

Water JPI Position Paper on the Horizon 2020 Societal Challenge 5 2016-2017 draft Work Programme (Version 0f 09/02/2015)

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I. The Water JPI and Horizon 2020

On June 21, 2013, the Water Joint Programming Initiative (JPI) released the strategic document entitled “Towards Partnership & Complementarities with Horizon 2020”¹. In this document, the basic traits of Horizon 2020 and the Water JPI were outlined, mapping the areas of thematic synergies and the differences in conception and implementation. Common paths and different footprints were described, and a proposal for partnering was issued. Among other actions, the Water JPI proposed:

Cooperation in the implementation of the synergy areas regarding projects and networking. The new ERA-Net scheme will be useful to attain the objectives of Horizon 2020 and the Water JPI. Topping up Water JPI activities represents an effective way of addressing the synergy areas. In other cases the Water JPI may suggest topics to be implemented in Horizon 2020 Work Programmes and benefit from Horizon 2020 potential.

In response to the EC Public Consultation on the Horizon 2020 Societal Challenge 5, the Water JPI submitted also a Position Paper² on the 16 June 2014.

Today, with this document, we would like to contribute to the definition of the 2016-2017 Work Programme for Societal Challenge 5, one of the Horizon 2020 Societal Challenges (SC) connected to water issues (e.g. SC 2, 5 and 7). It is with Societal Challenge 5 that the greatest level of synergies and potential areas of collaboration exist. This collaboration started with its SC 5 Work Programme 2014-2105, which provided support towards the implementation & activities of the Water JPI with the inclusion of two ERA-NET Cofund topics (Water-3-2014 and 2015 – to be submitted in April 2015).

The following sections provide insight on:

- I. The relevance of a continued Water Focus Area at the forefront of the Societal Challenge;

¹ <http://www.waterjpi.eu/images/documents/Water%20JPI%20Position%20to%20H2020.pdf>

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<http://www.waterjpi.eu/images/documents/Water%20JPI%20Position%20on%20the%20H2020%20%20SC5%202016-2017%20Work%20Programme.pdf>

2. The contribution of the Water sector to economic growth and jobs, as well as to the research and innovation community;
3. The Water JPI Strategic Research & Innovation Agenda;
4. The synergy areas between the research needs identified by the Water JPI and future topics for inclusion in Horizon 2020; and
5. Topics for interaction between Horizon 2020 and the Water JPI, contributing to support the implementation of the latter.

2. A Focus Area on Water in Horizon 2020

The Water JPI welcomed the creation of a Focus Area on Water in the first Work Programme of Societal Challenge 5 in Horizon 2020. We believe that this Focus Area shows coherence with the Water Challenges identified by both the Water JPI and the European Innovation Partnership (EIP) on Water.

A specific Focus Area dedicated to Water adds visibility to, and reduces fragmentation of Research, Development & Innovation (RDI) actions on water. It also establishes a contact point in Horizon 2020, which has facilitated our interactions with Horizon 2020 and our own development.

In our view, a Focus Area on water is synergic with the priorities discussed at the Advisory Group for this Societal Challenge (i.e. Systemic Eco-Innovation, Climate Services; Nature-Based Solutions and Sustainable Supply of Raw Materials). Water research and innovation actions are cross-cutting to all four priorities listed above.

Today, the European Commission and the Member States are tackling specific European Water challenges through the coordinated actions of Horizon 2020, the EIP on Water and the Water JPI. The objective of the Water Focus Area is to seize new and significant market opportunities by positioning Europe as a global market leader in related innovation and technology in the field of Water RDI. There is significant potential to boost the competitiveness and growth of European companies and SMEs in the water sector. In addition, as this is a worldwide societal challenge, it also creates potential in terms of international cooperation in this field.

The need for dedicated action in this area arises for the following reasons:

- Despite policy and research-driven efforts at the national and European levels, water resources are still under relevant pressure in numerous regions. According to the European Environment Agency (EEA), pressure will increase in the years to come. Immediate action is therefore necessary to address existing and emerging challenges in the field of water resources. Competition for water among different uses has turned this resource into a limiting factor for societal wellbeing, and in some areas for economic development (e.g. for the agriculture sector, including its energy production contribution).
- Significant effort in Water RDI is required to successfully implement EU Water policies (Blueprint on Water, Water Framework Directive (WFD) and related directives). These policies are closely related to the EU 2020 Strategy and, in

particular, to the 7th Environment Action Plan and the 2011 Resource Efficiency Roadmap.

- The current development of water technologies is insufficient to meet the Grand Challenge of achieving sustainable water systems. Systemic cross-overs are required with related fields, such as energy, sensors, nanotechnology and health.
- As identified by the Water Supply & Sanitation Technology Platform (WssTP), the main challenge that the European water sector is dealing with is fragmentation. This is an obstacle for developing a common research and innovation strategy for a competitive water sector.

3. Water Challenges: Contributing to Create Growth and Jobs in Europe

According to the Strategic Research Agenda of the Water Supply and Sanitation Technology Platform (WssTP)³, the European water sector has an annual turnover of 72,000 M €, sustains 600,000 jobs, manages a network of 5.7 M km, and operates 70,000 wastewater plants. These economic figures underline the social and economic relevance of the water industry. A 1% increase of the rate of growth of the water industry in Europe has been quoted to create up to 20,000 new jobs⁴. Partnerships bringing together different stakeholders have a key role to play in this.

The EIP on Water was established by the European Commission to facilitate water innovations leading to sustainable water management and boosting economic growth and the creation of jobs in the Water Sector⁵. European water companies (large multinational corporations and technology-rich SMEs) are world leaders in the water industry and in water services. SMEs make up to 80-90% of all European companies⁴, although their access to the export market is often limited.

Investments on Water research and innovation will contribute to further develop the industry in Europe, will increase exports of water technology and will sustain the provision of European water services to the world.

4. Water Challenges: Responding to the Research and Innovation Community

The European research and innovation community is showing very strong interest for the funding opportunities presented at European level by Horizon 2020 and by the Water JPI.

Preliminary results of the Societal Challenge 5 Work Programme 2014 show that while the indicative budget for the two-stage application topics was 52 M€, the amount of

³ <http://wsstp.eu/files/2013/11/SRA2010.pdf>

⁴ Developing new markets for eco-innovation With a special focus on water. Eco-innovation Action Plan. Monday 26 and Tuesday 27 November 2012. Lisbon, Portugal. 13th European Forum on Eco-innovation. ECO-INNOVERA. https://www.eco-innova.eu/publications?lwt_338cmd=download&lwt_338id=207

⁵ <http://www.eip-water.eu/get-involved/why-get-involved>

budget requested by the proposals submitted under the Call was 215 M€. For the one-stage application topics, the situation is similar, with an indicative budget of 15 M€ and a requested budget of 34 M€.

The mismatch between funding demand and supply has been even stronger at the Water JPI. The Pilot Call of the Water JPI has recently recommended for funding seven proposals (corresponding to the total available budget of 9 M€). However, 106 proposals were submitted, with a total requested budget of 117 M€.

For the second joint call related to “Research and Innovation for Developing Technological solutions and services for water systems”, which will be launched beginning of March 2015 (WaterWorks2014), the same pressure is foreseen.

These figures confirm the strong demand of the European research and innovation community for actions on water.

5. Our Own Foresight Document: The Water JPI Strategic Research & Innovation Agenda (SRIA)

The foresight document used to identify topics for the Horizon 2020 Societal Challenge 5 Work Programme is the Water JPI Strategic Research and Innovation Agenda (SRIA)⁶. The Water JPI covers a wide range of water challenges, focusing on ecosystems, citizens, industry, the bio-economy and closing the water cycle gap. This document has been produced by Research and Innovation Funding Programmes representing 88% of the European National Public investments in these topics. This wide representation of programmes and topics leads to priority setting in different thematic areas.

A large number of foresight documents have been gathered, reviewed and compiled to produce the Water JPI SRIA. Among them:

- National European Research, Development and Innovation (RDI) Programmes;
- The Water JPI mapping of European water RDI (policies and strategies, funding schemes and performance);
- The Implementation Plan of the EIP on Water, and its Action Groups;
- The Strategic Agenda of the Water Supply and Sanitation Technology Platform (WssTP);
- European Policy documents, including the Blueprint to Safeguard Europe’s Water Resources and related European roadmaps; and
- The 2014-2015 Work Programmes of Horizon 2020 Societal Challenges 2 and 5.

⁶ The Water JPI SRIA version 1.0 was released in October 2014, following the endorsement by the Water JPI Governing Board - (http://www.waterjpi.eu/images/SRIA/WATER%20JPI%20%20SRIA%201.0_2014.pdf).

6. Proposing Topics of Common Interest to Horizon 2020 and the Water JPI

The Research & Innovation topics proposed and discussed in this document are mapped in the overlap area between the Water JPI and Horizon 2020. These topics are included in the Water JPI SRIA and fit in the priorities expressed in the Horizon 2020 Specific Programme. The Water JPI has established the following criteria to identify and propose topics for Horizon 2020:

- Strong innovation orientation. Topics have been selected which are closer to innovation than to research;
- Clear capacity for short-term contribution to economic growth and job creation; alternatively, policy implementation impacting societal wellbeing;
- Large budget requirements in comparison to the expected allocation of funds to successful Water JPI proposals;
- Topics not previously addressed in the Water JPI Pilot Call and WaterWorks 2014 call, and not scheduled for implementation in the period 2016-2017 (future Eranet Cofunds).

In June 2014, the following common interest topics were proposed by the Water JPI for inclusion in the Horizon 2020 Societal Challenge 5 2016-2017 Work Programme (the order does not express priority):

Instrument	Ref.	Title
Collaborative Projects	A	Approaches for Assessing and Optimizing Ecosystem Services and the Ecological Functioning of Ecosystems
Collaborative Projects	B	Hydromorphology: Restoring Continuity, Sediment Transport and Fish Migration Within River Systems
Collaborative Projects	C	Understanding the Implications of Ecological Flows
Collaborative Projects	D	Assessing the Impacts of Unconventional Gas Exploration and Extraction on Water resources
Collaborative Projects	E	Systemic Reuse and Recycling Technologies in the Water Sector
Collaborative Projects	F	Towards Urban Flood Proof Cities
Coordination and Support Action	G	Measures to Achieve Water Framework Directive Objectives in Heavily Modified Water Bodies
Infrastructure	H	Infrastructure for Water Research and Innovation

The Water JPI welcomes the integration of some of these proposals in the current Horizon 2020 SC5 draft programme 2016-2017, e.g. the promotion of reuse and water

recycling technologies in all economic sectors and in urban areas which are growing (See fiche E).

The current Draft Work Programme is focusing on “Large-scale demonstrators” and innovation instruments. Nevertheless, for achieving the proposed objectives within the expected deadlines, academic and applied research will be needed. For some topics, dedicated RTDI infrastructures will be necessary: for example, the foreseen Large-scale demonstrator on nature-based solutions for hydro-meteorological risk reduction (2017), does not consider so far the associated hydraulic challenges (e.g. Examples to be given).

We also would like to remind the European Commission that Research infrastructure can be physical infrastructure (e.g. experimental catchments or field labs) or virtual databases / exchange platforms (supposed to guarantee long term records). Databases should be comprehensive, easy-to-access and interoperable

We would also like to remind the necessity of considering:

- Topic B: Hydromorphology and related issues, such as sediment transport and management, are fundamental for being able to the elaboration of proposals on several of the current WP 2016_2017 programme targets (e.g. nature-based solutions for climate resilience in cities or Large-scale demonstrators on nature-based solutions for hydro-meteorological risk reduction).
- Topic C: Assessing and operationalizing the concept of insurance value of ecosystems will request a better understanding of the ecological flows and the development of new innovative Decision support systems considering the inter-linkages between the different natural resources and the appropriate scales (including up-scaling and downscaling appraisal).

Water is considered as a cross-cutting issue of the different parts of the WP2016-17. However, the case could be made much stronger by the inclusion of “Water” / “Water-related” in the text itself for strengthening the necessary cross-sectorial demand-driven approach connecting the global challenges-based research and innovation for water.

7. Proposing Topics in Support of Water JPI Implementation

Two topics have been identified for energizing the Water JPI through the Water Focus Area of Horizon 2020 Societal Challenge 5. These topics are proposed for inclusion in the Horizon 2020 Societal Challenge 5 2016-2017 Work Programme (the order does not express priority):

Instrument	Ref.	Title
Coordination and Support		Support international cooperation activities on water (topic for 2016)

Action:
Grant to
Identified
Beneficiary
or
Proposal
ERA-NET
Cofund

J Closing the Water Cycle Gap (topic for 2017)

The first topic is deemed to ensure progress in different Joint Programming policy areas. Three such areas have been tentatively identified:

- Cooperation outside Europe in Water RDI: sustaining long-term partnerships with the pre-identified countries (cf. contacts developed under CSA WatEur and the integration of South Africa in the Joint Call of WaterWorks2014);
- Alignment of National Programmes: progressing and deepening efforts; and
- Meeting the Sustainable Development Goal on Water

This topic will be implemented through a Coordination and Support Action. As previously discussed, The “Grant to Identified Beneficiary” option is judged as the most adequate, since it alleviates the burden on the Water JPI and on the third countries (in terms of time resource preparing a proposal and carrying out the reporting on several concurrent actions) and on Horizon 2020 (in terms of time and costs resources associated with the evaluation and the management of the project, if funded). This topic would be foreseen for 2016, eight years from the onset of interaction with the European Commission in the framework of the Water JPI.

The second topic is an ERA-NET Cofund for the Joint Implementation of the Water JPI SRIA. A Call for proposals of Collaborative Projects will be performed on “Closing the Water Cycle Gap”. This topic would be foreseen for 2017. It is worthwhile noting that this topic is very relevant to some of the third countries contacted by the Water JPI during the last months (e.g. Canada, USA, Vietnam, India, etc.). Therefore, we welcome the inclusion of the ERANet COFUND on the “Closing the Water Cycle gap in 2017 but highlight the need for a better and more sustainable & productive way for DG Research to support the JPIs activities (rather than having to submit proposals on a yearly basis); and that we would welcome the inclusion of an additional topic (Research & Innovation Action) in the area of Closing the Water Cycle Gap - This would also allow for supporting international cooperation in light of the interest received to-date from 3rd countries.

Moving to a more flexible instrument such the FPA would allow easier involvement on the long-term of interested European parties and third countries. .

The Water JPI would welcome the opportunity to further discuss these topics with the Commission in order to reach a fruitful, efficient and effective collaboration with Horizon 2020. Additionally, the Governing Board of the Water JPI needs to adopt a resolution on the final form of these topics.

8. Conclusions

- The Water JPI welcomes the opportunity to provide input towards the preparation of Horizon 2020 Societal Challenge 5 Work programme 2016/2017.
- The Water JPI strongly supports the continuation of the Water Focus Area in the Societal Challenge 5 work programme.
- The Water JPI makes recommendation for inclusion of additional topics in the Horizon 2020 SC5 Work Programme 2016-2017. These topics stem from its own foresight activities, and meet the criteria for Horizon 2020 topics in terms of maximising EU added value; addressing and anticipating key trends, providing strong potential for impact; leveraging industrial participation; addressing key novelties; providing genuinely cross-cutting approaches; and fostering international cooperation.
- The Water JPI proposes the inclusion of specific topics in the Horizon 2020 Societal Challenge 5 Work Programme 2016/2017 aiming at energizing its own implementation via a Coordination and Support Action and an ERA-NET Cofund. Nevertheless the inclusion of an additional topic (Research & Innovation Action) in the area of Closing the Water Cycle Gap would also allow for supporting international cooperation in light of the interest received to-date from 3rd countries. It could also be done through any more flexible instrument (e.g. FPA) which could allow easier involvement on the long-term of interested European parties and third countries.

ANNEX I: Describing Topics of Common Interest to H2020 and the Water JPI

Each fiche below contains the following information:

- The topic title.
- A proposed Horizon 2020 Instrument.
- Responses to the seven Public Consultation Questions, including a topic description.
- The connection to the Water JPI SRIA.
- The connection to the Societal Challenge 5 Specific Programme.
- Relation to the Horizon 2020 Societal Challenge 5 Advisory Group priorities.
 - Systemic Eco-Innovation;
 - Climate Services;
 - Nature-Based Solutions;
 - Sustainable Supply of Raw Materials; and
 - Social Sciences and Humanities.
- Relation to the other Horizon 2020 societal Challenges:
 - SC1: Health, demographic change and wellbeing;
 - SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy;
 - SC3: Secure, clean and efficient energy;
 - SC4: Smart, green and integrated transport;
 - SC6: Europe in a changing world - inclusive, innovative and reflective societies; and
 - SC7: Secure societies - protecting freedom and security of Europe and its citizens.
- Relation to the Horizon 2020 strategic factors, as formulated in the document “Strategic approach for Horizon 2020 - a contribution from foresight”.
 - Population changes;
 - Globalisation and fragmentation;
 - ICT: the big disturbances are yet to come;
 - Transversality in new technologies and individual empowerment;
 - High expectations from new technologies;
 - Vulnerabilities are testing our resilience;
 - Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials; and
 - Constraints on materials and energy and the search for new opportunity spaces.

A	Developing approaches for assessing and optimizing Ecosystem Services (ESS) and the ecological functioning of ecosystems
<i>Instrument:</i>	<i>Collaborative Projects</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	ESS have been recognized as a promising issue for the EU water policy implementation. The WFD requires a good ecological status in water bodies, and ESS facilitate complying with this requirement and the provision of several benefits (water and food supply, biodiversity, landscape value, touristic-recreation activities). The ESS approach is expected to provide responses on the economic requirements of the WFD, in particular those concerning derogations based on disproportionate costs, cost recovery and incentive pricing. Research is required for: developing approaches for assessing and optimizing ESS and the ecological functioning of aquatic and riparian ecosystems; implementing methodologies for the valuation of ESS and establishing case study analyses; and integrating the ESS into water resources management.
Q2. Key assumptions	There is a need to ensure the good ecological quality of the aquatic environment while assuring access to water. The attribution of economic value to the environmental functions connected with the uses will facilitate decision making in water management, in particular under scarcity conditions (with limited trading capacity by the different stakeholders). Monetary valuation should be completed by social valuation of ecosystems, as some social values are enhanced by perception, history and traditional practice in the use of water and by the environmental, political and institutional context in which water regulation takes place.
Q3. Output, Impact and Success Landscape. Cooperation outside EU	The ESS approach will lead to progress in the analysis of water bodies status and main pressures, in the definition of legal measures, and in the decision-making and participation phases of the WFD. The development of methodologies and tools for the implementation of the European water policy will offer concrete solutions to be applied in the international context for sustainable integrated water resources management. This topic will lead to societal wellbeing through progress in the implementation of key European policies. Additionally, this action will provide a common language for international progress in this issue.
Q4. Bottlenecks, risks, uncertainties	ESS is still a relatively new concept amongst water policy makers and managers. This novelty often hampers its adoption at the operational level. Aquatic environments are very dynamic. Their change creates uncertainties in measuring and valuing water ESS. This concept needs to be applied to the whole ecosystem, and in a proper time-scale context to best express its potential benefit. From the technical point of view, a major challenge is how to account for future generations as well as non-use values, which are difficult to estimate in monetary terms.
Q5. Gaps, potential game changers	Knowledge gaps exist for valuing natural capital when it comes to land use planning and resources allocation. This often results in degradation and destruction of this natural capital, resulting very costly for society. Quantifying ESS and their contribution to welfare will eventually lead public decision makers to consider their protection when setting policy and action priorities.
Q6. Potential to leverage the knowledge base; involve industry	The ESS approach will facilitate the necessary transition towards sustainable economies, individuating and involving the sectors using water resources. Markets will be created to promote the provision of a range of water ecosystem services. Partnerships have a key role to play, for instance those involving forestry, farms and industries (such as hydropower), land and water management private entities.
Q7. Support integrated, cross-cutting activities	The involvement of a wide range of scientific and technical competences from the natural sciences to the socio-economical ones is essential for proper implementation of water ESS.
Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020	

<p>Relation to Water JPI SRIA:</p>	<ul style="list-style-type: none"> • <i>Maintaining ecosystem sustainability</i> <ul style="list-style-type: none"> ▪ <i>Developing approaches for assessing and optimising Ecosystems Services Approaches</i> ▪ <i>Integrated approaches: Developing and Applying Ecological Engineering and Ecohydrology</i> ▪ <i>Managing the Effects of Hydro-climatic Extremes and trends on Ecosystems and multiple pressures and impacts on ecosystems</i>
<p>Relation to the H2020 SC5 Specific Programme</p>	<ul style="list-style-type: none"> • <i>5.2. Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems</i> <ul style="list-style-type: none"> ▪ <i>5.2.1. Furthering our understanding of biodiversity and the functioning of ecosystems, their interactions with social systems and their role in sustaining the economy and human well-being:</i> The ESS concept was elaborated at UN level to highlight the importance of ecosystems and biodiversity protection to maintain economic activity and human wellbeing ESS helps us recognize the relationships between stocks of natural capital, such as land and water, and the services that they provide to support human prosperity and wellbeing. ▪ <i>5.2.3. Providing knowledge and tools for effective decision making and public engagement:</i> ESS provides decision making information for selecting cost-effective policy measures and also enables to raise awareness of the public on the importance of ecosystems on human well-being. It is expected that a sound application of valuation methods may improve the current water management and contribute to a better recognition of the value of protecting aquatic environments in the public debate.
<p>Relation to H2020 SC5 AG priorities</p>	<ul style="list-style-type: none"> • <i>Climate Services:</i> ESS protocols and tools may be applied in cascade to CC scenarios • <i>Nature-Based Solutions:</i> ESS approach ensures the protection of the natural environments while offering services • <i>Social Sciences and Humanities:</i> social understanding and consensus is relevant for the implementation of the approach and a proper communication may help in reaching the goals.
<p>Relation to other H2020 Challenges</p>	<ul style="list-style-type: none"> • <i>SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bio-economy:</i> water ecosystem services approach is a promising tool in implementing the European water directives and to link the environmental requirement of a good water ecological status to the development of a sustainable agriculture and forestry, food production and bio-economy. • <i>SC3: Secure, clean and efficient energy:</i> hydropower production is often considered an environmental service, but a number of ecosystem services are may be compromised by hydropower production.
<p>Relation to H2020 strategic factors</p>	<ul style="list-style-type: none"> • <i>Population changes:</i> increasing population the impact on aquatic environment and demand of water resources will increase enhancing the need for proper evaluations like that offered by ESS approach. • <i>Vulnerabilities are testing our resilience:</i> ESS may offer solutions in order to improve societal resilience to the natural and anthropological pressures on water environment • <i>Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials:</i> Water ESS approach has a strong relation with all these factors.

B	Hydromorphology: Restoring Continuity, Sediment Transport and Fish Migration Within River Systems
<i>Instrument:</i>	<i>Collaborative Projects</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	About 56% of Europe’s river water bodies (with a total length of 630,000 km) have not reached good ecological status or potential. Of these water bodies, 48% are affected by hydromorphological pressures, and 43% contain altered habitats. Research performed in Europe on Hydromorphology in the last decades has revealed a strong potential to improve the ecologic status of water bodies and riparian areas, to produce innovative approaches to ecologic engineering, and to implement key European water policies in a wide variety of environmental conditions. These approaches have a strong capacity to change the traditional concept of river engineering. Previous research on the processes and dynamics of sediment transport, debris flow, hydraulic connectivity, flow regimes and fish migration permit to formulate breakthrough innovations in the management of rivers, lakes and deltas. These innovations will facilitate the greening of the European river management and the related companies.
Q2. Key assumptions	European researchers, often funded by the Framework Programmes, have identified and assessed ecological engineering technologies to protect and restore Hydromorphology. These technologies are ready for deployment, and need to undergo pilot studies in diverse environments before they can be implemented in real scale projects.
Q3. Output, Impact and Success Landscape. Cooperation outside EU	Green technologies for Hydromorphology will be ready to implement in European and International projects. Cooperation with stakeholders from civil society and Public Administrations will modify the way river management projects are conceived. Ecological engineering will be added to the portfolio of large European engineering corporations operating worldwide. On the policy side, a relevant part of the Water Framework Directive will be implemented. Water bodies and riparian areas will increase their capacity to produce ecosystem services, thus returning investments to society at large. Companies will exploit this new portfolio in Europe and beyond, synchronizing environmental protection and economic development, and producing thousands of new, high-quality jobs in these technologies.
Q4. Bottlenecks, risks, uncertainties	<p>These can be formulated as:</p> <ul style="list-style-type: none"> • Companies need to learn from pilot sites that these technologies are feasible, and that the market is already demanding such products. • Public Administration needs to formulate green and innovative public procurement actions. Participation in the resulting projects will spread the interest and feasibility of the proposed solutions. • The risk remains that the benefits stemming from these technologies are not understood or shared by the actors.
Q5. Gaps, potential game changers	The main gap so far has been the lack of integration between supply and demand in terms of the restoration of river Hydromorphology. This innovation topic can reverse the trend and bridge the gap between abundant, high-quality European research and conservative river management schemes.
Q6. Potential to leverage the knowledge base; involve industry	This is a clear area for industrial application of research findings. Innovating in Hydromorphology will return the investments performed through the Framework Programmes and the National RDI programmes. Issues like the protection of riparian areas, dam decommissioning, fish scales, or sediment management schemes can contribute to societal wellbeing and to the European Gross Domestic Product.
Q7. Support integrated, cross-cutting activities	Hydromorphology can contribute to societal challenges 2 (related to inland water, riparian agriculture and forestry), and 4 (in what respects to sustainable navigation). This area is effectively related to the discipline of ecological engineering, which is strongly multidisciplinary

	(ecology, biology, natural sciences, engineering, economics...).
Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020	
Relation to Water JPI SRIA:	<ul style="list-style-type: none"> • <i>Maintaining ecosystem sustainability</i> <ul style="list-style-type: none"> ▪ <i>Integrated approaches: Developing and Applying Ecological Engineering and Ecohydrology</i>
Relation to the H2020 SC5 Specific Programme	<ul style="list-style-type: none"> • <i>5.2. Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems</i> <ul style="list-style-type: none"> ▪ <i>5.2.2. Developing integrated approaches to address water-related challenges and the transition to sustainable management and use of water resources and services:</i>
Relation to H2020 SC5 AG priorities	<ul style="list-style-type: none"> • <i>Nature-Based Solutions: protecting and restoring river Hydromorphology assumes that the ecosystem will apply again nature based solutions to problems like floods or water treatment, regaining good water status.</i> • <i>Social Sciences and Humanities: European society is pushing to restore the natural status of rivers, in order to enjoy the ecosystem services which were discontinued by modifications in Hydromorphology.</i>
Relation to other H2020 Challenges	<ul style="list-style-type: none"> • <i>SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy.</i> • <i>SC4: Smart, green and integrated transport.</i>
Relation to H2020 strategic factors	<ul style="list-style-type: none"> • <i>Vulnerabilities are testing our resilience: Restoring Hydromorphology will enhance the resilience of the river system.</i> • <i>Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials: Environmental protection will be a major output of the application of these technologies. River water quality will be enhanced.</i>

C	
Understanding the Implications of Ecological Flow	
<i>Instrument:</i>	<i>Collaborative Projects</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	The Blueprint to safeguard Europe's water resources asks for a common understanding the implication of ecological flow (e-flow) in achieving the environmental objectives of the Water Framework Directive. The main research needs regard: the estimation of e-flow considering ecological or environmental requirements; the improvement of methods for the quantification of the hydrological alterations and the effects of changes in flow regimes on ecosystems; and the development of tools for integrating e-flows into water management plans. Innovative approaches to e-flow assessment need to integrate natural sciences and socio-economic aspects (the human dimension, aesthetics, social costs and benefits, protection of cultural features and recreation). This will enlarge the concept from the traditional view of minimum water flow to the more comprehensive and holistic understanding of e-flow. Research and innovation activities are therefore required to comply with water policy requirements.
Q2. Key assumptions	The natural hydrological regime is strongly variable in space and time. It plays a primary role on biodiversity conservation and on the production and sustainability of aquatic ecosystems (native aquatic and riparian biota are adapted to this variability). For this reason, the magnitude, frequency, duration, timing and rate of change of the natural flow regime are essential elements to sustain and conserve the ecological integrity. The alteration of the hydrological regime may facilitate the invasion of exotic species.
Q3. Output, Impact and Success Landscape. Cooperation outside EU	E-flow implication in water management is an issue for research and innovation at European and International level. Cooperation with stakeholders from civil society and Public Administrations will facilitate the development of innovative and participative approaches. Progress in e-flow will improve the ecological status of water bodies and provide water security to European society. Pilot studies will demonstrate the applicability of the proposed approaches and the applicability to different hydrological and socio-economic conditions. The success landscape will include international cooperation (particularly in what regards transboundary watersheds), societal wellbeing and high-quality water management jobs.
Q4. Bottlenecks, risks, uncertainties	The implementation of e-flow methodologies at EU level will require intense efforts to address: the adaptation to different hydrological conditions; the development of monitoring systems; and the collection of standardized data. If different methodologies and tools were used in different parts of Europe, there would be no real possibility of comparison for management and policy support purposes.
Q5. Gaps, potential game changers	Many European water bodies are affected by severe hydrological pressures and are far from achieving the environmental objectives set at the first river basin management plans of the WFD. Dialogue with stakeholders and society at large is required to overcome this situation and to remove the barriers hindering the implementation of the e-flow concept.
Q6. Potential to leverage the knowledge base; involve industry	This issue is more related to the water policy implementation rather than to market development. However, economic aspects (i.e., decoupling growth and environmental degradation) play an important role in the implementation of e-flow.
Q7. Support integrated, cross-cutting activities	E-flow can contribute to Societal Challenge 2 (related to inland water, riparian agriculture and forestry). Water management and climate change impacts are both important framework for e-flow and the social acceptance is an important factor to be considered.
Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020	
<i>Relation to Water JPI SRIA:</i>	<ul style="list-style-type: none"> • <i>Maintaining ecosystem sustainability</i> <ul style="list-style-type: none"> ▪ <i>Integrated approaches: Developing and Applying Ecological Engineering and Ecohydrology</i> ▪ <i>Managing the Effects of Hydro-climatic Extremes and trends on Ecosystems and multiple</i>

	<p><i>pressures and impacts on ecosystems</i></p> <ul style="list-style-type: none"> • <i>Closing the water cycle gap</i> <ul style="list-style-type: none"> ▪ <i>Enabling Sustainable Management of Water Resources</i> ▪ <i>Strengthening Socio-economic Approaches to Water Management</i>
<i>Relation to the H2020 SC5 Specific Programme</i>	<ul style="list-style-type: none"> • <i>5.2. Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems</i> <ul style="list-style-type: none"> ▪ <i>5.2.1. Furthering our understanding of biodiversity and the functioning of ecosystems, their interactions with social systems and their role in sustaining the economy and human well-being:</i> ▪ <i>5.2.3. Providing knowledge and tools for effective decision making and public engagement:</i> • <i>5.5. Developing comprehensive and sustained global environmental observation and information systems: monitoring and data collection on hydrological and environmental conditions are essential activities for e-flow determination</i>
<i>Relation to H2020 SC5 AG priorities</i>	<ul style="list-style-type: none"> • <i>Climate Services: Climate change facts and predictions have an effect on e-flow.</i> • <i>Nature-Based Solutions: the application of the e-flow concept will enhance the capacity of the river to provide such solutions.</i> • <i>Social Sciences and Humanities: Socio-economic factors are critical in the determination of e-flows.</i>
<i>Relation to other H2020 Challenges</i>	<ul style="list-style-type: none"> • <i>SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy: Agricultural and forestry water uses, as well as the protection of deltas and estuaries are critical to the determination of e-flows.</i> • <i>SC3: Secure, clean and efficient energy: the hydropower production had to consider e-flow</i>
<i>Relation to H2020 strategic factors</i>	<ul style="list-style-type: none"> • <i>Vulnerabilities are testing our resilience: River vulnerability needs to be addressed by regulating water over-abstraction.</i> • <i>Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials: e-flows will control river degradation and protect the provision of services.</i>

D	Assessing the Impacts of Unconventional Gas Exploration and Extraction on Water Resources
<i>Instrument:</i>	<i>Collaborative Projects</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	<p>Recent developments in the field of Unconventional Gas Exploration and Extraction has created a pan-European Societal Challenge regarding its potential risks and environmental impacts and considerations on how turning it into a safe technology.</p> <p>If this technology is found to be or developed safe for the environment and human health, it could have a great potential for innovation, boosting growth and jobs and fostering international collaboration. These innovations could provide an alternative to standard fossil-fuel energy sources and could, if developed in a safe, environmentally-sound manner, give a competitive advantage to the European industries in the water and energy sectors. They would constitute a Systemic Eco-Innovation.</p>
Q2. Key assumptions	<p>This is a very contentious issue with, at the moment, different approaches being taken in Europe and worldwide. There is a need at European level to better understand the potential risks associated with these technologies and, in particular, their impacts on water resources (quantity & quality); and to assess how the use of this technology could be reconciled with environmental protection.</p>
Q3. Output, Impact and Success Landscape. Cooperation outside EU	<p>No European project on this issue has ever been carried out as part of EU FP. There have been recent projects funded at national level in the EU, and also research carried out in the US (for example). However, a pan-European research and innovation action encompassing all aspects from novel technologies to societal impacts seems required. This would support the development of a coordinated approach at the EU policy level. Opportunities to diversify energy supplies and improve competitiveness, including production of unconventional hydrocarbon, can be safely and effectively taken up in those Member states that choose to do so. This topic would target: clarity and predictability for both market operators and citizens including for exploration projects; full consideration of greenhouse gas emissions; and management of climate and environmental risks, including to health, in line with public expectations.</p> <p>This topic would provide:</p> <ul style="list-style-type: none"> • Market oriented solutions: safe alternative to fossil-fuel energy sources, waste water management... • Policies: Support of the WFD and EIA Directives and their relationships with the use of this technology. • Societal wellbeing: Protection of life and assets from environmental damages, social acceptance, potential for growth and jobs. • Active water industry, capitalizing on research via high-tech exports. • Reduced water-energy and greenhouse gas footprint of this activity. • International cooperation opportunities. <p>The success landscape will include environmental protection. If the technology can be implemented in a safe way, it has the potential to mobilize tenths of thousands of new jobs across Europe.</p>

<p>Q4. Bottlenecks, risks, uncertainties</p>	<p>These can be formulated as:</p> <ul style="list-style-type: none"> • Social Acceptance: this is a very contentious issue. Social and political acceptance may be an issue. • Companies need to learn from pilot sites that these novel technologies - once developed in environmentally-safe manner - are feasible without endangering the environment or human health. • Associated related Health dimension needs to be incorporated into the project, in order to evaluate the full potential impacts of this new technology. • The risk remains that the benefits stemming from these technologies are not understood or shared by the actors.
<p>Q5. Gaps, potential game changers</p>	<p>The main gap so far is the lack of understanding of the potential impacts of the technology on the environment and human health. National approaches also vary from country to country.</p>
<p>Q6. Potential to leverage the knowledge base; involve industry</p>	<p>This is a clear area for industrial application of research findings. The reliance on standard fossil-fuel energy sources will be relaxed. Large companies and SMEs can effectively transform research outputs into company products and services for widespread application. Issues like energy production, the safe treatment of wastewater can contribute to societal wellbeing and to the European Gross Domestic Product.</p>
<p>Q7. Support integrated, cross-cutting activities</p>	<p>This topic can contribute to Societal Challenges 1 (related to human health and wellbeing), 2 (related to inland water, agriculture and forestry), 3 (related to clean, safe and efficient energy), and 4 (in respects to safe transport of chemicals and waste). This area is effectively related to the disciplines of geology, engineering, construction and health. The research and innovation will also be open to wide societal participation.</p>
<p>Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020</p>	
<p>Relation to Water JPI SRIA:</p>	<ul style="list-style-type: none"> • <i>Promoting competitiveness in the water industry</i> <ul style="list-style-type: none"> ▪ <i>Developing Market-Oriented Solutions for the Water Industry</i> ▪ <i>Enhancing the Regulatory Framework</i>
<p>Relation to the H2020 SC5 Specific Programme</p>	<ul style="list-style-type: none"> • <i>5.1. Fighting and adapting to climate change</i> <ul style="list-style-type: none"> ▪ <i>5.1.2. Assessing impacts and vulnerabilities and developing innovative cost effective adaptation, risk prevention and management measures:</i> <p>This could have potential benefits in relation to lowering the reliance on fossil-fuel energy sources and reducing the carbon foot print of the energy sector.</p> • <i>5.2. Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems</i> <ul style="list-style-type: none"> ▪ <i>5.2.2. Developing integrated approaches to address water-related challenges and the transition to sustainable management and use of water resources and services:</i> <p>The use of this technology requires an integrated approach to ensure safe and sustainable use of water resources.</p> <ul style="list-style-type: none"> ▪ <i>5.2.3. Providing knowledge and tools for effective decision making and public engagement:</i> <p>This topic would provide the knowledge required to make decisions in relation to the “If”, “Where” and “How” to implement this technology while ensuring the protection of the environment and human health.</p>
<p>Relation to H2020 SC5 AG priorities</p>	<ul style="list-style-type: none"> • <i>Systemic Eco-Innovation:</i> Innovative technologies encompassing the environment, water, energy, climate change • <i>Climate Services:</i> reduction of dependence on fossil fuel energy sources • <i>Social Sciences and Humanities:</i> support towards the development of EU policies, governance system, best practices, social acceptance, socio-economic impacts

<p><i>Relation to other H2020 Challenges</i></p>	<ul style="list-style-type: none"> • <i>SC1: Health, demographic change and wellbeing</i>: Health impacts derived from Environmental degradation • <i>SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy</i>: In relation to competing demands on water and land. • <i>SC3: Secure, clean and efficient energy</i>: Provision of a non-fossil fuel alternative source of energy • <i>SC4: Transport</i>: In relation to the safe transport of chemicals and waste • <i>SC6: Europe in a changing world - inclusive, innovative and reflective societies</i>: Public participation, social acceptance required –very contentious issue • <i>SC7: Secure societies - protecting freedom and security of Europe and its citizens</i>: Security of water supplies and energy sources
<p><i>Relation to H2020 strategic factors</i></p>	<ul style="list-style-type: none"> • <i>High expectations from new technologies</i>: Decrease our reliance on fossil fuel energy sources while protecting the environment & human health • <i>Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials</i>: By reconciling the use of this technology with environmental & health protection as well as looking into competing demands from the various sectors on water use and land • <i>Constraints on materials and energy and the search for new opportunity spaces</i>: Decrease our reliance on fossil fuel energy sources

E	
Systemic Reuse and Recycling Technologies in the Water Sector	
<i>Instrument:</i>	<i>Collaborative Projects</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	In many European regions, particularly in coastal areas, wastewater can effectively close the water cycle gap. New technologies for the reuse of urban and industrial water will be upscaled and demonstrated, opening the path to their industrial application. These technologies will focus on water application for landscaping, agriculture, aquaculture or specific water management purposes, such as artificial aquifer recharge and industrial water reuse based on water “fit for use” concept and heading towards closed loop solutions in water consuming industries. Technologies will implement systemic eco-innovation concepts, by simultaneously promoting energy conservation and the circular economy of specific elements to be extracted from wastewater. These technologies will boost the water sector, providing a safe, low-input alternative to the production of landscape, animal feed, fibre and bio-fuel. Opportunities await for growth and jobs in this sector.
Q2. Key assumptions	European researchers, often funded by the Framework Programmes, have identified and assessed water reuse technologies. Their widespread application faces problems related to scaling-up, social acceptability and integration in urban and industrial areas. These technologies are ready for deployment, and need to undergo pilot studies in diverse environments before they can be implemented in real scale projects.
Q3. Output, Impact and Success Landscape. Cooperation outside EU	The results of this call for innovation proposals will differ from previous attempts to reuse urban and industrial waste water. The main difference will be the implementation of systemic eco-efficiency: water systems will be addressed as part of the urban/industrial landscape, and the economy of resources will be simultaneously applied to water, energy, and valuable elements contained in waste water. The variability in the considered targets for the reused water will contribute to develop site-specific solutions, adapted to the wide variety of hydrological contexts in Europe and in the world. Cooperation with stakeholders from civil society and Public Administrations will modify the way water reuse projects are conceived. Companies will exploit this new portfolio in Europe and beyond, synchronizing environmental protection and economic development. The deployment of effective reuse technologies represents a new market for European companies, with strong potential for job creation, which can be estimated in the tenths of thousands.
Q4. Bottlenecks, risks, uncertainties	These can be formulated as: <ul style="list-style-type: none"> • Companies in the water sector are often declared risk-adverse. Upscaling and demonstration are essential to reduce uncertainties. • Public Administration needs to formulate green and innovative public procurement actions regarding water treatment and reuse. • Water users and society are often reluctant towards water reuse. Demonstration sites on safe reuse operations increasing water security will change users perception.
Q5. Gaps, potential game changers	The main gap so far has been the safety of reused water, the lack of harmonized European regulations and the fact that a market for these products and services has not been established.
Q6. Potential to leverage the knowledge base; involve industry	With about 2,500 scientific publications on water reuse, and an h value of 60, the problem is not as much in the knowledge base, but on the upscaling and deployment of the resulting technology. This topic will evidence the systemic benefits of water reuse and prepare industrial actors for large scale deployment.
Q7. Support integrated, cross-cutting activities	The systemic approach will establish a link to fields such as energy or raw materials, and will strongly introduce social sciences and humanities to bridge the gaps in societal acceptance.
Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020	

Relation to Water JPI SRIA:	<ul style="list-style-type: none"> • Promoting competitiveness in the water industry <ul style="list-style-type: none"> ▪ Developing Market-Oriented Solutions for the Water Industry
Relation to the H2020 SC5 Specific Programme	<ul style="list-style-type: none"> • 5.2. Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems <ul style="list-style-type: none"> ▪ 5.2.2. Developing integrated approaches to address water-related challenges and the transition to sustainable management and use of water resources and services: development of a systemic eco-innovation approach to water reuse. ▪ 5.2.3. Providing knowledge and tools for effective decision making and public engagement: Establishing an enabling regulatory framework and promoting societal acceptance.
Relation to H2020 SC5 AG priorities	<ul style="list-style-type: none"> • Systemic eco-innovation: this is a core issue in this topic. • Nature-Based Solutions: Natural water treatment systems can be effectively included in these technologies. • Social Sciences and Humanities: Societal acceptance will require the deployment of societal research tools.
Relation to other H2020 Challenges	<ul style="list-style-type: none"> • SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy. • SC1: Health, demographic change and wellbeing. • SC3: Secure, clean and efficient energy. • SC6: Europe in a changing world - inclusive, innovative and reflective societies.
Relation to H2020 strategic factors	<ul style="list-style-type: none"> • Transversality in new technologies and individual empowerment. • Vulnerabilities are testing our resilience. • Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials. • Constraints on materials and energy and the search for new opportunity spaces.

F	Towards urban flood proof cities
<i>Instrument:</i>	<i>Collaborative Projects</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	Urban floods have often shown devastating effects to people, property and ecosystems in Europe and beyond. The EU Floods Directive underlines that the probability and the negative effects of floods in urban areas will increase as consequence of urbanisation (development of housing areas and businesses in river floodplains), soil sealing and climate change impacts. Participatory research and innovation approaches are required to manage these risks by developing and marketing: 1) Technological and managerial solutions to urban floods; 2) Integrated systems for the prediction and risk management of urban floods (overflows in advanced wastewater treatment facilities, urban hydrology, surrounding river flow, hydrodynamics, internet of things, drainage design, social sciences and climate change analysis); and 3) developing a smart city approach to integrate sensors and public information services designed for all event phases. Research on these topics has yielded key results in the last decades. Scaling up research results and building innovations seems affordable in a five-year time.
Q2. Key assumptions	The natural hazards causing the largest economic losses in Europe are floods and storms. More than three quarters of European population live in urban areas subjected to flood risks on a regular basis. The slower the adoption of research results the more dramatic the consequences for citizens will be, with loss of lives and assets, and related socio-economic aspects (lower productivity, failure of services, loss of jobs and income sources). These trends are currently accelerated by urbanisation and climate change.
Q3. Output, Impact and Success Landscape. Cooperation outside EU	<p>Success in reducing flood risks in urban areas will be brought about by:</p> <ul style="list-style-type: none"> • Changes in spatial and urban planning (cities may face flooding due to inappropriate land use and flood management in upstream regions; buildings and sensitive infrastructures may be today in a safe location, but be in a risk-prone area in the future; water retention areas can be created through green infrastructures like parks, green walls and roofs), • Innovative approaches like ecosystem services, • Technological solutions for drainage and sewage systems able to cope with heavier precipitation, risk management and emergency tools using the more advanced information systems, • Enhanced public administration responses • Stakeholders involvement and public awareness (in particular in vulnerable groups) and resilience. <p>International cooperation will facilitate the exchange of experiences. Being urban flooding connected to urbanization and climate change, it is a clear world-wide problem. Given the relevance of the problem, this topic is connected to relevant industrial applications and the creation of tenths of thousands of jobs in Europe.</p>
Q4. Bottlenecks, risks, uncertainties	The urban setting can severely alter the answer to a certain event respect to the surrounding areas. This amplifies the uncertainties connected with the meteo-hydrological forecasts and climate change projections. Paved areas and buildings modify the physical parameters, creating unique microclimates. Differences in urban design and management make cities vulnerable in different ways, even those situated in the same geographic region. Artificial surfaces keep rain water from draining into the ground, generating or worsening floods that can exceed the local drainage capacity and contribute to wash away pollutants from the urban context towards natural receptors.
Q5. Gaps, potential game changers	In order to manage urban floods it is important to: 1) Address the uncertainties of models and forecasting systems, particularly in downscaling; 2) Improve the reliability of projections at the

	various spatial and time scales, and 3) Increase the coordination of planning activities, overcoming sectoral approaches. It is essential to understand the causes and impacts of each flood event depending on local physical, administrative and socio-economic characteristics, and to develop a people-centered monitoring and Early Warning Systems that includes both expert and local knowledge. Improving the collection and analysis of post-disaster data (also on practices/ measures) may help in this way.
Q6. <i>Potential to leverage the knowledge base; involve industry</i>	Technological innovation can help implement new solutions applicable to all phases of urban flood management. Developing innovative tools (such as Early Warning Systems) for the forecasting, prevention and protection of extreme events, including sensor technology and monitoring networks need close collaboration between scientists and industries. A smart city approach integrating sensors and public ICT services seems a promising way to increase the resilience of local communities and the capacity to face emergencies.
Q7. <i>Support integrated, cross-cutting activities</i>	Urban flooding results from the interaction of several challenges, such as meteo-hydrological extreme events, climate change, urbanization, regional and local physical and socio-economic characteristics. Protecting citizens will require multidisciplinary and multi-stakeholder dialogue, as well as increased RDI efforts in disciplines such as water resources, hydrodynamics, ICT, geography and social sciences, to take account of all values and attitudes.
Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020	
<i>Relation to Water JPI SRIA:</i>	<ul style="list-style-type: none"> • <i>Maintaining ecosystem sustainability</i> <ul style="list-style-type: none"> ▪ <i>Developing approaches for assessing and optimising Ecosystems Services Approaches</i> ▪ <i>Integrated approaches: Developing and Applying Ecological Engineering and Eco-hydrology</i> ▪ <i>Managing the Effects of Hydro-climatic Extremes and trends on Ecosystems and multiple pressures and impacts on ecosystems</i> • <i>Developing safe water systems for the citizens</i> <ul style="list-style-type: none"> ▪ <i>Minimizing Risks Associated with Water Infrastructures and Natural Hazards</i>
<i>Relation to the H2020 SC5 Specific Programme</i>	<ul style="list-style-type: none"> • <i>5.2. Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems</i> <ul style="list-style-type: none"> ▪ <i>5.2.1. Furthering our understanding of biodiversity and the functioning of ecosystems, their interactions with social systems and their role in sustaining the economy and human well-being: in urban areas, blue-green networks of surface waters and ecosystems could be used to deliver clear benefits to society such as reduction of pluvial floods</i> ▪ <i>5.2.2. Developing integrated approaches to address water-related challenges and the transition to sustainable management and use of water resources and services: urban services are interconnected and a sustainable management of water resources and services will play an important role also in facing emergency events like floods</i> ▪ <i>5.2.3. Providing knowledge and tools for effective decision making and public engagement: risk-based decision-making and planning tools including socio-economy, effective communication and conflict resolution represent essential tools in coping with urban flooding</i> • <i>5.5. Developing comprehensive and sustained global environmental observation and information systems: the improvement of the observation (also from remote sensing platform) and information systems is envisaged as a promising way to gather useful information's to reduce uncertainties</i>
<i>Relation to H2020 SC5 AG priorities</i>	<ul style="list-style-type: none"> • <i>Climate Services: climate change may locally increase the frequency and intensity of floods, climate projections are very important in dealing with urban flooding</i> • <i>Nature-Based Solutions: at urban level, potential applications of Ecological Engineering could be found by combining the expertise of landscape architecture, urban planning and urban storm water management</i> • <i>Social Sciences and Humanities: protecting citizens from the effects of urban floods require</i>

	social sciences involvement
<i>Relation to other H2020 Challenges</i>	<ul style="list-style-type: none"> • <i>SC1: Health, demographic change and wellbeing</i>: floods cause loss of life and diseases • <i>SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bio-economy</i>: urban flooding depends from a lot of factors and are often consequences of external planning activities related to agriculture and forestry and water management. Integration of sectoral approaches and policies helps in facing complex issues like urban flooding
<i>Relation to H2020 strategic factors</i>	<ul style="list-style-type: none"> • <i>Population changes</i>: urbanization and density of population in flooding prone areas are factors to consider in coping urban flooding • <i>High expectations from new technologies</i>: development and improvement of innovative tools (such as EWS) for urban flooding forecasting, prevention and protection, including sensor technology and monitoring networks, is expecting to reduce associated risks (damages). • <i>Vulnerabilities are testing our resilience</i>: less urban vulnerability to flooding is expected from higher resilience of local communities (more awareness, information and proactive measures) • <i>Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials</i>: environmental degradation increase the flooding impacts.

G	Measures to achieve Water Framework Directive objectives in Heavily Modified Water Bodies
<i>Instrument:</i>	<i>Coordination and support action</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	<p>Heavily Modified Water Bodies (HMWB) are those for which the coexistence of multiple pressure factors modify their water quality/ quantity levels and/ or hydromorphological features. Pressure factors include water abstraction and inter-basin water transfer, the construction of regulating infrastructures like dams and reservoirs, or the dredging of large rivers and digging of new canals for navigation. Following the implementation of the Water Framework Directive (WFD), Member States committed to safeguarding the quality of their rivers and to establishing specific action-oriented frameworks for this purpose (River Basin Management Plans). Recent reports of the European Environment Agency show that, despite the efforts of many Member States, there is still a significant number of HMWB (more than 30% of water bodies are classified as HMWB in the South of England, Poland and south-eastern European countries; this figure adds up to 50% in The Netherlands, Belgium and Germany).</p> <p>The purpose of the RDI activities here proposed is to take advantage of the momentum created by the CIS-SPI initiative and continue with the development of knowledge management activities. Specific objectives are: (i) To facilitate the exchange of experiences and best practices amongst Member States to restore HMWB more efficiently and effectively; and (ii) to come up with robust and practicable recommendations regarding tools, practices and methods to meet the requirements of the WFD.</p>
Q2. Key assumptions	<p>European researchers, often funded by the Framework Programmes, have identified and assessed potential measures to restore HMWB. It is assumed that such measures are applied in some Member States. Experiences and best practices need to be further exchanged and discussed to better adapt them to current and emerging societal challenges.</p>
Q3. Output, Impact and Success Landscape. Cooperation outside EU	<p>The overarching expected impact is to effectively reach a better ecological status in a number of HMWB in the EU. Other expected impacts are:</p> <ul style="list-style-type: none"> • To promote knowledge exchange across Member States regarding tools, methods, solutions and recommendations for restoring HMWB as well as “success stories”; • To identify “enabling factors” for HMWB restoration; and • To support the development of existing action-oriented and policy frameworks (Water Blueprint) and future European policies.
Q4. Bottlenecks, risks, uncertainties	<p>Experience shows that the restoration of HMWB needs high implication of all actors i.e. policy makers and other stakeholders (civil society, economic sector, researchers, etc.). Amongst other factors, the mismatch between policy needs and available science, communication problems, cultural differences, unclear responsibilities, the lack of funding or even knowledge and trust issues have been reported as obstacles for a better knowledge exchange and dissemination of key lessons in water management.</p> <p>HMWB are not properly tackled in Europe due to the costs associated with their restoration and the insufficient knowledge on best possible measures.</p>
Q5. Gaps, potential game changers	<p>A number of gaps still remain:</p> <ul style="list-style-type: none"> • Development of methods to improve the effectiveness of communication between different communities; and • Improvement of dialogue and understanding between RDI and multiple actors at the local level.
Q6. Potential to leverage the knowledge base; involve industry	<p>This project will be based on a participatory approach and as such, all concerned stakeholders will be invited to participate in knowledge sharing and identification of viable and sound solutions. Industrial actors will therefore be invited to participate in discussions.</p>

<p>Q7. Support integrated, cross-cutting activities</p>	<p>This project will call for the participation of practitioners from a wide range of disciplines including:</p> <ul style="list-style-type: none"> • Ecology: study of ecosystems, multiple pressures models, hydromorphology, ecosystem services; • Social sciences: study of the behaviour of individuals and population groups, civil society's needs, analysis of the costs and benefits of proposed solutions; and • Engineering: design application of engineering-based solutions. <p>RDI on HMWB could contribute to challenge 2 (related to inland water, riparian agriculture and forestry) as higher quality water bodies could be used for irrigation purposes.</p>
<p>Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020</p>	
<p><i>Relation to Water JPI SRIA:</i></p>	<ul style="list-style-type: none"> • <i>Maintaining ecosystem sustainability</i> <ul style="list-style-type: none"> ▪ <i>Integrated approaches: Developing and Applying Ecological Engineering and Ecohydrology</i>
<p><i>Relation to the H2020 SC5 Specific Programme</i></p>	<ul style="list-style-type: none"> • <i>5.2. Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems</i> <ul style="list-style-type: none"> ▪ <i>5.2.2. Developing integrated approaches to address water-related challenges and the transition to sustainable management and use of water resources and services:</i>
<p><i>Relation to H2020 SC5 AG priorities</i></p>	<ul style="list-style-type: none"> • <i>Nature-Based Solutions:</i> Proposed solutions will aim at building ecosystem resilience so that the effects of external alterations are buffered. Proposed solutions will aim at maintaining and augmenting natural capital where possible. • <i>Social Sciences and Humanities:</i> SSH expertise will be necessary to understand what HMWB implies and to accompany change.
<p><i>Relation to other H2020 Challenges</i></p>	<ul style="list-style-type: none"> • <i>SC2: Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy.</i>
<p><i>Relation to H2020 strategic factors</i></p>	<ul style="list-style-type: none"> • <i>Vulnerabilities are testing our resilience:</i> Restoring HMWB will enhance the resilience of water bodies. • <i>Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials:</i> River water quality will be enhanced.

H	
Infrastructure for Water Research and Innovation	
<i>Instrument:</i>	<i>Infrastructure</i>
Responding to the seven Public Consultation Questions (Q1 to Q7)	
Q1. Rationale & description; innovation reaching market in 5-7 years	The mapping of European water infrastructure shows a clear deficit in comparison with other areas of knowledge. The Water JPI has set out to mobilise and support the development of joint infrastructures. The establishment of European research infrastructures will support fields such as up-scaling of water flow (runoff and groundwater), reactive transport and ecosystems up to the relevant scale in order to facilitate policy implementation and assist scientists worldwide. Research infrastructure can be physical infrastructure (e.g. experimental catchments or field labs) or virtual databases / exchange platforms (supposed to guarantee long term records). Databases should be comprehensive, easy-to-access and interoperable. The development of Water research and innovation infrastructure responds to a deficit which has not been addressed with sufficient energy. ESFRI has recently restated interest on distributed environmental infrastructure ⁷ . Added value includes the implementation of the INSPIRE Directive on data management and the relation on hydrological observatories with climate change and the development of climate services.
Q2. Key assumptions	European Research and innovation institutions have relevant infrastructures which would benefit from coordination and data sharing. In addition the need for innovative infrastructure in key water areas has been reflected in the Water JPI SRIA.
Q3. Output, Impact and Success Landscape. Cooperation outside EU	Coordinated infrastructure for hydrological and hydraulic purposes, the networking of protocols and data, and a strong profile for international cooperation in the gathering, sharing and exploitation of this information. Links can be established to international initiatives such as GEO or through the channels established by the Water JPI for cooperation outside Europe. Through this action, Europe will be able to coordinate hydrological data and organize access to it by scientists and companies. The indirect potential for the creation of quality jobs is high.
Q4. Bottlenecks, risks, uncertainties	The complexity and the site specificity of hydrological observatories and hydraulic infrastructure have resulted in different protocols, requiring standardization. The high costs of networking these infrastructures and building new infrastructures require action at the European level.
Q5. Gaps, potential game changers	Europe can no longer afford the current fragmentation of efforts and dispersion of hydrological data and water infrastructure facilities. Coordination of efforts, procedures and protocols for access by researchers and industry can be effective game changers.
Q6. Potential to leverage the knowledge base; involve industry	Infrastructure actions are the foundation for the generation of a comprehensive knowledge base. At the same time, opportunities arise to provide services not only to researchers, but also to industry. Such is the case, for instance, of climate services in what respects to hydrological data.
Q7. Support integrated, cross-cutting activities	Infrastructure is a cross-cutting activity, linked to the generation of data for a number of related challenges concerned with health, the protection of lives and assets, energy, agriculture, forestry and societal wellbeing in general.
Relating to the Water JPI SRIA, SC5 Specific Programme and priorities, and H2020	
<i>Relation to Water JPI SRIA:</i>	<ul style="list-style-type: none"> • This topic supports the implementation of the complete Water JPI SRIA
<i>Relation to the H2020 SC5 Specific Programme</i>	<ul style="list-style-type: none"> • 5.2. <i>Protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems</i>

⁷ Conclusions on the implementation of the roadmap for the European Strategy Forum on Research Infrastructures. Competitiveness Council Meeting. Brussels, 26 May 2014

<p><i>Relation to H2020 SC5 AG priorities</i></p>	<ul style="list-style-type: none"> • <i>This topic mainly related to Systemic eco-innovation and Nature-Based Solutions. However, it is a cross-cutting issue. Infrastructure will enable all priorities.</i>
<p><i>Relation to other H2020 Challenges</i></p>	<ul style="list-style-type: none"> • <i>This topic mainly related to SC2 (Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy). However, this is a cross-cutting topic, relating to all identified challenges.</i>
<p><i>Relation to H2020 strategic factors</i></p>	<ul style="list-style-type: none"> • <i>Transversality in new technologies and individual empowerment.</i> • <i>Vulnerabilities are testing our resilience.</i> • <i>Environmental degradation, food security, scarcities of natural resources and bioeconomy potentials.</i> • <i>Constraints on materials and energy and the search for new opportunity spaces.</i>

ANNEX II: Describing Topics in Support of Water JPI Implementation

I	Support to Water JPI Development in Specific Target Areas
<i>Instrument:</i>	<i>[2016] Coordination and Support Action formulated as a Grant to Identified Beneficiary or as a Call for Proposals</i>
Rationale	
<p>Challenge: The Joint Programming Initiative “Water Challenges for a Changing World” (the Water JPI) has been in formal operation since 2010. A number of milestones have been achieved, including: 1) reaching critical mass of partner countries and research and innovation programmes; 2) releasing a Vision Document and a Strategic Research and Innovation Agenda (SRIA); and 3) Publishing a Pilot Call for Proposals, which has resulted in recommendation for funding of nine projects for a total budget of 9 M€. The Water JPI is currently executing an FP7 Coordination and Support Action, which will finalize by the end of 2015. Ongoing activities include the launching of Calls in 2015 (for an expected amount of 20 M€) and 2016, the release of the second version of the SRIA (June 2014) and the publication of the 2014-2016 Implementation Plan (October 2014). After four years in operation, the JPI is entering a maturity phase in which it effectively addresses the identified water challenges in cooperation with Horizon 2020. This new phase requires adoption/strengthening of additional lines of work.</p> <p>Scope: This second Coordination and Support Action will tentatively focus on issues requiring particular energy in the foreseen execution period (2017-2019). The Water JPI has identified three such issues: 1) Developing and sustaining long-term partnerships in cooperation outside Europe; 2) Energizing the alignment of National Water RDI Programmes: progressing and deepening efforts; and 3) connecting Smart Specialisation (European Structural and Investment Funds) to the Water JPI.</p> <p>Expected impacts: This Coordination and Support Action will support the development of three specific lines of action in the last phase of the current Water JPI programming period. The current Water JPI objectives will be achieved by 2020, in complete coordination with the Horizon 2020 programme. The Coordination and support action, with an estimated budget of 2 M€, will permit to develop intense activity around the three abovementioned axes, ensuring progress in areas which are critical to the development of Joint Programming in water for the benefit of Member States, Associated Countries and the policies of the European Commission in Horizon 2020 and in water-related policies. The proposed CSA will raise the scale and ambition of the research and innovation activities carried out in the specified domain beyond the level that would be otherwise sustainable, globally increasing the coherence and efficiency in the use of European resources.</p> <p>The detailed scope for the 2016 ERA-NET Cofund proposal require further discussion and approval by the Water JPI GB as well with Horizon 2020. We would therefore welcome the opportunity to further discuss this proposed topic with the EC at the next Governing Board meeting of the Water JPI.</p>	

J	Closing the Water Cycle Gap
<i>Instrument:</i>	<i>[2017] ERA-NET Cofund (including a Call for transnational collaborative projects)</i>
Rationale	
<p>Challenge: Water demand, mismanagement and climate change inducing short- to long-term variations in water availability</p>	

(including extreme events) have increased the stress on water bodies, associated ecosystems and existing infrastructures. Research needs to be deployed in a number of scientific fields to improve the knowledge base on water resources availability and use. Water resources observation and modelling will be required to better understand hydrological processes and to analyse and forecast the effect of management options. Research and Innovation could use GEOSS information/data in order to support improved decision-making to ensure the long-term viability of water resources and to enable the integrated management of water resources at the national, basin, and global scales.

These technological and environmental research and innovation activities must be systematically combined with a socio-economic approach investigating the questions of adaptation strategies, participation, behaviour and commitment of stakeholders. The concept of water foot-printing needs to be deepened, establishing practical methods and certifiable systems. Innovative concepts for water resources management need to be developed, with the aim of providing science-proof solutions to societal water challenges. There is a need for integrated and interdisciplinary research and innovation aimed at understanding and maintaining and safeguarding the essential functions and processes of ecosystems (i.e. "ecosystem sustainability"). Ecosystem Services approaches can be effectively applied to address the water cycle gap.

This topic is a pan-European challenge, which will require a concerted action. To be more effective and to increase the added value of related investments, the efforts and strategic research agendas of the many funding networks and organisations existing in Europe need to be integrated to establish transnational and trans-disciplinary research and innovation actions.

Scope:

Proposals should pool the necessary financial resources from the participating national (or regional) research programmes with a view to implementing a joint call for proposals resulting in grants to third parties with EU co-funding to support the priorities identified in the Strategic Research Agenda of the Water Joint Programming Initiative. In line with the EU's strategy for international cooperation in research and innovation, international cooperation with international partners is encouraged. The call should support research and innovation to support the implementation of EU water policy, in particular on closing the water cycle gap.

Expected Impacts:

Better use of scarce human and financial resources in the area of water R&I. Reduced fragmentation of water research and innovation efforts across Europe. Improved synergy, coordination and coherence between national and EU funding in the relevant research fields through transnational collaboration. Improved implementation of research and innovation programmes in these fields through exchange of good practices. Contribution to the implementation of the JPI on Water.

The detailed scope for the 2017 ERA-NET Cofund proposal require further discussion and approval by the Water JPI GB as well with Horizon 2020. We would therefore welcome the opportunity to further discuss this proposed topic with the EC at the next Governing Board meeting of the Water JPI.