Water4All
Water security for the planet

European Partnership

PROGRESS REPORT: NEW INPUTS FOR THE REVISED SRIA

Water4All SRIA update process

Deliverable D1.5, January 2025

Co-funded by the European Union

OUTPUT SUMMARY PROJECT INFORMATION	
Project Title	European Partnership Water4All – Water security for the planet
Project Acronym	Water4All
Call Identifier	Horizon-CL6-2021-Climate-01-02
Contract Number	101060874
Starting Date	1 June 2022
End Date	31 May 2029
Web-Site Address	www.water4all-partnership.eu
Coordinator	ANR
Management Team	Ariane BLUM, Juliette ARABI, Armelle MONTROSE, Claire TREIGNIER
E-Mail	Water4All@agencerecherche.fr
Phone Number	+33 1 78 09 81 20 / +33 1 73 54 81 43

Deliverable Title	Progress report: new inputs for the revised SRIA
Deliverable Number	D1.5
Work Package	WP1 - Pillar A: Water4All Joint Vision and Strategic Research and Innovation Agenda
WP leader	ANR
Nature	Report
Dissemination	Public
Editor (s)	Esther DIEZ CEBOLLERO
E-Mail (s)	Esther.diezcebollero@agencerecherche.fr
Phone Number	+33 665 01 28 92
Date of Delivery	21/01/2025

Verification by	Claire TREIGNIER (ANR)
Date	06/02/2025
Validation by	Juliette ARABI (ANR)
Date	07/02/2025

Acknowledgements

Water4All has received funding from the European Union's Horizon Europe Programme under Grant Agreement 101060874.

The contents of this document mainly build upon the experiences accumulated by Water4All partners that contributed in the past to the development and update of the Water JPI strategic research and innovation agenda and in particular to the task aimed at the exploratory foresight on trends and drivers in relation to water issues. We wish to acknowledge the invaluable contribution of Water4All Pillar A partners in the preparation of this document. We wish to specially thank the European Commission for funding this ambitious programme.

TABLE OF CONTENT

LIST OF ACRONYMS

ACRONYM	FULL TITLE
AI	Artificial Intelligence
EU	European Union
CO_2	Carbon dioxide
EEA	European Environment Agency
EU	European
GIS	Geographical Information Systems
HEM	Hydro-Economic Model
IoT	Internet of Things
IWRM	Integrated Water Resource Management
NbS	Nature-based Solutions
NSSS	Non-Sewered Sanitation Systems
OECD	Organisation for Economic Co-operation and Development
R&I	Research and Innovation
SDGs	Sustainable Development Goals
SRIA	Strategic Research and Innovation Agenda
UN	United Nations
Water4All	European Partnership on Water Security for the Planet
WASH	Water, sanitation and hygiene
WSS	Water Supply and Sanitation

EXECUTIVE SUMMARY

The **Water4All Partnership** published its Strategic Research and Innovation Agenda (SRIA) in September 2022. The SRIA offers a whole catalogue of knowledge gaps that should be addressed by Research and Innovation (R&I) projects in order to offer responses and innovative strategies for securing water for all. During the first two years of the programme, the SRIA has proved its usefulness. Hence, it has guided the **Water4All Consortium** in the delineation of annual calls for proposals and the development of annual work plans.

We live in a rapidly changing world, in which new challenges emerge and new demands from our society arise. The SRIA must account for those evolutions; it is for this reason that the **Water4All Consortium** initiated more than two years ago a SRIA update process. The process involves different activities such as the organisation of consultative workshops, the launch of a public consultation, a foresight exercise, and a literature review of key documents from European and international sources. All these efforts will result in a new version for the SRIA that will be released at the end of 2025.

This deliverable presents knowledge gaps that are not contained in the first version of the SRIA and that have been identified through the literature review and the stakeholder consultative workshops held during the first two years of Water4All. The deliverable also lists the main barriers and enablers for achieving Water4All objectives. Barriers are understood as any factor that may impede from achieving the strategic and scientific objectives of Water4All whereas enablers correspond to all those instruments or initiatives that should facilitate the attainment of such objectives.

Looking at the results here presented, it is evident that new knowledge gaps have arisen as a result of the enhancement of digital tools, which offer today a whole range of applications for real-time control of water quality and water quantity. However, the full leverage of digital tools cannot be achieved if monitoring and data-sharing strategies are not improved. By improving data collection and sharing across both public and private sectors, decision-makers can create more informed and effective policies that address water issues more holistically. There are also significant challenges in establishing effective governance, including the gathering of data through citizen science. Questions arise about who collects the data, where it is stored, and how to ensure its quality and reliability. Additionally, interpreting the data correctly poses a challenge; having an abundance of data is of little value if we lack the ability to utilize or interpret it effectively.

Likewise, the results of our work show the need for a better integration of socioeconomic research into natural sciences. Understanding the socioeconomic dimensions, such as the distribution of water access, affordability, and the social costs of water scarcity or pollution, enables policy-makers to identify vulnerable populations and sectors most at risk. Moreover, incorporating socioeconomic analysis helps to determine the true value of water by accounting for its economic, social, and environmental significance. This approach also supports the development of incentive structures that encourage water conservation and guides the creation of policies that strike a balance between environmental sustainability and economic growth.

Finally, several knowledge gaps stress the need to support the upscaling and market uptake of innovative solutions. Despite significant advances in technology and research, there are still barriers that hinder the widespread adoption of innovative solutions, such as regulatory challenges, high upfront costs, and insufficient awareness of the benefits (sometimes uncertain). Bridging these gaps requires targeted research to demonstrate the feasibility, cost-effectiveness, and long-term sustainability of new technologies. Furthermore, creating conducive market conditions, including policy incentives, financial support, and clear regulatory frameworks, is essential for accelerating the deployment of innovative and effective solutions. Supporting the scaling-up process and addressing these gaps can lead to more efficient and resilient water management systems, ultimately enabling the successful transition towards sustainable water use practices across different sectors and regions.

PROGRESS REPORT:
NEW INPUTS FOR THE REVISED SRIA

INTRODUCTION

Water4All in a nutshell

The **Water4All Partnership** is a significant European initiative aimed at enhancing water security through advanced research, innovation, and collaborative action. Launched under the EU's Horizon Europe framework, Water4All unites a wide range of stakeholders, including public authorities, research organizations, industries, and civil society, with a shared mission to tackle the complex water-related challenges facing Europe and the world. These challenges include water scarcity, pollution, climate change impacts, and the need for sustainable water management practices. By fostering cross-sector and interdisciplinary cooperation, Water4All seeks to develop solutions that guarantee the long-term availability, quality, and equitable distribution of water resources.

A key feature of the **Water4All Partnership** is its **strategic framework**, which is organized into five pillars: **Pillar A: Joint Vision and Strategic Research and Innovation Agenda (SRIA)**, **Pillar B: Research and Innovation Development**, **Pillar C: Science-policy-end-users interface, Pillar D: Demonstration activities, Pillar E: Internationalisation**. Each pillar plays a distinct role in supporting the partnership's overall mission, with a strong focus on integrating scientific research with real-world applications to address water-related challenges.

As of September 2024, the **Water4All Partnership** unites **90 partners across 33 countries**, both within the European Union and internationally, including Brazil, Georgia, Israel, Moldova, Norway, South Africa, Switzerland, Turkey, Tunisia, and the United Kingdom. Coordinated by the French Research Agency (ANR), the partnership has been strategically formed to encompass the full spectrum of the water R&I chain. This includes academic institutions, R&I funders, water management authorities, water utilities, and water associations. Furthermore, partners will engage with other R&I initiatives within the European Research Area to maximize the impact of the partnership's activities. Collaborative efforts are already underway with EU Missions, such as the Mission "Restore our Ocean and Waters by 2030," and with other Horizon Europe Partnerships, including those on Biodiversity, Sustainable Blue Economy, and Driving Urban Transitions.

The anticipated outcomes of the Water4All Partnership include:

- Strengthening collaboration and strategic coordination in water R&I to conserve, restore, regenerate, and optimize the natural functions of groundwater, surface water, and the ecosystems that depend on or are associated with them.
- Promoting the demonstration and market access of innovative solutions.
- Disseminating water-related knowledge and data through open access platforms.
- Providing tools for effective water management through innovative knowledge, methodologies, and technologies.
- Designing and implementing participatory, accountable, and transparent approaches for the development of innovations, while ensuring the empowerment and capacity building of local communities.

Water4All's SRIA: main contents and update process

The Strategic Research and Innovation Agenda (SRIA) serves as a cornerstone document for Water4All, offering a detailed overview of key areas where knowledge gaps exist and where further research and innovation (R&I) efforts are necessary. Water4All's SRIA was published in September 2022; it is available at the following link: Water4All SRIA 2022-2025. Its development was tasked to Pillar A, which defines the strategic direction for Water4All.

The SRIA organizes these knowledge gaps into specific water-related research and innovation topics, which are categorised under seven key themes, as illustrated in Figure II.

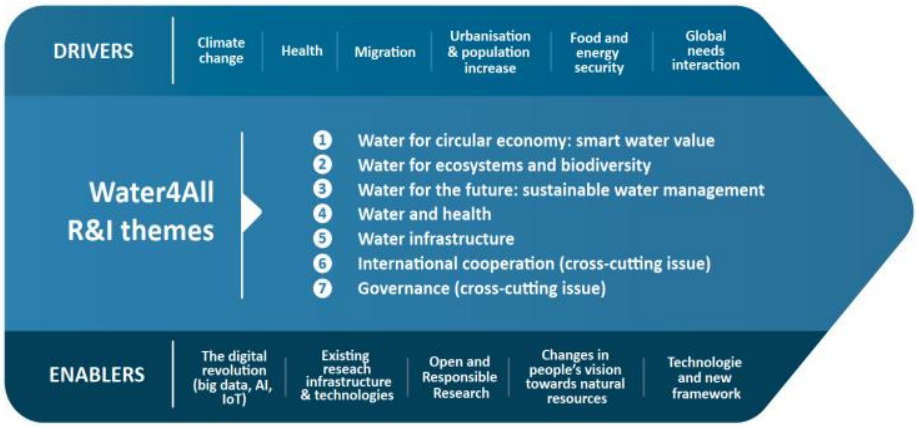

Figure II. Water4All's R&I Themes, Drivers, and Enablers.

In addition to these themes, the SRIA highlights key **drivers** and **enablers**—factors that significantly influence the development of Water4All's thematic orientations. Among these, the "digital revolution" (encompassing big data, Artificial Intelligence (AI), and Internet of Things (IoT)) is identified as a critical driver.

Given the rapidly changing global context—including accelerated climate change and the impact of geopolitical and health crises—ensuring a resilient and inclusive water supply has become more urgent than ever. **To address emerging needs and incorporate the latest scientific advancements, Water4All is in the process of updating its SRIA, with the revised version expected by the end of 2025.**

This update is being carried out through a participatory process that invites inputs from a diverse range of stakeholders and experts. The update activities include:

- A comprehensive review of water-related information sources **(Sub-Task A.1.1)**.
- A foresight exercise **(Task A.1.2)**.
- Two consultative workshops **(Task A.1.3)**.
- A public consultation **(Sub-Task A.1.4)**.

Stakeholder consultative workshops are pivotal to the SRIA update process. They ensure the document remains inclusive, socially relevant, and responsive to the needs of society, industry, and the research community. These workshops bring together a wide range of participants, including researchers, policy-makers, civil society organizations, and end-users, fostering a diversity of perspectives. This inclusive approach prevents the SRIA from becoming too narrow or disconnected from real-world challenges while capturing insights on emerging trends and future issues, paving the way for innovative and holistic solutions to complex water-related problems.

These workshops also act as forums for knowledge exchange, transforming the SRIA into a dynamic, living document that evolves in line with societal expectations, market shifts, and innovative developments. By aligning the SRIA's priorities with stakeholders' needs, the workshops enhance its relevance and feasibility.

Industry representatives can spotlight practical challenges, policy-makers can share regulatory insights, and societal actors can articulate public concerns.

Water4All has held two workshops during the first period. The first one took place in Helsinki (February 2023) and the second one in Lisbon (June 2024). Each one of these workshops gathered more than 30 experts and they enabled a better understanding of remaining knowledge gaps in the fields of ecosystems and biodiversity (first workshop) and the use of digital tools in the water sector (second workshop). Workshop participants included scientific experts, policy-makers and water managers, and representatives of water utilities. The organisation of these two consultative workshops responds to the overall objective of giving a voice and involving stakeholders in the definition of the strategic orientations of the Water4All in order to enhance the buy-in of future proposed solutions, approaches and recommendations for securing water for all.

On the other hand, the Water4All's **public consultation** was launched in the summer 2024 for almost four months. As a collaborative programme focused on addressing global water challenges, Water4All seeks to gather input from policy-makers, researchers, industry representatives, civil society organizations, and the general public to guide the development of its strategic goals and priorities. This participatory process ensures that the initiative remains responsive to the evolving needs of society, while fostering transparency and inclusiveness in decision-making.

One key objective of the public consultation is to identify pressing water-related issues that require targeted research and innovation efforts. By engaging with diverse stakeholders, Water4All aims to capture a wide range of perspectives on emerging challenges, such as water scarcity, pollution, ecosystem degradation, and climate resilience. This input helps to ensure that the SRIA prioritises research areas that are not only scientifically relevant but also socially and economically impactful. The results of the Water4All's public consultation will be available during the second quarter of 2025.

Additionally, the **foresight activity** seeks to ensure that Water4All remains a forward-looking and dynamic initiative. The foresight will allow anticipating, exploring a range of possible futures, and preparing for potential future developments, trends, and challenges.

Aim of this report

The primary purpose of this deliverable is to present a comprehensive overview of newly identified knowledge gaps related to water research and innovation. These knowledge gaps have been identified through the two Water4All's stakeholder consultative workshops held respectively in 2023 and 2024, and through a detailed review of nearly 50 key sources of literature, representing a diverse array of scientific studies and policy documents. It was agreed to focus on the reports provided by EU or international organisations like the European Environment Agency (EEA), Organisation for Economic Co-operation and Development (OECD) or the United Nations (UN) agencies. Inputs from peer-reviewed scientific publications will be considered at a later stage of the programme. This rigorous analysis aimed to pinpoint areas where additional research and innovation are necessary to address emerging challenges and opportunities in water management.

A complete list of the reviewed sources is provided in the annex, ensuring full transparency and enabling readers to trace the origins of the identified knowledge gaps. **It is important to emphasise that this report focuses exclusively on new knowledge gaps—those that are not already included in the existing SRIA of Water4All. By narrowing the scope in this way, the report ensures that it complements and enhances the SRIA rather than duplicating its content.**

The identified knowledge gaps will play a critical role in guiding Water4All partners during the preparation of the next version of the SRIA. These insights will help shape the strategic priorities of the initiative, ensuring that it remains aligned with emerging trends and responsive to the evolving needs of society, industry, and the research community. Furthermore, this deliverable includes introductory data sourced from the existing literature that will come to complement the introductory text to the themes already included in the SRIA. **The literature review was carried out by Water4All partners over a period of nearly two years and was completed in November 2024.**

KNOWLEDGE GAPS IDENTIFIED IN THE LITERATURE REVIEW AND STAKEHOLDER CONSULTATIVE WORKSHOPS

Theme I. Water for circular economy: smart water value

Water scarcity and the growing demand for water resources driven by population growth, food production and manufacturing needs are putting immense pressure on available water supplies. Without water-saving practices, including water reuse, the European Union estimates a potential 16% increase in water abstraction by 2030 (EEA, 2024). However, only 2.4% of treated urban wastewater in the EU is currently reused, highlighting the untapped potential of water reclamation (Giakoumis et al., 2020). Such facilities should further promote circular economy principles by harnessing the energy embedded in wastewater and recovering valuable resources like phosphorus and nitrates.

Agriculture, accounting for 69% of global water withdrawals, faces significant constraints. While food production is expected to increase by 50% by 2050, agricultural water use can only grow by 10%, necessitating improved efficiency and alternative water sources (FAO, 2022). In this context, it is increasingly necessary to consider unconventional and/ or regionally underutilised water resources as part of water management and water planning for the future.

By embracing innovative and unconventional solutions, expanding reclaimed water use, and fostering cross-sectoral coherence, water-stressed regions can enhance their resilience and sustainability while meeting growing water demands. Still, the use of innovative and unconventional technologies requires robust monitoring, effective regulations, and targeted investments to address concerns about human health and environmental risks.

Findings:

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
Water reuse integration and policy innovation: developing innovative policy frameworks, incentives, and market mechanisms that promote cross-sectoral water reuse across industrial, agricultural and domestic sectors. The focus is on overcoming legislative and market barriers to optimise water resource management, improve sustainability, and enhance resilience in water-stressed regions.	I.II	VII.III
Improving emissions assessment from Non-Sewered Sanitation Systems (NSSS) and other sanitation technologies to enable the implementation of more effective mitigation measures, particularly for Water, Sanitation, and Hygiene (WASH) climate-resilient development.	IV.III	---
Developing innovative approaches to wastewater treatment that address the recovery of energy, valuable products as nutrients and secondary by-products such as fibres and polymers. Market uptake strategies must be targeted.	I.II	IV.III
Decreasing energy consumption in wastewater treatment plants and seawater desalination processes coupled with a reduction in CO_2 emissions. Decreasing brine production in desalination plants.	I.II	V.I
Upscaling available wastewater treatment technologies such as high-rate anaerobic bioreactors enabling energy and nutrient recovery.	I.II	IV.III
Developing innovative technologies for safe potable reuse of treated wastewater in response to growing pressures on the scarcity of available water resources.	I.I	III.I
Combining data for benchmarking progress towards circular economy. This will involve comparing practices, outcomes, and indicators to evaluate how well a region, industry or organisation is transitioning toward a circular economy.	I.II	---

Theme II. Water for ecosystems and biodiversity

Although they account for just 0.01% of the world's water and cover only 0.8% of Earth's surface, water-related ecosystems support nearly 10% of known species (WWF, 2019), playing key roles in global hydrological, carbon, and nutrient cycles They also provide a range of ecosystem services including water purification, flood protection or support to activities like agriculture, energy generation, and tourism. However, these ecosystems face significant threats due to human activities such as dam construction, habitat destruction, and the impacts of climate change, including wildfires and pest outbreaks. Wetlands, in particular, are experiencing alarming degradation with a 35% reduction in their extent from 1970 to 2015 and a dramatic loss of freshwater species (Ramsar Convention on Wetlands, 2018). Since the 1700s, over 85% of global wetlands have been lost, and they continue to disappear at a rate three times faster than forests (UNESCO & UN-Water, 2020).

The rise in water temperatures is exacerbating these issues, disrupting biogeochemical balances, increasing algal blooms, and promoting pathogen growth, all of which threaten water quality. This situation weakens ecosystem resilience and increases vulnerability to both climate and non-climate risks. Invasive species have also become a growing concern, with their numbers increasing by 70% since 1970 (IPBES, 2019).

Findings:

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
Assessing the impact of hydromorphological changes – such as alterations in river flow, sediment transport, and channel structure – on aquatic habitats, species migration, and self-purification processes within river ecosystems.	II.III	II.I
Developing and evaluating innovative methodologies to detect river discontinuities, and implementing effective solutions. This will include the establishment of robust monitoring systems to enhance river connectivity and improve ecological health, and ultimately mitigate the impacts of discontinuities on water systems and biodiversity.	II.III	II.I
Exploring innovative technologies to restore abandoned mining sites to mitigate the environmental impact of past mining activities and regenerate these sites, improving ecological sustainability and resilience.	II.III	II.I
Developing a comprehensive economic valuation (costs and benefits) of integrated natural systems. Challenges remain in assigning values to environmental and social co-benefits.	II.I	II.III
Examining how ecosystems function at various levels, while also considering the role of human activities, through the use of modelling tools, and accounting for the multiple factors that influence ecosystems.	II.I	II.II
Redefining ecological status targets, indicators and baselines, including the adjustment of the criteria used to assess ecosystem health, ensuring they remain relevant and effective in guiding environmental policy, restoration and conservation actions.	II.III	II.I
Understanding the role of aquatic ecosystems in addressing climate change e.g. wetlands' contribution to CO_2 sequestration.	II.I	II.II
Developing and deploying tools to effectively convey and present the importance and benefits that ecosystems provide to humans in a clear and accessible way.	III.IV	---
Exploring the integration of ecohydrology and social/ economic considerations at different levels or scales to create holistic solutions that address both environmental sustainability and human needs.	II.III	VII.II
Understanding how the use of reclaimed water can enhance soil health and biodiversity.	II.I	II.III II.IV

Theme III. Water for the future: sustainable water management

The following figures, highlighted in the literature, provide invaluable insights into the current state of water resources:

- 40% of the global population faces water scarcity, with seawater intrusion impacting 30% of coastal populations.
- Over 3 billion people use water of unknown quality due to inadequate monitoring. Unsafe water and poor sanitation cause 829,000 annual deaths.
- Groundwater depletion is significant, with losses of 100–200 km^3/year, and intensive groundwater use jeopardizes aquifer sustainability.
- Agriculture consumes 69% of global water withdrawals.
- Global groundwater use for agriculture grows by 2.2% annually, contributing to aquifer degradation and saline intrusion.
- Between 2000 and 2019, 0.9 million hectares of water bodies disappeared, but 18.4 million hectares of new permanent water bodies were formed, mainly due to accelerated runoff and snowmelt.
- Projected increases in water abstraction in Europe (16% by 2030) underline the urgency for water-saving practices, interventions and investments allowing water retain, and long-term sustainable planning.
- One of the most significant drivers impacting the quality of European surface and groundwaters is the intensive use of nutrients and pesticides in agricultural production. Irrigated agriculture is also by far the highest net water consumer in Europe and places particular pressure on freshwater ecosystems in southern Europe.
- Europe is the fastest-warming continent worldwide, with climate risks of droughts and floods increasing in intensity and frequency.

In light of these figures, it is evident that urgent action is required to promote sustainable water management practices that address the growing pressures on global water resources. The challenges of water scarcity, groundwater depletion, and water quality risks demand innovative and adaptive solutions. Digital tools, such as smart monitoring devices, IoT communication networks, and data-driven technologies like AI and Geographical Information Systems (GIS), present significant opportunities to optimize water management. By leveraging these advancements, we can enhance monitoring, improve decision-making, and implement more efficient water-saving strategies, ensuring a sustainable future for water resources and the communities that depend on them.

Findings:

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
On droughts: • Improving the forecasting, monitoring and alert systems of droughts. • Developing integrated frameworks for understanding drought dynamics and managing cascading effects on ecosystems and societies. • Addressing the need to integrate large-scale drivers of drought, such as global climate patterns, with localised effects and responses to drought events. • Addressing the disproportionate effects of droughts and water scarcity on vulnerable populations, particularly rural households.	III.IV	II.II

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
• Investigating the social and economic distribution of drought impacts to better inform risk management strategies. • Improving the management of dam water bodies. • Developing drought observatories especially in transboundary catchments		
On floods: • Improving flood forecasting, monitoring and alert systems. • Improving the accuracy of merging techniques of ground and above ground rainfall data (radar, satellites) to increase the lead time of flash flood forecasting in real time. • Developing efficient flow monitoring techniques for ephemeral rivers. • Considering the hydrological impacts of climate change on the design of flood protection measures.	III.IV	III.V
On digitalization and data: • Addressing data limitations in groundwater monitoring and water scarcity assessments, especially in low-income regions. • Improving the sharing of water-related data across public and private sectors to inform better policies. • Facilitating water data interoperability and exchange across sectors to strengthen EU cooperation and decision-making. • Enhancing hydrological model performance and access to discharge data for better policy development. • Investigating modalities for enhancing the transfer of models and increase end-users' acceptance of digital tools. Showcasing the applications of digital tools for further deployment. • Developing business models to secure data accessibility. This involves the identification of financing mechanisms, the definition of ownership and licensing terms, investments in user-friendly infrastructure, and incentives for data sharing while maintaining quality and long-term viability.	III.V	---
On water quality and quantity: • Developing advanced water quantity and water quality monitoring systems to address pollution and prevent ecological disasters. • Harmonising monitoring systems across countries to assess and close gaps between current conditions and good water status. • Promoting water sensitive urban design. • Exploring citizen science initiatives to integrate local knowledge and improve hydrogeological assessments. • Characterising entire storage systems (both built and natural assets) within a basin to understand how much storage exists, how it is changing over time, and its various attributes (e.g. live storage available for different purposes). • Expanding, upgrading and automating hydrologic monitoring of water quantity and quality field data based on international measurement standards.	III.I III.V	III.II III.III IV.III VII.I
On groundwater: • Leveraging IoT, remote sensing, and machine learning for accurate mapping of groundwater changes and improved water resource management. • Addressing groundwater data scarcity by improving field-level assessments and ensuring public accessibility of collected data.	III.III	III.I III.V

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
• Fostering integrated policies that link groundwater and surface water management to address shared pressures and drivers e.g. illegal water abstractions. • Investigating terrestrial water interactions with other geospheres.		
On climate adaptation and resilience: • Investigating atmospheric water capture methods (fog harvesting, cloud seeding) to enhance water availability in arid regions. • Evaluating the impacts of climate change on water systems, with a focus on adaptation and tipping points. • Establishing an open access climate-water database.	II.II	III.I

Theme IV. Water and health

Water sanitation and financing face significant challenges, with over 80% of countries reporting insufficient funding for water supply and sanitation (WSS) services. To protect human health and aquatic ecosystems, advanced treatment methods are urgently needed for removing emerging pollutants such as pharmaceuticals, personal care products, microplastics, and endocrine-disrupting compounds (EDCs). Specific measures and investments to tackle these contaminants must align with the EU's "zero pollution" strategy, requiring an estimated EUR 129–206 billion by 2040.

Reducing water pollution at its source is also crucial for protecting ecosystems, ensuring clean water supplies, and supporting public health. Preventing contaminants from entering water bodies minimizes the need for costly treatment processes and reduces the risks posed to aquatic life and human communities. Source reduction also addresses the root causes of pollution, such as industrial discharges, agricultural runoff, and urban wastewater, promoting sustainable practices and reducing environmental degradation.

To address these issues and advance sustainable water management, targeted research and innovation (R&I) efforts are essential.

Findings:

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
Investigating the behaviour of contaminants like pesticides, nitrates and arsenic in the environment, and their treatment options.	IV.I	IV.III IV.IV
Developing applied research in the fields of environmental metrology, including fate and treatment of pollutants in the subsoil, retention of chemical elements by clay barriers.	IV.I	IV.III IV.IV
Developing sensors for detecting micro/nano pollutants to improve monitoring and response capacities.	IV.III	IV.II IV.II
Addressing the lack of accessible water-related data to promote innovation and competitiveness in technology development.	IV.III	VII.III

Theme V. Water infrastructures

Water supply and sewage networks, as well as flood protection facilities, often date back to the early 20th century. Consequently, many of these water infrastructure assets are nearing the end of their functional lifespan (Water Europe, 2021).

The need for integrating both green and grey infrastructure arises from their complementary strengths in addressing modern environmental and water management challenges. Grey infrastructure refers to traditional engineered solutions, such as dams, treatment plants, and pipelines, which are vital for water supply control, wastewater treatment, and flood prevention. While effective, these systems can be expensive to maintain and often lack flexibility to adapt to evolving environmental conditions. They are also contributors to CO_2 emissions. In contrast, green infrastructure such as Nature-based Solutions (NbS) employs natural processes—such as wetlands, permeable surfaces, and green roofs—to manage water and bolster ecosystem resilience. Green solutions offer additional benefits, including reducing flood risks, improving water quality, and enhancing biodiversity.

By combining green and grey systems into hybrid solutions, we can create more adaptive, cost-effective, and resilient infrastructure. This integrated approach addresses urbanisation pressures and climate change impacts by blending the reliability of grey infrastructure with the regenerative and sustainable qualities of green infrastructure. Such hybrid systems ensure long-term ecosystem health and sustainability while effectively meeting human needs.

Findings:

Knowledge gaps identified in the literature and consultative workshops	**Related sub-theme in the SRIA**	**Links to other sub-themes**
On integration and optimisation of hybrid systems: • Developing integrated systems combining grey and green infrastructure with smart technology for adaptable and resilient solutions in response to global changes. • Utilising artificial intelligence, real-time control, and monitoring techniques to enhance the performance of green infrastructure.	V.I V.II	III.V
On quantification and benefits of proposed solutions: • Quantifying the diverse benefits and co-benefits of hybrid solutions, grey infrastructure and/ or NbS, including physical, health, economic, ecological, social, and psychological advantages, through a multi- and interdisciplinary approach. • Exploring interactions of hybrid water solutions with the Water-Energy-Ecosystems-Food (WEFE) Nexus to understand their broader system impacts. • Developing and testing hydro-economic models (HEMs) to evaluate the effects of infrastructures (grey/ NbS or hybrid) and policy responses on water management challenges.	V.I V.II	II.III III.I
On governance, policy and institutional challenges for the implementation of infrastructures (grey/ NbS or hybrid): • Investigating institutional, governance, and spatial barriers hindering the implementation of infrastructure. • Developing adaptive policy pathways to overcome these barriers and enable the widespread adoption of infrastructure. • Developing compelling, evidence-based arguments that highlight the financial, technical, and societal value of infrastructure for stakeholders and investors.	V.I V.II	II.III VII.III
On innovation and business development: • Designing and testing business cases to support the financial feasibility and implementation of solutions.	V.I V.II	II.III VII.III

Theme VI. International cooperation

Achieving universal access to safely managed water, sanitation and hygiene (WASH), a cornerstone of the Sustainable Development Goals (SDGs), requires addressing significant disparities, particularly among vulnerable populations in rural and impoverished regions. Investments should focus on areas with low WASH coverage, where the disease burden is highest, especially in Sub-Saharan Africa, where untreated surface water remains a primary source. Women and girls in rural areas are disproportionately impacted by the labour-intensive task of water collection, highlighting the gender inequities tied to inadequate water infrastructure.

Despite some progress, rural areas continue to face challenges due to insufficient water infrastructure and limited institutional capacity for maintenance. Expanding infrastructure requires a balanced approach, combining large-scale projects with localised solutions to improve access and support small-scale agriculture.

Another significant challenge is that approaches commonly used in Europe—relying on advanced technologies and sophisticated infrastructure—may not be applicable or transferable to developing countries due to the absence of the necessary resources and infrastructure. This highlights the urgent need to support research and development efforts that are specifically tailored to the unique conditions, capacities, and resource availability of developing regions.

Transparent, people-centred investments, alongside robust governance and accountability mechanisms, are essential to advancing the human right to safe drinking water and sanitation. Transboundary water cooperation and water diplomacy play a crucial role in preventing and resolving conflicts over shared resources, fostering regional peace, prosperity, and environmental sustainability. By applying foreign policy tools and promoting joint governance frameworks, water diplomacy contributes to sustainable and equitable management of transboundary water systems.

Findings:

Knowledge gaps identified in the literature and consultative workshops	**Related sub-theme in the SRIA**	**Links to other sub-themes**
On early warning systems and data collection: • Developing drought and flood early warning systems, particularly in least developed countries, to mitigate water-related risks effectively. • Building capacities in collecting and analysing hydrological data to improve forecasting, planning and decision-making processes.	VI.I	III.I
Exploring the challenges posed by urbanisation on groundwater quality in developing countries.	VI.III	III.III
Reviewing and evaluating the state of Hydro-Economic Models (HEMs) used in transboundary river management with an emphasis on benefit sharing and trade-offs. Gaps in HEMs, such as the failure to quantify benefits of flood control, environmental flow impacts, or costs associated with infrastructure development, operation, and environmental degradation should be addressed.	VI.II	V.I V.II VII.III
Strengthening institutional and capacity-building frameworks in least developing countries to facilitate effective integrated water resource management adoption.	VI.III	VII.III
Identifying and evaluating the most effective tools and practices for water diplomacy to enhance cooperation, whilst preventing and resolving conflicts over shared water resources.	VI.I	VI.II
Developing frameworks for equitable transboundary water governance, fostering cooperation and benefit sharing.	VI.II	VI.I
Fostering active citizen engagement in water governance to promote inclusive, transparent, and equitable decision-making, contributing to the achievement of SDG6 and equality among countries.	VI.III	VII.I

Theme VII. Water governance

Despite advancements in modelling techniques, predicting the impacts of climate change at the scale of river basins, lakes, or aquifers remains challenging and uncertain. This highlights that water planning cannot rely solely on technical solutions or straightforward calculations. Instead, effective and resilient water management—particularly through Integrated Water Resource Management (IWRM)—requires a multi-stakeholder approach. This approach ensures that diverse perspectives from citizens, the private sector, and civil society are integrated into governance processes to address complex water challenges comprehensively.

"Good governance" in water management is guided by principles rooted in human rights, including effectiveness, responsiveness, accountability, openness, and transparency. It also emphasizes active participation in key governance functions, such as policy-making, institutional coordination, and regulatory oversight. IWRM serves as a valuable framework for bringing together stakeholders from across society, the economy, and the environment, fostering inclusive and collaborative decision-making processes to achieve sustainable water management in the face of climate change.

Findings:

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
Improving water governance through the establishment of national open access databases, the development of a water accounting system, the regulation of groundwater abstraction, sound water allocation and cuts, and the application of the climate-water-energy-food nexus. This topic will involve the promotion of regular monitoring and evaluation of water policy and governance where appropriate, as well as the sharing of results.	VII.II	VII.III
Exploring the role of gender inclusivity in water resource management, examining how incorporating gender perspectives can improve equity, efficiency, and sustainability in planning and decision-making processes. Research will identify barriers to gender inclusion, propose strategies to overcome them, and assess the impact of gender-responsive policies on water governance and community outcomes.	VI.III	III.I VII.III
Empowering science-to-policy dialogue through scenarios and “serious” games, enabling more effective communication and decision making.	VII.I	---
On integrating water economics into policy and practice: • Addressing methodological difficulties in estimating welfare loss from ecosystem degradation and characterising relationships between environmental status and economic uses. • Exploring water-saving incentives, depreciation methods, and peer learning to ensure affordability, cost recovery, and intergenerational equity in water resource management. • Investigating opportunities and challenges of implementing Land Value Capture (LVC) in the water sector and facilitate peer learning on its potential as a water finance tool.	VII.III	---
Improving data availability and accessibility, moving beyond siloed analyses, and develop frameworks for scaling statistical data to relevant local needs, such as water basin districts.	VII.II	III.V
Developing training programmes to address the shortage of qualified personnel in the public water sector, preparing for an increasing number of vacancies.	---	---
Encouraging capacity building and peer learning among European countries to address disparities in progress and foster knowledge sharing on innovative water management solutions.	---	---

Knowledge gaps identified in the literature and consultative workshops	Related sub-theme in the SRIA	Links to other sub-themes
On EU funding: • Supporting EU-funded initiatives, integrating the water sector, and aiming to demonstrate water circularity in ecosystems and integrating these practices into EU legislation to advance sustainability. • Scaling up nature-based solutions to enhance water retention and resilience across European regions.	VII.III	---

A new range of barriers

- Financing water-related measures – A major barrier in the implementation of the Water Framework Directive (WFD).
- Legislative, economic and market barriers to water reuse – Challenges in enabling water reuse between industrial, agricultural, and domestic sectors.
- Capacity and speed of progress – Differences in the ability to achieve progress between European countries and regions.
- Shortage of qualified personnel in the water sector – The need to develop training programs to address the growing number of vacancies in the public water sector.
- Lack of strong and effective coordination by Member States – Inadequate coordination on water-related topics at various administrative levels.
- Weak implementation of EU and national legislation.
- Water services invisibility – Water services are poorly understood by citizens, and their complexity is often not recognized.
- Absence of incentives and targets – The lack of appropriate incentives and targets for effective water management.
- Lack of groundwater professionals – Insufficient groundwater expertise and support within institutions and government agencies.
- Lack of international cooperation – Limited collaboration across borders for effective water management.
- Lack of data – Insufficient data for informed decision-making in water management.
- Socioeconomic and political factors – Competing priorities, lack of investment in Nature-based Solutions (NbS), and regulatory barriers that hinder the implementation of proposed solutions.
- Lack of investment and planning – Insufficient investment and planning to meet the requirements of directives such as the Urban Waste Water Treatment Directive (UWWTD), which requires over EUR 200 billion in investment.
- Lack of awareness and dialogue – The need for greater awareness and dialogue among stakeholders to drive better water management.

CONCLUSIONS

In this report, we have primarily identified key knowledge gaps in several critical areas essential for advancing water management strategies. The knowledge gaps result from the review of almost 50 references and two stakeholder consultative workshops held during the first two years of the **Water4All Partnership**.

Our findings underscore the pressing need for enhanced **digital tools and data sharing** mechanisms that can better integrate and analyse water-related data across public and private sectors. By addressing the limitations in data accessibility, interoperability, and real-time monitoring, we can improve decision-making processes and enable more responsive, data-driven policies for managing water resources. Significant gaps remain in the development and implementation of **grey, green and hybrid infrastructures**—solutions that combine traditional and nature-based approaches—requiring further research into their integration, performance, and long-term sustainability. Moreover, **data monitoring** techniques must be upgraded to capture more accurate and comprehensive information on water quality and quantity, utilizing advanced technologies such as remote sensing, IoT, and AI to address pollution, water scarcity, and ecosystem health. Finally, there is a clear need for more in-depth **socioeconomic research** to better understand the interplay between water resources, social dynamics, and economic activities. This will ensure that water management policies are not only environmentally sustainable but also equitable and inclusive, addressing the needs of vulnerable populations and fostering resilience to climate change. Bridging these gaps will facilitate more innovative, efficient, and inclusive water management practices, ultimately improving the sustainability and resilience of water systems. While the SRIA provides valuable insights into these domains, our findings suggest that further research is needed to refine and expand the scope of knowledge on emerging water-related challenges, particularly in the integration of digital tools, socioeconomic research and the development of infrastructure solutions.

Additionally, our work reveals that the current SRIA offers a comprehensive understanding of existing knowledge gaps in areas such as **water pollution** and **antimicrobial resistance (AMR)**. The SRIA outlines the need for advanced research into the detection, monitoring, and treatment of emerging pollutants, including pesticides, pharmaceuticals, heavy metals, and microplastics, which continue to threaten water quality and aquatic ecosystems. The identification of effective treatment technologies and innovative approaches to pollution prevention are vital to mitigating these risks. Only a few complementary knowledge gaps have been identified in the literature.

Ultimately, filling these knowledge gaps is crucial for improving water management, ensuring the sustainability of water resources, and enhancing resilience to environmental challenges. The ongoing efforts to update the SRIA and refine the research agenda will play a pivotal role in bridging these gaps and facilitating the successful implementation of innovative solutions in the water sector.

Looking ahead, the next phase of our work will involve a thorough review of the identified knowledge gaps by a group of experts. This expert panel will assess each gap to determine whether it should be retained or revised, ensuring that our research agenda remains relevant and aligned with the latest scientific and technological developments. Their insights will help refine our understanding of the most pressing challenges in water management, enabling us to focus on the gaps that have the greatest potential for driving innovation and policy improvements. In addition, a series of national workshops will be organized to further engage stakeholders and experts at the local level. These workshops will serve as a platform to gather additional input, explore emerging issues, and potentially identify new knowledge gaps that have not yet been captured. **This collaborative process will ensure that our research agenda is comprehensive, responsive to evolving needs, and grounded in the real-world experiences of water management professionals across different regions.**

REFERENCES

ECCA (2019). 4th European Climate Change Adaptation Conference. Research and practice gaps, and their relevance for Horizon Europe: outcomes from ECCA 2019: https://www.ecca2019.eu/wp-content/docs/ECCA2019-conference-briefing.pdf

Economic and Social Council of Greece- O.K.E (2023). Sustainable management of water resources under conditions of environmental crisis**.** Available online: https://www.oke.gr/el/opinions/viosimi-diaheirisi-ydatikon-poron-se-synthikes-klimatikis-krisis (In Greek)

EEA (2020). Bathing water management in Europe: successes and challenges. No11/2020: https://www.eea.europa.eu/en/analysis/publications/bathing-water-quality-2020

EEA (2020). Water availability, surface water quality and water use in the Eastern Partnership countries. An indicator-based assessment. No14/2020: https://op.europa.eu/de/publication-detail/-/publication/18ffcf2d-2239-11eb-b57e-01aa75ed71a1/language-en

EEA (2020). Water and agriculture: towards sustainable solutions. No17/2020: https://www.eea.europa.eu/en/analysis/publications/water-and-agriculture-towards-sustainable-solutions

EEA (2020). Tracking barriers and their impacts on European river ecosystems. Briefing 30/2020: Tracking barriers and their impacts on European river ecosystems | European Environment Agency's home page

EEA (2021). Drivers of and pressures arising from selected key water management challenges. A European overview. No09/2021: https://www.eea.europa.eu/en/analysis/publications/drivers-of-and-pressures-arising

EEA (2021). Water resources across Europe – confronting water stress: an updated assessment. No12/2021: https://www.eea.europa.eu/en/analysis/publications/water-resources-across-europe-confronting

EEA (2024). Water abstraction by source and economic sector in Europe. Data available at https://www.eea.europa.eu/en/analysis/indicators/water-abstraction-by-source-and. Accessed in December 2024.

EEA (2024). Europe's state of water 2024: The need for improved resilience. Available at https://www.eea.europa.eu/en/analysis/publications/europes-state-of-water-2024. Accessed in December 2024.

European Commission - DG ENV (2021). Report from the commission to the council and the European parliament on the implementation of the water framework directive (2000/60/ec), the environmental quality standards directive (2008/105/ec amended by directive 2013/39/eu) and the floods directive (2007/60/ec)**.** Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:0970:FIN

Eureau (2021). Products from waste water – algae biomass: https://www.eureau.org/documents/diverse/6078-factsheet-on-products-from-waste-water-algae-biomass/file

Eureau (2021). Products from waste water – fibres, polymers and other organics: https://www.eureau.org/documents/diverse/6080-factsheet-on-products-from-waste-water-fibres-and-polymers/file

Eureau (2021). Products from waste water – minerals: https://www.eureau.org/documents/diverse/6079-factsheet-on-products-from-waste-water-minerals/file

Eureau (2023). Innovating for a greener future: European water service priorities. 2023 update: https://www.eureau.org/resources/publications/eureau-publications/7470-water-sector-research-and-innovation-priorities-2023-update/file

Eureau (2023). Ambitions of the water sector – enabling factors: https://www.eureau.org/resources/publications/eureau-publications/7478-ambitions-of-the-water-sector-enabling-factors/file

Eureau (2024). A water resilience strategy for Europe. Our vision for our water's future: https://www.eureau.org/resources/publications/eureau-publications/7475-eureaus-water-resilience-strategy-for-europe-our-vision-for-our-waters-future/file

FAO (2022). The state of the world's land and water resources for food and agriculture – systems at breaking point. Main report. Refreshing H2O policy. An EU socio-economic workshop (2023). Synthesis of workshop discussions: https://www.fao.org/land-water/solaw2021/en/

Giakoumis, T, Vaghela, C., Voulvoulis, N. (2020). The role of water reuse in the circular economy. Advances in Chemical Pollution, Environmental Management and Protection. Volume 5, 2020, Pages 227-252. Available at https://www.sciencedirect.com/science/article/abs/pii/S2468928920300137

Global water partnership (2021). Advancing towards gender mainstreaming in water resources management: https://unepdhi.org/advancing-towards-gender-mainstreaming-in-water-resources-management-report/

Global water partnership (2021). Storing water: A new integrated approach for resilient development: https://www.gwp.org/globalassets/global/toolbox/publications/perspective-papers/perspectives-paper-on-water-storage.pdf

Global water partnership (2022). WASH climate resilient development. Strategic Framework: https://www.gwp.org/globalassets/global/about-gwp/publications/unicef-gwp/gwp_unicef_strategic_framework-2022-edition.pdf

IDMP (2022). Drought and water scarcity. WMO No.1284. Global Water Partnership, Stockholm, Sweden and World Meteorological Organization, Geneva, Switzerland.

International Science Council (2023). UN 2023 Water Conference: *ISC Policy brief*. Paris, International Science Council: https://council.science/publications/water-policy-brief/

IPBES (2019). Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn: https://www.ipbes.net/global-assessment

IPCC (2022). Annex II: Glossary [Möller, V., R. van Diemen, J.B.R. Matthews, C. Méndez, S. Semenov, J.S. Fuglestvedt, A. Reisinger (eds.)]. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 2897–2930, doi:10.1017/9781009325844.029.

IPCC (2022). Summary for Policymakers. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001

IWA World Water Congress and Exhibition (WWCE), (2022), Copenhagen, Denmark, September 11-15. Report available at: https://iwa-network.org/publications/copenhagen-report-2022-iwa-world-water-congress-exhibition/

IWA World Water Congress and Exhibition (WWCE), (2024), Toronto, Canada. August, 11-15. Conference Programme available at https://worldwatercongress.org/wp-content/uploads/2024/08/IWA-WWCE-2024-Programme-Overview.pdf and Proceedings

OECD (2023). Implementing water economics in the EU Water Framework Directive, OECD Studies on Water, OECD Publishing, Paris: https://www.oecd.org/en/publications/implementing-water-economics-in-the-eu-water-framework-directive_d6abda81-en.html

The Cyprus Institute (2022). Report of the Task Force on Water Resources, Eastern Mediterranean and Middle East Climate Change Initiative. Available online: https://emme-cci.org/?r3d=report-of-the-task-force-of-the-task-force-on-water-resources

UN Office for disaster risk reduction (2021). GAR Special Report on Drought 2021. Geneva: https://www.undrr.org/publication/gar-special-report-drought-2021

UN Water (2023). From commodity to common good: a feminist agenda to tackle the world's water crisis. Spotlight on Goal 6. https://www.unwomen.org/sites/default/files/2023-07/from-commodity-to-common-good-a-feminist-agenda-to-tackle-the-worlds-water-crisis-en.pdf

UNESCO (2019). The United Nations World Water Development Report 2019: Leaving no one behind. Paris: https://www.unwater.org/publications/un-world-water-development-report-2019

UNESCO, UN Water (2020). The United Nations World Water Development Report 2020: Water and climate change. Paris: https://unesdoc.unesco.org/ark:/48223/pf0000372985

UNESCO (2021). The United Nations World Water Development Report 2021: Valuing Water. Paris: https://www.unwater.org/publications/un-world-water-development-report-2021

UNESCO (2022). The United Nations World Water Development Report 2022: Groundwater: Making the invisible visible. Paris: https://www.unesco.org/reports/wwdr/2022/en

UNESCO (2023). The United Nations World Water Development Report 2023: Partnerships and cooperation for water. Paris: https://www.unwater.org/publications/un-world-water-development-report-2023

UNESCO (2024). The United Nations World Water Development Report 2024: Water for prosperity and peace. Paris: https://www.unwater.org/publications/un-world-water-development-report-2024

Water4All (2022). Water4All's Strategic Research and Innovation Agenda (SRIA): 2022-2025: https://www.water4all-partnership.eu/sites/www.water4all-partnership.eu/files/2023-02/Water4All_SRIA-2022-2025_A4_2311_bd.pdf

Water4All (2024). Atlas of Water-oriented Living Labs (WoLLs): https://www.water4all-partnership.eu/sites/www.water4all-partnership.eu/files/2024-05/Water4All_Atlas%20of%20WOLLs_2024%20.pdf

Water4All (2024). Proceedings from the stakeholder consultative workshops. Water4All SRIA update process: https://www.water4all-partnership.eu/sites/www.water4all-partnership.eu/files/2025-01/Water4All_D1.7_Proceedings%20from%20the%20consultative%20workshops.pdf

Water Europe (2022). Opportunities for hybrid grey and green infrastructure in water management: challenges and ways forward. White Paper.

Water Europe (2022). Soil health. Strengthening the water-soil nexus for a resilient ecosystem and a circular economy: https://watereurope.eu/wp-content/uploads/2023/12/PP-Soil-Health_FINAL-COMPLETE-PP-Factsheet-best-practices.pdf

Water Europe (2023). Blue Deal. Sectoral opportunities to achieve a water-smart society in Europe. White Paper: https://watereurope.eu/wp-content/uploads/2023/12/WE-Position-Paper-EESC-Blue-Deal.pdf

Water Europe (2023). Smart measuring devices for efficient water systems.

Water Europe (2024). For a green, circular and smart urban wastewater treatment Directive. Position Paper.

WMO (2022). State of global water resources 2021. World Meteorological Organization No.1308: https://wmo.int/publication-series/state-of-global-water-resources-2021

WMO (2023). State of global water resources 2022. World Meteorological Organization No.1333: https://wmo.int/publication-series/state-of-global-water-resources-2022

World Bank (2022). Water supply and sanitation policies, institutions, and regulation: Adapting to a changing world – synthesis report. Washington, DC: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099015208242275252/p165586002283004a086e105a00d8430696

World Bank (2023). The hidden wealth of nations: The economics of groundwater in times of climate change. By Rodella, Aude-Sophie, Esha Zaveri, and François Bertone. Washington, DC: https://www.worldbank.org/en/topic/water/publication/the-hidden-wealth-of-nations-groundwater-in-times-of-climate-change

water4all@agencerecherche.fr
www.water4all-partnership.eu

Grant Agreement n° 101060874

Co-funded by
the European Union