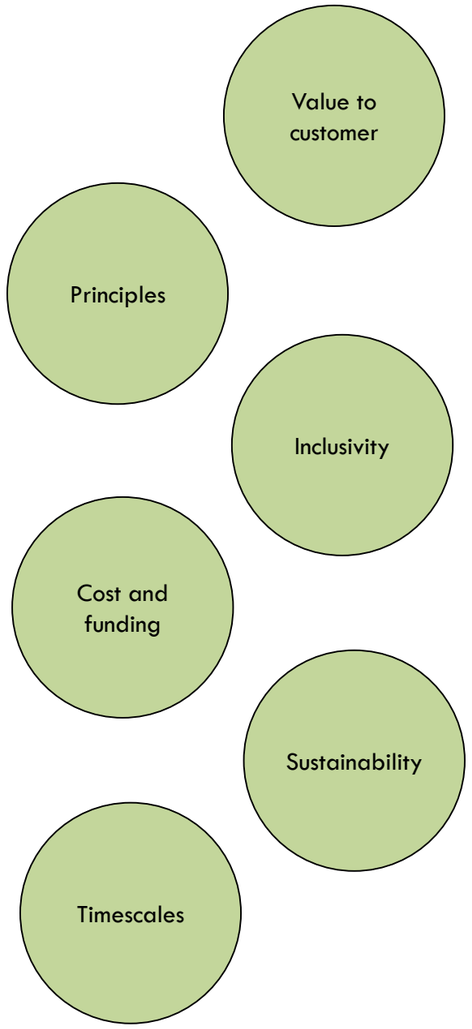
OPTION



ELEMENTS



CRITERIA



KEY			
	Element or criteria is not met	Element or criteria is partially met	Element or criteria is fully met

DRAFT

Our Vision

Phased implementation

We recognise there will be short, medium and long-term objectives for our strategy and that an agile, phased implementation plan is essential. In the short term, we will accelerate innovation activity around the industry's biggest challenges, as set out under each of our themes, and underpinned by UKWIR's Big Questions, to deliver tangible benefits to society and the environment over the next five years. In parallel, we will lay the foundation for delivering transformative innovation in the medium- and long-term by developing the enabling infrastructure and relationships needed to address multi-sector, multi-national challenges.

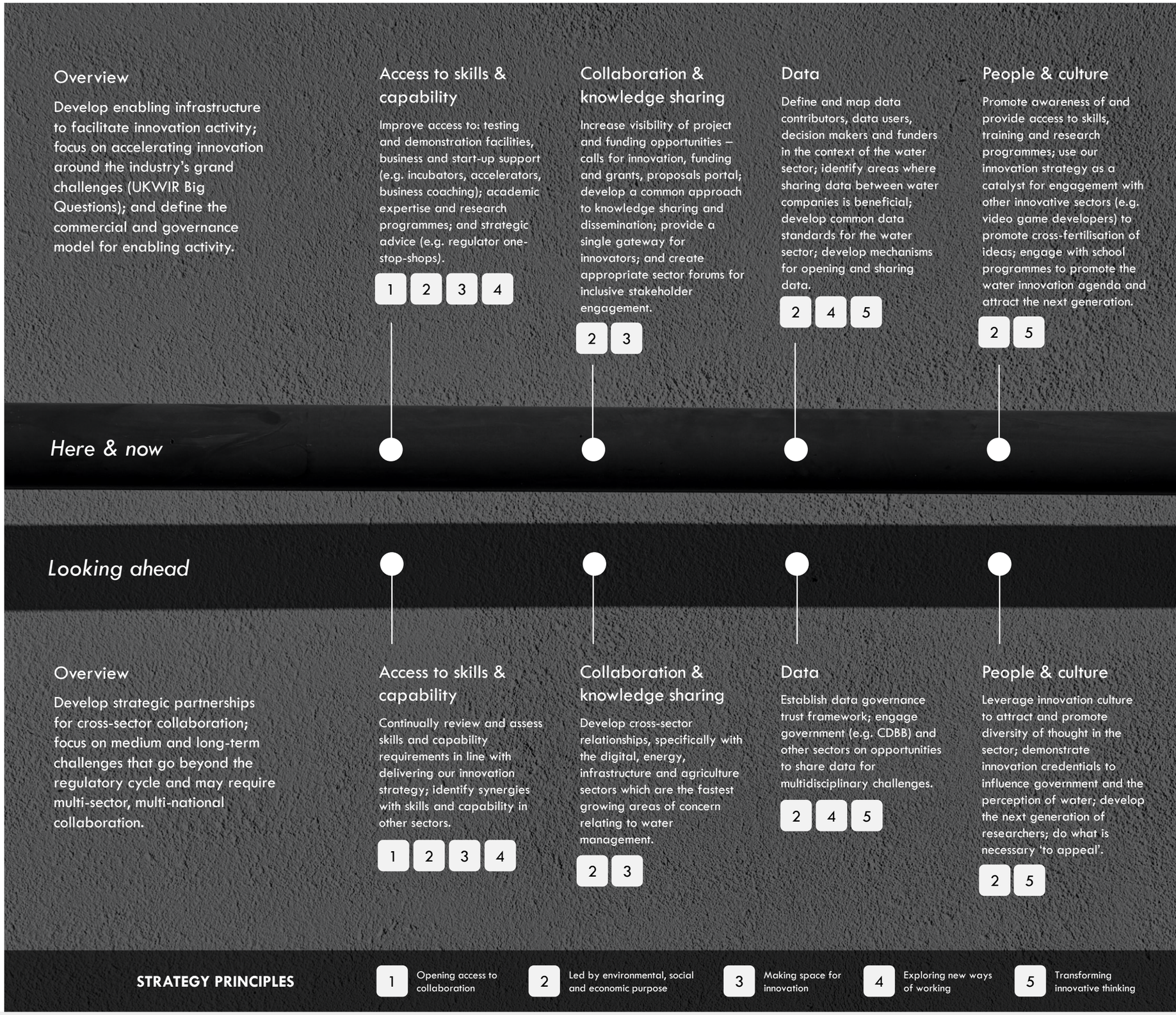
Enabling innovation

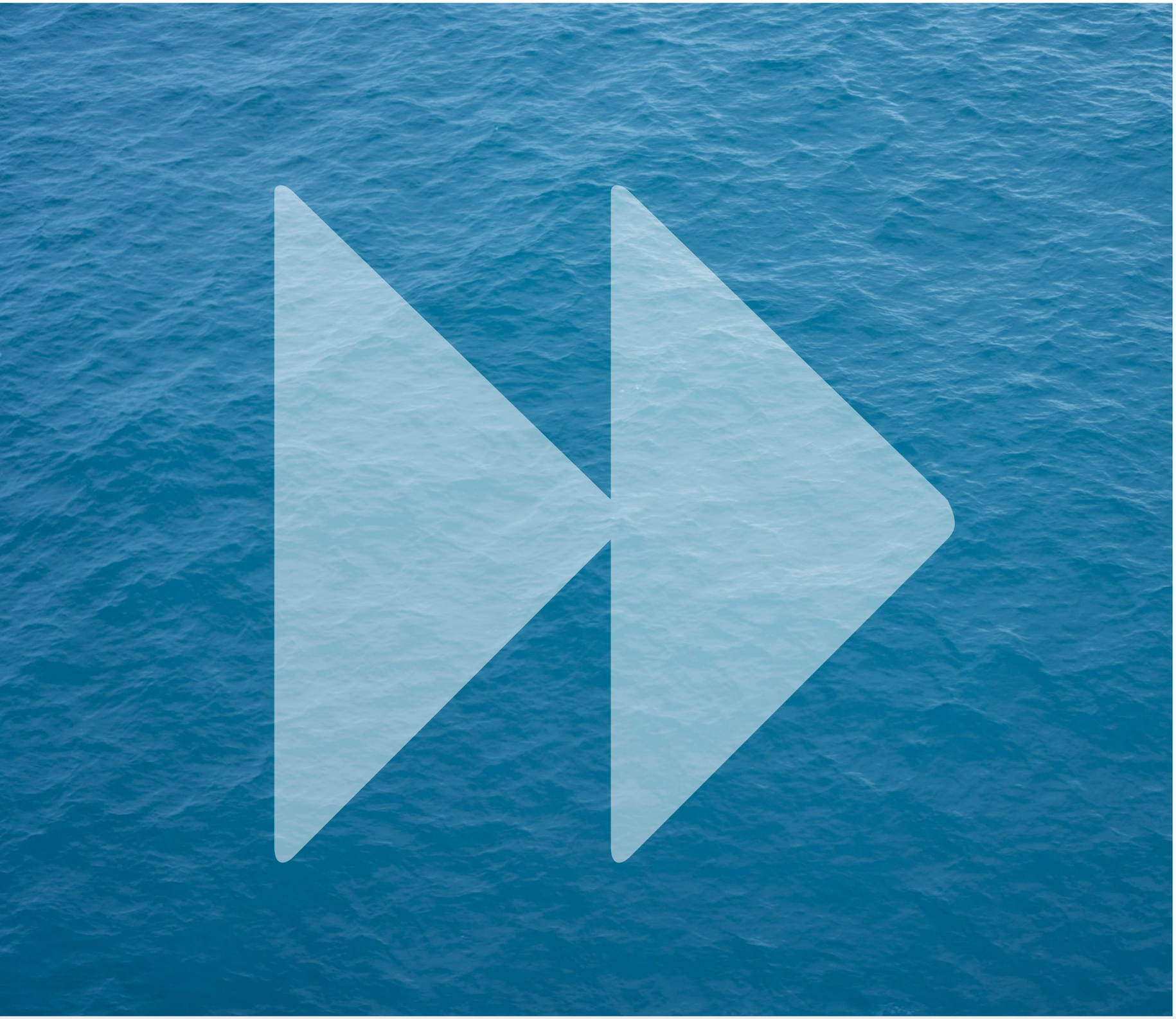
Delivering our strategy will require the right people, places and infrastructure (both physical and virtual). Across the UK, a lot of this already exists, but it is currently fragmented. We will therefore focus on connecting, coordinating and building on what is already in place to provide shared learning, avoid duplication and increase collaboration between water companies, the wider sector and beyond.

The diagram on the right hand side sets out what our focus will be in the short-term (*here and now*) and into the future *(looking ahead)*. As the principles of our joint innovation strategy identify how we need to innovate, we have mapped these against the elements that our Centre of Excellence will deliver.

Governance

Selecting the right commercial and governance model will be key to the sustainability and success of the Centre of Excellence. Over the coming period, we will together and with our stakeholders to identify, assess and agree on a sustainable model for managing the enabling infrastructure described herein. We will explore the pros and cons of various options (e.g. self-governance model, not-for-profit governance model) and look at ways to share costs, risks and benefits between partners.





SECTION 05

Next Steps

This document sets out our thinking so far on ***what*** is required to enable transformative innovation in the water sector. However, we recognise this is just the beginning of our path towards change.

As our strategy must adapt and develop over time to meet the emerging needs of the sector and the society which it serves, so must our Centre of Excellence. It must be agile and quick to set up, but with the capacity to grow and develop over time.

In the next phase of this process, we will work collaboratively with our stakeholders to develop an Outline Business Case, which will define:

1. **Who** will be involved in the governance, financing and delivery of the Centre of Excellence;
2. **What** aspects of the Centre of Excellence will need prioritisation and speedy delivery, and what the benefits of this will be;
3. **When** the Centre of Excellence will be set up, and the development of a programme for immediate delivery, as well as for the aspects that could be built in the medium and long term; and
4. **How** the Centre of Excellence will be financed, governed and delivered, how the risks will be shared, and the success monitored.

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