



D9.1– Policy framework and Information Management

WP9 – Policies, Information
Management & Standardisation



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ABSTRACT	This deliverable reports on the current and proposed European legal framework, including challenges within that framework, and provides policy recommendations for the future of water security.		

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ABBREVIATIONS/ACRONYMS

AI	Artificial intelligence
AMR	Smart metering system
CCTV	Closed-circuit television
CEN	European Committee for Standardisation
CESCR	Committee on Economic, Social and Cultural Rights
CSIRT	Computer Security Incident Response Team
DWD	Drinking water directive (98/83/EC)
DWTP	Drinking Water Treatment Plant
EC	European Commission
ECHA	European Chemicals Agency
ECI	European Citizens' Initiative
ECID	Directive for European Critical Infrastructure (2008/114/EC)
ECID	Directive of European Critical Infrastructures
EEA	European Economic Area
EICD	Supervisory control and data acquisition
EQS	Environmental Quality Standards
EU	European Union
FAO	Food and Agriculture Organization
FD	Floods Directive (2007/60/EC)
GDWQ	WHO Guidelines for Drinking-water Quality
GLAAS	Global Analysis and Assessment of Sanitation and Drinking-Water
ICT	Integrated Pollution Prevention and Control
IPPC Directive	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization
MSFD	Marine Strategy Framework Directive
NIS Directive	Directive on security of network and information systems
NRW	Non-revenue water
OPS	Operator Security Plan (according to 2008/114/EC)
OSP	The operator security plan
SCADA	Supervisory control and data acquisition
SDGs	Sustainable Development Goals (of 2030 Agenda for Sustainable

	Development)
UN	United Nations
UNCE	United Nation Committee of Experts
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNISDR	United Nations Office for Disaster Risk Reduction
WAREG	European Water Regulators
WFD	Water framework directive (2000/60/EC)
WHO	United Nations World Health Organization
WP	Work package
WSP	Water Safety Plan

1. Executive summary

The present deliverable represents the main outcome of task T9.1 “Policy framework and Information Management” of WP9. According to the Gant Agreement, the objective of this task is to explore the current and proposed European legal framework regulating water security to understand the policy requirements that need to be set in place to fully implement the aqua3S innovative technologies.

In order to achieve this goal, the document firstly aims to clarify the concept of ‘water security’, as defined by international regulation (Section 3), since its common, ‘intuitive’, meanings could be various and sensibly different with each other and from the official definition established by the United Nation in 2013. The deliverable then presents a summary of the most relevant EU regulations related to water security (Section 5); as is going to be thoroughly discussed in this document, a unique dedicated regulation for water security does not exist; instead, there are many different regulations which cover different topics included into the concept of water security. The Section 5 also includes some relevant initiatives and outcomes that, even if they are not currently part of the European laws, they are affecting (or can potentially affect) the future EU regulation, as well as the ongoing revision of some directives.

It should be clarified that, since the concept of water security is very wide and includes many different aspects that are not unified in a single regulation, the related existing European framework is vast, including hundreds of different directives and laws. This document is not meant to be fully exhaustive in this sense, but it aims to provide an overview of the main relevant aspects and issues for the aqua3S project and solutions.

In addition to the research of the water security legislative environment, in compliance with T9.1, the document also includes a report of a survey among key stakeholders of the water sector, performed by means of a survey poll, with the modalities described in Section. 6.

The survey poll is not limited to only understanding which aspects of the current regulation are adequate or – on the contrary – outdated- in the stakeholders’ opinion; but it is also targeted to collect feedback from stakeholders about new standards, strategies and technologies that, if adopted at a European level, could help to enhance the water security in all these aspects.

The outcomes of the previous two activities are extensively discussed in Section 7, which also includes a list of policy recommendations resulted. These recommendations, as stated in the final Section 8, will be disseminated all over the aqua3S project.

2. Introduction

Thinking to water security at an intuitive level, many different issues to be addressed comes into mind: ranging from the human right of access to water for everyone, to national and international security, environmental preservation, qualitative and quantitative issues and economic sustainability.

The data listed below quantifies the extension of these issues. For example, dealing with **Water Bone Disasters and bad water quality**, numbers say:

- UN World Health Organization (WHO) in 2003 estimated that waterborne diseases are responsible for 80 per cent of all illnesses and deaths in the developing world;
- In the south of Europe, direct relation has been observed between climate-related disasters such as floods, heavy rainfalls, and waterborne diseases. Typically, waterborne diseases and zoonotic infections increase after floods and rainfall, and high temperature also supports the growth of waterborne diseases (Funari et al, 2012);
- 1.8 billion people around the world are obliged to consume water contaminated by sewerage for drinking, which practice transfers diseases like cholera, typhoid, dysentery, and polio. Empirical studies have already indicated the downside effects on human health of pollution and poor water quality due to the rapid increase in population and urbanization (Ashbolt, 2004);
- Most problems related to water quality are caused by intensive agriculture, industrial production, mining and untreated urban runoff and wastewater.(UN-Water, 2011);
- Water pollution is worsening in many parts of the world, adversely affecting the quality and quantity of water available to meet human needs and sustain ecosystems. Roughly 80 per cent of wastewater is discharged into the environment untreated, contaminating surface water, groundwater, soil, and the oceans. Wastewater includes effluent from industry, agriculture, households, and institutions, as well as urban run-off. The health and environmental costs of water pollution from agriculture alone are hundreds of billions of dollars annually. Even in States with advanced wastewater treatment facilities, challenges remain, including pharmaceuticals, personal care products and microplastics. (UN, 2021);

Quantitative issues are related to **water scarcity**, term which, according to United Nations, can mean scarcity in availability due to physical shortage, or scarcity in access due to the failure of institutions to ensure a regular supply or due to a lack of adequate infrastructure. Water scarcity already affects every continent. Water use has been growing globally at more than twice the rate of population increasing in the last century, and an increasing number of regions are reaching the limit at which water services can be sustainably delivered, especially in arid regions. For example:

- One out of six persons lives without regular access to safe drinking water. Over twice that number -- 2.4 billion people -- lack access to adequate sanitation (WHO 2003);
- It has been estimated that half of the world's population will suffer water stress conditions by 2025. (WHO, 2016);
- Water availability has been decreasing in all sectors by 7–11% during the last two decades (UNDP 2016);
- About 4 billion people, representing nearly two-thirds of the world population, experience severe water scarcity during at least one month of the year (Mekonnen and Hoekstra, 2016);
- With the existing climate change scenario, by 2030, water scarcity in some arid and semi-arid places will displace between 24 million and 700 million people. (UN, 2009);
- A third of the world's biggest groundwater systems are already in distress (Richey et al., 2015);

- Nearly half the global population are already living in potential water scarce areas, at least one month per year. This could increase to some 4.8–5.7 billion in 2050. About 73% of the affected people live in Asia (69% by 2050) (Burek et al., 2016);
- Global water use is six times higher than it was 100 years ago and continues to increase by 1 per cent per year, twice as fast as the human population grows. More than half of the world's accessible freshwater flows are appropriated for human use. (UN, 2021);
- In Europe, renewable freshwater resources per inhabitant showed a decreasing trend across all regions, except eastern Europe over the period 1990-2017. Large decreases were observed in Spain (-65 %), Malta (-54 %) and Cyprus (-32 %). Climate change and population increase exerted high pressures on renewable freshwater resources in Europe over this period. The increasing frequency and magnitude of extreme droughts and floods enhance the risk of there being reduced volumes of renewable freshwater resources in the future. (EEA, 2017).

A complementary aspect, related to the quantitative issue, is the **occurrence of water related natural disaster**: when disaster strikes, it usually manifests itself through water. According to United Nations, Floods, landslides, tsunamis, storms, heat waves, cold spells, droughts, and waterborne disease outbreaks are all becoming more frequent and more intense. The impacts and costs of these events are exacerbated by such factors as unplanned urbanization and degradation of ecosystem services. Reducing risk to, and improving the resilience of, water and sanitation services will be key to maintaining access during a climatically uncertain future. For example:

- Around 74% of all natural disasters between 2001 and 2018 were water-related and during the past 20 years, the total number of deaths caused only by floods and droughts exceeded 166,000, while floods and droughts affected over three billion people, and caused total economic damage of almost US\$700 billion. (UNESCO, 2020);
- Droughts accounted for 5% of natural disasters, affecting 1.1 billion people, killing 22,000, and causing US\$100 billion in damage between 1995 and 2015. (UNISDR, 2015);
- 700 million people worldwide could be displaced by intense water scarcity by 2030. (Global Water Institute, 2013);
- Since 1900, more than 11 million people have died as a consequence of drought and more than 2 billion have been affected by drought, more than any other physical hazard. (FAO, 2013);
- By 2050, rising populations in flood prone lands, climate change, deforestation, loss of wetlands and rising sea levels are expected to increase the number of people vulnerable to flood disaster to 2 billion. (UNESCO, 2012);
- Overall, annual economic losses from weather-related disasters are estimated at between US\$ 250 billion and US\$ 300 billion. (UNISDR, 2015).
- Climate change is exacerbating the risks, consequences and inequities associated with water pollution, water scarcity and water-related disasters. Increasing global temperatures inevitably impact the hydrological cycle. Extreme precipitation events are more intense and frequent, increasing flood risks. Heatwaves are occurring more often and lasting longer, exacerbating water scarcity. Sea level rise can cause saltwater intrusion, making groundwater in coastal aquifers unfit for domestic or agricultural use. Sanitation systems are vulnerable to flooding from storms and sea level rise or have less water for flushing and conveying sewage. Small island developing States are particularly vulnerable to climate change and water-related disasters, and many are experiencing increased water stress. Climate change is used to justify renewed interest in hydropower projects, despite their potentially adverse effects on human rights and ecosystem health (UN, 2021).

There are also many intrinsic issues related to the management of water supply and distribution networks in urban areas. This includes also significant financing, policy and governance gaps between aspiration and the current reality with respect to reaching every citizen with safe and affordable drinking water, adequate sanitation, and hygiene. Just to provide a brief overview of the matter:

- Over 50% of countries say that household tariffs are insufficient to recover operation and maintenance costs, leading to an increase in disrepair and service failure. (GLAAS 2017);
- By 2050, close to 70% of the world's population will live in cities, compared to 50% today. Currently, most cities do not have inadequate infrastructure and resources to address wastewater management in an efficient and sustainable way. (UNDESA, 2014);
- In 2003, EEA performed a survey about water use efficiency, with a particular focus on leakages on the water distribution networks. Leakages translated both in an economic loss for the water supply distributor and in a waste of resource for the whole Citizen; moreover, problems with leakage are not only related to the efficiency of the network but also to water quality (contamination of drinking water if the pressure in the distribution network is exceptionally low). According to the study, the leakages are a problem diffused across all the Europe; the percentage of the leakage, expressed in term of percentage of the total volume of water introduced into the network, can exceed the 40% in countries as Bulgaria and Slovenia, whereas the average for the investigated nation is more than 25%.

These numbers, even if they do not aim to provide an exhaustive overview of the complexity of the problem, speak eloquently that coping with water-related issues, thus ensure the water security, is crucial for human health, urban resiliency, socio-politic stability, economic growth as well as environmental preservation. Moreover, this is an issue that should be addressed with the uttermost urgency, as well, in the view of the future generations, since the quality and quantity of water resources is deteriorating all over the world with a worrisome rate, in parallel with the increasing of water related – natural and anthropic – large scale disasters.

The first and more effective step to achieve this goal is, of course, to set an international, or at least a European, framework on water security, intending both at a legal framework as well as at a comprehensive technical normative with a dedicated set of standards.

It is also clear that there is a number of challenges behind such a regulation, as this topic requires vastly different backgrounds and knowledges to be addressed: ranging from the legal world, to the technical one, passing through environmental issues, health and medicine, human rights, economy, disaster management etc.

3. Relation with standardisation activities

This report is focusing on the activities of Task 9.1 on Policy framework and management activities and not on detailed standardization activities carried out within Task 9.2 which will be subject to Deliverable D9.2 due in M30.

However, there is synchronization and cooperation with the whole work package for instance when we organized the workshop in [May 2021](#).

To give an overview of standardization activities before publication of the deliverable D9.2 we can provide the following summary:

Domain of standardization and cooperation with relevant standardization committees:

Within aqua3S we have two parallel tracks of contributions to standardization which are:

- Standardisation on digital water addressing the way the digital information is collected and processed;
- Standardisation on water security contexts, sensors, and crisis management.

For the digital water standardization, we followed the overall discussion within the ICT4water cluster (<https://ict4water.eu/>) implementing the Digital Water strategy established by the EC. We participate in many working groups such as the Action Group on Standardisation and Interoperability. In a recent piece of news "[ICT4Water cluster and ETSI cooperate to deliver open standards supporting digitalisation of the water domain](#)" the group highlights the cooperation with:

- ETSI TC M2M on SAREF4Water specification
- ETSI ISG CIM on key specification called NGSI-LD. Complementing this ontology, the ETSI Industry Specification Group on Context Information Management (ISG CIM) is developing a cross-domain model and an application programming interface to allow the data exchange, using ontologies such as SAREF4WATR to contextualise the information.

Many aqua3S members are following up and contributing to these actions under the leadership of EGM which is an ETSI member, at the origin of the creation of ISG CIM and provide vi-chairmanship of the ISG.

The activities are permanent and regular with the objectives:

- To educate the aqua3S Consortium and the whole water community on these standards with many webinars being organised.
- To provide feedback to the communities to the standardisation committees.

For the water security contexts, sensors, and crisis management standardisation we have analyzed important standards and actions where we can contribute, and we have therefore established liaison and discussion with the following CEN committees:

- CEN TC 164 – Water Supply

We have identified the standard **EN 15975** (Security of drinking water supply – Guidelines for risk and crisis management – Part 1: Crisis management & Part 2: Risk management) where aqua3S can contribute. This standard describes at high level how to set a water security plan and from many discussions such as from the workshop organized by aqua3S, there is room for complementing this standard. ERNCIP has already produced good guidelines on this standard while common actions and a

workshop are planned in fall 2021 with ERNCIP. In the meantime we have discussed with TC 164 officials and in June 2021 at the official meeting, the liaison with aqua3S was approved.

Time frame for contribution: new workshop fall 2021, text contribution early 2022.

➤ CEN TC 230 - Water analysis

We have established liaisons with TC 230 officials and we have identified the standard **EN 17075** (Water quality — General requirements and performance test procedures for water monitoring equipment — Continuous measuring devices) has a key area for contribution. The document is under revision and aqua3S has great opportunity to contribute. The draft plan is to:

- (1) contribute to the general requirements and the requirements for CMDs (Continuous measuring devices) given the new technologies developed within aqua3S;
- (2) benefit from the existence of different sensors measuring same substances in the different pilots. Develop standards for characterisation and comparison of sensors (based on different disciplines or the same one) which are absent from present document in terms of the MIR sensor and the RI sensor;
- (3) to provide guidelines for laboratory performance tests for solutions like the MIR sensor.

We plan to request liaison and send our contribution in 2021.

Time frame for contribution: fall 2021.

➤ CEN TC 391 - Societal and Citizen Security and in particular WG3 Crisis management/civil protection

We have participated in a key workshop in [June 2021](#) and established contact for cooperation with TC 391. We have identified the standards CEN/TS 17091:2018 (Crisis management - Guidance for developing a strategic capability) as a good candidate for aqua3S to provide its feedback on crisis management modelling. Discussion with Patricia Compard Chair-woman TC 391 has taken place and she welcomed any prospect cooperation with aqua3S and in particular contribution to CEN/TS 17091. A common workshop is agreed to be organised for fall 2021.

Time frame for contribution: workshop with CEN TC 391 fall 2021, contribution early 2022.

We will continue to discuss with the various committees as well as to organize market feedbacks. From these discussions we will discuss the opportunity to set a CWA (CEN Workshop Agreement). We will start the CWA process discussion in September 2021.

4. The Concept of Water Security

In the previous sections water security and of its wide implications have already been discussed, even if in an ‘intuitive way’, without explicitly define the concept.

Even if the meaning of this term could seem quite obvious, however, as it will be discussed more in-depth in subsection 7.2, one of the most interesting outcomes of the survey performed amongst key stakeholders is that there is not always a common understanding when it comes to ‘water security’, nor the awareness that an official definition has been established by the UN General Assembly in 2013.

This should not be surprising, since the definition is relatively new and it also involves a wide spectrum of different aspects, some of them not so obvious or apparently not directly related to water, thus some stakeholders are mainly aware only of the ones which are more pertinent to their work.

For this reason, a general clarification of the meaning of Water Security is necessary, in order to set a unique common definition to be used inside aqua3S. The reference, in this sense, is going to be the abovementioned UN definition of 2013, which will be discussed deeply into the following part of this Section, together with a brief overview of the long and articulate international framework where it is placed.

4.1 The official UN Definition

The official definition of water security is one of the many outcomes of the international debate about water which started in the 70’s and is still ongoing.

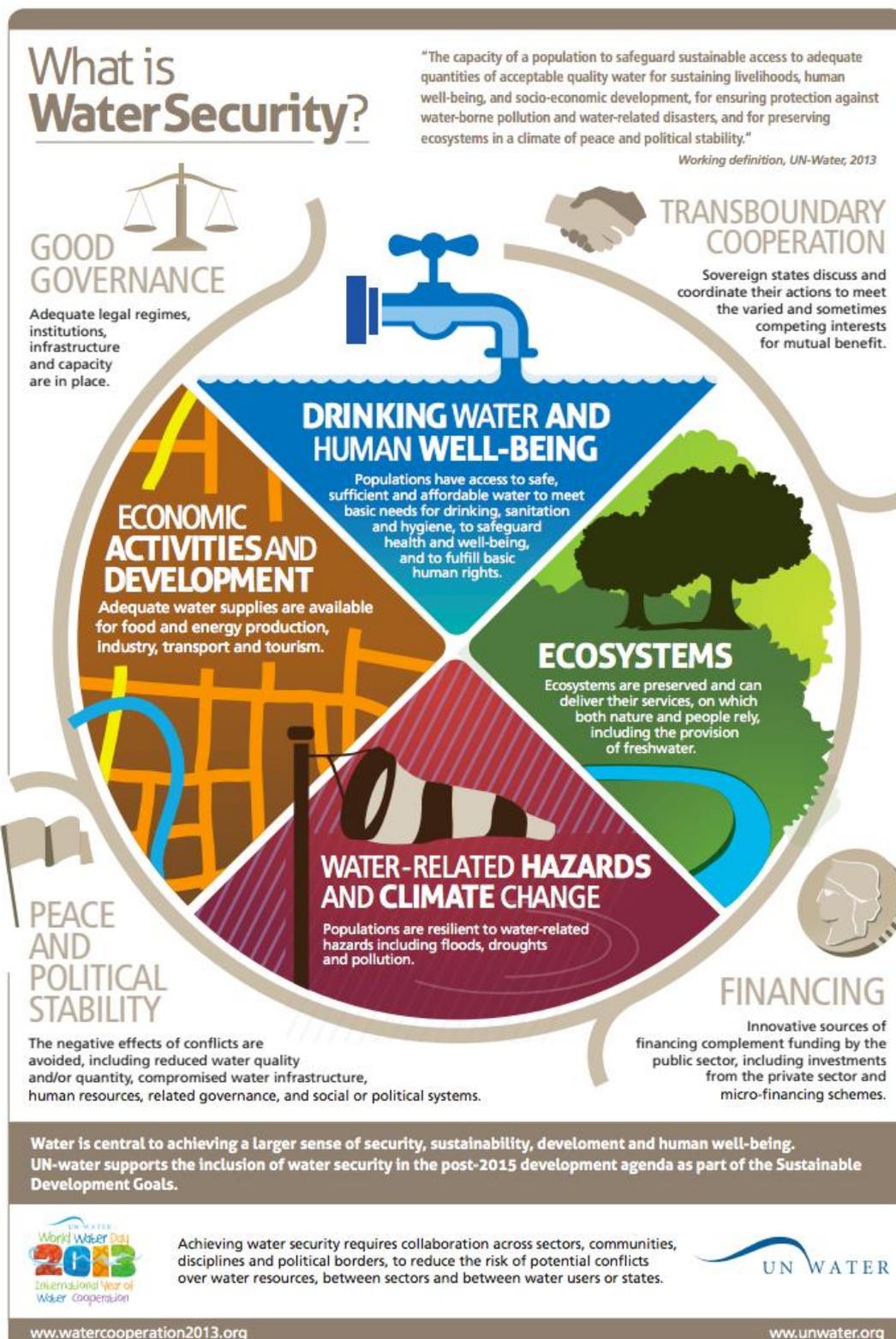
In line with the evolution of this debate, the concept of water security had been progressively enriched with the inclusion of many aspects such as: access to water, quality, quantity, health, economy, time, and preference; then, sustainable development, preservation of the ecosystems, natural hazards, livelihoods, sanitation, food, energy, industrial resources, and transportation, peace, national security, global change, and resilience were also included (Scocca, 2019).

As stated above, until 2013 there was not a common unique definition of water security, for example in 2010 Wouters has identified the three most common understandings of this notion:

- Safe water supply and sanitation, including water for food production and hydrosolidarity between those living upstream and those living downstream in a river basin, and water pollution avoidance;
- Adequate protection from wate-related disasters and diseases and access to sufficient quantity and quality of water, at affordable cost, to meet the basic food, energy, and other requirements essential for leading a healthy and productive without compromising the sustainability of vital ecosystems;
- The reliable availability of an acceptable quantity and quality of water for health, livelihoods, and production, coupled with an acceptable level of water - related risks;

All these different aspects have been encompassed by the UN General Assembly, which proposed in 2013 the following definition, that will be used as reference in this document and in aqua3S context:

“The capacity of a population to safeguard sustainable access to adequate quantities of and 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.”



version October 2013

Figure 1. Concept of Water Security according to UN official Definition (UN, 2013: <https://www.unwater.org/publications/water-security-infographic/>)

This definition was provided with the aim to provide a common framework for collaboration across the UN system.

As evident from the definition, water security encapsulates complex and interconnected challenges and highlights water's centrality for achieving a larger sense of security, sustainability, development and human well-being.

For example, recognition of the human right to safe drinking water and sanitation is an important step towards ensuring water security at the individual and community levels. A human rights based approach to water security addresses critical gaps and bottlenecks and emphasizes the establishment of regulatory functions and mechanisms for efficiency, participation and accountability.

Transboundary waters management also represents enormous challenges for achieving water security in systems, such as river or lake basins and aquifers, which are shared across political boundaries. In such cases, water-related challenges are compounded by the need to ensure coordination and dialogue between sovereign states, each with its own set of varied and sometimes competing interests.

It is also important to ensure that water security is achieved for all users, whether up- or downstream, and does not come at the expense of water insecurity for some.

Good water governance is of course also essential to achieving water security and requires well-designed and empowered institutions with supporting legislative and policy instruments, institutional, legal, and regulatory support and capacity for change, adaptive management structures, new forms of relationships, and multi-layered models capable of integrating complex natural and social dimensions.

Water Security is menaced by political instability, since in conflict and disaster zones, threats to water security increase through inequitable and difficult access to water supply and related services, which may in turn aggravate existing social fragility, tensions, violence, and conflict. In conflict and disaster zones, threats to water security are manifested also through negative impacts on water resources and related ecosystems, both in quantity and quality.

In addition, water security is compromised also by the consequences of climate change, as the vast majority of its impacts will be on the water cycle, resulting in higher climatic and hydrological variability, with important consequences for societies. These effects on water security will differ regionally and will depend upon a number of factors, including geographic location and features, conditions of water availability and utilization, demographic changes, existing manage-meant and allocation systems, legal frameworks for water management, existing governance structures and institutions, and the resilience of ecosystems. Changes in the hydrological cycle will threaten existing water infrastructure, making societies more vulnerable to extreme water-related events and resulting in increased insecurity. Ensuring that ecosystems are protected and conserved is central to achieving water security – both for people and for nature.

Ecosystems are vital to sustaining the quantity and quality of water available within a watershed, which both nature and people rely on. Maintaining the integrity of ecosystems is essential for supporting the diverse needs of humans, including domestic, agricultural, energy and industrial water use, and for the sustainability of ecosystems, including protecting the water-provisioning services they provide.

For these reasons, policy makers need to identify existing capacities, as well as gaps, in order to properly address the water security challenge. Capacity development is a long-term process based on

incentives, good governance, leadership, and knowledge management and transfer, which need to be continuously adapted according to stakeholders' feedback and needs.

To summarize, the main key points of the wide topic of water security identified by UN are:

- Access to safe and sufficient drinking water at an affordable cost in order to meet basic needs, which includes sanitation and hygiene, and the safeguarding of health and well-being;
- Protection of livelihoods, human rights, and cultural and recreational values;
- Preservation and protection of ecosystems in water allocation and management systems in order to maintain their ability to deliver and sustain the functioning of essential ecosystem services;
- Water supplies for socio-economic development and activities (such as energy, transport, industry, tourism);
- Collection and treatment of used water to protect human life and the environment from pollution;
- Collaborative approaches to transboundary water resources management within and between countries to promote freshwater sustainability and cooperation;
- The ability to cope with uncertainties and risks of water-related hazards, such as floods, droughts and pollution, among others;
- Good governance and accountability, and the due consideration of the interests of all stakeholders through: appropriate and effective legal regimes; transparent, participatory and accountable institutions; properly planned, operated and maintained infrastructure; and capacity development.

This is a very innovative approach, because it considers that many factors, and thus actors, contribute to water security, ranging from biophysical to infrastructural, institutional, political, social, and financial – many of which lie outside the water realm. In this respect, water security lies in the center of many security areas, each of which is intricately linked to water. Addressing this goal therefore requires interdisciplinary collaboration across sectors, communities, and political borders.

Moreover, in occasion of the United Nations General Assembly of 2010, which recognized officially the right to safe and clean drinking water and sanitation as a human right, UN provided some definition for the most common adjectives used to quantify the water in the definition of water security and into the international debate about these topics.

- **“Sufficient”**: The water supply for each person must be sufficient and continuous for personal and domestic use. These uses ordinarily include drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene.
- **“Safe”**: The water required for each personal or domestic use must be safe, therefore free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person's health. Measures of drinking-water safety are usually defined by national and/or local standards for drinking-water quality.
- **“Acceptable”**: Water should be of an acceptable colour, odour and taste for each personal or domestic use. All water facilities and services must be culturally appropriate and sensitive to gender, lifecycle, and privacy requirements.
- **“Physically accessible”**: Everyone has the right to a water and sanitation service that is physically accessible within, or in the immediate vicinity of the household, educational institution, workplace, or health institution.
- **“Affordable”**: Water, and water facilities and services, must be affordable for all.

4.2 Overview of the International Framework

The concept of water security is well encapsulated in a long international legal framework about water regulation, the environmental preservation as well in the international guidelines about drinking-water quality and the safeguard of resources, which are in turn all strictly related to the human right laws.

4.2.1 International regulation over the uses of transboundary water bodies

Dealing about the International water regulation, the water management has been for a long period addressed as “a domestic jurisdiction” matter inside the single states, except for the economic claims over transboundary watercourses (Tanzi, 2015). In fact, international rules governing water are based on the premise of the States’ national sovereignty over the resources within their territory or jurisdiction and they are established as a limitation to its proper exercise (Brown Weiss, 2009).

However, there are more than 2000 international agreements, mainly focused on the watercourse management Scocca (2019). The two most relevant documents in this sense are the 1997 UN Convention on the Law of Non - Navigational Uses of International Watercourses (1997) and the Convention on the protection and Use of Transboundary Watercourse and International Lake, adopted by the United Nation Committee of Experts (UNECE) in 1992 (Convention on the protection and Use of Transboundary Watercourse and International Lake, 1992). They constitute the two global treaties in force on the same subject matter, acting respectively at the global and regional level.

The first Convention has been established in 1997, after three decades of work by the International Law Commission, the UN General Assembly. Shortly, it arranges the rights and the obligations of countries sharing international watercourses (Scocca, 2019).

Concerning the aspect of water security, the Convention requires States to use international watercourse in an equitable and reasonable manner (Article 5); it invokes the obligation to not cause significant harm (Article 7) and the duty to cooperate (Article 8), inviting the Watercourse States to take appropriate measures to protect, preserve and manage the ecosystems of international watercourses (Article 20; Article 21), (Scocca, 2019).

The UNECE Water Convention represents one of the relatively few multilateral agreements to address the water issue not linked to a specific international river or river basin. The text was directed toward strengthening national measures for protection and ecologically sound management of transboundary surface water and ground waters, aiming to ensure the sustainable use of transboundary water resources by facilitating cooperation. The document put more emphasis on establishing joint agreements and institutional arrangements, providing also an institutional framework to improve its implementation. (Scocca, 2019).

In 2003, the text of the Convention was amended, allowing the accession of non - UNECE countries.

The initiative entered into force on 6 February 2013, transformed the treaty into a potential global instrument, offering the opportunity to create an international framework for preventive diplomacy, dealing with transboundary water issues.

Another important milestone related to the water security topic into the International water regulation was reached in 1999, during the Third Ministerial Conference on Environment and Health in London. There for the first time, WHO and UNECE jointly drafted a text having the form of a Protocol

to the 1992 Convention, which provided the general policy framework to address the efforts of the parties, assuming water as a prerequisite to promote health and sustainable development. More specifically, the Protocol on Water and Health aims to promote the protection of human health and well-being by improving water management and combating water-related diseases. It implemented parameters and preventive measures, with a wider scope than that of the 1992 Convention, based on the principle of integrated management, providing a framework to translate into practice the human rights to water and sanitation, and, subsequently, to implementation of Sustainable Development Goal (SDG) 6 of the 2030 Agenda for Sustainable Development. (Scocca, 2019).

4.2.2 International debate about drinking water quality and water safety plan

Another parallel current into the international framework, the one related to the drinking water quality and standards, needs to be briefly mentioned there, since it provided important milestones into the topic of water security as well.

The first World Health Organization (WHO) publication dealing specifically with drinking-water quality was published in 1958 as International Standards for Drinking-water. It was subsequently revised in 1963 and in 1971 under the same title. In 1984-85, the first edition of the WHO Guidelines for Drinking-water Quality (GDWQ) was published in three volumes. The second editions of the three volumes of the Guidelines were published in 1993, 1996 and 1997, respectively. Addenda to the first and second volumes were published in 1998, addressing selected chemicals only. An addendum on microbial aspects reviewing selected microorganisms was published in 2002.

The primary aim of the GDWQ is the protection of public health, providing an assessment of the health risk presented by microorganisms, chemicals and radionuclides present in drinking-water. The guideline values recommended for individual constituents of water are not mandatory limits, instead they are intended to be used in the development of risk management strategies, including national or regional standards developed in the context of local or national environmental, social, economic and cultural conditions. Such strategies, if properly implemented, will ensure the safety of drinking-water supplies through the elimination, or reduction to an acceptable concentration, of constituents of water that are known to be hazardous to health.

the GDWQ undergo a rolling revision process, through which, microbes and chemicals are subject to periodic review, and documentation related to aspects of protection and control of drinking-water quality is prepared progressively. This process was initiated at a meeting of the Coordinating Committee for the Rolling Revision of the GDWQ, at which three working groups (namely the Microbial Aspects working group, the Chemical Aspects working group and the Aspects of Protection and Control of drinking-water quality working group) were established.

During the revision of the WHO Guidelines for Drinking-water Quality leading to the 3rd edition, the value of the Water Safety Plan (WSP) approach has repeatedly been highlighted. The potential for water safety plan application has been evaluated in a series of expert review meetings in Berlin (2000), Adelaide (2001) and Loughborough (2001). WSPs require a risk assessment including all steps in water supply from catchment to consumer, followed by implementation and monitoring of risk management control measures, with a focus on high priority risks. Where risks cannot be immediately addressed, the WSP approach allows for incremental improvements to be implemented systematically over time. WSPs should be implemented within a public health context, responding to clear health-based targets and quality-checked through independent surveillance.

According to WHO provisions, the use of water safety plans has the potential greatly enhance the confidence of policy makers and sector stakeholders that the target has genuinely been achieved and contributes to the improved public health and reduced poverty.

For that reason, the WSP has been one of the key topics in the discussion of the latest decade about drinking water and water security, with many publications related. For example, in 2009 WHO published Water Safety Plan Manual intended as step-by-step risk management for drinking water suppliers.

The fourth edition of the WHO's GDWQ (2011 and 2017); it laid down Water Safety Plan approach, including small communities, together with standard EN 15975-2 concerning security of drinking water supply.

Currently Water Safety Plans can be effectively defined an improved risk management tool designed to ensure the safety of drinking water through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer. They are thus adaptable to all types and sizes of water supply and can be effectively applied in all socioeconomic settings. The water safety planning approach is increasingly being adopted globally as best practice for the provision of safe drinking-water.

4.2.3 International debate about Human Right for water

A very exhaustive summary of the 50 years long international debate about the inclusion of water as human right has been provided by Scocca (2019).

The recognition of a human right to water started in in 1977 during the UN Conference on the water in Mar del Plata (Argentina). The conference produced the earliest recorded statement acknowledging the existence of a universal right to water at the international level and the first action plan on water resources including environment, health, and pollution control.

The dialogue continued through the 1990s, particularly with the 1992 International Conference on water and sustainable development, recognizing in the Dublin principles: “the basic right of all human beings to have access to clean water and sanitation at an affordable price”. The debate at the time suggested the development of a new right to water followed by another important event in the same year, the 1992 Rio Conference and the Agenda 21, both supporting that “in the developing and using water resources, priority has to be given to the satisfaction of the basic needs and the safeguarding of ecosystems (···)” (United Nations Conference on Environment & Development, 1992).

Meanwhile, the right to water was explicitly recognized in specific international documents, such as the Convention on the Elimination of All Forms of Discrimination against Women (Article 14) and the Convention on the Rights of the Child (Article 24), as well as Other regional sources of law (i.e. the case of the African Charter on the Rights and Welfare of Child, Article 14; the European Charter on Water Resources; Article 5; together with the additional protocol to the American Convention on human rights dealing with economic, social, and cultural rights in America, Article 10).

After 10 years of work negotiating, the UN Committee on Economic, Social and Cultural Rights (CESCR) released the General Comment no. 15 and the document assumed a catalyst role for the discussion of the right to water and it has triggered its further recognition (Winkler, 2012).

Following the work of the CESCR, in August 2007 the UN High Commissioner for Human Rights presented a report dealing with “the scope and content of the relevant human rights obligation

related to equitable access to safe drinking water and sanitation under international human rights instruments”.

In July 2010, the UN General Assembly adopted a resolution on the right to water and sanitation explicitly recognizing a right to “safe and clean drinking water and sanitation as a human right that is essential for the full enjoyment of life and all human rights” (United Nations General Assembly, 2010).

To this initiative followed a second resolution by the Human Rights Council (September 2010), which stated that the human right to safe drinking water and sanitation is derived from the right to an adequate standard of living and inextricably related to the right to the highest attainable standard of physical and mental health, as well as the right to life and to human dignity (UN Human Rights Council, 2010).

These resolutions represent a fundamental milestone in terms of the recognition right for water, formally acknowledging water as a human right, as well as for the water security.

Following to these milestones, in March 2012, the Ministerial Declaration of the sixth World Water Forum recognized the human right to water for the first time and highlighted the importance of a global approach, understanding the economic, social, and environmental nature of water (World Water Council, 2012). The same year, the outcome document of the UN Conference on Sustainable Development acknowledged the right to water (United Nations General Assembly, 2012).

in September 2012, the United Nations Human Rights Council adopted unanimously the resolution on the human right to safe drinking water and sanitation, with States making only supportive.

statements in the accompanying debate. Since then, the UN General Assembly adopted three further resolutions on the right (United Nations General Assembly, 2013, 2017; UN General Assembly, 2015a, 2015a).

Finally, as latest piece, in very recent times (January 2021) the United Nation General Assembly published an update of its “report of the Special Rapporteur on the issue of human rights obligations relating to the enjoyment of a safe, clean, healthy and sustainable environment” in view of the forthcoming 46th session of Human Rights Council (22 February–19 March 2021)

This report describes safe and sufficient water as one of the substantive components of the right to a safe, clean, healthy and sustainable environment. Moreover, it describes the causes and consequences of the global water crisis, focusing on the negative impacts of water pollution, water scarcity and water-related disasters on the enjoyment of many human rights, with disproportionate effects upon vulnerable and marginalized groups. Finally, it highlights procedural and substantive State obligations related to ensuring safe and sufficient water, identifying also good practices that have helped to reduce or prevent water pollution, alleviate water scarcity, reduce risks associated with water-related disasters and protect or restore aquatic ecosystems. More in detail The Special Rapporteur provides a seven-step process for States to employ a rights-based approach to water governance, as well as recommendations for actions.

This report is particularly relevant since it well highlights the interconnection of the different aspect of water security and proposes actions for enhance them all as a whole. The human right to water is in fact indissolubly related to the right to a healthy environment, which requires States to prevent water pollution and depletion, prevent or mitigate water-related disasters and protect or restore aquatic ecosystems. As part of implementing the rights-based approach to ensuring water security, different type of actions for States have been identified and classified in categories which reflect the different

aspect of water security (Actions to maintain or improve water quality, Actions to prevent or alleviate water scarcity, Actions to improve water governance, Actions to prevent water-related disasters and increase resilience, Actions to achieve water and climate co-benefits).

4.2.4 European framework about sustainable use of water

In parallel to the **international debates described into the prevision subsections, very relevant acknowledge related to the sustainable use of water**, as well as environmental preservation, took place in Europe, leading to the various directives and initiatives that will be described into the detail in Section 5.

Firstly, as set out in Article 174 of (EC, 2012), the Community policy on the environment is to contribute to pursuit of the objectives of preserving, protecting, and improving the quality of the environment, in prudent and rational utilization of natural resources, and to be based on the precautionary principle and on the principles that preventive action should be taken, environmental damage should, as a priority, be rectified at source and that the polluter should pay.

The European Debate started with the assumption that Water is not a commercial product like any other but, rather, a heritage which must be protected, defended, and treated as such.

More into detail, the conclusions of the Community Water Policy Ministerial Seminar in Frankfurt in 1988 highlighted the need for Community legislation covering ecological quality. The Council in its resolution of 28 June 1988 asked the Commission to submit proposals to improve ecological quality in Community surface waters. The next step was the declaration of the Ministerial Seminar on groundwater held at The Hague in 1991, which recognised the need for action to avoid long-term deterioration of freshwater quality and quantity and called for a programme of actions to be implemented by the year 2000 aiming at sustainable management and protection of freshwater resources.

In its resolutions of 25 February 1992, and 20 February 1995, the Council requested an action program for groundwater and a revision of Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances, as part of an overall policy on freshwater protection.

In Parallel, the Commission recognized that waters in the Community were under increasing pressure from the continuous growth in demand for sufficient quantities of good quality water for all purposes. For this reason, on 10 November 1995, the European Environment Agency in its report "Environment in the European Union - 1995" presented an updated state of the environment report, confirming the need for action to protect Community waters in qualitative as well as in quantitative terms.

On 18 December 1995, the Council adopted conclusions requiring, inter alia, the drawing up of a new framework Directive establishing the basic principles of sustainable water policy in the European Union and inviting the Commission to come forward with a proposal. Then, on 21 February 1996 the Commission adopted a communication to the European Parliament and the Council on European Community water policy setting out the principles for a Community water policy. On 9 September 1996, the Commission presented a proposal for a Decision of the European Parliament and of the Council on an action programme for integrated protection and management of groundwater. In that proposal the Commission pointed to the need to establish procedures for the regulation of abstraction of freshwater and for the monitoring of freshwater quality and quantity. On 29 May 1995, the Commission adopted a communication to the European Parliament and the Council on the wise use

and conservation of wetlands, which recognized the important functions they perform for the protection of water resources.

It should be also remembered that the Community and Member States are party to various international agreements containing important obligations on the protection of marine waters from pollution, in particular the Convention on the Protection of the Marine Environment of the Baltic Sea Area, signed in Helsinki on 9 April 1992 and approved by Council Decision 94/157/EC(11), the Convention for the Protection of the Marine Environment of the North-East Atlantic, signed in Paris on 22 September 1992 and approved by Council Decision 98/249/EC(12), and the Convention for the Protection of the Mediterranean Sea Against Pollution, signed in Barcelona on 16 February 1976 and approved by Council Decision 77/585/EEC(13), and its Protocol for the Protection of the Mediterranean Sea Against Pollution from Land-Based Sources, signed in Athens on 17 May 1980 and approved by Council Decision 83/101/EEC.

4.2.5 Relation between law and technical standards

Finally, another point that it worth to be briefly discussed is the relation, as well as the difference, between law and technical standards. Standards have in fact a particular relevance for the water security sector, so that currently many different standards exist and are continuously updated and revised according to the new technical a scientific development; for example, we can quote here a list of the most relevant ones for aqua3S' purpose, without the aim to be fully exhaustive and remanding to D9.2 for more in-depth analysis:

- General Standard procedure, general scheme of crisis management overview of management approach (CEN EN 15975)
- ISO/TC 147: quality of water, health risk management
- ISO/FDIS 24527:2020: alternative drinking water service provision during a crisis: water supplied for drinking (hospital, school, ...), Water supplied for industrial agricultural or commercial purposes, water supplied to temporary settlements as refugees camp, this ISO standard explain all the temporary action and way to provide water during a crisis to different facilities.
- ISO/DIS 24518: crisis management steps: leadership, tasks, organization role, control about the documented information, Competences, awareness, communication. It's a very typical management way of handling a crisis using schemes and detailing steps about what to do in general when a crisis happens from its beginning to the moment when the situation come back to normal.
- EN 15975-1: Crisis management: preparedness, coordination, recovery, quite similar to ISO 24518 and in Annex A: example of crisis management control room configuration and equipment + Annex B "Recommendations on qualification of personnel"
- EN 15975-2: Risks analysis, definition and description of hazards and hazardous events, risk evaluation + Risk assessment matrix
- ISO 24520: Crisis management phases, risk assessment, tools and procedures to identify a crisis and initiate the crisis management team.
- Resistant: A critical evaluation of standardization as a tool for improving preparedness, crisis management and disaster resilience with recommendations for future development and actions: text showing the efficiency of using standards, global disaster management policies.
- CEN/TC 164/WG 15: business plan, purpose and objective of standards

As mentioned in the previous subsection, international framework about water security, in particular the one related to drinking water quality, has often developed a strictly relationship with the international standards. However, a substantial difference between the two exist: **The important distinction between standards and legislation is that standards are voluntary, whereas legislation is mandatory** (ISO, 2021).

The application of technical standards is on voluntary basis. In fact, standards and other standardisation publications are voluntary guidelines providing technical specifications for products, services, and processes - from industrial safety helmets or chargers for electronic devices to service quality levels in public transport. Standards are developed by private standardisation organisations usually on the initiative of stakeholders who see a need to apply a standard. Although standards as such are voluntary, using them proves that a products and services reach a certain level of quality, safety, and reliability (EU, 2021)

Nevertheless, the situation is different when standards are referenced in legislation as a **preferred way** or even as a **mandatory requirement** to comply with specific laws. In fact, when regulatory authorities use standards as a basis for legislation, only then do they become mandatory, and then only within the jurisdiction covered by the legislation. Regulatory authorities decide themselves whether to use Standards to support their technical regulations. Once this happens, there are various ways of referring to the legal text (ISO, 2021)

- Direct references to a standard, without specifying the edition (undated direct reference).
- Direct references to specific editions of a given standard (dated direct reference).
- Indirect references to the use of the standard, such as use of official standards register which is kept up to date and made publicly available.

5. Water Security in the EU regulation

After providing a brief overview of the international and European framework about water security, as well as the principal lines of the international debates which involve this topic, this Section now focuses on specific contents of some existing and proposed European directives and other initiatives. As is easy to understand, there are potentially hundreds of regulations and initiatives which can involve, directly or indirectly, the water security and this document is not meant to be fully exhaustive in this sense. Thus, we are going to present in the following Section only some of the elements which have been considered particular relevant for aqua3S project.

5.1 Most relevant existing EU directives about water security related topics

Currently, a single regulation specifically targeted to address water security do not exist in the European framework. Nevertheless, as already discusses, the concept of water security is quite new and very wide, involves many different aspects that, even if they are not unified in a single regulation nor they are explicitly referred as 'water security matters', are subject of several existing directives. In particular, the European Council carried out in the last decades a relevant effort, still ongoing, to define a unique framework for different water related topics, to be used by the State Members as guidelines for adapt their internal regulations. For that reason, we limit to describe these European directives, and not the regulation of the single Member state which adopted them.

5.1.1 The Drinking water directive (DWD) and the amendment of the Directive 2015/1787

The DWD 98/83/EC of 3rd November 1998 (EC, 1998) can be seen as outcome of the International debate about drinking water quality discussed in §4.2.2.

Short summary of the main contents of DWD

This Directive concerns the quality of water intended for human consumption [Article 1 comma 1] Its objective shall be to protect human health from the adverse effects of anycontamination of water intended for human consumptionby ensuring that it is wholesome and clean [Article 1 comma 2].

The Directive laid down the essential quality standards at european level. A total of 48 microbiological, chemical and indicator parameters must be monitored and tested regularly. In general, World Health Organization's guidelines for drinking water and the opinion of the Commission's Scientific Advisory Committee are used as the scientific basis for the quality standards in the drinking water.

The Drinking Water Directive applies to: all distribution systems serving more than 50 people or supplying more than 10 cubic meter per day, but also distribution systems serving less than 50 people/supplying less than 10 cubic meter per day if the water is supplied as part of an economic activity; drinking water from tankers, in bottles or containers; water used in the food-processing industry, unless the competent national authorities are satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form.

When translating the Drinking Water Directive into their own national legislation, Member States of the European Union can include additional requirements e.g., regulate additional substances that are relevant within their territory or set higher standards. Member States are not allowed, nevertheless,

to set lower standards as the level of protection of human health should be the same within the whole European Union.

Comment to contents of DWD from the point of view of the water security

To summarize: DWD addresses the water security topic mainly in terms of definition the quality standard of water intended for human consumption to protect human health from adverse effects of any contamination of water intended for human consumption.

It should be mentioned that the DWD do not contain any particular indication, let alone obligation, to specific technologies, standards or monitoring technique to ensure the quality standards there defined. The way to ensure these quality standards, in terms of technology, is in fact up to the single member States. For example, self-explicative in this sense is the article 5 comma 1: *“Member States shall take all measures necessary to ensure that regular monitoring of the quality of water intended for human consumption is carried out, in order to check that the water available to consumers meets the requirements of this Directive and in particular the parametric values [..]”* but this concept recurs many times into the directive.

DWD indirectly affects also the aspect related to human rights for water and good governance strategies, since the Directive also requires providing regular information to consumers, as well as periodic reporting to the European Commission every three years. Public information and reporting enhance in fact transparency in drinking water distribution and supply management, as well as it raises awareness amongst Citizens about their rights concerning the quality of the water they drinks.

Regarding the aspect of water security related to preservation and protection of the water resources and of the ecosystems that could be affected by qualitative and quantitative issues of the water, this topic is not directly addressed by the DWD. However, the EC dealt with these matters in a more comprehensive way two years after the DWD, with the introduction of the Water Framework Directive (2000/60/EU).

Short summary of the main contents of directive 2015/1787

The DWD Directive has been subject of many updates and amendments in the years, aligning the monitoring parameters in parallel with new international standards and the evolution of knowledge and technology in the years.

For example, the directive **2015/1787** (EC, 2015), amendment of the Annex II and III of the DWD, is particularly relevant for the topic of water security, and for aqua3S project, since it introduces a risk-based approach based onto the WHO's water safety plan approach (see § 4.2.2). It also aligned the Annex of the WFD to internationally recognized standard as EN 15975-2 (for Annex II) and EN ISO 9308-1, EN ISO 9308-2, EN ISO 14189 (for Annex III).

In particular, it established **monitoring programmes** for water intended for human consumption, which are reviewed on a continuous basis and updated or reconfirmed at least every 5 years.

Monitor programmes must: (a) verify that the measures in place to control risks to human health throughout the water supply chain from the catchment area through abstraction, treatment and storage to distribution are working effectively and that water at the point of compliance is wholesome and clean; (b) provide information on the quality of the water supplied for human consumption to demonstrate that the obligations of the directive are being met; (c) identify the most appropriate means of mitigating the risk to human health.

Moreover, the Directive set out that monitoring programmes may be based on a **risk assessment**.

Comment to contents of directive 2015/1787 from the point of view of the water security

The Directive 2015/1787 represents an improvement in the regulation about water security, in particular concerning the aspect of protect human health from adverse effects of the contamination of water intended for human consumption; it aligns in fact the DWD to the new international standards and it introduces a risk-based approach to deal with the possible threats for the quality of the water supply network.

In addition, it is relevant to notice that, according to the directive, the risk assessment shall take into account the results from the monitoring programmes established also by the WFD for water bodies. This is a key step further in terms of water security because it creates the basis for a link between two of the main aspects of water security that have been traditionally dealt separately by the DWD and the WFD, which are respectively: the quality of the water for human consumption and the qualitative/quantitative preservation of the water resources and ecosystems.

In fact, about this matter, the point 5 of the premise of the Directive says that *“to control risks to human health, the monitoring programmes should ensure that there are measures in place throughout the water supply chain and consider information from water bodies used for drinking water abstraction. The general obligations for monitoring programmes should bridge the gap between water abstraction and supply. Pursuant to Article 6 of Directive 2000/60/EC of the European Parliament and of the Council, Member States must ensure the establishment of register(s) of protected areas. [...]. Results from the monitoring of those bodies of water under the second subparagraph of Article 7 and Article 8 of that Directive should be used to determine the potential risk for drinking water before and after treatment for the purposes of Directive 98/83/EC”*.

To conclude this paragraph, it should be mentioned that on 16 December 2020, the European Parliament formally adopted the revised Drinking Water Directive (**Directive 2020/2184**), which is going to be discussed in §5.2.2. The Directive will enter in force on 12 January 2021, and Member States will have two years to transpose it into national legislation.

5.1.2 Water Framework directive (WFD)

Short summary of the main contents of WFD

The Water Framework Directive (2000/60/EC. EC, 2000a) can be seen as one of the main outcomes of the long-established European water legislation (§4.2.4) which began with standards for the rivers and lakes used for drinking water abstraction in 1975, and culminated in 1980 in setting binding quality targets for drinking water. The existing legislation was reviewed in 1988 during the Frankfurt ministerial seminar on water, by identify the improvements that could be made and gaps that could be filled. This resulted in the second phase of water legislation and the set out of the main relevant principles, purpose and concepts expressed by the WFD.

The goal of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater which:

- prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- promotes sustainable water use based on a long-term protection of available water resources;
- aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority

substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;

- ensures the progressive reduction of pollution of groundwater and prevents its further pollution;
- contributes to mitigating the effects of floods and droughts;

and thereby contributes to:

- the provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable, balanced, and equitable water use;
- a significant reduction in pollution of groundwater;
- the protection of territorial and marine waters;
- achieving the objectives of relevant international agreements, including those which aim to prevent and eliminate pollution of the marine environment, by Community action under) to cease or phase out discharges, emissions, and losses of priority hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substance.

Many innovations have been carried out by this directive; firstly, the introduction of a single system of water management: River basin management. For each river basin district - some of which will traverse national frontiers - a "**river basin management plan**" needs to be established and updated every six years, and this will provide the context for the co-ordination requirements identified above.

According to WFD, there are a number of objectives in respect of which the quality of water is protected. The key ones at European level are general protection of the aquatic ecology, specific protection of unique and valuable habitats, protection of drinking water resources, and protection of bathing water. All these objectives must be integrated for each river basin. It is clear that the last three - special habitats, drinking water areas and bathing water - apply only to specific bodies of. In contrast, ecological protection should apply to all waters: the central requirement of the Treaty is that the environment be protected to a high level in its entirety (EC, 2000). Thus, **the overall plan of objectives for the river basin will then require ecological and chemical protection everywhere as a minimum**, but where more stringent requirements are needed for particular uses, zones will be established, and higher objectives set within them.

The general requirements for ecological protection and the minimum chemical standards, introduced to cover all surface water, are the following:

- **Good ecological status:** defined (in Annex V) in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics. The controls are specified as allowing only a slight departure from the biological community which would be expected in conditions of minimal anthropogenic impact. A set of procedures for identifying that point for a given body of water, and establishing particular chemical or hydromorphological standards to achieve it, is provided, together with a system for ensuring that each Member State interprets the procedure in a consistent way (to ensure comparability);
- **Good chemical status** is defined in terms of compliance with all the quality standards established for chemical substances at European level. The Directive also provides a mechanism for renewing these standards and establishing new ones by means of a prioritisation mechanism for hazardous chemicals. This will ensure at least a minimum chemical quality, particularly in relation to very toxic substances, everywhere in the Union.

The WFD “good status” environmental objectives were to be met by 2015, provided that no deadline extension or exception was invoked. Member States that avail themselves of an extension beyond 2015 are required to achieve all WFD environmental objectives by the end of the second and third management cycles, which extend from 2015 to 2021 and 2021 to 2027 respectively (European Commission, 2012a).

So, uses of the water resource which adversely affect the ecological and chemical status of the water are in general not allowed, except in case where they are considered essential. The key examples are flood protection and essential drinking water supply; in those situations, the problem is dealt with by providing derogations from the requirement to achieve good status for these cases, so long as all appropriate mitigation measures are taken. Derogations are possible also in case of navigation and power generation, if the possible alternatives are technically impossible or they are prohibitively expensive, or these alternatives produce a worse overall environmental result.

The case of groundwater, WDF indicates that it should not be polluted at all. For this reason, WFD does not set chemical quality standards (as it gives the impression of an allowed level of pollution to which Member States can fill up), relying only on the few existing standards have been established at European level for particular issues (nitrates, pesticides and biocides), that must always be adhered to. But for general protection, it has been taken precautionary approach, comprising a prohibition on direct discharges to groundwater, and (to cover indirect discharges) a requirement to monitor groundwater bodies so as to detect changes in chemical composition, and to reverse any anthropogenically induced upward pollution trend. Taken together, these should ensure the protection of groundwater from all contamination, according to the principle of minimum anthropogenic impact. Quantity is also a major issue for groundwater, since there is only a certain amount of recharge into a groundwater each year, and of this recharge, some is needed to support connected ecosystems (whether they be surface water bodies, or terrestrial systems such as wetlands). For good management, only that portion of the overall recharge not needed by the ecology can be abstracted - this is the sustainable resource, and the Directive limits abstraction to that quantity.

All the elements of this analysis must be set out in the river basin management plan, which have to account how these objectives set for the river basin (ecological status, quantitative status, chemical status and protected area objectives) are to be reached within the timescale required, as well as cost-effectiveness evaluation of the various possible measures based on an economic analysis of water use within the river basin.

It is essential that all interested parties are fully involved in this discussion, and indeed in the preparation of the river basin management plan as a whole. Which leads to the final major element of the Directive, the public participation requirements. (EC, 2000b)

Comment to contents of WFD from the point of view of the water security

The WFD represents one of the most important European directives regarding the water security, as its main objectives, listed above, regard the safeguard of qualitative and quantitative aspects of water resources for a sustainable development, as well the preservation of the environment.

Regarding the aspect of the human right for water, WFD recognizes explicitly that "water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such". For that reason, the river basin management plan should be redacted by the competent authorities involving the Citizen and all the potential stakeholders through well-defined

modalities of public participation, which should ensure that every need and different point of view is taken into consideration during the redaction of the plan itself.

The application of economic criteria established as innovative principles for water management also follows this direction. The need to conserve adequate and equalitarian supplies of a resource for which demand is continuously increasing is in fact also one of the drivers behind what is arguably one of the Directive's most important innovations - the introduction of water pricing. According to the Art.9, Member States shall in fact take account of the principle of recovery of the costs of water services, including environmental and resource costs; water pricing should be adequate to the value of the resources, but, on the other hand, it should also provide an adequate incentive for the users to not waste the resource; another principle mentioned in the directive is also the “the polluter pays” principle.

Regarding the aspect of water security related to the preservation of the ecosystem and of the quality of the resource, as stated above, this is the main goal of the directive, which introduced several innovations into the existing regulation.

Firstly, the standards provided by the directive (the status of the water bodies) are both qualitative and quantitative, as well as both have short term and middle-long term objectives, in the view of the sustainability for the future generations. As for the DWD, the WFD does not contain any particular indication, let alone obligation, to specific technologies, standards or monitoring technique to ensure the objective there defined.

It is relevant to point out that, in order to reach these standards, the WFD recognized as best model the management by river basin, which is a natural geographical and hydrological unit, instead of according to administrative or political boundaries (EC, 2000b). The WFD requires that the competent authorities, who can thus be also of different Nations in case of transboundary basins, and all relevant parties cooperate to define their system of interest and have a more tailored understanding of its conditions. The WFD calls thus for a ‘catchment-based approach’ and ‘integrated river basin management’, terms both used to refer to the management of land and water as a system, thus requiring a paradigm shift in management, towards systems thinking, which adopts an interdisciplinary, integrated, and holistic approach (Voulvoulis, 2012). In fact, the introduction of the WFD aimed to facilitate a shift from existing fragmented policies to a holistic approach integrating all parts of the wider environmental system (Howarth, 2006).

Moreover, the Directive was adopted to succeed and replace traditional management practices predicated upon the command-and-control paradigm, which looked at pressures in isolation and reduced environmental systems to their constituent elements when setting specific water objectives (European Commission, 2012a). In fact, historically, there has been a dichotomy in approach to water pollution control at European level, with some controls concentrating on what is achievable at source, through the application of technology; and some dealing with the needs of the receiving environment in the form of quality objectives. The WFD formalize the need of a combined approach, integrating the two aspects. On the source side, it requires that as part of the basic measures to be taken in the river basin, all existing technology-driven source-based controls must be implemented as a first step. But over and above this, it also sets out a framework for developing further such controls. The framework comprises the development of a list of priority substances for action at EU level, prioritised on the basis of risk; and then the design of the most cost-effective set of measures to achieve load reduction of those substances, taking into account both product and process sources. On the effects side, it coordinates all the environmental objectives in existing legislation, and provides a new overall objective of good status for all waters, and requires that where the measures taken on the source side are not

sufficient to achieve these objectives, additional ones are required. (EC, 2000). These measures have also to be inserted in Programme of Measures taken to manage anthropogenic pressures, as integrant part of the Basin Management plan, which have to updated every 6 years

Another very relevant topic treated by the WFD is the synergy and coordination of other measures taken at Union level to tackle particular pollution problems and included in previous directives. Key examples are the Urban Wastewater Treatment Directive and the Nitrates Directive, which together tackle the problem of eutrophication (as well as health effects such as microbial pollution in bathing water areas and nitrates in drinking water); and the Industrial Emissions Directive, which deals with chemical pollution. The aim is to co-ordinate the application of these so as to meet the specific objectives of WFD established for the river basin. So, as part of the river basin plan, an analysis also of human impact has to be conducted so as to determine how far from the objective each body of water is. Then, the effect on the problems of each body of water of full implementation of all existing legislation is considered. If the existing legislation solves the problem, well and good, and the objective of the framework Directive is attained. However, if it does not, the Member State must identify exactly why, and design whatever additional measures are needed to satisfy all the objectives established. These might include stricter controls on polluting emissions from industry and agriculture, or urban wastewater sources.

However, this synergy, in terms of coordination of measure and standards with other directives, is not explicitly extended to the DWD, even if the two directives have many points of contacts under the umbrella of the water security; drinking water supply is in fact considered by one of the uses of water bodies which can, under a set of specific conditions, provide derogation from the requirement to achieve good status of the water bodies; however, a part for this point, there isn't a real link between the programmes of the DWD and the river basin management plan of the WFD. As stated in the previous paragraph, the amendment 2015/1787 of the DWD partially overcomes this gap, introducing the need for the risk assessments in the water safety plans to also consider the results from the monitoring programmes established also by the WFD.

Finally, related to the aspect of water security about the protection against water-related disasters, even if the WFD is not directly targeted to ensure this topic, it explicitly mentions that its goal contributes to mitigating the effects of floods and droughts. Moreover, floods protection is considered as potential cause of derogation from the requirement of good status of a water body. A part this, a more comprehensive regulation addressing this topic of water security came seven years later with the flood directive (2007/60/EU), which, starting from a similar setting of the WFD (catchment-based approach), extended the concept of the basin management also to the flood risk.

Regarding the impact of climate changes, it indeed affects and interacts with WFD implementation activities at different stages in the process. The design of the WFD provides scope to adapt to climate change through the cyclical river basin planning process. However, further clarification is needed as to how and at what stages climate change can be considered in river basin management planning (Ecologic, 2007).

5.1.3 The Floods Directive (FD)

Short summary of the main contents of FD

The objective of the Floods Directive (2007/60/EC) is to establish a framework for the assessment and management of flood risks to reduce the negative consequences of flooding on human health,

economic activities, the environment and cultural heritage in the European Union. The Directive applies to inland waters as well as all coastal waters across the whole territory of the Union.

The Directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps by 2013 and establish **flood risk management plans** by 2015. All these information have to be updated every 6 years.

Flood risk management plans shall address all aspects of flood risk management focusing on prevention, protection, preparedness, including flood forecasts and early warning systems and taking into account the characteristics of the particular river basin or sub-basin. Flood risk management plans may also include the promotion of sustainable land use practices, improvement of water retention as well as the controlled flooding of certain areas in the case of a flood event.

As general indication, the Flood Risk Management Plans refer to the same basin districts or unit of management defined to the WFD and are coordinated by the same Authorities; however, the FD allows the State member to appoint competent authorities or to refer to other unit of management than WFD, under specific motivations and ensuring the coordination with the two directives.

According to FD, Flood risk management plans include (EC, 2007a and 2007b):

- A list of competent authorities and, when appropriates, a description of the coordination process within any international river basin district and of the coordination process with Directive 2000/60/EC.
- Flood hazard and flood risk maps for three different scenarios of flood (low, medium and high probability scenarios).
- The conclusions drawn from the flood hazard and risk maps;
- Description of the appropriate objectives of flood risk management.
- Summary of the proposed measures and their prioritisation, aiming to achieve the appropriate objectives of flood risk. Measures should reduce the current situation of risk presented by the maps, by affecting: the hazard and/or risks and/or vulnerability; thus, different types of measure are possible (protection, prevention, preparedness, recovery and lesson learned). For each measure, the plan has to specify the proposed timing and manner of implementing the measures. including details about who is responsible for implementation, as well as a description of the way implementation of the measures will be monitored.
- Summary of the public information and consultation measures/actions taken; the Directive shall be carried out in coordination with the WFD, notably by flood risk management plans and river basin management plans being coordinated, and through coordination of the public participation procedures in the preparation of these plans. All assessments, maps and plans prepared shall be made available to the public.

Member States shall furthermore coordinate their flood risk management practices in shared river basins, including with third countries, and shall in solidarity not undertake measures that would increase the flood risk in neighbouring countries. Member States shall in take into consideration long term developments, including climate change, as well as sustainable land use practices in the flood risk management cycle addressed in this Directive.

Every future update of the flood risk management plan (after a cycle of 6years) has to assess the progress made towards the achievement of the objectives; it has to also include a description of, and an explanation for, any measures foreseen in the earlier version of the flood risk management plan

which were planned to be undertaken and have not been taken forward; a description of any additional measures since the publication of the previous version of the flood risk management plan.

Comment to contents of FD from the point of view of the water security

Reading from the lenses of water security, the FD aims to safeguard the physical safety, as well as the economic development, the environmental and cultural heritage, against the negative effects due occurrence of floods, which, along with storms, are the most important natural hazard in Europe in terms of economic damage (EEA, 2016). It thus complements the WFD and the DWD in terms of water security.

Regarding the aspect of human right, The Directive respects the fundamental rights and observes the principles recognised by the Charter of Fundamental Rights of the European Union. In particular, it seeks to promote the integration into Community policies of a high level of environmental protection in accordance with the principle of sustainable development. The solidarity principle is particularly important in the context of flood risk management. In the light of it Member States should be encouraged to seek a fair sharing of responsibilities, when measures are jointly decided for the common benefit, as regards flood risk management along water courses. Moreover, FD proposes the mechanism of public participation, already introduced by the WFD, as base criteria for the redaction of the flood risk management plan.

As WFD, the FD aims to the environmental preservation; on the other hand, similar to the DWD, FD is a directive targeted to reduce adverse effects on the human health of a water related hazardous event. However, to achieve this goal, it introduces a more innovative approach, based on a **risk assessment**. A risk-based approach has been instead introduced in the sector of the drinking water only with the amendment of the DWD with the Directive 2015/1787.

This risk-based approach is then encapsulated in the ‘catchment-based approach’ and ‘integrated river basin management’, already successfully implemented by the WFD. This can be translated in one of the most relevant introductions carried out by the FD in the context the water security framework: the obligation to create an extensive hazard and risk mapping of the unit of management.

In particular, if hazard is related to the probability of occurrence and the intensity of the adverse event, the concept of risk includes an evaluation of the expected damage, also considering the presence of exposed elements and their vulnerability. More in detail, as indicated by the FD, the risk assessment should be performed considering the indicative number of inhabitants potentially affected by a flood, the type of economic activity, the presence of strategic infrastructures, including water distribution and supply networks. This latest aspect creates, even if implicitly, synergy with the water safety plan introduced in the line of the water security regulation with deals about the drinking water (DWD and Directive 2015/1787).

Moreover, the flood risk maps should include, as specific exposed element, also the installations that cause accidental pollution in case of flooding and the potentially affected protected areas identified by the WFD and other EU Directives; this aspect represents instead a synergy with the WFD, indicating that the risk mapping activity has to consider also negative impacts that a flood can cause, directly or indirectly, on the status of the water bodies.

The approach introduced by the FD is it not only limited to the mapping of flood risk areas, but also on the definition of flood reduction measures for manage the current risk situation. As for the WFD, these measures are targeted both for short term, but also medium-long term management; in addition, the FD expresses the necessity to define flood risk reduction measures for all the phases of the flood

event, including not only the emergency, the post emergency, or the pre-emergency phases, but also the definition of actions that can be set up in the 'normal times' as prevention.

Mitigation measures can be both structural and non-structural. In the past, flood risk management relied mainly on the protection through structural measures; however, flood protection performed through structural interventions is never an absolute condition and can generate a false sense of security, known as residual risk.

For that reason, the Floods Directive strongly recommends, in parallel with structural interventions, new methodological approaches that are functional to reduce risk by affecting the exposure and vulnerability, falling in the categories of prevention, preparedness and emergency response measure, including the integration with civil protection plans. Moreover, often non-structural measures are functional also to achieve the objectives of the WFD (namely, they are win-win measures), whereas the structural measures may have a negative impact on the status of the water bodies.

There are indeed strong synergies between the FD and WFD: development of river basin management plans under Directive 2000/60/EC and of flood risk management plans under this Directive are elements of integrated river basin management. In that sense, FD indicates as natural choice for the definition of the competent authorities and of the units of management for the flood risk management plan the same designated by the WFD, even if allowing that they might be different.

Regarding the aspect of climate changes, FD is the first water security regulation that explicitly introduces the necessity of an estimation of their impacts while assessing the flood risk, as well as of the definition specific measure for adaptation to them, as part of Flood risk management plans (in particular from the second cycle).

5.1.4 The Directive on security of network and information systems (NIS Directive)

Short summary of the main contents of NIS Directive

The NIS Directive (2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union. EC, 2016b) is part of the European legislation on cybersecurity. It provides legal measures to boost the overall level of cybersecurity in the EU, by:

- Adopting a national strategy on the security of network and information systems;
- Establishing security and notification requirements for operators and suppliers;
- Designating national competent authorities, single points of contact, and CSIRTs with tasks related to the security of network and information systems;
- Enhance Member States' preparedness by requiring them to be appropriately equipped, e.g. via a Computer Security Incident Response Team (CSIRT) and a competent national NIS authority;
- Cooperation among all the Member States, by setting up a Cooperation Group, in order to support and facilitate strategic cooperation and the exchange of information among Member States. They will also need to set a CSIRT Network, in order to promote swift and effective operational cooperation on specific cybersecurity incidents and sharing information about risks;
- A culture of security across sectors which are vital for economy and society and moreover rely heavily on ICTs, such as energy, transport, water, banking, financial market infrastructures, healthcare and digital infrastructure. Businesses in these sectors that are identified by the Member States as operators of essential services will have to take appropriate security

measures and to notify serious incidents to the relevant national authority. Also, key digital service providers (search engines, cloud computing services and online marketplaces) will have to comply with the security and notification requirements under the new Directive.

National transpositions differ when it comes to the identification of critical sectors (Annex II of the NIS Directive). A common list of economic sectors is defined by the Directive, with the possible addition of member state-specific sectors. The definitions of essential services within each sector further differ in the degree of granularity. Some member states have chosen to include other essential services in addition to those mentioned by the Directive.

The identification of the Operators of Essentials Services (OES) by each member state generally follows one of two approaches. In a part of the member states, it is the responsibility of the operators to identify themselves as OES, based on criteria and thresholds made available publicly for each sector in the national law or regulation. In other member states, OES are designated by the competent authorities, based on criteria that can be either public or confidential. In this case, there is usually a formal notification of OES by the competent.

The NIS Directive is currently under revision, as indicated by Article 23 of the Directive itself, which requires the European Commission to review the functioning of this Directive periodically. As a result of the review process, the new legislative proposal has been presented on 16 December 2020, which will be discussed in §5.2.3.

Comment to contents of NIS directive from the point of view of the water security

The annex II of the NIS Directive includes Drinking water supply and distribution (as defined by the DWD) into the list of operators of essential services to whom the NIS Directive should be applied.

For this reason, Each Member State shall extend also to the water distribution and supply network the national strategy on the security of network and information systems identified by the NIS Directive; this includes defining the strategic objectives and appropriate policy and regulatory measures with a view to achieving and maintaining a high level of security of network and information systems.

Even if NIS Directive is not a water centered directive, considering nevertheless the water distribution networks' heavily dependence on ICTs (like SCADA systems) we can include this Directive into the Water Security framework. Setting minimum requirements and introducing national supervision is in fact functional to prevent and minimise the impact of incidents, malicious or hazardous events affecting the security of the network and information systems used for the provision of water. Thus, it enhances the water security regarding the aspect related to cope with uncertainties and with the risks of natural hazards, as well as accidental or malicious threats for the water supply and distribution system, which can lead to the disruption of the service.

However, NIS directive aims to establish a general framework in terms of cybersecurity, based also on the fact that not all of the EU member states had previously cybersecurity legislation in place and, when existed, it was heterogeneous across the Union. Moreover, the Directive applies to many different essential services, as well as to digital service providers, thus is not specific for the water distribution sector and it does not indicate specific security requirements for the ICTs and the technologies commonly used in the water supply network.

Regarding this aspect, the NIS Directive also says, in fact, that the member States shall ensure that operators of essential services take appropriate and proportionate technical and organisational measures to manage the risks posed to the security of network and information systems and to prevent and minimise the impact of incidents affecting them, with a view to ensuring the continuity of

the essential services. Moreover, operators of essential services should also notify the competent authority of incidents having a significant impact on the continuity of the essential services they provide. In order to determine the significance of the impact of an incident, some parameters have to be taken into account, as the number of users affected by the disruption of the essential service, the duration of the incident and the geographical spread with regard to the area affected by the incident.

So, once designated as Operator of Essential Service, is thus due the water supply and distribution companies themselves to conduct appropriate risk assessments, take adequate and specific security measures and adopt plans for security incidents, according also to the national regulation.

In this sense, the approach is somehow similar to the ones indicated by many of other water security Directives, which require risk assessment approach and the redaction of sectorial plans, as well as the definition of specific measures. However, currently this Directive does not explicitly mention synergies with other risk assessment procedure or security plans that could have already been defined for the same infrastructures, according to other specific sectorial EU Directives.

5.1.5 Other EU Directives

In this section we provide a short list of other EU directives which have a potential relevance for the topic of water security, based on the official UN definition; most of these directives have also synergies and interdependences with the others previously discussed in this Section.

A deeper analysis of these directives is not performed in this document, remanding to the specific literature, since we prefer to focus our analysis on the water security regulations which have a more direct pertinence to the aqua3S project.

- **Environmental Quality Standards Directive** (Directive 2008/105/EC setting environmental quality standards in the field of water policy. EC, 2008): It sets out environmental quality standards (EQSs) concerning the presence in surface water of certain substances or groups of substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment. These standards are in line with the strategy and objectives of the WFD, repealing oldest directives (82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC and 86/280/EEC);
- **Groundwater Directive** (Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration. EC, 2006): this Directive establishes a regime which sets groundwater quality standards and introduces measures to prevent or limit inputs of pollutants into groundwater. The directive establishes quality criteria that takes account local characteristics and allows for further improvements to be made based on monitoring data and new scientific knowledge. The directive thus represents a proportionate and scientifically sound response to the requirements of the WFD as it relates to assessments on chemical status of groundwater and the identification and reversal of significant and sustained upward trends in pollutant concentrations. Member States should establish standards at the most appropriate level and take into account local or regional conditions;
- **IPPC Directive** (Council Directive 96/61/EC of 24 September 1996 concerning Integrated Pollution Prevention and Control. EC, 1996a): the aim of this Directive is the integrated prevention and control of pollution arising from the activities such as: energy industries, production of basic organic chemicals, waste management, production of pulp from timber, slaughtering and production of food products from animal or vegetable raw materials. This

Directive lays down measures designed to prevent or reduce, as the case may be, emissions in the air, water and land from the activities aforementioned, in order to achieve a high level of the environment taken as a whole;

- **Seveso Directives** (included Seveso II Directive - Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances - and its amendment, the Seveso III Directive - 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances. EC, 1996b and 2012e): the directive aims at the prevention of major accidents involving dangerous substances. However, as accidents may nevertheless occur, it also aims at limiting the consequences of such accidents not only for human health but also for the environment. The Directive covers establishments where dangerous substances may be present (e.g., during processing or storage) in quantities exceeding certain threshold. Excluded from the Directive are certain industrial activities which are subject to other legislation providing a similar level of protection (e.g., nuclear establishments or the transport of dangerous substances);
- **The Nitrates Directive** (Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources. EC, 91a): It aims to protect water quality across Europe by preventing nitrates from agricultural sources polluting ground and surface waters and by promoting the use of good farming practices. The Nitrates Directive forms an integral part of the Water Framework Directive and is one of the key instruments in the protection of waters against agricultural pressures;
- **The Urban Waste-water Treatment Directive** (Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment and its amendments: Directive 98/15/EC and Commission Decision 2014/413/EU adopted on 26 June 2014. EC 1991b and EC 2014b): the major purpose of this European Directive is in reducing pollution in freshwater, estuarial and coastal waters by domestic sewage, industrial wastewater and run-off, (these three constituents make up urban waste water). It introduces standards for collection, treatment and discharge of such waters, and puts controls upon sewage sludge disposal. The directive determines a minimum standard of water waste treatment, which is dependent upon the population density of an urban area.

5.2 Most relevant ongoing and future updates to EU directives and other European initiatives or publication about water security related topics

While the previous subsection deals about currently en force EU Directives, the present one aims to provide an overview of some relevant context that are going - or could be – integrated in future regulation regarding water security. This includes:

- Proposal for new directives or for the amendment to the existing ones;
- Relevant projects, initiatives, guidelines, publications and documents that are relevant for the topic of water security and can thus represent a base for future integration of the regulation;
- Existing EU directives that currently does not apply to water security, but could be extended to it;
- New directives or amendment approved by EC but that have not been fully adopted by the State Members (due to their recently entering in force).

5.2.1 Directive of European Critical Infrastructures (ECID)

The Council Directive 2008/114/EC of 8 December 2008 on the “identification and designation of European critical infrastructures and the assessment of the need to improve their protection” (EC, 2008b) focuses on the topic of ensure protection of the so called European Critical Infrastructures.

This directive establishes a procedure for identifying and designating European Critical Infrastructures in the transport and energy sectors that, were they to be disrupted or destroyed, would have significant cross-border impacts. The Directive also provides for a common approach for assessing the need to improve the protection of designated infrastructures.

The Directive identifies as **critical infrastructure** an asset, system or part thereof located in Member States which is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which would have a significant impact in a Member State as a result of the failure to maintain those functions. Whereas a **European critical infrastructure**’ or means critical infrastructure located in Member States the disruption or destruction of which would have a significant impact on at least two Member States. The significance of the impact shall be assessed in terms of cross-cutting criteria. This includes effects resulting from cross-sector dependencies on other types of infrastructure.

The directive also introduces the concept of “The operator security plan (OSP)” as a procedure shall identify the critical infrastructure assets of the European Critical infrastructure and which security solutions exist or are being implemented for their protection. The minimum content to be addressed by an ECI OSP procedure is set out in Annex II of the directive.

Each Member State shall identify potential European Critical Infrastructure, according to the criteria inserted in the annexes of the directive. Then, Each Member State shall assess whether each designated ECI located on its territory possesses an OSP or has in place equivalent measures. In negative case, it shall ensure by any measures deemed appropriate, that the OSP or equivalent is prepared, set in place, and reviewed regularly within one year following designation of the critical infrastructure as an ECI.

The OSP procedure is based on a risk analysis approach: starting from the identification of the important assets; conducting then a risk analysis based on major threat scenarios, vulnerability of each asset, and potential impact; and finally, the identification, selection and prioritisation of countermeasures and procedures.

In addition, each Member State shall assess whether each designated European Critical Infrastructure located on its territory possesses a Security Liaison Officer, defined as “the point of contact for security related issues between the owner/operator of the ECI and the relevant Member State authority”.

ECID is not specific for water; nevertheless, it is clear that, if applied to the specific sector of water distribution and supply networks, this directive could be indeed considered as relevant to the topic of water security, filling the gaps left by the previous discussed directives, in particular with regards of the malicious threats (such as physical acts of sabotage, cyberattack on information systems or supervisory control and data acquisition systems, and contamination).

However, it should be considered that, at the state of art, ECID do not designate the water supply sector as a critical infrastructure, even if all governments recognise that their water supply is vital to national security. (Teixeira et al., 2019)

Comment from the point of view of the water security

As stated above, ECID cannot be currently considered as part of water security regulation since it does not explicitly refer to the water supply sector. Future policy development in the field of the water security could target to extend the contents of the Directive or establish a similar approach also to the water supply network, integrating the existing water safety plans.

5.2.2 Righth2water initiative and the update of DW Directive (Directive 2020/2184)

Since April 2012, EC established the ‘European Citizen’s Initiative’ (ECI) tool to promote a Citizens’ more active role in European political processes. In fact, Citizens can put an issue on the European political agenda by means of an ECI, which involves collecting one million signatures from at least seven different EU Member States.

One of the most relevant ECI initiative for the topic of water security is the ‘**right 2 water**’ initiative, which took place from January 2013 and September 2013 gaining 2019 signatures (right2water, 2013).

The ECI took up the challenge to get “implementation of the human right to water and sanitation” on the European political agenda, wanting to get a public debate going and shifting focus in European water policy. According to the ECI organizer, ECI the European Union's main aim was to create a single market in goods and services, whereas the human right must be central in water policy, not competition or the completion of the internal market (right2water, 2013). Thus, All citizens in the EU should have guaranteed water and sanitation services. When starting the ECI, righth2water calculated that there were still approximately 2 million people in Europe that do not have suitable water or sanitation. There were also many people with low incomes that are threatened with suspension as they cannot afford to pay their bills. (right2water, 2013).

In order to put the human right to water and sanitation on the European agenda and demand its implementation in European legislation and policies, it asked for: 1) Guaranteed water and sanitation services for all in the European Union. 2) Human rights above market interests: no liberalization of water services. 3) Global/universal access to water and sanitation for all. (Van den Berge, 2015).

Pressed by the successful result of this initiative, in 2014 EC released a press communication committing itself to the following concrete steps and new actions in areas that are of direct relevance to the initiative and its goals (EC, 2014):

- launch an EU-wide public consultation on the Drinking Water Directive to assess the need for improvements and how they could be achieved;
- improve information for citizens by further developing streamlined and more transparent data management and dissemination for urban wastewater and drinking water;
- explore the idea of benchmarking water quality;
- promote structured dialogue between stakeholders on transparency in the water sector;
- co-operate with existing initiatives to provide a wider set of benchmarks for water services, improving the transparency and accountability of water services providers by giving citizens access to comparable data on key economic and quality indicators;
- stimulate innovative approaches for development assistance (e.g. support for partnerships between water operators and for public-public partnerships) and promote best practices between Member States (e.g. on solidarity instruments);
- advocate universal access to safe drinking water and sanitation as a priority area for post-2015 Sustainable Development Goals;

- Invite the Member States, acting within their own competences, to take account of the concerns raised by citizens through this initiative and encourage them to step up their efforts to guarantee the provision of safe, clean and affordable water to all.

This led, in February 2018 to EC's proposal to revise the Drinking water regulation, taking into account the latest scientific knowledge and recommendations of the World Health Organization, in order to improve access to higher quality of drinking water and provide better information to citizens.

As final step, on 16 December 2020, the European Parliament formally adopted the revised Drinking Water Directive (Directive 2020/2184). The Directive is in force from 12 January 2021, and Member States will have two years to transpose it into national legislation.

The directive includes reinforced water quality standards which are more stringent than WHO recommendations. In addition, it includes tackling emerging pollutants, such as endocrine disruptors and PFA's, as well as microplastics - for which harmonised analytical methods will be developed in 2021.

The new law envisages the inclusion of detailed hygiene requirements for materials in contact with drinking water and a harmonisation of their quality standards; this will be regulated at EU level with the support of the European Chemicals Agency (ECHA), who will perform a key role to ensure that only safe substances may be used in products - such as pipes and taps - that are in contact with water.

The pulse from right2water ECI has been translated into the Directive as the obligation for Member States to improve or maintain access to safe drinking water for all, with focus on vulnerable and marginalised groups.

Moreover, the Directive foresees better access to information for citizens regarding water suppliers, concerning for example the quality and supply of drinking water in their living area. It also includes Measures to reduce water leakages and to increase transparency of the sector.

Finally, the directive will improve consumers' confidence in drinking water from the tap, cutting waste from the use of plastic bottled water, thanks to specific measures to promote tap water, including in public spaces and restaurants, to reduce plastic bottle consumption.

Comment from the point of view of the water security

Even if the real impact of this Directive cannot be assessed yet, since it has still to be transposed by the Member states, it contributes with many innovations to the European water security framework.

Firstly, it is remarkable that a truly relevant push forward this new regulation come from an ECI focused on implementation of the human right to water and sanitation. This is translated into acknowledge of the right of water also for vulnerable and marginalized groups who currently have difficult access to this resource. In light of this, Member States have to pay particular attention to vulnerable and marginalised groups (including refugees, nomadic communities, homeless people, and minority cultures whether sedentary or not. Such measures to improve access) by taking the necessary measures to improve access to water intended for human consumption as, for example, include providing alternative supply systems, such as individual treatment devices, providing water through the use of tankers, such as trucks and cisterns, and ensuring the necessary infrastructure for camps.

Moreover, again in relation with the topic of the human right for water, the Directive also enhance transparency in the management of the drinking water resource, requiring that the public has access to clear environmental information at national level. In this sense a great improvement will be carried out that the previous regulation; in fact, DWD only provided for passive access to information,

meaning that Member States merely had to ensure that information was available. Those provisions should therefore be replaced to ensure that up-to-date information is accessible to consumers on-line, in a user-friendly and customized way. Consumers should also be able to request access to this information by other means, upon justified request.

From the perspective of the safeguard of the human health against waterborne diseases, the Directive aligns the European Community to the latest international standards and WHO recommendations, which come, in particular, after the 2017 WHO Regional Office for Europe's review of the list of parameters and parametric values of the DWD.

In this sense, the Directive considers also that the nature of materials that come into contact with water intended for human consumption can have an impact on the quality of such water, through the migration of potentially harmful substances, by enhancing microbial growth or by influencing the odour, colour or taste of such water. The evaluation of DWD found that the provisions on quality assurance of treatment, equipment and materials provided too much legal flexibility, leading to different national approval systems across the Union for materials that come into contact with water intended for human consumption. Therefore, the updated Directive establishes more specific minimum hygiene requirements for materials intended to be used for the abstraction, treatment, storage or distribution of water intended for human consumption.

In order to facilitate uniform testing of products for compliance with the requirements of this Directive, the Commission should request the European Committee for Standardisation (CEN) to develop standards for uniform testing and assessment of products in contact with water intended for human consumption. When establishing and updating the European positive lists, the Commission should ensure that any relevant acts, or standardisation mandates, which it adopts pursuant to other Union legislation are consistent with this Directive.

Other relevant improvements in terms of water security regard the introduction of obligations for Member States to ensure that the supply, treatment, and distribution of water intended for human consumption is subject to a risk-based approach that covers the whole supply chain from the catchment area, abstraction, treatment, storage, and distribution of water to the point of compliance.

A risk-based approach has been already introduced previously in the drinking water regulation (2015/1787/EU), but it was basically limited to monitoring aspects, whereas the new Directive introduce a complete risk-based approach to water safety, covering the whole supply chain. Moreover, a particular emphasis is now given to the concept of reducing pollution to the source and to the need of taking of preventive measures, as already indicated by other water security directive as WFD and FD.

The risk assessment indicated by the new Directive follows a similar structure of the one indicated by the FD, as well as the ECID, and can be summarized in the following steps: First, identification of the hazards associated with the catchment areas for abstraction points ('risk assessment and risk management of the catchment areas for abstraction points of water intended for human consumption'), in line with the WHO Guidelines and Water Safety Plan Manual. Second, a possibility for the water supplier to adapt monitoring to the main risks and to take the necessary measures to manage the risks identified in the supply chain from the abstraction, treatment, storage, and distribution of water ('risk assessment and risk management of the supply system'). Third, an assessment of the potential risks stemming from domestic distribution systems, such as Legionella or lead ('risk assessment of the domestic distribution systems'), with special focus on priority premises.

Those assessments should be regularly reviewed, inter alia, in response to threats from climate-related extreme weather events, known changes of human activity in the abstraction area or in response to source-related incidents. The risk-based approach should ensure a continuous exchange of information between competent authorities and water suppliers.

It is also relevant to notice that, according to the Directive (Art.7 point 4), this approach should be based on the knowledge gained and actions carried out under the WFD and that, as for the FD, it should consider more effectively the impact of climate changes on water resources.

Moreover, the risk assessment and risk management of the catchment areas for abstraction points of water intended for human consumption which are carried out should not prejudice the objective of the WFD, in other word the status of the superficial water bodies.

Thus, unlike the previous drinking water regulation, the new Directive addresses the necessity for the drinking water sector to create synergies with other water safety directive, in particular with the WFD.

This represents a further step forward the creation of strong links and synergies between the various aspect of the water security, that have been traditionally dealt in separate ways by the dedicated regulations.

Another point of synergy with the WFD regards the preservation of the water resource and the reduction of the wastes. Based on these principles and in accordance with WFD, Member States shall ensure that an assessment of water leakage levels within their territory and of the potential for improvements in water leakage reduction is performed using the infrastructural leakage index (ILI) rating method or another appropriate method. That assessment shall take into account relevant public health, environmental, technical and economic aspects and cover at least water suppliers supplying at least 10 000 m³ per day or serving at least 50 000 people.

The new Directive introduces thus in the water security regulation the need to address to the problem of leakages, and thus of the efficiency, in the water distribution network, which has been mentioned in Section 2 as one of most relevant water related issue, since it causes every year severe losses of water resources.

Finally, the new Directive introduces in the water security framework also new topics that are particularly relevant into the environmental regulation, such as strategies for the reduction of the plastic usage and thus of the emission of micro-plastic into the environment.

5.2.3 Proposal for a revised NIS Directive (NIS2)

The NIS Directive (5.1.4) is currently under revision, as indicated by Article 23 of the Directive itself, which requires the European Commission to review the functioning of this Directive periodically. As part of its key policy objective to make “Europe fit for the digital age” as well as in line with the objectives of the Security Union, the Commission announced in its Work Programme 2020 that it would conduct the review by the end of 2020. As part of this process, a consultation opened on 7 July 2020 and ended the 2 October 2020.

The shortcomings of the current NIS Directives at the end of the review process can be summarized (EC,2020a):

- The scope of the NIS Directive is too limited in terms of the sectors covered, mainly due to increased digitisation in recent years and a higher degree of interconnectedness; in addition, the scope of the NIS Directive no longer reflecting all digitised sectors providing key services to the economy and society as a whole.

- The NIS Directive is not sufficiently clear when it comes to the scope for operators of essential services and its provisions do not provide sufficient clarity regarding national competence over digital service providers.
- The NIS Directive allowed wide discretion to the Member States when laying down security and incident reporting requirements for operators of essential services. The evaluation shows that in some instances Member States have implemented these requirements in significantly different ways, creating additional burden for companies operating in more than one Member State.
- The supervision and enforcement regime of the NIS Directive is ineffective. For example, Member States have been very reluctant to apply penalties to entities failing to put in place security requirements or report incidents. This can have negative consequences for the cyber resilience of individual entities.
- The financial and human resources set aside by Member States for fulfilling their tasks (, and consequently the different levels of maturity in dealing with cybersecurity risks, vary greatly. This further exacerbates the differences in cyber resilience between Member States.
- Member States do not share information systematically with one another, with negative consequences in particular for the effectiveness of the cybersecurity measures and for the level of joint situational awareness at EU level. This is also the case for information sharing among private entities, and for the engagement between the EU level cooperation structures and private entities.

The results of this consultation were used for the evaluation and impact assessment of the NIS Directive. As conclusion of the review process, the new legislative proposal has been presented on 16 December 2020.

To achieve the identified shortcomings, the NIS2 Proposal expands the scope of the current NIS Directive by adding new sectors based on their criticality for the economy and society, and by introducing a clear size cap – meaning that all medium and large companies in selected sectors will be included in the scope. At the same time, it leaves some flexibility for Member States to identify smaller entities with a high security risk profile.

The proposal also eliminates the distinction between operators of essential services and digital service providers. Entities would be classified based on their importance and divided respectively in essential and important categories, with the consequence of being subjected to different supervisory regimes.

The proposal strengthens security requirements for the companies, by imposing a risk management approach providing a minimum list of basic security elements that have to be applied. The proposal introduces more precise provisions on the process for incident reporting, content of the reports and timelines.

Furthermore, the Commission proposes to address security of supply chains and supplier relationships by requiring individual companies to address cybersecurity risks in supply chains and supplier relationships. At the European level, the proposal strengthens supply chain cybersecurity for key information and communication technologies.

The proposal introduces more stringent supervisory measures for national authorities, stricter enforcement requirements and aims at harmonising sanctions regimes across Member States.

The proposal also enhances the role of the Cooperation Group in shaping strategic policy decisions on emerging technologies and new trends, and increases information sharing and cooperation between

Member State authorities. It also enhances operational cooperation including on cyber crisis management.

Finally, the Commission proposal establishes a basic framework with responsible key actors on coordinated vulnerability disclosure for newly discovered vulnerabilities across the EU and creating an EU registry on that operated by the European Union Agency for Cybersecurity.

Comment from the point of view of the water security

NIS2 proposal of Directive will push for a further homogenization in European framework, as well as an alignment to the challenges of the digital society in continuous transformation; so, it is envisaged to lead a general improvement to the cybersecurity and, indirectly, to the related aspect of water security for the water supply and distribution systems.

A relevant addition of the proposal is the specification that the technical and organisational measures to manage the risks posed to the security of network and information systems, which have to be taken by essential entities (i.e., the essential services providers indicated by the NIS Directive), should include a set of minimum requirements, including:

- Risk analysis and information system security policies;
- Incident handling (prevention, detection, and response to incidents);
- Business continuity and crisis management;
- Supply chain security including security-related aspects concerning the relationships between each entity and its suppliers or service providers such as providers of data storage and processing services or managed security services
- Security in network and information systems acquisition, development and maintenance, including vulnerability handling and disclosure;
- Policies and procedures (testing and auditing) to assess the effectiveness of cybersecurity risk management measures;
- The use of cryptography and encryption.

All these specifications were not included into the NID Directive, which refers only to “appropriate measures to prevent and minimise the impact of incidents affecting the security of the network and information systems used for the provision of such essential services, with a view to ensuring the continuity of those services”. Thus, the NID2 Proposal of directive proposes the explicitly introduction of a risk analysis based approach to deal with cybersecurity. This approach, as discussed, many times is common to various other Directives of water security.

However, regarding the integration into the water security regulation, the NIS2 Proposal of Directive seems to be generic as NIS; in fact, it deals in general terms with operators of essential services, without differentiating the specific requirements for the various essential services (like water supply) or dealing with the integration with sectorial existing regulations.

5.2.4 Proposal for a Directive for the resilience-critical-entities.

On 16th of December 2020, the Commission presented the proposal for a directive on the resilience of critical entities in order to reduce vulnerabilities of the critical infrastructures that are essential for the functioning of societies and economy (EC, 2020b).

This proposal aims to enhance the provision in the internal market of services essential for the maintenance of vital societal functions or economic activities by increasing the resilience of critical entities providing such services. It reflects recent calls for action on the part of the Council and the

European Parliament, both of which have encouraged the Commission to revise the current approach to better reflect the increased challenges to critical entities, and to ensure closer alignment with the NIS Directive.

In fact, the current EU regulation is based on framework on the critical infrastructure protection, as defined by the ECI directive, which (as discussed in §5.2.1) is limited to the energy and transport infrastructure, the disruption or destruction of which would have significant cross-border impacts in at least two Member States.

Given the increasing interconnection among infrastructures, networks and operators delivering essential services across the internal market, it has been recognized as necessary to fundamentally switch the current approach from protecting specific assets towards reinforcing the resilience of the critical entities that operate them. Moreover, the concept of critical infrastructure resilience should be extended to many other sectors (including drinking water supply and management of wastewater) than the one indicated by the ECI Directive and it should include sectoral and cross-sectoral measures on *inter alia* climate proofing, civil protection, foreign direct investment and cybersecurity. (EC, 2020b)

Starting from this analysis of the shortcomings of the current existing regulation, with this proposal, the Commission intends to create an all-hazards framework to support Member States in ensuring that critical entities are able to prevent, resist, absorb and recover from disruptive incidents, no matter if they are caused by natural hazards, accidents, terrorism, insider threats, or public health emergencies like the one the world faces today. The proposal, which covers ten sectors, namely energy, transport, banking, financial market infrastructures, health, drinking water, wastewater, digital infrastructure, public administration, and space. Note-worthy provisions include:

- Member States would be obligated to, among other things, have a **strategy** for ensuring the resilience of critical entities, carry out a **national risk assessment** and, on this basis, **identify critical entities**;
- Critical entities would be required to carry out **risk assessments** of their own, take appropriate **technical and organisational measures** in order to boost resilience, and **report disruptive incidents** to national authorities;
- Critical entities providing services to or in at least one-third of Member States would be subject to specific oversight, including **advisory missions** organised by the Commission;
- The Commission would offer **different forms of support** to Member States and critical entities, a Union-level risk overview, best practices, methodologies, cross-border training activities and exercises to test the resilience of critical entities;
- Regular cross-border cooperation with regard to the implementation of the directive would be facilitated through an expert group, the **Critical Entities Resilience Group**.

The new proposal is also consistent and establishes close synergies with the proposal of the revision of the NIS Directive (Proposal of NIS2 Directive, adopted the same day), in order to address the increased interconnectedness between the physical and digital world through a legislative framework with robust resilience measures, both for cyber and physical aspects.

In order to ensure alignment between the two instruments, all critical entities identified under the critical entities' resilience directive would be subject to cyber resilience obligations under NIS2.

The proposed directive is now being considered in the Council and in the Parliament, both of which must agree on the text before it becomes EU law. This adopted act is open for feedback for a period of 8 weeks, starting on 16 December 2020 and ending at midnight Brussels time on 11 February 2021.

Comment from the point of view of the water security

This proposal is particularly relevant for the water security European Framework. Because the ECI Directive is not extended to the water distribution system, the current regulation lacks a common Directive ensuring the resilience of the water supply and distribution networks against disruptive incidents, in particular accidents, terrorism, insider threats, or public health emergencies.

However, the proposal of the Directive, in its premises says that “First of all, the proposed directive would have a much wider sectoral scope, covering ten sectors, namely energy, transport, banking, financial market infrastructure, health, drinking water, wastewater, digital infrastructure, public administration, and space” (EC 2020b).

Moreover, it also provides specific synergies with the Proposal of NIS2 Directive. So, if both of these two directives will be approved, this is going to ensure a strong connection between the aspect of physical resilience of the network and the cybersecurity of its informative systems. It is quite clear how much these aspects are related and that thus they need to be deal with a comprehensive approach.

Relevant for the topic of water security is also the fact that the proposal introduces the need for the Member States to perform an assessment of all relevant risks that may affect the provision of essential services; as stated many times, this approach is common to many other water security regulations.

This risk assessment shall account for all relevant natural and man-made risks, including accidents, natural disasters, public health emergencies, antagonistic threats, including terrorist offences.

However, this creates overlaps with other European sectorial Directives which already deal about the same issue, for example, in the case of water security, the Flood Directive and indirectly also the Water Framework Directive. As Already discussed, both these directives set out specific risk assessment, the redaction of sectorial plans and the definition of measures to address their specific water security topic.

In order to achieve a comprehensive framework regarding the water security, it is of critical importance that the envisaged strategy for ensuring the resilience of critical entities considers synergies with the approaches, analysis and the obligations established by the other regulations of water security.

This aspect seems to be only partially addressed by the Proposal, which says that “In carrying out the risk assessment, Member States shall take into account as a minimum: [...] other relevant risk assessments, carried out in accordance with the requirements of the relevant sector-specific acts of Union law, including Regulation (EU) 2019/941 of the European Parliament and of the Council and Regulation (EU) 2017/1938 of the European Parliament and of the Council”.

Synergies with other water security regulations, except than the NIS Directive, are thus not explicitly mentioned in this Directive, so for now the ongoing/proposed EU framework seems to still consider as separate parallel lines the different aspects which compose the water security.

5.2.5 Other relevant publication and communications

In addition to the Directives and proposals discussed in the previous paragraphs, the technical, ethical, legal, and scientific debate about water security is continuously ongoing, leading to relevant publications, guidelines and technical reports that could represent the basis for future regulation or for updating the existing one.

For example, in § 4.2 many publications by UN or WHO have been mentioned; in the European Union, the scientific community is as dynamic as the international one and there are countless publications, studies and initiatives from the EC, or founded or supported by it, that are related to the wide topic of water security. However, a similar detail of analysis is out the scope of the present deliverable, thus we list here only some particular relevant examples, without the intention to be exhaustive.

The documents mentioned in the following have been selected with the criteria of the relevance for aqua3S or because they could potentially address some of the gaps into the current legislation identified in the previous paragraphs.

Guidance on the production of a water security plan for drinking water supply

At the state of art, the EU Regulation (in particular the ECID, mentioned in § 5.2.1) do not designate the water supply sector as a critical infrastructure, even if all governments recognise that their water supply is vital to national security. (Teixeira et al., 2019)

The proposal for Directive about the resilience-critical-entities proposed to amend to this by introducing the concept of ‘critical entity’, which is supposed to encompass more categories than the one listed into the ECIS, including the water supply and distribution networks. However, as already emphasized, the proposal is not specific for the water supply and distribution network.

In parallel, many initiatives, guidelines technical reports and white papers for policy makers have been published in the last years to develop a specific approach to water supply network. Even if these documents do not imply policy position of the European Commission, they represent a fertile terrain for possible future update of the EU regulation in terms of water security.

For example, the Joint Research Centre of the European Commission’s science and knowledge service published in the 2019 the “**Guidance on the production of a water security plan for drinking water supply**” (Teixeira et al., 2019, founded by European Union’s Horizon 2020 research and innovation programme under grant agreement No775989, as part of the European Reference Network for Critical Infrastructure Protection project).

The guidance proposes to water utility operators an OSP based approach for assessing the risks they face and on the factors to consider if they want to improve their detection capabilities, named **water security plan**.

The proposed Water security planning approach aims to identify security vulnerabilities and establish security measures to detect the intentional contamination of water supply systems, including a communication strategy to facilitate a fast and effective response.

First step in water security planning is for the water utility operator to assess the risks of threats of the deliberate contamination of drinking water, with the risk assessment providing the basis for the design and implementation of the water security plan. Through this risk assessment process, a target protection level could be set, with utility operators identifying the benefits of installing sensors in the network together with event detection software and/or an event detection procedure.

It is recommended that the process for the creation and maintenance of a water security plan comprise four phases:

- Planning and preparation: includes creating and maintaining the water security plan, allocating roles and responsibilities, undertaking risk assessments to identify mitigation and security measures, and performing the relevant training and practical exercises;

- Event detection: it involves the monitoring of indicators and allows an immediate response in the case of potential contamination, followed by confirmation of the nature of the event;
- identification of possible emergency situations: water utility operators rely on information from monitoring and control systems, which can quickly identify an anomalous situation, and on information from various external sources. Online contamination warning systems are one focus of water security planning, along with customer complaint monitoring, public health surveillance and enhanced security;
- The remediation and rehabilitation phase: it forms the final step in the water security plan and will need to be developed after the contamination incident has been confirmed and the full extent determined.

Being based on a risk analysis, the proposed procedure has many points in common, in its structure, with similar approaches indicated in other water security directive, like the FD.

One important aspect that shall be considered however is the integration with existing Water Safety plans suggested in the context normative about drinking water quality (§ 3.2.2, § 4.1.1). This matter has not been exhaustively analysed yet, and it should be considered in eventual future policy developments in this direction. However, the guidance supports the development of a separate stand-alone water security plan in cases where a water safety plan is not yet in place and encourages a complementary approach in cases where there are existing water safety plans. A water security plan should be in fact considered complementary to verifying compliance with legal drinking water quality requirements and any existing water safety plan.

A Blueprint to Safeguard Europe's Water Resources

The European Commission released on the 14 November 2012 a communication entitled 'A Blueprint to Safeguard Europe's Water Resources' (EC, 2012b).

The Blueprint outlines actions that concentrate on better implementation of current water legislation, integration of water policy objectives into other policies, and filling the gaps in particular as regards water quantity and efficiency. The objective is to ensure that a sufficient quantity of good quality water is available for people's needs, the economy, and the environment throughout the EU. The Water Blueprint highlights that preserving water is not only about environmental protection, health, and well-being, but it is also about economic growth and prosperity. It is a way of ensuring that the EU develops fully its growth potential and that all economic sectors have the water available they need for creating growth and jobs. (EC, 2012c). In other words, it is a way for ensuring the Water Security.

The redaction of this blueprint was motivated by the report of the Member States about their national basin management plan, which highlighted that the objective of the WFD (reach a good status of water bodies until 2015) was likely be achieved in slightly over half (53 %) of EU waters.

The main causes of negative impacts recognized on water status were interlinked. These include climate change; land use; economic activities such as energy production, industry, agriculture, and tourism; urban development and demographic change. Pressure from these causes takes the form of pollutant emissions, water over-use (water stress), physical changes to water bodies and extreme events such as floods and drought, which are set to increase unless action is taken. As a result, the ecological and chemical status of EU waters is threatened, more parts of the EU are at risk of water scarcity, and the water ecosystems — on whose services our societies depend — may become more vulnerable to extreme events such as floods and droughts.

Major additional actions to WFD were therefore needed to preserve and improve EU waters, to preserve our resource base for life, nature and the economy and protect human health, in other words to ensure water security.

The Blueprint can be thus seen as a complementary document to the WFD to reach its objective of good water status with an enhanced approach, focused on (EC, 2012d):

- Improving implementation of current EU water policy by making full use of the opportunities provided by the current laws. For example, increasing the take-up of natural water retention measures such as the restoration of wetlands and floodplains or improving implementation of the "polluter pays" principle through metering, water-pricing and better economic analysis;
- Increasing the integration of water policy objectives into other relevant policy areas such as agriculture, fisheries, renewable energy, transport and the Cohesion and Structural Funds;
- Filling the gaps of the current framework, particularly in relation to the tools needed to increase water efficiency. In this regard, the Water Blueprint envisages water accounts and water efficiency targets to be set by Member States and the development of EU standards for water re-use.

2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint, including 17 Sustainable Development Goals which are an urgent call for action by all countries in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

One of the 17 Sustainable Development Goals (SDGs), the number six, is targeted to strengthen worldwide water security, as it aims to “**Ensure availability and sustainable management of water and sanitation for all**” including the following sub-goals:(UN, 2015b):

- By 2030, achieve universal and equitable access to safe and affordable drinking water for all;
- By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally;
- By 2030, substantially increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity;
- By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate;
- By 2020, protect and restore water related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes.
- By 2030, expand international cooperation and capacity building support to developing countries in water and sanitation related activities and programmes;
- Support and strengthen the participation of local communities in improving water and sanitation management.

The 2030 Agenda for sustainable development present thus a great challenge for all the Countries of the worlds in terms of enhancing water security in the policy and regulations of the following decades, to match the ambitious goal defined for 2030.

The EU has played an active role throughout the process and is committed to implementing the 2030 Agenda for Sustainable Development and the SDGs within the EU and in development cooperation with partner countries. On 22 November 2016, the EU presented its response to the 2030 Agenda and the SDGs and adopted a sustainable development package, including an overarching Communication on next steps for a sustainable European future accompanied by a Staff Working Document that describes in broad terms the contribution of the various EU policies and legislation to the SDGs. With the adopted approach, the EU seeks to mainstream the SDGs into the Commission's everyday work and to engage all stakeholders, Member States and the European Parliament in its implementation to work towards full implementation of the 2030 Agenda for Sustainable Development (EC, 2016).

EU Commission publications about climate changes

As discussed in the introduction, the effects of climate changes have significant impact, directly or indirectly, on water security across the different aspects included in this concept that we have previously identified. For this reason, many of the Directives discussed in previous part of this deliverable explicitly mention the need address the climate change, or at least to quantify their impacts and consider them when planning water security measures or performing risk assessment.

Related to this topic, a directive dedicated to climate change do not currently exists; nevertheless, the European Union is fighting climate change though several parallel actions and initiatives.

Of particular important in this sense is the EU Strategy on adaptation to climate change, adopted by the European Commission in April 2013 (EC,2013). It sets out a framework and mechanisms for taking the EU's preparedness for current and future climate impacts to a new level. To avoid the most serious risks of climate change, particularly large-scale irreversible impacts, the international community has agreed that global warming must be kept below 2°C compared to the pre-industrial temperature. International action to reduce greenhouse gas emissions will therefore be needed for decades to come. But however successful these mitigation efforts prove to be, the impact of climate change will increase in the coming decades due to the delayed impacts of past and current greenhouse gas emissions. Europe and other parts of the world therefore have to take adaptation measures to deal with the unavoidable climate impacts and their economic, environmental, and social costs. Prioritising coherent, flexible, and participatory approaches, has been recognized as much cheaper to take early, planned adaptation action than to pay the price of not adapting to climate change.

The Implementation of the EU Adaptation Strategy is based on eight actions, the of the most relevant for the topic of water security are:

- Action1: Encourage all Member States to adopt comprehensive adaptation strategies. As part of the Adaptation Strategy package the Commission has provided guidelines to help Member States formulate adaptation strategies. The Commission will develop an 'adaptation preparedness scoreboard', identifying key indicators for measuring Member States' level of readiness;
- Action3: Bridge the knowledge gap- The Commission will work further with Member States and stakeholders to identify adaptation knowledge gaps and the relevant tools and methodologies to address them. The Commission will promote EU-wide vulnerability assessments, taking into account, inter alia, the cross-sectoral EU overview of natural and man-made risks that it will produce;
- Action 7: Ensuring more resilient infrastructure- In 2013 the Commission launched a mandate for European standardisation organisations to start mapping industry-relevant standards in the area of energy, transport, and buildings and to identify standards that need to be revised to achieve better inclusion of adaptation considerations. - The Adaptation Strategy package

provides guidelines to help project developers working on infrastructure and physical assets to climate-proof vulnerable investments.

On 12 November 2018, the European Commission published a report on the implementation of the EU Strategy for Adaptation to Climate Change. The evaluation was accompanied by a public consultation from December 2017 to March 2018. The analysis resulted in a report on lessons learned and reflections on improvements for future action, accompanied by a staff working document presenting the evaluation in detail (EC, 2018).

The evaluation shows that the strategy has delivered on its objectives, with progress recorded against each of its eight individual actions. The report, nevertheless, outlines how Europe is still vulnerable to climate impacts within and outside its borders. Adaptation can and should be a powerful ally of sustainable development and disaster risk reduction efforts. EU policy must seek to create synergies between the three policies to avoid future damage and provide for long-term economic and social welfare in Europe and in partner countries.

5.2.6 The European Water Regulators Board

In April 2014 it was established in Europe the first network of of European Water Regulators (WAREG), which currently brings together 26 regulatory authorities with Member status and 5 regulatory authorities with Observer status. Any entity or legal body which is responsible for the regulation of water and/or wastewater services within a country in Europe may apply for membership or for observer status within WAREG (**Figure 2**):

This network has been established after recognizing that, even if there has been a significant evolution towards this direction by establishing a general framework for Community action in the field of water policy after the establishment of Water Framework Directive, further harmonization of water services regulation practices in Europe is still needed in order to better manage water resource at the European level, as well as to promote stable regulation of water services in European countries.

Many of the water security related challenges have been identified as promoter elements for the creation of WAREG as a dedicated instrument for cooperation between authorities of the different European countries and its engagement in the European institutions.

For example, as challenges of WAREG are explicitly mentioned the social concerns of equal accessibility for end-users, especially with respect to the sensitive issue of pricing policies, as are one of the main driver for regulators' intervention, especially in the context where water and sanitation are recognized as human rights. Additionally, it has been also recognized that these services are characterized by relevant financial issues, including the gap between financial needs to cover operating and capital costs and the self-financing capacity of operators, as well as by the presence of fixed and sunk costs, which increase the water sector risk. Finally, also considering the potential clash of opposing interests in this sector, the need strong commitment of national regulators has been recognized order to create a balance between operators and consumers in the interest of the entire sector, in accordance with EU rules (WAREG, 2014).

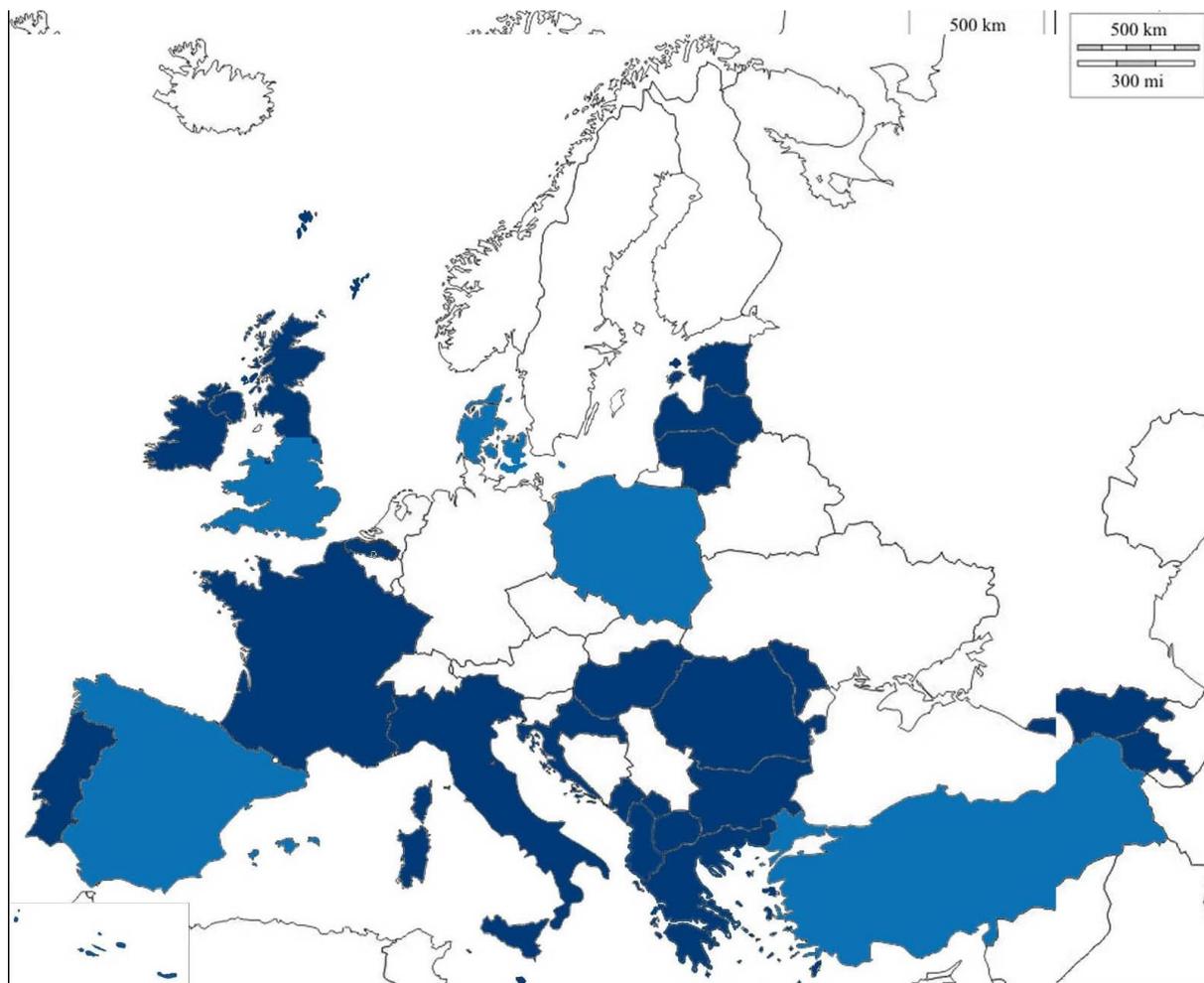


Figure 2. The current Members(deep blue) and Observers (light blue) of WAREG (WAREG, <https://www.wareg.org/members.php>)

To assess these water security related issues, some common objectives have been identified and inserted in the Action Plan approved by WAREG Assembly (WAREG, 2014):

- promote a harmonized, effective, efficient, and stable regulation framework of the water sector at EU level for water and wastewater services, aimed at supporting the sustainability of the services, adequate infrastructure investment, proper service quality standards and consumer protection;
- promote capacity building, organize specialized training, technical assistance, exchange of know-how and experience;
- promote best-practice and stable regulation of the water sector at European level for water and wastewater services, aimed at supporting the sustainability of the services, adequate infrastructure investment, proper service quality standards and consumer protection;
- prepare common positions about regulatory issues and speak with a stronger voice at European Community level;
- conduct an open dialogue with other relevant regional and international organizations and national institutions, with particular focus on European issues in the field of water services.

Even if not all the member States are currently represented in WAREG, the relevance of this initiative to the water security topic, as well its potential impacts in terms of ensuring water security in particular if extended wider into the EU, are indeed considerable.

6. Conducting research with key stakeholders

After the analysis of the existing and ongoing regulation about water security, as indicated by the Description of Action's description task 9.1, the work focused on conducting research with key stakeholders to detect existing criticism and issues with the water security legislative environment and identify the political environment for new legislation in this field. This includes an analysis of the political interest in new legislation and the extent to which existing regulation is outdated.

Also considering the current situation and the ongoing pandemic, the best way to perform this research was identified through a survey in the form of an online questionnaire (google form).

Since the water security field is indeed very wide, the survey was carefully designed in order to provide meaning results for aqua3S project and it was also highly influenced by the analysis, conducted in the previous Section, which helped to identify the most relevant topics to focus on.

For that reason, the survey contains specific questions about water security, and it is targeted not to a general public, but to a very expert audience. Moreover, it also includes many open answer questions, thus the effort requested from the stakeholders' side to fill it has been considerable (estimated time 45min-1h),

The full form of the questionnaire is reported in appendix, while in the next subparagraphs we will discuss about the general structure of the survey and how it has been influenced by the preliminary analysis of the normative framework, the selection of stakeholders and the analytics of the collected answers.

6.1 The Survey Poll about legal framework regarding water security

The questionnaire starts with an introduction to the project aqua3S and the scope of the activity; it also includes an Information sheet and the statement of informed consent.

The structure of the following parts of the survey has been greatly influenced by the outcomes of the preliminary analysis on the current and proposed regulation about water security, described in the previous Sections. For example, the first goal of the survey is in fact to assess if the stakeholders are aware of the UN's official definition of water security and of the real extension of this concept.

Then, the water security concept has been divided into various different 'aspects' identified both from the definition itself and by the different lines outlined into the EU and international regulation, which are:

- Aspect 1 of Water security definition: "safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development;
- Aspect 2a of water security definition: "ensuring protection against waterborne pollution and water-related disasters". Focus on water related Natural disasters (flood, droughts etc.);
- Aspect 2b of water security definition: "ensuring protection against waterborne pollution and water-related disasters". Focus on water related intentional human disaster (i.e., pollution and contamination) both accidental and voluntary;
- Aspect 3 of water security definition: preserving ecosystems in a climate of peace and political stability.

For each of these aspects, the questionnaire asks to the stakeholders to indicate how much his/her work is related to that specific topic. In case of positive answers, the stakeholder is asked to provide some specific details such as:

- If there are regulations of reference for his/her organization to ensure this aspect;
- The kind of measures his/her organization have adopted in order to abide by these regulations (special equipment installed, employment people of certain expertise, tests/checks on a frequent basis, etc.);
- Quantify (on personal opinion) how much, at the current state of art in terms both of regulation, and of technology, this specific aspect of water security is ensured;
- The new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security;
- The specific CEN/CENELEC/ETSI standards that are focused on or ensures this aspect;
- The eventual issues with existing security standards and policy that are counter-productive for achieving this specific aspect of water security (i.e., special equipment too expensive, the highly specialized professionals are rare, complex accreditation procedures etc.);
- The presence of other 'actors' (i.e., administrations, organizations, companies, public authorities etc.) which deal with this specific aspect of water security other than the stakeholder's own organization;
- If there are enough synergies (collaboration in everyday works, connections with different plans, defined protocols of communication and cooperation during the emergencies, etc.) between the stakeholder's organization and these other actors;
- if improving these synergies could effectively help to achieve a better level of water security (focusing on this specific aspect);
- Additional aspects that could be improved in a future regulation, in order to better achieve this specific aspect of water security.

These specific questions have been carefully formulated after the analysis of the legal framework, reported in the previous Sections. This analysis resulted essential to outline specific issues and topics (i.e., the fragmentation of the regulation, the need of synergies, the need of homogenization and standardization etc.) that are of particular interests also for the project and in relation of which the contributions and opinions of the stakeholders could add a great value.

Then, the questionnaire asks to the stakeholder to re consider the water security issue as a whole, with specific question about integration, synergies and harmonization between different regulations, technologies, standards, roles, and competences, which fall under the various aspect of water safety. This section also includes a global rating of the water security level, as well as opens answer questions to express policy and standardization suggestions.

The questionnaire ends with some general questions (i.e., the professional background, expertise, nationality etc.) both referred to the stakeholder and to his/her organization. The presence of this latest section is motivated by the need to assess if the chosen sample of stakeholders is assorted in terms of nationality, professional competence, roles etc.

6.2 Identification of the Stakeholders

The targets to this questionnaire have been identified both inside the consortium as well as in external stakeholders.

In regard with the internal members of the consortium, the survey has mainly addressed the end-user partners, as they represent both the main experts of the field and the users of the aqua3S platform.

The end user partners have also been encouraged to fill in the questionnaire together with other colleagues, even if not directly involved in aqua3S, who cover different role in their organization and may thus provide complementary information.

However, the survey was left open also to some technical partners who may have a long expertise in developing technologies in the water or security sector and thus they can provide useful insights from different point of views.

The survey was diffused amongst the aqua3S consortium from end of November 2020. With the beginning of 2021, the end user partners were asked to share the form also with carefully identified external stakeholders. Those external targets are experts of the water security sector and represent organizations, which cover, in the everyday work, a complementary role in terms of water security to the aqua3S partners. For example, water utility partners inside aqua3S sent the questionnaire to operators of Municipality or other regional authorities, who contribute to ensure the water security in their specific area. What has been clear for the beginning, in fact, is that there is not any single organization who, alone, is charge for all the aspects of water security identified. As discussed, water security needs synergies between different organizations, roles, sectors, and expertise.

In other cases, some other partners of aqua3S were part of specific groups related with water security topics (i.e., critical infrastructure etc.), and thus they diffused the survey to other members. Finally, another partner followed the approach of inserting the survey in the dedicated newsletter of its organization.

The reference contacts for external stakeholders were also encouraged to fill in the form together with more colleagues of their organizations, to consider the contribution of different roles and experiences.

After this operation, at the end of January 2021, we collected 25 filled forms. At first glance, this number could seem to be not exceedingly high, and indeed not all the external organizations, who had been contacted, provided a contribution. However, in this sense some aspects have to be considered. Firstly, the survey requires specific expertise and knowledge in the sector, is not targeted to a general audience. Secondly, considering also the many open answer questions, the questionnaire required a consistent effort from the stakeholders' side to be filled; some targets reported in fact that it occurred to them between 45min and 1hr to answer to the question; this represents much more time than a typical multiple choices questionnaire.

Moreover, as stated above, the questionnaire required a careful work of shaping to ensure a level of significance of the answer provided; this included not only a detailed analysis of the current existing framework of water security, but also an assessment of the first outcomes of the aqua3S project, that come from the evaluation of the first pilot. For that reason, the survey has been finalized only after this long process of analysis; thus, the form was left open to be filled by the stakeholders only for a relatively small period of time (about two months, with the Christmas and new year holidays in the middle), until the submission of the present document.

Finally, the current measures on force in Europe to avoid the further spread of the pandemic prevented the organization of physical meetings, workshops, or other face-to-face events, when this questionnaire could have been diffused 'in physical way' to stakeholders, limiting the ratio of unswerving contacts.

Based onto the previous considerations, the number of the reached stakeholders results indeed promising. More detailed analysis and considerations, including increase the target audience, could be carried on in the second part of the aqua3S project, in order to further expand the preliminary results collected until now.

6.3 Result of the survey

In the following section we are going to report the analytics obtained from the survey. More general considerations about the results are remanded to the next Section.

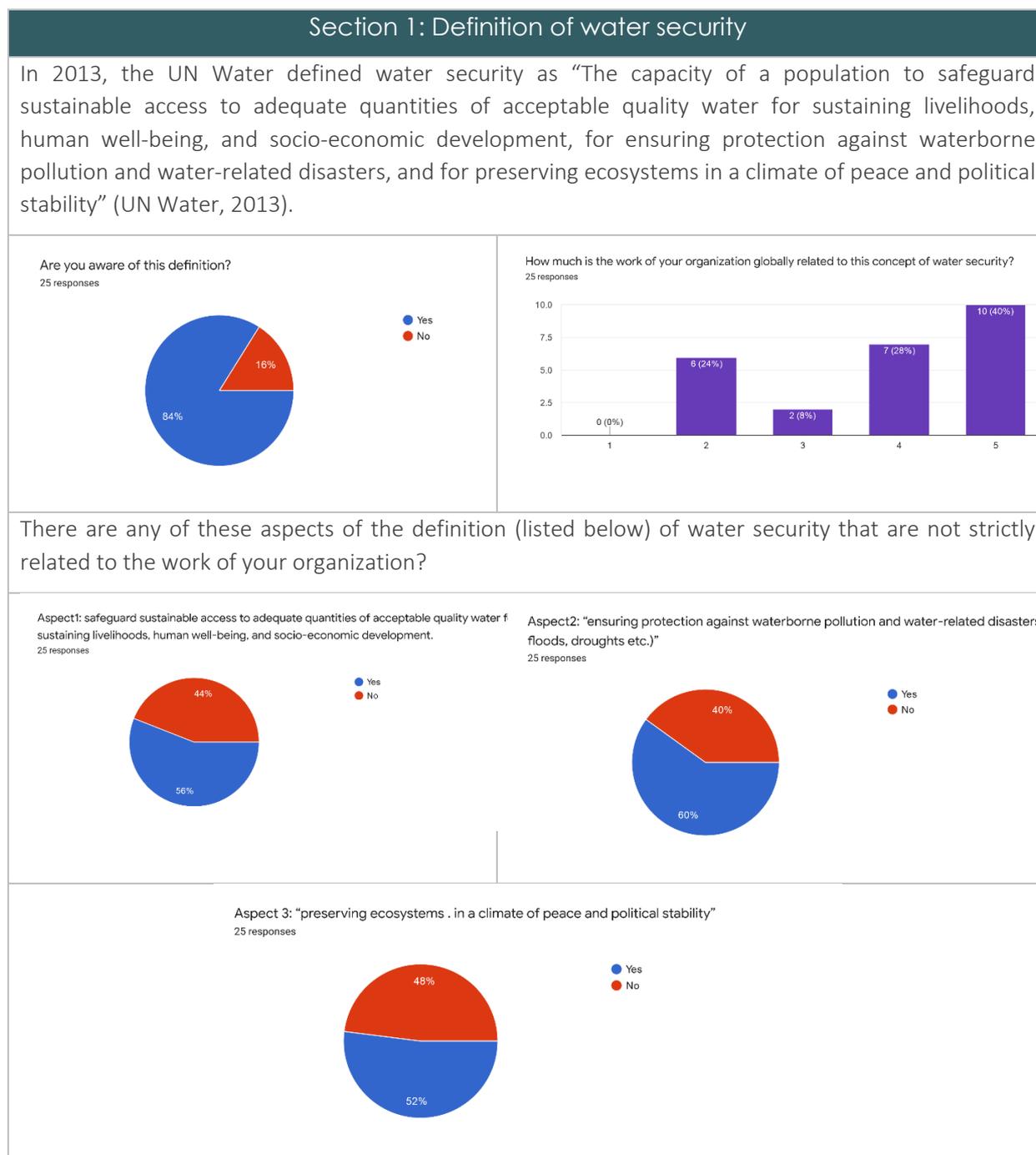
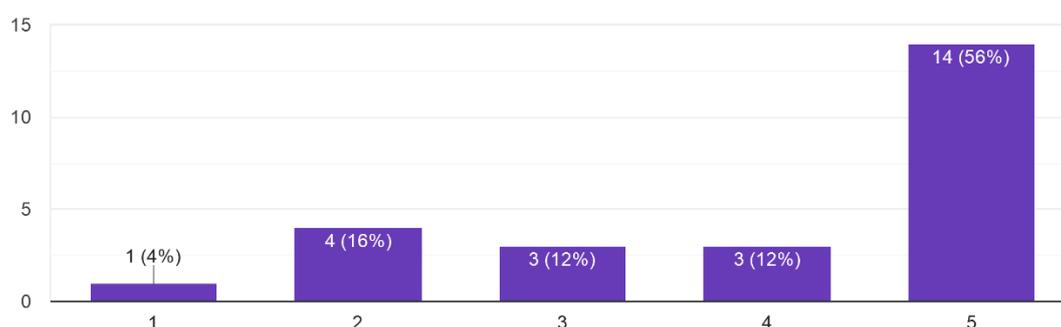


Table 1. Summary of the analytics of the survey – part1

Section 2- Aspect 1 of Water security definition: "safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development.

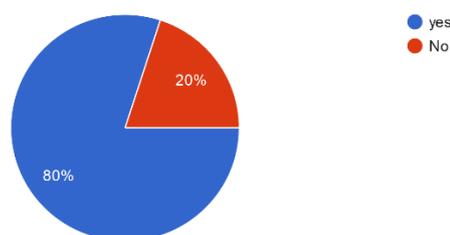
Focusing only on this specific aspect of water security, how much is the work of your organization related to it?

25 responses



Are you aware of specific regulation (European and/or National) which focuses or ensure this aspect?

25 responses



Specifications Provided regarding the regulation:

- the National Health Regulation: Γ1(δ)/ΓΠ οικ.67322/2017 in compliance with the European Regulation 98/83 as it is altered by the EU Directive 2015/1787;
- Drinking Water Directive; EU Water Framework directive (including Right2Water update); Flood Directive; The Water Supply (Water Quality) Regulations 2016 (England & Wales), S.I. No. 464/2017 - European Union (Drinking Water) (Amendment) Regulations 2017 (Rep. of Ireland);
- Regulation No. 9 on the quality of water intended for drinking and household purposes;
- EU Water framework directive 60/2000 and EU Drinking water directive;
- 2000/60/EC;
- European Drinking Water Directive; Code de la Santé Publique in France;
- European Directives: 2000/60/EC Water Framework Directive; 2007/60/EC Floods Directives;
- WFD, Nitrates Directive, Drinking Water Directive, Priority Substances Directive, Environmental Quality Standards Directive. A valuable tool is the Common Implementation Strategy with guidelines by EU experts commissions;
- 98/83/CE and new DWD;

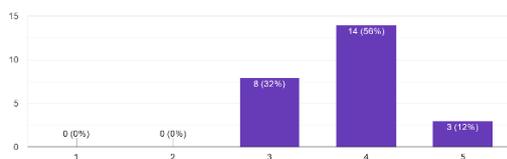
- French regulation on use of water resources, submitted to sustainable use and real needs, and formal approval of water treatment before building and operation;
- Drinking water directive;
- Drinking Water Directive;
- Bulgarian Water Law;
- European Water Framework Directive & Drinking Water Directive, French national legislation on water;
- Directive 98/83, Directive 2000/60, Directive 2009/128, Directive 98/8 and related sister directives + all their national transpositions;
- Dir 2000/60 CE, Dir 98/83/CE; and National (Italian) Regulation: D.Lgs. 152/2006 - D. Lgs. 31/2001;
- Water Act;
- Water Framework Directive, Drinking Water Directive and the relevant national laws and regulations;
- Directive 98/83/EC - Drinking water directive;

Specification provided about the measure adopted in order to abide by these regulations.

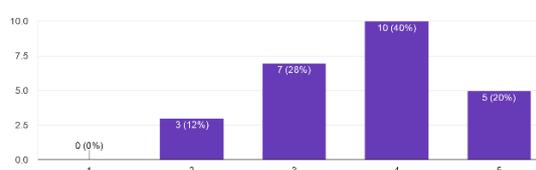
- We run tests on a three year basis on a supervisory level regarding the characteristics of the potable water in the Prefecture of Thessaloniki;
- Daily monitoring of all drinking water treatment plants is performed by our accredited laboratory;
- Dedicated drinking water quality lab with experienced and qualified personnel, fully equipped. Water quality online meters, SCADA;
- the water management plan (PGA);
- SUEZ, which is the company I work for, is specialized in managing water services and construction of water production plants. We promote water security approaches with adequate water treatment and quality monitoring. SUEZ complies with all the national regulations in each country of the world but also with internal recommended practices. SUEZ has a research center (CIRSEE) specialized in water quality;
- River Basin Authority developed Flood Risk Management Plan (Flood Directive (2007/60/EC),
- River Basin Management Plan (Water Framework Directive (2000/60/EC);
- To satisfy the water supply needs of the city, our company operates an advanced Drinking Water Treatment Plant (DWTP) as well as all the necessary drinking water distribution network and infrastructure;
- Online instrumentation installed consists of sensors monitoring the physicochemical properties of water such as pH, conductivity, colour, dissolved oxygen and turbidity as well as the residual chlorine concentration. Moreover, our company operates two fully equipped analytical quality control laboratories that run under ISO 17025 procedures;
- The Drinking Water Quality Control Laboratory, with highly experienced personnel in sampling procedures throughout the urban and peri-urban water supply infrastructure and network;
- The DWTP Quality Control Laboratory, with highly experienced personnel in sampling and analyzing surface water using advanced analytical instrumentation and methods;
- At present, the company is in the process of designing and implementing a new unified and upgraded SCADA system to run through all its water management and supply system, for monitoring all the processes, starting from its water resources until the urban distribution network. During this process, the addition of numerous online instrumentation and sensors

- for water quality monitoring, is already set out;
- Water safety plan under development, installation of remotely controlled sensors, high level of automation;
 - several projects to reduce water losses on distribution networks, to detect back flows (through private connections or fire hydrants for example), use of chlorine as a marker of water quality in tanks and networks, experts at regional, national, and international level;
 - we have monitoring equipment;
 - We apply a frequent sampling schedule. Chemical and microbiological test are performed at specific key points on a regular basis;
 - There are no specific measures taken, yet the whole working process has been created and is constantly being updated, so that all legislation norms are abided accordingly;
 - Monitoring stations for surveillance of water resources (quantity & quality), on-line sensors for water treatment performance and water quality monitoring (production & distribution of drinking water), laboratories for water quality analyses;
 - Employed people with specific expertise on control and test on food and beverage industries. Frequent tests and monitoring checks are run;
 - Water treatment and disinfection, resource monitoring, protection areas, specialized technical and scientific staff, renewal of pipe network, leak detection;
 - Water basin management plan;
 - Water reservoirs are installed to ensure quantity availability in case of an interruption in supply, pipe network is installed for the transport and distribution of necessary quantities to meet demand, personnel are employed for fixing network damages and leaks, personnel is employed to carry out necessary water quality tests, checks on water quality parameters are also carried out by the Ministry of Health (Laboratory General) and private certified laboratory;
 - We have installed different online sensors to monitor water quality parameters in: water catchments; drinking water treatment plants(DWTP). Additionally, daily we analyze raw water at the inlet and drinking water at the outlet of the DWTP in Laboratory.
 - On yearly basis we conduct a drill of the emergency situations

In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured?
25 responses

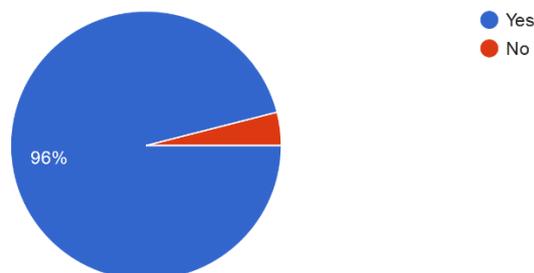


In your opinion, at the current state of art in terms of technology, how much this aspect of water security is ensured?
25 responses



In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security?

25 responses



Specifications provided:

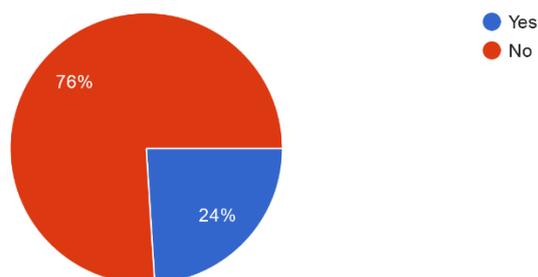
- Consider other sources apart from sensors from monitoring the water. Also, better visualization with alerts and sharing of information among different people either within the same organisation or different ones that need to coordinate in case of an event would benefit water organisations;
- the onset of a regular water surveillance programme (through the whole chain of the water distribution -from the water resource to the end user of the network) as to assure the protection (for both, the quantitative and the qualitative) of the water resource;
- Sensor technologies to detect anomalies and triangulate information, collection and utilisation of citizen generated information;
- Ensuring safe working conditions and guaranteeing the best possible service to our customers;
- Satellite pictures, drones, online meters improvement in microbiologic parameters;
- Increase number of sensors in the area;
- Real time detection of quality risks. For distribution systems, need of algorithms to interpret the large quantity of data which would come from different kinds of sensors in several locations;
- Water Safety Plans (WSP);
- Water Safety Plans, EQS, ISO/CEN standards, River Basin Management Plans, new technologies on nutrient and pollutants removal form water and wastewater:
- Disinfection;
- Higher number of parameters monitored;
- Automatisation of quality monitoring;
- action plan to reduce NRW, use of chlorine and monitoring on all networks;
- free drinking water at public places;
- On-line water quality monitoring;
- Automatisation, AI for pressure monitoring and faucet control, drone observation of reservoirs, sensors for different chemical substances;
- Bioassays for toxicity assessment, larger deployment of quality sensors;
- process modelisation, alternative water resources, physical security of assets, cybersecurity of management systems;
- Definition of Wellhead protection area;
- Ultrasonic algae control;
- CCTV security systems for water reservoirs, modern telemetry system for monitoring the

network, pressure sensors, chlorine sensors, multi-parametric quality sensors, water temperature sensors in reservoirs, digital flow meters, pressure regulating valves, noise loggers for leak detection, smart metering system (AMR), Water Safety Plan;

- Revision of the Drinking water Directive will set up new requirements and standards in the context of water safety and security;

Are you aware of specific CEN/CENELEC/ETSI standards that focus on or ensure this aspect?

25 responses

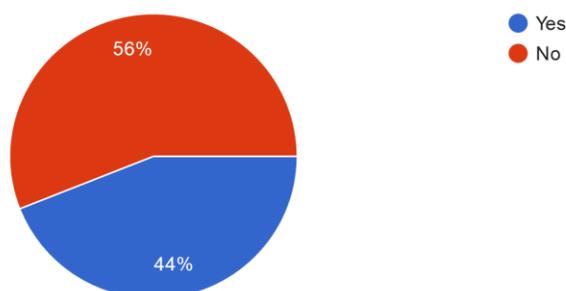


Specifications provided:

- CEN/TC 230 - Water analysis;
- EN 15975;
- EN 17034:2018 on chemicals used for treatment of water intended for human consumption and many others CEN/TC 164 Published Standards;
- CEN EN 15975-1 Security of drinking water supply - Guidelines for risk and crisis management - Part 1: Crisis management;
- CEN EN 15975-2 Security of drinking water supply - Guidelines for risk and crisis management - Part 2: Risk management;

In your opinion, are there any existing issues with existing security standards and policy that are counter-productive for achieving this specific asp... are rare, complex accreditation procedures etc.)?

25 responses



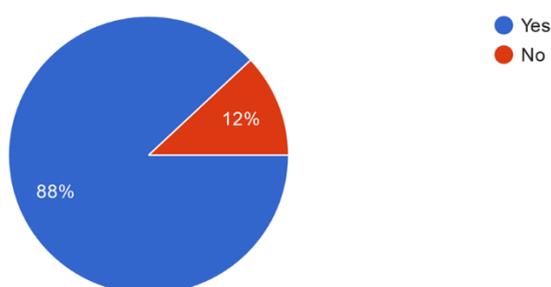
Specifications provided:

- special equipment too expensive, maintenance and replacement of the setups, pipes, installations too expensive;
- Political engagement/decisions and sometimes mentality of several actors/stakeholders;
- Expensive and complex equipment;

- difficulty to hire chemists and engineers;
- Very specialized technology, equipment, and procedures;
- The equipment is quite expensive and specialised technicians are hard to find.
- Security specialist are rare in the water industry, international or European policies asking for transparency (such as the Aarhus convention);
- Expensive equipment;
- Digitization and transition to a low-pollution, low-carbon and resource-efficient water sector require the development of new skills by existing personnel and new qualified professionals that are not broadly available in the market.

Are there any other 'actors' (i.e. administrations, organizations, authorities etc.) which deal with this specific aspect of water security other than you own organization?

25 responses



Specifications provided

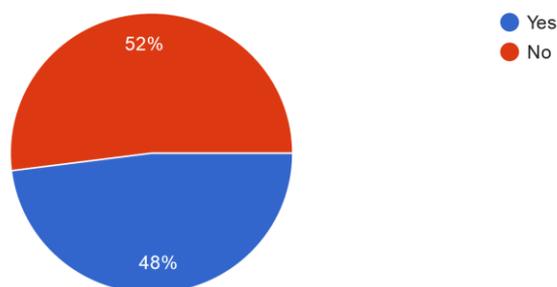
- the Water Providers, the Environmental Authorities, Administrations on a higher level than the Administration of the Region of Central Macedonia;
- Environment Agency (UK), The Water Services Regulation Authority (UK), UK water companies such as United Utilities, Yorkshire Water, Scottish Water, etc;
- State and regional authorities;
- Regions, AATO (water authorities), water industry;
- Ministry of Health; Home Office; Ministry of Defence; Municipalities (which are in charge of water services in France);
- Regional Authorities, Ministry of Environment, Decentralized Water Management Authority, NGOs;
- ARS (Agence régionale de santé) in France;
- ISS, ARPA in Italy;
- Ministry of Interior, Ministry of Health and its agencies and services, Ministry of Environment and its agencies and services;
- France Health Ministry;
- regional health authorities, municipalities;
- The Health Services (Ministry of Health), Water Development Department (Ministry of Agriculture, National Resources and Environment, Health Services of the Municipalities);
- Ministry of Regional development and public works;
- River basin agencies, health agencies;
- Civil protection, water authorities, municipalities, region government;
- Water administration, Coordination unit for threat assessment, Health directorate;
- Basin council, integrated water services, environmental Ministry, Regions and Autonomous

Provinces (in Italy);

- Water Development Department, Ministry of Health, other Water Boards, Sewerage Boards, the Parliament;
- Environmental authorities; Health authorities and Municipality;

In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections wit... between your organization and these other ones?

25 responses

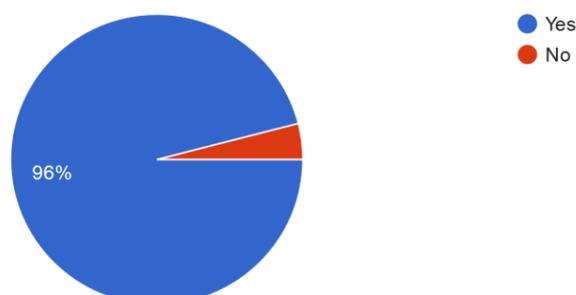


Comments/reflections:

- There are not defined protocols, but during emergencies we collaborate closely (by sharing information through personal mobile phones, e-mails) in order to cope with the problem and overcome the difficulties;
- Procedures are established by current legislation;
- Although there are typical communication pathways between authorities and water utilities, they cover mostly bureaucratic reasons. In case of emergency there is lack of coordination sometimes;
- Water safety plans are discussed on a monthly basis with other stakeholders;
- not enough work together on specific topics (CVM, backflows...) by lack of time or other priorities, resulting in quite slow improvements;
- There is frequent communication and collaboration but there are no defined protocols in case of emergency;
- Not enough collaboration with the coordination unit for threat assessment and health directorate;

Do you think that improving these synergies could effectively help to achieve a better level of water security (focusing on this specific aspect)?

25 responses



Comments/reflections:

- Improving the synergies would improve the prompt response to the emergencies;
- synergies can provide more concrete efforts to face problems;
- Citizen Observatory;
- Synergies and well-defined communication procedures and protocols can holistically improve action towards water security in regular basis or in a case of emergency;
- Always, when there is good communication and cooperation all the problems are solved. On this subject, because we deal with the health of a lot of people, all the actions for every player must be stated by Laws and Directives;
- By focusing more on threats and health issues related to the water industry;

Additional suggestions of improvement in a future regulation to better achieve this specific aspect of water security

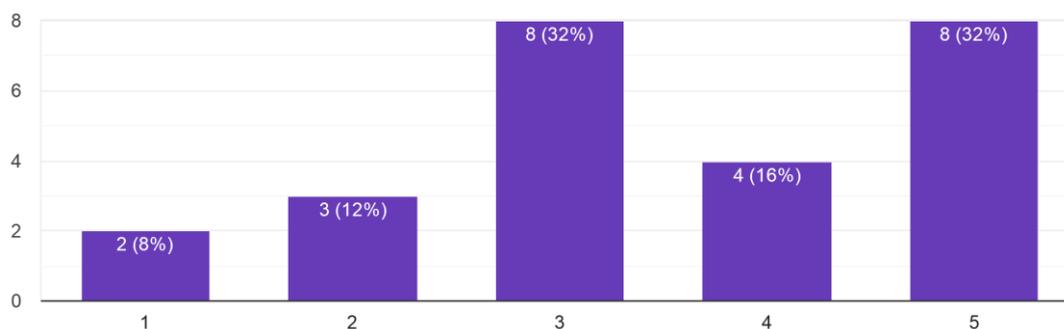
- The definition of the domain of each player involved could be improved. In Greece, both Water-providers and Public Health Authorities of the Prefectures are responsible for achieving the compliance of potable water with the national regulation, but the roles are not well defined. As a result, Water providers are the ones who on an emergency situation will decide whether to cut the distribution of the water through the network or to let it flow by giving strict guidance to the end users. Knowing what is on each one's control would help defining the jurisdiction of the Water providers and the Control Authorities;
- Implementation of the Right2Water update of the WFD;
- If all other companies in our country set as leading priorities the security of the services they offer and guarantee the best quality indicators, in my opinion the industry will go completely forward;
- Coherence among different water related regulations is always necessary;
- Sharing experiences;
- There should be a law or Directive with specific regulations and actions for every player involved;

Table 2. Summary of the analytics of the survey – part2

waterborne pollution and water-related disasters". Focus on water related Natural disasters (flood, droughts etc)

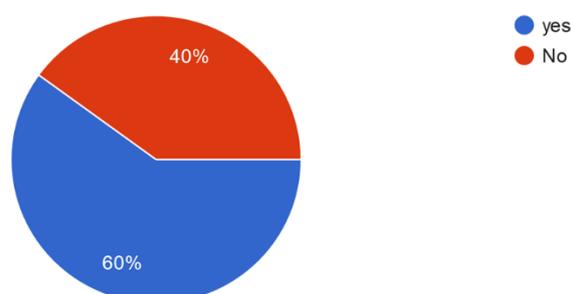
Focusing only on this specific aspect of water security, how much is the work of your organization related to it?

25 responses



Are you aware of specific regulation (European and/or National) which focuses or ensure this aspect?

25 responses



Specifications Provided regarding the regulation:

- There are water plans for each Water Department (WD) of Greece. The Prefecture of Thessaloniki belongs two WD 10 and WD 11;
- Drinking Water Directive; EU Water Framework directive (including Right2Water update); Flood Directive; Urban Wastewater Treatment Directive; Marine Strategy Framework Directive (MSFD);
- EU 60/2000 and DWD (both mainly concerning pollution);
- 2000/60/EC;
- In France: procedures for authorizations for production of drinking water, which include protection of catchment areas and maximum volumes of water abstraction; regional drought management plans from the State;
- Flood Directive (2007/60/EC);
- Drinking Water Directive, floods Directive;
- 98/83/CE and new DWD;
- Action plan against flooding mandatory if part of water quality system is in an area subjected to flooding (Plans de Prévention des Risques); 2004 law of Civil security, water

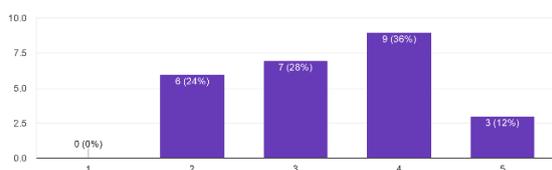
utilities are responsible for securing drinking water access during any natural disaster (for example through alternative resources, distribution of water in tank trucks, in bottles;

- Drinking water directive, wastewater directive;
- Directive on the quality of water intended for human consumption;
- Directive 2007/60;
- Dir. 2000/60 CE - Dir. 2007/60 CE - D.Lgs. 152/2006;
- Water Act;
- Water Framework Directive and relevant national law;

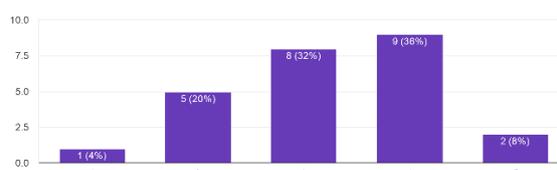
Specification provided about the measure adopted in order to abide by these regulations.

- Water management plan;
- Water quality: development by SUEZ of specific analytical tools (organic micropollutants and microbiological parameters such as virus and parasites) Water related disasters: development by SUEZ of "smart" tools for water quantity forecast (drought and floods);
- Flood Risk Management Plan (Flood Directive (2007/60/EC));
- Equipment is installed across the network and the plants;
- Alarms on water levels, specific organization and controls during storms, yearly training, sharing on national and international basis of Return of Experience after problems;
- Regular monitoring;
- Disinfection of water, continuous monitoring of chlorine residual in water, frequent sampling for microbiological and chemical analysis of water, installation of water quality sensors at key points of the network;
- Building water treatment plants;
- Sewage network modelisation, renewal of old sewage pipes, structural analysis of sewage pipes;
- Institution of " Permanent observatory for water emergencies and droughts";
- Measures are taken to save water (reduce consumption, minimize water leakage, etc) to mitigate the effects of climate change/ droughts;
- We have continuity plan. Also we conduct an emergency drills of such kind of disasters.

In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured?
25 responses

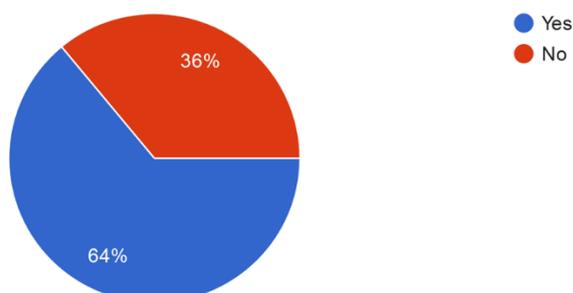


In your opinion, at the current state of art in terms of technology, how much this aspect of water security is ensured?
25 responses



In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security?

25 responses

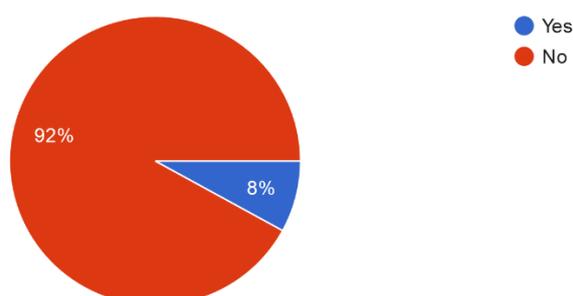


specification provided:

- Use sensors to identify with better accuracy substances found in the water even in small percentage. Also, more advanced systems of alarms, considering different sources, historical data and any other local information would help to localise "weak" areas and support them;
- Sensor technologies to detect anomalies and triangulate information, and processes for collecting citizen generated information as well as communicating risk and information across agencies;
- Tools to better forecast droughts and floods based on real time data;
- Automatic analyses of different kinds of pollutants;
- Citizen Observatory;
- Disinfection;
- Higher level of digitalization of the network;
- platforms for smart water quality management;
- Sensors, AI for prediction, video observation;
- Better sustainable use of water through new technologies and good practices;
- Oil pollution monitoring by drones at the water source;
- Technologies related to the reduction of consumption (e.g., Automated meter reading systems) and technologies and procedures related to the reduction of leaks (e.g. network monitoring systems, active leakage management, etc).

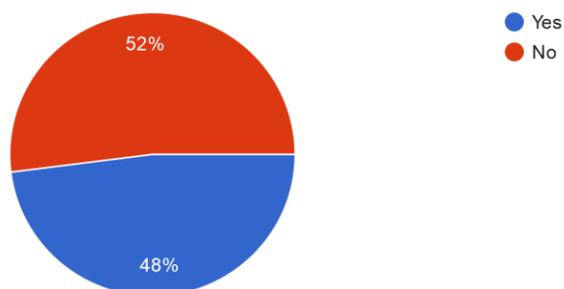
Are you aware of specific CEN/CENELEC/ETSI standards that focus on or ensure this aspect?

25 responses



In your opinion, are there any existing issues with existing security standards and policy that are counter-productive for achieving this specific asp... are rare, complex accreditation procedures etc.)?

25 responses

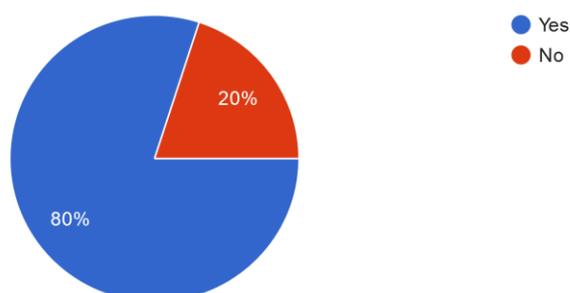


Specification provided:

- Financing issues of the projects to be carried out.
- Difficulties to aggregate data from different stakeholders (different State agencies, municipal and private operators, etc.)
- The problem is too complex and need international and global decisions.
- Big, Complex and specialized matter needs specialized personnel and equipment, some procedures last for hours in order to have a result.
- Equipment is very expensive, no technicians.
- Equipment and technology (like smart meters, noise loggers) are still expensive and require expertise

Are there any other 'actors' (i.e. administrations, organizations, authorities etc...) which deal with this specific aspect of water security other than you own organization?

25 responses



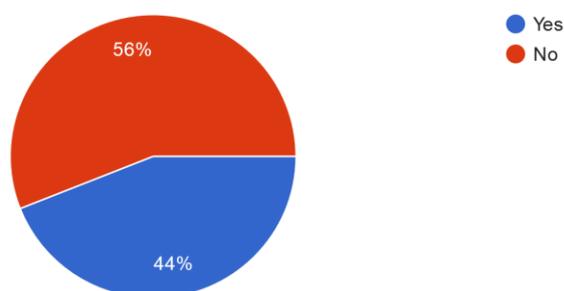
Specification Provided:

- The Water Services Regulation Authority (Ofwat), Environmental Agency;
- Water administration;
- Regions, AATO, water industry;
- Ministry of Regional Development, local and central authorities;
- Municipality; Health authorities; Environmental authorities;
- Ministry of Environment, Regional Authorities, Municipal authorities etc;
- Agency of environment; Regions, Soil reclamation consortiums, Municipalities;
- The Health Services (Ministry of Health), Water Development Department (Ministry of

- Agriculture, National Resources and Environment, Health Services of the Municipalities;
- State agencies and Ministries; local (municipalities) authorities;
- The Administration of Technical Work of the Region of Central Macedonia (RCM) and the Water Administration of the Decentralized Administration of Macedonia and Thrace (DAMTH), which is a higher level of Administration than the one of the RCM;
- Civil protection services;
- Regional health authorities;
- ARS (agence régionale de santé) in France;
- Water Development Department, Ministry of Agriculture;

In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections wit... between your organization and these other ones?)

25 responses

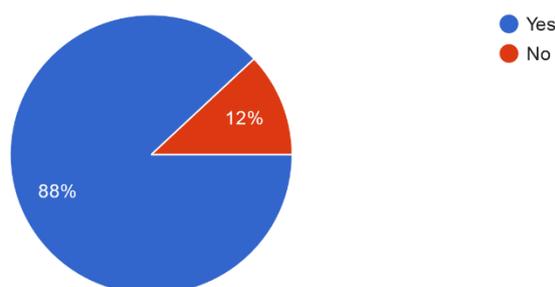


Comments/reflections:

- There should be better coordinated action, commonly implemented action plans, well defined protocols of communication, in everyday operation and in case of emergency;
- Municipalities usually lead the synergies across the stakeholders for what concerns wastewater security, while water security is discussed with a range of stakeholder at regional or national level;
- There is frequent communication and collaboration but there are no defined protocols in case of emergency;
- Collaboration to share data and if possible, with the same format;

Do you think that improving these synergies could effectively help to achieve a better level of water security (focusing on this specific aspect)?

25 responses



Additional suggestions of improvement in a future regulation to better achieve this specific aspect of

water security

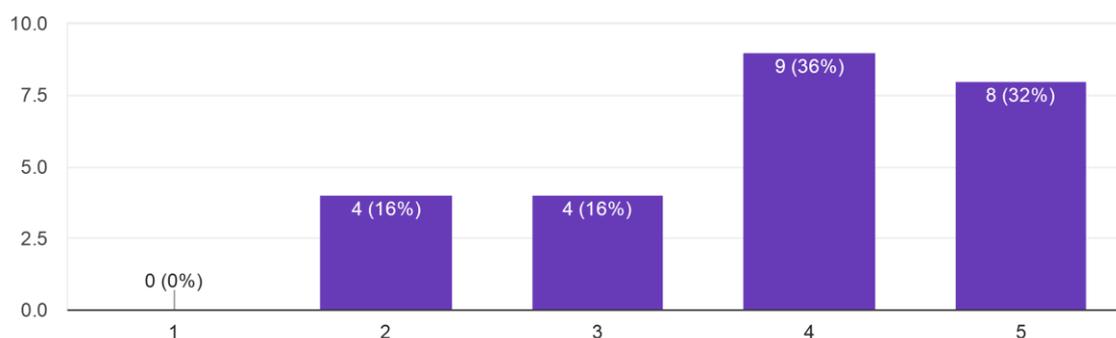
- Bigger restrictions towards factories and the main polluters;
- Outlining processes for collecting citizen generated information;
- Possibility to anticipate possible disasters under available conditions;
- There must be specific protocols with the actions every player must follow;
- Sharing experiences.

Table 3. Summary of the analytics of the survey – part3

Section 4: Aspect 2b of water security definition: "ensuring protection against waterborne pollution and water-related disasters". Focus on water related intentional human disaster (i.e., pollution and contamination) both accidental and voluntary.

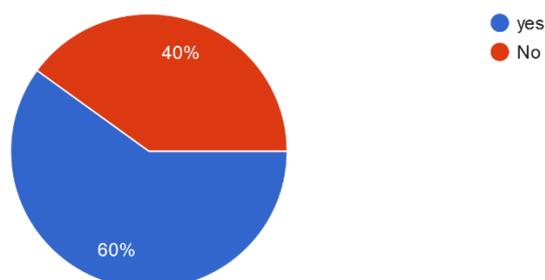
Focusing only on this specific aspect of water security, how much is the work of your organization related to it?

25 responses



Are you aware of specific regulation (European and/or National) which focuses or ensure this aspect?

25 responses



Specifications Provided regarding the regulation:

- Groundwater directive, Nitrate directive, Directive 2000/60, Directive 91/271;
- 2000/60/EC;

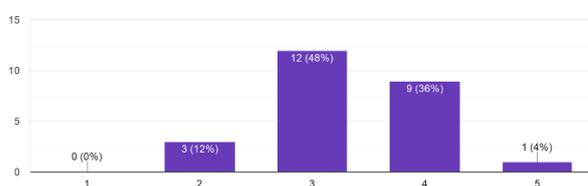
- National legislation related to sanitary protection zones around water sources;
- Drinking Water Directive; EU Water Framework directive (including Right2Water update); Flood Directive; Urban Wastewater Treatment Directive; Marine Strategy Framework Directive (MSFD); Directive 2013/39/EU;
- Dir 2000/60 CE - D.Lgs. 152/2006;
- WFD, drinking water directive;
- River Basin Management Plan (Water Framework Directive);
- 98/83/CE and new DWD;
- France: protection of catchment area for drinking water protection; need to have an assessment of the protection of water production sites;
- Mandatory audit and action plan for every plant or tank that delivers water to more than 10,000 inhabitants; regulations for protection (closure, alarms), Loi de programmation militaire for the biggest water systems (over several hundred thousands inhabitants);
- National Legislation Law 4042/2012 in compliance with the 2008/99 and 2008/98 EU Directive;
- French legislation on the protection of critical infrastructures (includes water);
- WFD, DWD;
- Water Act;

Specification provided about the measure adopted in order to abide by these regulations

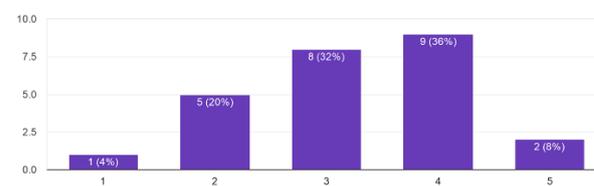
- Protection areas, Water treatment, Resource monitoring, SCADA surveillance, physical protection, cyber protection, online monitoring;
- Conformity with legal requirements;
- River Basin management plan;
- The daily quality control tests of raw and drinking water, which are conducted in the chemical and microbiological laboratories of our water company are designed to ensure and certify the excellent quality of water that provides to the citizens;
- For the quality of water to be controlled, operates two laboratories. These laboratories analyse samples of raw water from river/springs - reservoirs, the boreholes and samples of drinking water from the Water Treatment Plant of the Company and of the water supply network;
- Knowing that water serves as an inner carrier of pathogenic microorganisms, the analyses results certify that the quality of drinking water provided by our water company fully meet the legislative requirements of the Joint Ministerial Decision on the "Quality of water intended for human consumption" (JMD Γ1(δ)/ΓΠ ECO 67322/2017) as amended and currently in force and complies with the requirements of the Ministerial Decision on the "Quality required of surface water intended for drinking, bathing, living in freshwater fish and shellfish culture" (ECO 46399/1352/86);
- Many sensors installed across the network;
- The same mentioned for the aspect 2a;
- Definition of a specific area where human activities are regulated;
- Specific equipment and specific organisation; no description is possible; it is covered by secret;
- We contribute to the environmental control task force of the Environmental Authority of the RCM;
- Obligation of vulnerability assessment, physical protection, intrusion detection. Deployment of monitoring stations for surveillance of water resources, on-line sensors in treatment and distribution systems, connected to on-site and regional supervision.;

➤ Not much is done by my organization to ensure protection against these disasters;

In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured?
25 responses

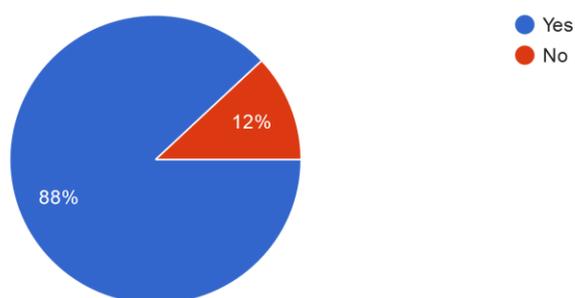


In your opinion, at the current state of art in terms of technology, how much this aspect of water security is ensured?
25 responses



In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security?

25 responses

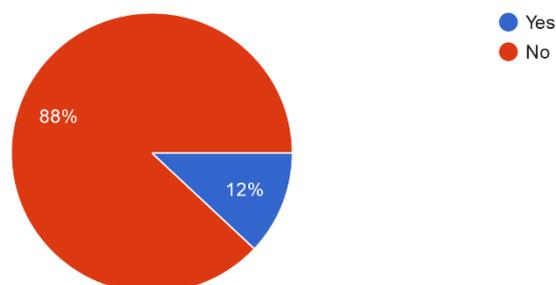


Specification provided:

- Sensors, AI for prediction, video observation
- Constant monitoring of all water resources or at least of the potentially endangered ones
- detection of anomalies in water systems and collection and utilization of citizen generated information;
- Water Safety Plans, Risk Assessment tools, ISO/CEN standards;
- Citizen Observatory;
- Same mentioned for the aspect 2a;
- A lot of small tanks, in semi-rural or rural areas, are not yet well protected, resulting in very late alarm, or in water shortage during analysis time of the incident;
- Larger deployment of on-line quality sensors and improvement of detection algorithms;
- Monitoring sensors;
- Disinfection;
- CCTV monitoring systems, water quality monitoring systems, water safety plans;

Are you aware of specific CEN/CENELEC/ETSI standards that focuses or ensures this aspect?

25 responses

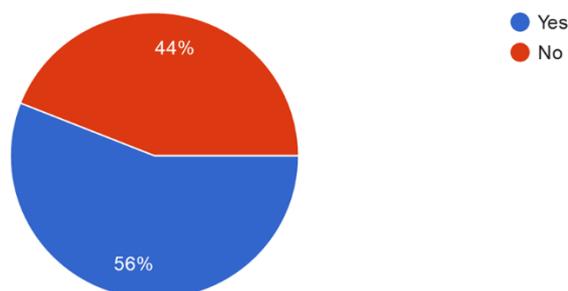


Specifications provided:

- Recommendations for prevention of Legionella growth in installations inside buildings conveying water for human consumption.

In your opinion, are there any existing issues with existing security standards and policy that are counter-productive for achieving this specific asp... are rare, complex accreditation procedures etc.)?

25 responses

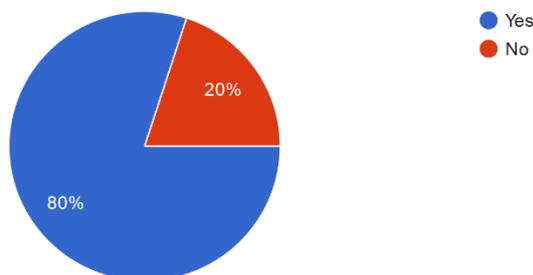


Specifications provided:

- Water management plan;
- Equipment too expensive, no technicians;
- Inadequate control;
- Outdated legislation;
- Same mentioned for the aspect 2a;
- Difficulties to protect water distribution networks;
- Financing problems;

Are there any other 'actors' (i.e. administrations, organizations, authorities etc.) which deal with this specific aspect of water security other than you own organization?

25 responses

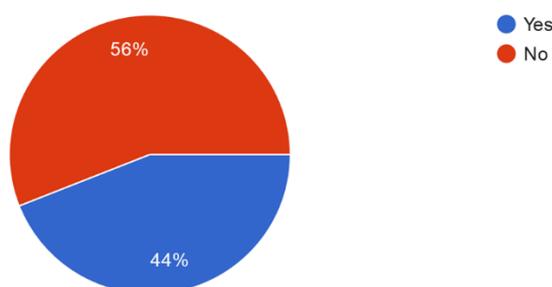


Specifications provided:

- Civil protection, Coordination unit for threat assessment, water administration;
- Regions, AATO, water industry;
- Ministry of Environment;
- Environmental (water) authorities;
- In Italy: Ministry of The Environment, Regions and Provinces, Soil Reclamation Consortia
- Ministry of Environment, Ministry of Public health, Regional authorities, ARPA (regional environmental protection agency);
- Same mentioned for the aspect 2a;
- National Ministries and local (municipalities) authorities;
- Environmental Authorities from both, RCM and DAMTH;
- ARS in France;
- Health agencies;

In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections wit... between your organization and these other ones?

25 responses



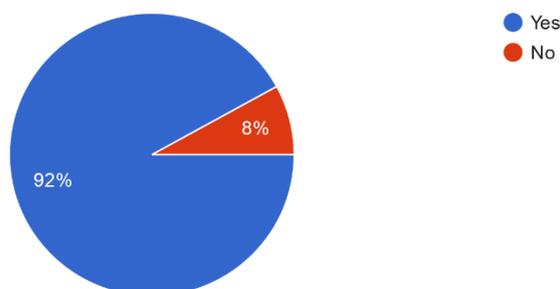
Comments/reflections:

- There is synergy between the various administrations but the current fragmentation of competences and the overlapping of different plans (e.g., Regional protection plan and water management plan) makes water quality management cumbersome and complicated;
- There should be better collaboration schemes in everyday works, interconnections with different plans should be in coherence, well defined protocols of communication and

cooperation during the emergencies are actually missing;

Do you think that improving these synergies could effectively help to achieve a better level of water security (focusing on this specific aspect)?

25 responses



Comments/reflections:

- Increased prevention and reactivity in case of disaster;
- There should be a single plan that pursues environmental quality objectives;
- Same mentioned for the aspect 2a;

Additional suggestions of improvement in a future regulation to better achieve this specific aspect of water security

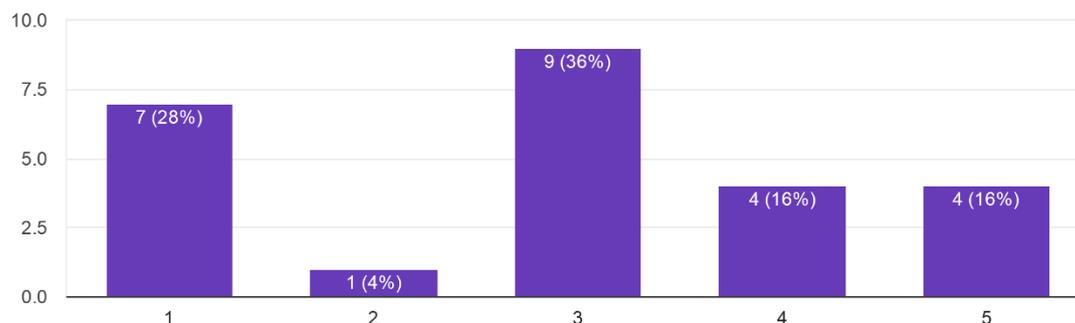
- Bigger penalties for main polluters (factories);
- Guidance on the use of sensor technologies to detect anomalies and the guidance on the collection and use of citizen generated information;
- There should be a single plan that pursues environmental quality objectives;
- The definition of the role of each Authority;
- Sharing experiences.

Table 4. Summary of the analytics of the survey – part4

Section 4: Aspect 3 of water security definition: preserving ecosystems in a climate of peace and political stability

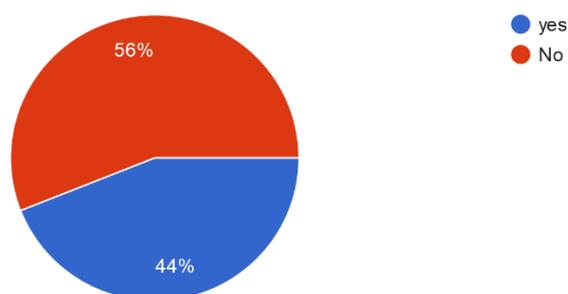
Focusing only on this specific aspect of water security, how much is the work of your organization related to it?

25 responses



Are you aware of specific regulation (European and/or National) which focuses or ensure this aspect?

25 responses



Specifications Provided regarding the regulation:

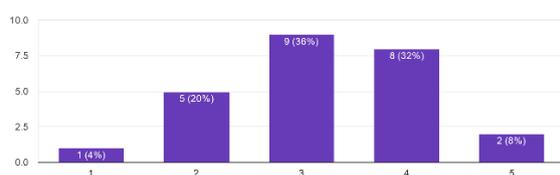
- Directive 2000/60;
- 2000/60/EC;
- Water Framework Directive; Drinking Water Directive (including Right2Water update);
- Dir 2000/60 CE - D.Lgs. 152/2006 (Italian Regulation) - Dir. 92/43/CEE "Habitat";
- Dir. 92/43/CEE - Dir. 79/409/CEE;
- European Framework Directive; European Urban Waste-water Directive;
- European Water Framework Directive and daughter directives, and French environmental legislation;
- Water Act;

Specification provided about the measure adopted in order to abide by these regulations

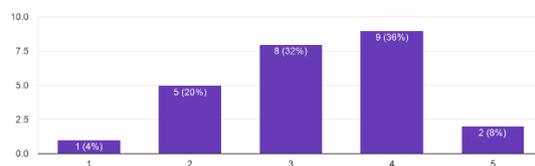
- Protection areas, zero pesticide, water resource preservation;
- We have adopted internal voluntary actions for: Biodiversity protection at sites (DWTPs/WWTPs) operated by Sofiyska voda; Certification under ISO 14001 and EMAS; Project for methane capture, electrical and thermal energy production in WWTP Kubratovo certified under Gold standard;
- Adoption of River Basin Management Plan;

➤ quality monitoring of treated effluents;

In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured?
25 responses

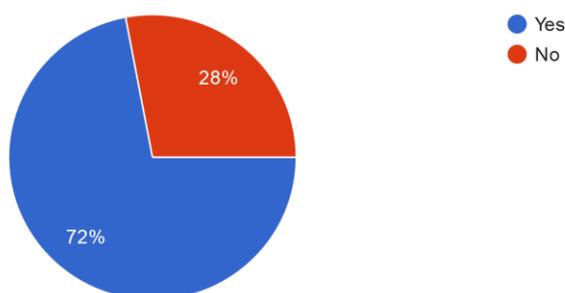


In your opinion, at the current state of art in terms of technology, how much this aspect of water security is ensured?
25 responses



In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security?

25 responses

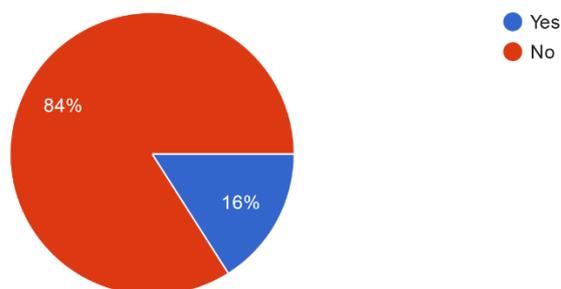


Specifications Provided:

- New legislation and employees, involved in the environmental aspect of water supply;
- Clean energy sources;
- Better appreciation of the individual needs of water users and particular vulnerability (through an intersectional lens);
- Monitoring of ecosystems in time through technology could help in faster and more efficient response to possible events that jeopardise the ecosystems. Such technologies could be sensors, and mostly data from satellite images that cover bigger areas;
- On-line sensors, toxicity bioassays, bio-monitoring;
- Help for people who cannot afford water;

Are you aware of specific CEN/CENELEC/ETSI standards that focuses or ensures this aspect?

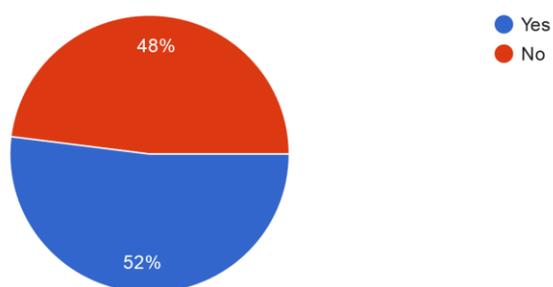
25 responses



- ISO 14001; EMAS; ISO 5001

In your opinion, are there any existing issues with existing security standards and policy that are counter-productive for achieving this specific asp... are rare, complex accreditation procedures etc.)?

25 responses

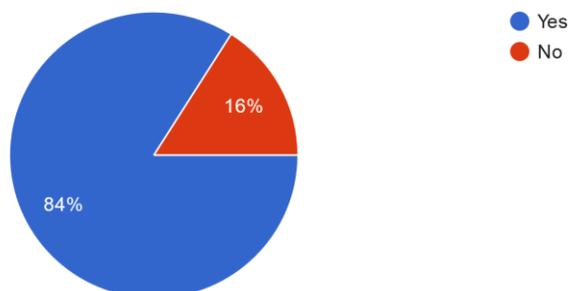


Specifications Provided:

- Not enough political engagement regarding the topic, therefore missing legislation and resources about it;
- Cost of wastewater treatment, in particular for micro pollutants;
- Conflict of interest;

Are there any other 'actors' (i.e. administrations, organizations, authorities etc.) which deal with this specific aspect of water security other than you own organization?

25 responses

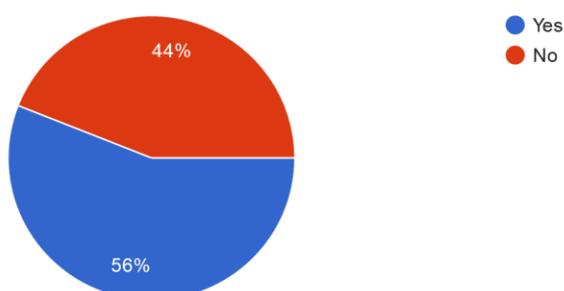


Specifications Provided:

- Department for International Development, Foreign and Commonwealth Office;
- Water administration, agriculture organization, industry;
- Ministry of Environment and Water;
- Ministry of Environment;
- Environmental authorities; Municipalities;
- National Ministries and local (municipalities) authorities;
- local and national administrations;
- environmental agencies, river basin agencies;
- Agences de bassin (in France);
- Energy and Water Regulatory Commission;

In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections wit... between your organization and these other ones?)

25 responses

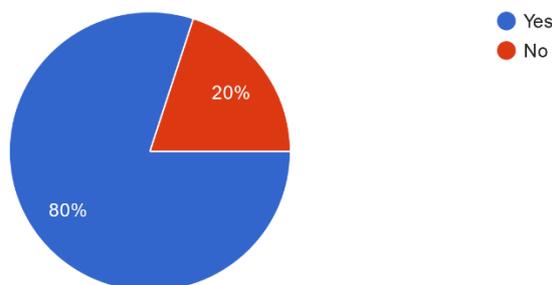


Comments/reflections:

- Poor collaboration with agriculture and industry;
- Communication of risk, human/ecosystem vulnerability, and prioritisation;

Do you think that improving these synergies could effectively help to achieve a better level of water security (focusing on this specific aspect)?

25 responses



Comments/reflections:

- By recognising and communicating vulnerabilities and risk in a robust manner, prioritisation can be developed in an equitable and just manner;
- Improving synergies is the key to political balance and common growth;

Additional suggestions of improvement in a future regulation to better achieve this specific aspect of water security

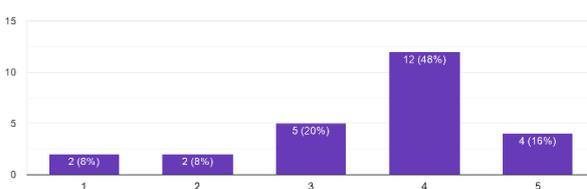
- Further guidance on understanding intersectional vulnerability and cross-border communication;
- include toxicity bioassays and/or bio-monitoring in the regulations;

Table 5. Summary of the analytics of the survey – part5

Section 5: Global Concept of Water Security

Considering all the previously discussed aspects that regard water security, how much do you agree with this statement: "the currently existing ...proach for dealing with water security as a whole"?

25 responses

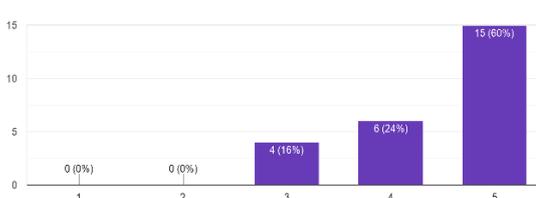


Comments/reflections:

- All European regulations have been elaborated independently from each other;
- When considered as a whole the regulatory framework in the EU addresses each aspect of this statement. The primary issues relate to the structural drivers of harm, such as underfunding, and economic policy;
- The deployment of Water Safety Plans at the European level will now lead to a

How much do you agree with this statement "reinforce connections, links and communication between existing plans and regulations about the di...help to improve water security at a global level"?

25 responses

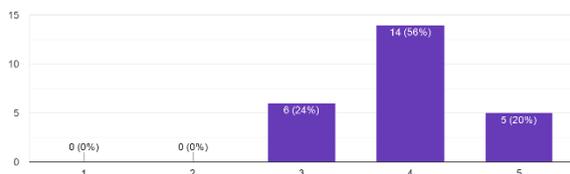


Comments/reflections:

- Given the cross-cutting and expansive nature of water security issues, reinforcing links and communication about the different aspects of water security is undoubtedly beneficial.

holistic approach of water safety including safety and security and a consideration of the whole water cycle in terms of quality and quantity.

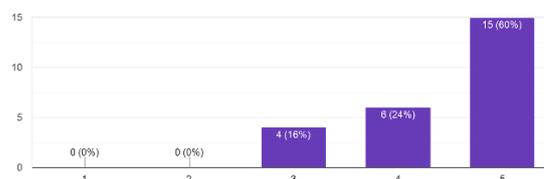
How much do you agree with this statement "The synergies between the various actors involved in the different aspects of water security are not suff...oper address the water security at a global level?"
25 responses



Comments/reflections:

- Water security is often considered as a minor issue compared to fire security, energy security, transport security, food security to cite a few;
- Many of the issues related to water security are being harmed by underlying structural issues. Locating the responsibility as the water service provider level may result in an inability to address the root causes of water insecurity.

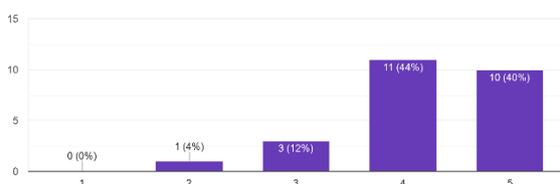
How much do you agree with this statement "reinforce these synergies between the various actors involved in the different aspects of water se...lp to improve the water security at a global level?"
25 responses



Comments/reflections:

- As above, the cross-cutting and expansive nature requires responses from a range of different actors.

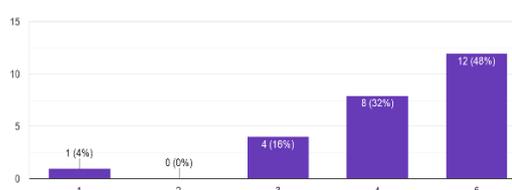
How much do you consider useful homogenizing all the different plans, procedures and regulations related to the various aspects of water security?"
25 responses



Comments/reflections:

- A common and harmonized framework may be beneficial in standardizing regulations. However, the local context of water supply, demand, social, economic, and environmental factors must be considered in order to be effective. Consideration should be paid to differences at local, regional, national, and supranational levels;
- At present it appears that much of the regulations and procedures are fragmented, and therefore potentially confusing/difficult to gather. Moreover, this may mean that scrutiny is less possible as

How much do you consider useful integrating all the different aspects of water security, with their dedicated regulation, into a unique dedicated European regulation?"
25 responses



Comments/reflections:

- As above, I believe this would be very beneficial in terms of accessibility and efficiency;
- European regulation would be a minimum level, each state issuing in complement specific regulations. It is already the case in France, and it's linked to civil and military protection;
- Water security encompasses many different aspects that cannot be integrated into a unique legislation. For more flexibility and rapidity in evolution, it is more efficient to have

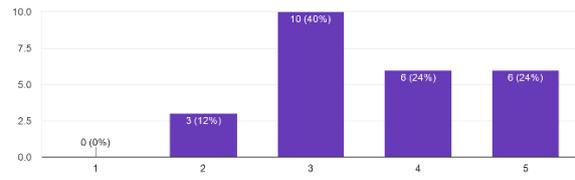
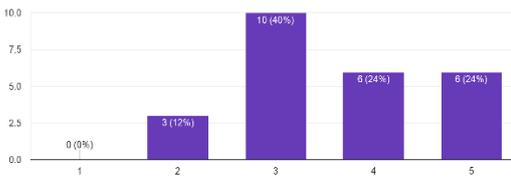
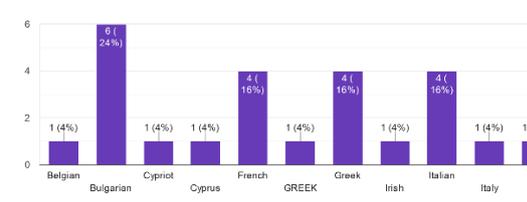
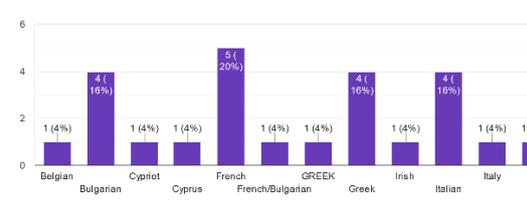
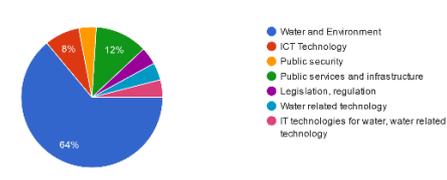
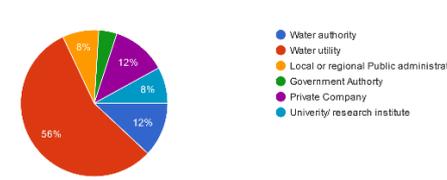
<p>only those with a knowledge of where to look are able to gain a knowledge of the regulations and procedures in practice;</p> <ul style="list-style-type: none"> ➤ It's good to harmonize plans and procedures but it is important to consider the different peculiarities of the single areas. 	<p>different specific legislations covering these different aspects.</p>
<p>Will you/your organization be willingly to support a similar initiative (proposing new standard from improve water security) into the future? 25 responses</p>  <p>Comments/reflections about regulation:</p> <ul style="list-style-type: none"> ➤ Regulation is not always an adequate answer to improve efficiency and collaboration. 	<p>Will you/your organization be willingly to support a similar initiative (proposing new standard from improve water security) into the future? 25 responses</p>  <p>Specific standard suggestion for improve water security regulation.</p> <ul style="list-style-type: none"> ➤ EN 15975-1

Table 6. Summary of the analytics of the survey – part6

Section 6: General Information	
<p>Nationality 25 responses</p> 	<p>Nationality of your organization 25 responses</p> 
<p>Main sectors pertinent to your organization 25 responses</p>  <p>Specifications Provided:</p> <ul style="list-style-type: none"> ➤ Drinking water production, water supply and sewerage; ➤ Human Rights, ethics and socio-legal approaches; ➤ In addition to the Emergency department, there is the Prevention Department with the Division "Health 	<p>Type of your organization 25 responses</p>  <p>Specifications Provided:</p> <ul style="list-style-type: none"> ➤ Research Organisation; ➤ ITI/ CERTH; ➤ SUEZ Water France; ➤ Public Health Authority of the Region of Central Macedonia;

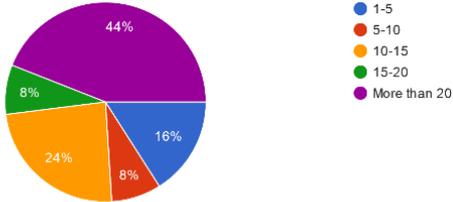
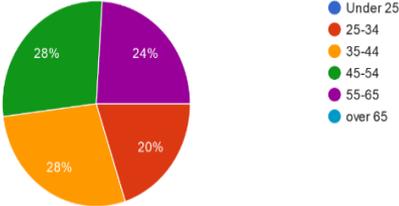
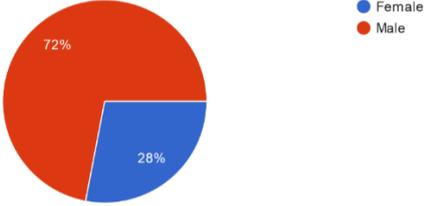
<p>and Environment": it has a role of vigilance on the urban and industrial development from a health point of view.</p> <ul style="list-style-type: none"> ➤ Public Health; ➤ Water supply, sewerage, and treatment; 	
<p>Your Professional Background 25 responses</p>  <p>Specifications Provided:</p> <ul style="list-style-type: none"> ● Specialist in international law; ● Geologist; ● Public Health Bachelor; 	<p>Years of professional experience 25 responses</p> 
<p>Age range 25 responses</p> 	<p>Gender 25 responses</p> 

Table 7. Summary of the analytics of the survey – part7

7. Critical analysis and policy recommendations

7.1 Comments and considerations related to European and international framework about water security

In Section 5 we discussed about the most relevant EU Directives (in-force and proposed) and initiatives for aqua3S project regarding water security. Each analyzed element has there been firstly summarized and then briefly commented from the point of view of water security. This paragraph is going to aggregate and summarise these analyses, and to explicit the considerations and conclusions that can be taken.

The first and most evident conclusion emerged from the analysis is the absence of a unique comprehensive regulation about water security, whereas the matter is threatened transversally in many different Directives, some of them neither strictly related to the “water sector” (as NIS Directive, EICD etc.). This, of course, is a direct consequence of the vastness of the topic of the water security itself, which envelope many different branched out aspects. Moreover, it is worth to be mentioned that the word ‘water security’ does not explicitly appear in any of these directives, who thus do not address themselves as ‘water security directives’. This situation could be explained again considering that, as discussed in §4.1, the official definition of water security is quite new and still not universally know (as emerged also from the results of the survey poll).

Thus, it is not surprising that most of the Directives analyzed focus on one of the specific topics recognized inside the definition of the water security (i.e. human right for water, preservation of ecosystem, qualitative and quantitative safeguard of the resource, safeguard of human health against water bone diseases, reduction of the negative impacts on environment and on society of the effects of water related disasters, protection against malicious threats for the drinking water sources and supply systems etc.), even if it is not unusual for one regulation having more or less explicit impacts also in other aspects. However, from the analysis of the regulation conducted, it emerged also than some of these topics (as the drinking water quality and the preservation of the water bodies, or the flood management and the security of the critical infrastructures) are traditionally treated by parallel lines of regulation and thus as separate matters, without points of common set out by the relative directives. As consequence (as was confirmed also by the results of the questionnaire), the different actors in charge for the implementation of a certain topic are usually unaware of the other lines of the water security regulation and of the interconnections between these different aspects.

The necessity to spread a common knowledge of the ramifications of the water security and to coordinate together the different topics, in order to ensure that they are not treated as separate parallel matters, is thus particular strong. This coordination should be done at many different scales and levels. For example, issue at the hand, most of these directives impose to their reference targets (who could be water utilities, water authorities, environmental agency, local government, etc., in other words the so called ‘actors of water security’) a common scheme to deal with a specific problem. Regardless the differences across directives, this approach is always similar and it usually consists in: an assessment the extension of a problem (i.e. flood risk, quality of the water, cybersecurity of the networks etc.) by a risk analysis; the identification of the actors involved, their specific competences and roles; the definition of a certain set of measures to address the problem (which could be preventive measures, protective measures, monitoring measures, new procedures etc...); finally, the redaction of a plan (a water safety plan, a flood risk management plan, a water management plan etc.) which summarizes the previous points.

Regardless the obvious advantage of imposing such a rigorous approach, it is quite clear that, if a minimum level of coordination is not ensured, this methodology could lead to an excessive fragmentation, as well as to the creation of many different plans with overlapping of contents and competences.

For that reason, it is essential to ensure coordination between the different actors and synergies between different plans, starting from the small scale (water utilities, local government bodies etc.) to the highest one (national and international coordination). Every actor of the water security should know the roles of the others and how they contribute to the final goal of enhancing water security. In addition, the goals and objectives of the other plans should be a common knowledge among the various actors involved into the water security, to ensure a clear understanding about how a set measures defined inside a specific regulation interacts with the aims of other water security regulations. This is a critical aspect, since some measures defined for achieving a specific goal of water security could be in contrast with other objectives (for example, the protection measures about natural or malicious hazards could deteriorate the quality status of the ecosystems; measures for ensure the adequate quantities of water for the socioeconomic development could impact on the environment and on the balance of the resources; security measures against external attacks to the water distribution network could result in less transparency for the customers, etc..). For that reason, there is need of a coordination at Community level about how the various actors involved have to conciliate these different, and in some case contrasting, needs, as well as a clear indication and orientation toward eventual **win - win measures**, that could encompass different goals.

Considering the water security as whole, it appears a concept too wide and complex to be regulated by one single Directive. Nevertheless, **there is the need of a common legislative instrument that is explicitly address to the water security as a whole, that should become a universally known terms, in all its implication, without ambiguities into its definition. This instrument should comprise all the existing regulations and provide a guidance about how to move between them;** this can achieve by creating (when do not exists), explicating (where are implicit) or strengthen (where are weak) the links and connections between these directives; a particular focus should be posed on aspects as: the roles of different actors, the coordination of different planes, the synergies between different type of measures.

Other general consideration that is emerged for the water security framework analysis is that, regardless the specific topic in analysis, climate changes can significantly impact on water security; many directives introduce the need to assess the problem of climate changes, and the EU itself adopted a common strategy of adaption; however, it is still not clear in many case **how to practically assess their impacts in the case of water security**, as well as how to consider them in an effective and meaningful way when redacting the various plans and defining the operative measures and procedures indicated by the regulations.

Furthermore, some aspect of water security, mainly the ones related to protection of water distribution networks (cyber security, enhancing of resilience etc.), are treated by regulations that are not water-centered (NIS, ECID, proposal of NIS2 and resilience of critical entities directives etc.). These normative settings ensure a common approach for all the infrastructures which provide essential services for the Community; however, since these essential infrastructures may have very different features and functions, water security framework could benefit from the **introduction sectorial regulations or guidance, which is specific for the water distribution network and for the water bodies** and which can thus address also to the water security specific needs.

Another general comment is that most of the European Directives about water security set out (minimum) qualitative or quantitative standards to be reached, as well impose minimum frequency for monitoring operations; however, they do not provide a common indication in terms of techniques, standards or technologies that can be used to achieve these goals. While an approach like this provides Single Member States with a huge degree of flexibility, from the other side it causes heterogeneity in the water distribution services across the European Union, as well as inside one single State; very common are situations of services aligned with the newest technologies and international standards, while other networks, even in a close geographical area, rely on antique procedure and legacy systems. This leads, of course, to different levels of water security; **guidance to the new standards and innovative technologies could be provided, in addition to qualitative thresholds indicated by the regulation.**

As final consideration, European regulation does not explicitly address as water as human right, like other international laws do, probably because the access to water is meant as a state of fact for many European Citizens (Europe is traditionally considered plenty of water sources). However, as data says, water resources in Europe are not unaffected by qualitative and quantitative deterioration and still minorities without water access exists (ScoCCA, 2019). In this sense, it should be specified that many of the latest water security related regulations (i.e., the WFD, FD etc.) include public participative process to enhance Citizens' participation and raise public awareness, with particular regards to the environmental preservation issue. Moreover, increasing the transparency related to the diffusion of information about the water supply and distribution networks has also been emphasized into the latest update of DWD, as consequence of the right2water initiative. However, the water is still currently treated mostly as a technical matter, in particular the water supply operators, who are often not fully aware of the legal and ethical implications behind the service they are providing. In the view of creating a unique framework for water security, the proper emphasis should be given also **to the need of marginalized categories and, more in general, to the concept of water as universal right for all the citizens.**

7.2 Comments and considerations from the survey poll amongst key stakeholder

The following considerations are based on the results of the survey provided by the stakeholders until the end January 2021 and extensively reported in §6.3. The sample of stakeholders is well assorted in terms of Nationality, as well age range and years of professional experience of the answerers, whereas about the 30% of them are females. Concerning the different sectors represented by the poll, the predominance is the water and environmental sector, even if many other sectors have been also represented (ICT, Public security, Public services and infrastructures, Legislation and regulation, water related technology development etc.). This heterogeneity is reflected also by the type of organizations represented into the poll, which mostly are water utilities, but there are also delegates from Water Authorities, Local or regional Public administrations, Government Authorities, Private Companies, Universities and or research institutes. Regarding the specific background of the answerers, it is mostly technical, even if a wide spectrum of different professional figures is included under this term: from water related technicians, ICT experts, geologists, economists, administration, managements, security experts, sustainable developers, etc.; legal and juridical background is also represented by the sample.

Based on these statistics, the sample, even if small, results well representative for dealing with the different aspects of water security.

Before proceeding further into the analysis, we briefly recall the subdivision in topics/aspects of water security used for the questionnaire and that will be taken as reference also for the following discussion:

- Aspect 1 of Water security definition: “safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development;
- Aspect 2a of water security definition: “ensuring protection against waterborne pollution and water-related disasters”. Focus on water related Natural disasters (flood, droughts etc.);
- Aspect 2b of water security definition: “ensuring protection against waterborne pollution and water-related disasters”. Focus on water related intentional human disaster (i.e., pollution and contamination) both accidental and voluntary;
- Aspect 3 of water security definition: preserving ecosystems in a climate of peace and political stability.

After this short premise, we can now focus onto the specific water-security related contents, provided by the stakeholders, and on the conclusions, we can take from these results.

Firstly, it is interesting that, as represented also during the analysis of the framework related to the water security, even if most of the answerers are experts into the water sector, there is still more than a 15% of them who is not aware of the official UN definition of water security.

The statistics provided are also representative of how the water security topic is wide; in fact, most of the stakeholders declared globally that their work is related to the water security in general terms; however, analyzing this data for the specific sectors identified inside the water security, the statistics are different, since not all the organizations represented in the poll deal with every aspect of water security; usually, their primary competences (that we can translated as rating 4 or 5 in the dedicated questions) are in fact limited to two or three aspects.

This result is not surprising, considering the vastness and variety of topics and regulation which fall under the umbrella of water security; thus, a sectorial development of competences has been expected.

For all of the aspects of the water security, however, more than half of the stakeholders declared that their organization has at least a medium (i.e., rating 3 or higher) relation with that specific aspect.

The highest scores in terms of relevance have been collected by the aspect 2b and aspect 1 (respectively the 84% and 80% of the answers falls in rating class 4, 3 or 5), whereas, on the contrary, the aspect 3 is the one with the lowest scores (32% of the results falls in rating 1 or 2). Aspect 2a is in the middle, since also in this case the 80% of the answerers declared at least a medium competence for their organization in this sector; however, the percentage of results falling into the medium class of relevance (score 3) is higher (32%) than the other aspects.

When asked to provide a list of reference regulations for their organization, the stakeholders mostly quoted the same European Directives previously analyzed in this document, with also additional remands to national regulations about drinking water, health, environment, and wastewater treatment. Common and frequent reference to the WFD (2000/60/EU) and the DWD appears in all the sectors; in addition, there are also recurring mentions to the FD and the Nitrates Directives, as well to water act and to the national transpositions of the EU regulation.

Regarding the measures adopted by the stakeholders' organizations to abide to the reference regulations, the contributions received are very various. Redaction and update of the plans indicated

by EU regulation (river basin plan, flood risk management plan, water safety plans, etc.) have been reported multiple times. In addition, some stakeholders reported specific technical procedures followed by their organization to ensure the required standards, this includes a wide spectrum of actions, such as: monitoring, laboratory analysis, quality controls in the network and treatment plans, installation of advanced online instrumentation and sensors, remote control systems, action to reduce water leakages, alarms systems, periodic emergency training and drills, continuity plan, procedures for biodiversity protection, etc. The variety of different measures indicated by the end users is remarkable and, again, very indicative of the vastness of the water security, as well as of the different approaches, actions, and professional figures necessary to deal with this topic.

When asked to rate how much every single aspect of water security is ensured by the current regulation, the results are generally positive for aspect 1, since the stakeholders mostly agree that a good level (rating 4) of water security is currently ensured. Similar qualitative results have been collected also for the question related to the level of water security ensured by the current technologies.

Mixed results have been instead obtained for the other three aspects, in particular for the 2a and 3; in these cases, we collect a relevant percentage of medium-low rating (i.e., 3 and 2 scores), which hints that more than one end user does not consider nor the current regulation, neither the legacy systems, fully adequate for ensuring these aspects of water security.

However, the end users agreed that there is room from improvement for any sector of water security, and that there are indeed many new technologies, standards, best practices, and procedures that could be adopted at a larger scale to further ensure water security.

Remarkably interesting suggestions have been added by the end users in this sense, which range for indication of technical equipment (ICTs, new advanced type of sensors, integration with satellite images, social media and UAVs) and the adoption of ISO/CEN standards, passing for the implementation of new procedures and of improved quality standards both for the workers and for the consumers, to the revision and update of current plans. More involvement of the Citizens in this topic, further support to marginalized people, a more sustainable use of the water and other resources, as well as the use of green energy sources, have been generally indicated as matters to focus on. in order to further enhance water security. The detailed suggestions of the end users are listed in §6.3.

Unlike the regulation, when asked about standards (like ISO/CEN/ETSI etc.), most of the end users declared unaware of the existence of specific ones related to their work. Considering the fact that the target of this survey has been an audience with very specific technical expertise in the water sector (competences that are also very evident from the suggestions and specifications provided in many other open questions of the survey), **this result is indicative of the lack of global knowledge and awareness about standardization, its relationship with the regulation and how this can improve water security.** The few users who are aware of such kind of standards quoted, for example: CEN/TC 2030 and 164, EN 15975 and 17034 (for aspect 1), ISO 14001 and 5001, EMAS (for aspect 4).

In occasion of the discussion about the presence of issues with existing water security regulation, as well standards and procedures, there has not been a general agreement between the end users. In fact, for all the four aspects of water security analyzed, the ratio of answers between 'yes' and 'no' has been (more or less) 50-50. Some users also provided clarifications to their answers. For example, regarding aspect 1, **recurring issues** have been identified in the high expenses for equipment, as well as the maintenance of the drinking network infrastructure; some others pointed out the difficulty to

recruit high qualified staff and, more in general, the high expertise necessary for use particular kind of equipment; an interesting comment regards the new skills requested by the digitalization and by the transition to the low-pollution and resource efficient management, skills that are not easily available in the market. Finally, one person complained about the political engagement and the decisions taken at that level, as well as the mentality of some of the actors and stakeholders involved in the water security. About the aspect 2a, in addition to the excessive costs of the equipment and the lack of qualified personnel, the stakeholders also expressed the opinion that this aspect is very complex and need global decisions; moreover, a difficulty into retrieving data from the different actors involved has been recognized.

Regarding the aspect 2b, the end users recognized as existing issue for ensure the water security, in addition to similar considerations already expressed in the previous sections, also: the outdated regulation, the lack of adequate controls and the difficulty to protect the water networks against hazardous events. Finally, regarding the latest aspect, the answerers recognized a lack of political engagement into the topic and thus a shortage of dedicated regulation and resources.

When the discussion shifted to the presence of other ‘actors’, globally the stakeholders agreed that in all the sectors of water security there are other organizations, than their owns, which have roles, competence and obligations. They also provided many examples, indicating a wide spectrum of public authorities and agencies, ministries, public or private companies, international groups, national, European, regional, or local public governments, public services suppliers, etc. This confirms again what already emerged by the analysis of the regulation framework: **ensure water security is not up to a single figure or organization, but it requires cooperation, coordination and integration of many different actors.**

When asked to express an opinion about the level of coordination and synergies currently ensured between these different actors to pursuit water security, the answers obtained are again mixed.

Regarding this, many interesting comments have been provided. Firstly, an end user raised the issue of the existing fragmentation of competence and the many overlapping of different plans (as civil protection plans with water management plans). This argument was confirmed by other comments which hope for more coherence between interconnecting plans. Regarding the communication in case of critical situations, some end users stated that there is a lack of defined protocols, and thus often the communication between the actors during the emergency has to rely on personal devices. Some other instead stated that, although there is cooperation and collaboration with the other actors in everyday work the emergency phase lacks adequate protocols. One answer said that the communication exists only at a bureaucratic level, not for emergency situations, while another expressed that the lack of time and common priorities slows the coordinated work of the various actors. An interesting comment regards the fact that ensure water security often requires synergies across stakeholders at a local level, whereas the decisions concerning water security are taken instead by stakeholders at regional or national level. An element of obstacle for ensuring the synergies has been recognized also in the different formats of data used by stakeholders, as well as in the difficulties in communicating risks and prioritizations. However, there are also some comments which express satisfaction about the level of synergies and cooperation currently ensured.

Nevertheless, **all the end users agreed that improving these synergies could help to achieve a better level of water security for all the aspects;** they also emphasized this concept in different comments. For example, it has been explicitly recognized that strengthen synergies will holistically improve water security, both on regular basis and in emergency.

Finally, when the survey asked to the end users to re-consider the water security as a whole, there has been a general agreement (score 4) that the currently existing plans and regulations about the different aspects of water security are not sufficiently related and connected together to ensure a comprehensive and unitary approach for dealing with water security as a whole.

A contrast opinion that has been collected argued that the EU regulatory addresses to the various aspect of water security, although a pending issue how to address to the structural drivers of harm, such as underfunding and the economic policy.

On the contrary, another user complained that water security is often considered a minor issue than other types of security (i.e., fire, food, transport, energy etc.). Furthermore, additional comments pointed out that the EU regulations have been elaborated independently each other and there is still a lack of holistic approach for water security. For example, the current methodology of the water safety plan does not integrate together safety and security, quality and quantity.

This aspect has also been confirmed by the general highest agreement (score 5) with the **need to homogenizing all the different plans, procedures and regulations related to the various aspects of water security**; wide consensus has been registered also by the need of **reinforce connections, links and communication between existing plans and regulations about the different aspects of water security**. Many remarks also emphasize this concept; however, a comment also recommends the importance, in parallel with this homogenization, to consider the different peculiarities of the single areas.

Most of the end users also agreed that the synergies between the various actors involved in the different aspects of water security are not sufficiently strong to proper address the water security at a global level; coherently, they also approved that improve these synergies could lead to enhance the water security.

About this topic, a user clarified that many issues related to water security are structural, and thus locating the responsibilities and causes at the water service provider level is not enough to address the root causes of the problem.

A general agreement has also been raised by the statement related to the need to integrate the different aspect of water security into a unique dedicated European regulation.

In that sense, the few lowest scores (i.e., the 20% of the scores equal or minor than 3) have been justified by two argumentations: the first is that European framework would be at a minimum level, in order to let each state issuing specific regulations in complement. The other comment regards the fact that water security encompasses many different aspects that cannot be integrated into a unique legislation; for more flexibility and rapidity in evolution, it is more efficient to have different specific legislations covering these different aspects.

Nevertheless, most of the answers declared **willingly to support future initiatives to enhance water security in terms of both regulation as well as standardization.**

Additional suggestions for future water security regulation about various issues have been also provided by the end users. For example;

- Enhance the share of experience between different actors and sectors;
- Focus on the predictions of disasters;
- Increase restrictions and penalties towards polluters;
- Unify in a single plan the many different ones who pursue the same objective;
- Clarify and further define the domain, roles and competence of the different actors involved;

- Impose, as priority action for all the water utilities, the security of their service, as well as higher quality indicators;
- Impose new advanced analysis techniques (i.e., toxicity bio-assays and bio-monitoring) into the regulation;
- include specific guidance in relation to many different technical issues, such as: communication protocols between different actors during the emergency, processes to collect citizen generated information, use of sensor technologies to detect anomalies, indications for understand intersectional vulnerabilities, procedures for cross border communication.

7.3 Summary of policy recommendations

The two analyses conducted in this deliverable, the one related to the current and proposed legal framework about water security, the other based on the survey poll amongst key stakeholders, lead to similar conclusions that can be here summarized as policy recommendations for future water security dedicated regulation:

- Water security appears as a concept too wide and complex to be regulated by one single Directive. Nevertheless, there is the need of a common legislative instrument that is explicitly address to the water security as a whole, which should remand to all the dedicated directives, providing also to the various actors a guidance and coordination when moving through the complex existing framework;
- Increase the political engagement in water security, as it is generally seen a ‘secondary issue’ respect to other types of security;
- Water security should become a universally known term, in all its implication, without ambiguities into its definition. It should be ensured at a normative level that all the actors are aware of: the different ramifications of the water security, the presence and roles of the other actors involved in this topic; the main goals of other water security regulations. This is crucial in order to ensure that different aspects of water security are not treated as separate parallel matters, or even worse, contrasting one to each other;
- It is desirable a guidance at European level aimed to create (when do not exists), explicate (where are implicit) or strengthen (where are weak) the links and connections between the water security directives. A specific focus should be given on issues as: the roles of different actors, the coordination of different planes, the synergies between different types of measures. These synergies should be ensured at every scale (from local distribution systems, to the national and international context);
- The coordination at Community level should provide indication about how the various actors involved have to conciliate the different, and in some cases even contrasting, needs related to the many aspects of water security; a clear orientation should be configured towards eventual **win - win measures**, namely measure that can achieve simultaneously the goals of different directives;
- Enhancing synergies, cooperation and collaboration of different actors should be ensured even in case of water security related emergency;
- **The Introduction of sectorial regulation or guidance specific for the water distribution networks and for the water bodies**, to integrate the aspects of water security which are currently treated by generic regulations (i.e., by regulation that are not water-centered, such as: cyber security, resilience, protection of critical infrastructure about natural and malicious hazards, etc.);
- Try to overcome some structural issues identified, such as the general underfunding in the water sectors, which instead requires a greater financial support to cope with the expense due equipment, monitoring, quality control procedures and the maintenance of the infrastructure;

- Provide to the technical staff of the water security sector (i.e. water utility operators) a guidance about international standards, new technologies and procedures, in order to overcome a general lack of specific knowledge regarding the latest technical and scientific developments, as well as to raise the awareness about specific tools, procedures and standardization aspects available on the market that can improve water security;
- Since In recent years, there were many innovations linked to the regulatory and legislative context, mainly due to the revision of obsolete standards and the publication of new sector regulations, it is important to underline the close relationship between technical standards and legislation because very often, operators consider that the application of the standard is not mandatory - and this is not always true;
- Water is still treated mostly as a mere ‘technical matter’. In the view of creating a unique framework for water security, the proper emphasis should be given to issues as the inclusion of marginalized categories, the transparency to the Customer, and, more in general, the water as universal right for all the Citizen. This includes also raising the awareness of water supply operators about the legal and ethical implications for the service they are providing;
- Provide a clear guidance about specific topics identified by the stakeholders because they are not treated by enough detail by the current regulation (such as assessing the impact of climate changes, protocols of communications between different actors during the emergency, processes to collect citizen generated information, use of sensor technologies to detect anomalies, forecasts of hazardous events, understand intersectional vulnerabilities, establish cross border communications etc.).

8. Conclusion and next steps

The present document summarizes the work carried out until M18 in relation to task T9.1. As first step, the concept of water security itself has been clarified, based onto the international framework and debate. Once identified the real extension of the concept, the current and proposed European legal framework regulating water security has been explored to understand the policy requirements that need to be put in place to fully implement the aqua3S technologies. The most relevant results in this sense are summarized in §7.1.

Exploring the European legal framework has been fundamental also to create the survey that has been diffused amongst the key stakeholders of the water sector. The survey poll does not only limit to understand which aspects of the current regulation are adequate or – on the contrary – outdated- in the stakeholders’ opinion; but it is also targeted to gain feedbacks from stakeholders about new standards, best practices, strategies, and technologies that, if adopted at a European level, could help to enhance the water security in all its aspects. The most relevant results in this sense are summarized in §7.1.

As final step, the outcomes of these two activities lead to the summary of the Policy recommendations presented in §7.1.

These results are strictly interlinked to the outcomes of T9.2 (Standardisation, strategy and policymaking. Guidelines), which follows a specular approach for the standardization. In addition, the survey about water security presented in this deliverable also included some questions about the standards, which can be useful for T9.2 as well.

Considered together, the results of T9.1 and T9.2 are going to provide an overview of gaps, needs and opportunities within the scope of aqua3S regarding the water security in it entirely, including both policy and standardization. For this reason, they are fundamental for T9.3 “Guidance for responsible applications of water security standards and policy”, which will build upon the results of Task 2.4 and the frameworks identified in Task 9.1 and Task 9.2, particularly in relation to the full implement the aqua3S innovative technologies; T9.3 will then develop guidance for the development and implementation of future of water security standards and disseminate these in the form of a white paper for the identified key stakeholders.

In addition, the results presented in this deliverable are strictly related to many other work packages of aqua3S - as WP2, WP8 and WP10 - and could be useful also to orient the next pilots for testing the prototypes of the aqua3S platform.

The future steps will focus of disseminating these results, taking advantage also of the dedicated aqua3S channels. For example, these outcomes are going to be presented in occasion of the standardization workshop scheduled for the 29th of March 2021.

Moreover, even if for the purpose of this deliverable we have presented the results of the survey poll collected until the end of January 2021, the poll itself is still open and the aqua3S consortium is actively disseminating it to external stakeholders. Thus, in case of new relevant contributions collected after the submission of the present document, the updates will be presented in the other WP9 deliverables.

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10. Appendix I – The form of the Survey Poll

The online form for the survey can be found at: https://docs.google.com/forms/d/1WRuYdXz-FoZij_D8ZGI85INf4n.

T9.1 Survey Poll about legal framework regarding water security

aqua3S: Enhancing standardisation strategies to integrate innovative technologies for Safety and Security in existing water networks.H2020-SU-SEC-2018: Pre-normative research and demonstration for disaster-resilient societies.

* Required

aqua3S project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 832876.



INTRODUCTION**Project brief description:**

Exposure of citizens to potential disasters has led to vulnerable societies that require risk reduction measures. Drinking water is one of the main risk sources when its safety and security are not ensured. aqua3S project steps in to combine novel technologies in water safety and security, aiming to standardize existing sensor technologies complemented by state-of-the-art detection mechanisms. Find out more at www.aqua3s.eu

About this survey

As part of the T9.1 of WP9 of aqua3S project, this form represents a survey poll about water security amongst key stakeholders in the sector of water. It aims to identify existing criticism and issues with the existing water security legislative environment and identify the basis for update the european policy. Based also on the outcomes of this survey, aqua3S consortium will develop policy recommendations for the future of water security in the form of a white paper for policy makers, water authorities, and community leaders. You have been invited to take part in the European Commission funded aqua3S project coordinated by the Centre for Research & Technology Hellas. The aqua3S consortium will be conducting this research. Your participation is voluntary, and you are free to withdraw your participation at any time. Before you decide whether or not to take part, you should understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask questions.

INFORMATION SHEET**Project brief description:**

Exposure of citizens to potential disasters has led to vulnerable societies that require risk reduction measures. Drinking water is one of the main risk sources when its safety and security are not ensured. aqua3S project steps in to combine novel technologies in water safety and security, aiming to standardize existing sensor technologies complemented by state-of-the-art detection mechanisms. Find out more at www.aqua3s.eu

About this survey

As part of the T9.1 of WP9 of aqua3S project, this form represents a survey poll about water security amongst key stakeholders in the sector of water. It aims to identify existing criticism and issues with the existing water security legislative environment and identify the basis for update the european policy. Based also on the outcomes of this survey, aqua3S consortium will develop policy recommendations for the future of water security in the form of a white paper for policy makers, water authorities, and community leaders. You have been invited to take part in the European Commission funded aqua3S project coordinated by the Centre for Research & Technology Hellas. The aqua3S consortium will be conducting this research. Your participation is voluntary, and you are free to withdraw your participation at any time. Before you decide whether or not to take part, you should understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask questions.

CONTACT FOR QUESTIONS, CONCERNS, OR FURTHER INFORMATION

If you have any questions about this research or your prospective involvement in it, please contact:

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Data Controllers/Data Controller contact point
Each aqua3S partner (listed above) is a joint-data controller.

The contact point for the aqua3S data controllers is:
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Trilateral Research Ltd,
Marine Point (2nd Floor),
Belview Port, Waterford, X91 W0XW,
Ireland

By signing this form, you agree to take part in the aqua3S research. The nature of the research, your involvement in it and your rights regarding your participation in the Action are explained in the Information Sheet accompanying this form.

1. Please place an "X" in the boxes to affirmatively consent to the following statements. *

Check all that apply.

- 1. I consent to my survey answers being included within aqua3S research, including my nationality, my organization, my function, gender & age bracket.
- 2. I consent to having my survey answers be used in aqua3S research and publications and to be quoted in academic and policy presentations and publications.
- 3. I understand my right to request access to any, and all, personal information that I have voluntarily provided as part of my participation, and that I may ask for that information to be rectified and/or amended if it is inaccurate, or request that all personal information that I have provided be deleted.
- 4. I understand that I am free to withdraw my consent without negative consequence at any time without giving reason and that my participation in this project is voluntary.
- 5. I understand that I am free to withdraw my consent without negative consequence at any time without giving reason and that my participation in this project is voluntary.
- 6. I agree to voluntarily take part in the aqua3S research.

Definition
of Water
security

In 2013, the UN Water defined water security as "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 waterborne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability" (UN Water, 2013).

2. Are you aware of this definition? *

Mark only one oval.

Yes

No

3. How much is the work of your organization globally related to this concept of water security? *

Mark only one oval.

1 2 3 4 5

not related fully related

There are any of these aspects of the definition (listed below) of water security that are not strictly related to the work of your organization?

Please, select 'yes' or 'no' for each of the following aspect

4. Aspect1: safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development. *

Mark only one oval.

Yes

No

5. Aspect2: “ensuring protection against waterborne pollution and water-related disasters (l.e. floods, droughts etc.)” *

Mark only one oval.

Yes

No

6. Aspect 3: "preserving ecosystems . in a climate of peace and political stability"

*

Mark only one oval.

Yes

No

Aspect 1 of Water security definition: "safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socio-economic development.

Let's try to answer to the following question focusing only on the aspect in the title

7. Focusing only on this specific aspect of water security, how much is the work of your organization related to it? *

Mark only one oval.

1 2 3 4 5

not related fully related

8. Are you aware of specific regulation (European and/or National) which focuses or ensure this aspect? *

Mark only one oval.

yes

No

9. Could you please indicate it/them?

10. In case of positive answer to the previous questions, can you describe what measures you have adopted in order to abide by these regulations (e.g. does your organization have special equipment installed in your premises? Does it employ people of certain expertise? do you run tests/checks on a frequent basis? etc.)

11. In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured? *

Mark only one oval.

	1	2	3	4	5	
very poorly ensured	<input type="radio"/>	very strongly ensured				

12. In your opinion, at the current state of art in terms of technology, how much this aspect of water security is ensured? *

Mark only one oval.

1 2 3 4 5

very poorly ensured very strongly ensured

13. In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security? *

Mark only one oval.

Yes

No

14. If yes was the answer to the previous question, could you please provide some examples?

15. Are you aware of specific CEN/CENELEC/ETSI standards that focus on or ensure this aspect? *

Mark only one oval.

Yes

No

16. If yes was the answer to the previous question, could you please indicate the standard(s)?

17. In your opinion, are there any existing issues with existing security standards and policy that are counter-productive for achieving this specific aspect of water security (i.e. special equipment too expensive, the highly specialized professionals are rare, complex accreditation procedures etc.)? *

Mark only one oval.

Yes

No

18. If yes was the answer to the previous question, could you please provide some examples?

19. Are there any other 'actors' (i.e. administrations, organizations, authorities etc.) which deal with this specific aspect of water security other than you own organization? *

Mark only one oval.

Yes

No

20. If yes was the answer to the previous question, could you please provide some examples?

21. In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections with different plans, defined protocols of communication and cooperation during the emergencies, etc.) between your organization and these other ones? *

Mark only one oval.

Yes

No

-
26. Focusing only on this specific aspect of water security, how much is the work of your organization related to it? *

Mark only one oval.

1 2 3 4 5

not related fully related

25. What also, in your opinion, could be improved in a future regulation to better achieve this specific aspect of water security?

27. Are you aware of specific regulation (European and/or National) which focuses or ensure this aspect? *

Mark only one oval.

yes

No

28. Could you please indicate it/them?

-
-
29. In case of positive answer to the previous questions, can you describe what measures you have adopted in order to abide by these regulations (e.g. does your organization have special equipment installed in your premises? Does it employ people of certain expertise? do you run tests/checks on a frequent basis? etc.)
-
-
-

30. In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured? *

Mark only one oval.

	1	2	3	4	5	
very poorly ensured	<input type="radio"/>	very strongly ensured				

31. In your opinion, at the current state of art in terms of technology, how much this aspect of water security is ensured? *

Mark only one oval.

	1	2	3	4	5	
very poorly ensured	<input type="radio"/>	very strongly ensured				

32. In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security? *

Mark only one oval.

Yes

No

33. If yes was the answer to the previous question, could you please provide some examples?

- 3 . 34. Are you aware of specific CEN/CENELEC/ETSI stan t
ensure this aspect? *

Mark only one oval.

Yes

No

35. If yes was the answer to the previous question, could you please indicate the
standard(s)?

36. In your opinion, are there any existing issues with existing security standards
and policy that are counter-productive for achieving this specific aspect of
water security (i.e. special equipment too expensive, the highly specialized
professionals are rare, complex accreditation procedures etc.)? *

Mark only one oval.

Yes

No

37. If yes was the answer to the previous question, could you please provide
some examples?

4 .

t

38. Are there any other 'actors' (i.e. administrations, organizations, authorities etc...) which deal with this specific aspect of water security other than you own organization? *

Mark only one oval.

Yes

No

39. If yes was the answer to the previous question, could you please provide some examples?

40. In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections with different plans, defined protocols of communication and cooperation during the emergencies, etc.) between your organization and these other ones? *

Mark only one oval.

Yes

No

4 .

t

44. What also, in your opinion, could be improved in a future regulation to better achieve this specific aspect of water security?

- 4 . 45. Focusing only on this specific aspect of ' s
of your organization related to it? *

Mark only one oval.

	1	2	3	4
not related	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

46. Are you aware of specific regulation (European and/or National) which
focuses or ensure this aspect? *

Mark only one oval.

yes

No

47. Could you please indicate it/them?

48. In case of positive answer to the previous questions, can you describe what
measures you have adopted in order to abide by these regulations (e.g. does
your organization have special equipment installed in your premises? Does it
employ people of certain expertise? do you run tests/checks on a frequent
basis? etc.)

4 .

49. In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured? *

Mark only one oval.

	1	2	3	4	5	
very poorly ensured	<input type="radio"/>	very strongly ensured				

50. In your opinion, at the current state of art in terms of technology, how much this aspect of water security is ensured? *

Mark only one oval.

	1	2	3	4	5	
very poorly ensured	<input type="radio"/>	very strongly ensured				

51. In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security? *

Mark only one oval.

Yes

No

- 4 . 52. If yes was the answer to the previous question, could you please provide some examples?

53. Are you aware of specific CEN/CENELEC/ETSI standards that focuses or ensures this aspect? *

Mark only one oval.

Yes

No

54. If yes was the answer to the previous question, could you please indicate the standard(s)?

- 4 . 55. In your opinion, are there any existing issues with existing security standards and policy that are counter-productive for achieving this specific aspect of water security (i.e. special equipment too expensive, the highly specialized professionals are rare, complex accreditation procedures etc.)? *

Mark only one oval.

Yes

No

56. If yes was the answer to the previous question, could you please provide some examples?

57. Are there any other 'actors' (i.e. administrations, organizations, authorities etc.) which deal with this specific aspect of water security other than your own organization? *

Mark only one oval.

Yes

No

58. If yes was the answer to the previous question, could you please provide some examples?

59. In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections with different plans, defined protocols of communication and cooperation during the emergencies, etc..) between your organization and these other ones? *

Mark only one oval.

Yes

No

60. If you want, you can add here some comments to the previous question

61. Do you think that improving these synergies could effectively help to achieve a better level of water security (focusing on this specific aspect)? *

Mark only one oval.

Yes

No

62. If you want, you can add here some comments to the previous question

Aspect 3 of water security definition:
preserving ecosystems in a climate of
peace and political stability

Let's try to answer to the following
question focusing only on the aspect
in the title

63. What also, in your opinion, could be improved in a future regulation to better achieve this specific aspect of water security?

64. Focusing only on this specific aspect of water security, how much is the work of your organization related to it? *

Mark only one oval.

1 2 3 4 5

not related fully related

65. Are you aware of specific regulation (European and/or National) which focuses or ensure this aspect? *

Mark only one oval.

yes

No

66. Could you please indicate it/them?

67. In case of positive answer to the previous questions, can you describe what measures you have adopted in order to abide by these regulations (e.g. does your organization have special equipment installed in your premises? Does it employ people of certain expertise? do you run tests/checks on a frequent basis? etc.)

68. In your opinion, at the current state of art in terms of regulation, how much this specific aspect of water security is ensured? *

Mark only one oval.

	1	2	3	4	5	
very poorly ensured	<input type="radio"/>	very strongly ensured				

69. In your opinion, at the current state of art in terms of how well is this aspect of water security is ensured? *

Mark only one oval.

	1	2	3	4	5	
very poorly ensured	<input type="radio"/>	very strongly ensured				

70. In your opinion, are there new technologies, best practices, standards, procedures etc. that, if adopted at a large, scale could improve this aspect of water security? *

Mark only one oval.

- Yes
 No

71. If yes was the answer to the previous question, could you please provide some examples?

72. If you were aware of specific CEN/CENELEC/ETSI standards that focus or ensure this aspect? *

Mark only one oval.

Yes

No

73. If yes to the answer to the previous question, could you please indicate the standard(s)?

74. In your opinion, are there any existing issues with existing security standards and policy that are counter-productive for achieving this specific aspect of water security (i.e. special equipment too expensive, the highly specialized professionals are rare, complex accreditation procedures etc.)? *

Mark only one oval.

Yes

No

75. If yes was the answer to the previous question, could you please provide some examples?

. If y w a t o l s i

76. Are there any other 'actors' (i.e. administrations, organizations, authorities etc.) which deal with this specific aspect of water security other than you own organization? *

Mark only one oval.

Yes

No

77. es s he answer to the previous question, c uld you p ea e provide some examples?

78. In case of presence of many 'actors' involved, do you think there are enough synergies (collaboration in everyday works, connections with different plans, defined protocols of communication and cooperation during the emergencies, etc.) between your organization and these other ones? *

Mark only one oval.

Yes

No

- . If you want to add here some comments to the previous question
79. If you want, you can add here some comments to the previous question

80. Do you think that improving these synergies could effectively help to achieve a better level of water security (focusing on this specific aspect)? *

Mark only one oval.

Yes

No

81. If you want, you can add here some comments to the previous question

82.

83.

Global
Concept
of Water
security.

Let focus now onto the water security in its entirety (consider the whole UN definition of water security: 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 waterborne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability")

1 2 3 4 5

Strongly disagree Strongly agree

84. If you want, you can add here some comments to the previous question

85. How much do you agree with this statement “reinforce connections, links and communication between existing plans and regulations about the different aspects of water security could help to improve water security at a global level”? *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	Strongly agree				

86. If you want, you can add here some comments to the previous question

88. If you want, you can add here some comments to the previous question

87.

1 2 3 4 5

Strongly disagree Strongly agree

89. How much do you agree with this statement “reinforce these synergies between the various actors involved in the different aspects of water security could help to improve the water security at a global level?” *

Mark only one oval.

1 2 3 4 5

Strongly disagree Strongly agree

90. If you want, you can add here some comments to the previous question

8 . If you want, you can add here some comments to the previous question

91. How much do you consider useful homogenizing all the different plans, procedures and regulations related to the various aspects of water security”?

*

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	Strongly agree				

92. If you want, you can add here some comments to the previous question

93. How much do you consider useful integrating all the different aspects of water security, with their dedicated regulation, into a unique dedicated European regulation"? *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	Strongly agree				

94. If you want, you can add here some comments to the previous question

96. If you want, you can add here some comments to the previous question

95.

1 2 3 4 5

Strongly disagree Strongly agree

97. Do you have any specific policy suggestion in this direction?

98. Do you have any specific standards (i.e CEN/CENELEC/ETSI) suggestions that can help to improve water security?

0 If **Nationality** you can add here some comments to the previous question

99. Will you/your organization be willingly to support a similar initiative (proposing new standard from improve water security) into the future? *

Mark only one oval.

	1	2	3	4	5	
Strongly disagree	<input type="radio"/>	Strongly agree				

General information

101. Nationality of your organization *

- . If you want, you can add here some comments to the previous question

102.

103. If you want, you can add here some specification to the previous question

104. Type of your organization *

Mark only one oval.

- Water authority
- Water utility
- Local or regional Public administration
- Government Authority
- Private Company
- University/ research institute
- Other: _____

5 If you want, you can add here some specification to the previous question

106. Your Professional Background *

Mark only one oval.

- Technical, water related
- legal, juridical
- Technical, ICT technologies
- Administrative
- Managment
- Economic
- Other: _____

107. If you want, you can add here some specification to the previous question

108. Years of professional experience *

Mark only one oval.

- 1-5
- 5-10
- 10-15
- 15-20
- More than 20

9 Age range *

Mark only one oval.

Under 25

25-34

35-44

45-54

55-65

over 65

110. Gender *

Mark only one oval.

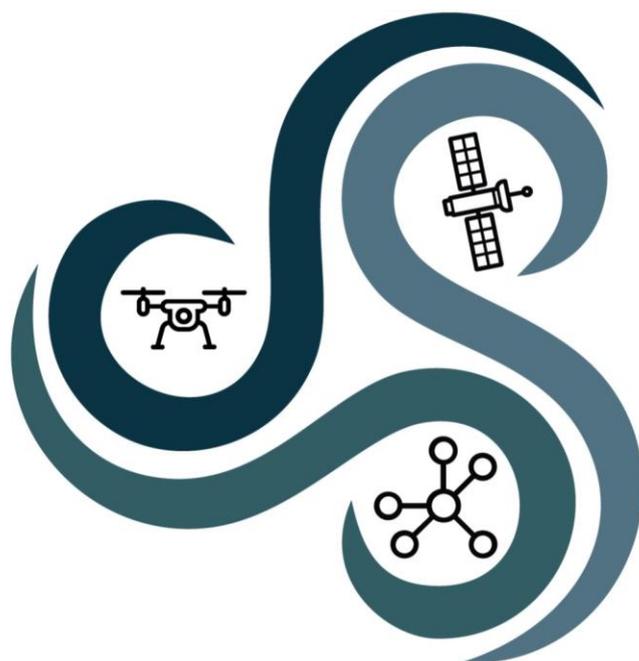
Female

Male

Thank you for your
kindly collaboration

Your input has been highly appreciated and will provide an important contribution to the project.

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aqua3S

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