THE UK WATER PARTNERSHIP

WATER RESILIENCE

CAPITALISING ON THE COMMERCIAL OPPORTUNITIES FOR UK PLC

A Capability Capture and Call to Action
by the UK Water Partnership

January 2025

PURPOSE

With cities worldwide expected to grow an estimated 2 billion residents by 2050, there is an urgent need for urban water management that ensures consistent, adequate and high-quality water services for all.

However, the scale and complexity of this need presents new challenges to decision-makers in government, civil society and the private sector.

The UK is in a strong position to help develop a water resilient future globally utilising its expertise, knowledge and global links.

This paper represents an updated version of the White Paper released by the UK Water Partnership (UKWP) in 2022. Its primary objective is to offer valuable insights into the water resilience capabilities and expertise of UK organisations. Through a collection of new case studies, this document showcases how the UK's experts, innovators, and entrepreneurs are leading the global response to the critical issue of water resilience.

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ABOUT THE UK WATER PARTNERSHIP

The UK Water Partnership (UKWP) was established in 2015 and provides a strategic vision for the development and growth of the UK water industry.

The Partnership brings together diverse water industry and related organisations in a single coherent alliance, promoting mutual understanding, co-operation and coordination.

It applies world-class research and innovation to address the challenges of global water security and the need for resilience in a changing environment – and to secure more of the $500 billion global water market.

See page 30 to find out about the benefits of joining the UK Water Partnership.

FOREWORD

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By 2050, it's projected that 66 percent of the world's population will live in urban areas, 2.5 billion more people than in 2018. Combined with the impacts of climate change, this presents increasing challenges for the world's water demand and associated issues with wastewater and water pollution. To address these challenges, we need to embed resilience at the heart of our water systems, both at a city-scale and across the catchment.

Water resilience comprises the ability to cope with and recover from shocks and stresses, disruption, and uncertainty, thereby maintaining essential services and protecting the environment now and into the future. Resilience has always been recognised as a priority for UK Government, and the industry has responded by delivering best-in-class solutions, regulation and innovative approaches.

So, I welcome the UK Water Partnership's efforts to capture UK capability in this document, which can serve to promote best practice globally and help to improve the planet's prospects for long-term water security and resilience.

Sarah Hendry
Chair of the UK Water Partnership
February 2022

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EXECUTIVE SUMMARY

Our planet faces an unprecedented combination of water security and resilience challenges. The UK Water Partnership (UKWP) is providing leadership and a unified approach to the UK's efforts to contribute to the development of sustainable solutions, and to ensure that the UK's experts, innovators and entrepreneurs are at the forefront of the global response.

The water sector will need to continue to embrace change in order to address the challenges and take full advantage of the opportunities.

With cities worldwide expected to grow an estimated 2 billion residents by 2050, there is an urgent need for urban water management that ensures consistent, adequate and high-quality water services for all. However, the scale and complexity of this need presents new challenges to decision-makers in government, civil society and the private sector.

WE DEFINE WATER RESILIENCE AS:

Providing access to high quality water resources for all residents.

Providing sanitation to protect public health.

Connecting residents through water-based mobility and activity.

Protecting people and their possessions from water-related hazards, including flooding and drought.

Protecting the natural environment from pollution and degradation.

The UK has a developed strong capability and expertise to deliver water resilience internationally. Built on domestic needs to manage water through efficiency and the development of new water resources and to develop nature and man-made solutions to protect against pluvial, fluvial and coastal flooding.

Climate change is already greatly exacerbating the world water crisis – intensifying floods, prolonging droughts,
and more. In many ways, the worst impacts of the climate crisis are felt through water.

Unless urgent action is taken, these impacts will only worsen in the coming years and decades.

Resilience is considered to be a characteristic of a system – that is, a capacity, ability or property – and these characteristics associated with resilience can be broken down into four capacities:

- Anticipate and absorb potential disruption
- Adapt to or accommodate changes within or around the system due to disruption
- Respond to and recover as quickly as possible after a disruption
- Learn and improve after the event to improve for future disruptions

A water resilient city is one that can survive and thrive in the face of shocks and stresses related specifically to water – ranging from drought to flooding, storm surges, and sea level rise – and adequately mitigate the impact of all shocks and stresses on the urban water system (e.g. the impact of an earthquake on key water infrastructure).

Resilience in this context means that the city exhibits the capacity to:

1. Provide access to high quality water resources for all residents
2. Protect residents from water-related hazards
3. Connect residents through water-based mobility

The global water resilience opportunity is compelling; a recent estimate of the scale of global economic losses related to water insecurity. According to UN Water (2024), flooding has caused US$832 billion in economic losses between 2002-2021 and US$45 billion in 2022. Over that same period, droughts have triggered US$170 billion in economic losses (CRED, 2023). Additionally, according to the World Economic Forum (2022), over half of the world's total GDP is interictally tied to nature (US$ 44 trillion) emphasizing the need to swiftly reverse the depletion of natural resources through the adoption of sustainable practices..

It's not just the economic cost that need to be reckoned with lives and livelihoods at risk from too little, too much and too polluted water.

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INTRODUCTION

The fact that our planet faces an unprecedented combination of water security and resilience challenges, caused by the cumulative impacts of population growth, increasing demand, declining resources, pollution and climate change, has been established beyond doubt.

The impacts have been described and analysed in forensic detail in numerous, authoritative research projects and reports.

The UK Water Partnership (UKWP) was specifically created to provide leadership and a unified approach to our efforts here in the UK, both to contribute to the development of sustainable solutions and to ensure that the UK's experts, innovators and entrepreneurs are at the forefront of the global response.

Against that background, this document, produced on behalf of the UKWP, is a complement to the first version of this white paper published in 2022.

You can find the original White Paper on water resilience by the UKWP here.

UNDERSTANDING WATER RESILIENCE

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A water resilient city is one that can survive and thrive in the face of shocks and stresses related specifically to water, ranging from drought to flooding, storm surges, and sea level rise.

Resilience as a general principle, can be defined in a number of ways:

"Resilience is the ability to cope with, and recover from, disruption, and anticipate trends and variability in order to maintain services for people and protect the natural environment now and in the future".
Definition of resilience from the Ofwat Resilience Task and Finish Group (Ofwat, 2015).

"Resilience is the ability of a system to undergo change without changing state".
Definition of resilience from the SCCG (Sydney Coast Council Group et al, 2013).

In the context of water, resilience has been defined as:

"The ability to anticipate, adapt, respond and flourish in the face of a range of shocks and stresses to the water sector in order to maintain services for people and protect the natural environment now and in the future."
Definition of resilience in the water context of the water sector, developed by Arup for the Lloyd's Register Foundation, The Resilience Shift 'Resilience in the Water Sector' Scoping Study (Arup, 2017).

The characteristics of resilience are a response to disruptors, which can be divided into acute shocks, which are sudden disruptive events and chronic stresses, which weaken the function of the organisation or system long-term. Stresses are also often felt as shocks when they reach a tipping point. The impacts of these shocks and stresses on the system are felt on people and the environment, the end-users of the system.

If an urban water system is impacted by one of the shocks or stresses, then the impact is experienced by the people it serves, and the natural environment.

The primary functions of an urban water system, which could be impacted by shocks and stresses, are to:

- Provide safe, clean drinking water to people
- Provide sanitation to protect public health
- Connect people through water-based transport
- Protect people and their possessions from flooding
- Protect the natural environment from pollution and degradation.

A water resilient city must adequately mitigate the impact of all shocks and stresses on the urban water system (e.g. the impact of an earthquake on key water infrastructure).

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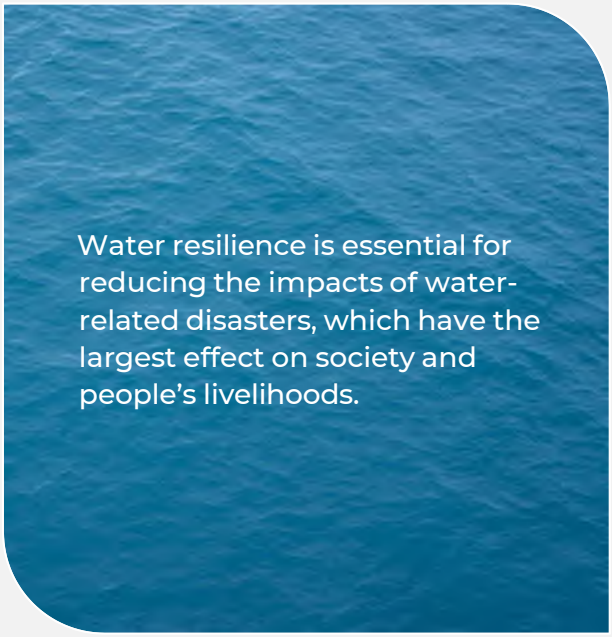
WHY IS WATER RESILIENCE IMPORTANT ?

Climate change affects, and is affected by, global water resources. It reduces the predictability of water availability and affects water quality. Climate change also increases the occurrence of extreme weather events, threatening sustainable social-economic development and biodiversity worldwide. This, in turn, has profound implications for water resources. As such, climate change exacerbates the ever-growing challenges associated with the sustainable management of water. Conversely, the way water is managed influences the drivers of climate change.

Water, therefore, is the ultimate connector in the global commitments towards a sustainable future: the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) are highly dependent on improved water management.



Water resilience is essential for reducing the impacts of water-related disasters, which have the largest effect on society and people's livelihoods.

With over 2 billion new urban residents anticipated globally by 2050, the challenges of climate change and water will inevitably become more profound. With one-third of the world's population living in water-stressed areas and 10% of the world's population in low-elevation coastal zones, the increase in the frequency of extreme weather events due to climate change will impact communities globally. Global water crises – from drought to flooding – are the biggest threats facing the planet over the next decade. There is a clear demand for new approaches for providing essential services to city residents (United Nations Department of Economic and Social Affairs, 2018).

The water challenges facing our planet are well-rehearsed and documented in many authoritative reports – here is just a small selection:

PEOPLE AND THEIR NEEDS

The global population will reach 10 billion by 2050, and potentially 16.5 billion by the end of the century, accompanied by a dramatic increase in demand for water and food. Increased urbanisation puts pressure on water networks and infrastructure, in particular affecting access to clean water and sanitation. Attitudes to water are changing, with citizens willing to save water when public authorities demonstrate that they are fixing leaks, spending money wisely and ensuring that bills are affordable.

ECONOMIC GROWTH AND DEVELOPMENT

To feed, house and care for an ever-increasing and ageing population suggests that the world economy will need to continue to grow rapidly to keep pace, adding to the demand for water and energy and, where unregulated, contributing to increased pollution and diminution of natural water sources.

THE ENVIRONMENT

The effects of climate change are now clear, with extreme weather events, increased risks of flooding, droughts and water stress. Groundwater is the most extracted raw material in the world – and supplies are dwindling. Feeding a growing population requires more water and energy for food production and transportation, at a time when reducing carbon emissions is essential to meet tougher environmental standards and slow down climate change.

UTILITY BUSINESSES

Ageing infrastructure must be replaced and maintained. Economic and regulatory pressures, and the need to keep bills affordable, means that investment in infrastructure is tightly controlled. Innovation and the embracing of new technology is now at the heart of business planning and will play a central role in achieving water reuse and recycling targets, reducing energy demands and delivering more efficient and longer-lasting infrastructure.

66%

OF THE WORLD'S POPULATION WILL BE LIVING IN URBAN AREAS BY 2050

33%

OF THE WORLD'S POPULATION LIVE IN WATER-STRESSED AREAS

10%

OF THE WORLD'S POPULATION LIVE IN LOW-ELEVATION COSTAL ZONES

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WHAT ARE THE OPPORTUNTIES IN THE UK AND OVERSEAS?

The UK water industry has demonstrated its capability in identifying solutions to a range of complex challenges and delivering cost-effective robust solutions throughout the world. This is supported by highly innovative organisations of all sizes and areas of expertise, supported by expertise in negotiating reliable and fair commercial contract arrangements.

The UK supply chain and supporting infrastructure, extensive market, world leading delivery system and a robust regulatory framework have enabled the UK to be a world leader in the global response to the need to plan for and deliver all aspects of water resilience.

The water supply chain is adaptive and robust, comprising specialist technology provision and capabilities in the delivery of tailored and integrated consultancy services.

This section highlights the size of the opportunity for UK innovators, organisations, the academic community and the support infrastructure provided by Government and its agencies in delivering water resilience solutions in the UK and overseas.

"Water resilience comprises the ability to cope with and recover from shocks and stresses, disruption and uncertainty, thereby maintaining essential services and protecting the environment both now and into the future.

Resilience has always been recognised as a priority for the UK and industry has responded by delivering first class solutions and performance.

The UK water sector and supporting organisations have continued to innovate and evolve, ensuring the industry is ready for current and future challenges.

These challenges are shared globally: urbanisation, population growth, aging infrastructure, climate change – with all nations having a desire to look for more sustainable and resilient solutions.

This paper discusses explores how UK expertise can deliver sustainable solutions in the water sector.

The UK government is taking the lead in tackling climate change, not least as hosts of COP26 in Glasgow. So, I am pleased to support the work of the UK Water Partnership and its various partner organisations and companies, in its ongoing efforts to promote UK capability in Water Resilience.

Sustainable Infrastructure is a key priority not just for the UK Government but for governments around the globe. This work will help DIT and other parts of UK government in our ongoing trade and investment conversations."

Rodney Berkeley
Director for Manufacturing, Energy and Infrastructure
Department for International Trade

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WHAT IS THE UK's EXPERTISE?

The UK has a wealth of expertise which is already exported around the world. We found evidence of research, consultancy, products and skills in most countries on the planet from Afghanistan to Zimbabwe. In this section we set out the key areas of that expertise, and then we provide more information in the case studies in Section 8. The UK has responded to the need to consider water as part of a *'systems of systems'* and creating the means to diagnose urban water resilience.

WATER

The UK has a history of planning water supplies. In spite of what is perceived as a 'wet' climate, the high population density and environmental requirements mean that water resource planning has been a strong theme. We are recognised experts in areas such as water supply assessment (hydrology and hydrogeology), and have developed tools to assess water supply resilience from drought, climate change and other risks (such as asset failure). These approaches, often modified for specific conditions, have been exported around the world. We are using the latest techniques to develop new approaches using information like earth observation data to advance these approaches.

WASTEWATER

Key areas of focus of the UK wastewater sector are on process improvements and asset reliability. Our experts provide advice on the design of wastewater networks, treatment works and management and re-use of waste products. Water companies, consultants and suppliers have focussed on developing solutions to wastewater which are resilient to climate change and are economic to operate. Research into issues such as microplastics, chemicals in wastewater and reducing energy requirements are emerging themes. We have seen how expertise in planning wastewater treatment processes and assets that are resilient to flooding is a particular strength.

FLOODING

The UK has a strong background in flood risk assessment, adaptation and control. There is particular expertise in understanding the risks of dam breach, climate and weather on flooding, and then turning these risk assessments into operational tools to manage those risks.

As well as helping design defences for some of the world's largest cities, the UK has developed a large range of products to reduce flood risks at an individual property scale and we have developed flood warning systems to alert those at risk.

SYSTEMS THINKING

It is inefficient to think of water supply, wastewater and flooding as separate issues – instead they need to be considered together to ensure that firstly no harm is done and secondly to maximise the opportunities available. For instance, in the UK now our water resources planning processes consider "best value" rather than least cost, so that plans which improve wastewater or flood resilience can be incorporated into strategic water resource planning.

This joined up approach to water supply, wastewater and flooding is now being exported to areas like the Caribbean.

PRODUCTS & SERVICES

The UK's expertise includes some of the world's greatest research organisations, including those leading the research on the impacts of climate change.

Our consultancy experts work on projects throughout the world, providing this insight into how to improve water supply, wastewater and flooding as an integrated offering; whilst our contractors and manufacturers build and produce some of the worlds most advanced processes and equipment. This is all underpinned by a range of legal, financial and insurance services, which support this work, providing governance and security.

ARTIFICIAL INTELLIGENCE

The UK government has announced a new plan to fully embrace artificial intelligence (AI) across various sectors as part of a national renewal strategy.

In the water sector, AI is being used to optimise efficiencies, reduce operational time, and enhance water management practices. Applications include predictive maintenance, real-time water quality monitoring, and smarter resource management. The government's commitment to AI is expected to drive innovation and sustainability in water management, addressing challenges such as climate change and population growth.

NATURE BASED SOLUTION

The UK Inter-Agency Climate Change Group (IACCG) showcases exemplary Nature-based Solutions (NBS) projects from across the UK, demonstrating the country's expertise in using nature to address climate change.

.Nature Based Solutions are crucial in enhancing water resilience due to their ability to use natural processes and ecosystems to manage water resources effectively. They can be used to manage floods, alleviate drought, improve water quality, enhance water recharge, prevent erosion etc.. Additionally, NBS are cost-effective, requiring less maintenance and addressing multiple issues simultaneously by providing amenity spaces, boosting biodiversity, and managing water resources.

08 NEXT STEPS

Water resilience is a broad and developing field of study. With this in mind, we will continue to review and update this document to capture existing and emerging knowledge, experience and expertise.

The activities set out below will guide the UK Water Partnership's efforts regarding the dissemination of this document and future focus on resilience.

1. Continue to harvest case studies through the UKWP Capabilities Directory, gathering further evidence to fill in any capability 'gaps'.
2. Review and update this document on a regular basis in line with existing and emerging UK capability, areas of expertise and target markets.
3. Disseminate this report and subsequent versions via the Department for Business and Trade channels and overseas posts.
4. Showcase UK expertise at international events and conferences including UN Climate Change Conference of the Parties (COP) and other international stages..
5. Convene a UK Resilience Forum to engage on international opportunities where the UK can provide solutions. This might involve active engagement with governments, utilities and other organisations through relationships with DBT colleagues overseas.

Water Resilience Showcase

On Wednesday 28 and Friday 30 June 2023 the UK Water Partnership and the UK Department for Business and Trade (DBT) co-hosted a Water Resilience Showcase. Aimed at disseminating globally the resilience capability of the UK industry, the hybrid event featured fifteen presentations on various areas of resilience showcasing case studies, learnings and opportunities for implementation in new geographies.

Speakers at the event included:

- Opening address – Hans Jensen, Director, UKWP
- Opening address – Stephanie Martin, Water Sector Manager, DBT
- Water Resilience Introduction – Martin Shouler, Water Resilience co-leader, UKWP & London Water leader, Arup
- Planning for Resilience: The City Water Resilience Approach (CWRA) – Martin Shouler, Arup
- Strategic national scale design under uncertainty – Julien Harou, NexSys Analytics
- Managing Flood Risk – Dr. Steven Cole, UK CEH
- Managing Water Security in Oman and Bangladesh – Richard Noakes, Mott MacDonald
- Developing a Water Quality Monitoring Programme – Dr. Austen Buck, WRc
- Disaster Management: Reconstruction. Rebuilding Hope – Siraj Tahir, Arup
- Disaster Management: Preparedness – Juan Gutierrez-Andres, HR Wallingford
- Improving water supply resilience of Metro Manila – Adrian Marsden and Mervick Salamat, Arup
- Improving the quality of Water by building high value ecosystems – Tom Godfrey, Earthchange
- Natural Infrastructure in St. Lucia and Derbyshire – Richard Noakes, Mott MacDonald
- Remote Tools for resilience – Juan Gutierrez-Andres, HR Wallingford
- Digital tools for efficiency – Juan Gutierrez-Andres, HR Wallingford
- Preventive management of critical infrastructure- Tom Sangster, Downley Consultants
- Non-Revenue Water – Justine Leadbetter, WRc

The event saw an impressive breath of experience and technical capacity by practitioners that are leading the development on their areas both domestically and overseas. It also raised a high level of interest from attendees for replicating and adapting some of the initiatives and methodologies to the local issues of their geographies.

Module			Red Room	Blue Room
0	15:00	15:20	**Welcome and Introduction***	
1	15:25	15:40	Planning for Resilience	Managing Resilient Systems
2	15:45	16:00	Planning for Resilience	Nature Based Solutions
3	16:05	16:20	Flood Management	Nature Based Solutions
B				
4	16:35	16:50	Water Scarcity	Digital tools for Resilience
5	16:55	17:10	Water Quality	Digital tools for Resilience
6	17:15	17:30	Disaster Management: Reconstruction	Managing Resilient Systems
7	17:35	17:50	Disaster Management: Preparedness	Managing Resilient Systems

THE BENEFITS OF BEING A MEMBER OF THE UK WATER PARTNERSHIP

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The UK Water Partnership was established in 2015 to provide a strategic vision for the development and growth of the UK water industry. It brings together a wide cross section of UK water sector stakeholders in a single coherent alliance to support research excellence, promote collaborative innovation and secure the UK a greater share of the $500 billion global water market.

Joining the UK Water Partnership gives you the opportunity to increase your influence, visibility and access to cutting edge research and innovation in the UK water sector,which will help you to grow your organisation and reduce business risk.

Membership

The UK Water Partnership membership consists of a broad and diverse range of organisations including academia, private sector companies, research institutes, and public bodies. This provides the UKWP members with a unique position to influence and better coordinate the work being done across the sector.
Members have a unique position to influence and better coordinate work being done across the water sector as well as directly address challenges.
They can gain exposure and influence, collaboration opportunities, and access to information across public, private, and academic sectors.
'Through involvement in UKWP we have gained greater access to organisations and people in the water sector, bringing in diversity of thinking to support and promote the development of our work assessing the public value of water. Through association with UKWP and its members, our work on public value of water attracts credibility, which in turn facilitates further opportunities to develop the work.' -Gavin Stonard,Business Development Director Water - Costain

What does the UKWP provide?

- Annual meetings and a summit, committing to collaboration and innovation
- UK and international visibility & chances to participate in overseas commercial missions
- Develop and enhance capability by collaborating on water sector projects
- Engage in networking and events across industry and with influential bodies
- Part of a collective voice delivering key reports to government and stakeholders
- Create workstreams for long term collaborative projects across member organisations
- Work, funding, and partnership opportunities on key bids and research
- An impartial not-for-profit space working across all types of organisations

Members of the UK Water Partnership have the opportunity to participate in one or more of our strategic Delivery Groups, which are driving transformative change in the UK water industry. In addition to Water Resilience, the partnership has recently focused on:

- **Water Resilient Places** –'Resilient Place' becoming increasingly prominent in government and agency policy agendas across the UK and more widely the UKWP will produce a consultation document on the challenge area.
- **Digital Water** –The UK Water Partnership launched an action plan to help UK plc win its share of the $30 billion digital revolution in water.
- **Circular Economy** – Capturing circular water solutions, showcasing UK capability, and identifying opportunities to embed circular economy thinking at the heart of the water cycle.
- **Greenhouse gases** – The UKQP aims to close the knowledge gap that currently exists in attempts to quantify emissions, which often underestimate the magnitude of emissions and do not fully account for the impact of more potent GHGs.
- **Capabilities Directory** – The UK Water Partnership has worked in partnership with the Department for International Trade to develop a UK water Capabilities Directory. This will be used to help UK-based organisations improve their access to UK and international markets.
- **Collaborative Initiatives** – The UKWP aims to collaborate with actors from across the sector to drive innovation, enhance thought leadership, and develop solutions to the key challenges. These collaboration initiatives include Future Talent and Skills, River, Catchment Health , Citizen Engagement and Trust, Data and AI.

OUR FOCUS:

Our Delivery Groups strive to:

- promote applied research excellence
- improve the ability to model and simulate urban water systems
- facilitate and accelerate the route to market for innovations in the water sector
- encourage research and testing capability in the UK
- drive engagement with Government, BEIS and the Industrial Strategy Challenge Fund
- improve the alignment of UK innovation with the UK water industry
- identify how global needs link to UK expertise
- develop the UK offer on flood resilience.

HOW WE ARE FINANCED

The UK Water Partnership is a public-private not-for-profit company limited by guarantee with its operations funded by financial contributions from its members.

Private sector contributions are used to carry out core operational activities such as administration, marketing and promotion, as well as planning and hosting events that help promote the UK water economy both at home and overseas.

The Partnership is indebted to its members, not just for their continued financial support, but also for their substantial gifts of time and for their willingness to co-design our emerging products and services.

CONTACT

For more details go to:

www.theukwaterpartnership.org/join-us

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