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WATER REUSE POLICIES ADVANCEMENT FOR RESOURCE EFFICIENT EUROPEAN REGIONS

A1.1: Final Report

Comparative analysis of regional and national policies on water reuse

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Summary

The present document aims to develop a methodology for the comparative analysis of existing water reuse policies in Partner Countries participating in the AQUARES Project of the Interreg Europe program. The application of the methodology and the analysis of the water reuse frameworks in the AQUARES partner countries will be used for the identification of suitable criteria and standards and of best practices for reuse, to be proposed for integration into the national regulatory frameworks. The Project thus aims to promote the exchange of best practices among partner countries, in order to improve the implementation of regional, state and local policies and programs, promoting the efficient use of water resources and supporting sustainable practices.

The document is structured as following:

Introduction provides the outline of the project AQUARES, in reference of which this deliverable is developed. Following the key concepts of the project are presented regarding the water reuse.

Part A describes the methodology developed and used for the comparative analysis of water reuse policies, which involves five main steps: Data collection, Selection of indicators, Evaluation of existing practices, Identification of best practices, and Identification of appropriate water quality criteria.

Part B comprises the application of the developed methodology and the comparative analysis of the water reuse legislator frameworks in the AQUARES project Partner Countries. The methodological steps of Part A are followed: Collection of the relevant data pertaining to the applicable water reuse legislative frameworks of AQUARES Partner Countries, followed by the selection of suitable indicators and the comparative analysis of these frameworks, in order to identify and propose best practices and the most suitable water quality criteria for water reuse.

Annex 1 provides the documentation form used for data collection, a questionnaire for the collection of the relevant information on water reuse policies in the AQUARES countries, and **Annex 2** includes the answered sheets of the documentation forms, as shared by the responded partners (Greece, Spain, Poland).

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Table of Abbreviations

AACC	American Association for Clinical Chemistry
AT	Austria
BE	Belgium
BG	Bulgaria
BOD	Biochemical oxygen demand
CFU	colony-forming unit
COD	Chemical Oxygen Demand
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EC	European Commision
EE	Estonia
EEC	European Economic Community
EL	Greece
ERSAR	Entidade Reguladora dos Serviços de Águas e Resídu (Water and Waste Services Regulation Authority)
ES	Spain
ETC	European Territorial Cooperation
EU	European Union
EWA	Energy and Water Agency
FI	Finland
FIEA	Euro-mediterranean Water Institute Foundation
FLA	Lombardy Foundation for the Environment
FR	France
HR	Croatia
HU	Hungary
IE	Ireland
ISO	International Organization for Standardization
IT	Italy
JORF	Journal Officiel de la République Française
JRC	Joint Research Centre
KYA	Κοινή Υπουργική Απόφαση (Joint Ministerial Decision)
LOD	Level of detail
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
NTU	Nephelometric Turbidity Units

OOWV	Water Board of Oldenburg and East Frisia
PL	Poland
PT	Portugal
RBMP	River Basin Management Plan
RD	Royal Decree
RO	Romania
RRAPK	The Regional Development Agency of the Pardubice Region
SE	Sweden
SI	Slovenia
SK	Slovakia
SWD	Staff Working Document
TSS	Total suspended solids
US EPA	United States Environmental Protection Agency
USA	United States of America
UWWTD	Urban Waste Water Treatment Directive
WFD	Water Framework Directive
WHO	World Health Organization
WWTP	Wastewater treatment plant

1. INTRODUCTION

1.1 Scope of this document

The purpose of this document is the development and application of a suitable methodology, in order to comparatively analyze existing water reuse policies in partner countries participating in the "AQUARES– Water reuse policies advancement for resource efficient European regions" project of the Interreg Europe program. This analysis will permit the identification of appropriate water quality criteria for reuse and the exchange of best water reuse practices among partner countries.

1.2 The AQUARES project

The international project "AQUARES – Water reuse policies advancement for resource efficient European regions", co-financed by European Union funds under the Interreg Europe Program, was launched in the Murcia Region of Spain (Murcia Region as a lead partner of the project) in the beginning of June 2018. Apart from the Murcia Region, the project is represented by representatives from Greece, Poland, Malta, Italy, Germany, Lithuania, Slovenia, Spain and Czech Republic.

The objective of the AQUARES project is to improve policy tools and water management concepts by integrating wastewater reuse into national, regional and local development plans to promote the efficient use of wastewater resources.

The project will increase the ability of public authorities to propose legislative changes concerning the water and drinking water framework directives. The project also puts emphasis on best practices to ensure compliance with water quality standards and promotes the adoption of sustainable development and eco-innovation in agriculture, industry, urban and recreational areas. Last but not least, the project draws on the experience of partner countries through the adoption of technological and managerial innovations in the area of water reuse in various sectors.

Water reuse is a key way to both promote resource efficiency in water scarce areas of Europe, and to profit from opportunities in the expanding water market, thereby alleviating pressure on wetlands and littoral areas of Europe. The EC "Strategic Implementation Plan of the European Innovation Partnership on Water", was set in place to promote and support efficient water management in Europe where water scarcity affects 11% of its population. In this context, AQUARES will support public authorities to initiate efforts, join forces and exchange experiences to:

a. identify viable strategies to utilise water reuse to confront inefficient uses of water,

b. make the most of EU financing tools, and

c. promote public dialogue to address conflicting interests.

The project is implemented in two phases. In the first phase of the project (from 2018 to 2020), key project activities will be implemented. From 2021 to 2022, in the second verification phase of the project, these proposed improvements will be tested and monitored by target group representatives. The AQUARES project consortium partners will not only monitor and test identified water reuse practices in the second

phase, but will also inform the relevant European institutions about the implementation and usefulness of project results. The AQUARES project is 85% co-funded by the European Union under the Interreg Europe Program.

Project objectives

The priority specific objective the project will contribute to, is improving the implementation of regional development policies and programmes, in particular programmes for Investment for Growth and Jobs and, where relevant, ETC programmes, aimed at increasing resource-efficiency, green growth and eco-innovation and environmental performance management.

Overall, AQUARES aims to improve policy instruments, by articulating a process of integration of water reuse in national, regional and local development plans, to promote the efficient use and management of water in EU regions and to support sustainable development and ecoinnovation adoption across the agricultural, industrial, urban and recreational sectors. AQUARES will:

a. support public authorities to plan for and support the utilisation of untapped water resources,

b. promote the adoption of water reuse technological and managerial innovations, and

c. highlight the best practices for ensuring compliance with water quality standards across different sectors.

Ultimately, AQUARES will increase the capacity of public authorities to implement the proposals of the soon to be revised Water Framework and Drinking

Expected impact

AQUARES is expected to have an impact by increasing the capacity of 200 staff of public administrations to effectively support water reuse. Additionally, 10+ million € investments will be unlocked to support projects on water efficiency and to improve the management of water bodies. Lastly, an increased awareness and consensus building among water providers, the workforce, and citizens, to support measures for water reuse (over 1000 individuals) will be achieved.

Main outputs & Beneficiaries

The AQUARES activities and events aim to produce outputs and results that will include 9 action plans to improve the addressed policy instruments, benefiting managing authorities and beneficiaries. Furthermore, 3 interregional workshops, 3 study visits and 10 bipartite site visits promoting capacity building among partners and stakeholders will be produced. An online toolkit on the evaluation of water reuse investments for regions promoting water efficiency and 5 joint thematic studies and analyses reports on territorial needs and opportunities for water reuse pathways will be developed.

Partnership

AQUARES brings together 10 partners from 9 countries (Table 1):

TABLE 1. PROJECT PARTNERS

Nº	Country		Partner
1.		**ES**	Regional Government of Murcia, Ministry of Water, Agriculture, Livestock and Fisheries – General Direction of Water (MURCIA-GDW)
2.		**EL**	Ministry of Environment and Energy, General Secretariat for Natural Environment and Water
3.		**PL**	Lodzkie Region (LODZKIE)
4.		**CZ**	The Regional Development Agency of the Pardubice Region (RRAPK)
5.		**MT**	Energy and Water Agency (EWA)
6.		**IT**	Lombardy Foundation for the Environment (FLA)
7.		**DE**	Water Board of Oldenburg and East Frisia (OOWV)
8.		**ES**	Euro-mediterranean Water Institute Foundation (FIEA)
9.		**LV**	Association "Baltic Coasts" (Baltic Coasts)
10.		**SI**	The Municipality of Trebnje (TREBNJE)

Overview of Activity 1.1

The objective of AQUARES Activity 1.1 is the comparative analysis of regional and national policies on water reuse, for which during the first semester of the project, which is the focus of this report, its methodological approach is developed. The effort of implementing this activity involves the identification and integration, through European cooperation, of the best water reuse techniques and procedures, and the definition / modification of appropriate water quality criteria to improve the implementation and control of existing institutional framework for reuse (the Common Ministerial Decision, KYA-145116/2011)

The policy goal of the activity is to facilitate among project partners an exchange of experience regarding data on water supply and sanitation networks. In order to achieve the activity's objective, the partner responsible, during the first semester, must develop the methodology and tools for the comparative analysis of existing territorial water reuse policies. The results of the activity will be the focus of discussion with stakeholders in stakeholder group meetings (AQUARES activity 2.1), and will be used as to provide input for the development of the partners' action plans (which aim to improve the policy instruments addressed by the project).

The partner responsible for the coordination of the activity is the Ministry of Environment and Energy General Secretariat for Natural Environment and Water.

2. KEY CONCEPTS DEFINITION

2.1 What is water reuse

Water scarcity, driven both by natural and anthropogenic factors, is a threat to many countries and regions of the world. In an era of increased urbanisation and increasing climatic uncertainty, some governments are turning to water reuse, recycling wastewater in order to increase available water resources in an effort to cover needs and contribute to the sustainable use of surface and ground waters. Following suitable treatment, recycled wastewater can be used for different purposes, which can be grouped in two major groups, depending on whether the resulting treated water is used to enhance potable or non-potable water supplies. Potable water reuse can be achieved either directly, by directing the recycled water straight into the potable water supply, or indirectly, through aquifer or reservoir recharge. Most commonly, however, water reuse is reserved for non-potable uses including irrigation of agricultural lands or urban green spaces, industrial uses and surface water recharge. Depending on local conditions, reuse may be more affordable than long-distance water transfers, and reuse often compares favourably with desalination in terms of energy requirement, operating costs and greenhouse gas emissions (Mukherjee and Jensen, 2020).

Available water treatment technologies, used appropriately, can achieve a high-quality, reliable recycled water supply that meets drinking water standards. However, the use of inadequate or inappropriate processes to recycle water, or badly managed systems, can result in risks to human health due to residual biological and chemical contaminants. Such events often lead to an overall negative view of water reuse by the public, as they consider the health risks of recycled water to be high. At the global level, the uptake of water reuse for municipal uses is rather limited, as public opposition can and does force governments to reconsider or abandon potable reuse. Nevertheless, public participation, enhanced awareness and access to adequate information can help in achieving a shift in public perceptions of recycled water; the main factors for such a shift are an improved understanding of the low level of health risks, comprehension of the value and benefits of reused water (particularly in areas facing water scarcity) and increased levels of trust in the agency operating or regulating the reuse scheme.

2.2 Water Reuse in Europe

The spatial distribution of water resources varies globally. In Europe, a significant spatial variance exists for allocation of water resources across different countries and even within the same country (especially in the Mediterranean area), as pointed out by a review on the current status of water reuse in Europe done in 2018 (Water Reuse Europe, 2018). One third of Europe was said to have a water availability of less than 5,000 m^3 per person and year, and about 17 percent of the EU territory faces water scarcity (Jeffrey, 2019). Increasing water scarcity is mainly driven by climate change, urbanization and the growing water demand of competing water uses. Degrading water quality puts further pressure on the availability of high quality water resources for drinking purposes and may increase the financial cost of water supply. Although water reuse is a widely recognized strategy to relieve water scarcity, the European water reuse sector is rather small in the global context. On a global scale 30 Mm^3/day of water are being reused, while only 2.6 Mm^3/day are being reused in Europe in 2006 (Water Reuse Europe, 2018). Annually, this results in an amount of 1,100 Mm^3/year of water that is reused in Europe, which is about 2 to 3% of the total

volume of treated wastewater and 0.5% of the total annual fresh water extractions in the EU (BIO by Deloitte, 2015). The main consumer of reclaimed water in the EU is Spain producing about half of the total amount of reclaimed water in Europe. However, overall the quantity of reclaimed water corresponded to only 5 to 12% of the total treated urban effluents in Greece, Italy and Spain. Cyprus on the other hand was reported to reuse about 90%-97% of all treated wastewater. In Malta, the share of reused water was is about 60% (BIO by Deloitte, 2015).

Across the EU a total of 787 reuse schemes distributed across 16 countries were identified in the Water Reuse Europe Review from 2018, indicating an increase by 437 schemes since 2006 (45 of which are pilot-scale). An overview of the countries with the majority of the schemes can be found in Table 3 together with the percentage distribution of intended reuse purposes in all schemes. Application in agriculture was the highest intended purpose for reclaimed water (39%: 307 of 787 schemes). And more than half of the total volume of reclaimed water in the EU (52%) is being used for agricultural purposes (BIO by Deloitte, 2015; Jeffrey 2019). The European market was estimated to have the potential to increase its reuse capacity to 6,000 Mm^3 per year until 2025, considering around 71,000 wastewater treatment plants in the 28 member states (Water Reuse Europe, 2018)

TABLE 2. WATER REUSE SCHEMES ACROSS THE EU (WATER REUSE EUROPE REVIEW, 2018)

Country	Number of reuse schemes
Southern Europe	537
Spain	361
Italy	99
Greece	44
Northern Europe	250
France	112
Germany	36
Netherlands	28

TABLE 3. COMMON REUSE PURPOSES ACROSS THE EU (WATER REUSE EUROPE REVIEW, 2018)

Percentage distribution of reuse purposes across the 787 schemes	
Agriculture	39%
Industry	15%
Recreation	12%
Environment	11%
Mixed	12%
Other users	12%

As pointed out in the Water Reuse Europe Review (2018), the demand for alternative water resources and the application of water reuse varies between European countries according to the quantity of accessible

natural water resources. This is underpinned by the fact that 62 percent of the 787 reuse schemes are located in water scarce areas, particularly "along coastlines where fresh water resources are limited and adversely affected by environmental issues such as drought as well as overabstraction of water due to tourism and agricultural activities" (Water Reuse Europe Review, 2018). This strongly concerns the Mediterranean coast at which 47 percent of the schemes are located. For example, out of the 361 Spanish reuse schemes 200 are located at the Mediterranean coast. Another 17 percent of the schemes were found on islands, including 16 sites on Greek islands. Water reuse is applied in a limited number of European countries, the most comprehensive water reuse regulations and standards have been developed in Cyprus, France, Greece, Italy, Spain and Portugal. Besides Portugal, the standards in all these countries are legally binding.

2.3 Significance of water reuse regulations

Article 12 of the Urban Wastewater Treatment Directive (91/271/EEC) requires that "treated wastewater shall be reused whenever appropriate", yet there are currently no widely accepted guidelines at the EU level to regulate the reuse of water. In May 2018 the European Commission published a proposal on minimum requirements for water reuse across the 27 (at that time 28) Member States. The opening statement of this proposal was: "*Water is a limited resource in the EU, with one third of the EU territory experiencing water stress. The growing needs of populations and climate change will make the availability of water in sufficient quantity and quality even more of a challenge in Europe in the future*." At the time that the present document is written, the process for the adoption of the EU proposal is still ongoing, at the stage of "*Discussions within the Council of the European Union or its preparatory bodies*".

The significance of the adoption of a regulatory framework defining a common set of minimum requirements may not be evident to all. Southern European countries, which often face moderate to severe water scarcity, have already developed and adopted legislation, regulations, and/or guidelines for water reuse. The reuse of wastewater is regulated in Cyprus, France, Greece, Italy, Portugal, and Spain, though sets of chemical and biological standards aiming to safeguard public health as well as protecting the environment. The existence of a strict regulatory framework does more than that though; it also helps instil confidence in the public, enhancing acceptance of the process and its products, such as crops irrigated with the reclaimed water. Comprehensive standards regulate the quality of the treated water and the manner in which it can be used, down to the specific method of irrigation for example, and provide the necessary information for monitoring protocols and their implementation, as well as for enforcement. This reduces the perceived risk in the eyes of the public, enabling the wider penetration and adoption of reuse and encouraging the development of new reuse technologies and methods.

In order therefore to successfully implement water reuse in countries and regions where standards are either unavailable or insufficient, the adoption of a comprehensive regulatory framework would be advisable, for safe and sustainable practices that are acceptable to the general public.

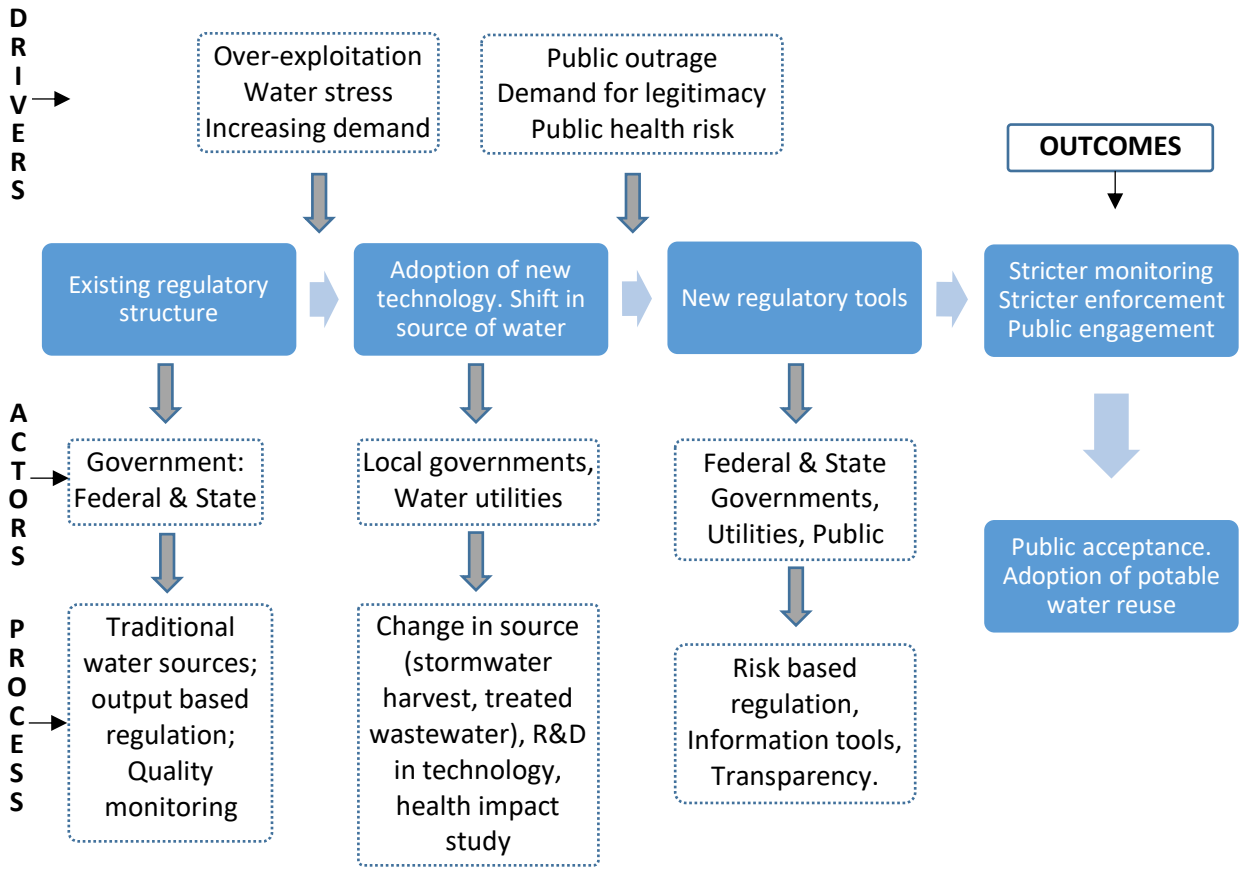

FIGURE 1. REGULATION AND INNOVATION ACCEPTANCE (FROM: MUKHERJEE AND JENSEN, 2020)

3. PART A - METHODOLOGY DEVELOPMENT

3.1 Outline of Methodology

The five main steps in the methodology for the comparative analysis of water reuse policies are the following, as analyzed in the paragraphs below:

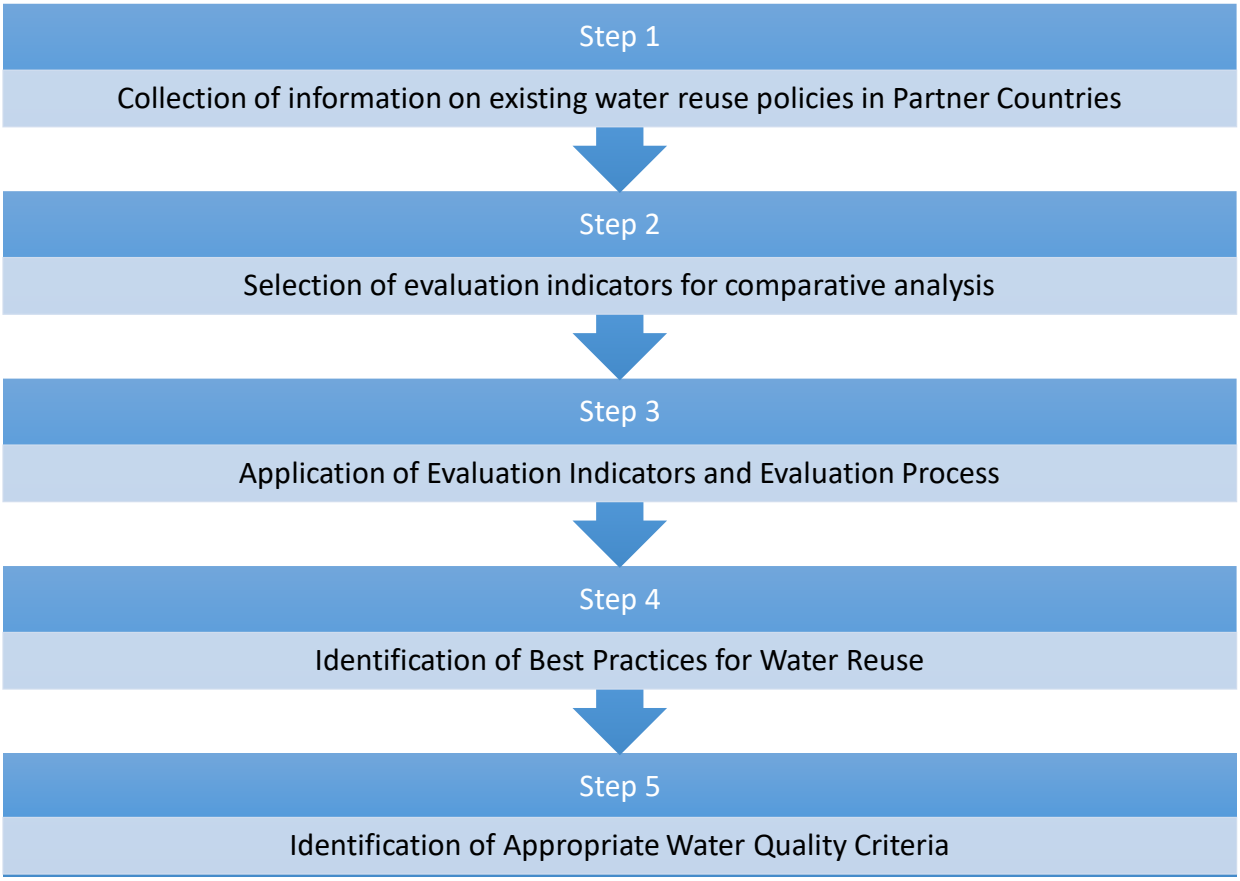

FIGURE 2. METHODOLOGICAL APPROACH

3.2 Methodology Steps

Step 1 - Collection of information on existing water reuse policies in Partner Countries

This step involves the collection of data on existing policies in the AQUARES Project Partner Countries, including applicable legislation and regulations, as well as data on the actual implementation of such policies in the partner countries. The main sources for the information and material collection are publications, including scientific papers, research project reports, information published by national/regional/local authorities and EU bodies.

There are currently no guidelines or regulations at the EU level, however there are a number of EU Directives which are relevant to water reuse (such as the Urban Wastewater Treatment Directive mentioned earlier, Council Directive 91/676/EEC on the protection of waters against pollution caused by nitrates from agricultural sources, etc.) and which have to be taken into consideration by all member states.

An inventory of existing legislation on water reuse in the EU Member States is provided in the report compiled by Gancheva, McNeill and Muro (2018) to advise the European Committee of the Regions (see Table 4).

TABLE 4. SUMMARY OF EXISTING WATER REUSE LEGISLATION IN THE EU COUNTRIES

State	Legislation	Other (e.g. Guidelines, Standards) already in place
AT	No	None
BE	No	Water reuse measures for some RBMPs
BG	No	Water reuse measures for some RBMPs
CY	Law N.106(I)/2002 and regulations K.D.P. 407/2002, 772/2003, 254/2003 and 269/2005, K.D. 379/2015	Guidelines in Code of Good Agriculture Practice (regulation K.D.P. 407/2002) Standards in Law 106 (I) 2002 and regulations K.D.P. 772/2003 and K.D.P. 269/2005 Water reuse measures in the RBMP
CZ	No	Water reuse measures for some RBMPs
DE	No	Subsidies for rainwater reuse; building regulations include fee for rainwater runoff discharge into the sewer
DK	No	Guidelines on water use in food businesses
EE	No	None
EL	Joint Ministerial Decree 145116/11	Guidelines and standards defined in Joint Ministerial Decree 145116/11
ES	Royal Decree 1620/2007	Guidelines and standards defined in Royal Decree 1620/2007 Water reuse measures for some RBMPs
FI	No	None
FR	2 August 2010 Decree amended in 2014 - JORF num. 0153 of 4 July 2014	Health Guidelines for reuse of wastewater for irrigation Standards in the 2 August 2010 Decree Financial incentives by the Catchment Authorities for reuse projects in industry Water reuse measures in some RBMPs
HR	No	None
HU	No	Environmental Programme and RBMP promote local reuse of treated wastewater for irrigation
IE	No	None

State	Legislation	Other (e.g. Guidelines, Standards) already in place
IT	Decree 11 May 1999, n. 152, Environmental Code	Guidelines in Ministerial Decree 185/2003 Standards in Decree 11 May 1999, n. 152, Environmental Code Water reuse measures for some RBMPs
LT	No	None
LU	No	None
LV	No	None
MT	No	Water reuse measures in the RBMP
NL	No	Taxes and limits on aquifer abstraction make industrial wastewater reuse attractive
PL	No	None
PT	NP 4434 2005 Reuse of reclaimed urban water for Irrigation	Guidelines of the National Regulator for water supply, wastewater and wastes services, (ERSAR): ERSAR Technical guide No14 for water reuse, 2010 Standards in NP 4434 2005 Water reuse measures for some RBMPs
RO	No	None
SE	No	None
SI	No	None
SK	No	None

Data collection from project partners

To ensure that all results are documented in a consistent and clearly structured manner, the methodology prescribes a common approach for reporting results. An input documentation form, presented in ANNEX 1, provides a tool for data collection.

The tool has five sections (A, B, C, D and E):

- **Section A – General information** aims to gather information on the profile of the partner
- **Section B - Institutional Framework for Water Reuse in partner countries** focuses on the water reuse policy framework that exists in partner's territories and countries
- **Section C – Best Practices for Water Reuse**
- **Section D – Water Quality Criteria**
- **Section E – Socio-economic factors**

The documentation form is intended to be filled-in with input followed by desk research, by the suitable partners that are members or staff of the organisations, represented in the project consortium or relevant experts.

Step 2 - Selection of evaluation indicators for comparative analysis

To compare the current volumes of reclaimed water used in European countries, existing data must be thoroughly reviewed. There is no EU-wide harmonized reporting scheme so Member States have adopted differing definitions of water reuse. For example, volumes of internally recycled water in the industry and of water which is used for planned indirect reuse purposes may or may not be included in the reported data (BIO by Deloitte, 2015). Overall, the application of water reuse in Europe is well below its potential. The most cited reason for this fact is the lack of EU-level environmental and health for water reuse practices. There is limited confidence in the environmental and health safety of water reuse practices without a harmonized European legal framework and relevant standards (Alcalde-Sanz & Gawlik, 2017) so a different approach is proposed to compare the current reuse policies in the project partner countries, through evaluation indicators.

The available literature offers a wide range of indicators that could be used for evaluating all aspects of water reuse; the need for its implementation for the protection of the environment, its penetration and effectiveness, the economic and social parameters. It is possible to visualize endless sets of indicators that could be used to assess the status and effectiveness of water reuse. Realistically however, data availability is the most important parameter for the selection of suitable indicators, as it is this crucial detail which sets limitations to the usefulness of indicators.

Some examples of indicators are grouped below (Dallhammer et al., 2017), provided as a set of indicators to assess the effect of minimum quality requirements for reused water in agricultural irrigation and aquifer recharge.

INDICATORS PICTURING ENVIRONMENTAL EFFECTS

- Agriculture depending on irrigated land
- Regions facing danger of droughts
- Regions facing heat waves
- Pollutants in soil and ground/surface water
- Economic growth
- R&D Climate
- Added value in agriculture and forestry

INDICATORS PICTURING SOCIETAL EFFECTS

- Employment in agriculture and forestry
- Out-migration/brain drain/“shrinking” of regions
- Healthy life expectancy

INDICATORS PICTURING GOVERNANCE EFFECTS

- Government effectiveness

The above indicators do not cover all effects that are caused by the development of minimum quality requirements for reused water in agricultural irrigation and aquifer recharge; the set of indicators is too high level and too generic and the correlation between the initiative and the indicators are generally weak (e.g. there is only a weak link between indicator on R&D climate of a region and whether there are

common quality standards for water reuse). The indicators only provide an indication on the effects. To that end, experts were called upon to identify a "wish list" of other indicators, which represent better the potential effects from the development of minimum quality requirements for reused water in agricultural irrigation and aquifer recharge:

- Population density;
- Amount of treated waste water;
- Output from agriculture from irrigated land;
- Employment in irrigation technologies;
- Water exploitation index at water basin level;
- Ratio crop water requirement and incoming water/satisfaction level;
- Indicators on water bodies status;
- Water prices;
- Energy balance for water reuse;
- Trade flows (agriculture);
- Compliance with the Urban Wastewater Treatment Directive.

The selection of indicators for the purposes of AQUARES is based upon the undertaken review of the indicators used in the project partner countries. The indicators used for different water reuse purposes in the partner countries are compared and the most suitable ones are selected for the analysis. In order to achieve a meaningful comparison among policy frameworks, these indicators must be comparable across countries, while at the same time the analysis should be able to take into account the specific characteristics of the area/region. It should be noted that the availability of data and measurements is key for the assessment of the examined indicator(s) and comparison among cases.

Step 3 – Application of Evaluation Indicators and Evaluation Process

Following the selection of appropriate indicators, the different practices applied by the participating countries are critically evaluated, also under the light of:

- The overall success in the application of indicator(s) in the country in question (based on data availability and collection);
- The efficiency of the implementation of water reuse in the country;
- The coverage of water needs through reuse.

To apply the evaluation indicators, concerning the formulation of regional wastewater reuse guidelines, one must ask some important questions:

- Is wastewater reuse already common practice in the country?
- Which are the main obstacles against wastewater reuse?
- What types of wastewater reuse are most relevant / mainly applied in the country?
- How is the wastewater usually treated before reuse?
- Which crops are mainly irrigated with reclaimed water?
- If wastewater reuse guidelines exist in the country, is the common practice in line with these

guidelines, and how is the compliance monitored?

- For the policy for wastewater reuse in irrigation, there are two different possibilities:
    - To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover.
    - To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.

    Which option is regarded as more appropriate for the region?
- What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?
- What standards are economically and administratively enforceable in the country?

Step 4 – Identification of Best Practices for Water Reuse

Based on the conclusions drawn from the evaluation of Step 3, specific practices, techniques and processes are identified as those most likely to yield an optimal water reuse outcome, for different reuse purposes. The selected practices are considered under different sets of circumstances in order to determine whether the proposed best practices should be region- and/or purpose-specific.

Step 5 – Identification of Appropriate Water Quality Criteria

The establishment of clear standards for the quality of water provided for both potable and non-potable uses is an important pre-requisite to water reuse. Such standards protect public health as well as providing an operational performance target and ensuring the safe operation for reuse scheme developers and operators.

Appropriate water quality criteria are identified and proposed to be adopted by partner countries, aiming at enhancing existing institutional/regulatory frameworks, improving their implementation and promoting compliance at the national and regional scale, and supporting the sustainable use of water overall.

Considerations for setting quality standards:

- Maintaining higher Quality standards where these exist; the proposal must not lead to a reduction of existing ambitious water goals, and should instead provide the possibility to opt for higher quality standards where some are already in place.
- Implementation; incentives are important, as the setting of criteria will not suffice. Subsidies for investment into irrigation could be relevant.
- Public acceptance; specific quality requirements for reused water in agricultural irrigation and aquifer recharge could improve the public acceptance of reused water, however care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.

4. PART B - COLLECTION AND ANALYSIS OF DATA - COMPARATIVE ANALYSIS AND CONCLUSIONS

4.1 Introduction

In Part B of this document, the methodology described in part A is applied, and the relevant information on existing water reuse policies in the partner countries of the AQUARES Project is collected and analysed. The comparative analysis undertaken aims to:

1. Record the existing institutional framework in relation to the reuse of water in the project partner countries,
2. Highlight the best practices for water reuse, and
3. Highlight potential policy proposals for the use of optimal techniques and water reuse processes in the AQUARES countries.

4.2 Existing Institutional Framework for Water Reuse in Europe

Water Reuse – Legislative Framework in EU Regions

To date, there is no legal framework for Europe as a whole, restricting water reuse practices and providing quality standards to ensure environmental and health safety of water reuse applications. The Water Framework Directive only mentions water reuse in Annex VI, Part B[1] as one of the "supplementary measures" in the list of measures to be included to achieve the environmental objectives of the Directive, while the Urban Wastewater Treatment Directive states "treated wastewater shall be reused whenever appropriate". However, none of them defines health and environmental safety standards for water reuse. Given the lack of an EU-wide regulation of water reuse, the Member States each follow their own approach.

Even though they are based on the same principles, the national water reuse regulations of EU member states differ significantly from each other and follow different approaches to classify water quality levels for different water uses. Each regulation considers different reclaimed water uses associated with different quality classes and respective definitions. This results in varying water quality classes and combinations of permitted reuse options across the different national regulations.

Overall, standards for water reuse have been developed by Cyprus, France, Greece, Italy, Spain and Portugal. For the first five countries, these standards were adopted as regulations into the national legislation; in Portugal they are guidelines to be considered by the national government whenever issuing water reuse permits - the Portuguese standards are not legally binding. The standards of France, Greece, Italy and Spain refer to the reuse of urban and industrial wastewater effluents, the standards of Cyprus and Portugal, however, refer only to the reuse of urban wastewater.

Throughout EU countries practicing water reuse, the number and type of quality parameters monitored and the defined limits which have to be met for each quality class vary greatly. In Italy, for example, three

[1] Water Framework Directive 2000/60/EC.

classes of water reuse are specified and only one set of water quality requirements applies to all of them. On the other hand, the Spanish water reuse legislation distinguishes among 24 water reuse purposes, which correspond to 14 water quality classes. The number of water quality parameters which are restricted by each national regulation also differs. In the Greek reuse legislation, 6 parameters are regulated for Wastewater Treatment Plants (WWTPs) serving less than 2,000 p.e., however, for WWTPs with higher capacity the number of restricted parameters can increase significantly. Six parameters are also regulated by the French water reuse legislation (the lowest number of parameters involved in national regulations), three of which are solely included in the French regulation. The Cypriot legislation regulates 10 and the Italian legislation regulates 55 parameters. In Italy, the limit values for certain parameters can be adapted by the regional government under the supervision of the Ministry of Environment, considering the limit values for water discharge into surface waters. In Spain, the number of regulated parameters varies with the type of reuse, and can be extended on a case by case basis by the regional government by up to 90 possible quality parameters, depending on external regulations concerning the protection of the receiving environment.

Apart from defined water reuse classes, regulated parameters and relevant limit values, the national reuse regulations also differ with regard to the compliance requirements. While some regulations specify a percentile of samples required to comply with the set limit values (e.g. 80% of annual samples need to meet the limit), others require the annual mean to comply with the limits. In addition, sometimes maximum allowed deviation limits for any sample exceeding the limit values are defined. These specifications may not only vary among different regulations, but also for different parameters in the same regulation, as well as among different quality classes for the same parameter in the same regulation.

Proposed EU Quality standards for Water Reuse

The proposal for a Regulation on water reuse[2] aims to lay down minimum requirements for water quality, monitoring and risk management for the safe reuse of treated urban wastewater in order to guarantee protection of human and animal health and the environment, while also addressing water scarcity. More specifically, it covers agricultural irrigation of food crops consumed raw, processed food crops and non-food crops. The proposal requires reclamation plant operators to ensure the reclaimed water for agricultural irrigation complies with a set of minimum requirements laid down in the proposal and any additional conditions set by the Member States. The Annex [3] of the proposal defines minimum requirements for the following parameters:

- Microbiological parameters: Escherichia coli (E.coli), Legionella and intestinal nematodes (Helminth eggs);
- Physical-chemical parameters: Biochemical Oxygen Demand 5 (BOD5), Total Suspended Solids (TSS) and turbidity.

[2] European Commission, 2018, Proposal for a Regulation of the European Parliament and of the Council on minimum requirements for water reuse, COM(2018) 337 Final, 28.5.2018

[3] European Commission, 2018, Annexes to the Proposal for a Regulation of the European Parliament and of the Council on minimum requirements for water reuse, COM(2018) 337 final, 28.5.2018.

In addition, reclamation plant operators have to prepare Water Reuse Risk Management Plans based on key risk management tasks such as identification of potential hazards, environment and population at risk, assessment of the environmental and human health risks and identification of preventive measures. Furthermore, the proposal sets out requirements about the information that Member States should make available to the public concerning water reuse, including the quantity and quality of the reclaimed water, permits granted or modified and results of the compliance checks stemming from the Regulation. Table 5 provides an information sheet detailing the main provisions of the proposal for a Regulation on water reuse.

TABLE 5. EU PROPOSAL ON MINIMUM REUSE QUALITY STANDARDS. SOURCE: GANCHEVA ET AL, 2018.[4]

Information sheet: Commission proposal for a Regulation on water reuse (COM(2018) 337 final)
1.Permits & competent authorities
Article 3(1) defines 'competent authority' as an authority or body designated by a Member State to carry out obligations arising from this Regulation. The competent authority is responsible for permitting the supply of reclaimed water as well as ensuring compliance with the conditions set out it the permit. Articles 6 and 7 define the permitting provisions: Any supply of reclaimed water destined for agricultural irrigation is subject to a permit. The operator shall submit an application for a permit or a modification of an existing permit to the competent authority, including (a) a Water Reuse Risk Management Plan drawn up in accordance with Article 5(2); (b) a description of how the reclamation plant operator will comply with the minimum requirements for water quality and monitoring set out in section 2 of Annex I; and (c) a description of how the reclamation plant operator will comply with the additional requirements proposed in the Water Reuse Risk Management Plan. The competent authority shall, if appropriate consult and exchange relevant information with other relevant authorities, in particular the water authority, before granting the permit. Where the competent authority decides to grant a permit, it shall determine the conditions applicable, including the following (as applicable): (a) conditions in relation to the minimum requirements for water quality and monitoring set out in section 2 of Annex I; (b) conditions in relation to the additional requirements proposed in the Water Reuse Risk Management Plan; (c) any other conditions necessary to further mitigate any unacceptable risks to the human and animal health or the environment. Permits need to be reviewed regularly, at least every five years and, if necessary, modified. Article 8 defines the compliance checks: Competent authorities are obliged to check whether reclaimed water meets the conditions set out in the permit through (a) on-spot checks; (b) use of monitoring data obtained under this Regulation, the UWWTD (91/271/EEC) and the WFD (2000/60/EC); (c) any other adequate means. In the event of non-compliance, the competent authority is required to instruct the reclamation plant operator to take any necessary measures to restore compliance without delay. In cases of a significant risk to the environment or to human health, the reclamation plant operator needs to immediately suspend any further supply of the reclaimed water until the competent authority

[4] The content of this table refers to the articles and provisions of COM(2018) 337

determines that compliance has been restored. If an incident affecting compliance with the permit's conditions occurs, the reclamation plant operator shall immediately inform the competent authority and the end-user(s) which may be potentially affected, and communicate to the competent authority the information necessary for assessing the impacts of such an incident.

In addition, Member States need to appoint a national contact point to cooperate as appropriate with other Member States (Article 9).

2a. Use of reclaimed water

Section 1 of Annex I specifies the application of the proposed Regulation to reclaimed water intended for specific uses, specifically the irrigation of:

- food crops consumed raw, meaning crops which are intended for human consumption to be eaten raw or unprocessed;
- processed food crops, meaning crops which are intended for human consumption not to be eaten raw but after a treatment process (i.e. cooked, industrially processed);
- non-food crops, meaning crops which are not intended for human consumption (e.g. pastures, forage, fiber, ornamental, seed, energy and turf crops).

2b. Classes of reclaimed water

Four classes of reclaimed water quality (A, B, C, and D) and corresponding allowed uses and irrigation methods are detailed in Annex 1, Section 2.1, Table 1.

	Class A	**Class B**	**Class C**	**Class D**
Crop category	All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water	Food crops consumed raw where the edible part is produced above ground and is not in direct contact with reclaimed	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	Industrial, energy, and seeded crops
Irrigation method	All irrigation methods	All irrigation	Drip irrigation only	All irrigation methods

2c. Requirements for the reclaimed water

Applies to all classes (Annex I, Section 2.1):

The reclaimed water will be considered compliant with the requirements set out in Table 2 if the measurements meet all of the following criteria:

- The indicated values for *E. coli*, *Legionella* spp and Intestinal nematodes are met in 90 % or more of the samples. None of the values of the samples can exceed the maximum deviation limit of 1 log unit from the indicated value for *E. coli* and *Legionella* and 100 % of the indicated value for intestinal nematodes.
- The indicated values for BOD_5, TSS, and turbidity in Class A are met in 90 % or more of the samples. None of the values of the samples can exceed the maximum deviation limit of 100% of the indicated value.

Quality requirements applicable to all classes (Annex I, Section 2.1(a), Table 2):

- *Legionella* spp.: <1,000 cfu/l where there is risk of aerosolization in greenhouses;
- Intestinal nematodes (helminth eggs): ≤1 egg/l for irrigation of pastures or forage.
- Class-specific requirements BOD5, TSS and Turbidity are laid out in Annex I, Section 2.1(a), Table 2.

	Class A	**Class B**	**Class C**	**Class D**
Indicative technology target	Secondary treatment, filtration, and disinfection	Secondary treatment, and disinfection	Secondary treatment, and disinfection	Secondary treatment, and disinfection
***E. coli* (cfu/100ml)**	≤10 or below LOD	≤100	≤1,000	≤10,000
BOD_5 (mg/l)	≤10	≤25 (according to UWWTD, Annex I, Table 1)	≤25 (according to UWWTD,	≤25 (according to UWWTD, Annex I, Table 1)
TSS (mg/l)	≤10	≤35 (according to UWWTD, Annex I, Table 1)	≤35 (according to UWWTD,	≤35 (according to UWWTD, Annex I, Table 1)
Turbidity (NTU)	**≤5**	--	--	--

2d. Monitoring requirements

Reclamation plant operators shall perform routine monitoring to verify that the reclaimed water is complying with the minimum water quality requirements set out in point (a). The routine monitoring shall be included in the verification procedures of the water reuse system (Annex I, Section 2(b).

Monitoring requirements applicable to all classes (Annex 1, Section 2.1(b), Table 3):

- *Legionella* (when applicable): Once a week.

- Intestinal nematodes (helminth eggs) (when applicable): Twice a month or frequency determined by the reclamation plant operator according to the number of eggs in waste water entering the reclamation plant.

Class-specific requirements on *E. coli*, BOD_5, TSS and Turbidity are laid out in Annex I, Section 2.1(b), Table 3.

	Class A	**Class B**	**Class C**	**Class D**
E. coli	Once/week	Once/week	Twice/month	Twice/month
BOD5 and TSS	Once/week	Once or twice per month depending on the size of the treatment plant (According to Directive 91/271/EEC - Annex I, Section D)	Once or twice per month depending on the size of the treatment plant (According to Directive 91/271/EEC - Annex I, Section D)	Once or twice per month depending on the size of the treatment plant (According to Directive 91/271/EEC - Annex I, Section D)
Turbidity:	Continuous	--	--	--

2e. Validation monitoring

Validation monitoring has to be performed before the reclamation plant is put into operation, when equipment is upgraded, and when new equipment or processes are added. It shall be performed for Class A, the most stringent reclaimed water quality class. Validation monitoring entails the monitoring of the indicator microorganisms associated to each group of pathogens (bacteria, virus and protozoa). Performance targets shall be met at the outlet of the reclamation plant (point of compliance), considering the concentrations of the raw waste water effluent entering the urban waste water treatment plant.

Performance targets for the treatment chain (log10 reduction) per indicator microorganism are described for class A (most stringent class) in Annex 1, Section 2.1(b), Table 4

- *E.coli*: ≥ 5.0.
- Total coliphages/ F-specific coliphages/somaticcoliphages/coliphages: ≥ 6.0. If analysis of total coliphages is not feasible, at least one of them (F-specific or somatic coliphages) has to be analyzed.
- *Clostridium perfringens* spores/spore-forming sulfate-reducing bacteria: ≥ 5.0. Spore-forming sulfate-reducing bacteria is an alternative if the concentration of *Clostridium perfringens* spores does not allow to validate the requested log10 removal.
- Possible alternative reference pathogens and performance targets:
  - *Campylobacter*: ≥ 5.0
  - *Rotavirus*: ≥ 6.0

- *Cryptosporidium*: ≥ 5.0

3. Water Reuse Risk Management Plan

Article 5 requires the reclamation plant operator to draw-up a Water Reuse Risk Management Plan in cooperation with relevant parties (the end-user of the reclaimed water, the urban wastewater treatment plant supplying water to the reclamation plant, etc.). The Risk Management Plan needs to be based on the following key risk management tasks set out in Annex II.

1. Describe the water reuse system, from the wastewater entering the urban waste water treatment plant to the point of use.
2. Identify potential hazards, in particular the presence of pollutants and pathogens, and the potential for hazardous events such as treatment failures, accidental leakages or contamination in the described water reuse system.
3. Identify the environments, populations and individuals at risk of direct or indirect exposure to the identified potential hazards.
4. Conduct a risk assessment covering both environmental risks and risks to human and animal health.
5. When necessary and appropriate to ensure sufficient protection of the environment and human health, specify requirements for water quality and monitoring that are additional to and/or stricter than those specified in Annex I.
6. Identify preventive measures that are already in place or that should be taken to limit risks so that all identified risks can be adequately managed (Specific preventive measures that may be relevant are set out in Table 1).
7. Ensure that adequate quality control systems and procedures are in place.
8. Ensure that environmental monitoring systems are in place that will detect any negative effects of the water reuse.
9. Ensure that an appropriate system is in place to manage incidents and emergencies.

4. Information to the public

According to Article 10 Member States are required to ensure that adequate and up-to-date information on reuse of water is available online to the public. The provision lists the following pieces of information to be provided to the public which need to be updated at least once a year:

a) the quantity and the quality of the reclaimed water supplied in accordance with this Regulation.
b) the percentage of the reclaimed water in the Member State supplied in accordance with this Regulation compared to the total amount of treated urban waste water.
c) permits granted or modified in accordance with this Regulation, including conditions set by competent authorities.
d) outcome of the compliance check performed in accordance with Article 8(1).
e) contact points designated in accordance with Article 9(1).

In addition, Article 12 requires Member States to ensure that citizens and NGOs have access to a review procedure before a court of law or another independent and impartial body established by law to review the decisions taken by Member States under this regulation. This Article is in line in line with

Article 47 of the Charter of Fundamental Rights and implements the Aarhus Convention with regard to access to justice.

4.3 Existing Institutional Framework for Water Reuse in the AQUARES Project Partner Countries Context

In terms of policies on water reuse, the nine countries participating in AQUARES are sharply divided into two geographically distinct groups: the Coastal Mediterranean countries (Greece, Italy and Spain), which face a greater threat from water scarcity and thus have adopted and enforced reuse policies, and the Central European & Baltic countries[5] (Poland, Slovenia, Germany, Czech Republic, Latvia), where, as of 2018, there were no widely applicable and legally binding water reuse policies. In that context, for the second group, the policy framework most relevant to water reuse was investigated for the countries of Poland, Czech Republic, Latvia and Slovenia. In the case of Malta, water reuse measures are foreseen at the RBMP level, however given the size and insular nature of the country this is reasonable. The data for the countries above, as derived from desk research and documentation forms filled in by the relevant authority, are presented as follows.

Greece

Greece is a country presenting significant variability in water availability, both regional and temporal. Water scarcity is greatest in the eastern part of the mainland and the Aegean islands, where rainfall is lower; it is also greater during the tourist season, when an influx of visitors leads to spikes in water demand while also coinciding with the increased irrigation water needs. While water reuse is a common practice in Greece, it is still at a low extend.

The water consumption in Greece is mainly generated by the agricultural sector (6531.1 hm^3/yr) followed on by the urban (1149 hm^3/yr), industrial (179.2 $1m^3$/yr) and livestock (63.5 hm^3/yr) sectors. More specifically, irrigation is the main water consumer in the country, accounting for 84% of the total consumption. Greece ranks 6th highest in irrigation intensity in Europe (3,800 m^3 of water per ha), while groundwater abstractions account for 38% of the total water abstracted. This has resulted in over-abstraction and salinization of groundwater aquifers in coastal areas. In addition, the leaching of nitrates from agriculture, as well as other pollutants from industry and human settlements further threaten the quality of the water resources. Water reuse, either for direct use or for aquifer recharge, offers an unmissable opportunity to relieve some of the pressure on freshwater resources and maintain the overall good state of Greek groundwaters (according to the WFD criteria, 80% of Greek groundwaters are in good state).

[5] Depending on context, Central European countries are sometimes grouped as Eastern or Western European countries, collectively or individually. For instance Slovenia, Czechia and Poland can be referred to as Central European, as well as Eastern European.

However, despite its potential, there is very limited practice of water reuse even though Greek legislation permits several different uses for reclaimed water. Although aquifer recharge with reclaimed water is included in the Greek water reuse regulation, there are only very few cases of aquifer recharge in Greece. In the Water Reuse Europe Review (2018) 36 reuse schemes have been identified in Greece.

It is estimated that the average daily volume of reused water is about 16,000 m^3/day, equaling about 10.2 Mm^3/year. Overall, less than 5% of the treated effluents are being reused in Greece, contributing less than 1% to the total water use of the country. The main water reuse sites are located in the cities of Thessaloniki and Chalkida, as well as in the areas Heraclion and Hersonissos in Crete.

Greece has a high compliance with the Urban Waste Water Treatment Directive. About 83% of effluents from wastewater treatment plants are produced in regions with a water deficit, and more than 88% of the treated effluents are discharged nearby available farmland. So, there is significant availability of high-quality treated wastewater, which could be potentially reused for agricultural irrigation in areas facing severe water stress. Hence, there is great potential for water reuse for irrigation, providing an economically and technically feasible option. The number of projects implementing water reuse for agricultural irrigation is increasing. However, the administrative burden concerning water reuse in the current socio-economic context is still high. There is a need to revise the regulatory, policy and economic instruments to enable the wider uptake of water reuse in Greece.

The currently applicable regulatory framework in Greece is defined by the Joint Ministerial Decision No. 145116, which came into force in 2011. The Greek water reuse legislation defines a comparatively high number of permitted uses of reclaimed water, grouped into three categories of effluent quality. Greek reuse standards have a high administrative burden, which may prevent the implementation of potential water reuse projects (EC, 2016). Regarding the policy for wastewater reuse in irrigation, it is most applicable for the country to choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover. The economically and administratively standards currently in place by the national legislation are considered relatively strict but necessary to ensure public health and water and environment protection. The permit is issued by either the Environment Authorities or the Water Directorates of the Decentralized Administrations. The user of the reclaimed water or the operator of the plant applies for the permit, (usually the water reuse permit is part of the environmental permit of the wastewater treatment plant).

The Greek water reuse legislation also states the required treatment level for each class to achieve the relevant water quality. The restricted quality parameters are *E. coli*, BOD_5, TSS and Turbidity. For class 1 (urban uses), the parameter *E. coli* is replaced by total coliforms. In addition, there are two limit values for Total Coliforms in the first and *E. coli* in the second class to be met concurrently with different limits for a required compliance of 80% and 95% of the samples, respectively. For the third class, the median value of all samples must comply with the limit value given for *E. coli*. For BOD_5 and TSS only one limit is given, which must be met by 80% of the samples in class 1 and 2. For class 3, the limit values and required compliance of these parameters is regulated through the Greek adaptation of the UWWTD (Joint Ministerial Decision 5673/400/1997). No limit for the maximum allowed deviation from the defined limit

values is stated for any class or parameter. Additional requirements for total nitrogen and ammonium nitrogen (NH_4-N) are applicable for certain reuse purposes depending on the vulnerability of the receiving environment. The wastewater is usually treated with secondary, tertiary treatment and disinfection.

In addition to the water quality requirements defined for these three classes, there is a set of limit values for 19 heavy metals and metalloids which need to be met by WWTPs serving more than 2,000 p.e., if the treated effluents are used for crop irrigation. This is in order to preserve soil quality in case of irrigation of specific crops. A list of desirable limits of parameters relevant for agronomic characteristics of the soil in case of agricultural reuse is also proposed (these parameters are not mandatory). Furthermore, there is a set of 40 organic compounds, which is required to be monitored by WWTPs serving more than 100,000 p.e., as well as in case of reuse of industrial effluents. The compliance with the national wastewater reuse guidelines is monitored and a responsibility of the treatment plants that provide treaded water for reuse. The users are responsible to comply with other provisions such us access restrictions etc. An environmental permit is issued for the reuse and the authorities (environmental, water, health) responsible for environmental inspections check compliance of water reuse.

Greece, among others, faces regional obstacles with wastewater reuse. One main obstacle is the relatively strict quality requirements for the reclaimed water. In most cases of water reuse more stringent treatment is required compared to the provisions of Directive 91/271/EEC. Transferring treated wastewater back for reuse is another issue. Therefore, in order to apply water reuse, costly investments relevant to treatment and transfer of reclaimed water are required. Another obstacle is the low acceptance of the public.

Water reuse quality standards in Greece

A detailed information sheet for the proposal and the national legislation in Greece (Greek Joint Ministerial Decree 145116/11) in comparison with EU proposal, is provided below.

TABLE 6. INFORMATION SHEET ON WATER REUSE IN GREECE – COMPARISON WITH EU PROPOSAL. SOURCE: GANCHEVA ET AL, 2018. [6]

Information sheet: Greece
1. Permits & competent authorities
The competent authority for the coordination and implementation for the use of reclaimed water is the Decentralized Directorate of Water Management. Permitting: The reuse of treated waste water for the uses and activities such as agricultural irrigation, the supply of underground aquifers, for urban and suburban use or industrial use shall require authorization. The permit for the reuse of liquid waste water is issued by the Secretary General of the Decentralized Administration, following the recommendation of the Decentralized Directorate of Water Management and the opinion of the competent departments. For the permit for the reuse of liquid waste water, a request from the user or the Recovery Water Management Authority is required

[6] The content of this table refers to the articles and provisions of the Greek Joint Ministerial Decree 145116/11

to the 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 law. When assessing the application, the Directorate of Waters of the Decentralized Management examines the compatibility of the proposed use with the approved Program of Measures within the framework of the achievement of the environmental objectives. In this context, considering the particular circumstances of the area. Additional information may be requested in order to ensure the protection of the aquatic recipient.

Compliance: According to Article 13 of the Joint Ministerial Decree 145116/11, the Decentralized Directorate of Water Management in cooperation with the relevant departments performs regular and emergency checks in order to verify compliance with the terms and conditions requirements laid down in the permit for reuse of treated waste water.

A violation of the water reuse legislation by an act or omission of a natural or legal person incurs a penalty. Likewise, an activity that causes damage or direct threat of damage to water bodies against infringement of the provisions of this Decision, bears environmental liability.

2a. Use of reclaimed water

The use of reclaimed water is specified in Joint Ministerial Decree 145116/11:

- Agricultural irrigation (Article 4) including firstly limited irrigation, which applies only to crops whose products are consumed after heat or other treatment or are not intended for human consumption or do not come into direct contact with the soil, and secondly unrestricted irrigation, which applies inter alia to all other types of crops such as vegetables, vines or crops whose products are consumed raw, flowering.
- Enrichment of underground aquifers (Article 5).
- Reuse of treated liquid waste water for urban and peri-urban activities (Article 6) including urban and suburban green, forest lands, recreation, restoration, natural environment, fire-fighting, cleaning roads, except for drinking, bathing and domestic activities.
- Reuse of liquid waste water in the industry (Article 7) includes applications such as water use cooling, recharging boiler water and utilizing for the various industrial processes. The above reuse does not apply to the beverages intended for human consumption.

2b. Classes of reclaimed water

Three categories of reclaimed water quality and corresponding allowed uses and irrigation methods are detailed in Annex 1, Table 1, Table 2 and Table 3:

Category A : Limited Irrigation

Agricultural use: Areas where public access is not expected, feed crops, industrial crops, meadows, trees (excluding fruit), provided that the harvest is not in contact with the soil, seed crops and crops producing products processed further before consumption. Irrigation will not apply.

Industrial use: Disinfection, Disposable cooling water. Residual chlorine: continuously (if chlorination is applied).

Feeding of underground aquifers not falling under Article 7 of Presidential Decree 51 / 2-3-2007, (without prejudice to Article 5, paragraphs 4 and 5), by filtration through a soil layer of sufficient thickness and suitable features.

Category B: Unlimited irrigation
Agricultural use: All crops such as vegetables, vines or crops whose products are consumed raw, greenhouses. Unlimited irrigation allows the application of various methods of irrigation.

Industrial use: of non-recirculating cooling water for re-circulating cooling water, boiler water, process water etc.

Another category C also existing concerning the urban and recreational uses of reclaimed water

2c. Requirements for the reclaimed water

The Annexes of the Joint Ministerial Decree 145116/11 include tables setting the maximum permitted levels; and restrictions on the various applications of retreatment of waste water.

Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer.

Quality requirements for the parameters common with the EU proposal:

- *E. coli* (cfu/100ml): ≤ 200
- BOD_5 (mg/l): ≤25mg
- TSS (mg/l): ≤10
- Turbidity (NTU): --

Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial use other than disposable cooling water.

Quality requirements:

- *E. coli* (cfu/100ml): ≤ 5 for 80% of the samples and ≤ 50 for 95% of the samples
- BOD_5 (mg/l): ≤ 10 for 80% of the samples
- TSS (mg/l): ≤ 10 for 80% of the samples
- Turbidity (NTU): ≤2 median

2d. Monitoring requirements
For the three water classes, inspections vary from 1-2 times per week to every 1-2 weeks depending on the materials tested. Other requirements for monitoring have not been identified except those referring to general urban waste management. Category A: The monitoring for the parameters common with the EU proposal are: • *E. coli* (cfu/100ml): 4 times per week • BOD_5 (mg/l): twice per month • TSS (mg/l): twice per month • Turbidity (NTU): 4 times per week. Category B: The monitoring for the parameters common with the EU proposal are: • *E. coli* (cfu/100ml): twice per week • BOD_5 (mg/l): once per month • TSS (mg/l): once per month • Turbidity (NTU): twice per week.
2e. Validation monitoring
A provision regarding validation monitoring in the sense of the EU proposal was not identified in the Greek Legislation. However, there are provisions that prior to the issue of the reuse permit, the Directorate of Waters of the Decentralized Administration and the other competent authorities shall carry out a relevant inspection to determine that the organization, construction and operation of this installation are consistent with the submitted study and are compatible with any approved environmental conditions of the particular activity.
3. Water Reuse Risk Management Plan
Provisions regarding risk management plans were not identified in the Greek legislation.
4. Information to the public
Provisions regarding information provided to the public were not identified in the Greek legislation.

With the above being defined as the national quality standards, the accuracy of their implementation was investigated through a documentation form filled in by the responsible partner providing the following data being the quality standards actually applied.

Classes of reclaimed water

Greece currently has 3 classes of reclaimed water in our legislation that do not match to the 4 described above. The above mentioned classes Category A, B, C and D are those included in the draft of the European Regulation.

REQUIREMENTS FOR THE RECLAIMED WATER:

1. **Category A:**
   Quality requirements:
   - E. coli (cfu/100ml): 200units/100ml
   - BOD5 (mg/l): 25mg/l
   - TSS (mg/l): 35mg/l
   - Turbidity (NTU): -
2. **Category B:**
   Quality requirements:
   - E. coli (cfu/100ml): 5 units/100ml
   - BOD5 (mg/l): 10mg/l
   - TSS (mg/l): 10mg/l
   - Turbidity (NTU): 2 NTU
3. **Category C:**
   The Greek legislation also includes a 3rd Category of reclaimed water for urban/ suburban reuse, aquifer recharge via drilling which includes stricter requirements:

   - E. coli 2 cfu/100ml,
   - BOD 10mg/l, SS 2mg/l
   - Turbidity 2 NTU

MONITORING REQUIREMENTS:

1. **Category A:**
   - E. coli (cfu/100ml): Every week
   - BOD5 (mg/l): According to Directive 91/271
   - TSS (mg/l): According to Directive 91/271
   - Turbidity (NTU): -
2. **Category B:**
   - E. coli (cfu/100ml): Every 2 days
   - BOD5 (mg/l): According to Directive 91/271
   - TSS (mg/l): According to Directive 91/271
   - Turbidity (NTU): -

Italy

In Italy, 50% of abstracted water is used for application in the agricultural sector, whereas about 19% is abstracted for domestic use (the remainder is used for industrial and cooling purposes). The domestic water demand has decreased significantly in recent years due to an increase in efficiency of the distribution system and the enhancement of public awareness. The distribution of freshwater resources varies between 59% in the north of the country to 18% in the center and south and 4.5% on the islands. About 70% of the annually available groundwater resources (13 billion m^3) are located in Northern Italy.

Surface and groundwater quality has increased in recent years due to less intense agricultural production, investments in sanitation and reduction of industrial pollution. However, industrial wastewater as well as industrial and domestic solid waste discharge put the main pressure on small or medium sized streams close to industrial and urban centers.

The annual amount of WWTP effluent in Italy is estimated to be 2,400 Mm^3. Only medium to large-sized plants (>100,000 p.e.) which produce about 60% of the treated urban wastewater are able to meet the high-quality standards required by the national water reuse regulations at a favorable cost/benefit ratio. Italy reused approximately 233 Mm^3 of water per year in 2016. In the Water Reuse Europe Review (2018) 99 reuse schemes have been identified in Italy that provide reclaimed water primarily for the agricultural sector. However, of the 2.4 million hectares of irrigated agricultural area only around 4,000 ha are irrigated with reclaimed water. Another financial disincentive for the uptake of more water reuse in Italy next to the cost of treating water to the high required quality is the cost of upgrading the distribution networks and irrigation systems to meet the strict legal requirements for water reuse. The fragmented management of infrastructure does not increase the chance of reducing these costs. The average cost of reclaimed water was calculated by the Italian Institute for Environmental Protection and Research, through a survey of several Italian recycling plants in 2009. The cost was found to range from 0.083 to 0.48 €/m^3 among the different plants and uses, with a typical value of about 0.25 €/m^3 (EC, 2016). In contrast, the cost of surface or groundwater abstraction is estimated to range only from 0.015 to 0.2 €/m^3 with typical values about 0.03 €/m^3. Overall, water reuse is not widely applied. This is mainly due to the high cost of water reclamation, distribution and monitoring of water reuse schemes, in order to meet the strict quality requirements for reclaimed water, which makes water reuse feasible only for large WWTPs (>100,000 p.e.).

The currently applicable regulatory framework in Italy is defined by the Ministry Decree No. 185, which came into force in 2003. This regulation defines three categories of water reuse. All three categories are regulated with the same set of water quality parameters and therefore fall into the same single quality class defined in the Italian regulation. Aquifer recharge with reclaimed water is not regulated as it is not applied in Italy.

The set of limits applicable for all three categories does not differentiate between types of crops and applied irrigation methods. This “one size fits all” approach must address the environmental and health risks associated with all permitted reuse purposes, requiring a high reclaimed water quality suitable for the most strictly regulated water reuse purpose.

The Italian regulation is considered very strict with an overabundant number of restricted parameters. The total number of parameters is 55; around 20% of them have the same limit values required for drinking water quality, while 37% of the parameters are not even included in the requirements for drinking water quality. The monitoring requirements for all these parameters make water reuse economically feasible only for large WWTPs.

The limit value for *E. coli* depends on the type of treatment, with a higher limit value applying for wastewater treated in constructed wetlands and stabilization ponds. The *E. coli* limit value must be met by 80% of the samples, while a maximum deviation value must not be exceeded by any sample. Salmonella must be absent in 100% of samples; if Salmonella is detected in any sample, reuse is suspended until concentrations of Salmonella are not found in at least three successive and consecutive samples (DM 185, 2003). For all physico-chemical parameters the defined limit value must be met by the annual average of samples. Only for electrical conductivity a specific (different) value limiting the maximum deviation is provided.

Water reuse quality standards in Italy

A detailed information sheet for the proposal and the national legislation in Italy (Italian Decree 11 May 1999, n. 152, Environmental Code) in comparison with EU proposal, is provided below.

TABLE 7. INFORMATION SHEET ON WATER REUSE IN ITALY– COMPARISON WITH EU PROPOSAL. SOURCE: GANCHEVA ET AL, 2018.[7]

Information sheet: Italy
1. Permits & competent authorities
Article 6 [8] states that the authorisation for the use of reclaimed water shall outline the rules to be followed to ensure that the treatment plant discharging water observes the limit values and the requirements of the decree. The authorisation regime is regulated by regional law in Italy. It is generally the province that release the authorisation.
2a. Use of reclaimed water
Article 3 defines that reclaimed water can be used for: irrigation, civil purposes and industrial purposes. *Irrigation*: Irrigation of crops for the production of food for human and animal consumption as well as non-food crops, and for the irrigation of green or recreation and sport areas. *Civil purposes*: i.e. washing of roads in urban centres, supply of heating or cooling system, feeding of dual supply networks (separate from drinking water network), with the exclusion of direct use of reclaimed water in building for civil use, with the exception of toilet drain systems. *Industrial purposes*: i.e. fire-fighting, industrial processing, industrial washing and thermal cycles of industrial processes, with the exclusion of the uses that involve a contact between the recovered waste water and food or pharmaceutical and cosmetic products.
2b. Classes of reclaimed water
The Decree only defines the reclaimed water uses and not classes.

[7] The content of this table refers to the articles and provisions of the Italian Decree 11 May 1999, n. 152, Environmental Code

[8] Legislative Decree 11 May 1999, n. 152, Environmental Code

2c. Requirements for the reclaimed water

Article 4 and the annex defines the requirements for the reclaimed water for irrigation and civil uses. Limit values are defined for some parameters covered by the Commission proposal and some additional parameters such as (but not limited to) COD, pH, heavy metals, phosphorus, nitrogen, sulphates, chlorides and Salmonella. Quality requirements for the parameters common with the EU proposal:

- TSS (mg/L): 10
- BOD_5 (mg O2/L): 20
- *E. coli* (cfu/100ml): 100

2d. Monitoring requirements

Article 7 defines requirements for the monitoring and control of recovery (treatment) facilities. Monitoring is agreed upon with the competent authority (i.e. the relevant regional authority in the province), based on the monitoring programme referred to in Article 49, paragraph 1 of legislative decree n. 152 of 1999. It is carried out by the treatment facility owner. The owner of the recovery facility must, in any case, ensure a sufficient number of self-checks at the plant outlet recovery, no fewer than the number envisaged in regional legislation in relation to specific uses. The results of the analysis must be made available of the control authorities. The waste water recovery plant is also subject to control by the competent authority, according to the article 49 of the legislative decree n. 152 of 1999, for the verification of the compliance with the provisions contained in the authorization referred to in Article 6.

Article 11 establishes requirements for the reuse activity: The owner of the distribution network monitors the chemical and microbiological parameters of reclaimed water as well as the environmental agronomic and ecological effects of the reuse. The health authority assesses any health and hygiene effects related to use of reclaimed water. The monitoring results are transmitted to the region with annual cadence.

2e. Validation monitoring

There is no requirement on validation monitoring in the decree.

3. Water Reuse Risk Management Plan

There is no requirement to prepare a Water Reuse Risk Management Plan. However, Article 10 establishes that reuse for irrigation is subject to compliance with a code of good practice in the agricultural sector, referred to in the decree of the Minister for Agricultural Policies and Forestry 19 April 1999, n. 86. In the case of re-uses for multiple uses such as irrigation, civil and industrial as defined in Article 3, or with multiple users, the owner of the distribution of the reclaimed water is responsible for the correct information of the users, the methods of use, the constraints to be respected, and the risks connected to improper re-use.

4. Information to the public

There is no public information requirement in the decree.

Spain

Water reuse plays an important role in Spain, not only for the prevention of water shortages, but also for improving the quality and resilience of freshwater systems. Economic activities and several drought events have put increasing pressure on natural water resources. In the most water stressed area in south-eastern Spain, high population density is combined with water intensive economic activities such as tourism, and the resulting water demand already exceeds the capacity of natural water resources, even when not facing a drought event.

The main water reuse sites are located in Murcia and the AACC of País Valenciano. In the region of Murcia the wastewater reuse is already a common practice at a great extent, where in the rest of the country, this is still in the process of implementation. The obstacles faced in the region of Murcia in order to achieve the rate of 98% wastewater reuse was mostly the social rejection of the fruit and vegetables at the markets and the tedious process (tests, controls) to guarantee the compliance to the rules in relation to other water sources.

Overall, the total national water abstraction is decreasing. However, since increasingly scarce sources such as groundwater come at a very low cost, alternative sources are only used in emergency situations. About 80% (26,949 Mm^3) of the total annual water demand is covered by surface water and the remaining 20% (6,595 Mm^3) by groundwater abstraction, with agriculture being the largest consumer of water (63%) followed by cooling and power generation (19%) and domestic water use (16%). For 2013, the volume of treated wastewater was estimated at 4,998 Mm^3 and of this, the volume of reclaimed water was reported by the Office for National Statistics as 413 Mm^3, while the River Basin Management Plans reported a total volume for reclaimed water of 531 Mm^3. Reclaimed water is mainly used for golf course and agricultural irrigation, groundwater recharge and river flow augmentation. It was reported by the Water General Directorate of the Region of Murcia – Spain that the crops mainly irrigated with reclaimed water is lettuce (25,000 has), broccoli (8,000 has), tomato and pepper (8,000 has) and citric like lemon (23,000 has). In all the cases the water is mixed with other water sources (groundwater and surface water), those crops aren't never irrigated only with water reused. The overall water reuse in Spain has remained at a steady level of 10 to 12% of the volume of treated wastewater, after the national water reuse regulation was implemented in 2007. In south-eastern Spain, in the Segura and Júcar River Basin Districts and on the Balearic Islands about 62%, 55% and 48% of treated effluent was being reused respectively.

A gradual increase in use of reclaimed water was expected without any policy intervention, and given the ongoing governmental awareness raising initiatives, a maximum amount of approximately 1,200 Mm^3/year of reclaimed water was expected to be achieved in 2018. More than 360 reuse schemes have been identified in Spain. Regarding the policy for wastewater reuse in irrigation, it is most applicable for the country to choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover.

The currently applicable legal framework for water reuse in Spain is defined by the Royal Decree no. 1620, which came into force in 2007. The Spanish regulation defines the highest number of permitted reclaimed water uses, including water reuse for irrigation of private gardens and for aquaculture. While

differentiating among urban, agricultural, industrial, recreational and environmental reuse categories, it follows the categorization of the US EPA, the Australian guidelines, and the Californian regulations. The compliance with the national wastewater reuse guidelines is monitored by the public company ESAMUR, by controlling the water at the exit of the WWTP and the Irrigator Communities in their facilities.

The Spanish regulation prohibits the following uses for reclaimed water (EC, 2016; BIO by Deloitte, 2015):

- Human consumption (not applicable in case of catastrophic events);
- Food industry (except for process and cleaning water, as defined by the Royal Decree 140/2003);
- Hospitals and the like;
- Filter-feeding mollusk aquaculture;
- Bathing waters (recreational uses);
- Fountains and ornamental products in public or interior spaces of public buildings; and
- Any other use public health or environmental authorities may consider risky.

The main parameters regulated by the Spanish water reuse legislation are *E. coli*, intestinal nematodes, TSS and turbidity. In addition, certain classes require compliance to additional parameters, such as *Legionella spp.* or nutrients. For example, in case of aquifer recharge with reclaimed water, additional requirements exist for total nitrogen and nitrate, while total phosphorus is regulated for stagnant waters in ornamental ponds and lakes with restricted public access. In general, at least 90% of samples must comply with the set limit values, while additional maximum deviation limits apply for intestinal nematodes, *E. coli*, TSS, turbidity, *Legionella* spp., *T. saginata*, *T. solium*, nitrate, total nitrogen and total phosphorus. The treatment applied on the wastewater in the region of Murcia is tertiary treatment (remove nitrates, phosphates, heavy metals, pathogens…) for the 66% of the water reused and a secondary treatment plus disinfection, after the water is discharged into the river and reused later for the rest 33%.

The absence of specific quality requirements for reused water in agricultural irrigation and aquifer recharge does not contribute in the public acceptance of reused water.

Water reuse quality standards in Spain

A detailed information sheet for the proposal and the national legislation in Spain (Spanish Royal Decree 1620/2007) in comparison with EU proposal, is provided below.

TABLE 8. INFORMATION SHEET ON WATER REUSE IN SPAIN– COMPARISON WITH EU PROPOSAL. SOURCE: GANCHEVA ET AL, 2018.[9]

Information sheet: Spain
1. Permits & competent authorities
The competent authority to grant the permit is the territorially competent basin organization. There are three different procedures for obtaining the permit depending on who is the applicant: 1. When the request to reuse water is made by someone already a licensee for the first use of

[9] The content of this table refers to the articles and provisions of the Spanish Royal Decree 1620/2007

the waters (Article 8), the procedure for obtaining the permit starts with the submission of the request to the competent authority indicating the objective of the reuse. The applicant must submit a project of reuse of waters with all documents needed (origin and localization of the delivered points for treated and reclaimed water, characteristics of the water, volume requested, use, erc.). Finally, if the final use of the waters is agricultural, then the applicant must provide the ownership of the land that will be irrigated. The competent authority must review the application and if it decides to proceed then it must request a report from the Autonomous Community/ies affected so they provide comments on the matters of their competence. The competent authority will then elaborate a proposal where it will establish the conditions of the permit. The applicant must decide on the proposal within a period of 10 days.

2. When the applicant has a discharge permit (Article 9), he will receive an additional administrative permit when all requirements and conditions on the reuse of water are established. If the permit on the reuse of water is requested at the same time than the discharge one, then the water reuse permit will be subject to the approval of the other. The Royal Decree includes in its annex the form to request the reuse. The review of the permit and grant of the permit follows the same rules as above.

3. When the applicant is a third party with no license for the first use of water or do not have a discharge permit or do not want to request it (Article 10), then the procedure is the general one for concessions included in Royal Decree 849/1986 on the Regulation of the Hydraulic Public Domain, but using the form included in the Annex of RD 1620/2007.

In any case all permits must be registered in the Register of Waters

2a. Use of reclaimed water

The Royal Decree (RD)[10] (Article 4) includes the permitted uses for reclaimed water by cross-referencing Annex IA which includes a list of quality criteria required for each type of use. Therefore, the RD includes different criteria for the following types:

1. Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;

2. Agricultural use (see below)

3. Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and

[10] Royal Decree: Ministerio de Medio Ambiente, "Guía para la Aplicación del R.D. 1620/2007 por el que se establece el Régimen Jurídico de la Reutilización de las Aguas Depuradas".

evaporative condensers;

4. Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;

5. Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).

For any other use, the competent basin organisation will require quality conditions adapted to the most similar use in the RD. The applicant must in any case explain the reuse for this other kind of use.

The RD (Article 4) expressively forbids the use of reclaimed water:

a) For human consumption, except situations declared a catastrophe in which the health authority will specify the levels of quality required to those waters and the uses.

b) For the proper uses of the food industry, as determined in Article 2.1.b) of Royal Decree 140/2003, of February 7, establishing the sanitary criteria for the quality of drinking water for humans (this is, all waters used in the food industry for the purpose of manufacturing, treatment, conservation or sale of products or substances intended for human consumption, as well as those used in the cleaning of surfaces, objects and materials that may be in contact with the food), except as provided in "Annex IA3.quality 3.1.c)" for the use of process and cleaning water in the food industry.

c) For use in hospital facilities and other similar uses.

d) For the culture of filtering molluscs in aquaculture.

e) For recreational use such as bathing water.

f) For the use in cooling towers and evaporative condensers, except for those intended for industrial use in "Annex I.A.3.quality 3.2."

g) For use in ornamental fountains and sheets in public spaces or interiors of public buildings.

h) For any other use that the health or environmental authority considers a risk to the health of the people or a harm to the environment, whatever the moment in which that risk or damage is appreciated.

2b. Classes of reclaimed water

The RD includes a list of quality criteria required which varies depending on each type of use, for

agricultural use the following classes are distinguished:

Quality 2.1 Irrigation of crops with a water application system that allows direct contact of reclaimed water with the edible parts for fresh human consumption;

Quality 2.2 Irrigation of products for human consumption with water application system that does not avoid the direct contact of regenerated water with the edible parts, but consumption is not fresh but with a subsequent industrial treatment; Irrigation of pastures for consumption of milk or meat producing animals; Aquaculture;

Quality 2.3 Localised irrigation of woody crops that prevents the contact of reclaimed water with the fruits consumed in human food; Irrigation of ornamental flower crops, nurseries, greenhouses without direct contact of reused water with production; Irrigation of non-food industrial crops, nurseries, silage, cereals and oilseeds.

2c. Requirements for the reclaimed water

The Spanish legislation applies to several uses, not only agriculture. Quality criteria varies depending on the use. Article 5 also specifies that if reused water has several uses, the most stringent values of the intended uses shall apply. Competent authorities can also demand criteria for other pollutants not included in the RD and even demand stringer values than those in the RD (they need to motivate their decision in such case).

For agricultural use, limit values are defined for various parameters, including some covered by the EU proposal depending on the water class:

Quality 2.1:

- Intestinal nematodes: 1 egg/10 L
- *E. coli*: 100 UFC/100 mL
- TSS: 20 mg/L
- Turbidity: 10 NTU
- *Legionella* spp. 1,000 CFU / L (if there is a risk of aerosolisation)

It is mandatory to carry out the detection of pathogens Presence/ Absence (Salmonella, etc.) when it is repeated habitually that c = 3 for M = 1.000

Quality 2.2:

- Intestinal nematodes: 1 egg/10 L
- *E. coli*: 1000 UFC/100 mL
- TSS: 35 mg/L
- Turbidity: No limit

It is mandatory to carry out detection of pathogens Presence/ Absence (Salmonella, etc.) when it is

repeated habitually that c = 3 for M = 10,000

Quality 2.3:

- Intestinal nematodes: 1 egg/10 L
- *E. coli*: 10000 UFC/100 mL
- TSS: 35 mg/L
- Turbidity: No limit
- *Legionella* spp. 100 CFU / L

2d. Monitoring requirements

According to Annex I.B on minimum frequency of sampling and analysis of each parameter, the monitoring must be done at the exit of the regeneration plant, and at all delivery points to the user.

The frequency of analysis will be modified in the following cases:

I. After 1 year of control a motivated request can be presented to reduce the frequency of analysis up to 50%, for those parameters that are not likely to be present in the waters.

II. If the number of samples with a concentration lower than the maximum admissible value of Annex I.A is less than 90% of the samples during one-quarter, the sampling frequency for the following period will be doubled.

III. If the result of a control exceeds at least one of the parameters the maximum deviation ranges established in Annex I.C, the control frequency of the parameter that exceeds the deviation ranges will double during the rest of this period and the following one.

The annex includes a table with the minimum frequency of sampling per use and type of pollutant. The requirements for the parameters covered by the EU proposal depending are:

Quality 2.1

- intestinal nematodes: every 15 days
- *E. coli*, TSS, turbidity: weekly

Quality 2.2 and Quality 2.3

- intestinal nematodes: every 15 days
- *E. coli*, TSS: weekly Turbidity: --

2e. Validation monitoring

There is no requirement on validation monitoring

3. Water Reuse Risk Management Plan
When requesting the permit, the applicant must submit a water reuse project that includes the necessary documentation to identify the origin and geographical location of the delivery points for purified and reclaimed water; the characterisation of purified water; the requested annual volume; the use for which it is destined; the place of use of the reused water, specifying the characteristics of the infrastructures foreseen from the exit of the reused water system to the places of use; the quality characteristics of the reused water corresponding to the intended use as well as the proposed analytical self-control as established in Annex I; the water reuse system; the control and signalling elements of the reuse system; the measures for the efficient use of water and the risk management measures in case the quality of the reclaimed water does not comply with the criteria established in Annex I corresponding to the permitted use. The form included in the Annex includes a question on the existence of measures on risk management in case inadmissible quality of the waters for the admitted use. No other specification is included regarding this topic.
4. Information to the public
The RD does not contain any provision at this regard. However, regarding the third type of procedure, when the applicant is a third party that has no license for the first use of waters or do not have a discharge permit or do not want to request it, Article 10 cross-refers to Royal Decree 849/1986 on the Regulation of the Hydraulic Public Domain to follow the general procedure on concessions. In this case, if the request is accepted by the competent authority then there is a period of public information of between 20 days to 1 month.

With the above being defined as the national quality standards, the accuracy of their implementation was investigated through a documentation form filled in by the responsible partner providing the following data being the quality standards actually applied.

REQUIREMENTS FOR THE RECLAIMED WATER:

1. **Category A:**
   Quality requirements:
   - E. coli (cfu/100ml):
     100 Units/100 mL (example lettuces in sprinkled irrigation)
     1000 Units/100 ml (drip Irrigation)
   - BOD5 (mg/l): -
   - TSS (mg/l): 20
   - Turbidity (NTU): 2
2. **Category B:**
   Quality requirements:
   - E. coli (cfu/100ml): 1000 units/100ml
   - BOD5 (mg/l): -
   - TSS (mg/l): 35
   - Turbidity (NTU): -

MONITORING REQUIREMENTS:

1. **Category A:**
    - E. coli (cfu/100ml): -
    - BOD5 (mg/l): -
    - TSS (mg/l): -
    - Turbidity (NTU): -
2. **Category B:**
    - E. coli (cfu/100ml): Every two weeks
    - BOD5 (mg/l): Every week
    - TSS (mg/l): Every week
    - Turbidity (NTU): Every week

Malta

As Malta suffers from water stress all year round, significant resources have been invested in water recycling technologies applied in the three Maltese Waste Water Treatment Plants. The recycled water is used for agricultural irrigation, and there is a dedicated distribution network specifically for the provision of reclaimed water to fields, while a number of distribution points are also available to farmers to collect water (Rebelo et al. 2018), and the distribution of water is regulated by means of a pre-paid card system. There is a dual benefit from this practice, from the conservation of the natural groundwater resources and their protection from over abstraction, eventually resulting in quality improvements as well, as well as from the provision of a more reliable source of water for farmers whose crops suffer during periodic drought events.

The water consumption in the country derives mainly by the agricultural sector (18 hm^3), followed by the industrial (4 hm^3), recreational (3 hm^3) and urban (2 hm^3) sector. The potential production capacity of reused water in the country is 17,000 m^3/day, where the actual production varies according to seasonal demand. The share of reused water in the total water consumption in the country is 3%, projected to be increased up to 8% once the New Water program[11] is concluded. The main water reuse sites are located in Ras il-Ħobż (Gozo New Water Polishing Plant), Iċ-Ċumnija (Malta North New Water Polishing Plant) and Ta' Barkat (Malta South Water Polishing Plant). The total annual amount of wastewater treatment plant effluent of Malta rises up to 22.6 hm^3/year, which originates mainly from the Malta South Water Polishing Plant 17.4 hm^3/year and with the contributions of the Malta North New Water Polishing Plant 3.7 hm^3/year and the Gozo New Water Polishing Plant 1.5 hm^3/year. The wastewater reuse is mainly applied in an major extend for agricultural uses, but also in a low extend for industrial uses

With the wastewater reuse being already a common practice in the country, the main challenges faced in order to adopt this practice is the distribution of this new water resource. Additionally, the salinity of the wastewater being high from sewerage infrastructure below sea level is also a challenge. This necessitates a desalination step to make the water suitable for reuse in agriculture.

[11] For further information visit: http://www.wsc.com.mt/information/new-water/

The wastewater is treated with regards to the UWWTP. The largest plant in Malta (Malta North) utilises a primary sedimentation followed by biological aerated filters. The two smaller plants utilise extended aeration for biological treatment directly after primary treatment which consists of a coarse and fine screens followed by aerated grit chamber and grease trap. A retrofit of an older UWWTP will utilise MBBR technology. Following the secondary treatment step water passes through sand filters, followed by ultrafiltration, reverse osmosis and an advanced oxidation process utilising hydrogen peroxide and UV.

In Malta, wherever access to reclaimed water is available, there is no restriction to which crops can be irrigated because of the high quality of the water. The recycled water produced in Malta can be used for all food crops, including root crops consumed raw and crops coming in direct contact with the water, using all irrigation methods. The applicable quality requirements are (Rebelo et al. 2018):

(i) *E. coli* ≤10cfu/100ml,
(ii) BOD_5 ≤10 mg/l,
(iii) TSS ≤10mg/l
(iv) Turbidity ≤5 NTU,
(v) *Legionella* spp. <1000cfu/l where there is a risk of aerosolization in greenhouses and
(vi) Intestinal nematodes (helminth eggs) ≤1 egg/l for irrigation of pastures or forage.

A monitoring framework has been established by the Water Services Corporation – internal compliance mechanism in order to monitor the wastewater reuse guidelines. 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.

All operations concerning the permits and competent authorities are undertaken by the central national utility (Water Services Corportation) and plants are authorised by the Food Safety Commission. The most suitable policy for wastewater reuse in irrigation in Malta was noted to have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.

Regarding the standards economically and administratively enforceable in the country, 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 disinfection of reservoirs. From commission stage, the highlighted guidelines have never been exceeded.

Poland

Poland, located in Central Europe, has no water reuse standards implemented. The policy frameworks applied in the country most relevant to water reuse are: "Water Law", "Act on Collective Water Supply and Collective Sewage Disposal", and "National program for urban waste water treatment", all developed by the Ministry of Environment for agricultural and urban use.

More specifically, for the Lodzkie Region data has shown that the main water consumption is generated by the urban (136.2 hm^3) and industrial (102.6 hm^3) sector followed by agricultural (51.6 hm^3) sector. The average annual volume of reused water in the region is 107.5 m^3, where the annual amount of wastewater treatment plant effluent is 141 hm^3. The wastewater reuse mainly applied, but at a low extend is for agricultural, industrial and environmental use and at no extend for urban use. The low extend in the agricultural use derives from the fact that in Poland it is not allowed to irrigate crops with reclaimed water. The wastewater is mostly treated with secondary treatment before reuse, but no wastewater reuse guidelines exist. As mentioned, the most appropriate policy for wastewater reuse in irrigation for the region would be to have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.

As so, the wastewater reuse is not a common practice in Poland, with the main obstacle being the absence of legal regulations related to water reuse standards and public concerns about the quality of reclaimed water. Despite the lack of standards for water reuse in Poland, technologies allowing the reuse of water from industrial processes (e.g. in the textile industry) are increasingly widely used. Such application seems therefore currently feasible under the assumption that public authorities will develop appropriate standards in cooperation with the private sector.

Czech Republic

Czech Republic does also not implement water reuse standards. However, the most relevant framework applied is the "Water Act Decree to this Act No. 252/2004 Coll." for drinking water and other uses, the "Water Act 274/2001 Coll." for water supply and sewerage systems for public use, and the "Water Act Decree of the Ministry of Health 252 / 2004Sb" that lays down hygienic requirements for drinking, hot water, frequency and scope of drinking water control. These Water Acts have been developed by 2001 Government of the Czech Republic, validity of laws as amended, covering the national level. The purpose of the Act is to protect surface and groundwater, to create conditions for economical use of water resources and to maintain and improve the quality of surface and groundwater, to create conditions for reducing the adverse effects of floods and droughts and to ensure the safety of waterworks.

The main water consumption in the Pardubice region of Czech Republic, originates from the urban stream (332.4 hm^3), followed by the surface and groundwater stream (108.0 hm^3) and the industrial stream (59.2 hm^3). The agricultural sector only contributes in a small amount to the regional water consumption (9.0 hm^3), while there are no available data for the recreational stream. The type of wastewater reuse mainly applied in the country is occasionally urban use, and at a low extend industrial, recreational, environmental use and Potable sector – grey water reuse in households –, while no agricultural use has been noted. In agriculture, water is not reused for irrigation of crops. In homes, people use grey or more often rainwater to water gardens and for flushing toilets. No wastewater reuse guidelines exist in the country.

The quality of drinking water in the Czech Republic is defined by Act No. 258/2000 Coll. (as amended) and the Decree to this Act (No. 252/2004 Coll., on Drinking Water and others). These regulations are based on the requirements of the European Drinking Water Directives (98/83 / EC). The health and purity requirements of drinking water are set by hygienic limits of microbiological, biological, physical, chemical and organoleptic parameters. These limits are regulated by implementing legislation or approved or determined by the competent public health protection authority.

Currently, recycled water in the Czech Republic is not used for irrigation, but with increasing drought it can be expected that this method will be relevant for e.g. in South Moravia or in the Elbe. National management of rainwater and recycled waste water in agriculture is soon under discussion. At the same time, it is necessary to eliminate all risks to the environment and human health that may be related to the use of recycled waste water.

With the wastewater reuse not being a common practice in the country, the main obstacle noted, includes legislation and standards in the Czech Republic. Awareness of recycling and its use in practice, hygiene standards, the price of drinking water and sewage collection are low, technology is available, but the price is not attracting consumers in terms of return on investment, low involvement of architects, no state incentives or recommendations from the state or municipalities. People using grey water are more in the field of water management or are ecologically oriented and make these activities out of their beliefs.

Latvia

Adding to the list, Latvia also does not implement water reuse standards. The most relevant policy framework is “Law on Water Management (2002)”, which sets the general framework for integrated water management and aims at good status of all surface waters and groundwater. 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.

The main water consumption is generated from the urban sector (104.1 hm^3) and more specifically mainly from domestic/ residential uses (103.8 hm^3). The industrial sector however, has also an important share in the water consumption (83.5 hm^3) which originates from the food and beverage industry (62.2 hm^3), as well as manufacturing (15.7 hm^3) and construction industry (0.03 hm^3). Additionally, the agricultural sector contributes to the national water consumption (21.6 hm^3) through agricultural irrigation, general crop and animal production, and the least contribution is noted by the recreational sector (1 hm^3). From the above only 10.14 % (0.06 hm^3) of the total water consumption in the country is reused, as there is no official water treatment plant for water reuse. The main type of water reuse applied is at a low extend for urban, industrial, recreational and environmental use. No wastewater reuse guidelines exist and no quality requirements have been identified for the country of Latvia.

Regarding standards that are economically and administratively enforceable in the county, Law on Water Management (2002) sets the general framework for integrated water management and aims at good status of all surface waters and groundwater. 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:

- 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

As the wastewater reuse is not a common practice in the country, there has been no or very little and rare scarcity of water resources in Latvia historically. Lately such situations have occurred due to periods of draught in summer and such need for water reuse has been noticed. Still there is a lack of a uniform and comprehensive regulatory framework for water reuse. There are no policy documents or guidelines for water reuse, also there are no specific standards at present for reclaimed water. The use of treated wastewater or surface run-off is possible for manufacturing supply of industrial water or irrigation. All other sectors use drinkable water, which have quality standards provided by respective regulatory enactments

As water reuse is a new approach to water management in Latvia, a complicated approach could worry the public. Unhurried adaptation to ideas about water reuse could work more successfully, thus care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.

The reuse of water would, of course, have a positive effect on the state of natural ecosystems as a whole, as it would prevent the deterioration of water quality. If treated wastewater becomes a common practice in the country, then some positive effects could diminish. The overall quality of surface water and the resulting impacts are likely to improve.

Currently, there is no shortage of water resources in Latvia, considering the fact that good quality water is available in sufficient quantities. Thus, as stated, no economic benefits are expected from reorganizing

the existing system towards increased water reuse. On the contrary, it will initially lead to additional costs without any economic benefit in the current situation. The situation could change in the future, assuming that water resources could be damaged as a result of ill-considered management.

Slovenia

Following on, similar to the above, Slovenia does not apply water reuse standards, but the most relevant frameworks of "Water Act (2002)", "Decree on the discharge and treatment of urban wastewater (2015)", drinking water directive and following decrees, e.g. Rules on drinking water (2004) that are developed by the national Government - Ministry of the Environment and Spatial Planning. The Ministry of the Environment and Spatial Planning and its agencies and institutions are responsible for the implementation and enforcement of the Water Framework Directive and Urban Waste Water Treatment Directive. On the second level, the implementing authorities are municipalities with public utility companies. The purpose of the Water Act is the protection of surface and underground water and sea, its quality, sustainable economical use of resources and the aim of good quality of water bodies, water ecosystem, safe use and sustainable water management.

The annual water consumption, based on the available data, originates mainly from the urban sector (79 hm^3/year) followed by the industrial (37.6 hm^3/year). Data also showed that an additional 27.6 hm^3/year is considered as lost/ waste water and that 5.9 hm^3/year are municipal/public use. No data is available on water reuse, as wastewater reuse is not a common practice in the country.

Lately situations of water scarcity are a fact in Slovenia and such need for water reuse has been noticed. The main obstacle is that despite few individual project the water reuse is not regulated and not known. The lack of policies on water reuse is the issue and it is essential to establish higher awareness regarding its reuse. There are no policy documentation or guidelines for water reuse. Water reuse is story of few individuals who believe in it or would like to reduce costs in the companies that need for production lots of water.

In Slovenia water reuse is limited to individual cases. There is no special treatment requested for water reuse since there is no standards for water reuse. The standard for the treatment of waste water is Decree on the discharge and treatment of urban wastewater.

Despite the lack of standards for water reuse in Slovenia, stakeholders from the industry are developing technologies and is getting widely use. There is the assumption that public authorities will develop appropriate standards in the cooperation with private sector.

The quality of drinking water in Slovenia is defined by decree that is based on Drinking Water Directive. The monitoring of treated waste water is defined in Decree on the discharge and treatment of urban wastewater. Regarding this decree, monitoring for permitted limit values at the outflow is obliged for parameters: BOD5, COD, N and suspended solids.

4.4 Highlighting Best Practices for Water Reuse

As shown in the previous paragraphs, there is great variability in the way water reuse is regulated, even in the handful of EU countries which have relevant legislation in place. The amount of reclaimed water used in Spain accounts for half of the total water reuse in the EU, and yet its full potential is not being exploited, mainly due to the high financial costs associated with treatment and distribution. In most countries, including Italy and Greece, the complex and strict water reuse regulations, combined with high administrative burden prevent the exploitation of the full potential of water reuse. In addition, limited awareness and knowledge of the actual risks and benefits of the water reuse practices applied can negatively affect public acceptance and hamper the implementation of water reuse projects.

It is clear from the overview of the different reuse practices in Europe that the main limiting factor for implementing reuse schemes and exploiting the full potential of reuse is the associated cost, both for additional treatment in order to satisfy the water quality requirements and for the necessary infrastructure to store and distribute the reclaimed water. However, the complexity of regulations, administrative problems and acceptance by the public are also vitally important, even where cost is not an issue. In a world of increasing water scarcity and climate uncertainty, it is critical to build institutional capacity in the EU as a whole for mitigating their effects, and the development of water reuse regulations falls under this heading.

In 2012, the necessity to address water reuse on an EU-wide level was identified by the European Commission. Subsequently, the Joint Research Centre proposed minimum requirements based on relevant EU regulations (e.g. Urban Wastewater Treatment and Drinking Water Directives) incorporating widely applied international guidelines (WHO guidelines for drinking water and for the safe use of wastewater, ISO standard 16075 for use of treated wastewater for irrigation projects, Australian guidelines for water recycling, and US EPA's and Californian guidelines for water reuse).

To foster the wider implementation of water reuse practices, the European Commission adopted these minimum requirements proposed by the JRC, and published a proposal for an EU-wide regulation of minimum requirements for water reuse for agricultural irrigation (COM337, 2018). The proposal for a water reuse regulation on EU level suggests a "*fit for purpose*" approach based on risk management. This approach is regarded to provide a higher environmental, economic and social benefit compared to a "*one size fits all*" approach (as in the case of Italian water reuse legislation).

The proposed regulation only considers reuse options for agricultural irrigation, differentiating among crop types (food and non-food crops, crops consumed raw/unprocessed, processed crops) and irrigation methods used. The proposal includes only 4 water quality classes and 6 restricted quality parameters, two of which are considered only for certain reuse purposes.

For unrestricted irrigation, the Commission's proposal includes performance criteria on top of effluent quality limits. Urban and industrial uses are not considered in this proposal, as agricultural irrigation is seen to have the highest potential for application of water reuse in Europe for alleviating water scarcity problems. Agricultural irrigation is responsible for about 60% of freshwater abstractions in southern and south-eastern Europe, while in some areas this share may reach up to 80%.

It is estimated that without changing the current reuse regulation in the EU the current amount of 1,1 billion m^3/year of water reused is expected to increase to 1,7 billion m^3/year by 2025, which equals an amount of 2 to 3% of the total amount of treated wastewater (BIO by Deloitte, 2015). However, in the Impact Assessment accompanying the COM337 proposal (SWD 249, 2018), the implementation of a legal instrument applying the "fit for purpose approach" which provides minimum quality requirements according to the category of food crop and the applied irrigation method, was analyzed to potentially enable a reuse of "more than 50% of the total water volume theoretically available for irrigation from wastewater treatment plants in the EU and avoid more than 5% of direct abstraction from water bodies and groundwater, resulting in a more than 5% reduction of water stress overall." Furthermore, a uniform water reuse regulation on European level is expected to boost public confidence in the safety of water reuse applications (COM337, 2018).

The adoption of the Commission's proposal is a critical first step to the implementation of best practices for water reuse in EU countries, but further initiatives will be needed at the EU-level in order to achieve a streamlined and effective regulatory framework. An effective regulatory framework for water reuse at EU level, setting a common set of water quality targets, will also provide a firm legal basis to protect public health and the environment, as well as a uniform environment throughout the European Union for businesses and other stakeholders involved with both the provision of recycled water and its end-use (e.g. farmers). Countries with benchmark water reuse operations (e.g. Australia, Cyprus and the USA) have strong and well established non-potable quality criteria and mature governance arrangements (Fawell et al. 2016), and for such water reuse sectors to operate efficiently and effectively, they require an appropriate regulatory framework, governing reuse methods and processes as well as consumption and supply.

Findings from documentation forms including questions answered by relevant partners also indicated the following regarding socio-economic factors. It is believed that essential for care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard. At the same time, the high quality requirements of the reclaimed water, if appropriately communicated, could improve public acceptance. As noted, the wastewater reuse has a generally neutral effect on reducing the dependence on outside sources and creating greater certainty of future water supplies and a moderate impact on the environment and public health regarding the water supply reliability. It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate parks and other recreational facilities (lakes, fountains). Additionally, it is supported that the economy is majorly affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse. Lastly, the wastewater reuse is considered as an important node in the road to a European and national sustainable growth and this policy should be highly communicated and adopted by the civil society.

In summary, to ensure that best practices are followed, it is recommended to proceed with the formulation and adoption of a unified, consistent regulatory framework for water reuse across the EU, based on the current proposal by the Commission and expanded to include non-irrigation end uses, to encourage reuse, facilitate compliance and ensure that public health is protected.

4.5 Identifying the Appropriate Water Quality Criteria

The implementation and operation of water reuse schemes largely depends on the definition of realistic and achievable standards, which are however sufficiently strict to protect public health and the environment, and carefully monitored to ensure compliance and risk minimization. The institution of such standards supports key stakeholders in the development of water reuse schemes while fostering public confidence in the recycled water and thus also in any end products of the water use, whether agricultural or industrial.

In the EU, several countries including Greece, Italy and Spain already have point-of-use standards for water reuse applications, which include microbiological parameters. *E. coli* is the indicator typically used, considered more accurate than total or fecal coliforms for assessing the microbial contamination of waters (Fawell et al. 2016). However, the *E. coli* limit values for irrigation (without restrictions) used in EU countries range from ≤ 5 cfu/100ml (Greece) to ≤ 250 cfu/100ml (France). Additional microbiological parameters are introduced by some countries, depending on the irrigation method used and the type of crops irrigated, in order to further reduce risks, which may add significantly to the costs and complexity of monitoring. The Greek, Italian and Spanish regulations each introduce dozens of additional ones, depending on use.

The European Commission's proposal for a uniform EU reuse regulation for agricultural irrigation (COM337, 2018) considered the national standards and assessed their efficiency, the corresponding costs and impacts, as well as the discharge limits of the Urban Waste Water Treatment Directive, and arrived at list of six water quality parameters (see Table 9): the main four are *E. coli*, BOD_5, TSS and turbidity, and the remaining two are *Legionella* spp. and intestinal nematodes, only monitored for certain water reuse purposes. At least 90% of the samples must meet the microbiological standards (*E. coli*, *Legionella* spp. and intestinal nematode eggs), and the maximum deviation limits are 1 log unit over the limit for *E. coli* and *Legionella* and 100% of the limit value for nematode eggs. For unrestricted irrigation, at least 90% of the samples must meet the limit values for the physico-chemical standards (BOD_5, TSS, and turbidity), and maximum deviation is 100% of the limit value. For the other quality classes, the requirements for compliance follow those of the UWWTD with respect to BOD_5 and TSS (depending on the number of samples, 75%-93% should comply), and the maximum deviation limits are 100% for BOD_5 and 150% for TSS.

TABLE 9. QUALITY PARAMETERS CONSIDERED IN NATIONAL WATER REUSE REGULATIONS OF AQUARES PARTICIPANT COUNTRIES AND IN THE COMMISSION'S PROPOSAL (ADAPTED FROM ALCALDE-SANZ & GAWLIK, 2014)

Parameter	GR	IT	ES	EC Proposal
E. coli	*	*	*	*
TSS	*	*	*	*
BOD_5	*	*		*
Turbidity	*		*	*

Parameter	GR	IT	ES	EC Proposal
Intestinal nematodes			*	*
Legionella spp.			*	*
Electrical Conductivity	*	*	*	
Heavy metals and metalloids	*	*	*	
Nitrogen (Total N, NH_4-N)	*	*	*	
SAR	*	*	*	
Toxic and priority substances	*	*	*	
Chlorides	*	*		
pH	*	*		
Residual Chlorine	*	*		
Total Phosphorus		*	*	
Coarse solids		*		
COD		*		
Fats/oils		*		
Salmonella spp.		*		
Total Coliforms	*			

The criteria proposed by the Commission have been carefully considered prior to selection and reflect an effort for consistency with EU Policies such as climate change adaptation and disaster prevention, while maintaining the environmental quality standards and protection requirements of the existing EU legislative framework on water. These criteria are widely applicable, offering easily measured parameters, which nevertheless afford a descriptive snapshot of the microbiological and physicochemical quality of the treated water and its suitability for reuse.

4.6 Conclusions

The effects of climatic variability, which are already being felt across the globe, are anticipated to increase the risk of clean water shortages, even in traditionally water-rich countries, necessitating the development of more resilient supply options. Wastewater reuse, and particularly municipal wastewater reuse, offers the potential to significantly increase available water resources while reducing pressure on freshwater systems and ecosystems. There is a multitude of treatment options, including engineered and managed natural treatment processes, which can address and eliminate contaminants in reclaimed water in a safe and reliable manner, in order to meet set water quality criteria. Provided that monitoring and operation plans are designed appropriately to respond to fluctuations, malfunctions and human error, ensuring that the recycled water meets the required quality standards for its destined use, there is great potential for reuse, even for potable uses in certain cases. However, it should be noted that the greatest obstacle to reuse is public perception, and that perceptions of technology risk only change slowly, through lengthy trust-building between the general public and its government. Gradual change, promoted by the provision of detailed information on risks and benefits, awareness campaigns, transparency in all relevant processes, public consultations, and provision of incentives can help in achieving the end goal of reuse technology uptake and implementation. The main tool however in all this is the development of suitable policies that establish a reliable framework for the application and monitoring of reuse schemes.

The implementation of a European Union-wide, consistent regulatory framework can encourage water reuse across the Union, including countries where it is currently absent, facilitating compliance throughout while ensuring the protection of public health and of the environment, and providing a secure and uniform context for the companies and investors involved in the provision of recycled water and for the actors utilizing the resource in their activities. To that end, the adoption of the Commission's proposal on minimum requirements for water reuse is not only recommended, it is imperative for addressing the long-term needs for water and for significantly increasing the total available water resources. However, incentives may be required at multiple points along the agricultural produce supply chain in order to encourage and increase water reuse for irrigation, and to overcome resistance due to mistrust. Furthermore, the inclusion of standards appropriate for non-irrigation end uses would contribute to the establishment of a cohesive, reliable integrated framework for water reuse in the EU, promoting advances in treatment technologies and opportunities that can accelerate water reuse uptake, and should be strongly encouraged.

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ANNEX 1. DOCUMENTATION FORM FOR DATA COLLECTION

AQUARES – Activity 1.1			
Documentation form			
A.	General information		
1.	Partner		
2.	Country* *where [country], hereafter [region] for MURCIA-GDW		
		☐	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)		
5.	Developed by		
6.	Implementing authority / (-ies)		
7.	Geographical coverage		
		☐	National
		☐	Regional
8.	Purpose/ use of the standards		
		☐	Agricultural
		☐	Industrial
		☐	Urban
		☐	Recreational
		☐	Other (please specify):
9.	Are there plans in your country for water reuse schemes (whether as an emergency response or as a means to		

	enhance sustainability)? Please describe. *(no more than 10 lines)*				
B.	Institutional Framework for Water Reuse in partner countries				
1.	Water consumer in the country/ region (fill in value and unit):				
			Uses	*(value)*	*(unit)*
		a.	Agricultural		
		b.	Industrial		
		c.	Urban		
		d.	Recreational		
		e.	Other (please specify)		
	a. Average daily volume of reused water in the country/ region:		*(value)*	*(unit)*	
	b. Share of reused water in the total water consumption in the country (%):				
3.	Location of main water reuse sites (refer to 3-4 main water reuse sites):				
4.	Annual amount of wastewater treatment plant effluent:		*(value)*	*(unit)*	
C.	Best Practices for Water Reuse				
1.	Is wastewater reuse already a common practice in your country?				
		☐	Yes		
			If yes, at what extend? *(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*		
			☐ 1	☐ 2	☐ 3	☐4	☐ 5
		☐	No		
2.	Which are the regional obstacles against wastewater reuse? *(no more than 10 lines)*				
3.	What types of wastewater reuse are mainly applied in the country, and at what extend?		*(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*		

<table>
<tr><td></td><td></td><td>a.</td><td colspan="5">Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;</td></tr>
<tr><td></td><td></td><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td></td><td></td><td>b.</td><td colspan="5">Agricultural sector</td></tr>
<tr><td></td><td></td><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td></td><td></td><td>c.</td><td colspan="5">Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;</td></tr>
<tr><td></td><td></td><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td></td><td></td><td>d.</td><td colspan="5">Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;</td></tr>
<tr><td></td><td></td><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td></td><td></td><td>e.</td><td colspan="5">Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).</td></tr>
<tr><td></td><td></td><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td></td><td></td><td>f.</td><td colspan="5">Potable sector</td></tr>
<tr><td></td><td></td><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td></td><td></td><td>g.</td><td colspan="5">Other (specify):</td></tr>
<tr><td></td><td></td><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td>4.</td><td>How is the wastewater usually treated before reuse?
(no more than 10 lines)</td><td></td><td colspan="5"></td></tr>
<tr><td>5.</td><td>Which crops are mainly irrigated with reclaimed water?</td><td></td><td colspan="5"></td></tr>
</table>

	(no more than 10 lines)			
6.	If wastewater reuse guidelines exist in the country, how is the compliance monitored? *(no more than 10 lines)*			
7.	For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?			
		☐	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover.
		☐	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.
8.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?			
		a.	Indicators picturing environmental effects	
		☐	Agriculture depending on irrigated land	
		☐	Regions facing danger of droughts	
		☐	Regions facing heat waves	
		☐	Pollutants in soil and ground/surface water	
		☐	Economic growth	
		☐	R&D Climate	
		☐	Added value in agriculture and forestry	
		b.	Indicators picturing societal effects	
		☐	Employment in agriculture and forestry	

			☐	Out-migration/brain drain/"shrinking" of regions
			☐	Healthy life expectancy
		c.	Indicators picturing governance effects	
			☐	Government effectiveness
		d.	Other	
			☐	Population density
			☐	Amount of treated waste water
			☐	Output from agriculture from irrigated land
			☐	Employment in irrigation technologies
			☐	Water exploitation index at water basin level
			☐	Ratio crop water requirement and incoming water/satisfaction level
			☐	Indicators on water bodies status
			☐	Water prices
			☐	Energy balance for water reuse
			☐	Trade flows (agriculture)
			☐	Compliance on UWWTD
9.	What standards are economically and administratively enforceable in the country? *(no more than 10 lines)*			
D.	Water Quality Criteria			
1.	Describe shortly your permits & competent authorities. *(no more than 10 lines)*			
2.	a. Classes of reclaimed water:		☐ Yes	☐ No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water	
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):	

			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine ☐ other (specify):
		2.	Class 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 to feed milk- or meat- producing animals
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☐ All irrigation methods ☐ Drip irrigation only

			☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):	
	b. Requirements for the reclaimed water:			
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer. Quality requirements for the parameters common with the EU proposal:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial use other than disposable cooling water. Quality requirements:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
	c. Monitoring requirements:[			
		1.	Category A:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
		2.	Category B:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	

3.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes				☐ No
4.	Do you provide information to the public on these aspects?		☐ Yes				☐ No
E.	Socio-economic factors						
1.	Do you think that enforcing EU-		☐ Yes				☐ No
	wide minimum water quality requirements for water reuse would improve public trust in recycled water? *(no more than 10 lines)*		If yes specify:				
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		☐ Yes				☐ No
4.	How informed are citizens in your Country regarding the reuse of wastewater for non-potable and for potable uses? Have any taken measures been taken to improve public perceptions of water reuse? *(no more than 10 lines)*						
5.	In what way the wastewater reuse impacts the water supply reliability?	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*				
			☐ 1	☐ 2	☐ 3	☐4	☐ 5
		B)	Environmental impacts and Public Health *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*				
			☐ 1	☐ 2	☐ 3	☐4	☐ 5
6.	It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate parks and other recreational facilities		☐ 1	☐ 2	☐ 3	☐4	☐ 5

	(lakes, fountains). What is your perception of that? *(1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)*						
7.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse? *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*		☐ 1	☐ 2	☐ 3	☐4	☐ 5
8.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3: Neutral, 4: Adequate communicated/largely adopted, 5: Totally communicated/totally adopted)*		☐ 1	☐ 2	☐ 3	☐4	☐ 5
9.	If your country face water scarcity, please provide details in brief on the water uses that are impacted by this, and the relevant costs incurred. *(no more than 10 lines)*						

ANNEX 2. DOCUMENDATION FORMS ANSWERED SHEETS

Greece

AQUARES – Activity 1.1			
Documentation form			
A.	General information - Institutional Framework for Water Reuse in partner countries		
9.	Partner	*Ministry of Environment and Energy/ General Secretariat for Natural Environment and Water*	
10.	Country* *where [country], hereafter [region] for MURCIA-GDW	*Greece/ Athens*	
		☒	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).
12.	Name of the standard (or most relevant framework)	*Joint Ministerial Decision 145116/2011 (Gov. 354/08.03.2011) "Establishment of measures, conditions and procedures for the re-use of treated waste water and other provisions"*	
13.	Developed by	*Ministry of Environment and Energy with Ministries of: Interior, Economy/Development, Health, Food and Agriculture*	
14.	Implementing authority / (-ies)	*Competent Authorities for Environmental Permitting, Water Authorities, Public Health and Agricultural Authorities*	
15.	Geographical coverage		
		☒	National
		☐	Regional
16.	Purpose/ use of the standards		
		☒	Agricultural
		☒	Industrial
		☒	Urban
		☒	Recreational
		☒	Other (please specify): *Aquifer recharge, suburban reuse*
B.	Institutional Framework for Water Reuse in partner countries		

<table>
<tr><td>1.</td><td>Water consumer in the country/ region (fill in value and unit):</td><td colspan="4"></td></tr>
<tr><td rowspan="5"></td><td rowspan="5"></td><td>a.</td><td>Agricultural</td><td>6531,1</td><td>10^6 m3/yr</td></tr>
<tr><td>b.</td><td>Industrial</td><td>179,2</td><td>10^6 m3/yr</td></tr>
<tr><td>c.</td><td>Urban</td><td>1149</td><td>10^6 m3/yr</td></tr>
<tr><td>d.</td><td>Recreational</td><td></td><td></td></tr>
<tr><td>e.</td><td>Other (livestock)</td><td>63,5</td><td>10^6 m3/yr</td></tr>
<tr><td rowspan="2"></td><td>a. Average daily volume of reused water in the country/ region:</td><td></td><td>16000</td><td colspan="2">m3/day</td></tr>
<tr><td>b. Share of reused water in the total water consumption in the country (%):</td><td></td><td colspan="3">Estimated below 0,5 %</td></tr>
<tr><td>3.</td><td>Location of main water reuse sites (refer to 3-4 main water reuse sites):</td><td></td><td colspan="3">Central and northern Greece and some islands (mainly Crete)</td></tr>
<tr><td>4.</td><td>Annual amount of wastewater treatment plant effluent:</td><td></td><td>Around 200</td><td colspan="2">10^6 m3/yr</td></tr>
<tr><td>C.</td><td colspan="5">Best Practices for Water Reuse</td></tr>
<tr><td>10.</td><td>Is wastewater reuse already a common practice in your country?</td><td colspan="4"></td></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td>☒</td><td colspan="3">Yes</td></tr>
<tr><td rowspan="2"></td><td colspan="3">If yes, at what extend?
(1: no extend, 2: low extend, 3: occasionally, 4: a moderate amount, 5: major extend)</td></tr>
<tr><td colspan="3">☐ 1 ☒ 2 ☐ 3 ☐ 4 ☐ 5</td></tr>
<tr><td>☐</td><td colspan="3">No</td></tr>
<tr><td>11.</td><td>Which are the regional obstacles against wastewater reuse?
(no more than 10 lines)</td><td></td><td colspan="3">One main obstacle is the relatively strict quality requirements for the reclaimed water. In most cases of water reuse more stringent treatment is required compared to the provisions of Directive 91/271/EEC. Transferring treated wastewater back for reuse is another issue. Therefore, in order to apply water reuse, costly investments relevant to treatment and transfer of reclaimed water are required. Another obstacle is the low acceptance of the public.</td></tr>
<tr><td>12.</td><td>What types of wastewater reuse are mainly applied in the country, and at what extend?</td><td></td><td colspan="3">(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)</td></tr>
<tr><td rowspan="3"></td><td rowspan="3"></td><td>a.</td><td colspan="3">Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;</td></tr>
<tr><td></td><td colspan="3">☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5</td></tr>
<tr><td>b.</td><td colspan="3">Agricultural sector</td></tr>
</table>

			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		c.	Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;				
			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		d.	Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;				
			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		e.	Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).				
			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		f.	Potable sector				
			☒ 1	☐ 2	☐ 3	☐4	☐ 5
		g.	Other (specify):				
			☐ 1	☐ 2	☐ 3	☐4	☐ 5
13.	How is the wastewater usually treated before reuse? *(no more than 10 lines)*		*Usually secondary treatment, with tertiary treatment and disinfection.*				
14.	Which crops are mainly irrigated with reclaimed water? *(no more than 10 lines)*		*Several crops, depending on the specific area*				
15.	If wastewater reuse guidelines exist in the country, how is the compliance monitored? *(no more than 10 lines)*		The treatment plants that provide treaded water for reuse are responsible for monitoring water quality. The users are responsible to comply with other provisions such us access restrictions etc. An environmental permit is issued for the reuse and the authorities (environmental, water, health) responsible for environmental inspections check compliance of water reuse.				
16.	For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?						

		☒	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover.
		☐	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.
17.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?			
		a.	Indicators picturing environmental effects	
		☒	Agriculture depending on irrigated land	
		☒	Regions facing danger of droughts	
		☐	Regions facing heat waves	
		☒	Pollutants in soil and ground/surface water	
		☒	Economic growth	
		☐	R&D Climate	
		☒	Added value in agriculture and forestry	
		b.	Indicators picturing societal effects	
		☒	Employment in agriculture and forestry	
		☐	Out-migration/brain drain/"shrinking" of regions	
		☒	Healthy life expectancy	
		c.	Indicators picturing governance effects	
		☐	Government effectiveness	
		d.	Other	
		☐	Population density	
		☒	Amount of treated waste water	
		☒	Output from agriculture from irrigated land	
		☒	Employment in irrigation technologies	
		☒	Water exploitation index at water basin level	
		☒	Ratio crop water requirement and incoming water/satisfaction level	

			☒	Indicators on water bodies status
			☒	Water prices
			☒	Energy balance for water reuse
			☐	Trade flows (agriculture)
			☒	Compliance on UWWTD
18.	What standards are economically and administratively enforceable in the country? *(no more than 10 lines)*		*The standards currently in place by our legislation are considered relatively strict but necessary to ensure public health and water and environment protection.*	
D.	Water Quality Criteria			
1.	Describe shortly your permits & competent authorities. *(no more than 10 lines)*		*The permit is issued either by the Environment Authorities or the Water Directorates of the Decentralized Administrations. The user of the reclaimed water or the operator of the plant applies for the permit, (usually the water reuse permit is part of the environmental permit of the wastewater treatment plant).*	
2.	a. Classes of reclaimed water:		☒ *Yes* *We currently have 3 classes of reclaimed water in our legislation that do not match to the 4 described below. Below mentioned classes A,B,C and D are those included in the draft of the European Regulation*	☐ No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water	
			Agricultural use: ☒ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☒ Residual chlorine ☐ other (specify):	
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine	

			☐ other (specify):
		2.	Class 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 to feed milk- or meat- producing animals
			Agricultural use: ☐ All irrigation methods ☒ Drip irrigation only ☐ Irrigation will not apply ☒ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☒ Drip irrigation only ☐ Irrigation will not apply ☒ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☐ All irrigation methods ☒ Drip irrigation only ☐ Irrigation will not apply ☒ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☐ All irrigation methods ☒ Drip irrigation only ☐ Irrigation will not apply ☒ Residual chlorine ☐ other (specify):
	b. Requirements for the reclaimed water:		
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of **reuse of treated** liquid **wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil**

			layer. Quality requirements for the parameters common with the EU proposal:	
			E. coli (cfu/100ml):	*200units/100ml*
			BOD5 (mg/l):	*25mg/l*
			TSS (mg/l):	*35mg/l*
			Turbidity (NTU):	
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for **unlimited irrigation and industrial use other than disposable cooling water**. Quality requirements:	
			E. coli (cfu/100ml):	*5 units/100ml*
			BOD5 (mg/l):	*10mg/l*
			TSS (mg/l):	*10mg/l*
			Turbidity (NTU):	*2 NTU* *Greek legislation also includes a 3rd Category of reclaimed water for urban/ suburban reuse, aquifer recharge via drilling which includes stricter requirements: E. coli 2 cfu/100ml, BOD 10mg/l, SS 2mg/l and turbidity 2 NTU*
	c. Monitoring requirements:[		*The frequency of the monitoring depends on each case, mainly on the capacity of the plant, in most cases it is determined in the permit*	
		1.	Category A:	
			E. coli (cfu/100ml):	*Every week*
			BOD5 (mg/l):	*According to Directive 91/271*
			TSS (mg/l):	*According to Directive 91/271*
			Turbidity (NTU):	
		2.	Category B:	
			E. coli (cfu/100ml):	*Every 2 days*
			BOD5 (mg/l):	*According to Directive 91/271*
			TSS (mg/l):	*According to Directive 91/271*
			Turbidity (NTU):	
3.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes	☒ No

4.	Do you provide information to the public on these aspects?		☐ Yes			☒ No	
E.	Socio-economic factors						
1.	Do you have any specific quality requirements for reused water in agricultural irrigation and aquifer recharge that could improve the public acceptance of reused water?		☒ Yes			☐ No	
			If yes specify: *the high quality requirements of the reclaimed water, if appropriately communicated, could improve* public acceptance				
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		☒ Yes			☐ No	
3.	In what way the wastewater reuse impacts the water supply reliability?	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☐ 2	☒ 3	☒4	☐ 5
		B)	Environmental impacts and Public Health (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☐ 2	☒ 3	☒4	☐ 5
4.	It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate parks and other recreational facilities (lakes, fountains). What is your perception of that? *(1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)*		☐ 1	☐ 2	☒ 3	☒4	☐ 5
5.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse? *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*		☐ 1	☐ 2	☐ 3	☒4	☐ 5
6.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this		☐ 1	☐ 2	☐ 3	☒4	☐ 5

	policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3: Neutral, 4: Adequate communicated/largely adopted, 5: Totally communicated/totally adopted)*						

Spain

AQUARES – Activity 1.1			
Documentation form			
A.	General information - Institutional Framework for Water Reuse in partner countries		
17.	Partner	WATER GENERAL DIRECTORATE	
18.	Country* *where [country], hereafter [region] for MURCIA-GDW	REGION OF MURCIA - SPAIN	
		☒	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).
20.	Name of the standard (or most relevant framework)	Royal Decree 1620/2007, 7th of December, whereby the legal regime of the reusing of the treated waters.	
21.	Developed by	National Government	
22.	Implementing authority / (-ies)	National Authority set the rules and the Autonomous Communities has the responsibility of the implementation.	
23.	Geographical coverage		
		☒	National
		☐	Regional
24.	Purpose/ use of the standards		
		☒	Agricultural
		☒	Industrial
		☒	Urban
		☒	Recreational

		☒	Other (please specify): Force majeure like forests fire.		
B.	Institutional Framework for Water Reuse in partner countries				
1.	Water consumer in the country/ region (fill in value and unit):				
		a.	Agricultural	*105*	*Hm3*
		b.	Industrial		
		c.	Urban		
		d.	Recreational		
		e.	Other (keep the ecological flow of the river)	0,5	Hm3
	a. Average daily volume of reused water in the country/ region:		*1,30/0,30*	*Hm3*	
	b. Share of reused water in the total water consumption in the country (%):		25 % (consider that Murcia only represents the 2,1 % of Spain surface)		
3.	Location of main water reuse sites (refer to 3-4 main water reuse sites):		In my country; besides Murcia, the AACC of País Valenciano has a high grade of implementation. In the case of Murcia the implementation is complete.		
4.	Annual amount of wastewater treatment plant effluent:		*108*	*Hm3*	
C.	Best Practices for Water Reuse				
19.	Is wastewater reuse already a common practice in your country?	In my region, absolutely. In my country is still in the process of implementation.			
		☒	Yes		
			If yes, at what extend? *(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*		
			☐ 1 ☐ 2 ☐ 3 ☐ 4 ☒ 5		
		☐	No		
20.	Which are the regional obstacles against wastewater reuse? *(no more than 10 lines)*		We can't talk about obstacles with a 98 % of reusing, however we can tell the problems until to reach this figure: 1) Social rejection of the fruit and vegetables when they arrive to the markets. Tedious process (tests, controls…) to guarantee the compliance to the rules in relation to other water sources.		
21.	What types of wastewater reuse are mainly applied in the country, and at what extend?		*(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, **5: major extend**)*		
		a.	Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances);		

			services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;				
			☐ 1	☐ 2	☒ 3	☐4	☐ 5
		b.	Agricultural sector				
			☐ 1	☐ 2	☐ 3	☐4	☒ 5
		c.	Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;				
			☐ 1	☐ 2	☒ 3	☐4	☐ 5
		d.	Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;				
			☐ 1	☐ 2	☐ 3	☒4	☐ 5
		e.	Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).				
			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		f.	Potable sector				
			☒ 1	☐ 2	☐ 3	☐4	☐ 5
		g.	Other (specify):				
			☐ 1	☐ 2	☐ 3	☐4	☐ 5
22.	How is the wastewater usually treated before reuse? *(no more than 10 lines)*		66 % of the water reused of Murcia is treated with a tertiary treatment (remove nitrates, phosphates, heavy metals, pathogens…) and the other 33 % is treated by a secondary treatment plus disinfection, after the water is discharged into the river and reused later.				
23.	Which crops are mainly irrigated with reclaimed water? *(no more than 10 lines)*		Lettuce (25.000 has), Broccoly (8.000), Tomato and Pepper (8000) and citrics like lemon (23000) In all the cases the water is mixed with other water sources (groundwater and surface water), those crops aren't never irrigated only with water reused.				

24.	If wastewater reuse guidelines exist in the country, how is the compliance monitored? *(no more than 10 lines)*		The Public company ESAMUR controls the water at the exit of the WWTP and the Irrigator Communities in their facilities.	
25.	For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?			
		☒	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover.
		☐	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.
26.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?			
		a.	Indicators picturing environmental effects	
		☒	Agriculture depending on irrigated land	
		☒	Regions facing danger of droughts	
		☐	Regions facing heat waves	
		☒	Pollutants in soil and ground/surface water	
		☒	Economic growth	
		☐	R&D Climate	
		☒	Added value in agriculture and forestry	
		b.	Indicators picturing societal effects	
		☒	Employment in agriculture and forestry	
		☐	Out-migration/brain drain/"shrinking" of regions	
		☐	Healthy life expectancy	
		c.	Indicators picturing governance effects	
		☐	Government effectiveness	

		d.	Other
			☐ Population density
			☒ Amount of treated waste water
			☒ Output from agriculture from irrigated land
			☒ Employment in irrigation technologies
			☒ Water exploitation index at water basin level
			☐ Ratio crop water requirement and incoming water/satisfaction level
			☐ Indicators on water bodies status
			☒ Water prices
			☒ Energy balance for water reuse
			☒ Trade flows (agriculture)
			☐ Compliance on UWWTD
27.	What standards are economically and administratively enforceable in the country? *(no more than 10 lines)*		Currently there is a very advanced document that will reuse with strict technical, economical and administrative requirements. Nevertheless our region will be prepared to comply this requirements, because we think it will be good for the consumers confidence and to increase the consumers health . It will require the upgrade of around 70 % of our reclamation facilities and the operational costs will be increased above 5c € of the current ones.be the new European regulation on water
D.	Water Quality Criteria		
1.	Describe shortly your permits & competent authorities. *(no more than 10 lines)*		If the water is produced by yourself, you need an authorization of the Water Basin Authority to reuse your own water, as long as you had an administrative concession for the land (if it's used for agricultural purposes) If the water proceeds from the WWTP, it is necessary an Administrative Concession by the Watershed Authority.
2.	a. Classes of reclaimed water:		☐ Yes ☐ No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water
			Agricultural use: ☒ All irrigation methods (the parameters of quality are higher depending the irrigation system…) ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use:

			☒ All irrigation methods (the parameters of quality are higher depending the irrigation system…) ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine ☐ other (specify):
		2.	Class 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 to feed milk- or meat- producing animals
			Agricultural use: ☒ All irrigation methods (the parameters of quality are higher depending the irrigation system…) ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☒ All irrigation methods (the parameters of quality are higher depending the irrigation system…) ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☒ All irrigation methods (the parameters of quality are higher depending the irrigation system…) ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☒ All irrigation methods (the parameters of quality are higher depending the irrigation system…) ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):

	b. Requirements for the reclaimed water:			
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer. Quality requirements for the parameters common with the EU proposal:	
			E. coli (cfu/100ml):	100 Units/100 mL (example lettuces in sprinkled irrigation) 1000 Units/100 ml (drip Irrigation)
			BOD5 (mg/l):	
			TSS (mg/l):	20 mg/l
			Turbidity (NTU):	2 NTU
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial use other than disposable cooling water. Quality requirements:	
			E. coli (cfu/100ml):	10000 units/100mL
			BOD5 (mg/l):	
			TSS (mg/l):	35 mg/L
			Turbidity (NTU):	-
	c. Monitoring requirements:[			
		1.	Category A:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
		2.	Category B:	
			E. coli (cfu/100ml):	Every two weeks
			BOD5 (mg/l):	Every week
			TSS (mg/l):	Every week
			Turbidity (NTU):	Every week
3.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes	☒ No
4.	Do you provide information to the public on these aspects?		☐ Yes	☒ No
E.	Socio-economic factors			

1.	Do you have any specific quality requirements for reused water in agricultural irrigation and aquifer recharge that could improve the public acceptance of reused water?		☐ Yes			☒ No	
			If yes specify:				
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		☒ Yes			☐ No	
3.	In what way the wastewater reuse impacts the water supply reliability?	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☐ 2	☒ 3	☐4	☐ 5
		B)	Environmental impacts and Public Health (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☐ 2	☐ 3	☒4	☐ 5
4.	It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate parks and other recreational facilities (lakes, fountains). What is your perception of that? (1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)		☐ 1	☐ 2	☐ 3	☐4	☒ 5
5.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse? (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)		☐ 1	☐ 2	☐ 3	☐4	☒ 5
6.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3:*		☐ 1	☐ 2	☐ 3	☐4	☒ 5

	Neutral, 4: Adequate communicated/largely adopted, 5: Totally communicated/totally adopted)						

Malta

AQUARES – Activity 1.1			
Documentation form			
A.	General information - Institutional Framework for Water Reuse in partner countries		
25.	Partner	Energy and Water Agency	
26.	Country* *where [country], hereafter [region] for MURCIA-GDW	Malta	
		☐	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).
28.	Name of the standard (or most relevant framework)	L. Alcalde-Sanz, B. M. Gawlik, Minimum quality requirements for water reuse in agricultural irrigation and aquifer recharge - Towards a legal instrument on water reuse at EU level, EUR 28962 EN, Publications Office of the European Union, Luxembourg, 2017, ISBN 978-92-79-77175-0, doi:10.2760/804116, JRC109291	
29.	Developed by	Joint Research Centre	
30.	Implementing authority / (-ies)	Food Safety Commission (Public Health and Regulatory Agency)	
31.	Geographical coverage	Malta	
		☒	National
		☐	Regional
32.	Purpose/ use of the standards		
		☒	Agricultural
		☐	Industrial
		☐	Urban
		☐	Recreational
		☐	Other (please specify):

B.	Institutional Framework for Water Reuse in partner countries				
1.	Water consumer in the country/ region (fill in value and unit):				
			Uses		(unit)
		a.	Agricultural	18	Million m^3/year
		b.	Industrial	4	Million m^3/year
		c.	Urban	2	Million m^3/year
		d.	Recreational	3	Million m^3/year
		e.	Other (please specify)	N/A	
	a. Average daily volume of reused water in the country/ region:		*Potential production capacity of 17000m3/day. Actual production varies according to seasonal demand.*	m^3/day	
	b. Share of reused water in the total water consumption in the country (%):		3% of Total water consumption (projected to go up to 8% once the New Water programme is concluded)		
3.	Location of main water reuse sites (refer to 3-4 main water reuse sites):		Ras il-Ħobż (Gozo New Water Polishing Plant) Iċ-Ċumnija (Malta North New Water Polishing Plant) Ta' Barkat (Malta South Water Polishing Plant)		
4.	Annual amount of wastewater treatment plant effluent:		*Malth North: 3,700,000* *Malta South: 17,400,000* *Gozo: 1,500,000* *Total: 22,600,000*	m^3/year	

C.	Best Practices for Water Reuse										
28.	Is wastewater reuse already a common practice in your country?										
		☒	Yes								
			If yes, at what extend? *(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*								
			☐	1	☐	2	☐	3	☐	4	☒	5
		☐	No								
29.	Which are the regional obstacles against wastewater reuse? *(no more than 10 lines)*		• The main challenge for water reuse in the country is for the distribution of this new water resource. • Salinity of the wastewater is high from sewerage infrastructure below sealevel is also a challenge. This necessitates a desalination step to make the water suitable for reuse in agriculture.								

30.	What types of wastewater reuse are mainly applied in the country, and at what extend?		*(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*
		a.	Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;
			☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5
		b.	Agricultural sector
			☐ 1 ☐ 2 ☐ 3 ☐4 ☒ 5
		c.	Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;
			☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5
		d.	Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;
			☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5
		e.	Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).
			☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5
		f.	Potable sector
			☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5
		g.	Other (specify):
			☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5
31.	How is the wastewater usually treated before reuse? *(no more than 10 lines)*		With regards to the UWWTPs, the largest plant in Malta (Malta North) utilises a primary sedimentation followed by biological aerated filters. The two smaller plants utilise extended aeration for biological treatment directly after primary treatment which consists of a coarse and fine screens followed by aerated grit chamber and grease trap. A retrofit of an older UWWTP will utilise MBBR technology.

			Following the secondary treatment step water passes through sand filters, followed by ultrafiltration, reverse osmosis and an advanced oxidation process utilising hydrogen peroxide and UV.		
32.	Which crops are mainly irrigated with reclaimed water? *(no more than 10 lines)*		In Malta, wherever access to reclaimed water is available, there is no restriction to which crops can be irrigated because of the high quality of the water and there all crops cultivated can use this water.		
33.	If wastewater reuse guidelines exist in the country, how is the compliance monitored? *(no more than 10 lines)*		A monitoring framekwork has been established by the Water Services 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.		
34.	For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?				
		☐	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover. The control of the water quality is then more difficult and misuse not easy to discover	
		☒	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.	
36.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?				
		a.	Indicators picturing environmental effects		
			☒	Agriculture depending on irrigated land	
			☒	Regions facing danger of droughts	
			☐	Regions facing heat waves	

			☒	Pollutants in soil and ground/surface water
			☐	Economic growth
			☐	R&D Climate
			☐	Added value in agriculture and forestry
		b.	Indicators picturing societal effects	
			☒	Employment in agriculture and forestry
			☐	Out-migration/brain drain/"shrinking" of regions
			☐	Healthy life expectancy
		c.	Indicators picturing governance effects	
			☐	Government effectiveness
		d.	Other	
			☐	Population density
			☒	Amount of treated waste water
			☒	Output from agriculture from irrigated land
			☐	Employment in irrigation technologies
			☐	Water exploitation index at water basin level
			☐	Ratio crop water requirement and incoming water/satisfaction level
			☒	Indicators on water bodies status
			☐	Water prices
			☐	Energy balance for water reuse
			☐	Trade flows (agriculture)
			☒	Compliance on UWWTD
37.	What standards are economically and administratively enforceable in the country? *(no more than 10 lines)*		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 disinfection of reservoirs. From commission stage the highlighted guidelines have never been exceeded.	
C.	Water Quality Criteria			
1.	Describe shortly your permits & competent authorities. *(no more than 10 lines)*		All operations are undertaken by the central national utility (Water Services Corportation) and plants are authorised by the Food Safety Commission.	
2.	a. Classes of reclaimed water:		☐ Yes	☒ No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water	
			Agricultural use: ☒ All irrigation methods	

			☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine ☐ other (specify):
		2.	Class 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 to feed milk- or meat- producing animals
			Agricultural use: ☒ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☒ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☒ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):

	b. Requirements for the reclaimed water:			
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer. Quality requirements for the parameters common with the EU proposal:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial use other than disposable cooling water. Quality requirements:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
	c. Monitoring requirements:[			
		1.	Category A:	
			E. coli (cfu/100ml):	<10
			BOD5 (mg/l):	<10
			TSS (mg/l):	<10
			Turbidity (NTU):	<5
		2.	Category B:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
3.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes	☒ No
4.	Do you provide information to the public on these aspects?		☒ Yes	☐ No
D.	Socio-economic factors			
1.	Do you have any specific quality requirements for reused water in agricultural irrigation and aquifer		☐ Yes	☒ No
			If yes specify:	

	recharge that could improve the public acceptance of reused water?						
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		☒ Yes		☐ No		
3.	In what way the wastewater reuse impacts the water supply reliability?	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☐ 2	☐ 3	☒4	☐ 5
		B)	Environmental impacts and Public Health (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☐ 2	☒ 3	☐4	☐ 5
4.	It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate parks and other recreational facilities (lakes, fountains). What is your perception of that? *(1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)*		☐ 1	☐ 2	☐ 3	☒4	☐ 5
5.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse? *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*		☐ 1	☐ 2	☐ 3	☒4	☐ 5
6.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3: Neutral, 4: Adequate communicated/largely adopted, 5:*		☐ 1	☐ 2	☐ 3	☒4	☐ 5

	Totally communicated/totally adopted)						

Poland

AQUARES – Activity 1.1			
Documentation form			
A.	General information - Institutional Framework for Water Reuse in partner countries		
1.	Partner	Lodzkie Region	
2.	Country* *where [country], hereafter [region] for MURCIA-GDW	Poland	
		☐	Yes
		x	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. Water Law 2. Act on Collective Water Supply and Collective Sewage Disposal 3. National programme for urban waste water treatment	
5.	Developed by	Ministry of Environment	
6.	Implementing authority / (-ies)	voivodeships, regions, municipalities, cities	
7.	Geographical coverage		
		x	National
		☐	Regional
8.	Purpose/ use of the standards		
		x	Agricultural
		☐	Industrial
		x	Urban
		☐	Recreational
		☐	Other (please specify):
B.	Institutional Framework for Water Reuse in partner countries		
1.	Water consumer in the country/ region (fill in value and unit):		

			Uses	*(value)*	*(unit)*
		a.	Agricultural	*hm3*	*51,6*
		b.	Industrial	hm3	102,6
		c.	Urban	hm3	136,2
		d.	Recreational		n/d
		e.	Other		
	a. Average daily volume of reused water in the country/ region:		*294,5*	*litres*	
	b. Share of reused water in the total water consumption in the country (%):				
3.	Location of main water reuse sites (refer to 3-4 main water reuse sites):		Łódź, Piotrków Trybunalski, Kutno, Sieradz		
4.	Annual amount of wastewater treatment plant effluent:		*141*	*hm3*	
C.	Best Practices for Water Reuse				
1.	Is wastewater reuse already a common practice in your country?				
		☐	Yes		
			If yes, at what extend? *(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*		
			☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		
		x	No		
2.	Which are the regional obstacles against wastewater reuse? *(no more than 10 lines)*		No legal regulations related to water reuse standards. Public concerns about the quality of reclaimed water.		
3.	What types of wastewater reuse are mainly applied in the country, and at what extend?		*(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*		
		a.	Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;		
			x1 ☐ 2 ☐ 3 ☐4 ☐ 5		
		b.	Agricultural sector		
			☐ 1 x2 ☐ 3 ☐4 ☐ 5		
		c.	Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;		

			☐ 1	x2	☐ 3	☐4	☐ 5
		d.	Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;				
			x1	☐ 2	☐ 3	☐4	☐ 5
		e.	Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).				
			☐ 1	x2	☐ 3	☐4	☐ 5
		f.	Potable sector				
			x1	☐ 2	☐ 3	☐4	☐ 5
		g.	Other (specify):				
			☐ 1	☐ 2	☐ 3	☐4	☐ 5
4.	How is the wastewater usually treated before reuse? *(no more than 10 lines)*		Mostly secondary treatment				
5.	Which crops are mainly irrigated with reclaimed water? *(no more than 10 lines)*		In Poland there is not allowed to irrigate crops with reclaimed water				
6.	If wastewater reuse guidelines exist in the country, how is the compliance monitored? *(no more than 10 lines)*		There are no such guidelines in Poland				
7.	For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?						
		☐	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover. The control of the water quality is then more difficult and misuse not easy to discover			

		x	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.
9.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?			
		a.	Indicators picturing environmental effects	
			x	Agriculture depending on irrigated land
			x	Regions facing danger of droughts
			☐	Regions facing heat waves
			☐	Pollutants in soil and ground/surface water
			x	Economic growth
			☐	R&D Climate
			☐	Added value in agriculture and forestry
		b.	Indicators picturing societal effects	
			x	Employment in agriculture and forestry
			☐	Out-migration/brain drain/"shrinking" of regions
			☐	Healthy life expectancy
		c.	Indicators picturing governance effects	
			x	Government effectiveness
		d.	Other	
			☐	Population density
			☐	Amount of treated waste water
			☐	Output from agriculture from irrigated land
			☐	Employment in irrigation technologies
			☐	Water exploitation index at water basin level
			☐	Ratio crop water requirement and incoming water/satisfaction level
			☐	Indicators on water bodies status
			x	Water prices
			☐	Energy balance for water reuse
			☐	Trade flows (agriculture)
			☐	Compliance on UWWTD
10.	What standards are economically and administratively enforceable in the country? *(no more than 10 lines)*		Despite the lack of standards for water reuse in Poland, technologies allowing the reuse of water from industrial processes (e.g. in the textile industry) are increasingly widely used. Such application seems	

			therefore currently feasible under the assumption that public authorities will develop appropriate standards in cooperation with the private sector.
D.	Water Quality Criteria		
	Describe shortly your permits & competent authorities. *(no more than 10 lines)*		
	a. Classes of reclaimed water:		☐ Yes | x No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine ☐ other (specify):
		2.	Class 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 to feed milk- or meat- producing animals
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
	b. Requirements for the reclaimed water:		
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer. Quality requirements for the parameters common with the EU proposal:
			E. coli (cfu/100ml):
			BOD5 (mg/l):
			TSS (mg/l):
			Turbidity (NTU):
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial use other than disposable cooling water. Quality requirements:
			E. coli (cfu/100ml):
			BOD5 (mg/l):
			TSS (mg/l):
			Turbidity (NTU):
	c. Monitoring requirements:[		
		1.	Category A:
			E. coli (cfu/100ml):
			BOD5 (mg/l):
			TSS (mg/l):
			Turbidity (NTU):
		2.	Category B:

			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes	xNo
.	Do you provide information to the public on these aspects?		☐ Yes	☐ No
E.	Socio-economic factors			
1.	Do you have any specific quality requirements for reused water in agricultural irrigation and aquifer recharge that could improve the public acceptance of reused water?		☐ Yes	xNo
			If yes specify:	
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		xYes	☐ No
3.	In what way the wastewater reuse impacts the water supply reliability?	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)	
			☐ 1 ☐ 2 ☐ 3 ☐4 x5	
		B)	Environmental impacts and Public Health (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)	
			☐ 1 ☐ 2 x3 ☐4 ☐ 5	
4.	It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate parks and other recreational facilities (lakes, fountains). What is your perception of that? *(1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)*		☐ 1 ☐ 2 ☐ 3 x ☐ 5	
5.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse?		☐ 1 ☐ 2 ☐ 3 ☐4 x5	

	(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)						
6.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3: Neutral, 4: Adequate communicated/largely adopted, 5: Totally communicated/totally adopted)*		x1	☐ 2	☐ 3	☐4	☐ 5

Czech Republic

AQUARES – Activity 1.1			
Documentation form			
A.	General information - Institutional Framework for Water Reuse in partner countries		
33.	Partner	The Regional Development Agency of the Pardubice region	
34.	Country* *where [country], hereafter [region] for MURCIA-GDW	The Pardubice region, Czech Republic	
		☐	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).
36.	Name of the standard (or most relevant framework)	Water Act Decree to this Act No. 252/2004 Coll., on drinking water and others 274/2001 Coll., On water supply and sewerage systems for public use Decree of the Ministry of Health 252 / 2004Sb. Laying down hygienic requirements for drinking and hot water and frequency and scope of drinking water control	

37.	Developed by	2001 Government of the Czech Republic, validity of laws as amended			
38.	Implementing authority / (-ies)	State through civil servants			
39.	Geographical coverage				
		☒	National		
		☐	Regional		
40.	Purpose/ use of the standards				
		☐	Agricultural		
		☐	Industrial		
		☐	Urban		
		☐	Recreational		
		☒	Other (please specify): The purpose of the Act is to protect surface and groundwater, to create conditions for economical use of water resources and to maintain and improve the quality of surface and groundwater, to create conditions for reducing the adverse effects of floods and droughts and to ensure the safety of waterworks.		
B.	Institutional Framework for Water Reuse in partner countries				
1.	Water consumer in the country/ region (fill in value and unit):				
			Uses	*(value)*	*(unit)*
		a.	Agricultural	*9,00*	*million cubic meters*
		b.	Industrial	59,20	million cubic meters
		c.	Urban	332,40	million cubic meters
		d.	Recreational	No data	No data
		e.	Other (please specify)	108,00	million cubic meters
	a. Average daily volume of reused water in the country/ region:		*No data*	*No data*	
	b. Share of reused water in the total water consumption in the country (%):		No data		
3.	Location of main water reuse sites (refer to 3-4 main water reuse sites):		The Botanica K project is a residence where gray water is used, followed by several households that use eg rainwater for flushing or watering. Otherwise the data are not known		
4.	Annual amount of wastewater treatment plant effluent:		*No data*	*No data*	
C.	Best Practices for Water Reuse				
38.	Is wastewater reuse already a common practice in your country?				

<table>
<tr><td rowspan="3"></td><td rowspan="3"></td><td>☐</td><td>Yes</td></tr>
<tr><td rowspan="2"></td><td>If yes, at what extend?
(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)
☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5</td></tr>
<tr><td>☒</td><td>No</td></tr>
<tr><td>39.</td><td>Which are the regional obstacles against wastewater reuse?
(no more than 10 lines)</td><td></td><td>The main obstacle is legislation and standards in the Czech Republic. Awareness of recycling and its use in practice, hygiene standards, the price of drinking water and sewage collection are low, technology is available, but the price is not interesting for consumers in terms of return on investment, low involvement of architects, no state incentives or recommendations from the state or municipalities. People using gray water are more in the field of water management or are ecologically oriented and make these activities out of their beliefs.</td></tr>
<tr><td>40.</td><td>What types of wastewater reuse are mainly applied in the country, and at what extend?</td><td></td><td>(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)</td></tr>
<tr><td rowspan="10"></td><td rowspan="10"></td><td>a.</td><td>Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;</td></tr>
<tr><td></td><td>☐ 1 ☐ 2 ☒ 3 ☐4 ☐ 5</td></tr>
<tr><td>b.</td><td>Agricultural sector</td></tr>
<tr><td></td><td>☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5</td></tr>
<tr><td>c.</td><td>Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;</td></tr>
<tr><td></td><td>☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5</td></tr>
<tr><td>d.</td><td>Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;</td></tr>
<tr><td></td><td>☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5</td></tr>
<tr><td>e.</td><td>Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public;</td></tr>
</table>

			forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).				
			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		f.	Potable sector – grey water reuse in households				
			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		g.	Other (specify):				
			☒ 1	☐ 2	☐ 3	☐4	☐ 5
41.	How is the wastewater usually treated before reuse? *(no more than 10 lines)*		Waste water is treated most often by using gray water to be used and we use it for flushing toilets. We also use rainwater for flushing and also for gardening. Usually it is mechanical processing and with the help of some chemical preparations. Waste water goes through the filtration, through the membrane and some goes to waste and some is reused. It depends on the technology. In the end, it is also modified by the use of criminal chemicals.				
42.	Which crops are mainly irrigated with reclaimed water? *(no more than 10 lines)*		In agriculture, water is not reused for irrigation of crops. In homes, people use gray or more often rainwater to water gardens and produce their own.				
43.	If wastewater reuse guidelines exist in the country, how is the compliance monitored? *(no more than 10 lines)*		There is no guidelines in the country.				
44.	For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?		We do not use waste water for irrigation in agriculture.				
		☒	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover. The control of the water quality is then more difficult and misuse not easy to discover			

		☐	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.
46.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?	Hygiene parameters, wastewater use standards, process parameters, sampling, controls, application specifications, irrigation methods, purified water requirements, etc.		
		a.	Indicators picturing environmental effects	
			☒	Agriculture depending on irrigated land
			☒	Regions facing danger of droughts
			☒	Regions facing heat waves
			☒	Pollutants in soil and ground/surface water
			☒	Economic growth
			☒	R&D Climate
			☒	Added value in agriculture and forestry
		b.	Indicators picturing societal effects	
			☒	Employment in agriculture and forestry
			☐	Out-migration/brain drain/"shrinking" of regions
			☐	Healthy life expectancy
		c.	Indicators picturing governance effects	
			☒	Government effectiveness
		d.	Other	
			☒	Population density
			☒	Amount of treated waste water
			☒	Output from agriculture from irrigated land
			☒	Employment in irrigation technologies
			☒	Water exploitation index at water basin level
			☒	Ratio crop water requirement and incoming water/satisfaction level
			☒	Indicators on water bodies status
			☒	Water prices
			☒	Energy balance for water reuse
			☐	Trade flows (agriculture)
			☒	Compliance on UWWTD
47.	What standards are economically and administratively enforceable in the country?		We have no standards set, violations of the Act on Waters and Hygiene Mines requirements and	

	(no more than 10 lines)		pollution is punished and sanctioned in the Czech Republic
C.	Water Quality Criteria		
1.	Describe shortly your permits & competent authorities. *(no more than 10 lines)*		The quality of drinking water in the Czech Republic is defined by Act No. 258/2000 Coll. (as amended) and the Decree to this Act (No. 252/2004 Coll., on Drinking Water and others). These regulations are based on the requirements of the European Drinking Water Directives (98/83 / EC). The health and purity requirements of drinking water are set by hygienic limits of microbiological, biological, physical, chemical and organoleptic parameters. These limits are regulated by implementing legislation or approved or determined by the competent public health protection authority. In the Czech Republic we do not use wastewater treatment, therefore the other ones are empty and not filled. We do not have nastevey standards for water reuse.
2.	a. Classes of reclaimed water:		☐ Yes ☒ No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine ☐ other (specify):
		2.	Class 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 to feed milk- or meat- producing animals
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply

			☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
	b. Requirements for the reclaimed water:		
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer. Quality requirements for the parameters common with the EU proposal:
			E. coli (cfu/100ml):
			BOD5 (mg/l):
			TSS (mg/l):
			Turbidity (NTU):
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial use other than disposable cooling water. Quality requirements:

			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
	c. Monitoring requirements:[			
		1.	Category A:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
		2.	Category B:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
3.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes	☒ No
4.	Do you provide information to the public on these aspects?		☐ Yes	☒ No
D.	Socio-economic factors			
1.	Do you have any specific quality requirements for reused water in agricultural irrigation and aquifer recharge that could improve the public acceptance of reused water?		☐ Yes	☒ No
			If yes specify:	
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		☒ Yes	☐ No
3.	In what way the wastewater reuse impacts the water supply reliability?	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)	
			☐ 1 ☐ 2 ☐ 3 ☒4 ☐ 5	
		B)	Environmental impacts and Public Health (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)	
			☐ 1 ☐ 2 ☐ 3 ☒4 ☐ 5	
4.	It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate		☐ 1 ☐ 2 ☐ 3 ☒4 ☐ 5	

	parks and other recreational facilities (lakes, fountains). What is your perception of that? *(1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)*						
5.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse? *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*		☐ 1	☐ 2	☒ 3	☐4	☐ 5
6.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3: Neutral, 4: Adequate communicated/largely adopted, 5: Totally communicated/totally adopted)*		☐ 1	☒ 2	☐ 3	☐4	☐ 5

Note: At present, recycled water in the Czech Republic is not used for irrigation, but with increasing drought it can be expected that this method will be relevant eg in South Moravia or in the Elbe. National management of rainwater and recycled waste water in agriculture is soon under discussion. At the same time, it is necessary to eliminate all risks to the environment and human health that may be related to the use of recycled waste water.

Latvia

AQUARES – Activity 1.1		
Documentation form		
A.	General information - Institutional Framework for Water Reuse in partner countries	
41.	Partner	Association “Baltic Coasts”
42.	Country* *where [country], hereafter [region] for MURCIA-GDW	Latvia

43.	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).
44.	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.***	
45.	Developed by		
46.	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.*	
47.	Geographical coverage		
		☒	National
		☐	Regional
48.	Purpose/ use of the standards		
		☐	Agricultural
		☒	Industrial
		☒	Urban
		☐	Recreational
		☐	Other (please specify):

B.	Institutional Framework for Water Reuse in partner countries				
1.	Water consumer in the country/ region (fill in value and unit):				
				(value)	*(unit)*
		a.	Agricultural Agricultural irrigation – general crop and animal production	21559830	m^3
		b.	Industrial	83484530	m^3

			Manufacturing	15736170	m^3
			Construction	30400	m^3
			Power generation	5557410	m^3
			Food and Beverage	62160550	m^3
		c.	Urban	104111847	m^3
			Municipal /Public uses	282560	m^3
			Domestic/residential	103829287	m^3
		d.	Recreational Tourism and recreation	1005350	m^3
		e.	Other (please specify)		
	a. Average daily volume of reused water in the country/ region:		*(value)* *58385*	*(unit)* m^3	
	b. Share of reused water in the total water consumption in the country (%):		10,14%		
3.	Location of main water reuse sites (refer to 3-4 main water reuse sites):		Bioswale at the SPICE Home shopping centre parking lot in Riga city; Latvian Road Maintainer (LAU) in Kandava municipality; Constructed wetland in Jelgava municipality; Evopipes Ltd., in Jelgava *(Note: These are the sites that we represent in our Good practices. If this doesn't count, then take them out.* *If it is intended as an official water treatment plant for water reuse, then, for now, there is no such in Latvia.)*		
4.	Annual amount of wastewater treatment plant effluent:		*(value)* 197288,68	*(unit)* **(th/m3)**	
C.	Best Practices for Water Reuse				
48.	Is wastewater reuse already a common practice in your country?				
		☐	Yes		
			If yes, at what extend? *(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)* ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		
		☒	No		
49.	Which are the regional obstacles against wastewater reuse? *(no more than 10 lines)*		There has been no or very little and rare scarcity of water resources in Latvia historically. Lately such situations have occurred due to periods of draught in summer and such need for water reuse has been noticed. Still there is a lack of a uniform and comprehensive regulatory framework for water		

			reuse. There are no policy documents or guidelines for water reuse, also there are no specific standards at present for reclaimed water. The use of treated wastewater or surface run-off is possible for manufacturing supply of industrial water or irrigation. All other sectors use drinkable water, which have quality standards provided by respective regulatory enactments.
50.	What types of wastewater reuse are mainly applied in the country, and at what extend?		*(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*
		a.	Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;
			☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5
		b.	Agricultural sector
			☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5
		c.	Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;
			☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5
		d.	Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;
			☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5
		e.	Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).
			☐ 1 ☒ 2 ☐ 3 ☐4 ☐ 5
		f.	Potable sector
			☒ 1 ☐ 2 ☐ 3 ☐4 ☐ 5
		g.	Other (specify):
			☐ 1 ☐ 2 ☐ 3 ☐4 ☐ 5

51.	How is the wastewater usually treated before reuse? *(no more than 10 lines)*		Water reuse is limited to separate cases in Latvia. For irrigating green urban areas, storm water is usually treated mechanically and biologically if needed. The treatment method usually is ndividually adapted to the water quality requirements epending on the risks.	
52.	Which crops are mainly irrigated with reclaimed water? *(no more than 10 lines)*		None or Grass in urban ares (If examples of park irrigation with rainwater are relevant.)	
53.	If wastewater reuse guidelines exist in the country, how is the compliance monitored? *(no more than 10 lines)*		Do not exist	
54.	For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?		There is no policy, no standards exist	
		☐	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover.
		☐	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.
55.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?	N/A		
		a.	Indicators picturing environmental effects	
			☐	Agriculture depending on irrigated land
			☐	Regions facing danger of droughts
			☐	Regions facing heat waves
			☐	Pollutants in soil and ground/surface water
			☐	Economic growth
			☐	R&D Climate
			☐	Added value in agriculture and forestry
		b.	Indicators picturing societal effects	

			☐	Employment in agriculture and forestry
			☐	Out-migration/brain drain/"shrinking" of regions
			☐	Healthy life expectancy
		c.	Indicators picturing governance effects	
			☐	Government effectiveness
		d.	Other	
			☐	Population density
			☐	Amount of treated waste water
			☐	Output from agriculture from irrigated land
			☐	Employment in irrigation technologies
			☐	Water exploitation index at water basin level
			☐	Ratio crop water requirement and incoming water/satisfaction level
			☐	Indicators on water bodies status
			☐	Water prices
			☐	Energy balance for water reuse
			☐	Trade flows (agriculture)
			☐	Compliance on UWWTD
56.	What standards are economically and administratively enforceable in the country? *(no more than 10 lines)*		***Law on Water Management (2002) sets the general framework for integrated water management and aims at good status of all surface waters and groundwater.*** *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:* • *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*
D.	Water Quality Criteria		
1.	Describe shortly your permits & competent authorities. *(no more than 10 lines)*		N/A
2.	a. Classes of reclaimed water:		☐ Yes ☐ No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine ☐ other (specify):
		2.	Class 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 to feed milk- or meat- producing animals
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine

			☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
	b. Requirements for the reclaimed water:		N/A
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer. Quality requirements for the parameters common with the EU proposal:
			E. coli (cfu/100ml):
			BOD5 (mg/l):
			TSS (mg/l):
			Turbidity (NTU):
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial use other than disposable cooling water. Quality requirements:

			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
	c. Monitoring requirements:[		N/A	
		1.	Category A:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
		2.	Category B:	
			E. coli (cfu/100ml):	
			BOD5 (mg/l):	
			TSS (mg/l):	
			Turbidity (NTU):	
3.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes	☒ No
4.	Do you provide information to the public on these aspects?		☐ Yes	☒ No
E.	Socio-economic factors			
1.	Do you have any specific quality requirements for reused water in agricultural irrigation and aquifer recharge that could improve the public acceptance of reused water?		☐ Yes	☒ No
			If yes specify:	
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		☒ Yes	☐ No
			Note: As this is a new approach to water management in Latvia, a complicated approach could worry the public. Unhurried adaptation to ideas about water reuse could work more successfully.	
3.	In what way the wastewater reuse impacts the water supply reliability? N/A	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)	
			☐ 1 ☐ 2 ☐ 3 ☐4 ☐ 5	
		B)	Environmental impacts and Public Health (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)	
			☐ 1 ☐ 2 ☐ 3 ☐4 ☐ 5	
4.	It is a common belief that the expansion of wastewater reuse could improve the living standards of the societal ecosystem through irrigate		☐ 1 ☐ 2 ☒ 3 ☐4 ☐ 5	
			Note: The reuse of water would, of course, have a positive effect on the state of natural ecosystems as a whole, as it would prevent the deterioration of water	

	parks and other recreational facilities (lakes, fountains). What is your perception of that? *(1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)*		*quality. Would the standard of living of the society improve? If we start using treated wastewater again, then some positive effects could diminish. The overall quality of surface water and the resulting impacts are likely to improve.*				
5.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse? *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*		☒ 1	☐ 2	☐ 3	☐4	☐ 5
			Note: Currently, there is no shortage of water resources in Latvia, including good quality water is available in sufficient quantities. Thus, no economic benefits are expected from reorganizing the existing system towards increased water reuse. On the contrary, it will initially lead to additional costs without any economic benefit in the current situation. The situation could change in the future, assuming that water resources could be damaged as a result of ill-considered management.				
6.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3: Neutral, 4: Adequate communicated/largely adopted, 5: Totally communicated/totally adopted)*		☒ 1	☐ 2	☐ 3	☐4	☐ 5

Slovenia

AQUARES – Activity 1.1		
Documentation form		
A.	General information - Institutional Framework for Water Reuse in partner countries	
49.	Partner	Municipality of Trebnje
50.	Country* *where [country], hereafter [region] for MURCIA-GDW	Slovenia

51.	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).
52.	Name of the standard (or most relevant framework)	Water Act (2002), Decree on the discharge and treatment of urban wastewater (2015), Drikning water directive and following decrees, e.g. Rules on drinking water (2004)	
53.	Developed by	Government - Ministry of the Environment and Spatial Planning	
54.	Implementing authority / (-ies)	Ministry of the Environment and Spatial Planning and its agencies and institutions are responsible for the implementation and enforncment of the Water Framework Directive and Urban Waste Water Treatment Directive. On the second level, the implementing authorities are municipalities with public utility companies.	
55.	Geographical coverage		
		☒	National
		☐	Regional
56.	Purpose/ use of the standards		
		☐	Agricultural
		☐	Industrial
		☐	Urban
		☐	Recreational
		☒	Other (please specify): the purpose of the Water Act is protection of surface and underground water and sea, its quality, sustainable economical use of resources and aiming good quality of water bodies, water ecosystem, safe use and sustainable water management

B.	Institutional Framework for Water Reuse in partner countries				
1.	Water consumer in the country/ region (fill in value and unit):				
			Uses	*(value)*	*(unit)*
		a.	Agricultural	*N/A*	
		b.	Industrial	37,6 million	m^3/year
		c.	Urban	79 milion	m^3/year
		d.	Recreational	N/A	
		e.	Other (losses and waste)	27,6 million	m^3/year

		f.	Other (municipal/public use)	5,9 million	m^3/year
	a. Average daily volume of reused water in the country/ region:		*No data*	*(unit)*	
	b. Share of reused water in the total water consumption in the country (%):		No data about water reuse.		
3.	Location of main water reuse sites (refer to 3-4 main water reuse sites):		Only few pilot projects that are not counted in statistics as well as some companies are closing loops but this is not evident. Plus private use of rainwater for irrigation.		
4.	Annual amount of wastewater treatment plant effluent:		*(value)*	*(unit)*	
C.	Best Practices for Water Reuse				
57.	Is wastewater reuse already a common practice in your country?				
		☐	Yes		
			If yes, at what extend? *(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)*		
			☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5		
		☒	No		
58.	Which are the regional obstacles against wastewater reuse? *(no more than 10 lines)*		It has been no or very little and rare water scarcity in Slovenia. Lately such situations have occurred and such need for water reuse has been noticed. The main obstacle is that despite few individual project (e.g. compaies are closing loops) athe water reuse is not regulated and not known. Tha main obstacle is lacking policies on water reuse and much needed higher awareness about recycling it. There are no policy documentation or guidelines for water reuse. Water reuse is story of few individuals who believe in it or would like to reduce costs in the companies that need for production lots of water.		
59.	What types of wastewater reuse are mainly applied in the country, and at what extend?		*(1: no extend, 2:low extend, 3: occasionally, 4: a moderate amount, 5: major extend)* *No data, bellow are just some observations and assumptions!*		
		a.	Urban Use: e.g. residential use (Irrigation of private gardens, and discharge of sanitary appliances); services (Irrigation of urban green areas (parks, sports fields and similar)), Street washing, Fire systems, and industrial washing of vehicles;		
			☐ 1	☒ 2	☐ 3 ☐4 ☐ 5

<table>
<tr><td rowspan="11"></td><td rowspan="11"></td><td>b.</td><td colspan="5">Agricultural sector</td></tr>
<tr><td></td><td>☒ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td>c.</td><td colspan="5">Industrial use: e.g. process and cleaning waters except in the food industry; other industrial uses; process and cleaning waters for use in the food industry; cooling towers and evaporative condensers;</td></tr>
<tr><td></td><td>☐ 1</td><td>☒ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td>d.</td><td colspan="5">Recreational use: e.g. irrigation of golf courses; ponds, water masses and ornamental circulating flows, where public access to water is impeded;</td></tr>
<tr><td></td><td>☐ 1</td><td>☒ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td>e.</td><td colspan="5">Environmental use: e.g. aquifer recharge by located percolation through the land; groundwater recharge by direct injection; irrigation of forests, green areas and other types not accessible to the public; forestry; other environmental uses (maintenance of wetlands, minimum flows and similar).</td></tr>
<tr><td></td><td>☒ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td>f.</td><td colspan="5">Potable sector</td></tr>
<tr><td></td><td>☒ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td>g.</td><td colspan="5">Other (specify):</td></tr>
<tr><td></td><td>☐ 1</td><td>☐ 2</td><td>☐ 3</td><td>☐4</td><td>☐ 5</td></tr>
<tr><td>60.</td><td>How is the wastewater usually treated before reuse? (no more than 10 lines)</td><td></td><td colspan="5">In Slovenia water reuse is limited to individual cases. There is no special treatment requested for water reuse since there is no standards for water reuse. The standard for the treatment of waste water is Decree on the discharge and treatment of urban wastewater.</td></tr>
<tr><td>61.</td><td>Which crops are mainly irrigated with reclaimed water? (no more than 10 lines)</td><td></td><td colspan="5">N/A</td></tr>
<tr><td>62.</td><td>If wastewater reuse guidelines exist in the country, how is the compliance monitored? (no more than 10 lines)</td><td></td><td colspan="5">In Slovenia it does not exist.</td></tr>
<tr><td>63.</td><td>For the policy for wastewater reuse in irrigation, there are two different possibilities. Which option is regarded as more appropriate for the region?</td><td></td><td colspan="5">No existing standards.</td></tr>
</table>

64.	For the policy for wastewater reuse in irrigation, there are two different possibilities: ○ To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements.	☒	1	To choose different categories such as restricted or unrestricted irrigation, crops eaten raw or not, sport fields etc., with different water quality requirements. The control of the water quality is then more difficult and misuse not easy to discover. The control of the water quality is then more difficult and misuse not easy to discover
		☐	2	To have restrictive standards, so that the treated wastewater can be used for irrigation everywhere. If quality requirements are not stringent enough, irrigation methods should be prescribed, which don't produce aerosols, and irrigation with treated wastewater has to be stopped for a determined period before harvesting.
65.	What parameters are considered most important to be reflected / regulated in wastewater reuse guidelines?	N/A		
		a.	Indicators picturing environmental effects	
			☐	Agriculture depending on irrigated land
			☐	Regions facing danger of droughts
			☐	Regions facing heat waves
			☐	Pollutants in soil and ground/surface water
			☐	Economic growth
			☐	R&D Climate
			☐	Added value in agriculture and forestry
		b.	Indicators picturing societal effects	
			☐	Employment in agriculture and forestry
			☐	Out-migration/brain drain/"shrinking" of regions
			☐	Healthy life expectancy
		c.	Indicators picturing governance effects	
			☐	Government effectiveness
		d.	Other	
			☐	Population density
			☐	Amount of treated waste water
			☐	Output from agriculture from irrigated land
			☐	Employment in irrigation technologies
			☐	Water exploitation index at water basin level
			☐	Ratio crop water requirement and incoming water/satisfaction level
			☐	Indicators on water bodies status

			☐	Water prices
			☐	Energy balance for water reuse
			☐	Trade flows (agriculture)
			☐	Compliance on UWWTD
66.	What standards are economically and administratively enforceable in the country? *(no more than 10 lines)*		Despite the lack of standards for water reuse in Slovenia,stakeholders in industry are developing technologies and is getting widely use. There is the assumption that public authorties will develop appropriate standards in the cooperation with private sector.	
C.	Water Quality Criteria			
1.	Describe shortly your permits & competent authorities. *(no more than 10 lines)*		The quality of drinking water in Slovenia is defined by decree that is based on Drinking Water Directive. The monitoring of treated waste water is defined in Decree on the discharge and treatment of urban wastewater. Regrding this decree, monitoring for permited limit values at the outflow is obliged for parameters: BOD5, COD, N and suspended solids.	
2.	a. Classes of reclaimed water:		☐ Yes	☒ No
		1.	Class A : All food crops, including root crops consumed raw and food crops where the edible part is in direct contact with reclaimed water	
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):	
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply. ☐ Residual chlorine ☐ other (specify):	
		2.	Class 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 to feed milk- or meat- producing animals	
			Agricultural use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply	

			☐ Residual chlorine ☐ other (specify):
			Industrial use: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		3.	Class 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 to feed milk- or meat-producing animals
			Urban and recreational uses of reclaimed water: ☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
		4.	Class D: Industrial, energy, and seeded crops
			☐ All irrigation methods ☐ Drip irrigation only ☐ Irrigation will not apply ☐ Residual chlorine ☐ other (specify):
	b. Requirements for the reclaimed water:		*N/A*
		1.	Category A: Limits for microbiological and conventional parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of reuse of treated liquid wastewater for limited irrigation, industrial use and underground enrichment aquifer, not used for drinking and by filtration through a suitable soil layer. Quality requirements for the parameters common with the EU proposal:
			E. coli (cfu/100ml):
			BOD5 (mg/l):
			TSS (mg/l):
			Turbidity (NTU):
		2.	Category B: Microbiological parameters as well as the minimum required treatment, frequency of sampling and analysis in the case of re-use of treated liquids wastes for unlimited irrigation and industrial

			use other than disposable cooling water. Quality requirements:				
			E. coli (cfu/100ml):				
			BOD5 (mg/l):				
			TSS (mg/l):				
			Turbidity (NTU):				
	c. Monitoring requirements:[		*N/A*				
		1.	Category A:				
			E. coli (cfu/100ml):				
			BOD5 (mg/l):				
			TSS (mg/l):				
			Turbidity (NTU):				
		2.	Category B:				
			E. coli (cfu/100ml):				
			BOD5 (mg/l):				
			TSS (mg/l):				
			Turbidity (NTU):				
3.	Do you have a specific water Reuse Risk Management Plan?		☐ Yes		☒ No		
4.	Do you provide information to the public on these aspects?		☐ Yes		☒ No		
D.	Socio-economic factors						
1.	Do you have any specific quality requirements for reused water in agricultural irrigation and aquifer recharge that could improve the public acceptance of reused water?		☐ Yes		☒ No		
			If yes specify:				
2.	Do you believe that care should be taken to avoid over-complicated standards confusing the public and creating a false perception that reuse is environmentally dangerous or a health hazard.		☒ Yes		☐ No		
3.	In what way the wastewater reuse impacts the water supply reliability?	A)	Reducing the dependence on outside sources and creating greater certainty of future water supplies (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☒ 2	☐ 3	☐4	☐ 5
		B)	Environmental impacts and Public Health (1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)				
			☐ 1	☐ 2	☒ 3	☐4	☐ 5
4.	It is a common belief that the expansion of wastewater reuse could		☐ 1	☐ 2	☒ 3	☐4	☐ 5

	improve the living standards of the societal ecosystem through irrigate parks and other recreational facilities (lakes, fountains). What is your perception of that? *(1: Not at all, 2: low impact, 3: Medium impact, 4: High impact, 5: Essential)*						
5.	How much is the economy affected by securing water reserves for agricultural, industrial or other uses through wastewater reuse? *(1: No affect, 2: Minor affect, 3: Neutral, 4: Moderate affect, 5: Major affect)*		☐ 1	☐ 2	☒ 3	☐4	☐ 5
6.	Is wastewater reuse considered as an important node in the road to a European and national sustainable growth? If yes, in what extend this policy is communicated and adopted by civil society? *(1: Totally not communicated/not adopted, 2: Inadequate communicated/ slightly adapted, 3: Neutral, 4: Adequate communicated/largely adopted, 5: Totally communicated/totally adopted)*		☐ 1	☒ 2	☐ 3	☐4	☐ 5