In collaboration with
McKinsey & Company

WORLD ECONOMIC FORUM

Water Futures:
Mobilizing Multi-Stakeholder Action for Resilience

WHITE PAPER

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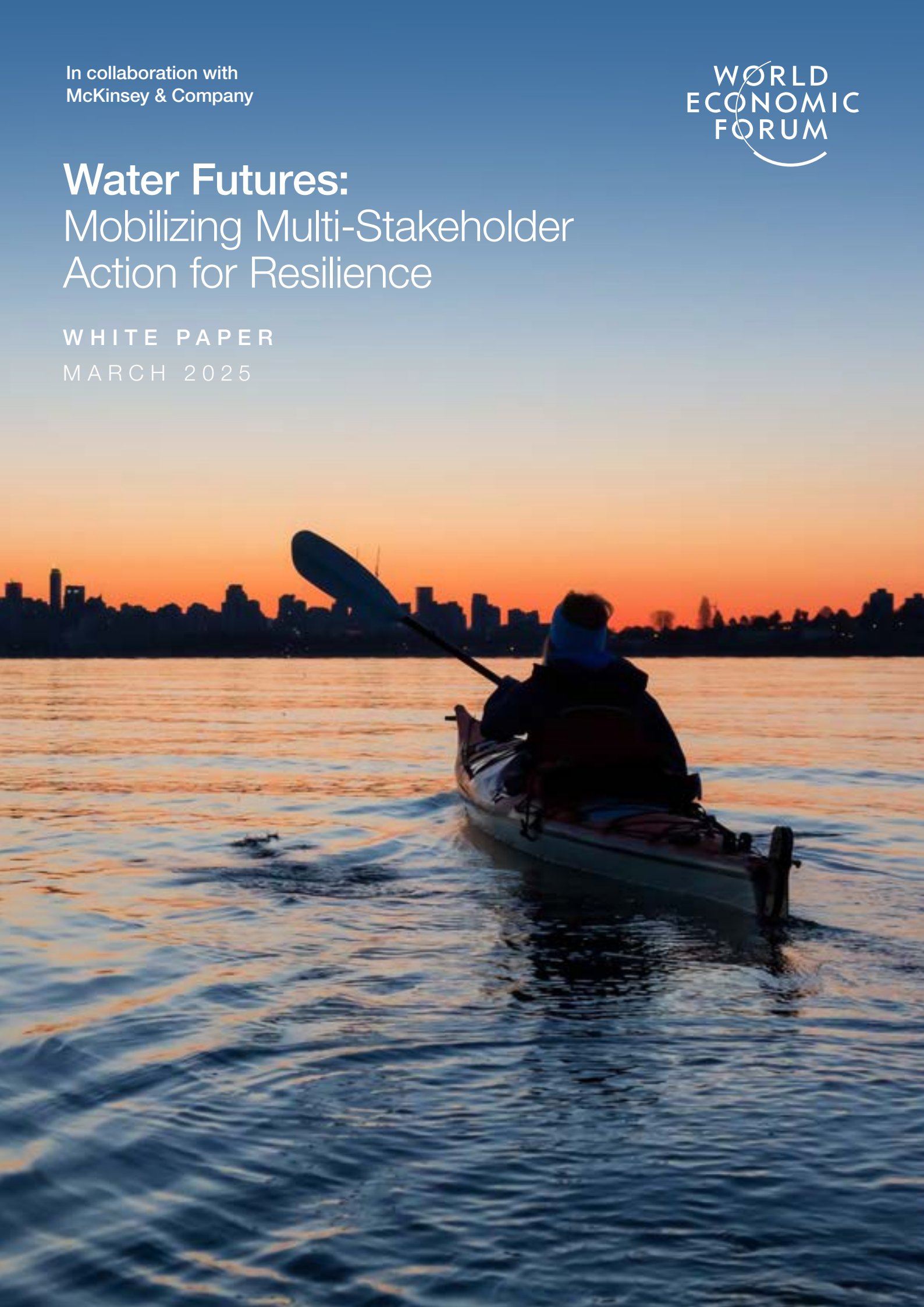

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Foreword

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Access to freshwater is changing rapidly worldwide, with water stress affecting billions of people and countless businesses each year. At the same time, extreme water-related events – such as droughts and floods – are becoming more frequent and severe. Water pollution continues to rise, with emerging risks from microplastics and "forever chemicals" further compounding the challenge. While we may not yet have reached a tipping point, current trends indicate that without urgent action, we could be approaching one in the near future.

Every industry depends on water. This makes water resilience – ensuring that water systems can prepare for and respond to future disruptions and shocks – not just an environmental concern, but a cornerstone of economic stability, business continuity and prosperity. Rising demand, driven by population growth, shifting consumption patterns, and the energy transition, is further straining resources. With the economic value of water estimated at $58 trillion – roughly 60% of global GDP – its critical importance and the scale of the challenge cannot be overstated.

No company or government can build water resilience alone. With the recent report published by the Global Commission on the Economics of Water, alongside advances in data-driven insights and reporting requirements, we now have both the data and the agency to place the hydrological cycle at the heart of our thinking and decision-making. Equipped with these tools, we are better positioned than ever to drive meaningful progress. Businesses, governments and financial institutions can work together to drive investment, improve governance and embed resilience in the way we steward our water resources.

The World Economic Forum's Water Futures Community is bringing together leaders from the private and public sectors to accelerate investment and action. In collaboration with McKinsey & Company, this report outlines key pathways to strengthen water resilience and highlights opportunities for collective action. Our aim is for this community of partners to use the report as guidance and reference. We hope the various tools, examples and best practice shared here will help foster more partnerships and accelerate solutions at scale.

Taking decisive steps today – through strategic investments, better governance and cross-sector collaboration – can help secure clean, reliable and sustainable water resources for current and future generations to come. The years ahead will depend on how we act now.

Executive summary

Five pathways to adopt a systems approach to water and bring back stability to an out-of-balance hydrological cycle.

Water is life. It sustains ecosystems, fuels economies and nourishes communities, yet our planet faces a growing water crisis. Climate change, population growth and industrial demand are driving water systems to the brink. From devastating droughts to catastrophic floods, water-related risks impact billions of people and threaten the well-being of future generations.

Amid this urgent crisis, there is hope – a chance to reimagine water finance, catalyse innovative solutions and inspire collective action, to ensure water of high quality is accessible and available to all. Water is not just an operational input – it is a cornerstone of sustainable development and global stability, and it is critical for sustaining lives and livelihoods. Securing the future of water within the global economy, society and environment demands bold action today.

This white paper calls for a transformative approach to water resilience, where "resilience" refers to a "system's ability to anticipate, reduce, accommodate, and recover from disruptions in a timely, efficient, and fair manner".[1] The paper emphasizes the vital role of public-private collaboration and cross-sector partnerships to meet emerging challenges and seeks to mobilize a freshwater multi-stakeholder community convened by the World Economic Forum.

Based on consultations with nearly 60 partner organizations, the white paper outlines five pathways for collective action, led by the private sector and multi-stakeholder platforms. Informed by a systems approach, it highlights key tools and examples to inspire and guide companies and public-private collaborations to work towards more resilient water systems. This systems approach applies to multiple scales – from the local to the level of ecosystems.

At a local scale, innovations in water solutions are critical, but require greater investment, data-driven approaches and supportive governance and policy. The aim here is to develop and expand circular net-zero water systems, using energy-neutral solutions with secure and sustainable water supplies.

At an ecosystem scale, a new approach to water use and ecosystem protection that recognizes and values the full hydrological cycle is needed. This requires holistic, innovation-driven strategies and collaborative models to build resilient, efficient and sustainable water systems.

The stakes are high: global economic resilience, social equity and environmental integrity hinge on actions that can be taken today. By embracing the water ecosystem – including both green and blue water[2] – as a shared responsibility across business, government and society, stakeholders acting together can transform challenges into opportunities and create a legacy of water resilience, equity and abundance for a future in which every drop counts.

Five pathways

1 Holistic water valuation

Better understanding and reflection of the value, price and cost of water are key for fostering initiatives and incentives for circularity as well as the better use and treatment of freshwater ecosystems.

2 Fit-for-purpose finance

Fit-for-purpose financing mechanisms that are deployed from diverse sources across project stages to mobilize capital are essential for supporting measures to address the two focus areas.

3 Sustained basin-level partnerships

Basin-level partnerships and collaborative approaches enable a holistic and system-wide approach towards rethinking water systems at all scales.

4 Adaptive water governance

Adaptive water governance approaches ensure resilience in times of uncertainty, while providing the incentive mechanisms required for holistic and systemic action across water scales.

5 Collaborative policy-innovation nexus

Policy that is in sync with innovation needs and progress is a catalyst for water solution development and deployment at scale across the focus areas.

Introduction

With 4 billion people facing severe water scarcity and demand for water soaring, the imperative to strengthen water resilience has never been so urgent.

“ 4 billion people face severe water scarcity for part of the year and an additional 3-4 billion people could experience physical water scarcity under 2-4°C of global warming.

Climate change is unfolding and water risks are increasing. Addressing these interconnected challenges requires rethinking water systems, long- term planning and bold collective action.

Water holds immense economic value. In fact, 60% of global annual GDP depends on water and freshwater ecosystems.[3] Yet the world’s water systems are increasingly out of balance, leaving societies vulnerable to water shocks and stresses exacerbated by climate change.

The effects of water challenges are already tangible: 500 million people live in areas now wetter than usual, 163 million people live in regions drier than before, 709 million live in places with heightened precipitation intensity, while 86 million live in locations where precipitation intensity has declined over the past 75 years.[4]

In addition, water-related disasters account for 70% of all deaths related to natural disasters.[5] Extreme water-related events, such as flooding and landslides, significantly degrade water quality. Approximately $77 billion is at stake from water-related supply chain risks, particularly affecting manufacturing, materials and food and beverage industries.[6] At the same time, 4 billion people face severe water scarcity for part of the year and an additional 3 to 4 billion people could experience physical water scarcity under 2-4°C of global warming.[7]

Responding to these compound risks requires building long-term capacity to anticipate, reduce, accommodate and recover from future disruptions in water systems – in other words, building water resilience. This demands understanding of the relationships between origins, interdependencies, impacts, ripple effects, tipping points and more on societal, environmental, economic, political and cultural levels. This is a complex undertaking; no actor or sector can achieve resilience on its own.

While water is increasingly taking centre stage as a standalone priority, policies and regulations are not evolving fast enough to create the incentives that could drive the changes needed from both the public and private sectors. There is limited progress, for example, on comprehensive policy frameworks that support water resilience in a holistic way. Nevertheless, many countries and regions are progressively developing water strategies[8] that address critical issues through targeted policies and planning. There is also more awareness of the urgent need for better regulations and directives relating to sustainability disclosures, for example, or controls on PFAS (per- and polyfluoroalkyl substances, sometimes referred to as “forever chemicals”).

A number of leading international organizations have laid the groundwork to enable the current momentum, offering scientific evidence and direction for the future of water practices. In 2022, a significant milestone was achieved with the launch of the Global Commission on the Economics of Water (GCEW) at the World Economic Forum Annual Meeting in Davos, followed by the publication of its landmark report in 2024, *The Economics of Water: Valuing the Hydrological Cycle as a Global Common Good*.

The GCEW’s report outlines what needs to happen to build water resilience and urges stakeholders globally to drive radical change in how water is valued, managed and used. Its ultimate purpose is to “bring back stability to the global water cycle, deliver on the human right to safe water, achieve food security and development that works for all and keep our planet safe for generations to come”. The next challenge is for multiple sectors, including the private sector and multi-stakeholder platforms, to define how they will take action.

In preparation for the UN Water Conference 2026, the World Economic Forum aims to mobilize its community for multi-stakeholder action on water. The increasing momentum around water underscores the urgent need to catalyse private sector action and shape a new generation of partnerships. The challenge is clear: water systems require systemic rethinking, long-term planning and bold collective action to build resilience for all. But how can multi-stakeholder collective action best mobilize to build water resilience?

This report outlines focus areas and pathways for action directed at the private sector and multi-stakeholder platforms, such as the Forum's Water Futures Community, which aim to foster water resilience. Through a consultation-based approach, this white paper is the next step towards mobilizing the private sector and fostering a new generation of multi-stakeholder partnerships to make water systems resilient.

The report is structured as follows:

- Chapter 1: An overview of key issues and trends shaping the future resilience of water systems.
- Chapter 2: Focus areas for action identified through the consultation process.
- Chapter 3: Pathways for action relevant to the private sector and multi-stakeholder platforms.

Approach

The content of this report is based on the priorities expressed by the Forum's partners and the broader water community. It positions these priorities in the context of emerging water resilience challenges and existing efforts to address them. It recognizes the recent publication of GCEW's landmark report and explores how the private sector and public-private collaboration can play a role in tackling global water challenges.

The report draws on insights shared by more than 55 partners who participated in consultations, as well as from a literature review of more than 100 papers and reports. From this wealth of input, the authors identified 15 recurring themes[9] highlighting shared priorities and challenges, which provide a foundation for understanding the key issues in water resilience. Together, they shape the methodology used to write this report (see Figure 1).

Stakeholder priorities were analysed using an inductive approach to uncover key opportunities and actions. This process identified two focus areas and five practical pathways for action. These are designed to guide efforts over the next 10 years, focusing on both private sector initiatives and public-private collaboration. Together, they provide a roadmap for building water resilience.

To guide the implementation of the pathways, the report identifies three components for each pathway:

- Collective outcomes to achieve.
- Short-term actions to drive collective efforts, with a focus on the private sector.
- Illustrative examples of initiatives that could be scaled-up or accelerated through collaboration in multi-stakeholder partnerships.

FIGURE 1 **Approach to determine themes, focus areas and pathways to water resilience**

1 Why building water resilience matters today

Water consumption is soaring – if supply is not protected, the GDP of high-income countries could fall 8% by 2050 and 10-15% for lower-income countries.

1.1 Emerging trends

> The total quantifiable economic use-value of water is estimated at $58 trillion a year - equal to ~60% of global GDP.

Water demand is increasing

Changes in water demand are creating an imbalance in supply, making it essential to build resilience today to ensure a water-secure future with safe and equitable access for all. Environmental risks of primary concern to water security over the coming decade include extreme weather events, biodiversity loss, climate change, natural resource shortages and pollution.[10]

Water consumption has also significantly increased over time. Total water withdrawal per capita has increased by more than 650% globally in the past three decades.[11] However, per capita water resources have steadily decreased in most countries. For example, China recorded a decrease of approximately 50% in per capita water availability from 1964-2020.[12]

Growing global shifts in consumption patterns, technology innovations and the water needs of decarbonization pathways will fuel competition for water resources. All industries are expected to require more water, with regional variations depending on different drivers.[13] The continued global shift towards digitalization and the resulting demand for data processing, storage and connectivity will drive the need for more and bigger data centres, which use water to cool servers. Consequently, the combination of growing water demand, increasing water withdrawals and decreasing water availability highlights the looming risk of a tipping point in water supply.

Water is critical to the economy

Water is among the most valuable yet least-valued resources in the world. It is vital for supporting life itself, and the sustainable development, economic growth, healthy environment and ecosystems on which all life depends.

The total quantifiable economic use-value of water – arising from direct consumption and its role in environmental regulation – is estimated at $58 trillion a year, equal to ~60% of global GDP.[14] Today, freshwater withdrawals are 4.3 trillion cubic metres (m^3) per year,[15] with agriculture consuming 70%, industry 20% and municipal uses 10%.[16] Water withdrawals vary according to regional economic drivers, with higher water uses for agriculture in Africa and Asia (80%), compared with higher uses for industry in Europe (60%). For industry, water is crucial in all steps of the value chain, from raw materials and suppliers to direct operations and product use, especially for sectors with high water demand such as mining and upstream oil and gas.

> In 2023, 25 countries housing a quarter of the world's population faced extremely high water stress, meaning that annual water withdrawals exceeded 80% of available renewable water supply.

Regardless of how water withdrawals are distributed across sectors, competition is increasing. For example, industrial uses such as data centres use potable water for cooling, while mining activities impact water quality in river basins, therefore competing with agriculture and domestic consumption. A one-megawatt (MW) data centre can use up to 25.5 million litres of water a year just for cooling[17] – equivalent to the daily water consumption of around 300,000 people.[18]

In the face of increasing competition and the challenges brought by climate change and overconsumption, water supply is increasingly at risk. If this valuable resource is not protected, the GDP of high-income countries could fall by an average of 8% by 2050 – and 10-15% for lower-income countries.[19] Moreover, weather, climate and water-related disasters cause significant economic losses, totalling $4.3 trillion from 1970 to 2021. Over that half century, losses increased almost 700% with around 30% (~$1.5 trillion) generated from 2010-2019.[20]

As a result, sectors such as fashion or pharmaceuticals, which have not traditionally considered water a critical input to their production processes and operations, are now shifting their strategies, making water a core part of their business and ultimately recognizing that every industry is a water industry.

Water offers multiple co-benefits

The impacts of water quality and availability go beyond the economy, touching on people's health, culture and values. In 2023, 25 countries housing a quarter of the world's population faced extremely high water stress, meaning that annual water withdrawals exceeded 80% of available renewable water supply.[21] Among these countries was India, whose 1.4 billion people are driving an ever-increasing demand for water. China and the US, the world's two largest economies, faced medium to high water stress, using respectively 20% and 40% of their water supplies.[22]

Water holds great importance for social and cultural purposes, its cultural and aesthetic value, its ability to enhance mental health and its spiritual significance across faiths.[23] These often-divergent views and uses of water can lead to disagreements and disruptions, calling for a more holistic and systemic view of water valuation and management.[24]

In this context, water has become an increasingly political issue, generating grounds for conflict concerning access to, or control of, water resources and uses. Since the early 2000s, the number of water-related conflicts globally has increased by more than 250%, mostly recorded in Sub-Saharan Africa and West and South Asia.[25]

Water faces systemic underfunding and ineffective governance

Globally, water supply and sanitation have been chronically underfunded, supported primarily by public sector investment.[26] This water financing gap is likely to skyrocket when factoring in the needs of societies and economies, alongside the challenges imposed by climate change, such as flood protection. Yet, the finance that has been deployed to date is often short-term and ultimately inadequate to systematically support water systems. The investment gap is compounded by a capacity and absorption gap, with the World Bank estimating an annual budget execution rate of about 72%.[27]

Additionally, water governance is very complex and often fragmented, as it requires the involvement of multiple institutions and stakeholders across different sectors. Water governance is typically limited by inadequate and siloed capacities, with insufficient coordination between the different levels of water management (e.g. community, urban, federal, national, international). This leads to inconsistent policies, overlapping jurisdictions and inefficient resource allocation.[28]

Understanding the hydrological cycle as a global common good

The landmark work of the GCEW has highlighted water's complex movements through rivers, lakes and aquifers (blue water), its presence in soils and plants (green water), and the flows of moisture formed through evaporation. This full and intricate hydrological cycle is transboundary by nature and holds immense economic and societal value. It is a global common good.

Placing the hydrological cycle at the centre of efforts to rethink water action can help embrace water's interconnectedness with climate, biodiversity and human development. It also strengthens the case for systemic governance and economic policies that reflect water's true value and ensure equitable, sustainable management.

Armed with this more comprehensive articulation of the hydrological cycle, multiple actors – including the private sector and multi-stakeholder partnerships – now bear the onus of taking urgent action.

1.2 Balancing rising challenges with transformative solutions

> The critical role of water for energy production and the energy transition means that water is not only a private sector concern, but also a matter of national security.

Business as usual shows current trajectories are unsustainable

Current trajectories are expected to lead towards increased drought and water stress. By 2050, approximately 5 to 6 billion people, making up more than half the world's population, are expected to live in water-stressed areas.[29] Given current trends, 40% of global water demand will be unmet by 2030, according to the World Bank.[30]

Unpredictable and out-of-balance water cycles could also negatively impact businesses and the economy. Beyond the GDP impact previously mentioned, global insurance losses from water-driven events are expected to average $200 billion annually by 2034, with potential losses reaching $350 billion.[31]

There is a critical opportunity to shift from current water-use patterns by redesigning water systems to make them more efficient, resilient and ready to absorb future shocks and stresses. Transforming how we think and manage water today could pave the way for a more sustainable and water-abundant future.

A cornerstone for the future of the energy transition

Water is mission-critical for the energy transition, as it is essential for a number of its key drivers. Preliminary estimates have found that, by 2030, clean energy measures alone[32] could require a total of approximately 900 cubic kilometres (km^3) of water annually,[33] in addition to regular consumption. For instance, biofuel production technologies require roughly 2,500L of water (including 820L of irrigation water) to produce 1L of liquid biofuel,[34] which will likely play a key role in the electrification of the transport sector. In addition, producing 1kg of hydrogen requires approximately 33L of water, depending on the production pathway.[35]

The transition of other emission-intensive sectors, such as the built environment, will also require the deployment and implementation of water efficiency measures. Buildings have significant energy footprints, currently representing around 40% of carbon emissions globally.[36] Lowering emissions from the building sector requires looking at the whole-life carbon emissions of buildings, which includes embodied[37] and operational carbon, the latter driven by direct and indirect emissions from utility energy and water consumption[38] for heating and cooling.[39]

The critical role of water for energy production and the energy transition means that water is not only a private sector concern, but also a matter of national security – one that requires collaboration and partnerships with state and non-state actors.

Transforming water systems is an investment opportunity

There is widespread consensus that transforming water systems requires significant amounts of investment and active participation by the private sector.

While estimates of future investment needs for the water sector vary widely between organizations,[40] the World Resources Institute (WRI) estimates that global sustainable water management[41] could cost approximately $1.04 trillion annually up to 2030,[42] with peaks in East Asia and Pacific (EAP) of around $250-$260 billion and in North America of around $180-$200 billion. This is mostly to address water scarcity, except in Sub-Saharan Africa, where access to sanitation remains the primary concern. The estimate is likely to be an underestimation, with costs being much larger when considering the full water-cycle.

There are significant investment opportunities for the private sector in water-related technologies. Global Water Intelligence (GWI) and XPV Water Partners estimate that, given the needs, total capital deployed for water security is projected to increase threefold and exceed $13 trillion in the next decade (see Figure 2). The projected investment in water-related assets is expected to equal 17% of global GDP in 2034. Although the public sector today supplies 78% of the capital employed in delivering water security, approximately 55% of future capital is expected to come from private sources, with opportunities across multiple dimensions of water resilience.[43]

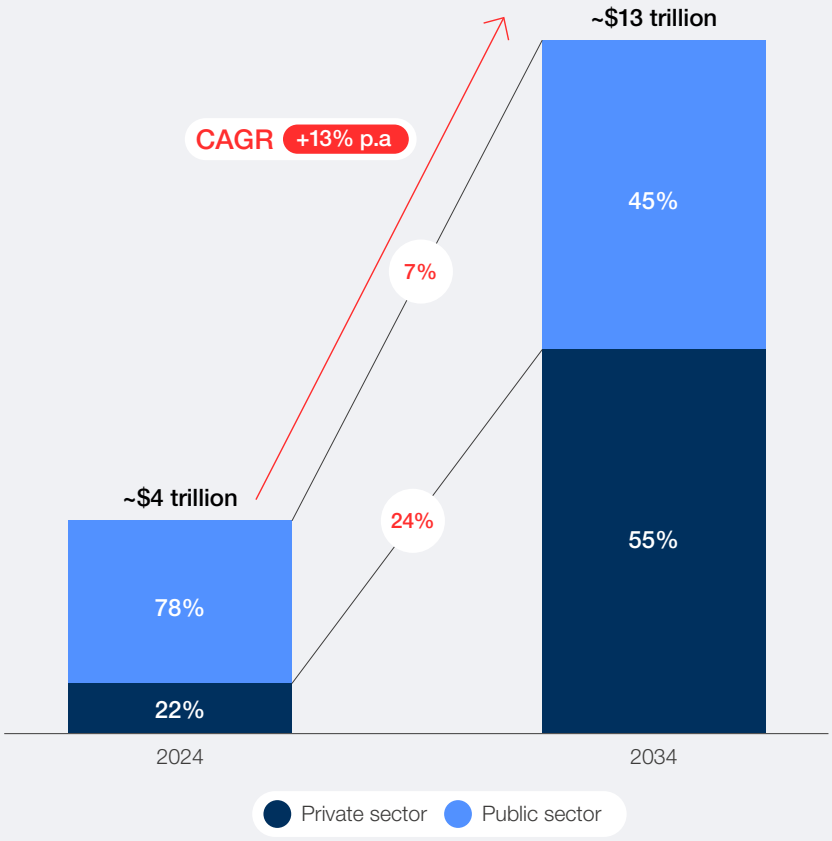
FIGURE 2 | **Estimated capital utilized in water security, 2024-2034**

3x

Increase in capital deployed for water security by 2034

~70%

of the increase is expected to come from private capital over the next 10 years



Note: CAGR = Compound annual growth rate.

Source: Global Water Intelligence (GWI) and XPV Water Partners.[44]

> Total capital deployed for water security is projected to increase threefold and exceed $13 trillion in the next decade.

Private sector investment opportunities include: asset ownership (e.g. regulated private utilities);[45] agricultural water (e.g. irrigation);[46] solutions and technology (e.g. water-related businesses);[47] corporate water (e.g. equity investments);[48] and impact financing (e.g. firms or funds unlocking the social value of water).[49]

Digital technologies hold much of the market potential for water

Achieving a water-resilient future will require not only transforming existing water systems, but also harnessing the power of digital technologies in water management.

The market for digital solutions is projected to increase by 35%, from around $37 billion in 2023 to $50 billion by 2028.[50] Technologies are expected to play a pivotal role in enhancing water treatment processes, and optimizing the efficiency of water networks is expected to account for more than half of projected market growth.[51]

These solutions will be essential to meet sustainability needs, as they help address water availability (e.g. technologies focused on conservation, desalination and water reuse), process efficiencies (e.g. improving productivity and lowering energy and chemicals demand) and water quality (e.g. measuring and maintaining high water quality, prevention of contamination at source).[52]

Examples include the use of fibre-optic leak detection technologies to improve efficiencies, the use of artificial intelligence (AI) such as artificial neural networks to transform wastewater treatment by predicting water quality, optimizing processes and enhancing pollutant removal, or the use of internet of things-based irrigation systems to monitor soil moisture, water salinity and turbidity, improve water and nutrient efficiency, and help water users (such as farmers) conserve water and increase crop productivity, especially in resource-limited areas.

The growing market for digital solutions is also expected to affect sludge management (CAGR of 8%), followed by water resources (6%) and customer services (5%).

Scaling-up these technologies and capturing market opportunities will require fit-for-purpose finance and a conducive policy environment that promotes innovation. Through these, solutions that tackle a number of obstacles to resilience (e.g. high CapEx cost of desalination, leakages, lack of data) can be deployed.

2 Shaping a systems approach

A multi-scale perspective can ensure that enabling policies and collaborative environments lay the foundation for scalable, basin-level action.

> To enable collective action from the private sector and multi-stakeholder partnerships, actors need to explore and understand the impact of interventions both in the immediate context and at a larger scale, including the entire hydrological cycle.

Water is increasingly at the centre of the global agenda, especially with drought, flooding and severe pollution becoming more prevalent and visible.[53] In recent years, the international community has responded by creating new platforms for visibility and discussion, such as the recent UN Water Conference in 2023, and water has now become a key topic at UN climate COP conferences.

Moreover, recent milestone publications – such as WWF's *The High Cost of Cheap Water*,[54] CDP's *Stewardship at the Source*,[55] and, crucially, GCEW's report *The Economics of Water: Valuing the Hydrological Cycle as a Global Common Good*[56] – have highlighted the critical role of water in our economies and prosperity. However, while the critical role of the water cycle in our economies is globally recognized as a priority for most sectors of the economy, the majority of private sector actors struggle to identify tangible entry points for taking effective action to build water resilience, beyond pilot projects.

This chapter summarizes the key themes and opportunities identified by Forum partners during the consultation process, which have been synthesized into two focus areas for building water resilience at different scales:

1. Mainstream circular water

2. Rethink water use and restore ecosystems

A key finding from the consultation was that actions by private sector actors and public-private collaborations often remain limited to piecemeal measures that are difficult to scale-up. While this approach has led to transformative ideas, partners overwhelmingly expressed the need for more actionable frameworks that integrate a systemic view to enable private sector action at scale.

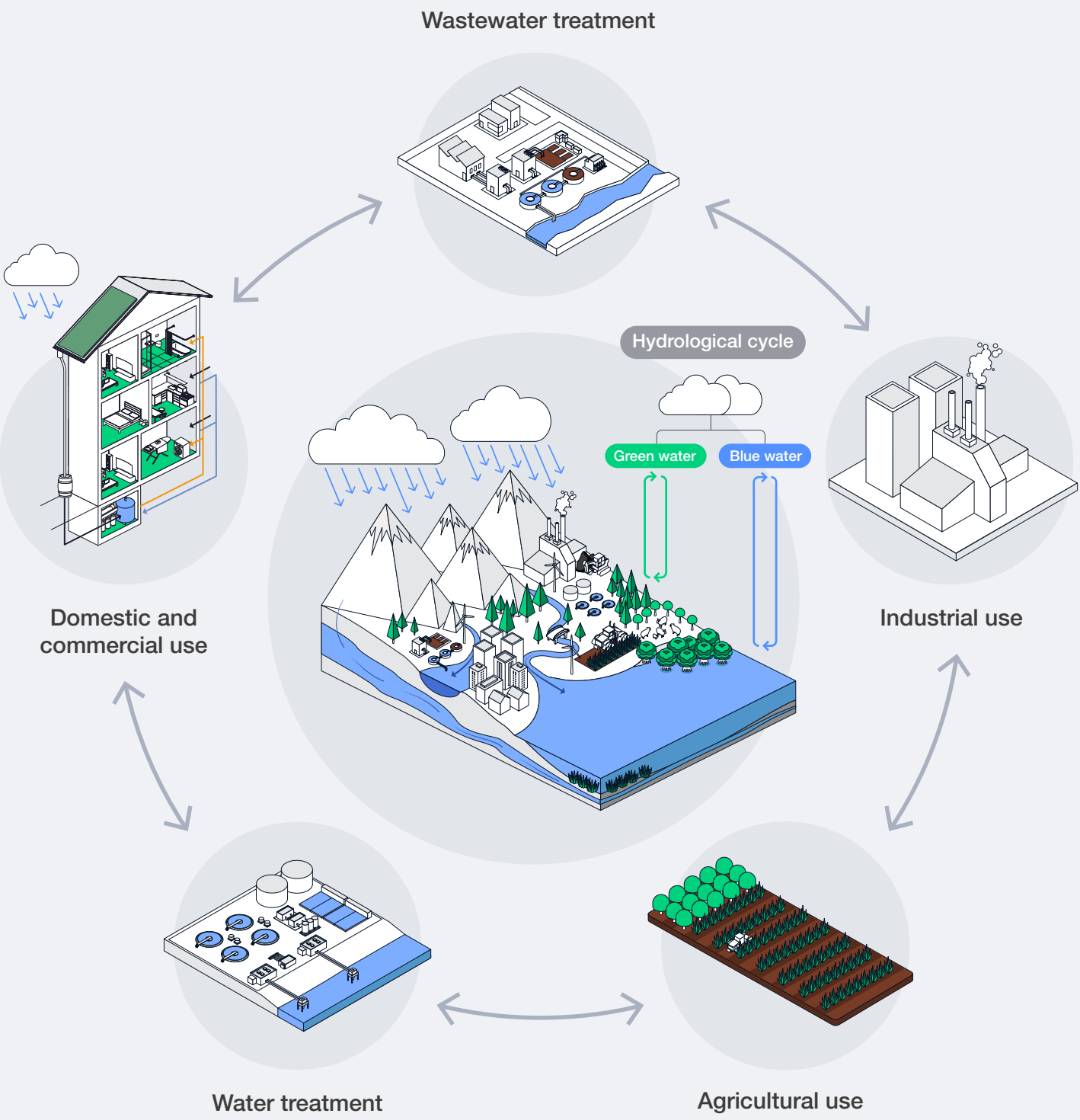
The consultation also revealed that the opportunity areas identified by partners tend to focus on specific assets and particular scales. However, synergies between assets, the impact of their investments on the hydrological cycle, as well as the broader enabling environment needed for large-scale or system-level action, remain largely unexplored by the private sector.

In this context, it is essential to consider both small-scale actions at the local level (e.g. farms, households, neighbourhoods) and large-scale actions (e.g. national, subnational, basin-level) as opportunity areas simultaneously. A multi-scale perspective can ensure that specific interventions account for their impact on the broader system while enabling policies and collaborative environments to lay the foundation for rapidly scalable and basin-level action. Adopting this multi-scale perspective can be a useful step towards a more systems-based approach to collective water action.

This report proposes that, to enable collective action from the private sector and multi-stakeholder partnerships, actors need to explore and understand the impact of interventions both in the immediate context and at a larger scale, including the entire hydrological cycle (see Figure 3). These two nested and interrelated scales represent critical opportunity areas where resilience can be strengthened through private sector actions, targeted investments and collaborative efforts among diverse stakeholders.

Possibilities for private sector and multi-stakeholder action are present – and needed – at multiple scales. Some opportunities call for localized, agile interventions where actors can coordinate effectively, while others necessitate broader, systemic approaches that engage a wide range of partners.

FIGURE 3 | **Focus areas for private sector and multi-stakeholder action**



Focus area 1
Mainstream circular water

> Circularity alone may fall short: the principle must be combined with a clear understanding of the water-energy nexus.

Support the development of and innovation in circular water systems, energy-neutral solutions and secure water supplies.

This focus area underscores the urgent need voiced by stakeholders to develop a new generation of circular solutions that can progressively replace the current "clean, use and dispose" water technology and infrastructure models, which are linear and based on 19th-century paradigms. However, circularity alone may fall short: the principle must be combined with a clear understanding of the water-energy nexus, opportunities provided by data, and behavioural change to ensure that water systems contribute to global decarbonization and the stability of the hydrological cycle.

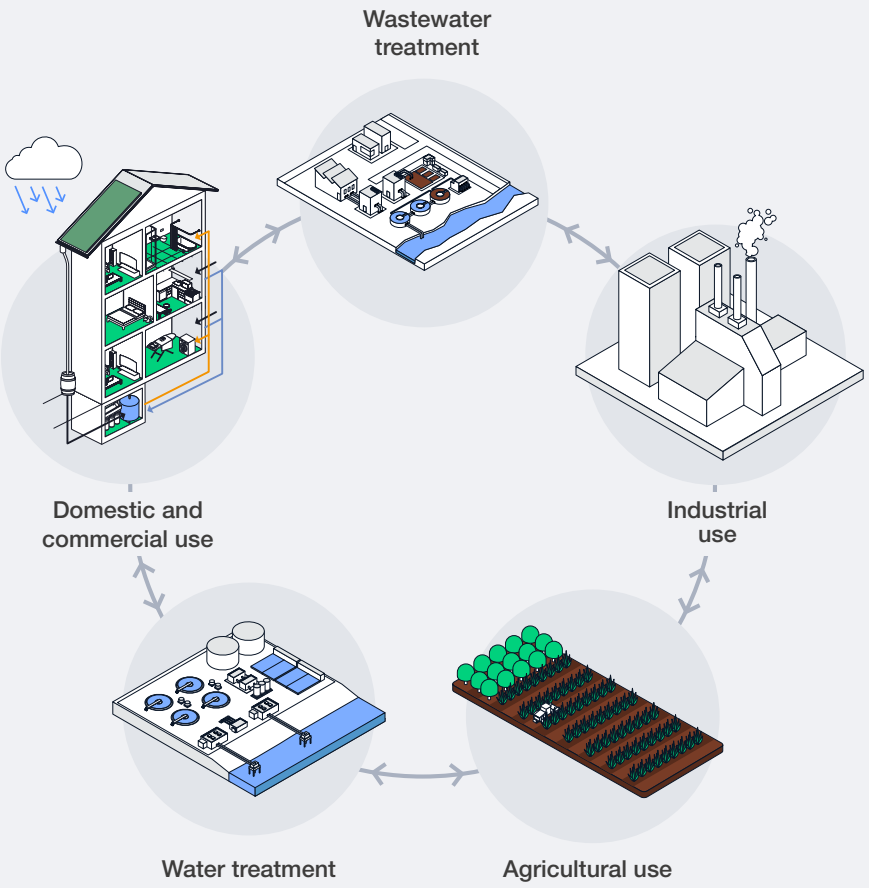
Importantly, circularity is an approach based on three design-driven principles:

- Eliminate waste and pollution.
- Circulate products and materials (at their highest value).
- Regenerate nature.[57]

Consultations for this report highlighted efforts to improve and scale-up water circularity in agriculture, industry and urban settings. These include recycled water in buildings, water reuse, rainwater harvesting and desalination systems, which aim to reduce water footprints and diversify water sources through interconnected innovations. Although the technology for these solutions exists, challenges in regulation, investments and infrastructure, as well as the lack of available information or data can hinder large-scale adoption, highlighting the need for government support and data-driven approaches.

Unlocking this opportunity lies in applying water circularity at all scales – from toilets and appliances to buildings, neighbourhoods and towns – and ensuring the water-energy nexus, powered by data, is a core factor in designing, operating and maintaining water infrastructure at all levels. Government support can drive circular water systems through adaptive regulations and appropriate incentives for investors and operators, with innovations playing a key role in future water security. Innovations can aim for an energy-neutral water cycle and leverage digital technologies such as digital twins and nanotechnology, while addressing adoption barriers such as data, standards and safety concerns.

FIGURE 4 **Focus area 1 – Mainstream circular water**



> Through a system-wide approach, solutions and measures can be deployed at scale, with the goal of minimizing the water footprint of human activities on freshwater ecosystems.

Based on consultations with stakeholders, the key themes to consider for maximizing this opportunity include:

- **Scale-up circularity everywhere**: stakeholders suggest that increasing water reuse requires a collaborative, multi-stakeholder approach to address financial, infrastructure and regulatory challenges, as fragmented efforts are insufficient to meet growing freshwater demands, despite technological advancements and increasing policy support.
- **Diversify water sources**: alternative water sources such as desalination and rainwater harvesting show potential to enhance water resilience, highlighting the need for cross-sector collaboration to overcome scalability challenges, reduce costs and develop innovative business models (e.g. approaching desalination as an "ecosystem venture" to unlock cross-industry synergies).
- **Make water supply energy-efficient**: water and energy must be addressed together, as water systems are major energy consumers and emitters, but improving efficiency and adopting circular wastewater management can reduce costs, carbon emissions and overall energy demand.

Focus area 2

Rethink water use and restore ecosystems

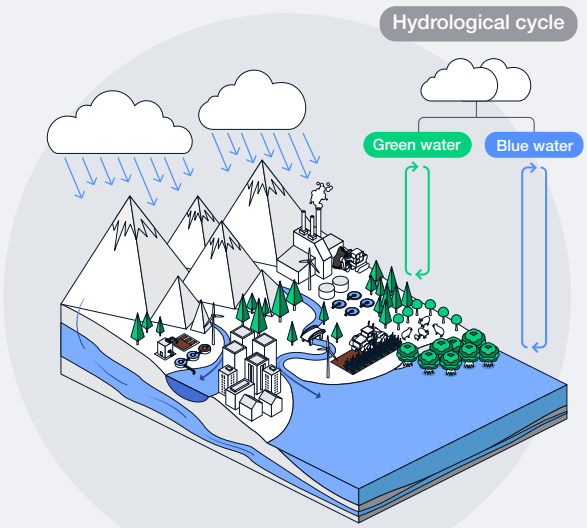
Put the hydrological cycle at the core of the thinking, and adopt holistic, innovation-driven strategies and collaborative models to build resilient, efficient and sustainable water systems.

This opportunity focuses on rethinking how water is used and governed in the long term, considering blue and green water, as well as the stark realities of grey water, which should be considered as a resource as well.[58] Shaping collaborative models that combine governance and stewardship should consider risk mitigation and the potential of digital tools and AI at their core.

Investments in resilient infrastructure should embrace a collaborative, evidence-based approach to ensure service delivery for all and protect communities and assets. Essential to this will be considering blue-green and grey-black cycles and engaging the entire value chain as well as multiple stakeholders. Through a system-wide approach, solutions and measures can be deployed at scale, focusing on stewardship at the basin and sub-basin levels, with the goal of minimizing the water footprint of human activities on freshwater ecosystems.

Consultations for this report highlighted the need to scale-up system-wide efforts to implement best practices for industrial and agricultural water use, improve governance and upgrade water infrastructure in different industries to better understand inefficiencies and losses, including measures such as KPI setting, leakage detection and crop rotations. In addition, efforts must be made to protect freshwater ecosystems, focus on replenishment and restoration, promote water reuse (such as rainwater or grey water), and ensure access to water.

FIGURE 5 **Focus area 2 – Rethink water use and restore ecosystems**



Based on consultations with stakeholders, key themes to consider for maximizing this opportunity include:

- **Scale-up best practices to reduce the stress on freshwater sources:** stakeholders highlighted increasing corporate efforts to improve water efficiency and reduce freshwater impact, particularly in industry and agriculture, but challenges in quantifying benefits hinder investment, requiring widely adopted standardized frameworks, government support and clearer water targets to drive accountability and sustainability.

- **Upgrade water infrastructure for water efficiency and resilience:** upgrading water infrastructure is perceived as essential for reducing water loss and promoting resilience, with a focus on smart technologies, adaptive planning and real-time data systems. However, high costs, market fragmentation and financing challenges require innovative investment strategies to scale-up solutions effectively.

- **Design cities and landscapes to retain water:** integrate best practices in regional and urban planning (e.g. Sponge Cities) to cater for increasing urbanization while reducing the risk of floods, improving water quality and enhancing biodiversity in urban areas. This includes using permeable surfaces, bioswales and ponds to retain and slow down water locally instead of immediately sending it downstream, an important factor for improving soil moisture, recharging aquifers and preventing flash floods.[59]

- **Strengthen efforts to protect and restore ecosystems:** protecting and restoring freshwater ecosystems is increasingly prioritized in corporate strategies, with nature-based solutions playing a key role in enhancing biodiversity, climate adaptation (e.g. flood management, moisture restoration) and climate mitigation. However, effective restoration requires coordinated, long-term, multi-stakeholder basin-level collaboration.

- **Address groundwater overuse and pollutants:** better valuation and management of groundwater – essential for industries and ecosystems – is crucial, as over-extraction and pollution threaten sustainability; this requires improved data collection, stronger regulations and governance to restore balance and protect long-term water security.

3

Five pathways to water resilience

How can the private sector and multi-stakeholder collaborations mobilize to build water resilience?

Action along five pathways can help deliver on the two focus areas for water resilience identified in the previous chapter (see Figure 6). Although these pathways outline an ambition that will take time to materialize, steps can be taken today, particularly when it comes to collaboration between stakeholders and the private sector.

FIGURE 6 **Five pathways to water resilience**

Pathway 1

Holistic water valuation

> Appropriate water pricing mechanisms are key stepping stones towards the creation of water markets to support the resilience of water systems.

Where we want to get

Societies, companies and global leaders will recognize the value of the water cycle, so it is reflected in policy-making, water strategies and investment decisions.

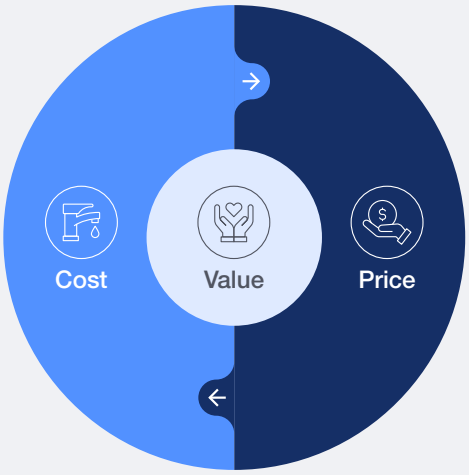
Water valuation involves recognizing and accounting for the numerous benefits that well-functioning water cycles provide across economic, social and ecological systems, including in adapting to and mitigating the impacts of climate change (e.g. managing floods, recharging aquifers, resisting droughts). Holistic water valuation, considering its value, cost and price, plays a key role in channelling decisions and building the business case for critical developments around water circularity as well as energy and data infrastructure with low water intensity.[60]

In this context:

- The **cost** of water must be clear and account for the full financial costs associated with its sustainable supply and use, as well as all long-term impacts from water use on the environment, society and future generations.
- The **price** of water must reflect its cost and the value of the full hydrological cycle, efficiently representing demand and supply interactions as well as leading to a just and efficient allocation, while allowing for the full cost recovery of water supply and water conservation.

Appropriate water valuation and water pricing mechanisms are key stepping stones towards the creation of water markets to support the resilience of water systems (Figure 7), as acknowledged by the recent work of the GCEW.[61] These mechanisms engage stakeholders, both public and private, in a dialogue; collaboration is needed to design efficient markets, while preparing them for the implications of such markets being established for businesses, society and the environment.

FIGURE 7 **Water valuation elements**



Cost: The total costs associated with providing and using water, accounting for all inputs and externalities

Value: Total benefit derived from water, reflecting how water is important to and used by all humans and the environment

Price: Amount paid for a given quantity, accounting for full cost recovery, efficiency, equity & justice and water conservation

> Pricing of water must integrate critical stakeholders such as farmer organizations and irrigation districts, industry and manufacturers, as well as water utilities and local governments.

Where to start

Multi-stakeholder collaboration

Build international consistency in collecting, sharing and using economic, environmental and social data through globally recognized methods to value and cost water cycles accurately. To value the full cost of water appropriately requires data on different aspects of water:

- Economic (e.g. real-time pricing, extraction, treatment, distribution, provisioning costs).
- Environmental (e.g. ecosystem services valuation, biodiversity impacts).
- Social (e.g. accessibility, equity, public health).
- Given the interconnectedness of water use, data-gathering efforts require coordination among stakeholders.

Articulate a globally relevant framework, with clear links to nature and climate agendas as well as economics. Water is often perceived as abundant and inexpensive. The international community must build globally recognized frameworks to articulate the economic and societal value of water and help explain their relevance to nature and climate agendas. Initiatives such as the Valuing Water Initiative[62] and Ceres[63] are already building the tools to support these efforts.

Mobilize multiple stakeholders, including international organizations, regulators, water suppliers and communities, among others, to pilot and scale-up the use of tools and methods. Mainstreaming of approaches can be accelerated by building consistency across multi-stakeholder platforms that guide water pricing at different levels. Good principles for pricing water can be developed at a global level, but their application to local settings needs to be context-specific. Pricing must therefore integrate critical stakeholders such as farmer organizations and irrigation districts, industry and manufacturers, as well as water utilities and local governments.

Private sector lead

Quantify the value of water and risk at the corporate level and across the supply chain. Doing this can help build the business case for action versus inaction. It can reinforce the case for increasing water resilience and encourage the deployment of measures to enhance the prevention of and response to water-related shocks and stresses across supply chains (e.g. droughts and floods), which have been identified by corporations as key drivers of negative water-related business impacts.[64]

Accelerate data collection to establish the true cost of water for a company. This should account for future trends around water supply and demand. Companies can take steps to collect water internally and along their value chains to understand how valuable water is to their business. Existing tools, such as the World Business Council for Sustainable Development's (WBCSD) guide[65] outlining water valuation techniques for business applications,[66] and Veolia's "True Cost of Water" tool which monetizes "blue risks", provide a step in this direction.[67]

Set internal water pricing to inform decision-making. Companies can quantify the monetary value of water to business, reflecting factors such as the benefits of improving water quality, efficiency and securing water supplies[68] and the risks of inaction.

TABLE 1 **Existing tools and frameworks that could support Pathway #1**

Name	Description
Valuing Water Initiative	A global effort aiming to integrate the diverse values of water into decision-making processes to achieve sustainable water security. It offers a series of tools that promote a better understanding of the value of water, including: **Value maps**: visual aids that help identify the multiple values of water from various perspectives. **Value conversation game**: an interactive tool designed to facilitate discussions among stakeholders, enabling the reconciliation of differing values related to water. **Systemic change tool**: a resource aimed at helping users comprehend complex water systems and implement systemic changes effectively. **Constellations methodology**: a technique used to visualize and analyse intricate situations or challenges in water management, fostering new insights and perspectives.
Ceres: The Global Assessment of Private Sector Impacts on Water	A comprehensive scientific review and analysis of industry impacts on freshwater resources, helping investors understand how they can engage companies and the industries that they invest in to halt the systemic harm these sectors are causing.
Ceres: Valuing Water Finance Initiative Benchmark	The benchmark is designed to assess and guide companies on water-related financial risks and sustainability performance. It helps investors and companies understand the financial implications of water management and encourages businesses to align with sustainable water practices.
WWF: Water Risk Filter	A corporate and portfolio-level screening tool to help companies and investors to prioritize action on what and where it matters the most to address water risks for enhancing business resilience and contributing to a sustainable future.
WBCSD: Business Guide to Water Valuation	A guide explaining key concepts and techniques associated with water valuation for business applications. The approach includes qualitative valuation (descriptive), quantitative valuation (based on physical units or indicators), and monetary valuation (determining actual money values). The guide underscores that valuations can vary depending on the objectives and context of each assessment and can include categories such as off-stream values, in-stream values, groundwater values, hydrological services, non-water impacts and extreme water-related events.

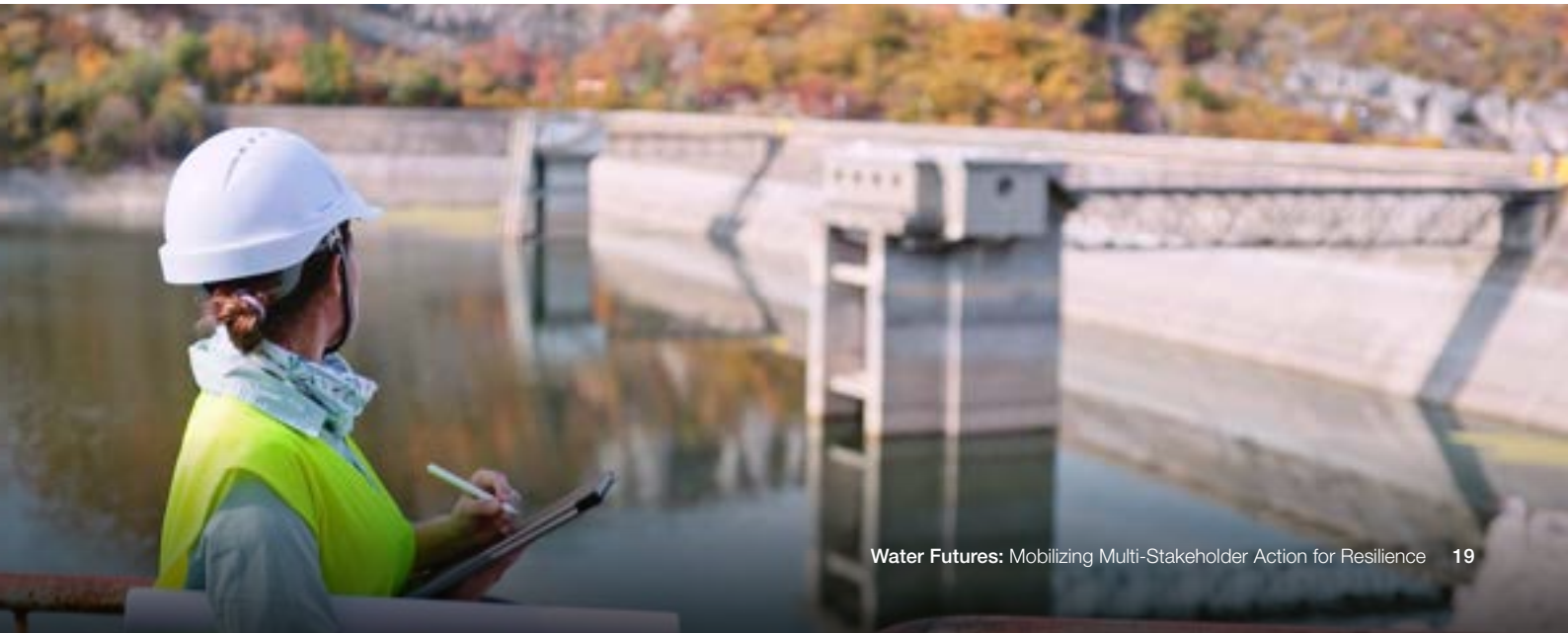
Inspiring examples of collaborative action

Zurich Insurance's new methodology to reflect and assess risk and resilience.

Investor-led engagement to increase transparency on the value and importance of water across the value chain, coordinated by Ceres and FAIRR.

Carbon Disclosure Project's (CDP) true cost of water valuation.

See Appendix for these case studies.



Pathway 2

Fit-for-purpose finance

By joining forces, financial players can leverage their diverse strengths and risk appetites to align, stack and deploy finance to key areas of water resilience.

Where we want to get

Various types and sources of finance are available for water resilience. Governments and leaders set priorities for water resilience investments in partnership with multiple stakeholders and access to suitable programmatic- and portfolio-based sources to finance water.

This approach encourages industries and communities to adopt sustainable, locally relevant water management practices, ensuring that scarce water resources are allocated more effectively and equitably and that climate risks are sufficiently accounted for.

The next generation of finance should include terms and rates of return suited to the long-term horizon of resilience-building efforts, alongside more diverse sources of income that capture co-benefits and avoid losses. Multiple financial and private actors, including philanthropic organizations, must help shape a new generation of financial mechanisms that address various risks across different project types – from infrastructure development to technology innovation – and at every phase, from early project identification to implementation and maintenance.

By joining forces, financial players can leverage their diverse strengths and risk appetites to align, stack and deploy finance to key areas of water resilience, including food systems transition, the circular economy and addressing the lack of access to safe water in vulnerable communities.[69]

FIGURE 8 **Fit-for-purpose finance**

Where to start

Multi-stakeholder collaboration

Identify and develop a portfolio of projects requiring investment to facilitate the involvement of international and private capital. Actors who want to invest in water can struggle to identify opportunities for engagement, according to stakeholder consultations. With this in mind, authorities, in collaboration with infrastructure operators, the private sector, NGOs and innovators can direct their efforts to create portfolios of projects that require investment.

Portfolios can include the segmentation of projects based on the roles of different investors across the asset's or project's life cycle, reflecting how various investors, with different risk appetites and return expectations, can participate in and benefit from water-related projects at different stages of development and operation.

Projects could also be identified following existing methodologies to facilitate the quantification of benefits, requiring multi-stakeholder collaboration.

> Water-related green bonds grew 30 percentage points faster than the overall green bonds market from 2020 to 2023.

Collect and share data to enable the tracking and evaluation of investment and financing needs in water resilience. The portfolio of projects would require provisions for data collection to ensure impact monitoring and assessment as well as to enable timely infrastructure maintenance and upgrades.

Stack up and streamline different types of finance to structure innovative market mechanisms and create investment opportunities at different scales. Public finance can target projects requiring long-term investment and patient capital to bridge financing gaps. Such finance can also attract private capital, through first-loss guarantees, concessional finance elements for lower-income countries, and co-investment arrangements to manage risks.

Collaboration with tech firms and water suppliers can enhance expertise sharing, benefiting investors new to water resilience. Collaboration could lead to innovative mechanisms, adapted from climate and nature instruments, to support freshwater ecosystem protection and restoration – for example:

- *Ecosystem value-based instruments*: sustainable use fees, payments for ecosystem services and insurance discounts for activities promoting water resilience, monetizing ecosystem services while targeting self-sustaining returns.
- *Water credits*: modelled after carbon and biodiversity credits, offering alternative revenue streams for suppliers and enabling large-scale project financing.
- *Water savings certificates*: inspired by the EU's energy efficiency certificates, these certify water savings from efficiency measures, with potential for a trading market to boost ROI on such projects.

Develop collaborative policies, regulations and standards that balance supply- and demand-side measures to foster sustainable water resilience investments. Examples include:

- *Supply-side measures*: grants, subsidies, tax breaks and mandates to promote investment in water reuse, desalination and efficient water use in industries, securing sustainable financing and resilience.
- *Demand-side measures*: pricing water to reflect its true value and offering incentives for private investments, large-scale adoption of conservation technologies and community education to drive behavioural change.
- *Utilities' governance*: transitioning utilities from local government departments to independent agencies for stronger governance and financing capacity. With 85% of utilities serving under 10,000 people,[70] addressing subscale cost-efficiency challenges requires continued dialogue and collaboration between governments and relevant stakeholders.

Private sector lead

Collaborate with other organizations, including utilities, government agencies, large private sector water consumers, insurers and innovators, to better understand water-related risks, share and gain expertise in investing in water, and identify opportunities.

Scale-up capital according to risk appetite and specialization:

- *Banks, insurers and pension funds* can focus on scaling-up existing innovative mechanisms (e.g. bonds) and mainstreaming the adoption of tools to understand water risk. Green bonds[71] are growing within the sustainable finance space,[72] and water-related green bonds specifically grew 30 percentage points faster than the overall green bonds market from 2020 to 2023, while water-related loans have grown 17 percentage points faster than sustainability-linked syndicated loans during the same period.[73]
- *Venture capital and private equity* can finance disruptive technologies and scalable solutions, while investing in market consolidation to address fragmentation in the water sector.
- *Impact investors* can provide patient capital for long-term, high-impact water projects, supporting resilient infrastructure and conservation.
- *Philanthropists* can offer financial support and strategic partnerships necessary to help catalyse water stewardship initiatives, while supporting innovative and experimental approaches and community-led initiatives.

TABLE 2 | **Existing tools and frameworks that could support Pathway #2**

Name	Description
International Finance Corporation (IFC): Guidelines for Blue Finance	Guidance for financing the blue economy, identifying eligible blue project categories to guide IFC investments to support the blue economy in line with the Green Bond Principles and the Green Loan Principles.
World Bank: 2030 Water Resources Group	This public, private, civil society partnership, incubated at the World Economic Forum and now hosted by the World Bank Group, drives systemic change and advances transformative leadership of institutions on water stewardship.
World Bank: Scaling Up Finance for Water	The strategic framework presented in this 2023 publication is the first concerted effort by the World Bank (including IBRD, IDA, IFC and MIGA) to jointly engage on programmatic- and project-level opportunities in the water sector, with the aim of unlocking private sector expertise, innovation, and capital.
Organisation for Economic Co-operation and Development (OECD): Financing Water: Investing in Sustainable Growth Water investment planning and financing	OECD's publications outline financial mechanisms and innovative investment strategies for water security, as well as approaches for mitigating water-related finance challenges.
Climate Policy Initiative (CPI): Global Landscape of Climate Finance (annual report)	CPI tracks climate financial flows, including for water and wastewater, providing analyses of public and private finance for water security, climate adaptation and resilience.
Meridiam: The Urban Resilience Fund	The fund, launched in partnership with The Rockefeller Foundation and the UN Capital Development Fund (UNCDF), offers a framework for deploying blended finance for climate adaptation.
World Water Council: Blended Finance in the Water Sector	The report provides an overview of the attributes that make blended finance for water projects successful.
Pacific Institute: A Multi-Benefit Approach to Water Management	A structured framework that enables water managers to systematically identify, evaluate and communicate the diverse benefits and trade-offs associated with water management decisions. This comprehensive approach enhances the attractiveness of projects to potential funders and stakeholders by highlighting multiple advantages, thereby broadening support and opening avenues for co-financing.

Inspiring examples of collaborative action

Water.org's WaterCredit loan programme for water and sanitation.

Partnership between ACEA (Italy's national water utility) and Intesa Sanpaolo (ISP) to improve water resource financing and management.

Water Funds for scalable investment opportunities across water resilience – a collaboration between The Nature Conservancy (TNC), Coca-Cola Company, Fundación

FEMSA, Global Environment Facility, Inter-American Development Bank and International Climate Initiative (IKI).

Collaboration between the International Finance Corporation (IFC) and Bank of Ayudhya to provide financing, services and guidelines to support the emerging sector of blue finance.

See Appendix for these case studies.

Pathway 3

Sustained basin-level partnerships

> Each actor can serve as a custodian, sharing water stewardship and responsibilities in the basins where they source resources, live, operate and benefit.

Where we want to get

Collaborative models and partnerships are broadly adopted and scaled-up at the basin level to ensure systemic, long-term impact on how water is used and managed.

These partnerships can be leveraged to enable and mainstream the development and implementation of comprehensive basin-level strategies. These strategies will support the equitable, adaptive, and appropiate allocation of water resources while ensuring the long-term preservation of groundwater and freshwater ecosystems.

Basin-level strategic plans can be effectively co-developed through the engagement of diverse stakeholders, including the private sector, government organizations, knowledge partners and local communities. Supported by a portfolio of projects within a strategic plan, each actor can serve as a custodian, sharing water stewardship and responsibilities in the basins where they source resources, live, operate and benefit.

Critical to the long-term impact of these partnerships is the development of processes to ensure their sustainability once they are well established and reach maturity. Considering how to institutionalize them in a locally relevant manner, including ensuring financial stability, is essential to their success. Special emphasis should be placed on areas traditionally outside the remit of private sector action, including supporting food systems transformation and the conservation and restoration of natural habitats to protect green water.[74]

FIGURE 9 **Basin-level strategies**

> Coordinated and integrated basin action can make companies more resilient and efficient.

Where to start

Multi-stakeholder collaboration

Accelerate and scale-up partnerships that have water conservation at the basin level as their scope of action, breaking down siloes and convening multiple stakeholders around shared goals. In many cases, basin-level management could require an integrated transboundary approach, ensuring international cooperation and partnerships. Initially these partnerships will naturally attract leaders and early adopters in specific basins, yet achieving scale should remain a short- or medium-term objective.

Build cross-sectoral trust and collaboration across stakeholders, through transparency, data and effective communication. Promoting dialogue and information exchange between relevant stakeholders at the basin level can reinforce a sense of trust, ensure transparency and improve collaboration. This should include transparent data-sharing platforms among government, private sector and civil society actors, as well as effective communication strategies to guide citizens on day-to-day stewardship.

Engage farmers and rural communities to empower them with best practices for water management in agriculture. This should include not only information-sharing and training but also promoting and supporting the adoption of technologies that enable highly efficient water use in agriculture (e.g. alternate wetting and drying (AWD) in rice cultivation or micro-irrigation), improving soil health and implementing approaches to maximize biodiversity in landscapes and rural settings.

Develop shared metrics for defining and measuring success and collective benchmarking at the basin level, to enable effective data governance and monitoring for evidence-based water management. Establish measurable goals for water management (e.g. water quality, availability, equity), to align and coordinate stakeholders, ensuring accountability and enabling the early identification and communication of challenges. This can be facilitated through participatory approaches, to tackle the current fragmentation and lack of water data.

Strengthen basin-level anchor institutions and build capacities to empower stakeholders and coordinate water management efforts. Provide stakeholders with the technical, financial and management capabilities required for effective water management at the basin level to respond to increasing water challenges. This can improve transparency, inclusivity, accountability and conflict resolution over water use, recognizing the value of all water resources.

Private sector lead

Assess the company's water footprint at the basin level, by collecting data following existing methodologies and standards.Examples include:

- *Water Footprint Assessment Tool*, developed by Water Footprint Implementation and the Water Footprint Network (WFN).[75]
- WFN's *Assessment Manual* provides a comprehensive set of definitions and methods for water footprint accounting, covering individual processes, products, consumers, nations and businesses.[76]
- *ISO 14046: Water Footprint Standard*, specifying principles, requirements and guidelines for conducting and reporting a water footprint assessment of products, processes and organizations.[77]

Promote the implementation and widespread adoption of standards across value chains as well as basin- and sub-basin-level partnerships. Such standards can serve as a foundational step towards scaling-up water stewardship. Examples include mechanisms such as ISO for water management at the farm level.

Raise ambition of corporate stewardship plans to the basin level. Water management efforts in the private sector can be strengthened and advanced by empowering corporates to minimize risks and negative environmental impacts, and to drive innovation in water-related data, tools and strategies at the basin level. Coordinated and integrated basin action can make companies more resilient and efficient, improve planning and enable cost-sharing and economic integrity.

TABLE 3 | **Existing tools and frameworks that could support Pathway #3**

Name	Description
Volumetric Water Benefit Accounting (VWBA)	A standardized methodology and set of indicators that helps calculate and communicate the volumetric water benefits of corporate water stewardship activities. VWBA has been adopted by several companies to meet their corporate or site water replenishment targets, including, among others, Meta, Microsoft, Cargil, Coca Cola.
International Water Management Institute (IWMI): Data & Tools	IWMI has published a rich set of databases that help explain the status of freshwater ecosystems and climate water phenomena (e.g. droughts, floods) that can be used to guide basin-level action.
Water Footprint Network: The Water Footprint Assessment Manual	This manual provides a standardized methodology for measuring and analysing water consumption and pollution across industries, products and regions. It helps businesses, policy-makers and organizations to assess the environmental impacts of their water use and to improve water management strategies.
Water Footprint Network: The Water Footprint Assessment Tool	This tool offers a practical, interactive platform to apply the methodology for calculating and mapping a company's water footprint, assess its sustainability, and identify strategic actions to improve the sustainability, efficiency and equitability of water use.
International Organization for Standardization: ISO Standards	The ISO has published over 550 standards related to water, tackling issues such as service management of drinking and wastewater systems, water supply during crisis situations, irrigation, quality and conservation (e.g. hydrometry, quality sampling, water footprint) and infrastructure (e.g. pipes, valves, metering).
UN Global Compact, CEO Water Mandate: Water Action Hub Water Stewardship Toolbox Water Resilience Coalition (WRC)	These platforms offer digital resources that support water stewardship (including a library of best practice) and help organizations find partners for water stewardship projects at the basin level. The toolbox centralizes access to tools, guidance, case studies and datasets. WRC provides, among other things, a global list of priority basins for collective action.
Ecolab: Smart Water Navigator	An online tool helping organizations optimize water use to increase business resilience. Companies can use the tool to build a strategic water management plan to safeguard growth in any water basin.

Inspiring examples of collaborative action

Danube Partnership – collective action at the basin-level to address watershed health, a collaboration between WWF and the Coca-Cola Foundation.

Partnerships between PepsiCo and multiple stakeholders to deliver on water stewardship ambitions.

Water Resilience Coalition (WRC) – partnership and financing to advance water action from businesses at the basin level.

California Water Resilience Initiative – private sector-led initiative to accelerate collective action to achieve water resiliency for California.

See Appendix for these case studies.

Pathway 4

Adaptive water governance

Where we want to get

The governance of freshwater resources is appropriate for local culture and institutions, capable of long-term planning and able to adapt in a timely manner at times of uncertainty and risk.

Based on a consultative and evidence-based approach, water governance can integrate tools and mechanisms that enable preventive and responsive action to growing uncertainty and evolving risk.

Water governance should be integrated consistently across different scales and build links with non-government actors. Decision-making processes should consider the needs and perspectives of multiple stakeholders and prove resilient to political cycles and change as the water cycle evolves. From city to state to national levels, water governance should reflect the reality that the hydrological cycle goes beyond administrative boundaries and that communities, regions and nations are interdependent in their use of water resources.

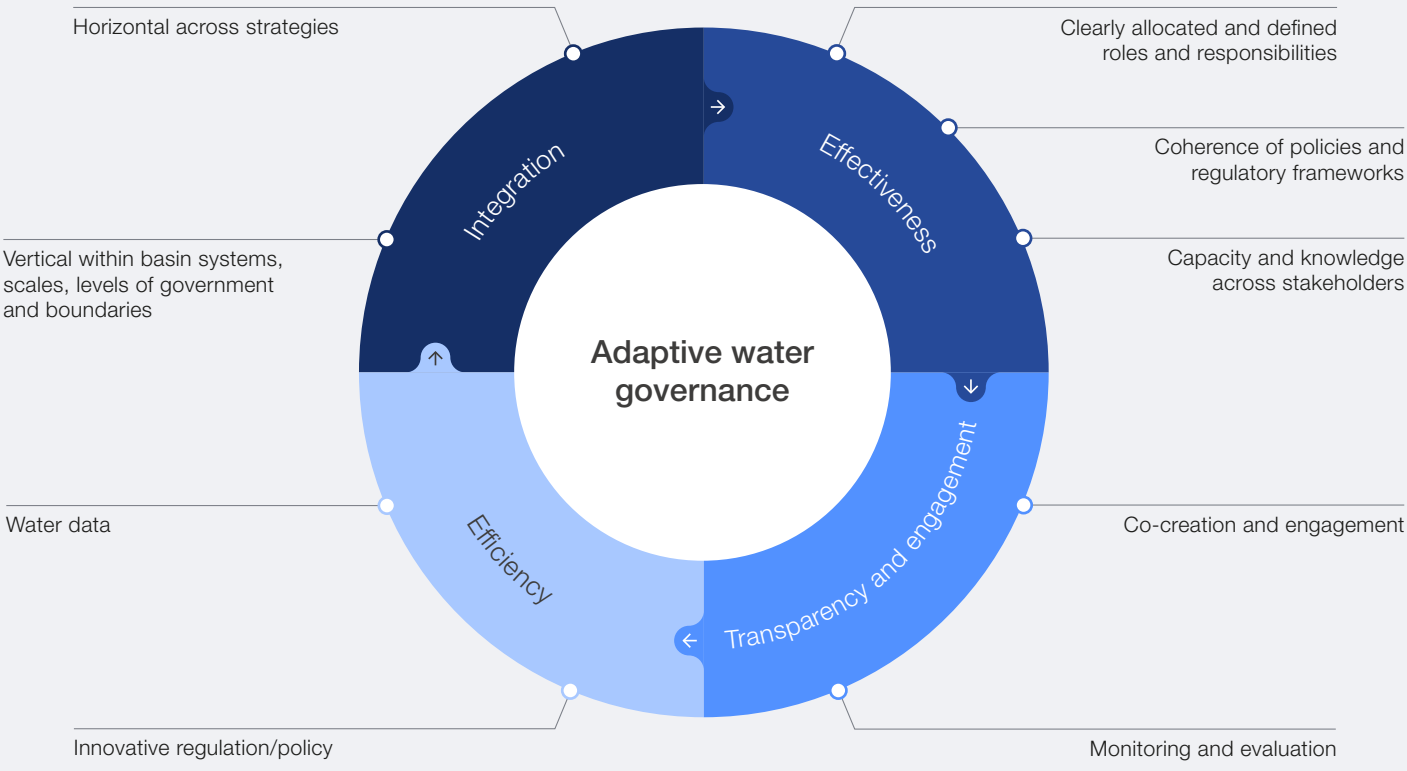
Future water governance should engage multiple stakeholders, institutional actors and local communities to foster inclusive decision-making at every level. Integrated governance enables agility, as water impacts are hyperlocal but require large-scale coordinated efforts. Such a multi-scale approach can simultaneously support key global missions, including sustaining and restoring natural habitats, establishing a circular water economy, and minimizing water intensity in emerging energy and data infrastructure.[78]

Where to start

Multi-stakeholder collaboration

Co-create a strategic plan that enables horizontal and vertical integration of water governance (see Figure 10). Such a plan should adopt a resilience-based approach to water resource management. Inspired by essential work undertaken by the Organisation for Economic Co-operation and Development (OECD) in **2015 and the Global Commission on the Economics of** Water (GCEW) in 2024, water governance proposals should consider the value of the hydrological cycle as a whole.

FIGURE 10 **Key principles of adaptive water governance**



Source: Adapted from OECD. (2015). *OECD Principles on Water Governance. Centre for Entrepreneurship, SMEs, Regions and Cities.*[79]

> Water governance should be no longer siloed but fully embedded into climate action plans and other development strategies across industries and sectors, including urban development plans.

Support institutions in integrating water governance horizontally by positioning water resilience as a core principle of national security and local resilience issues. This means addressing fragmentation and coordination failures and integrating water resources management within broader strategies and sector development agendas. Water governance should be no longer siloed but fully embedded into climate action plans and other development strategies across industries and sectors, including urban development plans.

Support institutions in integrating water governance vertically by co-designing consultative platforms and tools at the appropriate level and scale within basin systems and effectively coordinating across levels of government and administrative boundaries. Capacity building for local professionals, institutions and partnerships is a key challenge that multi-stakeholder collaboration can help address. The participation of social representatives, including youth, Indigenous groups and campaigners, plays a critical role in building awareness of essential water issues and building more comprehensive perspectives.

Ensure that water data and risk management tools and mechanisms play a key role in the water governance system to enhance transparency, accountability and the integration of local knowledge. Effective and adaptive water governance should be inclusive, data-driven and information-based, enabling stakeholders to make informed decisions about water management, risk management and multi-stakeholder dialogue. Avoiding the compartmentalization of data and decision-making is essential for developing comprehensive approaches. This requires integrating not only data on surface water but also other components of the hydrological cycle, including groundwater, green water and key management variables such as land tenure, water rights and climate projections.

Build capacity, knowledge and awareness across levels of government and local communities. This can help ensure that flexibility and agility are built in to water management programmes. Strategies and frameworks should be created to foster learning, education and awareness-raising among water-focused institutions and other stakeholders.

Private sector lead

Integrate water governance within the broader corporate strategy. Companies are increasingly appointing dedicated roles to water. Water considerations and strategies should not be siloed but made core to a company's overall strategy, including supply chain management and technology investments.

Collect and disclose company water-related data to facilitate water governance. Data collection at the company level can help companies better engage with water governance, as it creates transparency about companies' water needs and uses.

Establish a private sector association or mechanism that brings together key private sector actors, particularly large water consumers. This would facilitate more effective participation in basin-level governance and partnerships. By ensuring legitimacy and a deep understanding of private sector needs, such a collaboration could proactively participate in multi-stakeholder processes.

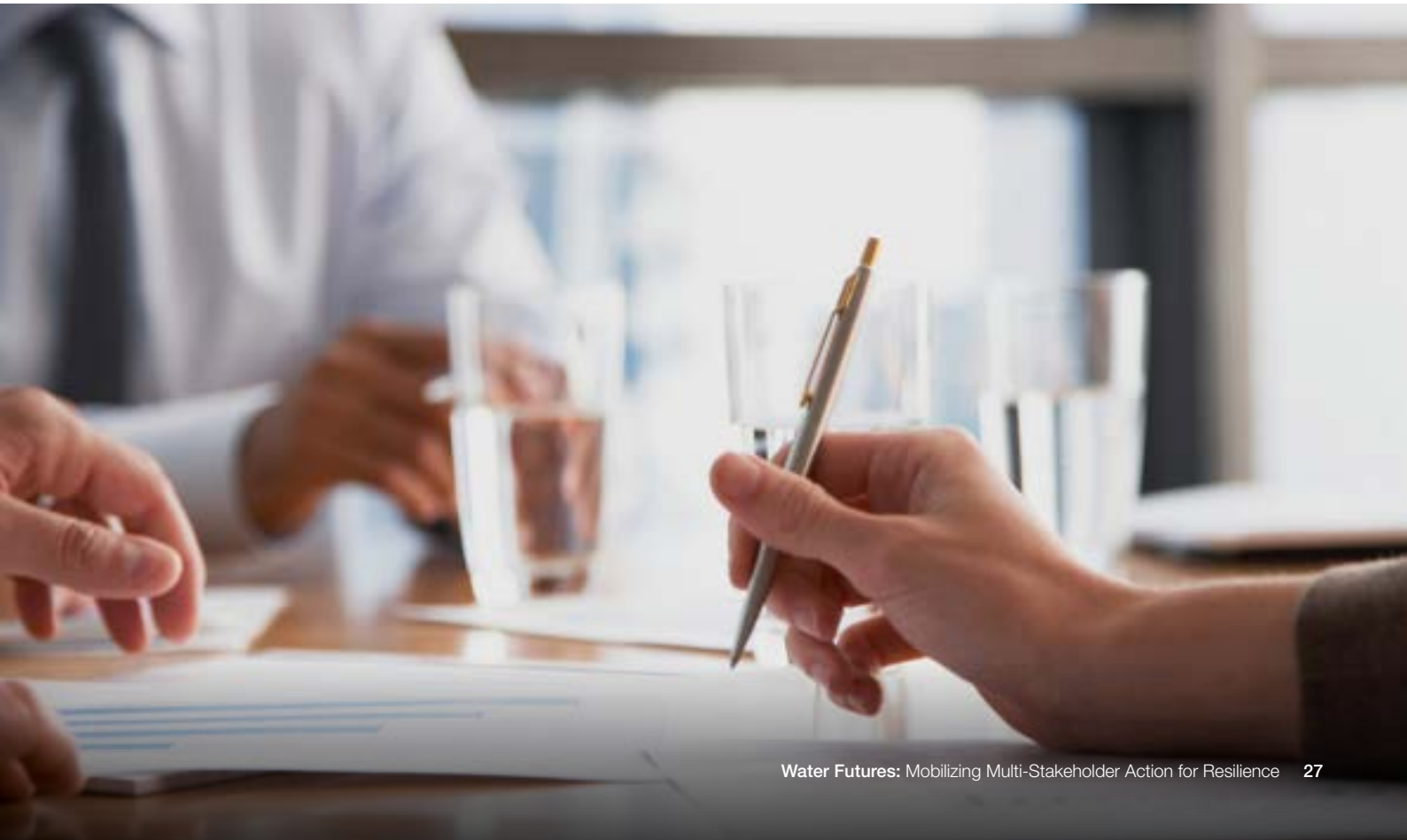


TABLE 4 **Existing tools and frameworks that could support Pathway #4**

Name	Description
The OECD Principles on Water Governance	A set of guidelines designed to promote effective, efficient and inclusive water governance at national, regional and local levels. These principles aim to enhance decision-making, foster sustainable management of water resources and ensure equitable access to water for all.
UN Development Programme (UNDP): What Works in Water and Ocean Governance	This report provides examples of successful water and ocean governance case studies from UNDP's water & ocean governance portfolio.
Arup: City Water Resilience Approach	Arup presents a framework for building water resilience in urban settings, comprising five key steps from stakeholder engagement and baseline assessment to action and implementation planning.

Inspiring examples of collaborative action

Partnership for integrated water governance and climate adaptation – a collaboration between Xylem and the South Bend water utility, Indiana, US.

Arup's innovative approach to facilitate decision-making in urban water management – a collaboration between Arup, Rockefeller Foundation, The Resilience Shift and Stockholm International Water Institute (SIWI)

See Appendix for these case studies.

Pathway 5

Collaborative policy-innovation nexus

Innovators play a core role in driving water resilience by developing solutions to achieve policy goals.

Where we want to get

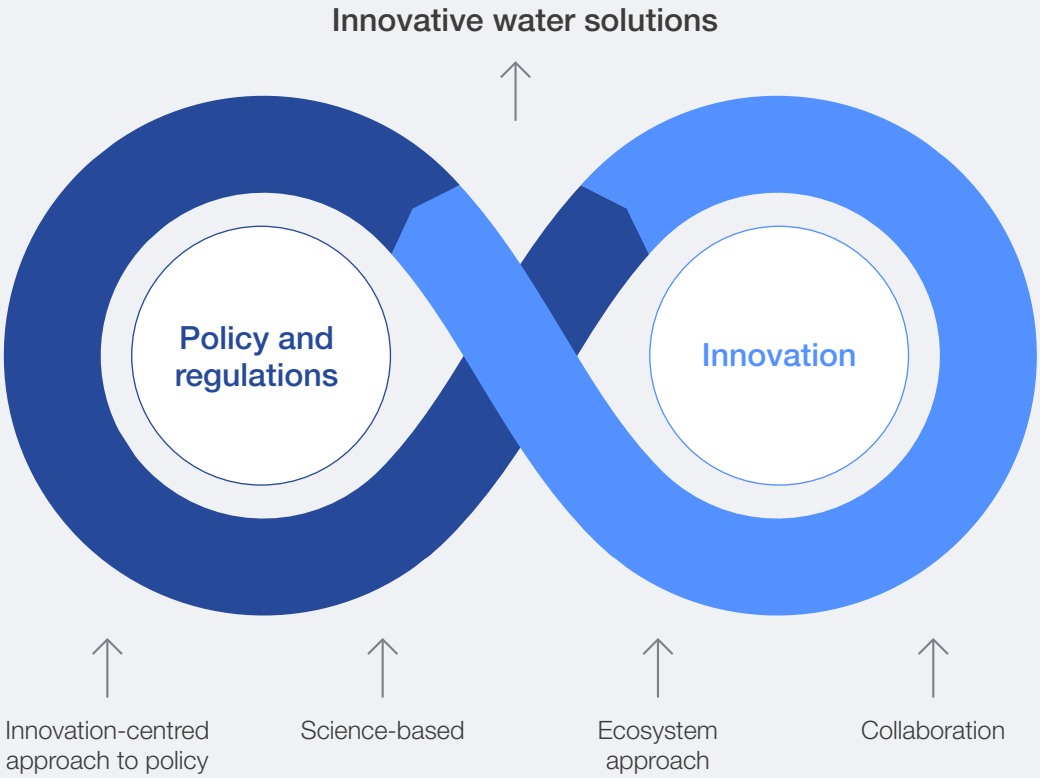
Policy and innovation advance in sync to enable the piloting, development and large-scale deployment of innovative solutions that promote water conservation, while preparing nations, regions and communities for water scarcity, flooding and pollution.

Grounded in robust scientific evidence and the experience of local and international practitioners and experts, policy and regulations can be both robust and adaptable, evolving as innovations demonstrate their impact or as environmental conditions change. Innovators play a core role in driving water resilience by developing solutions to achieve policy goals. However, policy frameworks must enforce public health requirements and promote the adoption of relevant innovations.

Global frameworks can inspire and drive local governments to develop innovative water management strategies by encouraging adaptable policies and fostering collaborations. Establishing agile, science-based frameworks to simultaneously protect public health and promote innovation can create the necessary environment to accelerate the urgent adoption of circular water economy principles and low water intensity solutions for emerging energy and data infrastructure.[80]

The aim of this pathway is to foster collaborative approaches to build better alignment so that policy is no longer a barrier to water innovation but an enabler of safe, affordable and equitable solutions.

FIGURE 11 **Collaborative policy-innovation nexus**



Where to start

Multi-stakeholder collaboration

Develop policy frameworks that put innovation at the centre of water resilience objectives. For the water sector to thrive and adapt to future challenges, policy-makers need to actively encourage and support innovation by providing clarity on policy objectives and coordination. This means deploying policy instruments that permit experimentation and innovation.

Co-create a robust science-based body of evidence and advice to guide the development, piloting and widespread adoption of innovative water solutions. This requires a policy environment that not only enables the deployment of existing and tested solutions, but also incentivizes the testing, piloting and acceleration of innovative technologies. Tested solutions can include electro-ceramic desalination technology or nanobubble technology to optimize water usage, improve crop health and support environmental rehabilitation, among other things.

Innovations can include:

- Rainwater and stormwater harvesting (e.g. sustainable groundwater recharge systems that capture and store rainwater).
- Modular, nature-based technologies that enable sites or facilities to be water- and climate-efficient.
- Membrane crystallization or reverse electrodialysis, for improved brine management.
- Technologies harnessing energy generated from wastewater treatment (e.g. thermal hydrolysis or microbial fuel cells).
- Critically, the perspectives and needs of water users in agriculture, industrial facilities and urban areas should be engaged in this process. For example, the US's National Blue Ribbon Commission for Onsite Non-potable Water Systems is a collaboration guided by science-based policy recommendations and risk-based science and research, to advance the onsite reuse of wastewater, stormwater and rainwater.[81]

Build an ecosystem conducive to innovation. Policy-makers, in collaboration with the private sector, could create frameworks that remove barriers to technological advancement and provide incentives for the development and adoption of new solutions. This includes providing financial and regulatory support at all stages, from development to deployment, through dedicated incentives and public funding.

Establish collaboration between innovators and policy-makers. The fostering of strong partnerships between policy-makers, industry leaders, utilities and technology innovators helps leverage a collective pool of expertise. Through workshops and collaborations, multi-stakeholder platforms can be formed where innovators can inform policy change, while policy-makers can influence innovators to create solutions aligned with policy priorities. For example, the 50L Home Coalition brings together policy-makers, utilities and technology providers for effective discussions on transformative strategies and policies.

Private sector lead

Engage with policy-makers to learn about strategic priorities for water. Such priorities should consider which innovative technologies are needed.

Form partnerships for the co-creation of innovative solutions. Tech companies can partner with water suppliers and users to test and deploy solutions at scale.

TABLE 5 **Existing tools and frameworks that could support Pathway #5**

Name	Description
Water Europe: Water Innovation Europe 2024 Policy Report	This report provides a framework for achieving a water-smart Europe. It offers key strategic guidelines and recommendations aimed at enhancing water management, sustainability and resilience across the continent.
National Blue Ribbon Commission for Onsite Non-potable Water Systems: Highlights and Accomplishments; A Guidebook for Developing and Implementing Regulations for Onsite Non-potable Water Systems	The Commission's publications provide research and guidelines supporting the adoption of onsite non-potable water systems. The Guidebook provides a framework for developing and implementing policies, regulations and local programmes.
UN Water: UN-Water Innovation Task Force	Ongoing work to develop recommendations for advancing the innovation accelerator for water.
50L Home Coalition	This public-private collaborative hosted by WBCSD and the World Economic Forum explores, co-develops and scales-up net-zero water efficiency solutions in urban households.

Inspiring examples of collaborative action

Targeted financing, multi-stakeholder collaboration and policy frameworks to drive innovation and resilience in Singapore's water and affiliated sectors – in a collaboration between Singapore's National Water Agency (PUB) and National Environment Agency.

Aquapreneur Innovation Initiative by UpLink and HCL Group to accelerate progress on the water innovation agenda.

San Francisco advances water resilience and circularity through partnerships, policy dialogues and innovations, in a collaboration between San Francisco Public Utilities Commission (SFPUC), National Blue Ribbon Commission, Water Environment & Reuse Foundation, Water Research Foundation and Epic Cleantec.

See Appendix for these case studies.

Call to action

Water systems are near a tipping point. Now is the moment for collaboration to build a more resilient future for the water systems on which all societies and businesses depend.

Many opportunities exist to shift the unsustainable trajectory of water systems today and make them more resilient. The growing importance of water in the global agenda has created momentum and opportunity for public and private actors to act now. The landmark report by the Global Commission on the Economics of Water (GCEW) points to where action should be prioritized.

This white paper marks a step towards putting the proposals of GCEW into action, by mobilizing private sector and multistakeholder platforms such as the private sector and multi-stakeholder platforms such as the Forum's Water Futures Community. Further efforts by the Forum and its members will continue to advance the global water resilience agenda through thought leadership, innovation, collaboration and partnerships.

The Water Futures Community will develop the pathways towards water resilience presented in this report through a series of dedicated working groups. Members of the Forum, from all industries, are invited to take part in this work.

Appendix: Case studies

Pathway 1

Holistic water valuation: case studies

CASE STUDY 1

Zurich Insurance's methodology to help public and private organizations assess risk and resilience

Organization: Zurich Insurance.

Description: Zurich Resilience Solutions (ZRS) has developed a new methodology, which helps uncover climate risks until the year 2100 and can be used to assess risk and resilience. The methodology can be used by businesses, municipalities and other public entities to generate knowledge and insights for developing and implementing an action plan for increasing resilience and then evaluating and adapting this plan on an ongoing basis. By leveraging climate data, it can be used to create heat maps or other risk quantifications for data-driven and future-orientated analytics.

Modelling climate risks and mapping them in specific contexts is key to understanding which interventions are required to increase resilience, as well as determining the value derived from these interventions. Assessing risk and resilience is essential for insurance and for informing investment decisions, especially with water infrastructure, which is expected to be increasingly exposed to risks from climate change.

Source: See endnotes.[82,83]

CASE STUDY 2

Investor-led engagement to increase transparency around the value and importance of water across the value chain

Organizations: Co-ordinated by Ceres and FAIRR.

Description: In 2019, global investors representing more than $6.5 trillion in combined assets urged six of the world's largest fast-food companies (Chipotle, Domino's, McDonald's, Restaurant Brands International, Wendy's, Yum!) to take action to mitigate climate and water risks in their meat and dairy supply chains. To ensure resilience across their supply chain, these investors requested companies to: (1) develop strong supplier policies on climate and water risks, (2) set science-based targets (SBTs) to lower their greenhouse gas emissions, (3) improve their water use and (4) perform climate-related scenario analyses to understand risks and opportunities for their operations and businesses.

A year after the launch of this investor engagement, the second phase of the initiative aims to continue dialogue with the six companies, with the added support of an expanded coalition of more than 90 investors, now totalling $11.4 trillion in combined assets. These discussions and engagements have enabled investors and companies to increase transparency and reporting around water, to better understand its true value and to appreciate what is at risk.

Source: See endnote.[84]

CASE STUDY 3

CDP's true cost of water valuation

Organization: Carbon Disclosure Project (CDP).

Description: In 2022, 16% of companies (3,909 total) responding to CDP's questionnaire reported setting an internal price for water, to reflect more accurately the costs of water provision. These companies were mostly from the energy, materials, food and beverage and agriculture sectors. Despite water generally being undervalued, some companies are increasingly realizing the importance of water for their businesses.

Companies with an internal water price reported opportunities related to water efficiency of around $49 million – six times higher than the $8 million reported by companies without internal water prices.

Source: See endnote.[85]

CASE STUDY 4

Scottish Water and Xylem's partnership on using net zero as a catalyst for innovation

Organizations: Xylem and Scottish Water.

Description: Scottish Water is leveraging its net-zero commitment as a catalyst for innovation by optimizing energy use, reducing maintenance costs, and lowering carbon emissions. Partnering with Xylem, the utility is upgrading hundreds of pumping stations with sustainable technology. A smart pumping trial at two pilot sites achieved significant cost savings, including a 99% reduction in unplanned maintenance and a 40% drop in energy use, leading to wider adoption. Through remote monitoring and digital solutions, Scottish Water is enhancing efficiency while advancing environmental and operational goals, demonstrating the sector's potential for sustainable, resilient, and cost-effective services.

Source: See endnote.[86]

Pathway 2

Fit-for-purpose finance: case studies

CASE STUDY 5

Water.org's microfinance loan programme for water and sanitation

Organizations:	Water.org.
Description:	Financial institutions in developing countries often do not offer loans for water and sanitation to those living in poverty. To address this barrier of affordable financing, Water.org has created and scaled-up a solution known as WaterCredit®. Through this initiative, Water.org partners with financial institutions to generate microfinance loans for families who invest in their own water and sanitation improvements. To date, this approach has impacted more than 77 million people, generated 17 million water and sanitation loans and disbursed $6.6 billion in financial capital.
Source:	See endnote.[87]

CASE STUDY 6

Public-private partnership in Italy to improve water resource financing and management

Organizations:	ACEA (Italy's national water utility) and Intesa Sanpaolo (ISP).
Description:	In 2024, ACEA and ISP signed the first national agreement for the protection and sustainable management of water in company production processes. The aim is to develop new systemic initiatives with innovative solutions to encourage efficient water use through technological advisory services and investments for the reuse of purified water. ISP will provide €20 billion ($21 billion)[88] in financing to support company and operators' initiatives in the water supply chain, whereas ACEA will offer technological advisory services to the recipients of the investment.
Source:	See endnote.[89]

CASE STUDY 7

Water funds for scalable investment opportunities across water resilience in Latin America

Organizations: The Nature Conservancy (TNC), The Coca-Cola Company, Fundación FEMSA, Global Environment Facility (GEF), Inter-American Development Bank (IDB), International Climate Initiative (IKI).

Description: TNC has engaged multiple, diverse stakeholders to bring together a variety of funding sources to create investment opportunities in the water sector. These collective funds share key characteristics and drive the implementation of natural infrastructure and innovative projects at the basin level, while offering an attractive mechanism of cost-effective investments in watersheds.

Twenty-five different water funds have been created under the Latin America Water Funds Partnership, with contributors such as Fundación FEMSA, GEF, IDB and IKI. The water funds have involved public and private partners, aiming to catalyse additional watershed investment programmes, focusing on areas such as water conservation.

Source: See endnote.[90]

CASE STUDY 8

IFC's financing, advisory services and guidelines to support the emerging sector of blue finance

Organizations: International Finance Corporation (IFC), Bank of Ayudhya.

Description: IFC offers advisory and investment services and access to concessional finance and guarantees. In doing so, it mobilizes private capital and collaborates with development partners and the private and public sectors to build innovative, market-orientated and long-term solutions to solve infrastructure challenges in the water sector. For example, IFC's Utilities for Climate (U4C) initiative offers access to IFC's investment products, advisory services and a knowledge-sharing global network for participating utilities. U4C can support clients in areas such as preparation of climate change action plans, non-revenue water (NRW) reduction, energy efficiency and improved sludge management.

Moreover, IFC offers several financing products, including debt, mezzanine and equity. IFC's experts can support with the structuring and tendering of concessions, while managing technical, environmental and social risks. Its Scaling ReWater programme can help clients develop wastewater treatments or reuse existing infrastructure while mobilizing public, private and concessional capital.

IFC has also facilitated the issuance of blue bonds in the East Asia Pacific region. For example, in 2023, IFC supported the Bank of Ayudhya in Thailand to issue the first such blue and green bond, subscribing $400 million, of which $50 million will support the development of the Bank's eligible blue assets such as water supply.

Finally, IFC has responded to the emerging sector of blue finance, which offers opportunities to safeguard access to clean water, protect underwater environments and invest in a sustainable water economy. Through financing instruments such as blue bonds and blue loans, IFC has raised and earmarked funds for investments in water and wastewater management. In 2022, IFC published the Guidelines for Blue Finance to facilitate the development of global standards for eligibility criteria for projects, making blue economy financing principles easier to understand by financial institutions, through practical guidance for blue bond issuances and blue lending.

Sources: See endnotes.[91,92,93]

Sustained basin-level partnerships: case studies

CASE STUDY 9

Living Danube Partnership – collective action at the basin-level to address watershed health

Organizations: WWF, The Coca-Cola Foundation (TCCF).

Description: The Living Danube Partnership is an example of collective action, uniting multiple stakeholders including, among others, WWF, the International Commission for the Protection of the Danube River and TCCF. This partnership aims to implement basin-level water management, breaking down silos to achieve the shared goal of improving watershed health in the Danube basin. By engaging decision-makers from politics and business, the partnership promotes a shift in mindset and awareness regarding water stewardship.

The partnership has restored vital wetlands, rivers and floodplains along the Danube and its tributaries, increasing the river's capacity by 12 million m^3 and restoring 53 km^2 of wetland habitat. This initiative was supported by funding from TCCF ($4.4 million), as well as from the EU's LIFE Nature programme, GEF/World Bank and others.

Sources: See endnotes.[94,95]

CASE STUDY 10

PepsiCo's public-private-philanthropic partnerships to deliver on water stewardship ambitions in multiple regions

Organizations: PepsiCo with Inter-American Development Bank, TNC, WWF and others.

Description: PepsiCo has implemented plans to address water risk and resilience at a watershed level and has formed stakeholder partnerships in water-stressed areas to amplify impact and improve broader watershed health. PepsiCo draws on the expertise and local knowledge of multiple partners to deliver on its water stewardship ambitions, including with non-profit organizations, research institutions, developmental experts and collaborative initiatives. Partnerships to drive action at the watershed level have been formed with the following actors:

- Inter-American Development Bank (IDB): a public-private-philanthropic partnership between PepsiCo, the PepsiCo Foundation and IDB for collaborative efforts across Latin America. Its work includes installing water connections for difficult-to-reach rural and dispersed communities in Peru, Mexico, Colombia, Brazil, Guatemala and Honduras. IDB and PepsiCo have also launched a modelling tool called Hydro-BID to help local governments estimate the availability of freshwater in water-scarce regions and to support water budgeting and water-resource planning.
- TNC: a partnership on water stewardship efforts and in implementing projects to achieve PepsiCo's 2030 goal (replenishing back into the local watershed more than 100% of the water used in PepsiCo's high water-risk manufacturing facilities). In 2023, there were 22 active partnerships between PepsiCo and TNC spanning North America, Latin America and Africa, returning over 9 billion litres of water back into local watersheds.
- WWF, Pakistan: a partnership to improve water security near Lahore and Multan, with rainwater harvesting, water recharge interventions and constructed wetlands. This expanded to South Africa in 2021, adding additional programmes in high water-risk watersheds. On a global scale, PepsiCo engaged with WWF to develop a PepsiCo Stakeholder Engagement Guide.

Sources: See endnotes.[96,97]

CASE STUDY 11

CEO-led partnership and financing to advance water action by businesses in water-stressed basins

Organizations: Water Resilience Coalition (WRC) – Ecolab, AB InBev, Starbucks, Gap, Reckitt, DuPont, Diageo, Dow, Microsoft, PVH Corp, The Coca-Cola Company (TCCC), HEINEKEN, Levi Strauss & Co., Woolworths.

Description: The CEO Water Mandate, an initiative of the UN Global Compact, partnered with global companies to launch the WRC, an industry-driven, CEO-led initiative pledging to preserve freshwater resources through collective action in water-stressed basins and setting the following commitments by 2050:

- Deliver net-positive water impact in water-stressed basins, focusing on the availability, quality and accessibility of freshwater resources.
- Develop, implement and enable strategies for water resilient value chains.
- Raise the ambition of water resilience through global leadership.

An example of the WRC's work includes the launch of the WRC Investment Portfolio and the WaterEquity Global Access Fund IV. Five WRC member companies (Ecolab, Starbucks, Gap, Reckitt, DuPont) partnered to invest with the U.S. International Development Finance Corporation, pooling together resources and bringing the investment fund total to $150 million.

Sources: See endnotes.[98,99,100]

CASE STUDY 12

Private sector-led initiative to accelerate collective action between private, public and non-profit sectors to achieve a water-resilient future for California

Organizations: Pacific Institute, Ecolab, General Mills, LimnoTech.

Description: The California Water Resilience Initiative (CWRI), launched in 2023, is a time-bound, private sector-led initiative to accelerate collective action across sectors to achieve a water-resilient future for California. It was established to support the ambitions of the CEO Water Mandate's Water Resilience Coalition to mobilize corporate water stewardship in pursuit of positive water impact in 100 basins globally.

Following predictions by state scientists that California will face a 10% supply gap by 2040, CWRI has set a target to reduce, reuse and restore one million acre-feet of water per year by 2030 and 1.8 million by 2040. CWRI is managed by Pacific Institute, with Ecolab as basin champion, General Mills as basin leader and LimnoTech as technical advisor. By creating new types of partnerships, scaling-up existing efforts and enabling innovative solutions, CWRI is accelerating corporate engagement in California to help close the water-demand gap.

Source: See endnote.[101]

CASE STUDY 13

The Freshwater Challenge

Organization: The Freshwater Challenge

Description:

The Freshwater Challenge (FWC) is a voluntary, country-led partnership with the goal to restore 300,000 kilometres of degraded rivers and 350 million hectares of degraded wetlands by 2030, while securing the protection of freshwater ecosystems important for biodiversity and ecosystem services. The challenge was launched at the UN Water Conference in New York in March 2023 by the governments of Colombia, DR Congo, Ecuador, Gabon, Mexico and Zambia. To date, 49 countries and the European Union have joined the Freshwater Challenge. The Freshwater Challenge is rooted in Targets 2 and 3 of the Kunming-Montreal Global Biodiversity Framework, which commits parties to restore 30% of degraded inland waters and conserve 30% of freshwater ecosystems by 2030, creating a critical milestone for global freshwater ecosystems.

The FWC's purpose is to accelerate delivery of national plans and strategies to restore and conserve freshwater ecosystems, by supporting and accelerating targeted interventions for rivers, lakes and other wetlands. The challenge will increase overall investment into the restoration and conservation of freshwater ecosystems and substantially increase the social and economic returns on those investments. In doing so, the challenge will support countries to achieve their international commitments on climate, biodiversity, ecosystem protection and restoration, flood and drought resilience, land degradation, disaster risk reduction and the SDGs.

Members of the FWC commit, by the end of 2025, to set and subsequently implement quantifiable targets in their national plans to restore and conserve freshwater ecosystems, thereby supporting national and global commitments by 2030. To ensure transparency, member countries' national commitments will be documented and publicly accessible on FWC's website.

Source: See endnote.[102]

Pathway 4 Adaptive water governance: case studies

CASE STUDY 14

Partnership for integrated water governance and climate adaptation

Organizations: Xylem, South Bend water utility (Indiana)

Description:

This partnership between Xylem and South Bend, Indiana's water utility, showcases a collaborative effort between the private and public sectors to integrate water governance in climate adaptation governance. The aim of this collaboration is the mitigation of storm overflows resulting from flooding and the creation of a climate action plan through the deployment of water technologies to manage storm water overflows.

Technologies include real-time monitoring and adaptive control systems in the sewer systems, which enable the transformation of the city's ageing sewer infrastructure into a dynamic, adaptive and responsive network able to tackle flooding. The technologies helped reduce sewer overflows by 80% and improved water quality in St. Joseph River by 50%.

Source: See endnote.[103]

CASE STUDY 15

Arup's innovative approach to facilitate decision-making in urban water management

Organizations: Arup, Rockefeller Foundation, The Resilience Shift, Stockholm International Water Institute (SIWI)

Description: To deal with urban water management challenges in cities and facilitate decision-making in governments, civil society and the private sector, Arup developed the City Water Resilience Approach (CWRA). CWRA is an innovative approach and tool to help cities build water resilience, grow their capacities to provide high-quality water, protect citizens from water-related hazards and enable their connection through water-based transportation networks.

CWRA offers additional resources targeting specific challenges in the management and governance of water systems, including the City Water Resilience Framework and Our Water. The former is a tool enabling cities to evaluate their current strengths and weaknesses in urban water systems. The latter is a digital tool enabling cities to better understand their local water basins.

To ensure CWRA is practical and applicable across cities, it was co-developed by engaging city stakeholders across eight cities, including Cape Town, South Africa; Mexico City, Mexico; Miami and the Beaches, US; Kingston upon Hull, UK; Amman, Jordan; Rotterdam, Holland; Thessaloniki, Greece; and Greater Manchester, UK.

Source: See endnote.[104]

Pathway 5 Collaborative policy-innovation nexus: case studies

CASE STUDY 16

Aquapreneur Innovation Initiative

Organizations: World Economic Forum and HCL Group.

Description: The World Economic Forum's UpLink has partnered with leading global conglomerate HCL Group to drive freshwater conservation and management through the Aquapreneur Innovation Initiative. Through a $15 million investment over five years, UpLink and the HCL Group, supported by the Forum's Food and Water Initiative, will create a first-of-its kind innovation ecosystem for the global freshwater sector, accelerating progress on the water innovation agenda.

Each year the initiative sources up to 10 innovators or "aquapreneurs" through its innovation challenges. Since being selected, the first two cohorts of 20 aquapreneurs have raised $70 million in additional funding. For more information, see endnote.

Source: See endnote.[105]

CASE STUDY 17

Targeted financing, multi-stakeholder collaboration and policy frameworks to drive innovation and resilience in Singapore's water and affiliated sectors

Organizations:

Singapore's National Water Agency (PUB) and National Environment Agency (NEA).

Description:

The government of Singapore and affiliated agencies including the National Water Agency (commonly known as PUB) have implemented mechanisms that foster and enable innovation and growth in the water sector. Such mechanisms include targeted financing for R&D, collaborations with agencies to increase resource recovery and efficiency at the facility level and policy mechanisms to drive innovation in water resilience.

Targeted financing: in 2022, the government of Singapore allocated $161.5 million for water technologies and resource circularity. This funding was under the Research, Innovation and Enterprise 2025 Urban Solutions & Sustainability (USS) domain; $63.8 million was allocated to three water technology focus areas: (1) desalination and water reuse, (2) used-water treatment and (3) waste reduction and resource recovery. The funds allocated to water will support the Nanyang Environment and Water Research Institute (NEWRI) and the Separation Technologies Applied Research and Translation (START) initiative, which are part of PUB's centres of excellence programme. This financing aims to increase research and innovation, green growth, private sector R&D spending, job creation and technology spin-offs in water and affiliated sectors.

Resource recovery: PUB is partnering with NEA for the construction of Tuas Nexus, Singapore's first integrated water and waste treatment facility for energy and resource recovery. The facility will be equipped to receive domestic and industrial used water; it will incorporate advanced physical, biological and chemical treatment processes and house one of the largest membrane bioreactor facilities.

Policy for water resilience: in 2023, PUB introduced new mandatory minimum recycling requirements to increase water efficiency in water-intensive industries and advance water resilience and environmental sustainability in non-domestic sectors. These new requirements are mandated for new projects in water fabrication, electronics and biomedical industries, effective from 1 January 2024.

Sources:

See endnotes.[106,107,108]

CASE STUDY 18

Public-private partnerships, policy dialogues and innovations to advance water resilience and circularity in San Francisco

Organizations:	San Francisco Public Utilities Commission (SFPUC) (Chair), National Blue Ribbon Commission – US Water Alliance, Water Environment & Reuse Foundation, Water Research Foundation, Epic Cleantec.
Description:	To increase water conservation and protection against drought, the city of San Francisco has built an environment conducive to water innovation, circularity and resilience. Water circularity is fostered through policies such as: (1) its non-potable water ordinance, which allows for collecting, treating and using alternative water sources for non-potable uses in buildings; and (2) the recycled water ordinance, which sets requirements for installing recycled water systems in new construction, modification or remodel projects. In addition, San Francisco has adopted OneWaterSF, an integrated approach for long-term water resilience that embodies the concept of "one water". Within this local water programme, San Francisco has a conservation, groundwater, recycled water, on-site water reuse and innovations programme, underscoring the need for combining different strategies to make the city's water system more resilient. Within this context, SFPUC, a key provider of drinking water and wastewater services, has advanced water resilience and circularity through partnerships such as the National Blue Ribbon Commission, chaired by SFPUC, which focuses on creating tools and resources to support implementation of sustainable water strategies and to foster collaborations. This policy leadership has enabled innovative companies like Epic Cleantec to develop and scale-up water reuse technologies. In 2022, the company launched San Francisco's first approved and operational onsite water reuse system at a high-rise apartment building.
Sources:	See endnotes.[109,110,111,112]

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2. Blue water refers to water in rivers, lakes and aquifers; green water refers to the water stored as soil moisture and in vegetation, which returns to the air through evaporation and transpiration; grey water refers to all domestic wastewater discharged from showers, bathtubs, sinks, kitchens, dishwashers, laundry tubs and washing machines; black water refers to toilet water.
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8. For instance, Singapore with its "Four National Taps" strategy, Australia with the Murray-Darling Basin Plan, the Netherlands with its Delta Programme, Germany with its National Water Strategy and Saudi Arabia with its National Water Strategy 2030, have comprehensive and integrated approaches to managing water resources.
9. The GCEW's 15 recurring themes are: freshwater management, technology, circularity, financing, policy management, water infrastructure, partnership models, industrial best practices, water supply chain resilience, governance, water-energy nexus, desalination, other alternate water sources, water access and affordability, domestic behaviour.
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46. E.g. opportunities to invest in irrigation and suppliers of water-efficient agricultural equipment.

47. E.g. opportunities to invest in water-related businesses, directly or through specialist water funds and/or to acquire water-related businesses or invest in specialized funds.

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