



2nd Draft

Strategic Research and Innovation Agenda

08/02/2021

European Partnership WATER4ALL “Water Security for the Planet”

0. Introduction

Under Horizon Europe, the EU 2021-2027 Research & Innovation Framework Programme, [European Partnerships](#) bring the European Commission together with public and private partners to address some of the most pressing challenges through joint development and implementation of research and innovation activities (R&I). These **partnerships should accelerate the transition towards a green, resilient and competitive Europe** and thus support the achievement of major EU policy objectives, such as those set for instance in the European Green Deal. Among the 49 candidate Partnerships, **Water4All** is proposed for a co-funded Partnership to address the challenges related to water: It aims at **enabling water security for all on the long term** through a broad range of activities.

The candidate Partnerships are currently under development: the Water4All proposal is expected to be submitted to the first call for proposals issued by Horizon Europe, for a formal launch of activities in late 2021 / early 2022. A draft description of the rationale, the objectives and the organisation of the Water4All Partnership candidate is available at:

https://ec.europa.eu/info/sites/info/files/research_and_innovation/funding/documents/ec_rtd_h_e-partnerships-water4all.pdf

The coordination of activities carried out under the Partnership should be based on a shared long-term vision. The key thematic areas for which coordinated and joint activities are needed have to be agreed in a **Strategic Research and Innovation Agenda (SRIA)**. In the end, the activities of the Partnership should rely on three complementary documents that will have to be considered together:

- The Partnership proposal describing its rationale and objectives, as well as the organisation and the various tools considered to reach these objectives. The full proposal will be submitted to the EC call for proposals (deadline still to be defined by the Commission). It will constitute the reference document for the whole duration of the Partnership.
- The Strategic Research and Innovation Agenda describing the themes and topics that the partners consider important to address in order to enable water security for all on the long

08/02/2021



- term. A first version will be published by the time the Commission commits to the Partnership. It will be reviewed and updated, if necessary, during the Partnership lifetime.
- Annual Implementation Plans will be issued along the duration of the Partnership, describing for the next year which topics from the SRIA should be tackled in priority and through which tools among those described in the Proposal. The first Implementation Plan will be published when the Partnership is established.

In addition, a Monitoring template will be issued describing the Key Performance Indicators to monitor the progress of the Partnership.

The present document **contains a preliminary version** of the SRIA of the future Water4All Partnership, based on the assessment of existing relevant SRIAs and a Stakeholders Consultation (December – January 2021). A consolidated and enhanced version of the agenda is due by May 2021.

The purpose of this preliminary version is to provide a general overview of the Water Research, Innovation and implementation priorities of Water4All in order to respond to the challenge of **“enabling water security for all on the long term”**. The structure of the document is as follows:

- Section 1: Vision and objectives of Water4All.
- Section 2: Aims of Water4All’s SRIA and development process.
- Section 3: Water4All’s added value in the European context.
- Section 4. Detailed outline of Water4All’s research, innovation and implementation areas to be addressed in order to respond to the overall challenge of enabling water security.
- Section 5: Links between the Water4All’s research and innovation areas outlined in Section 4 and EU frameworks (e.g. the EU Green Deal) and other EU programs and initiatives (notably, under Horizon Europe).

This document has been drafted by a Working Group bringing together representatives of the European Commission and main water-related initiatives, networks of experts and associations in Europe (*Water JPI, EurAqua, EurEau, Aqua Publica Europea, Water Europe, European Water Association*).

1. Water4All’s Vision, objectives and directions

a. Scope of Water4All

According to UN Water (2013), “water security” stands for *“the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability”*¹. The Water4All Partnership is guided by this definition and addresses

¹ <https://www.unwater.org/publications/water-security-infographic/>



its various dimensions (*i.e.*, preservation of ecosystems, health, safeguarding of water resources for sustaining livelihoods and economic development, water-related disasters, governance).

The Water4All Partnership will address freshwater security challenges in (Figure 1):

- **Inland surface waters: rivers, streams, lakes, wetlands.**
- **Transitional and coastal waters (hyporheic zone, estuaries, coastal lagoons).**
- **Underground water, including the vadose zone and the saturated zone (capillary fringe + groundwater)**

Water4All adopts a systemic approach from source to sea, and therefore considers all kinds of territories crossed by freshwater streams: urban areas as well as rural areas.

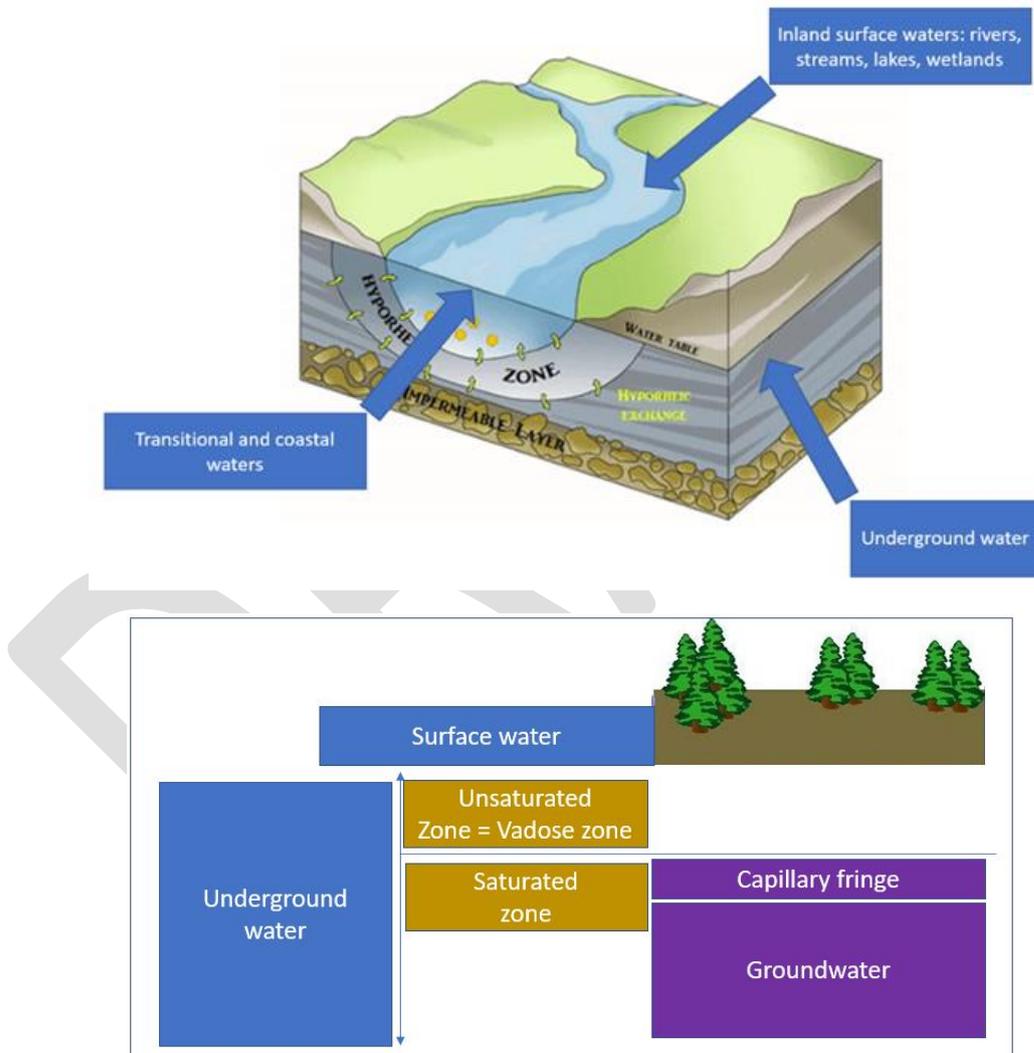


Figure 1. Representation of the physical domains addressed by Water4All.
 Source: <https://files.dnr.state.mn.us/assistance/backyard/healthyrivers/course/>



b. Water4All's Vision

Water4All's Vision is to **“boost the systemic transformations and changes across the entire research – water innovation pipeline, fostering the matchmaking between problem owners and solution providers for ensuring water security for all in the long term”** through:

- Conservation, restoration, regeneration and best use of the natural functions of groundwater, surface water and dependent or associated ecosystems.
- Demonstration, from pilot- to full-scale, and implementation of solutions, respecting integrated and nexus approaches. This covers both technical and non-technical solutions, e.g. relating to governance or economics.
- Support to European and international action plans and regulatory frameworks related to water (e.g. EU Green Deal, Water Framework Directive and daughter directives, Drinking Water Directive, SDGs) or having an influence on water (e.g. Common Agricultural Policy, Soil Thematic Strategy) through the provision of scientific evidence and validated approaches.
- Support to efficient collaboration and integration of European and international R&I activities.
- Open access to water knowledge and web services via communication and valorisation activities.

The rationale for the Partnership instrument to address water security challenges, as compared to previous R&I instruments or other Horizon Europe instruments, is to **cover the whole range of activities from knowledge creation, to practical implementation and practice**. The Partnership will emphasize the Innovation part and the implementation of solutions, as many have already been developed by scientists, but their uptake by policy makers, end-users and the society is often too limited or too slow to deliver on water challenges at a sufficient pace. To this end, Water4All will require **inter- and transdisciplinary** research and innovation activities, from physical and biological sciences to human and social sciences.

In addition, Water4All will develop **broad international cooperation** in R&I programming to create joint solutions for global societal challenges and mutual economic benefits. The ambitious goals of Water4All are solution-driven and include the establishment of new relationships to facilitate multidisciplinary networking across the water challenges on a wider scale, with respect to research and to targeted geographical areas. Water4All will therefore seek to make a significant contribution to the SDGs related to water, in particular SDG 6, by speeding up the systemic transformation of European societies but also pulling other countries on this way. It will do so in an adaptive manner, building on the knowledge and on the socio-economic and governance capacities of partner countries and regions.

c. Water4All Expected impacts

Joint activities in Water4All should contribute, in the long term, to achieving the objectives set by UN Water's definition for Water Security and in the **Sustainable Development Goals** related to **water**:



- Firstly, **SDG 6 “Ensure availability and sustainable management of water and sanitation for all”**, and
- In a correlated way, SDGs addressing Poverty (1), Hunger (2), Health (3), Clean Energy (7), Cities (11), Responsible Consumption and Production (12), Climate (13), Life below Water (14) and on Land (15), Peace, justice and strong institutions (16), and Partnerships for implementation within and beyond Europe (17).

The actions from Water4All should then enable the following expected impacts:

- Ensure **safe and uninterrupted water services** for all EU citizen,
- Substantially **improve water availability in sufficient quantity and quality** for all uses in Europe, including food and energy production as well as industrial processes,
- Implement a **water-circular EU Economy**,
- **Restore European water-related ecosystems** and their ability to deliver their services, including the support to biodiversity,
- Improve **resilience** of European populations to **water-related hazards** including floods, droughts and pollution, and to **climate change**,
- Set up and promote a **governance of the water cycle** that allows an inclusive, **integrated and sustainable management** at European and international level,
- Strengthen **European leadership in the international collaboration** for achieving the SDGs.

To effectively produce these impacts, Water4All is meant to achieve the following specific objectives:

- **Strengthen the European and international water R&I community** and leverage its action,
- **Deliver and implement efficient and affordable solutions** (incl. Nature-based) to water security challenges in Europe and beyond, supported by appropriate framework conditions for market uptake,
- **Provide scientific evidence** for tackling and integrating water issues in **all relevant policies** at local, national and European level and in international policy frameworks,
- **Develop capacity and community building** to drive necessary societal transformations required for securing water for all.

d. Water4All themes, Drivers and Enablers

Figure 2 depicts Water4All’s **thematic fields of interest as well as potential drivers and enablers**. Water4All themes respond to specific needs of society at large (socioeconomic, political and health needs), ecosystems, and infrastructures. The SRIA is structured around five main themes (1-5 in the list below) and two cross-cutting themes – regarding respectively governance and international cooperation. Each theme is then broken down into specific sub-themes and topics, *i.e.*, specific R&I issues for which joint actions are recommended (a full description of sub-themes and topics is provided in **Section 4**).

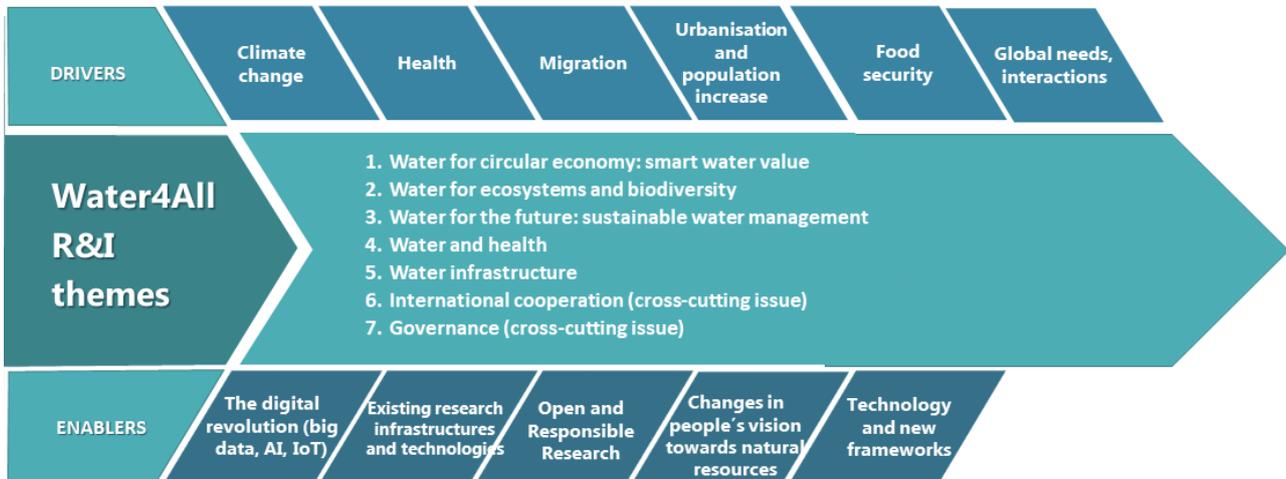


Figure 2. Water4All's R&I themes, drivers and enablers.

Drivers refer to possible factors that may trigger changes in the strategic priorities identified in the SRIA for the next 7 years of the programme. Possible drivers for change include:

- Climate change and biodiversity loss: Water is the primary medium through which we feel the effects of climate change (UN Water). Changes in climate will affect the hydrological cycle and current weather projections predict more extreme hydrological events inside and outside Europe. More floods and severe droughts are expected, impacting both water quantity and quality and, hence, all water related sectors. Climate change and the associated sea-level rise are drivers for natural hazards, soil erosion, biodiversity loss, water scarcity (or excess), water quality reduction. This may ultimately trigger food shortage, population impoverishment, economic crisis, migration dynamics and political instability.
- Human and ecosystem health: As we recently experienced with the recent COVID-19 pandemic, but also during other natural disasters or climatic shocks that were accompanied by epidemic, health and water security determine each other. Health issues can generate chronic risks. Health issues may undermine secure water availability and jeopardize washing and sanitation.
- Migration: Migration phenomena are likely to intensify in certain regions of the world due to climate change, economic crisis or political instability. Water resources and inadequate water services are key parameters spurring migration, which in turn may result in higher pressure on water resources in destination areas.
- Urbanisation and population growth and dynamics: Population dynamics towards urban areas account for water stress, water quality degradation and water sanitation needs. Global trends indicate that this phenomenon is expected to exacerbate.
- Food security: In the same vein, population growth will compromise water availability, quality and food security. In this sense, conjunctive use of surface water and groundwater and efficient agricultural water management (including irrigation and rainwater harvesting) have crucial roles in sustaining agricultural systems productivity and in buffering the year-to-year fluctuations due to variable climatic conditions.
- Global needs and interactions in water management and the implementation of solutions. Water4All will boost systemic transformations in water management through the



integration of both local and distant human-nature interactions , e.g. local and global water demand as a result of land use change or impacts of hydroclimatic extreme events on water security.

Enablers represent any factors facilitating activities and the attainment of objectives:

- The digital revolution (big data, AI, IoT, remote Earth observation, water sensors real-time monitoring, data assimilation). The combination of data surplus stemming from new systems and devices along with an increasing computer capacity offer an untapped potential for the monitoring of water resources and ecosystems, the visualisation and evaluation of management/ policy options, and the communication of decisions.
- Existing/ future research infrastructures (see Table 3). Research infrastructures offer functionalities for the collection, analysis and modelling of data for water management. Water4All will strengthen collaboration with relevant national and European research infrastructures in order to exploit at best those functionalities and avoid the duplication of efforts.
- Global and European initiatives that support Open Science and Responsible Research and Innovation. Open Science provides opportunities for the sharing of data and knowledge, which enables reproducibility and access to research data. Water4All will be attentive to privacy and security issues stemming from the sharing of sensitive data and information (ethical data management). Data privacy/ security violations are particularly likely to occur in the collection of data from remote sensing, smart meters (related to water consumption) and digital trace data (Zipper et al. 2019²).
- Technologies and new regulatory and economic frameworks enabling more efficient water management. Water4All embraces forward-thinking applications and solutions to progress in safe and clean water for all. The initiative will seek to promote the implementation and practice of innovative solutions in all sectors across Europe and abroad through new technologies and governance (see section e below for more information).
- Changes in people's awareness on and vision towards natural resources. Communication and global outreach play a key role in shaping people's awareness of, and behaviour towards, water challenges. Water4All must seize the opportunities provided by social networks and digital media to inform objectively and responsibly of the work carried out by the initiative, current challenges and best possible ways to safeguard water security for all.

e. Addressing barriers to implementation – Water4All activities

Achieving the desired water security level requires a combination of solid legal and regulatory framework setting, government capacity for enforcement, available technological solutions and, importantly, a market demand. Alignment of funding programmes (from research to innovation implementation, and efficiency demonstration) and timelines is necessary for creating the critical

² Zipper et al. 2019. Balancing open science and data privacy in the water sciences. Water Resources Research. Volume 55, issue 7.



mass required by the challenges still faced by the countries, the water resources users and the public. Moreover, the building of new knowledge insights and the development of new solutions may be in vain without:

- adequate **incentives**, *e.g.* innovation uptake and transformation shift in public procurements, pricing and tariff setting (*e.g.* prices reflecting true cost of water services), or allowing / facilitating synergistic solutions between sectors and actors,
- **sound economic framework conditions** for the service and solutions providers (*e.g.* water utilities) to be able to scale-up the solutions and implement them. This includes connecting research and innovation funding programmes with “downstream” funding programmes (equipment investments, demonstration at policy scales) to demonstrate the efficiency and fairness of new innovations at the field scale, and transform pilots into operations,
- and also a **global environmental governance paradigm**, which encourages market demand for **integrated solutions** (*e.g.* wastewater treatment plants with high level of energy efficiency, thereby contributing to climate neutrality.)

Already today, state-of-the-art solutions exist, which yet have to become market mainstream products and services, among others subsidized water and energy prices being the main reason for the market to underplay these features. Water4All will work on developing solutions driven by societal and market demand, and on decreasing the barriers to implementation of the solutions, either existing or newly developed.

Water4All is organised in five pillars shown on Figure 3, and foresees a broad range of activities along the whole R&I value chain to investigate the identified themes and foster implementation of innovation. These activities are described in the main proposal and include in particular:

- Leading alignment of national and regional programmes; creating research synergies among networks (Pillar A);
- Implementing Joint transnational calls for projects, including calls for innovation transfer to the relevant end-users, maturation calls (Pillar B);
- Launching Thematic Annual Programming actions (clusters of projects funded through national calls) (Pillar B);
- Running knowledge hubs (Pillar C);
- Producing science – policy interface documents and events (policy briefs, factsheets, policy conference...) (Pillar C);
- Digital data and web services, promoting Open innovation / Open science (Pillars A&C);
- Supporting the uptake of innovation by the economic sectors: access to financial programmes, creation of start-ups, confirmation of business relevance (Pillar C);
- Designing capacity development programmes for targeted groups such as policy makers, decision-makers, service providers: dissemination programmes, MOOC, webinars (Pillar C);
- Building capacity for entrepreneurs and start-ups from the Water sector (training, mentoring) (Pillar C);



- Designing training programmes for students or young professionals (Pillar C);
- Proposing mobility schemes (Pillar C);
- Engaging with ongoing or new demonstration sites or living labs to test and implement solutions (Pillar D);
- Conducting roadshows for promoting innovative approaches (Pillars D&E);
- Feeding data and evidence from R&I programmes into UN SDGs monitoring (Pillar E);
- Testing innovative tools to strengthen international cooperation (Pillar E).

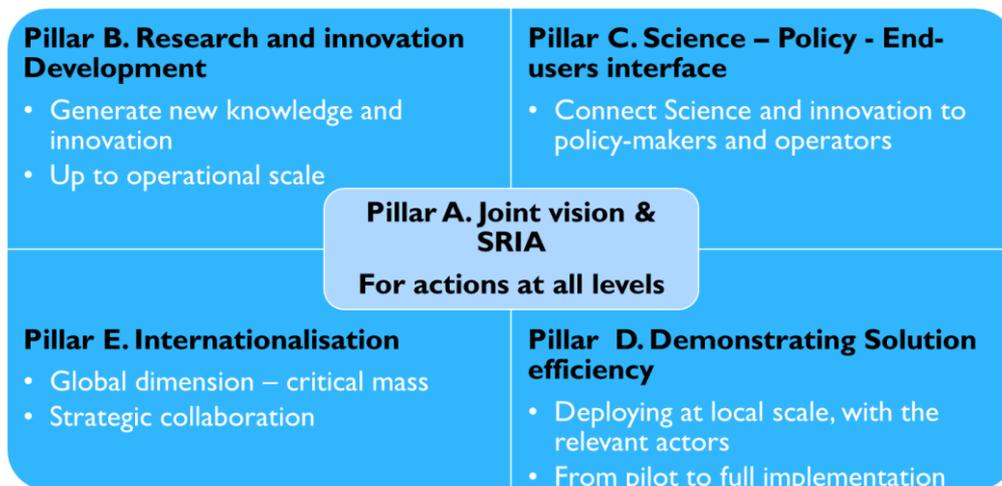


Figure 3. Water4All structure in five pillars

The most suitable tool(s) will be chosen at the stage of the Implementation Plan to address each considered topic, depending on the nature of the bottleneck³ (e.g. research gap or lack of uptake by decision-makers or the economic sector). The **present SRIA will apply to and guide all activities carried out under Water4All**; in the description of the R&I themes below, we indicatively suggest the main Pillars that could be considered to cover each subtheme, to support the identification of appropriate tools in later stages.

We acknowledge the strong interrelations between the themes presented below. While the presentation requires assigning topics to a theme, most, if not all of the topics have relevance for one or several other themes. In its systemic vision, Water4All aims at an encompassing approach breaking the silos of disciplines or applications. This is why in our future activities, in particular in the calls for project that will be launched, we will foster jointly addressing several topics across the themes (including the two cross-cutting themes).

³ For instance, the development of “Smart water systems” under Subtheme III.V may include activities close to market such as transfer calls or support to start-up creation; exploring the response of ecosystems to hydro-climatic events under Subtheme II.II would rather be addressed through knowledge creation and sharing activities such as joint calls or TAP; the development of Risk Assessment procedures under Subtheme IV.IV may combine knowledge creation activities with science-policy interface actions.



2. SRIA: Aims and development process

A SRIA allows having a better understanding of Research and Innovation priority areas and their implementation to be explored and funded within the timeline of the Partnership, its objectives and expected impacts. The SRIA will guide stakeholders from national/ regional funding agencies, research operators, academia, industry, policy and society in addressing water security challenges. The SRIA is therefore conceived as the **“strategic backbone” of the upcoming Water4All Partnership.**

Water security (both in terms of quantity and quality) being an issue in many Member States and at European level, water is the object of numerous initiatives (cf. figure 14 of Water4All candidate description). Some of these initiatives have established their own strategic R&I agenda as a way to guide their activities and influence the EU Research and Innovation setting. Water4All does not aim at developing a SRIA from scratch. On the contrary, **it builds upon these agendas.** Following a mapping exercise carried out by the Drafting Group of Water4All, existing SRIAs from major water initiatives, networks of experts and associations were identified and critically reviewed (*i.e.* agendas from the Water JPI, EurAqua, Water Europe, EurEau, PRIMA, FACCE JPI). All R&I needs identified in those agendas were grouped together into different themes according to the overarching aim they refer to. R&I needs identified in recent conferences or events (Water Europe, GeoERA, EuroGeoSurveys, ESA EO4Water...) have also been considered, as well as the draft versions of the Strategic Research and Innovation Agenda from upcoming EU Partnerships within the framework of Horizon Europe’s Cluster 6: Sustainable blue Economy and Biodiversity

The process for developing the agenda and its provisional schedule are summarised in the figure (**Figure 4**) below. A first draft has been produced on the 7th December 2020, on the basis on the review and assessment of R&I needs in EU water agendas and of exchanges during a meeting of the Advisory Boards of the Water JPI at the beginning of October 2020. Representatives of most of the institutions involved in the Water4All SRIA Drafting Group were as well present in the meeting. Water4All participating countries have been consulted on this first draft, and an open consultation has been online between the 10th December 2020 and the 18th January 2021, attracting 93 valid contributions^{4, 5}. The current 2nd draft takes account of the feedback received from these consultations.

⁴ As explicitly mentioned in the Privacy policy of the survey, anonymous contributions to the consultation were not accepted. One contribution has been disregarded for this reason.

⁵ The contributions received through the online consultation can be accessed at:
https://ec.europa.eu/eusurvey/publication/Water4All_SRIA_2020

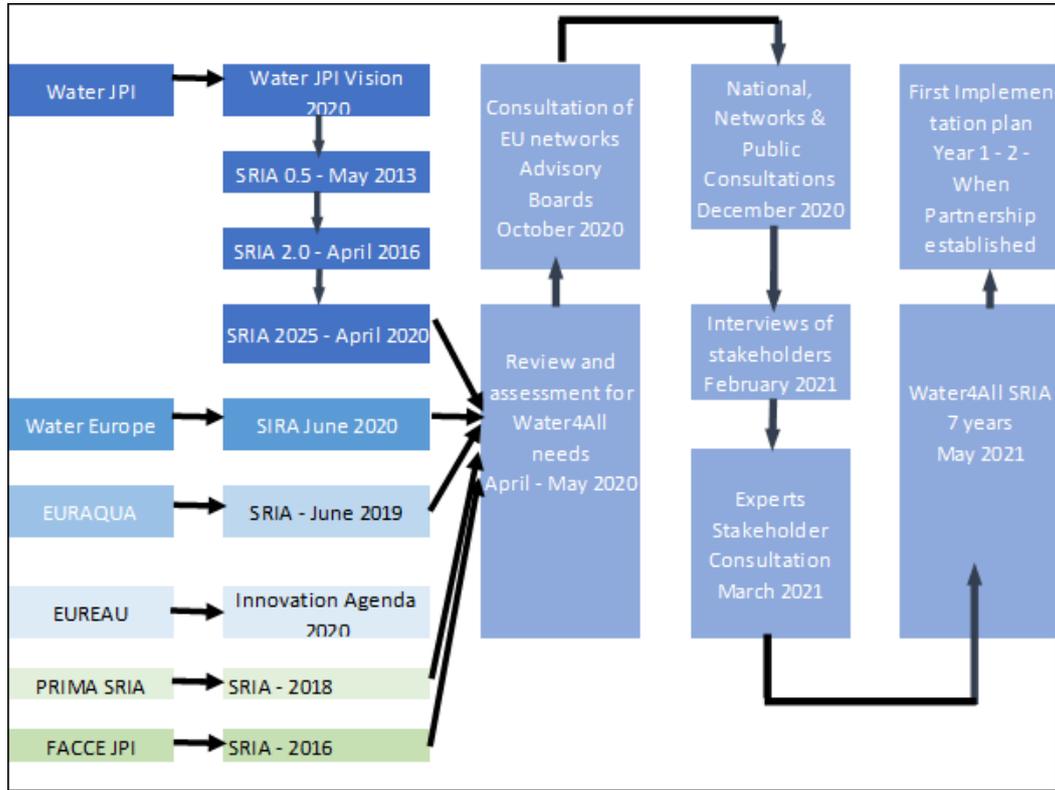


Figure 4. Water4All's SRIA development process.

Additional interviews and consultation of water experts and stakeholders will guide adjustments towards the final version of the document. The resulting Water4All SRIA, version 1.0, expected for publication by May 2021, will be re-evaluated and updated halfway during the Partnership.

3. Water4All's added value in the European context

“Europe’s environment is at a tipping point. We have a narrow window of opportunity in the next decade to scale up measures to protect nature, lessen the impacts of climate change and radically reduce our consumption of natural resources”. These are the words of the EEA Executive Director, Hans Bruyninckx. It reflects the concerns of high-level EU environmental policy actors. Water is scarce in many European regions (especially in southern areas or highly densely populated regions) and projections indicate that **water scarcity episodes will exacerbate** in the future. Only around 40% of surface waters (those of interest for Water4All, *i.e.* rivers, lakes and transitional and coastal waters) are in good ecological status and only 38% are in good chemical status (EC COM(2019) 95 final). To make matter worse, **water quality is expected to further decrease** due to higher diffuse pollution loading released during precipitation events and/ or reduced dilution capacity of rivers in low flow periods. Results are better for groundwater resources as 74% of the aquifers achieve good chemical status. However, uncontrolled and even illegal abstraction puts water availability of these resources at risk in certain European regions and for specific uses (*e.g.* ecosystem maintenance, agriculture, tourism, hydropower sector).



Enough fit-for-purpose water is a prerequisite for achieving the Green Deal. Water is essential in all its nine policy components: Biodiversity, From Farm to Fork, Sustainable agriculture, Clean energy, Sustainable industry, Building and renovating, Sustainable mobility, Eliminating pollution, Climate action. Water is also an essential asset in at least **4 of the 5 Horizon Europe Missions** on:

- Adaptation to climate change including societal transformation;
- Climate-neutral and smart cities;
- Soils health and food; and
- Healthy oceans, seas, coastal and inland waters).

Current trends in water quantity and quality will also undermine progress towards EU policy targets and achievement of the Sustainable Development Goals (SDGs) on Water (SDG6), Poverty (1), Hunger (2), Health (3), Clean Energy (7), Cities (11), Responsible Consumption and Production (12), Climate (13), Life below Water (14) and on Land (15), Peace, justice and strong institutions (16), and Partnerships for implementation within and beyond Europe (17).

The rationale for Water4All is to **gather water actors and stakeholders at scale and appropriate duration to generate the necessary transformations** to solve the water-related issues. **The European water sector is strongly fragmented. The experience accumulated by existing initiatives, and quite notably that of the Water JPI, will be seized to spark up cooperation amongst national/regional funding agencies, academia, research operators, water authorities, water utilities, and the water private sector. Key lessons will be exploited at most in order to capitalise human and financial resources.**

Water security being a global challenge, Water4All will boost synergies and cooperation with other international water initiatives (SDG 17). Cooperation agreements with international partners and strategic geographical regions for Europe will be sought. Water4All will build upon the work carried out in the Water JPI and its dedicated CSA, IC4WATER, International cooperation for Water as well as within the frame of the EU-India Partnership and the China-Europe Water Platform. **Diplomacy issues, transboundary water management and cooperation modalities will be explored.**

Water is essential to basically any sector of life, from natural functions of the environment through health, food, energy or industrial production, building industry... Therefore, Water4All interfaces with many other initiatives at EU-scale. Interfaces may correspond to:

- Geographical connections:
 - o Coastal areas and transition waters connect to the **Climate Neutral, Sustainable and Productive Blue Economy** Partnership and **JPI Oceans**
 - o Underground waters connect to the **CSA for a Geological Service for Europe**
 - o Water in soils and water sediment transportation connect to the **EJP Soil**
 - o Water in cities connect to the **Driving Urban Transition to a sustainable future** Partnership
 - o The Mediterranean area is an area with specific concerns regarding water, addressed in **PRIMA (2017 – 2027)**



- Uses of water:
 - o Agricultural water consumption connects to the **Agro-ecology living labs and research infrastructures** and **Environmental observations for a sustainable EU agriculture** Partnerships, and to the **FACCE JPI**; food production at large connects to the **Safe and Sustainable Food System** Partnership.
 - o Water in production processes connect to the **Processes4Planet** and the **Circular bio-based Europe** Partnerships
 - o Water for energy production connects to the **Clean Energy Transition Partnership**
- Water as a medium:
 - o Aquatic ecosystems, as habitats, connect to the **Rescuing biodiversity to safeguard life on Earth** Partnership; as victims of climate change and contributors to its mitigation, they connect to the **KIC Climate** and **JPI Climate**
 - o Pollutant's transportation in waters connects to the **One Health European Joint Programming** and the **Chemical Risk Assessment** Partnership
 - o Rivers as a support for transportation connect to the **Zero-emission Water Borne transport** Partnership
- The production of data related to water, which connects to the **European Metrology** and the **European Open Science Cloud** Partnerships.

Water4All will seek synergies and collaboration opportunities with other EU initiatives connected to water and aquatic ecosystems challenges, in order to leverage the actions and maximise the respective impact of the initiatives. Such collaborations may take various forms, such as joint workshops, cross-partnerships calls for projects or Thematic Annual Programming, common knowledge hubs, joint capacity building programmes etc. The modalities for collaboration will be discussed bilaterally with each initiative and detailed in the successive implementation plans. **Table 2** at the end of this document indicates the main EU initiatives connected to each theme.



4. Water4All proposed R&I themes

The Water4All's SRIA is structured in 3 levels. First, it lays out main **Themes**, conceived as general overarching areas of research and innovation in the field of water. A number of **sub-themes** are then established for each theme. Finally, each sub-theme contains a variable number of **topics** that refer to specific issues for which R&I activities are recommended.

This section outlines Water4All's R&I themes, sub-themes and topics that could be addressed by the initiative. The presentation of themes is structured as follows: first, a short description on why each theme has been included in the agenda is provided (*i.e.* environmental, political, socioeconomic relevance). This is followed by a list of main keywords. A table then details the sub-themes and specific topics, as well as the links between those sub-themes and main Water4All's pillars.

According to the UN Water's framework mentioned above (**Section 1**), **enabling water security** is not only about ensuring access to safe and sufficient drinking water at an affordable cost in order to meet basic needs, including sanitation and hygiene. **Water security embraces as well:**

- **The protection of livelihoods and human rights** (especially tackled in Themes 1 and 4);
- **The safeguard of human health** (Theme 4);
- **The conservation and restoration of ecosystems and biodiversity** (Theme 2);
- **The sustainability of economic development and activities (such as energy, agriculture, industry)** (Theme 1)
- **The protection of society and related infrastructures against natural hazards** (Theme 5);
- **Collaborative approaches to transboundary water management** (Theme 6);
- **Good governance** (Theme 7).

The synthesis list of core Water4All's Themes and sub-themes is provided in the following **Table 1**, together with the SDGs they are contributing to.



Table 1. Water4All Themes, sub-themes and related SDGs

THEME VII		
G O V E R N A N C E I N T E R N A T I O N A L C O O P E R A T I O N	THEME VI Research theme and sub-themes	EU Pollides supported by Water4All
	THEME I - WATER FOR CIRCULAR ECONOMY: SMART WATER VALUE	
	I.I Water supplies for socio-economic development and activities	EU Green Deal
	I.II Circular economy	Water Framework, Bathing Waters, Urban Waste Water Treatment, Groundwater Directives
	I.III Empowering the public, water users and stakeholders in valuing water	Common Agricultural Policy Circular Economy Action Plan
	THEME II - WATER FOR ECOSYSTEMS AND BIODIVERSITY	
	II.I Functioning and biodiversity	EU Green Deal
	II.II Resilience, mitigation and adaptation of aquatic ecosystems and ecosystem services to global changes	Water Framework, Shellfish Waters, Dangerous Substances (and its 'daughter' directives), Nitrates, Freshwater Fisheries, Exchange of Information on the Quality of Surface Freshwaters, Groundwater Directives
	II.III Developing and applying ecological engineering and ecohydrology for ecosystems restoration	
	II.IV Integrating ecosystem services into the management of water resources	EU Biodiversity Strategy
	THEME III - WATER FOR THE FUTURE: SUSTAINABLE WATER MANAGEMENT	
	III.I Water Resources Management	EU Green Deal
	III.II River basin management	Water Framework, Dangerous Substances (and its 'daughter' directives), Nitrates, Freshwater Fisheries, Exchange of Information on the Quality of Surface Freshwaters, Groundwater Directives
	III.III Groundwater management	
	III.IV Resilience, adaptation and mitigation to hydroclimatic extreme events	Shaping Europe's Digital Future
	III.V Tools for water management	European strategy for data
	THEME IV - WATER AND HEALTH	
	IV.I Behaviour and effects of contaminants of emerging concern, plastics, endocrine disruptors	EU Green Deal
	IV.II Water dimension in antimicrobial resistance	Water Framework, Bathing Waters, Dangerous Substances (and its 'daughter' directives), Urban Waste Water Treatment Directives
	IV.III Innovative water tools and technologies for water quality monitoring and water treatment, remediation and disinfection	
IV.IV Risk Assessment	Marine Strategy	
THEME V - INFRASTRUCTURES FOR WATER		
V.I Adaptation of existing water infrastructures to new challenges	EU Green Deal	
V.II Water infrastructures resilience	EU Adaptation Strategy	
V.III Water infrastructures security (including cyber and terrorism security)		
VI.I Water diplomacy		
VI.II Establishing tools for trans-boundary cooperation	(EU Green Deal)	
VI.III Developing integrated, fair and adaptive water resource management systems		
VIII.I Developing methods for more efficient citizen and wider stakeholder engagement		
VIII.II Strengthening policy integration, alignment, coherence and water policy coordination in order to exert a real change in society	Common Agricultural Policy EU Green Deal EU Adaptation Strategy	
VIII.III Enhancing the regulatory framework	Circular Economy Action Plan Water Framework Directive	



Theme I: Water for circular economy: smart water value

Why this theme? Climate conditions and water demand are the two key factors driving water stress. Being people-centred, this theme will look at tools, methodologies and approaches enabling water resource efficiency, water allocation and water use optimisation **for different economic sectors (agriculture, aquaculture, industry, tourism, energy production) in both rural and urban areas** through the promotion of innovative technologies, management practices and governance models. Water4All will boost synergies across water uses and needs as an alternative strategy to trade-offs strategies and in support of the fair distribution of water and the optimisation of the resource. Water4All thus wish to contribute to the resolution of conflicts around the use of limited water resources.

The effects of proposed solutions for water use efficiency in reducing resource interdependencies and increasing climate change resilience will be further analysed.

In a context of global changes, Water4All will favour the development and implementation of best available solutions for water treatment and reuse, resource recovery and resource valorisation (reduce, reuse, recycling). Water4All will strive to develop new circular feedstocks and value chains from water and industrial sectors through water technologies to enable the circular and bio-based economy. By ensuring the supply of scarce resources, circular economy approaches should reduce pressures in the Water-Energy-Food-Ecosystems nexus (WEFE nexus).

Water circularity for the recovery and storage of water in aquifers or other bodies is not considered in this topic as it is an object of interest within theme 3 (sustainable water management).

Water has a value: an economic, a societal and an environmental value. The use of water is heavily dependent on the value that individuals allocate to the resource. Water4All will explore that value through participatory approaches and the empowering of users. Questions on awareness, water footprint and paradigm changes will be addressed within this theme.

This theme is linked to all the Green Deal policy areas, the Mission on Adaptation to climate change including societal transformation and the proposed Partnership Processes4Planet (Cluster 4). This theme is strongly linked to the Theme VII on Governance.

Key words: circular economy, fit for use, WEFE nexus, water value, partnerships and business models, water pricing, bio-based feedstocks, value chains, resource recovery, diffuse pollution.

Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
I.I. Water supplies for socio-economic development and activities, such as agricultural, aquaculture,	• Developing innovative water allocation policies and management practices.	VII.II	B – C – D
	• Developing a new water demand management approach including long-term water demand forecasting and scenarios.	I.II	
	• Developing smart water use and efficient technologies for irrigation and industrial purposes.	III.I	



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
urban, industrial and energy uses.	<ul style="list-style-type: none"> Mitigating impacts from energy and raw materials production. 	V.II	
	<ul style="list-style-type: none"> Developing and testing scalable and affordable solutions to allow the prioritisation of investment and activities for climate change resilience. 	V.I V.II VII.III	
I.II. Circular economy.	<ul style="list-style-type: none"> Developing circular economy approaches to urban and industrial wastewater treatment plants. 	IV.III V.I	B – D
	<ul style="list-style-type: none"> Water –Energy – Food – Ecosystems (WEFE) Nexus: <ul style="list-style-type: none"> Assess the interlinkages and interdependencies of water, food and energy sectors and ecosystems in a context of climate change in different water bodies, in particular transboundary ones (from monitoring schemes, demand forecasting, socio-economic assessments, scenario planning, behavioural change, cost-benefit analysis), to implement a real water-energy-food nexus approach and increase efficiencies, equity and sustainability. Advancing a holistic approach in the WEFE Nexus through the inclusion of health (One Health concept). Identifying and investigating drivers, pathways, nature and types of barriers of the Nexus. 	I.I	
	<ul style="list-style-type: none"> Developing and implementing the “Fit-for-use” concept for water-dependent sectors. 	IV.III V.I	
	<ul style="list-style-type: none"> Understanding and quantifying trade-offs between alternative interventions for a better integration in the implementation of interventions. 	III.II	
	<ul style="list-style-type: none"> Developing and optimizing technologies for the recovery and valorisation of resources (including energy, minerals, metals, salts, nutrients, cellulose) from (waste) water, and the production of novel feedstocks from wastewater (e.g. bio-plastics, PHA, natural flocculants, kaumera gum, etc.), brines and sludges. 	---	
	<ul style="list-style-type: none"> Sustainable sediment recovery and use from reservoirs 	III.I III.II	
	<ul style="list-style-type: none"> Developing innovative traceability systems to guarantee the quality of recovered products and improve confidence of the market. 	VII.III	
	<ul style="list-style-type: none"> Quantifying the long-term implications of water reuse on environmental compartments. 	II.I	
	<ul style="list-style-type: none"> Developing robust methods and indicators for measuring transition to circularity, its benefits, challenges and trade-offs. 	VII.III	
	<ul style="list-style-type: none"> Developing new management tools and methodologies, partnerships and business models for industrial processes and agricultural water reuse and recycling. This topic will also look at the development of matchmaking platforms for the valorisation of wastewater based on its value for 	IV.III VII.III	



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
	different industries (and sectors), and the implementation of decentralised treatment systems in synergy with existing centralised treatments.		
	<ul style="list-style-type: none"> Progressing in the understanding of the socioeconomic aspects, governance and behavioural changes for developing social acceptance of reused wastewater. 	VII.I VII.III	
I.III. Empowering the public, water users and stakeholders in valuing water.	<ul style="list-style-type: none"> Developing a bottom-up approach for co-design and co-construction of solutions for water users. 	VII.I	B – C – D
	<ul style="list-style-type: none"> Raising public awareness for the value of water and public participation in RDI through the use of water footprint models. 	VII.I	
	<ul style="list-style-type: none"> Understanding and assessing the values of water for the public and stakeholders to guarantee sustainability of water and limit use conflicts. 	VI.I	
	<ul style="list-style-type: none"> Developing methodologies to assess stakeholder responsibilities in setting the right prices to reflect the marginal value of water. 	VII.I	
	<ul style="list-style-type: none"> Developing participatory foresight approaches to raise stakeholders' awareness of the long-term value of water resource protection. 	VII.I	
	<ul style="list-style-type: none"> Exploring the possible routes to conduct paradigm changes to be innovative for water governance. 	VII.II	

Theme II: Water for ecosystems and Biodiversity

Why this theme? The quality of surface and subsurface aquatic ecosystems as well as on transitional and coastal waters is threatened by the presence of pollutants - mainly originating from agricultural land use, but still also from cities and industry -, changes in the water cycle, climate change, habitat degradation, biodiversity loss, damages to hydraulic connectivity and exotic species invasions.

More than half of river and lake water bodies in Europe are reported to hold less than good ecological status (EEA, 2018). The overall proportion of groundwater body areas at risk or not achieving good chemical status is of around 30% (2nd River Basin Management Plans, RBMPs). Poor chemical status of water can be a risk for human health as well as the structure and functioning of aquatic ecosystems (surface and subsurface aquatic ecosystems from catchment to coast).

Poor ecological status *e.g.* eutrophication of aquatic ecosystems can result in damages to biodiversity, the degradation of fragile and rare ecosystems (wetlands, intermittent rivers, Arctic and boreal ecosystems), and the loss of water quality and ecosystem services such as water purification, regulation of the flow of flood events, and provision of clean drinking water. The achievement of good quality of aquatic ecosystems cannot happen without an appropriate



management of water from catchments to sea. It is for this reason that this Theme and Theme III (Water for the future: Sustainable Water Management) are intrinsically linked.

This theme addresses issues concerning aquatic ecosystems (including biodiversity) above and below surface as well as in “interface areas” (capillary fringe, vadose zone, hyporheic zone) with a “source-to-sea” perspective. Linkages between upstream and downstream water management and land use impacts on water resources are therefore considered. More specifically, this theme will tackle topics for the monitoring and evaluation of the functioning of surface aquatic and groundwater dependent ecosystems, resilience and adaptation to global changes *e.g.* climate change and restoration measures, and tools for decision making support. It looks in particular at synergies between green/ blue infrastructure and Nature-Based Solutions (NBS) for climate change resilience and adaptation. Issues for improving the uptake of monitoring methods into routine use and ensuring the interoperability of tools are considered.

With this theme, Water4all wants to contribute mainly to the Green Deal Action Plan, the European Biodiversity strategy, the Water Framework Directive and “daughter” directives, and the Missions on Healthy oceans, seas, coastal and inland waters and on Soils health and food.

Key words: ecosystems quality, multiple stressors, resilience, ecosystem restoration, ecosystem services nature-based solutions, eutrophication, nutrient and pollution loadings, groundwater, surface water

Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
II.I. Functioning and biodiversity	<ul style="list-style-type: none"> Setting minimum requirements for meta-data descriptions, data accuracy, data handling and processing for sequencing data produced by molecular methods. 	III.V	B – C
	<ul style="list-style-type: none"> Monitoring and assessing the functioning and evolution of ecosystems, ecosystem goods and services. Attention will be paid to: <ul style="list-style-type: none"> Understanding of connections between aquatic ecosystems and the C, O₂, P, N, S, Fe and energy cycles. Understanding the effects of pesticides, microplastics and micropollutants on ecosystems and biodiversity. Opportunities provided by new data and tools will be seized <i>e.g.</i> big data, models, observatories, computing power, artificial intelligence, innovative molecular sensor, biosensors. 	III.V	
	<ul style="list-style-type: none"> Implementing innovative and adaptive biodiversity and ecosystems monitoring tools at different scales (from eDNA in water to Earth observations) and systems (from ponds to large rivers) and their integration into information technology observatories that combine data and model prediction. 	III.V	
	<ul style="list-style-type: none"> Using novel monitoring methods for managing the risks posed by invasive species and monitoring remediation options. 	II.III	



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
	<ul style="list-style-type: none"> Enhancing the role of inland and coastal aquatic ecosystems in carbon sequestration and the reduction of GHG emissions, and its link to the ecological status (sensu WFD), the conservation status (sensu Habitats Directive) and the pressure levels experienced. 	II.III	
	<ul style="list-style-type: none"> Understanding and predicting multiple pressure (including anthropogenic pressures)–impact–response relationships in aquatic ecosystems (cumulative effects, domino effects) and ecosystem services through advanced methods and techniques. 	II.II III.II	
	<ul style="list-style-type: none"> Developing prediction models of ecosystem “tipping points”, sustainability, productivity and resilience in response to environmental stressors e.g. hydro-climatic extreme events. 	II.II	
	<ul style="list-style-type: none"> Understanding the dynamics and functioning of a range of vulnerable water ecosystems of regional interest (including intermittent rivers, wetlands, lagoons, alpine areas and glaciers, Arctic and boreal water systems, peatlands, estuaries). 	I.II III.I	
	<ul style="list-style-type: none"> Developing evaluation and prediction methodologies to assess the economic and social value of ecosystem services and the intrinsic value of biodiversity across the diverse regions of the EU. Concepts and indicators of ecological economics will be explored. 	II.IV	
	<ul style="list-style-type: none"> Analysing the linkage between upstream and downstream areas, the role and functional importance of floodplain/ lateral connectivity and channel dynamics, and the interaction between groundwater and the hyporheic zone. 	II.IV III.I	
	<ul style="list-style-type: none"> Improving knowledge on the quantity and quality of matter flowing across the various reactive zones between soil-plant systems and the different water bodies (vadose zone, capillary fringe, hyporheic zone and coastal zone). 	II.IV III.I	
II.II. Resilience, mitigation and adaptation of aquatic ecosystems and ecosystem services to global changes e.g. climate change.	<ul style="list-style-type: none"> Using the understanding gained in multiple pressure-impact-response relationships (<i>topic listed above</i>) to counteract pressure factors/ stressors. 	II.I	B
	<ul style="list-style-type: none"> Exploring the connection between biodiversity (in particular invasive species), ecosystems services and waterborne diseases as a result of climate change and improved transport modes. 	II.I	
	<ul style="list-style-type: none"> Developing improved tools for adaptation and mitigation to hydro-climatic extreme events, especially floods (including “flash-floods”), heat waves and droughts in a catchment to sea context including the urban dimension. 	III.IV III.V	
	<ul style="list-style-type: none"> Exploring synergies between green and blue nature-based solutions (NBS) to both mitigate and adapt to water related natural hazards, providing biodiversity and GHG mitigation both in natural and urban environments. 	V.II	
II.III. Developing and applying ecological engineering and	<ul style="list-style-type: none"> Understanding, managing and restoring the ecological functioning of aquatic systems (morphological conditions, river continuity, sediment flows, hydraulic connectivity and ecological flow), ecosystem services and biodiversity. 	II.I	B – C



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
ecohydrology for ecosystems restoration.	Opportunities provided by technology (sensors, digitally derived biodiversity indicators, artificial intelligence, digital platforms) will be seized.		
	<ul style="list-style-type: none"> Developing and evaluating in the short- and long-term Nature-Based Solutions (NBS) and engineered solutions (including hybrid grey-green) for the remediation and mitigation of degraded water bodies and aquatic ecosystems. 	II.II	
	<ul style="list-style-type: none"> Understanding the social and environmental impacts of proposed solutions for ecosystems restoration. 	II.IV	
II.IV. Integrating ecosystem services into the management of water resources	<ul style="list-style-type: none"> Monitoring the effects of water management measures on ecosystems (including biodiversity) and social systems, including analysis of trade-offs and synergies between water quality objectives, targets and land use planning and governance systems. 	II.III III.I VII.III	B - C
	<ul style="list-style-type: none"> Developing methodologies for the valuation of ecosystem services, including intrinsic social values (e.g. well-being, cultural) as well as approaches to include the intrinsic value of ecosystem services in decision-making. 	III.I VII.III	
	<ul style="list-style-type: none"> Exploring land-sea continuity and interactions above and below the surface for biodiversity and ecosystem services conservation at global scale. 	III.I	

Theme III: Water for the future: sustainable water management

Why this theme? The primary purpose of EU water policy is to ensure access to adequate water quantity and quality water for all and the good status of water bodies/ ecosystems across Europe. Considerable policy efforts have been made by the European Commission and Member States to support the achievement of this objective, but experience shows that many obstacles remain in the implementation of the Water Framework Directive and other pieces of legislation.

Building upon a multi-disciplinary approach to water, Water4All will develop, assess and demonstrate Integrated Water Management with a source to sea perspective. The impact of land use on water will be further investigated and proposed solutions will be communicated in support of the WFD and related water policies. Water4All will therefore seek to provide models, approaches, tools and methodologies to underpin the implementation of EU policy and EU water management plans/ strategies for natural resource efficiency, natural resource protection, and adaptation and resilience to hydroclimatic extreme events.

Many regions and sectors will face increased water scarcity with climate change. Water4All will look into tools to support decision making in water management. Since a huge share of water abstraction (60-90 %) is used for irrigation, there is a need for the development of water saving irrigation strategies including ground, soil and airborne sensor technologies. Relevant tools for decision



support will be developed or improved in order to respond more efficiently to emerging water issues and hydroclimatic hazards. In this sense, Water4All will promote and support water RDI data (according to the principle of Open Science) and infrastructures for a better understanding of hydrological processes at different scales.

This theme is directly related to the Missions on Healthy oceans, seas, coastal and inland waters and on Soil health and food.

Key words: river basin management, groundwater management, integrated water management, source-to-sea, hydroclimatic hazards and extreme events, nature-based solutions, land-sea continuum, disaster risk reduction, decision support tools, water retention measures.

Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
III.I. Integrated Water Resources Management	<ul style="list-style-type: none"> Developing integrated, robust and multiscale numerical tools on the water cycle, ecosystems and economic systems to address water resource management. 	II.IV III.V VI.III	B – C – D – E
	<ul style="list-style-type: none"> Assessing water management practice and its consequences to erosion, soil / subsoil stability, sediment transport, soil/water quality and water quantity, hydrological regime. 	II.I	
	<ul style="list-style-type: none"> Develop planning and governance tools and multi-disciplinary approaches to link landscape management to river basin management planning, to understand and manage land-water-ecosystem-human relationships and to assess the effect of different land uses on inland and coastal water resources (including <i>e.g.</i> nutrients, hazardous substances and brownification). 	II.IV	
	<ul style="list-style-type: none"> Developing and demonstrating Integrated management and monitoring of the whole water cycle (including surface water and groundwater interaction, water reuse, storage and managed aquifer recharge) in the framework of the land-water interface. 	I.II III.III VI.III	
	<ul style="list-style-type: none"> Developing new tools and models for water resources assessment to be extrapolated to water bodies in scarcely monitored areas. 	VI.II IV.III	
	<ul style="list-style-type: none"> Understanding the dynamics and functioning of a range of vulnerable water ecosystems of regional interest (including intermittent rivers, wetlands, lagoons, alpine areas and glaciers, Arctic and boreal water systems, peatlands, estuaries). 	II.I	
III.II. River Basin Management	<ul style="list-style-type: none"> Understanding the connection between Programmes of Measures (PoMs) and their effect on ecological indicators (biological quality elements (BQEs) as well as the temporal and spatial cumulative effects of measures in regard to the goals of the WFD (water quantity and quality, ecosystem quality) and the biodiversity strategies. 	VII.II	B – C – E



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
	<ul style="list-style-type: none"> Improving monitoring tools, monitoring schemes and global strategies for the WFD implementation and the related daughter directives, <i>e.g.</i> Floods Directive. 	III.II	
	<ul style="list-style-type: none"> Develop decision support tools at the River Basin scale to help simulating and predicting the effect of PoMs to reach the objectives both for water management and climate change mitigation and adaptation. Deepen understanding of effectiveness, cost/efficiency, acceptance, trade-offs of natural water retention measures 	III.I III.V VII.II	
III.III. Groundwater management	<ul style="list-style-type: none"> Estimating aquifer resources at various space and time scales (recharge water, stored water) to support decision-making and to safeguard groundwater resources and groundwater dependent ecosystems. 	II.I III.IV VII.II	B – C
	<ul style="list-style-type: none"> Supporting land and aquifer management in inland and coastal aquifers through a better understanding of abstraction and recharge volumes, seawater intrusion and salinization and contamination. 	I.I	
	<ul style="list-style-type: none"> Supporting urban groundwater management to account for too high or too low water levels increasing the risk for groundwater flooding and geo-technical consequences including construction damage and land subsidence. 		
	<ul style="list-style-type: none"> Developing models of reducing knowledge gaps on GW recharge and water quality projections in the context of climate and global change (<i>e.g.</i> long-term effects of droughts, legacy pollution). 		
III.IV. Resilience, adaptation and mitigation to hydroclimatic extreme events	<ul style="list-style-type: none"> Understanding the causes of drought/scarcity, predicting drought events and water scarcity (also understanding possible seasonal variability in climate services) for developing climate change adaptation and mitigation measures. This topic will focus on both groundwater, soil moisture and surface water. 	III.I III.II III.III	B – C – D – E
	<ul style="list-style-type: none"> Developing a multi-risk approach and decision support tools (including monetary/non monetary costs valuation) to deal with extreme events. 	II.II III.V VI.III	
	Water scarcity management: developing forecasting systems for the monitoring of anthropogenic impacts on the integrated water cycle.	III.V VI.III	
	<ul style="list-style-type: none"> Improving water management to mitigate the harmful impacts of extreme events in groundwater, inland surface water, transitional and coastal waters. 	III.I	
	<ul style="list-style-type: none"> Developing innovative (or improved) tools for adaptation and mitigation to hydro-climatic extreme events, especially floods and drought in a catchment, coastal and urban context, soil erosion and flash floods. 	III.V	
	<ul style="list-style-type: none"> Understanding the disaster management cycle in the face of climate change, effects on society and mitigation measures. 	---	



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
	<ul style="list-style-type: none"> Progressing towards more resilient coastal and inland cities and communities in the face of climate change and increasing natural hazards. 	V.II	
III.V. Tools for water management, including: <ul style="list-style-type: none"> - Big data - Earth observation - Sensor/monitoring tools - Artificial intelligence - DSS - Scenario analysis 	<ul style="list-style-type: none"> Developing smart infrastructure by combining physical and digital facilities (IoT, sensors, networks, BIM/GIS, Big Data & Machine Learning) in order to decrease water volume and increase data value. 	---	B – C – D
	<ul style="list-style-type: none"> “Smartening the water system” for advanced decision support and priority setting: sensor networks, big data, information and control systems for water, network communications, digital twin models, advanced technologies and capabilities (<i>i.e.</i> HPC – high performance computing, advances in communication 5G and 6G solutions) for quasi-real time data collection, analysis, modelling, forecasting and visualisation technologies fs. 	I.I III.I V.I V.II	
	<ul style="list-style-type: none"> Investigating how to strengthen the use of large amount and variety of observation data (<i>e.g.</i> Earth Observation data) by end-users and decision-makers 	VII.I	

Theme IV: Water and health

Why this theme? Water quality is threatened by pollutants from diverse sources (urban consumption, agriculture, industry, etc.). The presence of certain emerging pollutants such as endocrine disruptors has become an area of growing concern because of their effect on human and animal health. Furthermore global pandemic outbreaks like Covid-19 pose new challenges for water management and health. An explicit challenge during the early days of the pandemic outbreak had been to maintain the import flow of chemicals needed for wastewater treatment in some countries, while the alerting challenge of lack of access to basic water and sanitation has become a bigger issue than ever as a public health concern. Innovative water technologies should be developed to guarantee high water quality, which can ideally contribute to ensuring health of people, animal and ecosystems holistically and in line with the One Health perspective. Advanced methods of water quality monitoring, conversation and treatment are attributed pivotal roles under this theme for ensuring healthy ecosystems and society.

This theme is strongly related to the Zero pollution Action Plan and to the Mission on Healthy oceans, seas, coastal and inland waters by, among other, developing smart monitoring and control systems that may contribute to better delineate affected areas.

Key words: drinking water and sanitation, contaminants of emerging concern, emerging pollutants, risk assessment, treatment technologies, micropollutants



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
IV.I. Behaviour and effects of contaminants of emerging concern, litter, plastics, endocrine disruptors	<ul style="list-style-type: none"> Understanding and predicting the environmental occurrence, concentration, behaviour and effects of transformation products, contaminants and pathogens (including Covid-19), and their responses to water treatments, including the relation between disinfection and wastewater treatment. 	IV.III	B
	<ul style="list-style-type: none"> Understanding and predicting occurrence of opportunistic pathogens and their vectors in water resources along the global water cycle, water distribution networks and other engineered water systems _aggravated under climate change. 	II.I V.I V.II	
	<ul style="list-style-type: none"> Monitoring of invasive species as (potential) vectors of (tropical) diseases. 	II.I II.II III.IV	
IV.II. Water dimension of anti-microbial resistance	<ul style="list-style-type: none"> Understanding the mechanisms determining the selection and spread of AMR genes in aquatic environments: transmission mechanisms including the role of water as a vector or as a sink. 	II.I	B
	<ul style="list-style-type: none"> Developing new tools for monitoring AMR genes and the use of surveillance of AMR data in aquatic environments. 	III.V IV.III IV.IV	
	<ul style="list-style-type: none"> Developing technologies and innovative interventions that rapidly reduce and control AMR in wastewater treatment. 	IV.III	
	<ul style="list-style-type: none"> Improving new tools for surveillance of communicable diseases, including zoonotic pathogens threads in wastewater. 	IV.I IV.II IV.IV	
IV.III. Innovative water tools and technologies for water quality monitoring and water treatment, remediation and disinfection	<ul style="list-style-type: none"> Water quality monitoring: <ul style="list-style-type: none"> Developing and testing reliable, affordable and low impact methods, including real-time methods, for monitoring water quality, with a focus on contaminants of emerging concern and micropollutants, and assessing related risks (rapid screening, online, targeted & non-targeted, passive samplers) in support to the development of exposome/eco-exposome approaches. Connecting Earth Observation to local / regional monitoring of water resources for improved water quality assessments. Developing new approaches to analyse the combined effects of chemicals (<i>i.e.</i> chemical mixtures, “cocktail” effects), integrative bio-assessment tools and new biomarkers and bioassays. Enhanced knowledge about pollution sources (including sources discrimination, environmental forensics), processes (transformation, degradation, natural attenuation) and fate in order to attenuate the impact of anthropogenic activities on water resources availability and quality. 	III.V IV.I IV.II	B – C – D - E



	<ul style="list-style-type: none"> • Water treatment, remediation and disinfection for drinking water and sanitation: <ul style="list-style-type: none"> ○ Developing more efficient, cost-effective, less energy dependant, low carbon footprint and easier-to-implement technological solutions for drinking water and wastewater treatment. ○ ○ Developing methodologies and strategies to remediate and reduce contaminants of concern at point and non-point sources, including their environmental effects in water, soil, sediment and sludge. ○ Developing new process and product controls for small decentralised drinking water treatment systems. ○ Developing pollution prevention methodologies to reduce the investment and operational costs of treatment applications. ○ Sustainable management and valorisation of residues from desalination plants to protect land, water and sea ecosystems altogether. ○ Improving wastewater technologies for removal of ARB (anti-biotic resistant bacteria), the inactivation of ARGs (anti-biotic resistant genes), viruses and contaminants of emerging concern. ○ Developing wastewater technologies for removal of microplastics at household and wastewater treatment plant level. 	I.II III.V IV.II VII.III	
IV.IV. Risk Assessment and threshold values for protection of human health and ecosystems.	<ul style="list-style-type: none"> • Assessing possible effects on humans and ecosystems of (chronic) exposure to low levels of chemical substances and mixtures. 	IV.I	B – C – E
	<ul style="list-style-type: none"> • Integrated water exposure (chemicals, plastics, bacteria, microbes, viruses, protozoa, etc.) and its integration in global exposure (air, water, soil, food, social and psychological effects/stressors) – One Health/Eco Health concepts. 	IV.I	
	<ul style="list-style-type: none"> • Developing integrated risk assessment procedures, including the effects of long-term exposure and cocktail effects, for antibiotics and other emerging pollutants (both regulated and unregulated), toxic trace elements and other pollutants of concern (e.g. nitrate, pesticides and pathogens). 	IV.I IV.II	
	<ul style="list-style-type: none"> • The assessment of nature-based solutions’ co-benefits, including pollution reduction and enabling environment of green and blue infrastructure for outdoor activities benefitting health in multiple ways. 	V.I	
	<ul style="list-style-type: none"> • Quantifying risks in a “one health” conceptual model – AMR and genes. 	IV.II	



Theme V: Water Infrastructure

Why this theme? European water infrastructures need to adapt to emerging needs and environmental and socioeconomic challenges. Dams, water intakes, water and wastewater treatment plants, water distribution networks and drainage systems are ageing in many European countries and the risks posed by climate change, extreme weather events and other external factors call for innovative infrastructure adaptation plans (e.g. storm management plans, cybersecurity).

Besides improvements on the conventional water infrastructure, the varied applications of blue and green infrastructure both in urban and rural areas hold a promising potential to overcome water security challenges. Water4All will look at the potential of green and blue infrastructures for community resilience in response to hydroclimatic extreme events. Issues around the maintenance of these infrastructures will also be at the centre of interest.

Research infrastructures, understood as facilities for conducting research and fostering innovation, are not within the remit of this theme⁶. Specific topics related to research infrastructures are addressed within sub-theme III.V.

This theme has a direct link with the building and renovation strategy of the Green Deal, making both cities and rural areas climate resilient and circular, and to the Mission on Adaptation to climate change including societal transformation.

Key words: water infrastructures adaptation, resilience, security, accounting, disaster risk reduction, environmental sustainability.

Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
V.I. Adaptation of existing water infrastructures to new challenges	<ul style="list-style-type: none"> Developing methodologies to organise effectively and in a cost-effective and energy-neutral manner the replacement and large-scale renovation of water infrastructure by also considering the blue and green infrastructure as alternative solutions. 	II.III V.II	B – C – D - E
	<ul style="list-style-type: none"> Assessing the efficiency of existing wastewater treatment technologies in the inactivation of chemical and biological contaminants of emerging concern. 	IV.III	
	<ul style="list-style-type: none"> Assessing the environmental impact of water infrastructure, including the significance of N₂O emissions from wastewater treatment plants on climate change. 	II.II III.I IV.III	
	<ul style="list-style-type: none"> New sustainable treatment systems to secure water quality (robustness, security, operable, energy efficiency and chemical consumption, at lower cost) 	I.II IV.III	
	<ul style="list-style-type: none"> Developing new strategies based on smart metering and system analysis to optimise distribution networks (consumption patterns, pumping strategies, leakage or 	III.V	

⁶ Let us make clear however that some research infrastructures may obviously be used to study water infrastructures



Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
	contamination detection...) and wastewater and stormwater drainage systems.		
	<ul style="list-style-type: none"> Developing emergency treatment units for drinking water production in emergency response situations. 	IV.III	
	<ul style="list-style-type: none"> Adaptation of existing dams to climate change, (e.g. reservoir optimization management for different uses and water availability scenarios, discharge capacity of dam spillways, etc.) 	III.IV IV.II IV.III	
	<ul style="list-style-type: none"> Investigating regulation needs for sustainable and environmentally sound application and operation of water infrastructure, including hydropower plants and dams. 		
V.II. Water infrastructures resilience	<ul style="list-style-type: none"> Developing smart monitoring and control systems, from assets to water supply, and reclaimed water networks, including methodologies for extending the technological and functional lifespan of water infrastructures. 	III.V IV.III V.I	B – C – D – E
	<ul style="list-style-type: none"> Improving models and solutions for systems interoperability to allow critical water infrastructures to exchange data and enhance compatibility. 	III.V	
	<ul style="list-style-type: none"> Progressing towards more water-resilient cities and communities in the face of climate change and increasing natural hazards and the issues associated with older and ageing infrastructure. 	III.IV V.I	
	<ul style="list-style-type: none"> Studying the effects of increasing population density caused by mass migration due to climate change on existing water infrastructure. 	V.I	
	<ul style="list-style-type: none"> Understanding and minimising the risks associated with water infrastructures and increasing their resilience in response to climate change effects and natural hazards, including design and implementation of green and blue infrastructure and nature-based solutions. 	V.I	
V.III. Water Infrastructures security (including cyber and terrorism security)	<ul style="list-style-type: none"> Developing or improving existing technologies able to differentiate attacks and propose mitigation measures to protect IT/OT (Information Technology/ Operational Technology) infrastructures of water services. 	---	B – C – E
	<ul style="list-style-type: none"> Improving the security and performance of water assets and infrastructures – water sources reservoir, limiting the risk of any pollution including pathogens from source to tap. 	V.I V.III	
	<ul style="list-style-type: none"> Developing innovative data driven approaches to asset management, including the security (i.e. cyber-security) of critical infrastructure and the valuation of long-term benefits vs current costs and benefits. 	---	
	<ul style="list-style-type: none"> Developing surveillance system through sewage monitoring of the potential virus circulation. 	IV.II IV.IV	
	<ul style="list-style-type: none"> Addressing ageing water infrastructure, including water losses management through intelligent monitoring of water pipe quality and replacement before pipe bursts. 		



Cross-cutting issues:

Theme VI. International cooperation

Why this theme? Water challenges are global and as such, Water4All will encourage cooperation with international partners. Water4All will promote knowledge and technology transfer, networking, capacity-building, education, technical advocacy, expertise and in general any other tools in support of water security for all, both in Europe and abroad. It is in this context that Water4All will look for specific agreements with priority countries/ regions. The development of a strategy for international cooperation for Water4All is based on the work achieved these past years by the Water JPI and its dedicated CSA, IC4WATER, International cooperation for Water. Hence, criteria to enlarge international partners within Water4All are multifold: excellence, market access, demonstration sites, support for geopolitical strategy, bottom-up approach through existing collaborations, hand-holding for capacity building, addressing UN SDGs. Moreover, to achieve the development of strategic international partners, a dialogue on developing international cooperation should be maintained with other Partnerships, Policy-Makers and European public Research and Development initiatives as well as multilateral organisations (World Bank, OECD, UN) and international initiatives (e.g. China’s Belt and Road Initiative).

Priority countries/regions could therefore include:

- Selected technology hot spots, e.g. Israel, South Korea, Singapore;
- Selected priority overseas markets, e.g. USA, China, India, Brazil;

Regions of priority geopolitical relevance, as set out for instance by the EC Recovery Plan: the neighbourhood countries, in particular the Mediterranean basin and the Western Balkans are directly connected to the EU in hydrological terms, or Africa. Trans-boundary cooperation will be coupled with joint actions in water diplomacy, coming in support of activities within the governance cross-cutting theme.

Key words: water diplomacy, trans-boundary cooperation, mass migrations, water access

Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
VI.I. Water diplomacy	<ul style="list-style-type: none"> • Developing new concepts of benefit sharing, trust building and issue-linkage for water related conflict management. 	I.I I.III VII.I	B – C - E
	<ul style="list-style-type: none"> • Designing inclusive, partnership oriented, multi-track approaches (political, technical, practices) for water diplomacy processes. 	I.III VII.I	
	<ul style="list-style-type: none"> • Assessing the opportunity of an Early Warning system as a preventive diplomacy measure. 	III.IV	
	<ul style="list-style-type: none"> • Strengthening the implementation of international regulations in order to better protect downstream countries and their ecosystems from upstream induced pollution. 	II.IV VII.III	



	<ul style="list-style-type: none"> Assessing sources of conflicts on shared water resources in complex contexts (climate change, migration, land use, food security, lack of well-functioning political institutions, social services ...) 	I.I I.III VII.I	
VI.II. Establishing tools for trans-boundary cooperation	<ul style="list-style-type: none"> Developing a human rights-based approach for transboundary water management, encompassing inclusive participatory approaches, information transparency and improved accountability. 	I.III VII.I	B – C - E
	<ul style="list-style-type: none"> Strengthening international cooperation through the support to cohesive policy making (and financing) around UN SDGs – SDGs on water and on Partnerships. 	VII.II	
VI.III. Developing integrated, fair and adaptive water resource management systems	<ul style="list-style-type: none"> Understanding the effects of mass migration due to climate change on existing water resources and infrastructures. 	III.I V.II	B – C – D - E
	<ul style="list-style-type: none"> Understanding the underlying power dynamics and structural barriers that reinforce gender inequalities in safe water access. 	VII.I	
	<ul style="list-style-type: none"> Supporting worldwide access rights to water and sanitation: considering the economic value of resources and services as well as their impacts on consumers. 	VII.III	
	<ul style="list-style-type: none"> Assessing the impacts and risks of extreme weather events and global change on the water cycle and uses. 	III.I	
	<ul style="list-style-type: none"> Developing and testing improved plans and methodologies for integrated adaptive water management in relation to global change. 	III.I VII.I	
	<ul style="list-style-type: none"> Development of indicators of spatial vulnerability to global change. 	III.IV	

Theme VII. Governance

Why this theme? Global water demand will increase by 55% by 2050 due to growing demand from manufacturing (especially food production), thermal electricity and domestic use (OECD Water Governance Programme). Higher demands for these sectors, coupled with higher population density in certain regions of the world and climate change effects, will increase water stress. This calls for innovative governance tools, practices and processes to underpin robust decisions and legislation over the protection and use of the resource whilst considering the interests of stakeholders and enabling the sharing of water. Multidisciplinary research activities will be strongly encouraged within this theme.

Governance plays a key role in each of the Water4All themes as good governance is a key element in the identification and implementation of best available measures for people, water and other systems. Innovative governance models will be sought by different activities and specific actions will be targeted at enhancing the participation of stakeholders and society at large in water management issues. Co-creation of solutions will also require activities in the field of communication, public awareness and education. With water having a cross-sector “nature”, water governance should in itself strive to act in a cross-sectorial setting.



Some of the topics within this theme look at current barriers for the adoption of research products/ solutions. Attention is paid to time to market issues and the implementation of key lessons from other disciplines in the valorisation of research results.

Water management issues usually fall in the realm of a post-normal approach of science (facts are uncertain, values in dispute, and decisions are urgent) (Funtowicz and Ravetz, 1990⁷). Theme VII of this agenda may offer the opportunity to elaborate on Post-Normal Science and enable a dynamic governance style through the democratisation of knowledge, dialogue and mediation tools.

This theme is linked to all the Green Deal policy issues and is particularly related to the Mission on Healthy oceans, seas, coastal and inland waters and on Adaptation to climate change including societal transformation.

Key words: participatory tools and web services, stakeholder participation, enhancing policy integration and regulatory framework, social sciences, policy instruments, FAIR data.

Sub-themes	Related topics	Links to other sub-themes	Reference Water4All Pillar
VII.I. Developing methods for more efficient citizen and wider stakeholder engagement	<ul style="list-style-type: none"> Developing new participatory approaches and tools (co-production, integration of indigenous, local and technology knowledge, integration of women, ICT tools, telecoupling, etc.) for water management. 	I.III	C – D
	<ul style="list-style-type: none"> Advancing in the application of citizen science in data and knowledge generation as a complement to more traditional ways of water monitoring. Actions will address issues linked to the processing, interpretation and use of data, as well as the quantification of uncertainties and complementarity with other data sources. 	I.III	
	<ul style="list-style-type: none"> Raising social awareness of water challenges and strengthening communication between the scientific community and society at large. 	I.III	
	<ul style="list-style-type: none"> Enhancing the dissemination of information on good practices in the agricultural and industrial fields (reduction in water consumption, optimisation of resources). 	VII.I	
	<ul style="list-style-type: none"> Public responses to water resources: Perceptions of risk, and particularly health risk, associated with the unsustainable use of water, <i>e.g.</i>, over-abstraction and environmental pollution and the use of water from unconventional sources (recycled water, desalination, etc.) 	I.III VI.I	
VII.II. Strengthening policy integration, alignment, coherence and water policy coordination to	<ul style="list-style-type: none"> Connecting institutions managing water to improve coordination and increase our capacity to reduce vulnerability to extreme events, as well as effectively respond to them. 	VII.III	C – D – E
	<ul style="list-style-type: none"> Assessing opportunities for the upgrading of EU Water-related Directives to incorporate energy efficiency, climate neutrality measures, zero emissions, removal of hazardous 	VII.III	

⁷ http://icta.uab.cat/Newsletter/F&Ravetz_SFfinal.pdf



<p>exert a change in society</p>	<p>substances and medical remnants, reduce overflows caused by cloudbursts and releasing the potential of digitalization.</p>		
<p>VII.III. Enhancing the regulatory framework</p>	<ul style="list-style-type: none"> • Exploring regulatory, market, governance, education, recherche and innovation (tenders' procedures) and management conditions impairing the demand and the adoption of innovations in water. Specific mechanisms, such as financial credit ratings or sustainability reporting, for incentivising the adoption of innovations will be analysed. 	---	<p>C – D – E</p>
	<ul style="list-style-type: none"> • Reducing the time to market of proposed solutions through effective policy and management frameworks. 	---	
	<ul style="list-style-type: none"> • Favouring knowledge transfer from other scientific fields regarding key lessons in the commercialisation of products and solutions. Supporting the transfer of relevant results from other scientific fields for their application in the water R&I domain. 	---	
	<ul style="list-style-type: none"> • Understanding the requirements driving the social adoption of innovations by integrating technical and social sciences and humanities research and innovation, by involving stakeholders at the adequate level and scales of participation, and by enabling large-scale socio-technical experimentation. 	---	
	<ul style="list-style-type: none"> • Identifying opportunities for the creation of new financial mechanisms for an innovative water sector. 	---	
	<ul style="list-style-type: none"> • Exploring policy instruments to ensure cost-efficient, flexible and fair regulation of water and aquatic ecosystems. 	<p>II.IV VI.I</p>	





5. Existing links between Water4All's themes and sub-themes and EU policies and other initiatives

Table 2. SRIA's Themes, sub-themes, key topics

THEMES	I. Water for circular economy : smart water value	II. Water ecosystems and biodiversity	III. Water for the future: sustainable water management	IV. Water and health	V. Infrastructures for water	VI. International cooperation	VII. Governance
Sub-themes	<ul style="list-style-type: none"> • Water supplies for socio-economic development and activities. • Circular economy. • Empowering the public, water users and stakeholders in valuing water. 	<ul style="list-style-type: none"> • Functioning and biodiversity. • Resilience, mitigation and adaptation of aquatic ecosystems and ecosystem services to global changes. • Developing and applying ecological engineering and ecohydrology for ecosystems restoration. • Integrating ecosystem services into the management of water resources. 	<ul style="list-style-type: none"> • Water Resources Management. • River basin management. • Groundwater management. • Resilience, adaptation and mitigation to hydroclimatic extreme events. • Tools for water management. 	<ul style="list-style-type: none"> • Behaviour and effects of contaminants of emerging concern, plastics, endocrine disruptors. • Water dimension in antimicrobial resistance. • Innovative water tools and technologies for water quality monitoring and water treatment, remediation and disinfection. • Risk Assessment. 	<ul style="list-style-type: none"> • Adaptation of existing water infrastructures to new challenges. • Water infrastructures resilience. • Water Infrastructures security (including cyber and terrorism security). 	<ul style="list-style-type: none"> • Water diplomacy. • Establishing tools for trans-boundary cooperation. • Developing integrated, fair and adaptive water resource management systems. 	<ul style="list-style-type: none"> • Developing methods for more efficient citizen and wider stakeholder engagement. • Strengthening policy integration, alignment, coherence and water policy coordination in order to exert a real change in society. • Enhancing the regulatory framework.
Links with HEU Destinations	6.3. Circular economy and	6.1. Biodiversity and ecosystem services	6.6. Resilient, inclusive, healthy and green rural,	6.4. Clean environment and zero pollution	6.5. Land, oceans and water for climate action	5.2 Cross-sectoral solutions for the climate transition	6.3. Circular economy and



THEMES	I. Water for circular economy : smart water value	II. Water ecosystems and biodiversity	III. Water for the future: sustainable water management	IV. Water and health	V. Infrastructures for water	VI. International cooperation	VII. Governance
in WP 2021-2022	bioeconomy sectors 6.7. Innovative governance, environmental observations and digital solutions in support of the Green Deal 2.1. Innovative Research on Democracy and Governance 2.3. Innovative Research on Social and Economic Transformations 4.1. Climate neutral, circular, and digitised production 4.2. A digitised, resource-efficient and resilience industry	6.5. Land, oceans and water for climate action	coastal and urban communities 6.5. Land, oceans and water for climate action 6.7. Innovative governance, environmental observations and digital solutions in support of the Green Deal 4.3 World leading data and computing technologies 4.4. Digital and emerging technologies for competitiveness and fit for the green deal	1.1. Staying healthy in a rapidly changing society 1.2. Living and working in a health-promoting environment 1.3 Tackling diseases and reducing disease burden 1.5. Unlocking the full potential of new tools, technologies and digital solutions for a healthy society	3.1. Better protect the EU and its citizens against Crime and Terrorism 3.3. Protected Infrastructure 3.4. Increased Cybersecurity 3.5. A Disaster-Resilient Society for Europe 3.6. SSRI (Strengthened Security Research and Innovation) 5.2. Cross-sectoral solutions for the climate transition	6.6 Resilient, inclusive, healthy and green rural, coastal and urban communities 2.1. Innovative Research on Democracy and Governance	bioeconomy sectors 6.6. Resilient, inclusive, healthy and green rural, coastal and urban communities 6.7. Innovative governance, environmental observations and digital solutions in support of the Green Deal 2.1. Innovative Research on Democracy and Governance 2.3. Innovative Research on Social and Economic Transformations



THEMES	I. Water for circular economy : smart water value	II. Water ecosystems and biodiversity	III. Water for the future: sustainable water management	IV. Water and health	V. Infrastructures for water	VI. International cooperation	VII. Governance
	<p>5.2. Cross-sectoral solutions for the climate transition</p> <p>5.5. Clean and competitive solutions for all transport modes</p>						
EU Policies supported by Water4All	EU Green Deal Water Framework, Bathing Waters, Urban Waste Water Treatment, Groundwater Directives Common Agricultural Policy Circular Economy Action Plan	EU Green Deal Water Framework, Shellfish Waters, Dangerous Substances (and its 'daughter' directives), Nitrates, Freshwater Fisheries, Exchange of Information on the Quality of Surface Freshwaters, Groundwater Directives EU Biodiversity Strategy	EU Green Deal Water Framework, Dangerous Substances (and its 'daughter' directives), Nitrates, Freshwater Fisheries, Exchange of Information on the Quality of Surface Freshwaters, Groundwater Directives	EU Green Deal Water Framework, Bathing Waters, Dangerous Substances (and its 'daughter' directives), Urban WasteWater Treatment Directives Marine Strategy	EU Green Deal EU Adaptation Strategy	(EU Green Deal)	Common Agricultural Policy, EU Green Deal, EU Adaptation Strategy, Circular Economy Action Plan, Water Framework Directive



THEMES	I. Water for circular economy : smart water value	II. Water ecosystems biodiversity	for and III. Water for the future: sustainable water management	IV. Water and health	V. Infrastructures for water	VI. International cooperation	VII. Governance
			Shaping Europe's Digital Future European strategy for data				
Main links to other EU initiatives							
Mission Healthy oceans, seas, coastal and inland waters	X	X	X	X			X
Mission Adaptation to climate change		X	X		X		
Mission Climate-Neutral and Smart Cities	X		X	X	X		
Mission Soils Health and Food			X	X			X
Partnership Agro-Ecology LL	X	X					



THEMES	I. Water for circular economy : smart water value	II. Water ecosystems biodiversity	for and III. Water for the future: sustainable water management	IV. Water and health	V. Infrastructures for water	VI. International cooperation	VII. Governance
Partnership Biodiversity		X					
Partnership Blue economy	X	X	X				
Partnership Chemical Risks Assessment				X			
Partnership Circular bio-based Europe	X			X			
Partnership DUT	X				X		
Partnership Environmental data for agriculture			X				
Partnership European Metrology				X			
Partnership Processes4Planet	X						



THEMES	I. Water for circular economy : smart water value	II. Water ecosystems biodiversity	for and III. Water for the future: sustainable water management	IV. Water and health	V. Infrastructures for water	VI. International cooperation	VII. Governance
Partnership Safe Food System	X			X			
KIC Climate	X	X					
JPI Climate	X	X					
ESA – Copernicus			X				
PRIMA	X		X			X	
CSA European Geological Services			X				

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Table 3. Interactions between Water4All Pillars, SRIA's Themes and key Policy Issues

Water4All Pillars		A Joint Vision	B Developing knowledge & solutions	C Transfer knowledge and innovations	D Demonstrating innovative solutions	E International Cooperation
Principal tools for implementation		SRIA	Research and Innovation Calls	Policy papers & Knowledge Hub	Demonstrators and pilots	International projects
Green Deal Key Policy Issues	Increasing climate ambition	I,II,III,IV,V,VI	I,II,III,IV,V,VI, VII	I,II,III,IV,V,VI	I,II,III,IV,V,VI	VI
	Clean, affordable and secure energy	I,II,III	I,II,III	I,II,III		VI
	Sustainable and smart mobility	I,V, VII	I,V	VII	I,V	
	Energy and resource efficient buildings	I,V	I,V		I,V	
	Farm to fork	I,II,III,IV,V,VI, VII	I,II,III,IV,V,VI, VII	I,II,III,IV,V,VI, VII	I,II,III,IV,V,VI, VII	VI
	Biodiversity and ecosystems	I,II	I,II	I,II	I,II	
	Zero-pollution, toxic-free environments	I,IV	I,IV, VII	I,IV, VII	I,IV	VI
	Water Framework Directive and daughter Directives		VII	I,II,III, VII		VI
	Common Agricultural Policy	VII	VII	I,II,III,VII		
	International cooperation					VI

Legend – Themes: I: Water for circular economy; II: Water for ecosystems and biodiversity; III: Water for the future: sustainable water management; IV: Water and health; V: Water infrastructure; VI. International cooperation ; VII Governance



Table 4. Existing Research Infrastructures on water in EU

List of relevant infrastructures to be established later on the basis of ongoing work by the Water JPI.

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