AQUARES
Interreg Europe

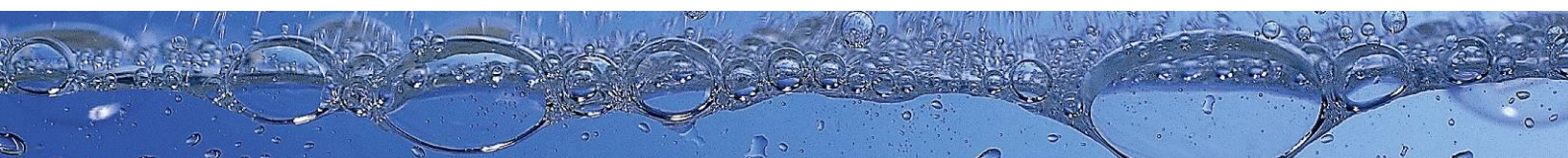
European Union
European Regional
Development Fund

EVALUATION REPORT ON WATER REUSE TECHNOLOGIES AND PRACTICES IN AQUARES REGIONS

AQUARES A1.4: EVALUATION OF BEST PRACTICES FOR MONITORING, ASSESSING, AND ENSURING COMPLIANCE WITH WATER REUSE STANDARDS

November 2020

OOWV
Oldenburgisch-Ostfriesischer Wasserverband



Authors

IWW Water Centre
Moritzstraße 26
45476 Mülheim an der Ruhr
www.iww-online.de

Kristina Wencki (Project Lead)
Phone: +49 (0)208 40303-341
k.wencki@iww-online.de

Alexandra Schmuck
Phone: +49 (0)208 40303-257
a.schmuck@iww-online.de

Oldenburgisch-Ostfriesischer-Wasserverband (OOWV)
Georgstraße 4
26919 Brake

Silke Mollenhauer
Telefon: +49 (0)4401 916-3302
mollenhauer@oowv.de
www.oowv.de

Processing Period: August 2020 to November 2020

Results of the project with service no. 10187/2020/25514

IWW Rheinisch-Westfälisches Institut für Wasser
Beratungs- und Entwicklungsgesellschaft mbH

Mülheim an der Ruhr, den 16.11.2020

ppa. i.V.

Dr. D. Schwesig A. Hein

Executive Summary

"Water reuse policies advancement for resource efficient European regions" (AQUARES) is an INTERREG Europe project that brings together ten partners from nine countries to achieve efficient water management through water reuse. With regards to this, AQUARES activity 1.4 (A 1.4) focusses on existing water reuse monitoring practices used in the AQUARES partner countries Czech Republic, Germany, Greece, Italy, Latvia, Malta, Poland, Slovenia, and Spain. The objective of this study was to assess and identify the best practice that ensures compliance with existing national and European water reuse standards (WRS) applying for different sectors, e.g. agricultural, industrial or environmental uses.

Relevant data was identified by the AQUARES partners in a desk research and collected using a specially developed data collection tool. Based on the information provided, monitoring practises were evaluated individually according to a predefined point system in order to derive a ranking of the individual national approaches with regards to their level of effectiveness. In sum, the Maltese monitoring practise received the highest score and was classified as the most effective monitoring practice to ensure compliance with WRS. The Maltese monitoring practise is based on a guideline developed by the Joint Research Centre (JRC), which was also a major information source for the European Regulation on minimum quality requirements on water reuse in agricultural irrigation that entered into force in May 2020.

Key findings and conclusions drawn from the evaluation of the best practices for monitoring, assessing and ensuring compliance with WRS include:

- Practicability and flexibility: Monitoring programmes should be made fit-for-purpose ensuring minimum quality requirements but maintaining enough flexibility to allow for stricter emission limits depending on the local conditions of individual regions/member states, more frequent monitoring, and other influencing factors such as technical advances (e.g. monitoring equipment, method) and changes in focus parameters (e.g. emerging pollutants).
- Conformity with overriding directives and laws: Member states that already have a WRS in place may have to adapt their current practise to ensure conformity with the new EU regulations that entered into force in May 2020 and will be apply from 26 June 2023. However, if the WRS is already following an established approach (WHO, ISO, JRC) only minor adaptations such as frequency of monitoring, risk management or the inclusion of certain parameters may be needed.
- Level of digitalization: Digitalization can help to minimise health and environmental risks, e. g. through online (real time) monitoring of critical control points (CCPs).

Collecting monitoring data online might generate additional benefits such as the potential to use big data analysis. Beyond monitoring, digitalization might help to manage water networks more systematically by installing intelligent sensors and benefit from opportunities such as smart metering.

- Transparency: Communicating the results to the public can help to increase confidence in water reuse projects.
- Compliance mechanisms: WRS should be accompanied by organisation structures with clear responsibilities and adequate measures defined to ensure compliance and efficiency of the requirements made.

Abbreviations

A 1.4	AQUARES Activity 1.4
BOD_5	Biochemical Oxygen Demand after 5 days
CCPs	Critical Control Points
DWD	Drinking Water Directive
EC	European Commission
ICT	Information Communication Technology
ISO	International Organization for Standardization
JMD	Joint Ministerial Decree
JRC	Joint Research Centre
RBMP	River Basin Management Plan
SSP	Sanitation Safety Planning
TSS	Total Suspended Solids
UWTD	Urban Wastewater Treatment Directive
WHO	World Health Organisation
WFD	Water Framework Directive
WRS	Water Reuse Standard(s)
WWTP	Wastewater Treatment Plant

Contents

List of Figures

List of Tables

1 Introduction

In May 2020 the EU regulation No. 2020/741 on minimum requirements for water reuse for agricultural irrigation entered into force. This regulation is a response of the European Commission (EC) to the issue of growing water scarcity. Water scarcity has increased across the European Union in terms of quantity (e.g. limited access to new conventional water resources) and quality (e.g. contamination of water resources). In the next decades, water stress is likely to continue to intensify due to various reasons such as climate change (leading to changes in precipitation patterns, higher frequency and severity of droughts, higher irrigation water demand) and regional economic and/or population growth (leading to increased water demand for industrial and municipal purposes). According to the EC, it can be estimated that water scarcity currently affects at least 11% of the European population and 17% of the EU territory. The Mediterranean region is particularly affected by water scarcity with approximately 20% of the population living under constant water stress (EC 2017). In the Mediterranean area- but also selected other EU regions- freshwater resources are often not sufficient with regards to quantity and water quality to satisfy a populations water needs. Thus, alternative water resources, such as reclaimed water from treated municipal wastewater, are more and more considered as reliable alternatives to satisfy water demand.

Water reuse can and should be practised best fit-for-purpose in order to ensure fulfilment of the usage-dependent quality requirements for agricultural irrigation, industrial reuse, aquifer recharge or even potable reuse. Water reuse technologies are implemented worldwide, notably the US, Australia, Singapore, and Israel. In Europe there is still a high but nearly untapped potential. In northern Europe, recycled water is mainly used for urban, environmental or industrial applications. Best practice examples for the reuse of urban wastewater for industrial purposes, and for aquifer recharge can be found in the city Terneuzen in the Netherlands, and in Wulpen-Torreele-St. André in Belgium, respectively (Becker et al. 2017). Despite being coastal cities, water resources are limited in both regions due to the constant threat of saltwater intrusion into the groundwater aquifers. In Belgium, groundwater levels could be successfully raised by infiltrating highly treated urban wastewater into the local groundwater aquifer (Becker et al. 2017). In Terneuzen water scarcity is further increased by the large water demand of local industries, agriculture and urban users. ‘The Dow Chemical Company’ (Dow) Terneuzen is Dow’s second largest manufacturing location with a great freshwater demand for its manufacturing processes. In order to meet its own freshwater demand, Dow Terneuzen has been investigating into alternative water sources since the 1990ies. An alliance formed by the municipal water board, the city Terneuzen, the regional

water supplier and Dow Terneuzen could develop a new form of water management that conserves freshwater and energy. Urban wastewater is treated to a very high quality that can be used by Dow Terneuzen twice prior to discharge – first as process water and second as cooling water. As of 2017, Dow was using 10,000 m^3 recycled urban wastewater daily with the potential to increase the share of reused water in the future. The reuse of urban wastewater does not only save freshwater, but saves Dow Terneuzen 95% energy compared to the equivalent generation of freshwater by desalination (Becker et al. 2017).

Despite these best practice examples, to date, mainly the Mediterranean countries are practicing water reuse (e.g. Cyprus, Italy, Spain, Portugal, Malta, and Greece). In the southern EU member states reused water is applied predominantly for agricultural irrigation and for urban and environmental applications. It was estimated that for Malta, Cyprus, Greece and Spain water reuse might cover up to 26%, 7.6%, 5%, and 3%,of their future water demand in 2025 (Angelakis and Gikas 2014). As of 2015, within the EU only about 1.1 billion m^3/year of treated municipal wastewater was reused, which is low compared to the annual EU freshwater withdrawal of 257 billion m^3 (BIO 2015). It is estimated that the overall potential for water reuse in the EU is approximately 6 billion m^3/year by 2025, which is six times the current volume (EC 2020). By exploring this potential, EU member states could significantly save freshwater resources, and at the same time, tap into an unused economic potential, since already a 1% increase in water industry´s growth rate is expected to create up to 20,000 new jobs.

1.1 The AQUARES Project

The “Water reuse policies advancement for resource efficient European regions” (AQUARES) is an INTERREG Europe project[1], which brings together ten partners from nine countries (Czech Republic, Germany, Greece, Italy, Latvia, Malta, Poland, Slovenia, and Spain) to achieve efficient water management through water reuse, green growth, and improved environmental performance. AQUARES provides a platform for its members to cooperate, exchange best practices, and address territorial problems. One of AQUARES´ goals is to develop nine action plans to improve selected policy instruments concerning water reuse. Thereby, AQUARES supports public authorities to implement efficient water reuse practices and reduce inefficient use of water, to benefit from EU financing tools, and to overcome conflicting interests by promoting public dialogue. AQUARES assists partner regions to save water through improved policies and better planning, to promote new business models that involve revenue streams from reusable water resources, to attract investments in more

[1] Further information: https://www.interregeurope.eu/aquares/

innovative and efficient water management technologies, and to mitigate the risks associated with volatile global economy and resource depletion.

AQUARES contributes to the EU 2020 strategy targets, according to which water reuse is one of the five priority areas of work of the European Innovation Partnership on Water.

1.2 Scope of AQUARES activity 1.4

The objectives of AQUARES activity 1.4 (A 1.4) is to identify best practices to monitor, assess and/or ensure effectively the compliance of i.e. water treatment plants with relevant quality standards/requirements. The activity's scope extends to the regions of the partnership and to all sectors for which water reuse requirements exist (agricultural, urban, industrial, recreational use, and aquifer recharge).

The policy goal of A 1.4 is to facilitate an exchange of experience regarding successful water reuse monitoring practices amongst the project partners. The results of A 1.4 will further provide input for the development of the partner's action plan, which aims to improve the policy instruments addressed by the project.

The aim of this evaluation report is to provide policy makers with a guideline on best practices for monitoring, assessing and ensuring compliance with water reuse standards (WRS). For this purpose, this study is addressing the following questions:

- What are the monitoring elements that project partners' regions and countries, and other EU-28 member states[2] use to ensure compliance with water reuse requirements?
- What is the most effective way to implement monitoring practices in the water reuse sector in AQUARES regions and countries, and other EU-28 countries?

2 Frameworks for water reuse management

To respond to water stress issues, EU regions should implement and promote efficient management of their water resources. Reusing treated urban effluent can be environmentally advantageous, since it is usually associated with lower environmental impacts than alternative supply solutions, such as water transfers or desalination. Further, the current management practice of water in urban settings is characterised as an 'open loop' (i.e. water is abstracted, used once, and discarded). Water reuse practises can close this open loop, thereby helping to preserve water resources, and achieving full compliance with the circular economy objective.

[2] The UK was still a part of the EU at the time of project development and data collection.

Water reuse is a key aspect of the EU Water Framework Directive (WFD) (Directive 2000/60/EC, latest review in 2019 (SWD(2019) 439)), in which water reuse is mentioned as one supplementary measure to achieve the Directives quality goals. Additionally, water reuse is mentioned in the Drinking Water Directive (DWD) (Directive 98/83/EC). According to the Urban Wastewater Treatment Directive (UWTD) (Directive 91/271/EEC) water reuse should be applied whenever appropriate. Prior to May 2020, minimum requirements for water reuse across the EU member states were lacking and so was a coherent and comprehensive legislative framework. Due to the lack of European wide regulations, those EU member states that wished to implement water reuse often developed their own regulations or guidelines (e.g. Cyprus, Portugal, and France). These national guidelines diverged in some important aspects, such as the permitted uses of reclaimed water (Alcalde-Sanz and Gawlik 2014), thereby potentially evoking trade barriers, e.g. for agricultural goods irrigated with reclaimed water. This lack of harmonization in the regulatory framework to manage health and environmental risks was identified as one of the main barriers for the implementation of water reuse at the EU level so far and generated a lack of confidence in the health and environmental safety of water reuse practices (Alcalde-Sanz and Gawlik 2017).

2.1 Policy context of water reuse in the EU

The EC has been working on legislative and other policy instruments to boost water reuse when it is cost-effective and safe for health and the environment. The most relevant EU initiatives regarding water reuse include:

- Blueprint to Safeguard Europe's Water Resources: The need to address the problem of water scarcity at EU level has been acknowledged in the Blueprint to Safeguard Europe's Water Resources (COM(2012) 673). The document highlights water reuse as a concrete and valid alternative supply option to address water scarcity issues.
- Fitness Check of the EU Freshwater policy: In a building block of the Blueprint, the Fitness Check of the EU Freshwater policy (SWD(2012) 393), published in November 2012, concluded that "alternative water supply options with low environmental impact need to be further relied upon" in order to address water scarcity.
- EU Action Plan on circular economy: A number of actions to promote water reuse were included in the EU Action Plan on circular economy (COM(2015) 614). According to this document, water reuse should be practised where it is cost-effective and safe for health and environment. One action calls for the preparation of a legislative proposal on minimum requirements for water reuse for irrigation and aquifer recharge. This

proposal has been included in the EC's work programme of 2017 and 2018 as it contributes to the political priorities to promote a more circular economy.

- Proposal on the adoption of WRS for agricultural irrigation: A proposal on the adoption of WRS for agricultural irrigation was issued in May 2018 (COM(2018) 337). This policy development was supported by an impact assessment study in 2015, and a public online consultation involving both private citizens and stakeholder during the autumn of 2014. The aim of the public consultation was to evaluate the most suitable EU-level instrument/s to foster water reuse, while ensuring the protection of the environment and human health as well as free trade of food products. The online consultation was supported by a stakeholder meeting in December 2014 in Brussels. The public consultation revealed a general support for the initiative, in particular the development of EU-level minimum quality requirements for water reuse. A final report summarises the results of the online consultation and the stakeholder meeting (BIO 2015).
- Regulation No. 2020/741 of the European Parliament and the Council: The Regulation No. 2020/741 of the European Parliament and the Council of 25 May 2020 on minimum requirements for water reuse entered into force on 25 May 2020 and has to apply in national law from 26 June 2023. The minimum requirements are part of the new Circular Economy Action Plan (SWD(2020) 100), which was likewise adopted in 2020. According to this Action Plan water reuse should also be facilitated in other sectors than agricultural irrigation such as industrial processes.

2.2 Regulation No. 2020/741 of the European Parliament and the Council of 25 May 2020 on minimum requirements for water reuse

The regulation establishes harmonized minimum requirements across the EU member states in particular with respect to key parameters of pathogens, and the quality of recovered water and monitoring in combination with harmonized risk management tasks. It is expected to stimulate and facilitate water reuse in the EU.

The regulation will be effective whenever water reuse is practised, however member states will have the option to opt out of water reuse (Article 2). Member states have to justify their decision to opt out based on established criteria, present the decision in the River Basin Management Plans (RBMP) and need to review their decision every six years taking into account climate change projections. The responsibility of the reclamation facility operator to ensure that reclaimed water adheres at least to the minimum quality requirements at the point of compliance is formulated in Article 4. Minimum quality requirements are defined in Annex I, section 2. The regulation further requires a risk management plan (Article 5), permits (Article

6), compliance checks (Article 7), and public information (Article 9/10). The regulation has to be evaluated and reviewed eight years after entering into force (Article 12). This review has to focus specifically on: minimum quality requirements, key element of risk management, additional requirements set by competent authorities, impacts of water reuse on the environment and public health. The review should also consider to extend the scope of the regulation beyond agricultural irrigation.

In Annex II key elements of a risk management framework are presented. The risk management framework follows the World Health Organisation (WHO) guidelines (WHO 2006) as the most suitable approach to control health and environmental risks in water reuse practices. The risk assessment shall take into account the requirements and obligations, as a minimum, of other relevant EU policy frameworks such as Directive 91/676/EEC (Prevent water pollution from nitrates), Directive 98/83/EC (Protect areas for water intended for human consumption), and the WFD.

2.3 Water reuse monitoring standards

Water reuse monitoring standards refer to the procedures and tools that exist for safeguarding the quality of the water and for ensuring that there are adequate mechanisms for mitigating health, environmental, or biological risks involved. Monitoring activities can be further divided into operational, verification and validation monitoring; thus ideally ensuring the quality of water and minimising the risks from the point of withdrawal until the intended end use.

WRS are often formulated as risk management frameworks, including monitoring procedures. A risk management framework is a systematic management tool that consistently ensures safety and acceptability of water reuse practices. A central element is the holistic nature of the described approach, which means that it is sufficiently flexible to be applied to all types of water reuse systems, irrespective of size and complexity.

A systematic risk management framework approach is included in the EU Directive 2015/1787 that amends Directive 98/83/EC on the quality of water intended for human consumption. Internationally, the guidelines developed by the WHO, and by Australian and US governments are using the same risk management framework approach. In the context of water reuse, this approach consists of eight steps:

1) Assembly of a risk management team
2) Description of the water reuse system
3) Identification of hazards and hazardous events, and risk assessment
4) Determination of preventive measures to limit risks

5) Development of operational procedures
6) Verification of water quality and the receiving environment
7) Validation of processes and procedures
8) Management of incidents and emergencies

Of these eight steps, steps 5, 6 and 7 are considered main elements of monitoring; steps 1, 2, 3, 4 and 8 support monitoring, but are not monitoring procedures per se.

Operational monitoring includes the procedures that assure water safety, i.e. the delivery of the requested quality level of reclaimed water. It should further contain the management of incidents, emergencies and advanced additional mitigation measures regarding treatment. It applies to the whole water reuse system from raw water to end use. Important element of operational monitoring is the definition of critical control points (CCPs) (i.e. those points where a failure of standard operation could cause deterioration to the quality of the water, the point at which control can be applied and a hazard can be prevented, eliminated, or reduced). The definition of CCPs are crucial to monitoring, since they determine the focus of the operational monitoring, indicators and parameters that have to be monitored (e.g. physical, chemical and biological) including critical limits to signal if corrective measures are needed), monitoring method and frequency, corrective actions, documentation, and audits. The monitoring techniques and the frequencies with which they are applied should be chosen carefully since they ensure the effectiveness of the monitoring system. Online and real-time monitoring should be preferred where possible, since it provides immediate results and can trigger a quicker response to hazards.

Verification monitoring confirms the effectiveness of the operational monitoring, and manages the risks with water quality within the water reuse system. Verification monitoring is less frequent than operational monitoring, but generally includes more parameters and tests. Test are normally performed in an accredited analytical laboratory.

The goal of validation monitoring is to ensure that processes and procedures control hazards effectively, and that the water reuse system is capable of meeting its design requirements. One objective is to prove the ability to deliver the expected water quality specified for the intended use. Validation monitoring has to be executed when a new water reuse system is established, or when equipment is upgraded, or a new equipment or a new process are added.

A selection of monitoring water reuse standards are presented to highlight those water reuse monitoring standards that have been included in the A 1.4 data collection tool, and those that formed the basis of the water reuse monitoring standard included in Regulation No. 2020/741 of the European Parliament and the Council of 25 May 2020.

2.3.1 Monitoring procedures defined by Regulation No. 2020/741 of the European Parliament and the Council of 25 May 2020 on minimum requirements for water reuse

The monitoring procedures are described in Annex I of the new EU regulations. In section 2 of this annex, minimum quality requirements are defined for specific reclaimed water classes. For each water class (A: All food crops consumed raw where the edible part is in direct contact with reclaimed water and root crops consumed raw, all irrigation methods; B: Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops used to feed milk- or meat-producing animals, all irrigation methods; C: Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed water, processed food crops and non-food crops including crops used to feed milk- or meat producing animals, drip irrigation or other irrigation method that avoids direct contact with the edible part of the crop; D: Industrial, energy and seeded crops, all irrigation methods), permitted uses, irrigation methods, and minimum microbiological (E.coli, helminth eggs, legionella) and physio-chemical requirements (BOD_5, TSS, turbidity) associated to it are described. Minimum monitoring requirements are defined according to water quality class as well, and differ for instance with regards to the frequency of measurements required.

Samples to verify compliance with microbiological parameters have to be taken in accordance with DIN EN ISO 19458 or any other national or international standard ensuring equivalent quality. Monitoring consists of routine monitoring on minimum quality requirements performed by the reclamation facility operators, e.g. water samples have to be tested once a week for *E.coli* for reclaimed water of the quality class A, and validation monitoring. Validation monitoring is based on bacterial, viral and protozoan indicators and has to be performed before a reclamation facility goes into operation, equipment is upgraded or new equipment/processes are added, and for water quality of class A. Validation monitoring covers a range of indicator microorganisms associated with target pathogens, namely bacteria, viruses, and protozoa.

The monitoring of minimum quality requirements is currently only defined until the point of delivery, e.g. that point where reclamation facility operators deliver the water to the customer. Potential quality changes past the point of delivery, i.e. in storage tanks or the distribution network, are not part of Regulation No. 2020/741. These risks should be covered by the accompanying risk management, which is mandatory and shall cover the complete system. Within the risk management there is the option to include additional requirements such as heavy metals, disinfection byproducts, trace organic chemicals, and antimicrobial resistances.

2.3.2 Minimum quality requirements for water reuse applications by Joint Research Centre

The Joint Research Centre (JRC) developed minimum quality requirements for water reuse applications in 2017 which are the basis of the EU Regulation 2020/741. The JRC approach in turn, follows the WHO recommendation. It includes a risk management framework with the previously defined elements (see introduction to chapter 2.3), which is essential for any water reuse scheme. One assumption of the JRC is that discharged water from wastewater treatment plants has to follow at least the minimum requirements defined in the Urban Water Framework Directive (UWFD) (Alcalde-Sanz and Gawlik 2017).

Monitoring consists of operational, verification and validation elements and should include an operational monitoring protocol to define operational procedures for activities and processes applied within the whole water reuse system from the point of entrance to the wastewater treatment plant (WWTP) until the irrigation system. The protocol should include CCPs, identify parameters, include online real time monitoring (if possible), and procedures for corrective actions. Verification monitoring of the environmental matrices at risk and validation of the systems' capability to deliver the required quality should be part of the monitoring. The frequencies of water quality monitoring are in line with the frequencies recommended by the ISO guidelines.

Minimum quality requirements include microbiological and physio-chemical parameters, associated limit values and monitoring frequencies. Further, the JRC defines preventive measures to be adopted. Reclaimed water is defined according to quality classes from class A (high quality) to class D (minimum quality). Routine monitoring has to be performed to verify that reclaimed water is complying with minimum quality requirements. Validation monitoring is mandatory for reclaimed water of quality class A, which allows irrigation of food crops eaten raw. The JRC approach includes WHO recommended parameters but also viral and protozoan indicators for validation monitoring.

2.3.3 ISO 16075:2015

The International Organization for Standardization (ISO) issued recommendations for the application of treated wastewater for irrigation projects including recommendations for monitoring programmes in 2015. ISO 16075:2015 defines water quality requirements like microbiological and chemical parameters, recommendations for irrigation systems, and monitoring. Parameters and limit values are based on international regulations, such as WHO

and US EPA guidelines. Monitoring is identified as a key feature to ensure that the system functions as planned and designed.

Within ISO there are five categories of wastewater defined according to its quality ranging from A (high quality) to E (extensively treated wastewater). The end use of the reclaimed water is coupled to the treatment quality (fit-for-purpose) and includes unrestricted irrigation of agricultural crops, restricted irrigation, or irrigation of private gardens.

The ISO provides a range of monitoring frequencies, which should be adapted to local conditions. This flexible ISO approach is used currently in Spain.

2.3.4 Guidelines for Safe Use of Wastewater, Excreta and Greywater by World Health Organisation

The Guidelines for Safe Use of Wastewater, Excreta and Greywater are designed to provide a framework to identify and manage health risk associated with the use of wastewater, excreta and greywater in agriculture and aquaculture (WHO 2006). The WHO recommends the inclusion of a risk management plan together with a risk assessment for water reuse systems. Within the Sanitation Safety Planning (SSP) Manual for safe use and disposal of wastewater, greywater and excreta, the WHO provides an assistance tool to implement the guidelines by presenting the recommended risk based approach in a stepwise process with monitoring being one of six steps (WHO 2016). The SSP follows the concept of the WHO water safety plan developed for drinking water supply systems (WHO 2004).

Monitoring is designed to provide a simple and rapid feedback on how effectively the control is operating in order to take corrective actions as timely as possible through operational monitoring. Operational monitoring contains relevant parameters (e.g. flow rates, turbidity, pH, BOD, dissolved oxygen), method and frequency of monitoring, critical limits, and control measures. Further, through dedicated verification procedures it is checked periodically whether the system meets the intended performance outputs (e.g. quality of effluent). Verification procedures require the selection of critical points along the sanitation chain and generally a more complex analysis due to the types of parameters measured (e.g. *E.coli*). It should contain all elements of operational monitoring e.g. parameters, frequency, methods. However, verification procedures require fewer monitoring points, i.e. generally system end points are observed, and less frequent measurements compared to operational monitoring. For example, it is recommended to monitor microbial performance, e.g. *E.coli* and helminth eggs at 3 to 6 months intervals at the points of exposure (WHO 2006).

Lastly, audits can be used as part of the surveillance, especially in those countries, where certification requirements exists. Audits should show that the SSPs are designed and implemented correctly, and that they are effective. Water reuse auditing is explained in more detail in WHO Practical Guide to Auditing Water Safety Plans (2016).

3 Materials and Methods

3.1 Research methodology

Data on the current monitoring practices of each partner country was collected by AQUARES partners by desk research in the period of March 2019 to October 2019. The partners were instructed to collect information from primary sources (e.g. surveys, interviews, case studies) and from literature. The desk research was supposed to include:

- internal reports and studies on water reuse (wastewater and water reuse, impact assessment for water reuse, proposals or communication on wastewater and water reuse, communication with stakeholders), and
- external reports (policy framework EU, WHO/ISO/national regulations, journals and academic sources, research reports, EU projects).

A selection of external sources useful for investigation was distributed by A 1.4 task members to the partners.

3.2 Data collection tool

The data was inserted by AQUARES partners in a data collection tool that allowed for consistent and structured documentation of relevant data. The data collection tool consisted of 25 questions, which were a mixture of multiple choice (16) and text input (9) questions, split in three sections:

- Section A aimed to gather information on the overall water reuse policy framework that exists in partner's territories and countries, the elements included in the framework, and the number of treatment plants, sectors, and actors benefiting from it.
- Section B focused on the monitoring procedures that are in place to ensure compliance with WRS, i.e. elements that comprise monitoring, its effectiveness and reporting mechanisms.
- Section C gathered information about the elements that support monitoring indirectly, i.e. adequate laboratory equipment and personnel.

All project partner filled-in the input forms according to the provided methodology guidelines. The desk research was performed on national level, except MURCIA-GDW (Spain), which gathered regional data. Complementary to its national data, LODZKIE (Poland) collected data on the relevant practices of other EU-28 countries (Cyprus, France, Portugal, UK, Ireland, Luxembourg, Belgium, Netherlands, Sweden, Finland, Denmark, Slovakia, Lithuania, Estonia, Hungary, Bulgaria, Romania, Croatia, Austria).

3.3 Evaluation criteria

The information provided by each project partner was evaluated using pre-defined evaluation criteria that are part of a scoring system (see Appendix 1). The evaluation was made based on the responses to 13 (multiple choice) questions. Points were awarded for each of the questions with a maximum score of 300 points in total. Based on the score, each monitoring framework was classified as best (>220), good (181-220), promising (121-180) or poor (0-120) (see table 1), and ranked in order of effectiveness. The monitoring practice with the highest score was identified as the most effective practice.

Table 1 Classification system of cases & points. The table is adapted from OOWV (2018).

Classification system of cases	Points
Poor	0-120
Promising	121-180
Good	181-220
Best	>220

4 Key findings

4.1 Exemplary national water reuse standards in EU countries

At the time of the data collection no harmonized legislative criteria on water reuse across the EU were available. Thus, contents, obligations, responsibilities, and implementation status of national legislations differed between EU member states. In some countries WRS exists, other have requirements or guidelines implemented, or are in the process of preparing them (see table 2).

Table 2 Water reuse regulations in EU member states according to research conducted within the scope of AQUARES 1.4 by LODZKIE. The table is adapted from ASM on the basis of Water Reuse – Legislative Framework in EU Regions (2018)

Water reuse regulation	Countries
Water Reuse Standard	Cyprus, France, Portugal, Greece, Italy, Spain
Requirements/Guidelines	Malta, Denmark
Guideline Proposals	Belgium, Bulgaria
Other relevant measures or incentives	Belgium, Bulgaria, Hungary, Netherlands, Romania, UK, Germany, Slovenia, Latvia, Poland
None identified	Austria, Croatia, Estonia, Finland, Ireland, Lithuania, Luxembourg, Slovakia, Sweden

Of the 28 selected member states, six have either a WRS or practices governing water reuse implemented: Cyprus, France, Greece, Italy, Portugal, and Spain. In Malta water reuse is regulated via minimum requirements on water reuse. A summary of WRS of countries that are not covered by AQUARES partners (i.e. Cyprus, France, and Portugal) is presented based on the information gathered by LODZKIE, Poland.

4.1.1 Short profile: Cyprus

Policy framework

- Water Pollution Control Laws (106(I)/2002 to 2009)
- Water Pollution Control Regulations of 2003 (No. 772/2003)
- Water Pollution Control Ministerial Decree of 2004 (No. 111/214)
- Code of Good Agricultural Practice Decree (No. 263/2007)

Description

In Cyprus, the risks of treated effluent reuse are minimised through strict regulations, advanced treatment, mandatory code of practice, research, and quality control. Mandatory tertiary treatment was introduced with the aim to eliminate health and environmental risks and concerns, and to reduce scepticism of relevant stakeholder on water reuse. By this means

barriers to water reuse decreased, while public acceptance and marketability of crops increased. Further, reclaimed water is cheaper than freshwater, thereby adding an economic incentive. To achieve the lower price of reclaimed water, the government pays for treatment and the cost of infrastructure to the agricultural areas in case of new irrigation networks.

Within the WRS discharge permits are required. The quality control within the WRS contains procedures on sampling and analysis following the requirements of their discharge permits. Monitoring procedures include quality characteristics and frequency of controls of treated effluent. The Code of Good Agricultural Practices supports the WRS by stating which crops may be irrigated with reclaimed water. Further, it defines the appropriate irrigation methods according to the kind of crops and water used, and safety precautions for the proper use of water (e.g. only authorised persons, marking pipes, ensure protections to hydrants).

4.1.2 Short profile: France

Policy framework

- Circular no. 51 of July 22, 1991 of the Ministry of Health defining water reuse criteria
- Order of 2014 (Journal Officiel de la République Française (JORF) num. 0153, 4 July 2014)

Description

French water reuse requirements were enacted in 2010 in form of regulations that follow the revised WHO guidelines of 2006. The French criteria include guidelines for Enterococci, spores and *E.coli* limits. The JORF num. 0153 passed at 4th July 2014 addresses the use of water from treated urban wastewater for irrigation of green areas such as golf courses.

The French WRS introduces quality standards that are defined according to chemical and microbiological properties, the intended end use, and monitoring requirements. A higher level of human exposure requires a higher quality standard, which in turn involve more complicated treatment methods and therefore higher prices of water. There are currently four quality categories ranging from A (high quality) to D (minimum quality). The WRS also mentions setback distances, soil water content, soil properties, parent material and irrigation methods. Water reuse in France is intended for agricultural and green area irrigation only. According to research conducted by LODZKIE, water reuse is not commonly practised in France. It is restricted to certain regions and only about 40 projects were identified.

4.1.3 Short profile: Portugal

Policy framework

- NP 4434 2005 Guidelines for Reuse of reclaimed urban water for irrigation, Portugal Quality Institute

Description

In Portugal, WRS are issued as a guideline only. The WRS is enforced through permitting requirements, and applies only to urban wastewaters, and agricultural and landscape irrigation. The WRS contains quality requirements (e.g. microbiological characteristics of water), guidance on safe practices (e.g. irrigation equipment and methods), and environmental protection including verification monitoring. The irrigation methods depend on the use of the plant, which are classified in four classes from A to D according to the level of risk of microbiological contamination generated by irrigation with treated urban wastewater; nearly all irrigation methods are accepted but preference is given to those that limit the contact between plant and water, and reduce runoff and risk of spray. The WRS also contains a risk management framework, which establishes procedures to reduce risks to groundwater and surface water, and human and environmental health. Operational monitoring procedures and a technical guide on water reuse are in place.

4.2 Water reuse policy framework in AQUARES partner countries

Out of the nine countries studied in AQUARES only four have a standalone WRS (Spain, Italy, and Greece) or minimum quality requirements (Malta) implemented. Of those four partners, Malta is the highest scoring country with 224.5 points, followed by Spain, Italy and Greece with 213, 208 and 180 points, respectively.

In the other participating countries (Czech Republic, Germany, Latvia, Poland, and Slovenia) water reuse is currently not regulated via standalone standards or minimum quality requirements. Despite the lack of regulation, water reuse or *defacto* reuse, e.g. the unintentional reuse of water, may be practised.

Table 3 provides an overview of the overall water reuse policy framework as reported by project partners. The information on Spain is a combination of the regional data provided by Murcia and the national data provided by the Euro-Mediterranean Water Institute Foundation. The regional and national data on Spain only differs in the purpose/use of the WRS. The divergence in information is indicated in the table by a (*).

Table 3 Overview of the water reuse policy frameworks in AQUARES partner countries.

Criteria	Malta	Spain	Italy	Greece	Poland	Latvia	Czech Republic	Germany	Slovenia
WRS implemented	No	Yes	Yes	Yes	No	No	No	No	No
Name of WRS or most relevant framework	Minimum Requirements for water reuse in agricultural irrigation and aquifer recharge	Royal Decree 1620/2007 of 7 December	Ministerial Decree 185/2003	Joint Ministerial Decree (JMD) 145116/11	KPOSK Act of 20 July 2017 EU Proposal on Minimum Requirements for Water Reuse	Law on Water Management 2002	Water law 254/2001, Government Regulations 401/2015 and 57/2016	Water Resource Act, Lower Saxony Water Act	Decree on the Discharge and Treatment of Urban Wastewater (98/15, 76/17)
Geographical Range	National	National, Regional	National, Regional	National	National	National	National	Regional	National
Purpose/use of WRS or most relevant framework	Agricultural, Aquifer Recharge	Agricultural*, Industrial, Urban, Recreational, Environmental	Agricultural, Industrial, Urban	Agricultural, Industrial, Urban, Environmental	Agricultural, Industrial, Recreational	Industrial, Urban	Industrial, Urban, Recreational	Agricultural, Industrial, Urban, Recreational	Urban
Standalone	No	No	No	No	EU proposal: Yes, Others: No	No	Yes	No	No
Inclusion of a risk management approach	Yes	Yes	No	No	Yes	Yes	No**	No**	No**

* Almost exclusively agricultural use in the Murcia Region

**No water reuse standard is implemented.

4.2.1 Malta

In Malta water reuse has already been practiced as part of the integral water management for many years. Water reuse is regulated via the National Law on Water Reuse. According to this law, recovered water may be used for agricultural irrigation, irrigation of public spaces, street cleaning, process water, and aquifer recharge. It is not allowed to reuse water for tourism or recreational purposes (see AQUARES activity A 1.2). Water reuse is practised on a national scale by three treatment facilities located in the North and South of the island as well as on Gozo. In total, 73,000 m^3/day of water is reused. End users are exclusively farmers; in total 491, of which 122 are located in Gozo, 353 in North Malta, and 16 in South Malta.

Malta is the partner with the most effective water monitoring standard/minimum requirements. Water reuse is regulated via minimum requirements, which were developed by the JRC (Alcalde-Sanz and Gawlik 2017) and are implemented by the Food and Safety Commission (i.e. Public Health Regulatory Agency). The minimum requirements are part of the second RBMP[3], and include a risk management framework (see table 2) consisting of all identified risk framework elements. Malta is the only country that has a dedicated (risk) management team. Relevant stakeholders were consulted in and provided opinions and information on the process of implementing the minimum requirements on water reuse.

Water reuse requires a permit, which is issued by the Food and Safety Commission. The permit granting process is described as very effective, i.e. without delays or administrative setbacks. An internal compliance mechanism monitors compliance with the minimum requirements; generally most compliance issues are treated in time and resolved. In case that key monitoring parameters are exceeding the values defined in the JRC guidelines, operators are informed and actions are taken in accordance to the type and frequency of exceedance. The used monitoring checks are defined by EU regulations (Directives 91/271/EEC and 2000/60/EC) and include further physio-chemical parameters (e.g. micropollutants, trace residues, trace medicines). So far, the highlighted guidelines have never been exceeded from the commissioning stage.

4.2.2 Spain

In Spain, water reuse is governed by the Royal Decree 1620/2007, which was developed by the Ministry of the Presidency and implemented by the Spanish River Basin Authorities. The WRS is considered as the mandatory minimum requirements. The Spanish River Basin

[3] https://www.energywateragency.gov.mt/life-integrated-project/

Authorities demand for stricter quality conditions of treated effluents that are adapted to the most similar use of the quality standard laid out by the Royal Decree 1620/2007. The WRS is part of the Law 11/2005 of June 22, and therefore also part of the wider policy framework of the National Hydrological Plan and of the Spanish Water Law.

In Spain, an estimate of 540 WWTPs are implementing tertiary treatment which fulfil the requirements for water reuse. Approximately 400 million m^3/year or 13% of treated wastewater are reused, mostly in agricultural irrigation (60%). In Murcia, of the 93 WWTPs, 60 have tertiary treatment implemented and 33 have secondary treatment plus disinfection. The regions reported that the 93 WWTPs generated approximately 110 million m^3/year (data from 2019) of reusable water (i.e. 96% of wastewater generated in Murcia), which covered around 10% of the agricultural water demand of the region[4].

Water reuse requires a permit, which is issued by Water Authorities, and granted on a public tender basis when the water volume is over 100,000 m^3/year. Non-compliance is managed by discontinuing reuse until the cause of non-compliance is detected. Treated water is dumped in the meantime and extraordinary fines may apply for the WWTP operator. Compliance checks are carried out by the holder of the permit and the water authority at the outlet, and by the end users at their own intake. The processes of granting permits, managing non-compliance, and compliance check procedures are considered as very effective. Relevant stakeholder have increased managerial responsibilities in implementing the WRS and are engaged in co-shaping the policy direction of the standard.

4.2.3 Italy

The Italian WRS was developed by the Ministry of the Environment and for Territorial Protection and is implemented by the Regional Agencies for Environmental Protection, local Sanitary Agencies, and local Water Services Authorities. The WRS is part of the Framework for the environment, Leg. Decree 152/2006.It defines reuse purposes and application areas, quality objectives depending on end use (e.g. 53 physio-chemical and 2 microbiological parameters for urban and agricultural uses), and monitoring obligations. Regional authorities must define a monitoring programme including a list of hazardous parameters to be monitored in discharged water, which will be executed by the owner of the water distribution network. Monitoring data has to be reported yearly to the Regional Authorities.

[4] https://www.esamur.com/reutilizacion

As of 2015, tertiary/advanced treatment was included in 2309 or 12.9% of Italy's WWTPs that cumulative treat 59.6% of urban wastewater. Despite that most of these WWTPs are located in the northern regions, most southern regions WWTPs have advanced treatment. According to the WRS regional authorities regulate the permit granting process, take steps in case of non-compliance, i.e. warnings, temporarily suspension of the authorization, withdrawal of the authorization, and must ensure a monitoring protocol. Neither a risk management framework nor monitoring procedures are defined within the WRS. Italy reported the lowest stakeholder engagement in terms of stakeholder involvement in implementation of the WRS of AQUARES partners.

4.2.4 Greece

The Greek water reuse standard, the Joint Ministerial Decree (JMD), was developed jointly by several Ministries (see Appendix) and is implemented by the Decentralized Directorate of Water Management. The JMD describes measures, definitions and procedures for the reuse of treated wastewater not only for agricultural and industrial purposes but also for the supply of groundwater and water bodies used for the abstraction of drinking water. It complies with several EU Directives. Within the JMD specific characteristics of wastewater reuse are described, e.g. the categories of reclaimed water (depending on water quality), specific requirements for reclaimed water classification, and monitoring requirements.

To date, water reuse is practiced by 25 wastewater treatments plants, which reclaim only 2% of the wastewater quantities treated. Reclaimed water is used for agricultural irrigation. Monitoring procedures are defined within the JMD, however, a risk management framework is not included. Water reuse permits are issued by the Secretary General of the Decentralized Administration, along with recommendations and opinions of the responsible and competent authorities. Permit seekers must demonstrate compliance with environmental conditions defined by law, e.g. by supplying the authorities with the design and the operation of the activity. Authorisation is granted for water reuse operations that are in line with environmental objectives, and are compatible with the approved program of measures. Overall, the permit granting process is operational, but delays and bureaucratic drawbacks are sometimes hindering the process of granting permits. Compliance with the conditions of the permits should be checked regularly by the implementing authorities. Any non-compliance or environmental liability is foreseen with a penalty.

4.2.5 Other countries without WRS

The AQUARES partners without national WRS (Poland, Latvia, Czech Republic, Germany, and Slovenia) collected data on the regulations and laws relevant to water reuse. These regulations and laws were all part of the wider EU Community Legislation, namely UWTD, WFD, and Directive 2006/118/EC (Protection of Groundwater against Pollution). These Directives aim to reduce untreated discharges, thereby protecting water resources and the environment, add to the sustainable development goal especially with regards to water, and maintain the supply of drinking water. Within UWFD and WFD a risk management framework is included as well as monitoring procedures for wastewater discharge including permits, non-compliance, and compliance check.

In Poland water management is under the responsibility of Polish Water, and by those entities that purify and reuse water or discharge it into the environment. A risk management framework is part of the Polish water laws and also includes monitoring procedures. The discharge of water requires permits, which are issued by relevant public authorities. The underlying authorization process is described as effective. Non-compliance issues are treated in time and are resolved. Compliance checks are very effective.

Within **Latvian** water law, permits are only required for the discharge of wastewater loads exceeding 5 m^3/day. Permits always include monitoring and analysis requirements. The permitting process shows some potential for improvements especially with regards to delays and bureaucratic drawbacks that are reported. The State Environmental Services act as the enforcement and inspection authority, which is also allowed to penalise non-compliance with taxes. This process is described as very effective.

Water management in the **Czech Republic** is governed by several legal documents, which aim to transpose the European Community legislation. Within this policy framework, there are monitoring procedures and procedures to manage incidents and emergencies. Wastewater discharge is accompanied by a very effective permit granting process, an effective non-compliance process, where at least half of the non-compliance issues are resolved, and a very effective compliance check, which is conform to EU regulations.

Those countries that reported on the status of connectivity to WWTPs, identified a difference for urban areas where connectivity was generally high, e.g. 95% in Poland, 84.1% in Latvia, while rural areas had less infrastructure in place, e.g. only 25% in Poland and 70% in Latvia (data from 2016). In order to fully exploit the potential of water reuse, the connection of urban and rural areas to WWTPs should be maximised within EU member states. Losing a large part of urban wastewater due to non-collection, is an inefficient use of the resource. Besides the

need to increase the connection to WWTPs, the sewage treatment infrastructure should also be improved, e.g. the level of tertiary treatment. For instance, in Poland tertiary treatment is installed in 853 out of the 4,139 industrial and municipal WWTPs (data from 2018), thereby limiting the amount of WWTPs that could practise water reuse according to the new EU regulation. All member states should also aim to minimise water losses from the sewage system in order to increase the recovery potential of wastewater. Estimates water losses of the individual AQUARES partners are reported in AQUARES activity A 1.2.

4.3 Comparison of water reuse policy frameworks in EU member states with water reuse standards

Common aspects covered by WRS in AQUARES partners´ countries and other EU countries are the listing of critical analytical parameters (i.e. microbiological and physio-chemical) often with maximum limit values for each parameter, monitoring protocols and additional preventive measures for health and environmental protection. The WRS reflect the requirements of the EU Directives 91/271/EEC, 2008/105/EC, and 91/676/EEC regarding physio-chemical parameters, and were issued for a national coverage with regional adaptions where appropriate. For instance the frequency of analysis (Portugal), the types of stakeholders included and the application areas of reused water (Spain) may differ regionally. The WRS are reported to have very effective procedures for granting permits, managing non-compliance, and regulating compliance checks.

All WRS include a bacterial indicator but not always the same. So far, the risk of pathogenic viruses and protozoan parasites are only considered in France and Malta. Cyprus´, Portugal´s and the EU regulation include helminth eggs, which are recommended by the WHO but not included in the US EPA or JRC guidelines, since helminth eggs are not considered a risk in developed countries (Alcalde-Sanz and Gawlik 2017). Other differences in WRS include the end-uses of reused water as well as the types and level of engagement of relevant stakeholders in the implementation process.

4.3.1 Close up: Stakeholders

The inclusion of relevant stakeholders in the implementation of water reuse practices is mentioned as success factor. Within the data collection tool, the AQUARES partner were asked to select the stakeholder groups that were involved feedback processes and implementing the standard (see figure 1). NGOs, consumer representatives, and local communities/citizen initiatives are the stakeholders are barely included. Each AQUARES partner reported the involvement of at least public authorities, water supply

companies/organisations and the operator/owner of the reuse plant system.

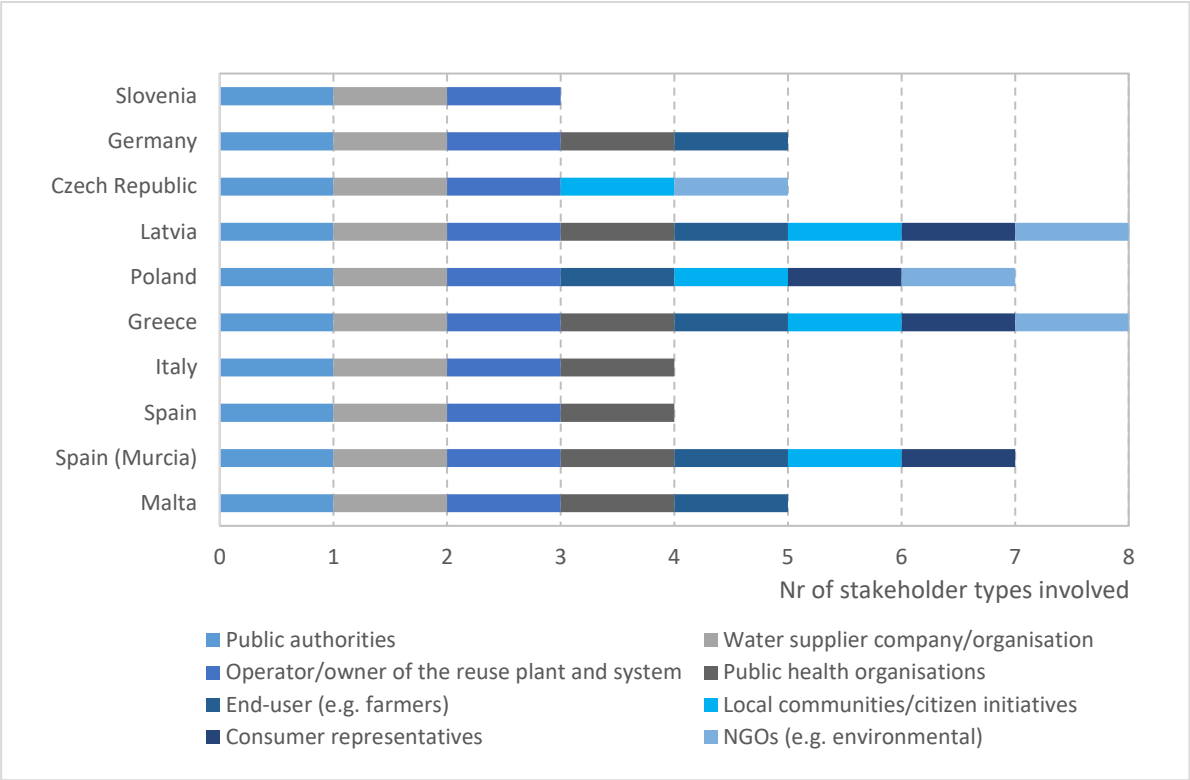


Figure 1 Comparison of the types of stakeholders involved in providing feedback and the implementation of the water reuse standard/relevant policy frameworks in AQUARES partner countries

The involvement of stakeholders in Spain may differ on a regional level, since there were more stakeholder groups involved in the Murcia region than required on a national level. WRS should allow for enough flexibility in terms of stakeholder engagement when implementing a national WRS on a regional scale. Regional groups such as consumer representatives and local communities may be crucial in the implementation process in order to increase public acceptance and decrease barriers and concerns of WRS.

The level of involvement of the stakeholders differed according to the AQUARES partners´ feedback, however all AQUARES partners reported some level of stakeholder involvement. Over half of the AQUARES partners (70%) reported either a minimum stakeholder involvement of type 2 (stakeholder information) or type 3 (stakeholder consultation), which scored 30% and 40%, respectively (see figure 2). Only Spain is currently granting stakeholders managerial responsibilities, thereby allowing them to take a level of ownership of WRS by shaping the policy direction of the standard (type 5, reported in Spain on national and regional level).

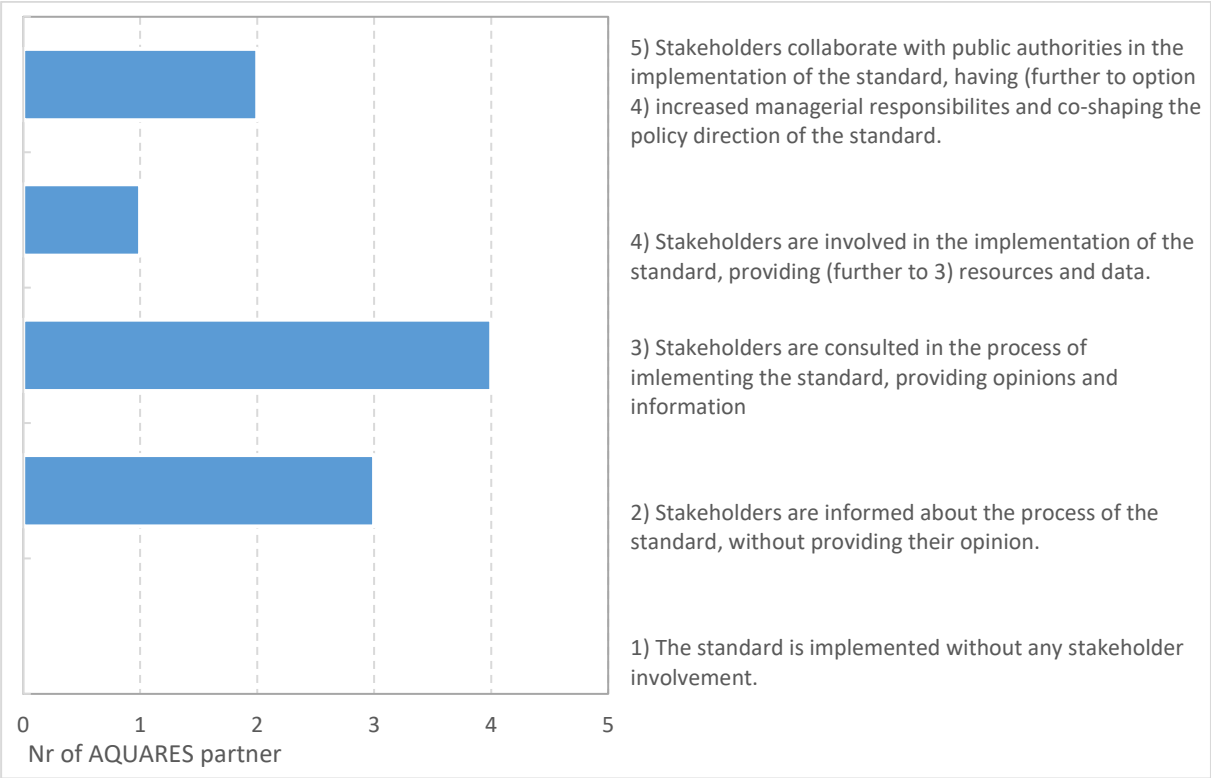


Figure 2 Overview of the level of involvement of the stakeholder types in the implementation of the standard across all AQUARES countries.

Within the new EU regulation, the level of stakeholder engagement is not regulated; however, the public needs to be informed regularly about water reuse projects. The early inclusion of relevant stakeholders in water reuse projects is a key element of implementation success. This may be especially important in those countries, in which water reuse has not received a lot of attention yet, or in countries where a large opposition to water reuse is expected. A high level of stakeholders inclusion, for instance as reported in Spain, including the implementation of advanced treatment to eliminate health concerns as in Cyprus, may be advisable to enhance the implementation success of future project.

4.3.2 Close up: Elements of water reuse standards

Of the AQUARES partner countries with a WRS, Malta is the highest scoring country, followed by Spain. The Italian WRS does not contain elements crucial for a risk assessment and preventive measures to limit risks. The Spanish model on the other hand lacks procedures to manage incidents and emergencies. The Greek WRS does neither include elements crucial for a risk assessment nor procedures to manage incidents and emergencies. All AQUARES partner countries´ authorities except for Malta lack the operation of a (risk) management team (see figure 3).

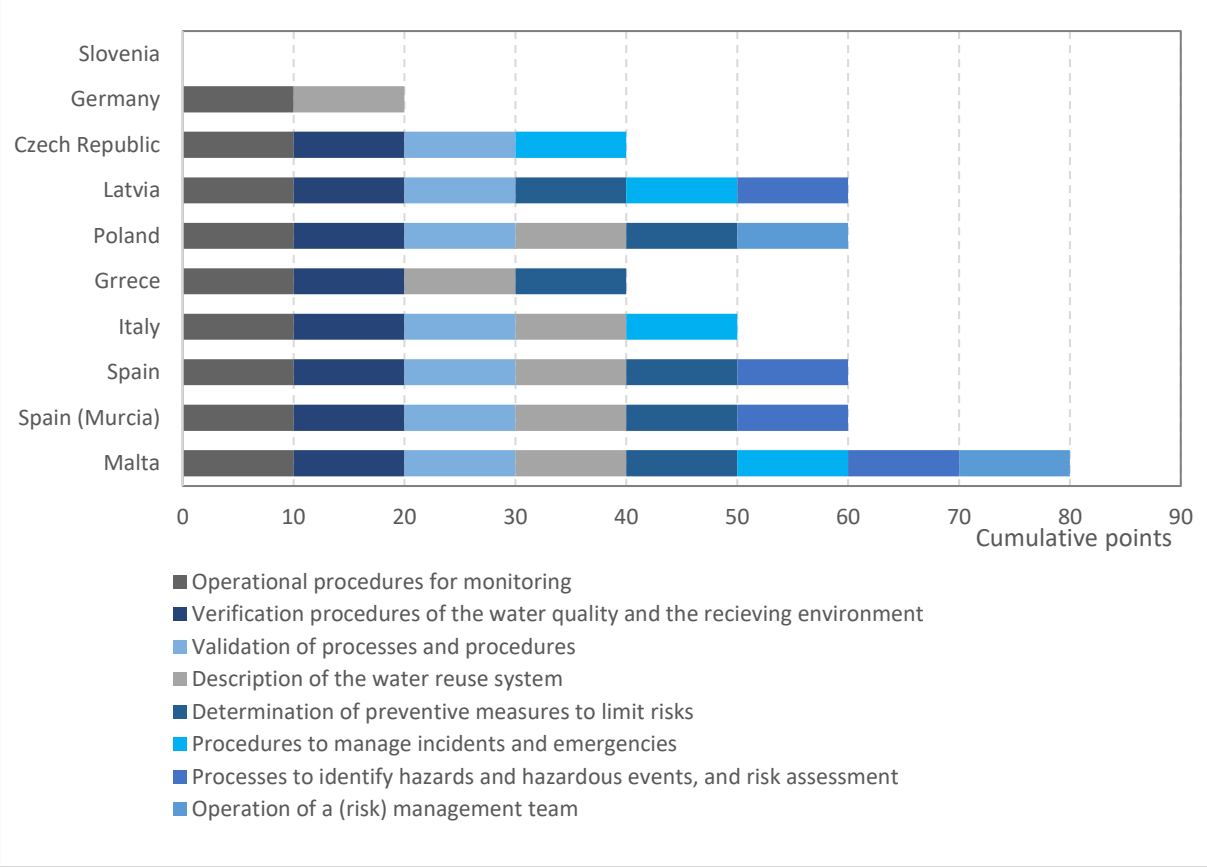


Figure 3 Inclusion of essential elements of a water reuse standard framework in AQUARES partner countries
Note: Each element gave 10 points, with a total score of 80 points. Slovenia did not report any data, because it does not have a WRS implemented**.**

Operational procedures for monitoring are implemented in all partner countries except Slovenia, and verification and validation procedures are implemented in all partner countries except Germany and Slovenia (see figure 3). When comparing the AQUARES partner countries without WRS it has to be noted that a direct comparison may not be possible, because they reported on different data. Latvian, and the Czech Republic partners reported on their general policy framework concerning the treatment of urban wastewater and management of water. The Slovenian did not report any data, due to the lack of a national WRS. Germany is practising water reuse in two WWTPs, however not regulated by a specific WRS and therefore not accompanied by more WRS elements.

4.4 Evaluation of water reuse monitoring in AQUARES countries

The evaluation of water reuse monitoring standards will primarily focus on those partners that have a WRS implemented (Malta, Spain, Italy, Greece) (see table 4). The information delivered by the other AQUARES partners is presented separately to show the quality of monitoring standards that are already in place for other policy instruments. If monitoring is already

effectively practised for other water management aspects such as the fulfilment of requirements concerning the discharge of urban wastewater, this monitoring infrastructure may be transferable to water reuse monitoring, thereby facilitating the implementation of water reuse monitoring standards. The collected data on quality and elements of monitoring by AQUARES partners is presented in table 4.

Table 4 Quality and Elements of Monitoring in AQUARES Partners

	With water reuse standards				No water reuse standard				
Criteria	**Malta**	**Spain**	**Italy**	**Greece**	**Poland**	**Latvia**	**Czech Republic**	**Germany**	**Slovenia**
Definition of monitoring standards within the WRS	Yes	Yes	No	Yes	No	No	Yes	No	No
Monitoring follows established approach/uses best practices	WHO, ISO 16075:2016, ISO 16075:2015	USEPA Guidelines for Water Reuse	ISS database based on UNI CEI EN ISO/ICE 2015:17025	WHO, ISO 16075:2016	WHO, ISO 16075:2016	WHO	No	DIN 191650, category IV	No
Data transparency/ administrative efficiency	ICT	ICT	ICT	Release the data to public, regular public reports ICT	Release the data to public, regular public reports	Release the data to public, regular public reports	Release the data to public, regular public reports	Intern data files (Excel)	
Problems with the monitoring practice	Minor to no difficulties	No difficulties	No difficulties	Minor difficulties	Minor difficulties	Minor difficulties	Major problems that hindered implementation	Minor difficulties	Occasional significant problems
Effectiveness of implementation	Smooth, outperformed expectations	Outperformed expectations (Murcia) Smooth	Outperformed expectations	Smooth	Smooth	Smooth	Implementation was hindered but not fully	Smooth	Problems were treated in time and did not pose a problem for the implementation
Skilled personnel	Qualified, up to date	Qualified, up to date	Qualified, up to date	Qualified, up to date	Qualified, up to date	Qualified, up to date	Qualified	Qualified, up to date	
Adequate lab equipment	Advanced	Advanced (Murcia)/ Adequate	Advanced	Advanced	Advanced	Advanced	Adequate	Adequate	
Score	224.5	213	208	180	262	254	108.5	96	33
Classification	Best	Good	Good	Promising	Best	Best	Promising	Poor	Poor

4.4.1 AQUARES partner countries without water reuse standards

In Poland, monitoring procedures are indirectly defined in the Water Law Act. They are based on the WHO guidelines and ISO 16075:2016. Current monitoring practice could be improved by adding online monitoring facilities. The **Latvian** monitoring procedures are also based on the WHO guidelines and include all relevant monitoring elements. In Latvia, binding regulations of municipalities determine minimum requirements for wastewater collectors; these requirements include an agreement about the delivery of collected wastewater with the WWTP, and a requirement to submit data about the collected wastewater volume. Inspection plans are developed by the State Environmental Service every year, which determine the frequency of inspections of wastewater discharge permit holders. From Latvia, no problems with the implementation of the monitoring procedures were reported. For Poland some problems were identified, namely problems related to an ambiguous understanding of issues, which lead to confusion on the implementation controlling line, and the short time in which monitoring standards need to be implemented. Further, there may be interpretation problems within documents that originally were not prepared in Polish, due to incorrect translations of the water industry specific language. Both in Poland and in Latvia, there are no ICT methods in place, instead monitoring data is released to the public via regular public reports. Current monitoring procedures are assessed as being effective.

The **Czech Republic´s** monitoring procedures are defined but do not follow an established approach. The data on monitoring is released to the public. Problems are reported in terms of the implementation of monitoring in small WWTPs. There are currently not enough officials who can control compliance and there are reports of non-compliance with the quality of sludge cleaning. Due to these problems the monitoring is assessed as not being very effective. Further, the supplementing elements (personnel and lab equipment) could be updated to the newest standards (see table 4).

Water reuse in **Germany** is currently limited to two WWTPs with the end product being used for irrigation. There is no data on the number of end users. Water reuse is not accompanied by a risk management framework, but there exist descriptions of the reuse system and operational procedures for monitoring. Monitoring procedures are based on DIN 19650, category IV[5], which defines physical water quality parameters and indicators, manual and verification monitoring. Data is documented in internal data files. Weekly data on nutrient contents of the reclaimed water are provided to the farmers for needs-oriented fertilisation.

[5] DIN 19650, 1999, Hygienic-microbiological classification and application of irrigation water, version 2016.

Sampling is automated. Monitoring is judged as effective, however the lab equipment could be updated to include the possibility to analyse emergent pollutants.

In **Slovenia** the decree on the discharge and treatment of urban wastewater (98/15, and 76/17) requires that public utilities are obliged to report the amount and the purpose of municipal wastewater to be reused, and the treatment plants from which urban wastewater is being reused. So far, only a small part of the treated wastewater is reused including reuse within the installation itself. There is no risk management framework that accompanies the reuse. Monitoring of wastewater treatment and discharge is based on EU and WHO guidelines, but there is no monitoring specifically for water reuse.

4.4.2 AQUARES partner countries with water reuse standards

In **Greece**, half of the identified monitoring procedures are implemented and assessed as effective. While operational monitoring is included, the current monitoring procedure lacks verification and validation monitoring (see figure 4). In the future, this has to be included under the EU Regulation (EU) 2020/741. According to the Greek partner, the requirements foreseen within the JMD is more stringent than the EU water reuse standard defined by the UWD. For that reason, one problem that was reported as hindering the implementation of the monitoring procedures is the high infrastructure cost that is associated with wastewater treatment in Greece. Increasing the water reuse efforts will require not only investments in monitoring processes but also investments in new infrastructure, e.g. distribution systems from the reclamation facilities to the reused water users. These costs associated with water reuse projects may be one barrier to implement water reuse not only in Greece but in all EU countries.

In **Italy**, regional authorities define monitoring procedures within the Program for Protection and Use of Water. Monitoring is jointly managed by water utilities and the regional agencies for environmental protection. Procedures on sampling, preservation, analysis, laboratory best practices are included in the analytical methodologies database of the Institute Superiore di Sanita. This database is based on UNI CEI EN ISO/ICE 17025:2005; regional authorities can define updated guidelines on more recent standards. Italy scored highest in the rubric of essential elements on water reuse monitoring of the three AQUARES partner countries with WRS (70 out of 85 points, see figure 4).

In **Spain**, the monitoring procedures are based on the US EPA 2004 Guidelines for Water Reuse, however, described as more thorough and strict. Monitoring covers the treatment plant, the water authority, and the final users. The national procedures contain six of the eight monitoring elements, but Murcia only reported five monitoring elements (i. e. procedures for initiating corrective actions are not applied in Murcia) (see figure 4). In Murcia, the quality of

monitoring is judged to be absolutely effective. However, problems may derive from inadequate facilities to achieve the quality requirements. Although the lab equipment is adequate to measure water quality parameters, microorganisms and pathogens, it may lack nationwide coverage for additional parameters such as micro-pollutants or trace organic chemicals.

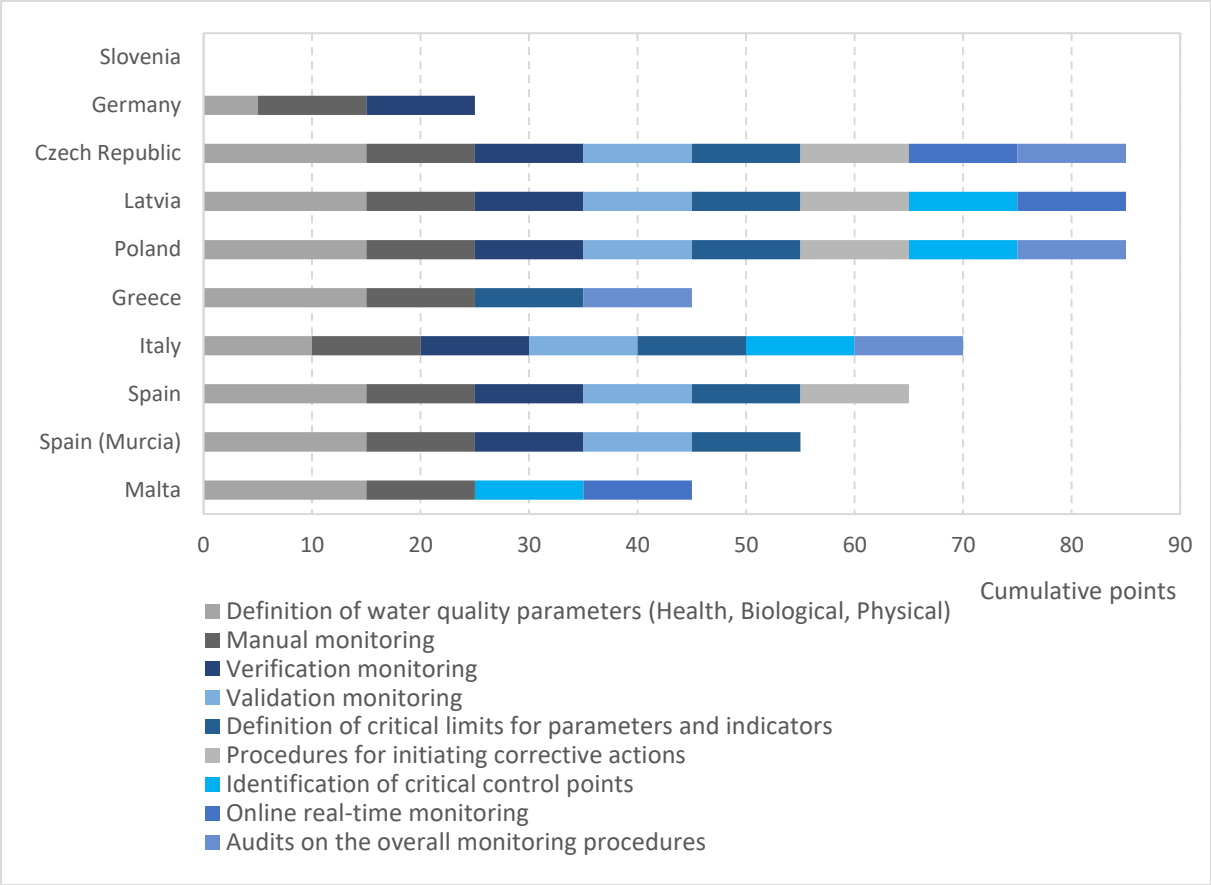


Figure 4 Elements of water reuse monitoring implemented by AQUARES partners

Note: Each element was awarded 10 points, except water quality parameters which scored 5 points each. The total score is 95 points. AQUARES partners without WRS reported on the policy framework most relevant to water reuse. Slovenia did not report any data, since it does not have a WRS implemented. Germany reported data on two national water reuse projects.

In **Malta**, the monitoring procedures defined within the minimum quality requirements for water reuse are considered to be effective. The procedures include the identification of critical control points from where water samples are collected twice weekly and checked for water quality parameters defined within the JRC document. The parameters include microbiological and chemical ones and the results are reported to the public health authorities on a quarterly basis. Additionally, there are yearly tests for the parameters defined in the Drinking Water Directive.

Malta is amongst the only partner countries that has online real-time monitoring installed (see figure 4). The monitoring procedure is characterised as having if only minor problems during implementation. But in general, its implementation was smooth and may have exceeded the expectations.

4.5 Guidelines on effective monitoring

- Cooperation between relevant actors

An effective monitoring standard will require an overarching cooperation between relevant stakeholders such as public authorities, end users, and water providers. These stakeholders should be included in the monitoring process at least to the level of providing opinions and information on the practice. The EU regulation does not specify on the monitoring implementation responsibilities, however, clear responsibilities should be defined by each member state. Amongst the AQUARES partner countries, monitoring was often conducted by the water provider itself or by public authorities. Member states may be able to use existing water related monitoring infrastructure (e. g. laboratories, sampling) for future water reuse projects in case that they have no WRS implemented yet. The new EU regulation allows for enough flexibility to accommodate national preferences and needs. Cooperation between the water reuse actors is advisable to maximise any potential additional benefits from reuse projects. For instance, Germany reported a decrease in application of artificial fertilisers by the farmers that use reclaimed water with known nutrient content for agricultural irrigation.

- Conformity with the new EU regulation

All AQUARES countries with a WRS have monitoring practices that are based on an established approach or a best practice. These countries also reported only minor or no problems with the implementation of the monitoring standards, and that monitoring exceeded their expectation. There are numerous approaches that can be used as a basis for monitoring, however the EU Regulation No. 2020/741 on minimum requirements for water reuse is based on the JRC guidelines, which in turn is based on the WHO guideline. Monitoring water reuse standards of the EU is based on the common risk management approach consisting of eight steps, and essential monitoring elements. AQUARES countries without WRS have a majority of the monitoring elements already implemented in respect of other water policy issues. Therefore, there exists a good foundation to achieve conformity with the new EU regulation. Those partners that already employ WRS based on other established approaches may have to adapt their current practice; however, adaptations may only be minor in those cases where

risk management is already practised, since the EU regulation is based on established practices and the conformity amongst the presented practices is high.

- Inclusion of established monitoring elements

Water reuse monitoring standards should contain certain elements such as the definition of water quality parameters (biological, health, physical), monitoring (operational, verification, validation), and CCPs. All of the presented best practices on water reuse monitoring contain relevant monitoring elements including microbial and viral parameters, and requirements on monitoring frequency and techniques.

Since not all AQUARES partners reported the inclusion of all relevant elements in their countries monitoring practise, there should be enough flexibility in the standard to allow for national or even regional differences. For example it may not be economically or technically feasible for all treatment facility operators to install online monitoring. However, key aspects such as frequency of monitoring and minimum monitoring parameters should be equal for all regions within a country, and for all member stated within the EU to increase homogeneity amongst EU members.

An increased homogeneity is the foundation of trust in water reuse practices, which in turn might help to overcome some of the barriers associated with the implementation of water reuse practices. Monitoring might also be used to overcome psychological barriers in water reuse, because monitoring safeguards the quality of treated effluent. By communicating the monitoring results regularly and transparent to the public, monitoring can help to foster and maintain trust in water reuse applications.

- Efficient data reporting tools

All AQUARES partners with WRS in their countries in place reported the implementation of ICT tools. ICTs allow for greater data transferability, transparency, and administration efficiency and should be used for data collection and reporting. Further, online monitoring might generate additional benefits such as enhanced problem screening, quicker response to hazards and the potential to make use of big data analysis.

With increased digitalization arises the opportunity to manage water networks more systematically by installing for instance intelligent sensors, automatic pumps, and smart meters. Especially the application of smart meters might help to increase water resource efficiency by minimising water losses in the water transportation network.

A potential problem associated with increased digitalisation is the risk of IT security, for instance through cyber-attacks. To improve the security of water reuse practices, water reuse monitoring standards should consider cyber security aspects.

- Supporting elements

Key factors to successful and reliable monitoring are supporting elements of WRS such as qualified personnel and laboratory equipment. Personnel should be qualified and up to date in terms of sampling methods and best practices to safeguard the quality of monitoring. Laboratory equipment should at least be adequate to analyse the usual water quality parameters such as BOD_5, micro-organisms and pathogens, but better advanced to cover also additional parameters such as emergent pollutants.

One of the problems encountered during this project was the lack of information and data, especially with regards to those supporting elements of (water reuse) monitoring. Also, the lack of qualified personnel was named as one of the problems in ensuring effective monitoring amongst AQUARES partners. Further, the data on the quality and quantity of resources in water treatment services was reported as often too little and outdated. One aspect of a smooth implementation of water reuse practices will be sufficient information on the current infrastructure in terms of quantity (How much water can be reused?), quality of infrastructure (What kind of treatment is in place? What needs to be invested/improved?) and of supporting elements (more staff needed; What kind of equipment is there for monitoring?). Member states should invest in gathering sufficient data on the state of the art of their urban wastewater infrastructure, and also invest in new/updated infrastructure where necessary, i. e. increase connectivity to WWTPs, install tertiary treatment, personal training and laboratory equipment.

- Flexibility

Monitoring water reuse standards should contain enough flexibility to allow for the consideration of local conditions, advances in technology and/or emergence of new pollutants, and enough flexibility in terms of monitoring frequency. Minimum requirements should be defined to ensure health/environment protection.

- Cost efficiency

One of the aspects that was not considered in the data collection tool was the aspect of cost-efficiency. In Cyprus, the lower price of reclaimed water compared to “normal” water was used as an economic incentive to reuse water. Other countries may prefer to subsidize prices of reused water or infrastructure needed to install water reuse projects. Cost efficiency in

monitoring may be related to select suitable monitoring frequencies, parameters and facilities to meet health targets but also economic aspects in order to minimise costs of reused water.

5 Conclusion

In water reuse key aspects are to safeguard the quality of water and to ensure that there are adequate mechanisms for minimizing health and environmental risks. This is the task of water reuse legislation, guidelines or standards that defining adequate monitoring rules.

The AQUARES survey results revealed a divergence amongst EU member states in terms of regulations on water reuse but also in terms of existing wastewater treatment infrastructure. Implementing water reuse monitoring may not only be problematic due to a lack of time to implement the new regulations, but also because of the different levels of wastewater treatment in terms of level of treatment (primary, secondary, tertiary), the connection rate of people to the sewer system, the level of willingness to invest in new infrastructure, and the pricing of reused water compared to freshwater.

EU member states with existing monitoring schemes as part of their water safety planning can use some of the already existing monitoring infrastructure for water reuse monitoring. However, there are some key differences between monitoring for water safety planning and water reuse, namely that water reuse monitoring has multiple objectives, more stakeholders, and addresses risks to multiple exposure groups. Further, water reuse monitoring should operate in a less rigid regulatory environment allowing to tailor to local conditions, while at the same time ensuring minimum quality standards across the EU. For instance, water reuse monitoring must follow the complete sanitation chain, and consider multiple exposure groups (e.g. farm workers, WWTP operators, end users).

Based on the AQUARES results, Malta's approach was identified as the best practice. Since this approach is based on the JRC guideline, which in turn is based on WHO guidelines both approaches can be identified as effective. The Regulation No. 2020/741 of the European Parliament and the Council of 25 May 2020 on minimum requirements for water reuse is based on the JRC guidelines and introduces a regulatory framework in order to homogenise current water reuse practices across the EU. Effective water reuse monitoring standards should be conform to the EU regulation, be flexible, practicable and cost-efficient. An effective monitoring is essential to safeguard public and the environment. Water reuse is already implemented safely in many parts of the world including water reuse monitoring standards to safeguard water quality and thereby minimising the risks to public and environmental health. It can be concluded that water reuse following established approaches and best practices can help to conserve existing water resources, create new economic opportunities while being conform to

the circular economy objective, and deliver a water resource that is safe to use for agricultural and other purposes.

6 Literature

Alcalde-Sanz, L. and Gawlik, B.M. (2014) Water Reuse in Europe - Relevant guidelines, need for and barrier to innovation. Publications Office of the European Union, Luxembourg, Luxembourg.

Alcalde-Sanz, L. and Gawlik, B.M. (2017) Minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge - Towards a water reuse regulatory instrument at EU level. Publications Office of the European Union, Luxembourg, Luxembourg.

ASM (2019) Effective practices in monitoring, assessing and ensuring compliance with water reuse standards in Poland and selected European Union countries. Report commissioned by Marshal Office of the Lodz Voivodeship within a frame of AQUARES project. ASM- Market Research and Analysis Centre LTD, Kutno, Poland.

Becker, D., Frey, A., Jungfer, C., Krömer, K., Kulse, P., Maaßen, S., Schramm, E., Wencki, K., Zimmermann, B. and Zimmermann, M. (2017) Marktpotenziale der Wasserwiederverwendung. Anforderungen und Kriterien in unterschiedlichen Sektoren und möglichen Zielmärkten für das MULTI-ReUse-Verfahren. Institut für sozial-ökologische Forschung (ISOE) GmbH, Frankfurt am Main, Germany.

BIO by Deloitte (2015) Optimising water reuse in the EU - Public consultation analysis report prepared for the European Commission. Publications Office of the European Union, Luxembourg.

COM(2012) 673 A Blueprint to Safeguard Europe's Water Resources. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. European Commission, Brussels, Belgium.

COM(2015) 614 Closing the loop – An EU action plan for the Circular Economy. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. European Commission, Brussels, Belgium.

COM(2018) 337 Proposal for a regulation of the European Parliament and of the Council on minimum requirements for water reuse. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. European Commission, Brussels, Belgium

DIN EN ISO 19458:2006 Water quality – Sampling for microbiological analysis (ISO 19458:2006). Beuth publishing, Berlin, Germany.

Directive 91/271/EEC of the Council of 21 May 1991 concerning urban waste water treatment. Official Journal of the European Union. L 135/40, 30 May 1991.

Directive 91/676/EEC of the European Parliament and of the Council of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources. Official Journal of the European Union. L 375/1, 31 December 1991.

Directive 98/83/EC of the European Parliament and of the Council of 12 December 1998 on the quality of water intended for human consumption. Official Journal of the European Union. L 330/32, 5 December 1998.

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for community action in the field of water policy. Official Journal of the European Union. L 327/1, 23 October 2000.

European Commission (2017) *Water reuse factsheet*. Viewed 28 August 2020 https://ec.europa.eu/environment/water/pdf/water_reuse_factsheet_en.pdf

European Commission (2020) *Water reuse*. Viewed on 28 August 2020 https://ec.europa.eu/environment/water/reuse.htm

ISO 16075 (2015) Guidelines for treated wastewater use for irrigation projects. International Organization for Standardization, Geneva, Switzerland.

OOWV (2018) A1.4 Methodology to collect successful practices in monitoring, assessing and ensuring compliance with water reuse standards. Water Board of Oldenburg and East Frisia (OOWV), Oldenburg, Germany.

Raso, J. (2013) Update of the final report on wastewater reuse in the European Union. Project: Service contract for the support to the follow-up of the communication on water scarcity and droughts. TYPSA Consulting Engineers and Architects, Barcelona, Spain.

Regulation (EU) 2020/741 of the European Parliament and of the Council of 25 May 2020 on minimum requirements for water reuse. Official Journal of the European Union, L 177/32, Brussels, Belgium.

SWD(2012) 393 The Fitness Check of EU Freshwater Policy. Commission Staff Working Document. European Commission, Brussels, Belgium.

SWD(2019) 439 Fitness check of the Water Framework Directive and the Floods Directive. Commission Staff Working Document. European Commission, Brussels, Belgium.

SWD(2020) 100 Circular Economy Action Plan – For a cleaner and more competitive Europe. European Commission, Brussels, Belgium.

WHO (2004) Guidelines for Drinking-water quality. World Health Organisation, Geneva, Switzerland.

WHO (2006) Guidelines for the safe use of wastewater, excreta and greywater. World Health Organisation, Geneva, Switzerland.

WHO (2016) Sanitation Safety Planning. Manual for safe use and disposal of wastewater, greywater and excreta. World Health Organisation, Geneva, Switzerland.

7 Annex

Index

Annex 1: Evaluation criteria of the data collection tool

Annex 2: Data collection tools of AQUARES Partners

Annex 1: Evaluation criteria of the data collection tool

Overview of evaluation criteria				
Criteria	**Relevant question**	**Points awarded**		
Section A: Monitoring framework				
Integration with other water reuse regulations	A9b	For option a): 10 For option b) and c): 5		
Stakeholder's involvement in the development of the standard	A9c	N*1 (e.g. if three boxes checked, 3*1=3)		
	A9d	N*2 (e.g. if option 4, then 4*2=8)		
Inclusion of a risk management approach	A11	For option a): 10 For option b): 0		
Inclusion of essential elements of a water reuse monitoring framework	A12	For each option: 10 For each extra option: 5		
Inclusion & effectiveness of provision on permits, compliance checks, and non-compliance procedures	A13a	For each option: 5		
	A13c	For each option: N*1		
Section B: Quality and elements of monitoring				
Follows established approach/uses best practices	B2	For option a): 2 For all other options: 5		
Includes essential elements of water reuse monitoring	B3	For all options apart b): 10 For option b): 5		
Data transparency & administrative efficiency	B4	For option a) and b): 5 For each extra option: 2		
Effectiveness of implementation	B5	Unsurmountable problems were encountered during the implementation of the monitoring practice. The monitoring practice was not implemented fully due to these problems.	1	*5 (e.g. 3*5=15)
		The monitoring practice had major problems that hindered its implementation, but in the end they did not hinder its full implementation	2	
		The monitoring practice occasionally encountered significant problems, which were treated in time and did not pose a problem for its implementation.	3	
		The monitoring practice faced minor difficulties and had an overall smooth implementation.	4	
		The implementation of the monitoring practice had no problems or difficulties whatsoever, outperforming implementation expectations.	5	
Section C: Supporting elements				
Skilled personnel	C1	N*2 (e.g. if option 3, then 3*2=6)		
Adequate lab equipment	C2	N*2		

Annex 2: Data collection tools of AQUARES Partners

MALTA			
A.	**General information**		
1)	Partner	Energy & Water Agency	
2)	Country	Malta	
3)	Does your country implement water reuse standards?	☐	Yes
		☒	No* *If your country does not implement water reuse standards, please use the policy framework most relevant to water reuse to fill-in the rest of the form (e.g. risk management framework for wastewater treatment).
4)	Name of the standard (or most relevant framework)	Minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge (Alcalde-Sanz, L.; Gawlik, B.M, 2017)	
5)	Developed by	Joint Research Centre	
6)	Implementing authority / (-ies)	Food Safety Commission (Public Health Regulatory Agency)	
7)	Geographical coverage	☒	National
		☐	Regional
8)	Purpose/use of the standard	☒	Agricultural
		☐	Industrial
		☐	Urban
		☐	Recreational
		☒	Other (please specify): Aquifer recharge
9)	a) Please briefly describe the main aspects of the standard.	JRC guidance document which proposed water quality standards for ensuring the safe use of reclaimed water. The document forms the basis of the proposed EU Regulation on Water Reuse	
	b) Is it standalone or part of a wider policy framework for water reuse?	☐	Standalone
		☒	Part of a wider policy framework (please specify which): 2nd RBMP
		☐	Other (please specify):
	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☒	Public authorities
		☒	Water supplier company / organisation
		☒	Operator/owner of the reuse plant and system
		☒	End-users (e.g. farmers)
		☒	Public health organisations
		☐	Consumer representatives

		☐	NGOs (e.g. environmental)	
		☐	Local communities / citizen initiatives	
		☐	Other (please specify):	
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☐	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☒	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☐	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☐	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	Three treatment facilities use these standers which are located in the North and South of Malta and one of which is in Gozo. All of the facilities use secondary and denitrification level of treatment. In total they have a production capacity of around 75,000 m^3 /day. The end users are all farmers and are distributed as follows: • *Gozo 122* • *Malta North 353* • *Malta South 16*		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☒	Yes	
		☐	No	
12)	Which of the following elements comprise the water reuse standard?	☒	Operation of a (risk) management team	
		☒	Description of the water reuse system	
		☒	Processes to identify hazards and hazardous events, and risk assessment	
		☒	Determination of preventive measures to limit risks	
		☒	Operational procedures for monitoring	
		☒	Verification procedures of the water quality and the receiving environment	
		☒	Validation of processes and procedures	
		☒	Procedures to manage incidents and emergencies	
		☐	Other(s) (please describe):	
13)	a) Does the water reuse standard define:	☐	Provisions for granting permits to treatment plants	
		☐	Steps for managing non-compliance	

		☐		Regulations defining compliance checks procedures
	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	1		"Water Services Corporation" applies for the operational authorisation which is issued by the "Food Safety Commission"
		2		A monitoring framework has been established by the Corporation – internal compliance mechanism. The results of this monitoring framework is reported to the Food Safety Commission, as part of the requirements of the authorisation issued by the same Commission.
		3		If key monitoring parameters (those included in the JRC document), have exceeded the recommended limit, operations are immediately informed and actions are taken accordingly depending on the type and frequency of exceedance. These corrective actions such as washing of distribution or disinfected the reservoirs. From commissioning stage the highlighted guidelines have never been exceeded.
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.
		☐	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☒	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☒	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)

		☒	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).

B.	**Monitoring water reuse**				
1)	Are monitoring procedures defined within the water reuse standard?	☒	Yes		
		☐	No (please describe the framework under which they are defined):		
2)	Do the monitoring procedures follow / are based on an established approach?	☐	No		
		☒	World Health Organisation approach (WHO)		
		☒	ISO 16075:2016		
		☒	Other (please describe below): ISO 16075: 2015		
3)	Does the monitoring procedures include one of the following (select all that apply):	☒	Identification of critical control points (or similar monitoring points)		
		☒	Definition of water quality parameters & indicators	☒	Health
				☒	Biological
				☒	Physical
		☐	Definition of critical limits for parameters & indicators		
		☒	On-line real-time monitoring		
		☒	Manual monitoring		
		☐	Other type(s) of monitoring method (please specify):		
		☐	Procedures for initiating corrective actions		
		☐	Verification monitoring		
		☐	Validation monitoring		
		☐	Audits on the overall monitoring procedures		
4)	In documenting monitoring data, do you (select all that apply):	☐	Release the data to the public / regular public reports		
		☒	Use ICT methods to document data		
		☐	Other(s) (please describe below):		
5)	Please provide information regarding the implementation of the monitoring	New Water (reclaimed water) quality is monitored by the WSC laboratory to ensure that recommended guidelines (JRC identified parameters) are met, and			

	procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?)	that the quality of reclaimed water is not deteriorating along the distribution network. Twice weekly samples are collected from sampling points as listed below: • Gozo New Water Polishing- Plant Outlet and Reservoir • North New Water Polishing- Plant Outlet and Distribution Point towards the end of the network • South New Water Polishing- Plant Outlet The parameters tested include both Chemical and Microbiological ones and results are reported to the public health on a quarterly basis. Once yearly all water produced form the reclamation plants is tested for the all the parameters stipulated in drinking water directive.					
6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?	1	2	3	4	5
		☐	☐	☐	☒	☐
C.	**Elements supporting monitoring**					
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.		
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.		
		☒	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.		
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.		
		☐	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).		
		☒	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.		

SPAIN - Murcia Region			
A.	**General information**		
1)	Partner	GDW	
2)	Country* *where [country], hereafter [region] for MURCIA-GDW	SPAIN – MURCIA REGION	
3)	Does your country implement water reuse standards?	☒	Yes
		☐	No
4)	Name of the standard (or most relevant framework)	Urban Use: Standard 1.1: RESIDENTIAL a) Irrigation of private gardens. b) Discharge of sanitary devices. Standard 1.2: SERVICES a) Irrigation of urban green areas (parks, sports, fields and the like). b) Street wash. c) Fire systems. d) Industrial car wash. Agricultural Use: Standard 2.12: a) Irrigation of crops with water application system that allows direct contact of the regenerated water with the edible parts for fresh human food. Standard 2.2: a) Irrigation of products for human consumption with a water application system that does not prevent the direct contact of the regenerated water with the edible parts, but the consumption is not fresh but with a subsequent industrial treatment. b) Irrigation of pastures for consumption of animals producing milk or meat. c) Aquaculture. Standard 2.3 a) Localized irrigation of woody crops that prevents the contact of the regenerated water with the fruits consumed in human food. b) Irrigation of ornamental flower crops, nurseries, greenhouses without direct contact of the regenerated water with the productions. c) Irrigation of non-food industrial crops, nurseries, silage forages, cereals and seeds oilseeds. Industrial Purpose: Standard 3.11 a) Process and cleaning waters except in the food industry. b) Other industrial uses. c) Process and cleaning waters for use in the food industry Standard 3.2 a) Cooling towers and evaporative condensers	

		Recreational Use: Standard 4.1 a) Irrigation of golf courses. Standard 4.2 a) Ponds, bodies of water and ornamental circulating flows, in which public access to water is impeded. Environmental Uses: Standard 5.1 a) Recharge of aquifers by percolation located across the land. Standard 5.2 a) Recharge of aquifers by direct injection. Standard 5.3 a) Irrigation of forests, green areas and other areas not accessible to the public. b) Forestry. Standard 5.4 a) Other environmental uses (maintenance of wetlands, minimum flows and the like).	
5)	Developed by	MINISTRY OF THE PRESIDENCY: Royal Decree 1620/2007 (RDR)	
6)	Implementing authority / (-ies)	River Segura Basin Authority	
7)	Geographical coverage	☐	National
		☒	Regional
8)	Purpose/use of the standard	☒	Agricultural (almost 100 %)
		☐	Industrial
		☐	Urban
		☐	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard.	These standards are considered mandatory minimum due. The River Segura Basin Authorities will require quality conditions that are adapted to the most similar use of those quality standards aforementioned.	
	b) Is it standalone or part of a wider policy framework for water reuse?	☐	Standalone
		☒	Part of a wider policy framework (please specify which): **Law 11/2005, of June 22**, which modifies Law 10/2001, of July 5, of the National Hydrological Plan, contains a modification of the consolidated text of the Water Law, approved by the Royal Legislative Decree 1/2001, of July 20, in which a new wording of article 109.1 has been given “the Government will establish the basic conditions for the water reuse, specifying the quality required of purified water according to the intended uses.”
		☐	Other (please specify):
		☒	Public authorities

	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☒	Water supplier company / organisation	
		☒	Operator/owner of the reuse plant and system	
		☒	End-users (e.g. farmers)	
		☒	Public health organisations	
		☒	Consumer representatives	
		☐	NGOs (e.g. environmental)	
		☒	Local communities / citizen initiatives	
		☐	Other (please specify):	
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☐	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☐	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☐	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☒	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	Around 110 hm^3/year, 96 % of the wastewater generated in Murcia, 65 % with tertiary treatment and 33 % with secondary treatment plus disinfection, in 93 WWTPs. Source: http://www.esamur.com/reutilizacion		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☒	Yes	
		☐	No	
12)	Which of the following elements comprise the water reuse standard?	☐	Operation of a (risk) management team	
		☒	Description of the water reuse system	
		☒	Processes to identify hazards and hazardous events, and risk assessment	
		☒	Determination of preventive measures to limit risks	
		☒	Operational procedures for monitoring	

<table>
<tr><td rowspan="5"></td><td rowspan="5"></td><td>☒</td><td colspan="2">Verification procedures of the water quality and the receiving environment</td></tr>
<tr><td>☒</td><td colspan="2">Validation of processes and procedures</td></tr>
<tr><td>☐</td><td colspan="2">Procedures to manage incidents and emergencies</td></tr>
<tr><td rowspan="2">☐</td><td colspan="2">Other(s) (please describe):</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="11">13)</td><td rowspan="3">a) Does the water reuse standard define:</td><td>☒</td><td colspan="2">Provisions for granting permits to treatment plants</td></tr>
<tr><td>☐</td><td colspan="2">Steps for managing non-compliance</td></tr>
<tr><td>☒</td><td colspan="2">Regulations defining compliance checks procedures</td></tr>
<tr><td rowspan="3">b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.</td><td>1</td><td colspan="2">The permits are granted on a public tender basis when volume is over 100.000 m3/yr. If the volume is lower or the application comes from the holder of the dumping permit, tender is not necessary. Permits are issued by Water Authorities, of which there is one per water district according to WFD. All permit applications must include a Water reuse project.</td></tr>
<tr><td>2</td><td colspan="2">In case non-compliance is detected, reuse is discontinued until the cause is determined and the problem sorted out. In the meantime, water is dumped and extraordinary charges and/or fines for non-compliance may apply for the WWTP operator</td></tr>
<tr><td>3</td><td colspan="2">Compliance checks are carried out by the holder of the dumping permit, at the outlet; by the water authority, also at the outlet; and by the end user, at their own intake.</td></tr>
<tr><td rowspan="6">c) How effective do you consider the processes of:</td><td colspan="3">1) Granting permits to treatment plants</td></tr>
<tr><td>☐</td><td>1</td><td>Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.</td></tr>
<tr><td>☐</td><td>2</td><td>Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.</td></tr>
<tr><td>☒</td><td>3</td><td>Very effective: The process of granting permits does not have any delays or administrative setbacks.</td></tr>
<tr><td colspan="3">2) Managing non-compliance issues</td></tr>
<tr><td>☐</td><td>1</td><td>Not effective: Most non-compliance issues are not treated in time and are not resolved.</td></tr>
</table>

		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☒	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☒	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).
B.	**Monitoring water reuse**			
1)	Are monitoring procedures defined within the water reuse standard?	☒	Yes	
		☐	No (please describe the framework under which they are defined):	
2)	Do the monitoring procedures follow / are based on an established approach?	☐	No	
		☐	World Health Organisation approach (WHO)	
		☐	ISO 16075:2016	
		☒	Other (please describe below): Other (please describe below): USEPA Guidelines for Water Reuse, 2004, although the Spanish regulation is more thorough and strict.	
3)	Does the monitoring procedures include one of the following (select all that apply):	☐	Identification of critical control points (or similar monitoring points)	
		☒	Definition of water quality parameters & indicators	☒ Health ☒ Biological ☒ Physical
		☒	Definition of critical limits for parameters & indicators	
		☐	On-line real-time monitoring	
		☒	Manual monitoring	
		☐	Other type(s) of monitoring method (please specify):	

		☐	Procedures for initiating corrective actions
		☒	Verification monitoring
		☒	Validation monitoring
		☐	Audits on the overall monitoring procedures
4)	In documenting monitoring data, do you (select all that apply):	☐	Release the data to the public / regular public reports
		☒	Use ICT methods to document data
		☐	Other(s) (please describe below):
5)	Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?)	The monitoring process involves the treatment plant, the water authority, and the final users. Possible problems during the implementation may derive from inadequate facilities to achieve the quality requirements.	

6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?	1	2	3	4	5
		☐	☐	☐	☐	☒

C.	**Elements supporting monitoring**			
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.
		☒	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☐	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☒	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Spain			
A.	**General information**		
1)	Partner	Euro-Mediterranean Water Institute Foundation	
2)	Country	SPAIN	
3)	Does your country implement water reuse standards?	☒	Yes
		☐	No
4)	Name of the standard (or most relevant framework)	**Urban** Use: **Standard 1.1: RESIDENTIAL** a) Irrigation of private gardens. b) Discharge of sanitary devices. **Standards 1.2**: **SERVICES** a) Irrigation of urban green areas (parks, sports, fields and the like). b) Street wash. c) Fire systems. d) Industrial car wash. **Agricultural Use:** **Standard 2.12** a) Irrigation of crops with water application system that allows direct contact of the regenerated water with the edible parts for fresh human food. **Standard 2.2** a) Irrigation of products for human consumption with a water application system that does not prevent the direct contact of the regenerated water with the edible parts, but the consumption is not fresh but with a subsequent industrial treatment. b) Irrigation of pastures for consumption of animals producing milk or meat. c) Aquaculture. **Standard 2.3** a) Localized irrigation of woody crops that prevents the contact of the regenerated water with the fruits consumed in human food. b) Irrigation of ornamental flower crops, nurseries, greenhouses without direct contact of the regenerated water with the productions. c) Irrigation of non-food industrial crops, nurseries, silage forages, cereals and seeds oilseeds. **Industrial Purpose:** **Standard 3.11** a) Process and cleaning waters except in the food industry. b) Other industrial uses. c) Process and cleaning waters for use in the food industry **Standard 3.2** a) Cooling towers and evaporative condensers	

		Recreational Use: **Standard 4.1** a) Irrigation of golf courses. **Standard 4.2** a) Ponds, bodies of water and ornamental circulating flows, in which public access to water is impeded. **Environmental Uses:** **Standard 5.1** a) Recharge of aquifers by percolation located across the land. **Standard 5.2** a) Recharge of aquifers by direct injection. **Standard 5.3** a) Irrigation of forests, green areas and other areas not accessible to the public. b) Forestry. **Standard 5.4** a) Other environmental uses (maintenance of wetlands, minimum flows and the like).	
5)	Developed by	MINISTRY OF THE PRESIDENCY Royal Decree 1620/2007 (RDR)	
6)	Implementing authority / (-ies)	Spanish River Basin Authority	
7)	Geographical coverage	☒	National
		☐	Regional
8)	Purpose/use of the standard	☒	Agricultural (almost 100 %)
		☒	Industrial
		☒	Urban
		☒	Recreational
		☒	Other (please specify): Environmental Uses
9)	a) Please briefly describe the main aspects of the standard.	These standards are considered mandatory minimum due. The River Basin Authorities will require quality conditions that are adapted to the most similar use of those quality standards aforementioned.	
	b) Is it standalone or part of a wider policy framework for water reuse?	☐	Standalone
		☒	Part of a wider policy framework (please specify which): Law 11/2005, of June 22, which modifies Law 10/2001, of July 5, of the National Hydrological Plan, contains a modification of the consolidated text of the Water Law, approved by the Royal Legislative Decree 1/2001, of July 20, in which a new wording of article 109.1 has been given “the Government will establish the basic conditions for the water reuse, specifying the quality required of purified water according to the intended uses.
		☐	Other (please specify):
		☒	Public authorities

	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☒	Water supplier company / organisation	
		☒	Operator/owner of the reuse plant and system	
		☐	End-users (e.g. farmers)	
		☒	Public health organisations	
		☐	Consumer representatives	
		☐	NGOs (e.g. environmental)	
		☐	Local communities / citizen initiatives	
		☐	Other (please specify):	
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☐	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☐	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☐	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☒	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	Around 540 are implementing tertiary treatment to fulfil requirements for water reuse. 400 hm3 are reused annually, amounting to 13% of treated wastewater. Around 60% is used in irrigation farming, with the remaining going to golf course irrigation or municipal uses (street maintenance, parks&garden irrigation). Source: Spanish association for desalination & Reuse, AEDyR: https://www.aedyr.com/es/blog/cifras-reutilizacion-agua-espana		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☒	Yes	
		☐	No	
12)	Which of the following elements comprise the water reuse standard?	☐	Operation of a (risk) management team	
		☒	Description of the water reuse system	
		☒	Processes to identify hazards and hazardous events, and risk assessment	
		☒	Determination of preventive measures to limit risks	

		☒		Operational procedures for monitoring
		☒		Verification procedures of the water quality and the receiving environment
		☒		Validation of processes and procedures
		☐		Procedures to manage incidents and emergencies
		☐		Other(s) (please describe):
13)	a) Does the water reuse standard define:	☒		Provisions for granting permits to treatment plants
		☐		Steps for managing non-compliance
		☒		Regulations defining compliance checks procedures
	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	1		The permits are granted on a public tender basis when volume is over 100.000 m3/yr. If the volume is lower or the application comes from the holder of the dumping permit, tender is not necessary. Permits are issued by Water Authorities, of which there is one per water district according to WFD. All permit applications must include a Water reuse project.
		2		In case non-compliance is detected, reuse is discontinued until the cause is determined and the problem sorted out. In the meantime, water is dumped and extraordinary charges and/or fines for non-compliance may apply for the WWTP operator
		3		Compliance checks are carried out by the holder of the dumping permit, at the outlet; by the water authority, also at the outlet; and by the end user, at their own intake.
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.
		☐	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☒	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☒	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.

		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☒	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).

B.	**Monitoring water reuse**				
1)	Are monitoring procedures defined within the water reuse standard?	☒	Yes		
		☐	No (please describe the framework under which they are defined):		
2)	Do the monitoring procedures follow / are based on an established approach?	☐	No		
		☐	World Health Organisation approach (WHO)		
		☐	ISO 16075:2016		
		☒	Other (please describe below): USEPA Guidelines for Water Reuse, 2004, although the Spanish regulation is more thorough and strict.		
3)	Does the monitoring procedures include one of the following (select all that apply):	☐	Identification of critical control points (or similar monitoring points)		
		☒	Definition of water quality parameters & indicators	☒	Health
				☒	Biological
				☒	Physical
		☒	Definition of critical limits for parameters & indicators		
		☐	On-line real-time monitoring		
		☒	Manual monitoring		
		☐	Other type(s) of monitoring method (please specify):		
		☒	Procedures for initiating corrective actions		
		☒	Verification monitoring		
		☒	Validation monitoring		
		☐	Audits on the overall monitoring procedures		
4)	In documenting monitoring data, do you (select all that apply):	☐	Release the data to the public / regular public reports		
		☒	Use ICT methods to document data		
		☐	Other(s) (please describe below):		

5)	Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?)	The monitoring process involves the treatment plant, the water authority, and the final users. Possible problems during the implementation may derive from inadequate facilities to achieve the quality requirements.				
6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?	1	2	3	4	5
		☐	☐	☐	☒	☐

C.	**Elements supporting monitoring**			
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.
		☒	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☒	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☐	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Italy			
A	**General information**		
1)	Partner	FLA – Lombardy Foundation for the Environment	
2)	Country	Italy	
3)	Does your country implement water reuse standards?	☑	Yes
		☐	No
4)	Name of the standard (or most relevant framework)	Ministerial Decree 185/2003 (and Regional *"PTUA – Program for Protection and Use of Water"* documents)	
5)	Developed by	Ministry of the Environment and for Territorial Protection	
6)	Implementing authority / (-ies)	• ARPA – Regional Agencies for Environmental Protection • Local Sanitary Agency • Local Water Services Authority	
7)	Geographical coverage	☑	National
		☑	Regional
8)	Purpose/use of the standard	☑	Agricultural
		☑	Industrial
		☑	Urban
		☐	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard.	M.D. 185/03 defines (Art. 3) urban, industrial and agricultural possible reuse destinations. The reuse process must guarantee environmental safety to ecosystems, soil, crops and avoid any sanitary-hygienic risk to exposed people (Art. 1). Quality objectives (Art. 4) for urban and agricultural uses include 53 physio-chemical and 2 microbiological parameters (Annex, Table). Industrial applications have less stringent limits (Tab. 3 Annex 5 of Lgs. D. 152/06 - discharge in surface water bodies) unless the process has specific requirements. Furthermore, the Decree identifies Regions duties: among others, they must define a list of hazardous parameters to keep monitored in discharged water and a monitoring program for the owner of water distribution network, which must report the results to Regional Authorities yearly.	
		☐	Standalone

	b) Is it standalone or part of a wider policy framework for water reuse?	☐		Part of a wider policy framework (please specify which):
		☑		Other (please specify): Leg. Decree 152/2006 *Framework for the environment*
	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☑		Public authorities
		☐		Water supplier company/organisation
		☑		Operator/owner of the reuse plant and system
		☐		End-users (e.g. farmers)
		☑		Public health organisations
		☐		Consumer representatives
		☐		NGOs (e.g. environmental)
		☐		Local communities/citizen initiatives
		☑		Other (please specify): Owner of the water distribution system
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☑	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☐	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☐	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☐	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	According to 2015 ISTAT's (Italian Statistics Institute) census, Italy has 17,897 wastewater treatment plants. Despite tertiary/advanced treatment is conducted only in 2,309 (12.9%) of the WWTPs, those plants treat about 59.6% of civil pollutants loads. Most of these plants are located in Northern Regions, in particular Lombardy and Veneto have 373 and 259 plants, respectively. Southern Regions show, instead, the highest ratios of advanced treatment plants over total number of WWTPs: 98.8% in Basilicata, 97.4% in Puglia, 94.3% in Sardegna.		
11)	Is the water reuse standard embedded in or accompanied	☐		Yes
		☑		No

	by a risk management framework?			
12)	Which of the following elements comprise the water reuse standard?	☐		Operation of a (risk) management team
		☑		Description of the water reuse system
		☐		Processes to identify hazards and hazardous events, and risk assessment
		☐		Determination of preventive measures to limit risks
		☑		Operational procedures for monitoring
		☑		Verification procedures of the water quality and the receiving environment
		☑		Validation of processes and procedures
		☑		Procedures to manage incidents and emergencies
		☑		Other(s) (please describe): • Monitoring parameters • Maximum concentrations allowed in reclaimed water
13)	a) Does the water reuse standard define:	☑		Provisions for granting permits to treatment plants
		☑		Steps for managing non-compliance
		☐		Regulations defining compliance checks procedures
	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	1		Each Region can define the approval procedures and the management modes (Art 47 of D.lgs. 152/1999).
		2		In case of non-compliance the competent Authority can, according to the severity of the violation: - Give *warning*, defining a deadline for compliance - Give *warning* and *temporary suspend the authorization* if public health and environment are in danger - *Withdraw the authorization* if compliance is not achieved after *warning* and/or in case of repeated violations (Art 51 of D.lgs. 152/1999)
		3		The competent Authority must ensure a periodical, extensive, effective and impartial monitoring protocol (Art 49 of D.lgs. 152/1999).
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.
		☐	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☐	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.

		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☐	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☐	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).
B	**Monitoring water reuse**			
1)	Are monitoring procedures defined within the water reuse standard?	☐	Yes	
		☑	No (please describe the framework under which they are defined): • Regions define monitoring procedures in *"PTUA – Program for Protection and Use of Water"* documents. Monitoring programs are generally jointly managed by Water Utility and Regional Environmental Agency (ARPA). • The ISS (Istituto Superiore di Sanità – Italian Health Organisation) provides an "Analytical Methodologies" database for chemical and microbiological water analyses, which includes sampling and preservation methods, analytical procedures, laboratory best practices, and so on.	
2)	Do the monitoring procedures follow / are based on an established approach?	☐	No	
		☐	World Health Organisation approach (WHO)	
		☐	ISO 16075:2016	
		☑	Other (please describe below): ISS's database of suggested methodologies is based on UNI CEI EN ISO/IEC 17025: 2005 but regional authorities can define updated guidelines based on more recent standards.	

<table>
<tr><td rowspan="10">3)</td><td rowspan="10">Does the monitoring procedures include one of the following (select all that apply):</td><td>☑</td><td colspan="3">Identification of critical control points (or similar monitoring points)</td></tr>
<tr><td rowspan="3">☑</td><td rowspan="3">Definition of water quality parameters & indicators</td><td>☐</td><td>Health</td></tr>
<tr><td>☑</td><td>Biological</td></tr>
<tr><td>☑</td><td>Physical</td></tr>
<tr><td>☑</td><td colspan="3">Definition of critical limits for parameters & indicators</td></tr>
<tr><td>☑</td><td colspan="3">On-line real-time monitoring</td></tr>
<tr><td>☑</td><td colspan="3">Manual monitoring</td></tr>
<tr><td>☐</td><td colspan="3">Other type(s) of monitoring method (please specify):</td></tr>
<tr><td>☐</td><td colspan="3">Procedures for initiating corrective actions</td></tr>
<tr><td>☑</td><td colspan="3">Verification monitoring</td></tr>
<tr><td>☑</td><td colspan="3">Validation monitoring</td></tr>
<tr><td>☑</td><td colspan="3">Audits on the overall monitoring procedures</td></tr>
<tr><td rowspan="3">4)</td><td rowspan="3">In documenting monitoring data, do you (select all that apply):</td><td>☐</td><td colspan="3">Release the data to the public / regular public reports</td></tr>
<tr><td>☑</td><td colspan="3">Use ICT methods to document data</td></tr>
<tr><td>☐</td><td colspan="3">Other(s) (please describe below):</td></tr>
<tr><td>5)</td><td>Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of <u>problems</u>?
(For example, is there a frequent need to take corrective actions?)</td><td colspan="4"></td></tr>
<tr><td rowspan="2">6)</td><td rowspan="2">With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☑</td></tr>
<tr><td colspan="2">C</td><td colspan="4">Elements supporting monitoring</td></tr>
<tr><td rowspan="3">1)</td><td rowspan="3">How would you assess the quality of the personnel that implements the monitoring?</td><td>☐</td><td>1</td><td colspan="3">Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.</td></tr>
<tr><td>☐</td><td>2</td><td colspan="3">Qualified: The personnel includes specialised chemists, engineers or technicians.</td></tr>
<tr><td>☑</td><td>3</td><td colspan="3">Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.</td></tr>
<tr><td>2)</td><td></td><td>☐</td><td>1</td><td colspan="3">Basic equipment: Can measure microorganisms, pathogens.</td></tr>
</table>

	How would you assess the lab equipment used for monitoring?	☐	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☑	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD_5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Greece			
A	**General information**		
1)	Partner	Ministry of Environment and Energy, General Secretariat for Natural Environment and Water	
2)	Country	Greece	
3)	Does your country implement water reuse standards?	☑	Yes
		☐	No
4)	Name of the standard (or most relevant framework)	Joint Ministerial Decree (JMD) 145116/11	
5)	Developed by	Ministry of the Interior, Decentralisation and Electronic Government Ministry of Economy, Competitiveness and Shipping Ministry of Environment and Energy Ministry of Health and Social Solidarity Ministry of Rural Development and Food	
6)	Implementing authority / (-ies)	Decentralized Directorate of Water Management	
7)	Geographical coverage	☑	National
		☐	Regional
8)	Purpose/use of the standard	☐	Agricultural
		☐	Industrial
		☐	Urban
		☐	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard.	This legislation describes the measures, definitions and procedures for the reuse of treated wastewater for i) agricultural use (irrigation), ii) groundwater supply, iii) urban and suburban use, iv) industrial use, and v) water bodies used for abstraction of drinking water (as thoroughly describes in Article 7 of Presidential Decree 51/2007). To this end, specific characteristics of wastewater reuse are described, such as categories of reclaimed water depending on water quality, specific requirements for reclaimed water classification, as well as monitoring requirements.	
	b) Is it standalone or part of a wider policy framework for water reuse?	☐	Standalone
		☐	Part of a wider policy framework (please specify which):
		☑	Other (please specify): Several EU Directives compliance
		☑	Public authorities

	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☑		Water supplier company/organisation
		☑		Operator/owner of the reuse plant and system
		☑		End-users (e.g. farmers)
		☑		Public health organisations
		☑		Consumer representatives
		☑		NGOs (e.g. environmental)
		☑		Local communities/citizen initiatives
		☐		Other (please specify): Owner of the water distribution system
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☐	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☑	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☑	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☐	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	25 wastewater treatment plants that cover areas falling under the Urban Wastewater Treatment Directive (91/21/EEC) reuse the reclaimed water for irrigation. The reclaimed water used covers 2% of the wastewater quantities treated by these 25 treatment plants.		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☐		Yes
		☑		No
12)	Which of the following elements comprise the water reuse standard?	☐		Operation of a (risk) management team
		☑		Description of the water reuse system
		☐		Processes to identify hazards and hazardous events, and risk assessment
		☑		Determination of preventive measures to limit risks
		☑		Operational procedures for monitoring

		☑		Verification procedures of the water quality and the receiving environment
		☐		Validation of processes and procedures
		☐		Procedures to manage incidents and emergencies
		☐		Other(s) (please describe):
13)	a) Does the water reuse standard define:	☑		Provisions for granting permits to treatment plants
		☑		Steps for managing non-compliance
		☑		Regulations defining compliance checks procedures
	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	1		The permit for the reuse of liquid waste water is issued by the Secretary General of the Decentralized Administration, along with the recommendation of the Decentralized Directorate of Water Management and the opinion of the competent departments. For the permit for the reuse of liquid wastewater, an application of the user of the Recovery Water Management Authority has to be assessed be relevant Department of Water of the Decentralized Administration. This application shall be accompanied by a study of the design and operation of the activity, which shall comply with the environmental conditions adopted by the law. When assessing the application, the Directorate of Waters of the Decentralized Management evaluates the compatibility of the proposed use with the approved Program of Measures, and more specifically the achievement of the environmental objectives. In this context, considering the each area's characteristics, additional information may be requested thus ensuring the protection of the aquatic recipient.
		2		Penalty is foreseen for any type of non-compliance with the water reuse legislation, as well as environmental liability.
		3		Article 12 of the JMD 145116/11 defines that the Decentralized Directorate of Water Management along with competent authorities shall perform regular and special inspections for verifying compliance.
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.
		☑	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☐	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		

		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☑	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☑	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).

B	**Monitoring water reuse**				
1)	Are monitoring procedures defined within the water reuse standard?	☑	Yes		
		☐	No (please describe the framework under which they are defined):		
2)	Do the monitoring procedures follow / are based on an established approach?	☐	No		
		☑	World Health Organisation approach (WHO)		
		☑	ISO 16075:2016		
		☐	Other (please describe below):		
3)	Does the monitoring procedures include one of the following (select all that apply):	☐	Identification of critical control points (or similar monitoring points)		
		☑	Definition of water quality parameters & indicators	☐	Health
				☑	Biological
				☑	Physical
		☑	Definition of critical limits for parameters & indicators		
		☐	On-line real-time monitoring		
		☑	Manual monitoring		
		☐	Other type(s) of monitoring method (please specify):		
		☐	Procedures for initiating corrective actions		
		☐	Verification monitoring		

		☐	Validation monitoring
		☑	Audits on the overall monitoring procedures
4)	In documenting monitoring data, do you (select all that apply):	☑	Release the data to the public / regular public reports
		☑	Use ICT methods to document data
		☐	Other(s) (please describe below):
5)	Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?)	The requirements foreseen within this JMD is more stringent than the rest EU water reuse standards (Directive 91/271/EEC). To this end, investments for wastewater treatment require high infrastructure costs.	

6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?	1	2	3	4	5
		☐	☐	☐	☑	☐

C	**Elements supporting monitoring**			
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.
		☑	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☐	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☑	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD_5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Poland			
A.	**General information**		
1)	Partner	Lodzkie	
2)	Country	Poland	
3)	Does your country implement water reuse standards?	☐	Yes
		☒	No* *If your country does not implement water reuse standards, please use the policy framework most relevant to water reuse to fill-in the rest of the form (e.g. risk management framework for wastewater treatment).
4)	Name of the standard (or most relevant framework)	1. KPOŚK - National Urban Waste Water Treatment Program (2003), 2. The Act of 20 July 2017. - Water law, 3. Legislative proposal - REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on minimum requirements for water reuse (2018).	
5)	Developed by	1. KPOŚK was approved by the Council of Ministers in 2003, its provisions are a consequence of the need to adapt Polish wastewater management to the requirements of Directive 91/271 / EEC of May 21, 1991 regarding urban wastewater treatment. 2. The Water Law Act, issuing authority: SEJM (lower house of parliament), obligated authorities: PRESIDIUM OF THE COUNCIL OF MINISTERS, minister competent for health, competent minister for fisheries, competent minister for agriculture, minister competent for justice, minister competent for planning and spatial management and housing, Council of Ministers. 3. Proposal - REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on minimum requirements for water reuse (2018) - the document issued by the European Parliament was the result of organized public consultations (including via the Internet); A wide range of stakeholders took part in the consultations: representatives of private enterprises, the drinking water sector, sanitary infrastructure, the food industry and the environment from EU Member States.	
6)	Implementing authority / (-ies)	• Polish Water - the main entity responsible for water management in Poland and its organizational units: ○ National Water Management Authority, ○ Regional Water Management Boards, • Entities that purify and reuse water or discharge it into the environment, including sewage treatment	

		plants or other units with closed water circulation, e.g. industrial plants.	
7)	Geographical coverage	☒	National
		☐	Regional
8)	Purpose/use of the standard	☒	Agricultural
		☒	Industrial
		☐	Urban
		☒	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard. *(No more than 15 lines)*	**Act of 20 July 2017. Water law** The Act regulates water management in accordance with the principle of sustainable development, in particular the shaping and protection of water resources, water use and management of water resources. The Act also describes water management while maintaining a rational and comprehensive treatment of surface and groundwater resources, including their quantity and quality. **KPOŚK** The objective of the Program, by implementing the investments included in it, is to reduce discharges of insufficiently treated wastewater, and thus to protect the aquatic environment. KPOŚK is a strategic document which estimates the needs and specifies activities for equipping the agglomeration, with RLM greater than 2000, with sewage systems and municipal sewage treatment plants. Pursuant to the Water Law Act, KPOŚK is periodically updated at least once every four years. The last and fourth update of the Program was approved by the Council of Ministers on April 21, 2016. **Proposal for a Regulation of the European Parliament and of the Council on minimum requirements for the reuse of water:** The overall goal is to contribute to reducing water scarcity across the EU, primarily by increasing the use of reclaimed water, in particular for agricultural irrigation. The establishment of harmonized minimum requirements (in particular key parameters of pathogens) regarding the quality of recovered water and monitoring, combined with harmonized risk management tasks, will ensure a level playing field for those who have an impact. Article I lays down minimum requirements for water quality and monitoring, along with the establishment of key risk management tasks to ensure the safe use of purified waters. Article II specifies the standards for specific applications. Article IV speaks of the minimum requirements that must be met for agricultural irrigation. Article V sets out risk management procedures that should be carried out by the purification plant operator or in cooperation with relevant parties. Article VI sets	

		out the procedure for the submission of applications for permits for the supply of recovered water (including list of documents). Article VII deals with procedures and conditions for authorization. Article VIII deals with checking compliance of the recovered water with the conditions set out in the permit (sets out the obligations of the competent authorities together with the rules to be followed in the event of non-compliance).		
	b) Is it standalone or part of a wider policy framework for water reuse?	☒	Standalone (regarding the Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on minimum requirements for water reuse)	
		☒	Part of a wider policy framework (please specify which): regarding KPOŚK and the Water Law Act); framework documents: Directive 91/271 / EEC of 21 May 1991 concerning urban waste-water treatment, Directive 2000/60 / EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, Directive 2006/118 / EC Of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and the deterioration of their status	
		☐	Other (please specify):	
	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☒	Public authorities	
		☒	Water supplier company / organisation	
		☒	Operator/owner of the reuse plant and system	
		☒	End-users (e.g. farmers)	
		☐	Public health organisations	
		☒	Consumer representatives	
		☒	NGOs (e.g. environmental)	
		☒	Local communities / citizen initiatives	
		☐	Other (please specify):	
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☒	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☐	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.

		☐	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☐	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities. *(No more than 10 lines)*	According to data from the Central Statistical Office of Poland, in 2018 there were a total of 4,139 industrial and municipal sewage treatment plants. Among all sewage treatment plants in 2018, there were 853 entities where the tertiary treatment takes place. The number of people using urban and rural sewage treatment plants in 2018 was 28,410 645 in Poland. Importantly, the total number of people connected to tertiary treatment plants was 23,044,623. Water used in Poland by all sectors in 2015 (including households) was equal to 1 595.1 million m^3. Households constitute the largest group among end users served by wastewater treatment plants - based on EUROSTAT data in 2015, they consumed 1,236.5 million m^3 of water. The services sector came second in terms of water consumption - services consumed 160.8 million m^3 in 2015. Next were: industry (31.4 million m^3), production (18.7 million m^3), mining and quarrying (6.4 million m^3), generation and supply of electricity (5.4 million m^3), construction (less than 1 million m^3). Due to the lack of data, EUROSTAT does not present water consumption for the Agriculture, forestry and fisheries section.		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☒	Yes	
		☐	No	
12)	Which of the following elements comprise the water reuse standard?	☒	Operation of a (risk) management team	
		☒	Description of the water reuse system	
		☐	Processes to identify hazards and hazardous events, and risk assessment	
		☒	Determination of preventive measures to limit risks	
		☒	Operational procedures for monitoring	
		☒	Verification procedures of the water quality and the receiving environment	
		☒	Validation of processes and procedures	
		☒	Procedures to manage incidents and emergencies	
		☐	Other(s) (please describe):	

<table>
<tr><td rowspan="5">13)</td><td rowspan="3">a) Does the water reuse standard define:</td><td>☒</td><td colspan="2">Provisions for granting permits to treatment plants</td></tr>
<tr><td>☒</td><td colspan="2">Steps for managing non-compliance</td></tr>
<tr><td>☒</td><td colspan="2">Regulations defining compliance checks procedures</td></tr>
<tr><td rowspan="3">b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.

(No more than 15 lines)</td><td>1</td><td colspan="2">In Poland, water law permits require, in particular, special use of water and construction of water facilities, as well as other activities that may affect the status of waters. A person interested in such a permit, referred to in the Water Law as a plant, should submit an application for its granting to the competent public administration body. Water-law permits are granted by the competent authorities with respect to the place of use of the applied permit: starosts, presidents of cities with privat rights, marshals of voivodships, and from 15 November 2008 also directors of regional water management boards.

A person applying for a water law permit should submit an application for its issuing, containing a brief description of the subject of the application (the basic document is a water law document consisting of two parts: descriptive and graphic) and outline the purpose of the intended activity in a non technical language).</td></tr>
<tr><td>2</td><td colspan="2">• Correspondence with the superior (supervisory) body so that it returns to its initial state (meeting all standards before failure).
• Take all necessary measures for the operation of the plant to meet all the requirements obtained in the permit.
• Correspondence on the line: director of the plant granted with permission - Polish Waters - Chief Inspectorate for Environmental Protection and the State Sanitary Inspection.</td></tr>
<tr><td>3</td><td colspan="2">• The competent authorities check compliance of the recovered water with the conditions set out in the permit. The authorities competent to control water law permits are the authorities that issued them (point 12.1).
• Checks are carried out on the spot.
• Verification of compliance of the values of the analyzed water parameters (permission obtained VS. results of subsequent tests).</td></tr>
<tr><td rowspan="3">c) How effective do you consider the processes of:</td><td colspan="3">1) Granting permits to treatment plants</td></tr>
<tr><td>☐</td><td>1</td><td>Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.</td></tr>
<tr><td>☐</td><td>2</td><td>Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.</td></tr>
</table>

		☒	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☒	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☒	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).

B.	**Monitoring water reuse**				
1)	Are monitoring procedures defined within the water reuse standard?	☐	Yes		
		☒	No (please describe the framework under which they are defined): Monitoring procedures are indirectly defined in the following documents: • Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on minimum requirements for the reuse of water, • Act of 20 July 2017 - Water law.		
2)	Do the monitoring procedures follow / are based on an established approach?	☐	No		
		☒	World Health Organisation approach (WHO)		
		☒	ISO 16075:2016		
		☐	Other (please describe below):		
3)	Does the monitoring procedures include one of the following (select all that apply):	☒	Identification of critical control points (or similar monitoring points)		
		☒		☒	Health

			Definition of water quality parameters & indicators	☒	Biological
				☒	Physical
		☒	Definition of critical limits for parameters & indicators		
		☐	On-line real-time monitoring		
		☒	Manual monitoring		
		☐	Other type(s) of monitoring method (please specify):		
		☒	Procedures for initiating corrective actions		
		☒	Verification monitoring		
		☒	Validation monitoring		
		☒	Audits on the overall monitoring procedures		
4)	In documenting monitoring data, do you (select all that apply):	☒	Release the data to the public / regular public reports		
		☐	Use ICT methods to document data		
		☐	Other(s) (please describe below):		
5)	Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?) *(No more than 20 lines)*	• The most common problem encountered when implementing monitoring procedures is incomplete understanding. Ambiguous understanding of issues leads to confusion on the implementation-controlling line. • If there is a necessity / need to refer to documents originally prepared in a language other than Polish, interpretation problems also arise - specialists in a water industry are often not responsible for translation, the translations are made by people who have too little knowledge in this area. • Another problem mentioned is the short time in which standards need to be implemented.				
6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?	1	2	3	4	5
		☐	☐	☐	☒	☐
C.	**Elements supporting monitoring**					
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.		
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.		
		☒	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers		

				or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☐	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☒	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Latvia			
A.	**General information**		
1)	Partner	Association “Baltic Coasts”	
2)	Country	Latvia	
3)	Does your country implement water reuse standards?	☐	Yes
		☒	No* *If your country does not implement water reuse standards, please use the policy framework most relevant to water reuse to fill-in the rest of the form (e.g. risk management framework for wastewater treatment).
4)	Name of the standard (or most relevant framework)	Law on Water Management (2002) sets the general framework for integrated water management and aims at good status of all surface waters and groundwater.	
5)	Developed by		
6)	Implementing authority / (-ies)	The competences are divided on a basis of the legal acts that determine each institution's responsibility in the public administration system. The Ministry of Environmental Protection and Regional Development and its institutions are responsible for the implementation and enforcement of the Water Framework Directive (WFD) and most of the water sector legislation, and Latvian environmental enforcement and inspection authority – the State Environmental Service (SES). The Ministry of Health and its institutions hold responsibility for the State control of the quality of drinking water and bathing waters. The Ministry of Agriculture and its institutions are responsible for implementation of the Drinking Water Directive as well as the State control of water, used for food production, including bottled water.	
7)	Geographical coverage	☒	National
		☐	Regional
8)	Purpose/use of the standard	☐	Agricultural
		☒	Industrial
		☒	Urban
		☐	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard.	The Law on Water Management (2000) is the main regulation in water management sustainable and rational use of water resources, prevents the deterioration of water and protects ecosystem, gradually reduces emission and discharge of polluting substances, as well as ensures the protection of the marine waters. Under the Law on Water Management River Basin Management Plans (RBMPs) are	

		established, which include the assessment of current water quality, evaluation of the causes of the problems, determine water quality objectives and indicate measures for improvement and protection of water status. Several laws and regulations of the Cabinet of Ministers are resultant from the Law of Water Management, water protection, and particularly, the wastewater treatment, is also regulated by the Law on Pollution and resultant laws and regulations and protection. The aim is to establish surface water and groundwater protection and management system that facilitates Cabinet Regulations No 34 “Regulations regarding Discharge of Polluting Substances into Water” (2002) • Cabinet Regulations No 1082 “Procedure by Which Polluting Activities of Category A, B and C Shall Be Declared and Permits for the Performance of Category A and B Polluting Activities Shall Be Issued (2010) • Cabinet Regulations No. 384 “Regulations Regarding the Management and Registration of Decentralised Sewerage Systems” (2017) • Natural Resources Tax Law (2005) • Cabinet Regulations No 235 “Mandatory Harmlessness and Quality Requirements for Drinking Water, and the Procedures for Monitoring and Control thereof” (2017) • Cabinet Regulations No.256 "Regulations on Latvian Construction Standard LBN 221-98« Internal water supply and sewerage of buildings” (1998) • Cabinet Regulations No.214 “Regulations on Latvian Construction Standard LBN 223-99 "External sewerage networks and structures" (1999) • Law on Regulators of Public Utilities
	b) Is it standalone or part of a wider policy framework for water reuse?	☐	Standalone
		☒	Part of a wider policy framework (please specify which): *environmental protection, resource efficiency*
		☐	Other (please specify):
	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☒	Public authorities
		☒	Water supplier company / organisation
		☒	Operator/owner of the reuse plant and system
		☒	End-users (e.g. farmers)

		☒	Public health organisations	
		☒	Consumer representatives	
		☒	NGOs (e.g. environmental)	
		☒	Local communities / citizen initiatives	
		☐	Other (please specify):	
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☐	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☒	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☐	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☐	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	In 2016, Latvia had 74 urban waste water agglomerations >2,000 p.e, and 95% of the load is connected to collecting systems and 5% addressed through individual (storage or septic tanks, micro-stations). In 2016, 94.4% of the population in agglomerations >2,000 and 75% of the population in agglomerations <2,000 had access to centralized wastewater network. Real connection rates are lower: ~84.1 % in larger and ~70.0 % in smaller agglomerations. Population according to 2015 data: 1,986,096. Collected wastewater: 192 mil. m^3/y, According to data of 2018, the number of treatment facilities is 911: 740 – biological, 171 – mechanical, and 1 chemical.		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☒	Yes	
		☐	No	
12)	Which of the following elements comprise the water reuse standard?	☐	Operation of a (risk) management team	
		☐	Description of the water reuse system	
		☒	Processes to identify hazards and hazardous events, and risk assessment	
		☒	Determination of preventive measures to limit risks	
		☒	Operational procedures for monitoring	

		☒		Verification procedures of the water quality and the receiving environment
		☒		Validation of processes and procedures
		☒		Procedures to manage incidents and emergencies
		☐		Other(s) (please describe):
13)	a) Does the water reuse standard define:	☒		Provisions for granting permits to treatment plants
		☒		Steps for managing non-compliance
		☒		Regulations defining compliance checks procedures
	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	1		Category B permit for all discharges of wastewater exceeding 20 m3 daily is required, category C - for discharges from 5 to 20 m3 of wastewater per day. The environmental authorities include in the permits, inter alia, emission limits, requirements for monitoring to be performed by the wastewater discharger, including a requirement to obey the procedures and reference methods of analysis specified in the legislation.
		2		If non-conformity of discharge with the permit conditions is detected, the discharger shall notify the environmental and sanitary authorities and carry out the necessary measures to ensure conformity and to prevent environmental pollution. According to the Natural Resources Tax Law (2005), this tax shall be also paid for emission of wastewater into the environment; its rate depends on the substances present in the wastewater. The tax for emitted pollution above the volume specified in the permit is calculated applying the tenfold tax rate
		3		Latvian environmental enforcement and inspection authority – the State Environmental Service (SES) – inspects both urban wastewater treatment plants and enterprises that are holders of integrated permits. The SES has a methodology to prioritize those wastewater treatment plants that shall be visited and inspected first of all. If any non-compliance is detected, the SES starts an administrative procedure and requires action to ensure compliance; it also has a rights to impose administrative penalties. Therefore the inspection work is targeted to pay more attention to potentially problematic wastewater dischargers and there is a mechanism in place to reduce the cases of discharges of untreated wastewater.
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.

		☒	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☐	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☒	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☒	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).
B.	**Monitoring water reuse**			
1)	Are monitoring procedures defined within the water reuse standard?	☐	Yes	
		☒	No (please describe the framework under which they are defined): Cabinet Regulations No.384 “Regulations Regarding the Management and Registration of Decentralised Sewerage Systems”. It determines the responsibilities of the owners of so-called decentralized wastewater systems, municipalities and wastewater collectors. Besides, the legislation establishes a mechanism for collection and treatment of wastewater that is not collected via centralised sewers. Binding regulations of municipalities determine minimum requirements for wastewater collectors; these requirements include an obligation to conclude an agreement with the wastewater treatment plant about delivery of collected wastewater. Besides, binding regulations of municipalities prohibit discharge of collected wastewater in the environment or inappropriate	

<table>
<tr><td></td><td></td><td></td><td>places. The wastewater collector is also required annually submit data about the amounts of collected wastewater to the municipality. Besides, all decentralised wastewater systems shall be registered in the respective municipality and municipalities have a mandate to determine procedures for their supervision and control in their binding regulations.

Information on water quality is publicly available and annual reports are prepared. There are various ways how the public can inform enforcement authorities on present or potential pollution of the environment, thereby preventing violation of legislation.

Inspection plan is developed by SES every year and there are clear requirements on how often the holders of permits for polluting activities shall be inspected, taking into account their potential impact. The SES has a methodology to prioritise those wastewater treatment plants that shall be visited and inspected first of all. Among the other things, performance of the treatment plant, compliance with the treatment requirements and previous problems are taken into account, when the decision of the inspection frequency is taken. The inspection work is targeted to pay more attention to potentially problematic wastewater dischargers and there is a mechanism in place to reduce the cases of discharges of untreated wastewater.</td></tr>
<tr><td rowspan="4">2)</td><td rowspan="4">Do the monitoring procedures follow / are based on an established approach?</td><td>☐</td><td>No</td></tr>
<tr><td>☒</td><td>World Health Organisation approach (WHO)</td></tr>
<tr><td>☐</td><td>ISO 16075:2016</td></tr>
<tr><td>☐</td><td>Other (please describe below):</td></tr>
<tr><td rowspan="8">3)</td><td rowspan="8">Does the monitoring procedures include one of the following (select all that apply):</td><td>☒</td><td>Identification of critical control points (or similar monitoring points)</td></tr>
<tr><td rowspan="3">☒</td><td rowspan="3">Definition of water quality parameters & indicators</td><td>☒</td><td>Health</td></tr>
<tr><td>☒</td><td>Biological</td></tr>
<tr><td>☒</td><td>Physical</td></tr>
<tr><td>☒</td><td colspan="2">Definition of critical limits for parameters & indicators</td></tr>
<tr><td>☒</td><td colspan="2">On-line real-time monitoring</td></tr>
<tr><td>☒</td><td colspan="2">Manual monitoring</td></tr>
<tr><td>☐</td><td colspan="2">Other type(s) of monitoring method (please specify):</td></tr>
<tr><td>☒</td><td colspan="2">Procedures for initiating corrective actions</td></tr>
</table>

		☒	Verification monitoring
		☒	Validation monitoring
		☒	Audits on the overall monitoring procedures
4)	In documenting monitoring data, do you (select all that apply):	☒	Release the data to the public / regular public reports
		☐	Use ICT methods to document data
		☐	Other(s) (please describe below):
5)	Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?)		

6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?	1	2	3	4	5
		☐	☐	☐	☒	☐

C.	**Elements supporting monitoring**			
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.
		☒	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☐	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☒	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Czech Republic			
A.	**General information**		
1)	Partner	RRA PK	
2)	Country	Pardubice – Czech republic	
3)	Does your country implement water reuse standards?	☐	Yes
		☒	No* *If your country does not implement water reuse standards, please use the policy framework most relevant to water reuse to fill-in the rest of the form (e.g. risk management framework for wastewater treatment).
4)	Name of the standard (or most relevant framework)	Water law 254/2001, government regulations 401/2015 and 57/2016	
5)	Developed by	2001 + novels	
6)	Implementing authority / (-ies)	Minister of Environment, OPV = ground water protection, regional offices	
7)	Geographical coverage	☒	National
		☐	Regional
8)	Purpose/use of the standard	☐	Agricultural
		☒	Industrial
		☒	Urban
		☒	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard.	The purpose of this act is to protect surface water and groundwater, to set conditions for the economical use of water resources and to improve the quality of surface and groundwater, to create conditions for reducing the adverse effects of flood risks and water works in accordance with European Community legislation. The purpose of this law is also to contribute to ensuring the supply of drinking water to the population and the protection of aquatic ecosystems	
	b) Is it standalone or part of a wider policy framework for water reuse?	☒	Standalone
		☐	Part of a wider policy framework (please specify which):
		☐	Other (please specify):
	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☒	Public authorities
		☒	Water supplier company / organisation
		☒	Operator/owner of the reuse plant and system

		☐	End-users (e.g. farmers)	
		☐	Public health organisations	
		☐	Consumer representatives	
		☒	NGOs (e.g. environmental)	
		☐	Local communities / citizen initiatives	
		☐	Other (please specify):	
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☐	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☒	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☐	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☐	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	X (do not know how to explain for wastewater treatment)		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☐	Yes	
		☒	No (we do not have water reuse standard)	
12)	Which of the following elements comprise the water reuse standard?	☐	Operation of a (risk) management team	
		☐	Description of the water reuse system	
		☐	Processes to identify hazards and hazardous events, and risk assessment	
		☐	Determination of preventive measures to limit risks	
		☒	Operational procedures for monitoring	
		☒	Verification procedures of the water quality and the receiving environment	
		☒	Validation of processes and procedures	
		☒	Procedures to manage incidents and emergencies	
			Other(s) (please describe):	

		☐		
13)	a) Does the water reuse standard define:	☐		Provisions for granting permits to treatment plants
		☐		Steps for managing non-compliance
		☐		Regulations defining compliance checks procedures
	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	1		
		2		
		3		
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.
		☐	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☒	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☒	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☐	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☒	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).
B.	**Monitoring water reuse**			
1)	Are monitoring procedures defined within the water reuse standard?	☒		Yes
		☐		No (please describe the framework under which they are defined):

2)	Do the monitoring procedures follow / are based on an established approach?	☒	No				
		☐	World Health Organisation approach (WHO)				
		☐	ISO 16075:2016				
		☐	Other (please describe below):				
3)	Does the monitoring procedures include one of the following (select all that apply):	☐	Identification of critical control points (or similar monitoring points)				
		☒	Definition of water quality parameters & indicators	☒	Health		
				☒	Biological		
				☒	Physical		
		☒	Definition of critical limits for parameters & indicators				
		☒	On-line real-time monitoring				
		☒	Manual monitoring				
		☐	Other type(s) of monitoring method (please specify):				
		☒	Procedures for initiating corrective actions				
		☒	Verification monitoring				
		☒	Validation monitoring				
		☒	Audits on the overall monitoring procedures				
4)	In documenting monitoring data, do you (select all that apply):	☒	Release the data to the public / regular public reports				
		☐	Use ICT methods to document data				
		☐	Other(s) (please describe below):				
5)	Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?)	There are not so many problems with urban wastewater treatment, but there are problems with small wastewater treatment - we do not have many officials who can control small wastewater treatment and not all sludge cleaning qualities are respected.					
6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?	1	2	3	4	5	
		☐	☒	☒	☐	☐	
C.	**Elements supporting monitoring**						
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.			

		☒	2	Qualified: The personnel includes specialised chemists, engineers or technicians.
		☐	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☒	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☐	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Germany			
A.	**General information**		
1)	Partner	KWB on behalf of OOWV	
2)	Country	Lower Saxony (Germany)	
3)	Does your country implement water reuse standards?	☐	Yes
		☒	No* *If your country does not implement water reuse standards, please use the policy framework most relevant to water reuse to fill-in the rest of the form (e.g. risk management framework for wastewater treatment).
4)	Name of the standard (or most relevant framework)	It is the task of the water authorities to implement the Water Resources Act (WHG) and the Lower Saxony Water Act (NWG)	
5)	Developed by	The Lower Saxony Ministry for the Environment, Energy and climate protection (Oberste Wasserbehörde)	
6)	Implementing authority / (-ies)	Lower Water Authority (Untere Wasserbehörde)	
7)	Geographical coverage	☐	National
		☒	Regional
8)	Purpose/use of the standard	☒	Agricultural
		☒	Industrial
		☒	Urban
		☒	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard.	The Water Resources Act contains provisions on the protection and use of surface waters and groundwater	
	b) Is it standalone or part of a wider policy framework for water reuse?	☐	Standalone
		☒	Part of a wider policy framework (please specify which): Federal and EU framework
		☐	Other (please specify):
	c) What types of stakeholders are involved in providing feedback and implementing the standard?	☒	Public authorities
		☒	Water supplier company / organisation
		☒	Operator/owner of the reuse plant and system
		☒	End-users (e.g. farmers)
		☒	Public health organisations
		☐	Consumer representatives
		☐	NGOs (e.g. environmental)

		☐	Local communities / citizen initiatives	
		☐	Other (please specify):	
	d) How intensely are stakeholders involved in the implementation of the standard?	☐	1	The standard is implemented without any stakeholder involvement.
		☐	2	Stakeholders are informed about the implementation process of the standard, without providing their opinion.
		☒	3	Stakeholders are consulted in the process of implementing the standard, providing opinions and information.
		☒	4	Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.
		☐	5	Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.
10)	Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.	2 treatment plants End use: irrigation Number of end-users: not reported		
11)	Is the water reuse standard embedded in or accompanied by a risk management framework?	☐	Yes	
		☒	No	
12)	Which of the following elements comprise the water reuse standard?	☐	Operation of a (risk) management team	
		☒	Description of the water reuse system	
		☐	Processes to identify hazards and hazardous events, and risk assessment	
		☐	Determination of preventive measures to limit risks	
		☒	Operational procedures for monitoring	
		☐	Verification procedures of the water quality and the receiving environment	
		☐	Validation of processes and procedures	
		☐	Procedures to manage incidents and emergencies	
		☐	Other(s) (please describe):	
13)	a) Does the water reuse standard define: (comment: there is no water reuse standard)	☐	Provisions for granting permits to treatment plants	
		☐	Steps for managing non-compliance	
		☐	Regulations defining compliance checks procedures	
		1		

	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	2		
		3		
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.
		☐	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☐	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☐	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☐	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☐	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).
B.	**Monitoring water reuse**			
1)	Are monitoring procedures defined within the water reuse standard?	☐	Yes	
		☒	No (please describe the framework under which they are defined):	
2)	Do the monitoring procedures follow / are based on an established approach?	☐	No	
		☐	World Health Organisation approach (WHO)	
		☐	ISO 16075:2016	

<table>
<tr><td></td><td></td><td>☒</td><td colspan="3">Other (please describe below): DIN 19650, category IV[6]</td></tr>
<tr><td rowspan="11">3)</td><td rowspan="11">Does the monitoring procedures include one of the following (select all that apply):</td><td>☐</td><td colspan="3">Identification of critical control points (or similar monitoring points)</td></tr>
<tr><td rowspan="3">☒</td><td rowspan="3">Definition of water quality parameters & indicators</td><td>☐</td><td>Health</td></tr>
<tr><td>☐</td><td>Biological</td></tr>
<tr><td>☒</td><td>Physical</td></tr>
<tr><td>☐</td><td colspan="3">Definition of critical limits for parameters & indicators</td></tr>
<tr><td>☐</td><td colspan="3">On-line real-time monitoring</td></tr>
<tr><td>☒</td><td colspan="3">Manual monitoring</td></tr>
<tr><td>☐</td><td colspan="3">Other type(s) of monitoring method (please specify):</td></tr>
<tr><td>☐</td><td colspan="3">Procedures for initiating corrective actions</td></tr>
<tr><td>☒</td><td colspan="3">Verification monitoring</td></tr>
<tr><td>☐</td><td colspan="3">Validation monitoring</td></tr>
<tr><td>☐</td><td colspan="3">Audits on the overall monitoring procedures</td></tr>
<tr><td rowspan="3">4)</td><td rowspan="3">In documenting monitoring data, do you (select all that apply):</td><td>☐</td><td colspan="3">Release the data to the public / regular public reports</td></tr>
<tr><td>☐</td><td colspan="3">Use ICT methods to document data</td></tr>
<tr><td>☒</td><td colspan="3">Other(s) (please describe below): Intern Data files (Excel)</td></tr>
<tr><td>5)</td><td>Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems?

(For example, is there a frequent need to take corrective actions?)</td><td colspan="4">Currently the monitoring of irrigation water within the Braunschweig water reuse scheme includes the following parameters:
• Nutrients (P, Mg, Ca, Ka, Na, N, S)
• Heavy metals
• Physical properties (pH, conductivity, O2, temperature)
Information about nutrient concentration + amount is provided to farmers for their fertilizer calculation regarding needs-oriented fertilization.

The sampling is automated and generates a 24h sample (once a week).</td></tr>
<tr><td>6)</td><td>With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess (according to your own judgement) the quality of monitoring?</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td></td><td></td><td>☐</td><td>☐</td><td>☐</td><td>☒</td><td>☐</td></tr>
<tr><td colspan="2">C.</td><td colspan="5">Elements supporting monitoring</td></tr>
</table>

[6] DIN-19650 (1999) Hygienisch-mikrobiologische Klassifizierung und Anwendung von Bewässerungswasser, Version 2016. Hygienic-microbiological classification and application of irrigation water, version 2016

1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.
		☒	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☒	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☐	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.

Slovenia			
A.	**General information**		
1)	Partner	Municipality of Trebnje	
2)	Country	Slovenia	
3)	Does your country implement water reuse standards?	☐	Yes
		☒	No* *If your country does not implement water reuse standards, please use the policy framework most relevant to water reuse to fill-in the rest of the form (e.g. risk management framework for wastewater treatment).
4)	Name of the standard (or most relevant framework)	Decree on the discharge and treatment of urban wastewater (98/15, 76/17)	
5)	Developed by	Ministry of Environment and Spatial Planning	
6)	Implementing authority / (-ies)	Municipalities	
7)	Geographical coverage	☒	National
		☐	Regional
8)	Purpose/use of the standard	☐	Agricultural
		☐	Industrial
		☒	Urban
		☐	Recreational
		☐	Other (please specify):
9)	a) Please briefly describe the main aspects of the standard.	This Decree of the Government of the Republic of Slovenia establishes details on the tasks related to services required municipal utilities concerning discharge and purification treatment of urban wastewater and rainwater. The present Regulation lays down measures for these public services: the management and content of the register of providers of the public services; the management and content of the register of public sewer; obligations of municipalities and public service. In this Decree it is written that public utilities are obliged to report the amount of municipal waste water to be reused, the treatment plants from which the urban waste water is being reused and the purpose of its use.	
	b) Is it standalone or part of a wider policy framework for water reuse?	☐	Standalone
		☒	Part of a wider policy framework (please specify which): Directive 91/271/EEC concerning urban waste-water treatment, Directive 2000/60/EC
		☐	Other (please specify):

<table>
<tr><td rowspan="10"></td><td rowspan="8">c) What types of stakeholders are involved in providing feedback and implementing the standard?</td><td>☒</td><td colspan="2">Public authorities</td></tr>
<tr><td>☒</td><td colspan="2">Water supplier company / organisation</td></tr>
<tr><td>☒</td><td colspan="2">Operator/owner of the reuse plant and system</td></tr>
<tr><td>☐</td><td colspan="2">End-users (e.g. farmers)</td></tr>
<tr><td>☐</td><td colspan="2">Public health organisations</td></tr>
<tr><td>☐</td><td colspan="2">Consumer representatives</td></tr>
<tr><td>☐</td><td colspan="2">NGOs (e.g. environmental)</td></tr>
<tr><td>☐</td><td colspan="2">Local communities / citizen initiatives</td></tr>
<tr><td>☐</td><td colspan="2">Other (please specify):</td></tr>
<tr><td rowspan="5">d) How intensely are stakeholders involved in the implementation of the standard?</td><td>☐</td><td>1</td><td>The standard is implemented without any stakeholder involvement.</td></tr>
<tr><td>☒</td><td>2</td><td>Stakeholders are informed about the implementation process of the standard, without providing their opinion.</td></tr>
<tr><td>☐</td><td>3</td><td>Stakeholders are consulted in the process of implementing the standard, providing opinions and information.</td></tr>
<tr><td>☐</td><td>4</td><td>Stakeholders are involved in the implementation of the standard, providing (further to option 3) resources and data.</td></tr>
<tr><td>☐</td><td>5</td><td>Stakeholders collaborate with public authorities in the implementation of the standard, having (further to option 4) increased managerial responsibilities and co-shaping the policy direction of the standard.</td></tr>
<tr><td>10)</td><td>Please provide data on the number of treatment facilities that implement the standard, including data (if available) on the type and number of end users served by those facilities.</td><td colspan="3">More than 450 municipal public utilities are in charge for waste water treatment; a share of treated waste water discharged from sewage sludge network is 72%.
The UWWTD requires that “Treated waste water shall be reused whenever appropriate.” Nevertheless, treated waste water is only reused in some cases inside the installation itself. There is no national legislation devoted to this particular question, except for the requirements from the UWWTD</td></tr>
<tr><td rowspan="2">11)</td><td rowspan="2">Is the water reuse standard embedded in or accompanied by a risk management framework?</td><td>☐</td><td colspan="2">Yes</td></tr>
<tr><td>☐</td><td colspan="2">No</td></tr>
<tr><td rowspan="5">12)</td><td rowspan="5">Which of the following elements comprise the water reuse standard?</td><td>☐</td><td colspan="2">Operation of a (risk) management team</td></tr>
<tr><td>☐</td><td colspan="2">Description of the water reuse system</td></tr>
<tr><td>☐</td><td colspan="2">Processes to identify hazards and hazardous events, and risk assessment</td></tr>
<tr><td>☐</td><td colspan="2">Determination of preventive measures to limit risks</td></tr>
<tr><td>☐</td><td colspan="2">Operational procedures for monitoring</td></tr>
</table>

		☐		Verification procedures of the water quality and the receiving environment
		☐		Validation of processes and procedures
		☐		Procedures to manage incidents and emergencies
		☐		Other(s) (please describe):
13)	a) Does the water reuse standard define: (comment: there is no water reuse standard)	☐		Provisions for granting permits to treatment plants
		☐		Steps for managing non-compliance
		☐		Regulations defining compliance checks procedures
	b) If existing, please briefly describe the steps followed for 1) granting permits, 2) coping with non-compliance issues, and 3) compliance checks.	1		
		2		
		3		
	c) How effective do you consider the processes of:	1) Granting permits to treatment plants		
		☐	1	Not effective: There are a lot of delays and bureaucratic drawbacks for granting permits.
		☒	2	Moderately effective: There are some delays and bureaucratic drawbacks, sometimes hindering the process of granting permits, but it is overall operational.
		☐	3	Very effective: The process of granting permits does not have any delays or administrative setbacks.
		2) Managing non-compliance issues		
		☐	1	Not effective: Most non-compliance issues are not treated in time and are not resolved.
		☒	2	Moderately effective: Around half of the non-compliance issues are treated in time and resolved.
		☐	3	Very effective: Most non-compliance issues are treated in time and resolved.
		3) Compliance checks procedures		
		☐	1	Not effective: Compliance checks rely solely on on-spot checks.
		☐	2	Moderately effective: Compliance checks use both on-spot checks and monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC)
		☐	3	Very effective: Compliance checks use on-spot checks, monitoring checks defined in EU regulations (Directives 91/271/EEC and 2000/60/EC), and include additional physio-chemical parameters (e.g. micro-pollutants, trace residues from medicine).

B.	Monitoring water reuse		
1)	Are monitoring procedures defined within the water reuse standard?	☐	Yes
		☒	No (please describe the framework under which they are defined): Following EU and WHO guidelines, but no official regulation for water reuse. Hence, monitoring of water reuse is not definite.
2)	Do the monitoring procedures follow / are based on an established approach?	☒	No
		☐	World Health Organisation approach (WHO)
		☐	ISO 16075:2016
		☐	Other (please describe below):
3)	Does the monitoring procedures include one of the following (select all that apply):	☐	Identification of critical control points (or similar monitoring points)
		☐	Definition of water quality parameters & indicators: ☐ Health; ☐ Biological; ☐ Physical
		☐	Definition of critical limits for parameters & indicators
		☐	On-line real-time monitoring
		☐	Manual monitoring
		☐	Other type(s) of monitoring method (please specify):
		☐	Procedures for initiating corrective actions
		☐	Verification monitoring
		☐	Validation monitoring
		☐	Audits on the overall monitoring procedures
4)	In documenting monitoring data, do you (select all that apply):	☐	Release the data to the public / regular public reports
		☐	Use ICT methods to document data
		☐	Other(s) (please describe below): Intern Data files (Excel)
5)	Please provide information regarding the implementation of the monitoring procedures. Does the implementation run into any kind of problems? (For example, is there a frequent need to take corrective actions?)	The monitoring of water bodies in which treated urban waste water or biodegradable industrial waste water is discharged is part of the state monitoring of water status in accordance with the regulations governing the status of surface waters, the state of groundwater or the management of bathing water quality, if it is expected that the discharge of treated waste water will have a significant impact on the status of these water bodies or on the quality of bathing water.	
6)	With 1 being not effective at all and 5 being absolutely effective, how good (overall) do you assess	1	2	3	4	5

	(according to your own judgement) the quality of monitoring?	☐	☐	☒	☐	☐

C.	**Elements supporting monitoring**			
1)	How would you assess the quality of the personnel that implements the monitoring?	☐	1	Not adequately qualified: The personnel does not include specialised chemists, engineers or technicians.
		☐	2	Qualified: The personnel includes specialised chemists, engineers or technicians.
		☐	3	Qualified and up-to-date: The personnel includes specialised chemists, engineers or technicians, who undergo additional training regularly.
2)	How would you assess the lab equipment used for monitoring?	☐	1	Basic equipment: Can measure microorganisms, pathogens.
		☐	2	Adequate equipment: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS).
		☐	3	Advanced: Can measure microorganisms, pathogens, water quality parameters (e.g. BOD5, TSS), and additional parameters such as micro-pollutants, trace residues, heavy metals, and/or other physio-chemical parameters.