Ref. Ares(2025)7353157 - 06/09/2025

AWARD

Alternative Water Resources and Deliberation processes to renew water supply strategic planning

D5.5 - Demo case#4 Implementation progress report

(AIMEN & CETAQUA)

Co-author(s): Santiago Gómez (AIMEN) Luz P. Herrero (AIMEN), Sergio Santorio (CETAQUA), Brais García (CETAQUA), Mar Llorente (CETAQUA)

Funded by the European Union

Disclaimer

This document arises from the European project Alternative Water Resources and Deliberation process to renew water supply strategic planning (AWARD), which has received funding from the European Union, under the Grant Agreement N° 101136987.

This document reflects only the authors' view. The European Commission is not responsible for any use that may be made of the information it contains.

Any communication or dissemination activity related to the action must use factually accurate information. Moreover, it must indicate the following disclaimer (translated into local languages where appropriate): "Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency. Neither the European Union nor the granting authority can be held responsible for them."

Intellectual Property Rights

Project Consortium

EXECUTIVE SUMMARY

WP5 (*Experiencing AWRs solutions in demo cases for strategic planning*) aims at experimenting AWRs (alternative water resources) at the local scale in four different areas across EU. Each Demo case is confronted to water scarcity due to climate change and needs to assess the multiple benefits of AWRs to provide social innovative solutions to existing or potential water uses conflict. Within this WP, Task 5.2 is focused on the Demo case implementation and subtask 5.2.4 particularly in the Demo Case 4 (DC#4) located in Santiago de Compostela (Spain). Deliverable D5.5 summarises the main results from DC#4). It follows the recommendations established in D5.1 to harmonise the management and communication structures among all demo cases. It comprises a description of DC#4, a description of the existing infrastructure and required upgrades, operation activities (start-up, monitoring plan and problems faced), a summary of the social activities and final goals and expected results.

The goal of **DC#4** is the assessment is to collect and treat the rain and storm water with a combination of NBS (nature-based solutions) to provide water with quality to reuse in public and private applications according to the European and national legislation. This demo case also focusses on the engagement of stakeholders and the increase of society awareness and acceptance in close collaboration with WP2 (*socio-political support and engagement for AWRs management*) and WP6 (*Impact maximisation*). The stormwater and rainwater are collected and treated in a pilot plant implemented in the framework of another HE project (WATERUN Grant Agreement: 101060922). This Demo case is taking advantage of the pilot plant constructed in WATERUN to treat rain and stormwater. However, AWARD activities on this Demo case will be focused on the assessment of treated rain and stormwater as an alternative source of water to reuse. Some problems to obtain the regional and local permits to construct the pilot plant have delayed the commissioning of the infrastructure and the start-up and operation. Currently, it is full operative and the monitoring campaigns have started and will be intensified during the rainy season in autumn- winter 2025-2026. Preliminary results on characterisation of runoff shows the need of treatment and disinfection to comply with national and EU legislation on water reuse. AIMEN is in charge of the monitoring campaigns on DC#4 to assess the water quality. CETAQUA is working on the maintenance activities of the pilot plant necessary to ensure the correct operation.

CETAQUA is leading the activities of assessment of water reuse in the industrial park taking into account the company typologies located in the industrial park and their water demands (flows, required quality, seasonality) and the best ways to distribute the water. Moreover, the potential of replication of decentralised rainwater management will be addressed in other locations to increase the market potential and national or regional level. Both partners (AIMEN and CETAQUA are collaborating in the activities planned in WP3 (*Patrimonial framework for AWRs assessment)*, WP4 (*Digital Ecosystem for AWRs Planning*) and WP6 (*Impact maximisation)* to increase societal awareness and acceptance of AWRs.

The key findings during this period are summarised as follows:

Infrastructure and Operation

A pilot system based on Nature-Based Solutions (NBS) was implemented, consisting of:

- A vertical flow constructed wetland for physical and biological treatment.
- A horizontal wetland pond for further pollutant removal and pathogen retention.

Initial operational challenges (e.g., pipe leaks, pump energy demands) were resolved, and the system entered a stable phase. Monitoring is focused on flow rates, infiltration velocity, water quality, and plant health.

Water Quality Results and Compliance

- Rainwater runoff showed high levels of pollutants (COD, TSS, turbidity, EC, nitrogen).
- Groundwater had lower pollutant levels but still exceeded some thresholds (e.g., *E. coli*).
- Mixed water samples (runoff + groundwater) showed intermediate pollutant levels.
- Treatment is essential to meet the standards set by:
    - EU Directive 2024/3019 on Urban Wastewater Treatment.
    - Spanish Royal Decree 1085/2024 on Water Reuse.
- While the constructed wetland effectively reduces organic and nutrient pollutants, additional disinfection is required to ensure safe reuse.

Stakeholder Engagement

- A Local Water Forum was held on World Environment Day (June 5, 2025), with thirteen participants (academia, administration and industry) and positive feedback.
- A public survey revealed that 87% of citizens had never participated in water-related decisions.
- Collaboration with Université Paris-Saclay and ePLANETe supported socio-political and digital ecosystem development.

These efforts enhanced public awareness and engagement, aligning with AWARD's goals of fostering social innovation in water management.

RELATED DELIVERABLES AND WORKPACKAGES' CONNECTION

Deliverable D5.5 is linked to other deliverables and Work Packages:

- The work carried out was based on the inputs from WP5 **Experiencing AWRs solutions in demo cases for strategic planning** (Task5.2 – Demo case implementation) and especially the results concerning subtask 5.2.4 – Demo case 4 -Santiago de Compostela and according to the common framework for all demo cases set in Task 5.1
- The AWR regulatory of this deliverable is in line with Deliverable D2.1 "AWR regulatory, policy framework and funding mechanisms"
- The results presented in this deliverable have been feeding:
    - **WP3 - *Patrimonial framework for AWRs assessment*** (Task 3.2 - Development of Multi-Scales Multi-Actors Strategic Foresight): by supporting the development of the Strategic Foresight Framework for Demo Case #4.

    - **WP4 - Digital Ecosystem for AWRs Planning** (Task 4.2 - Representation of Water contributions to Territorial Sustainable Development): by providing input on the key characteristics and operational features of the Alternative Water Resources (AWR) system in Demo Case #4.

Additionally, the results will feed in the following months:

- **WP5** – **Experiencing AWRs solutions in demo cases for strategic planning** with contributions to deliverable D5.6 – Demo Cases' implementation report providing the main findings obtained from demo case #4 (Task 5.2 and subtask 5.2.4).
- **WP6 – Impact maximisation** providing information and results to present in communication and dissemination events.

DOCUMENT INFORMATION

Grant Agreement N°	101136987
Project Acronym	AWARD
Project full name	Alternative Water Resources and Deliberation process to renew water supply strategic planning
Start of the project	1 January 2024
Duration	36 months
Deliverable	**D5.5: Demo case#4 Implementation progress report**
Work Package	**WP5: Experiencing AWRs solutions in demo cases for strategic planning.**
Task	Task 5.2: Demo case implementation
Author(s)	Santiago Gómez, Luz P. Herrero (AIMEN), Sergio Santorio, Brais García, Mar Llorente (CETAQUA)
Co-author(s)	
Quality check	Eleni Nyktari (NTUA)
Due Date	31/08/2025
Delivery Date	06/09/2025
Explanation of the delay (if any)	To include additional information of construction delays and to improve some sections.
Citation	Gómez, S. *et al*. (2025): *Demo case#4 Implementation progress report,* Deliverable D5.5, Public, EU Horizon AWARD Project, Grant agreement N° 101136987
Dissemination Level	Public

REVISION HISTORY

Version	Date	Who	What
V1	29.11.2024	Santiago Gómez Cuervo (AIMEN)	First draft
V1.1	06.08.2025	Brais García (CETAQUA)	Revision of first draft
V1.2	29.08.205	Luz Herrero (AIMEN)	Revision by AIMEN, NTUA and OIEAU
V1.3	04/09/2025	Luz Herero (AIMEN)	Comments by reviewers solved
V1.3	04/09/2025	Eleni Nyktari (NTUA)	Quality check
VF	05/09/2025	Luz Herero (AIMEN)	Final version sent to coordinator

TABLE OF CONTENT

LIST OF ACRONYMS

AWR	Alternative water resources
DC	Demo case
HE	Horizon Europe
WP	Work Package
NW	Northwest
NBS	Nature based solutions
COD	Chemical oxygen demand
TSS	Total suspended solids
EC	Electrical conductivity
TOC	Total organic carbon
T.N.	Total Nitrogen
T.P.	Total Phosphorus
CFU	Colony forming units
RD	Royal Decree
PAH	Polycyclic aromatic hydrocarbons

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Deliverable D5.5 presents the implementation progress of Demo Case #4 (DC#4) within the framework of the AWARD project.

DC#4 is located in Santiago de Compostela, Galicia (NW Spain), within the Sionlla Industrial Park, an area facing increasing pressure on water resources due to climate change-induced droughts and reduced groundwater recharge. The demo case aims to explore the technical feasibility and social acceptance of using alternative water resources (AWRs)—specifically rainwater and stormwater—as a sustainable solution to meet urban and industrial water demands.

The pilot infrastructure consists of a settling tank followed by a constructed wetland system combining vertical and horizontal flow units designed to treat runoff water. In the next months, a disinfection unit will be designed and installed in the facility as a final treatment step to comply with national legislation.

The AWARD project builds upon this infrastructure to assess the quality of treated water, its compliance with EU and national reuse regulations, and its potential for reuse in various urban applications such as Irrigation of green areas, street cleaning, firefighting systems, industrial processes or ornamental water features.

This deliverable outlines the technical setup, operational strategy, monitoring plan of the pilot system, and preliminary characterization results of water inlet as well as the social engagement activities carried out to foster stakeholder involvement and public awareness. It also highlights the challenges faced during implementation, including delays, and provides preliminary results on water quality and treatment performance.

By demonstrating a replicable model for decentralised rainwater management, DC#4 supports AWARD's overarching goal of promoting resilient, inclusive, and sustainable water planning across Europe.

I Description of the demo

I.1 Description of the area/ region

The Demo case #4 is located in Santiago de Compostela (Galicia, NW Spain), a medium-sized city with around 100,000 inhabitants and recognized as a cultural, educational, and administrative hub. The city hosts the University of Santiago de Compostela, one of the oldest universities in Europe, and functions as the political capital of the Autonomous Community of Galicia. Its economy is mainly based on services (public administration, education, tourism, and commerce), but in recent decades it has promoted the development of industrial and technological areas to diversify economic activities and reduce dependency on tertiary sectors. In this city, it was selected as area under study an industrial park close to the centre: Sionlla Industrial Park.

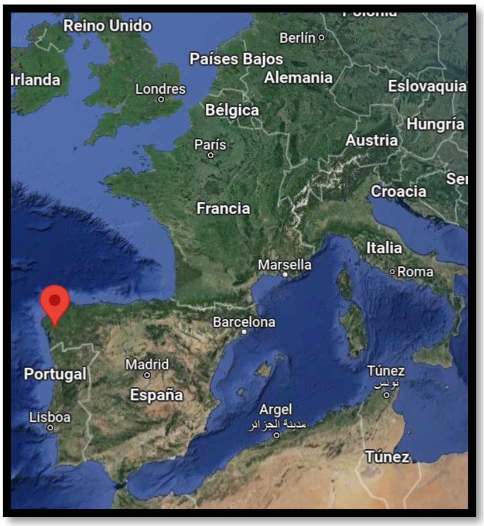

Figure 1: Santiago de Compostela location in Europe (red dot). Source: Google maps

The Sionlla Industrial Park hosts a combination of logistics and distribution facilities, large-scale retail warehouses, and service-oriented commercial activities, alongside areas reserved for manufacturing, construction-related businesses, and transport infrastructure. Born as a natural extension of the Tambre and Costa Vella industrial parks, also located in the Santiago de Compostela municipality, it provides 1,400,000 square meters of gross surface area, with its main uses being industrial and commercial land (778,000 m^2), and facilities and roadways (51,000 m^2). This mix of sectors reflects its role as both an industrial and commercial hub in the city, attracting activities requiring efficient connectivity and space for expansion.

Regarding the city, Santiago de Compostela, the capital city of the pluvious region of Galicia in Spain, is located in the Atlantic Bio-geographical Region, according to the European Environment Agency[1].

The rainfall characteristics of Santiago de Compostela are an annual precipitation ranging between 1200 – 1600 L/m^2 with the months of higher rainfall events are centre in autumn and winter as it is shown in Figure 2:

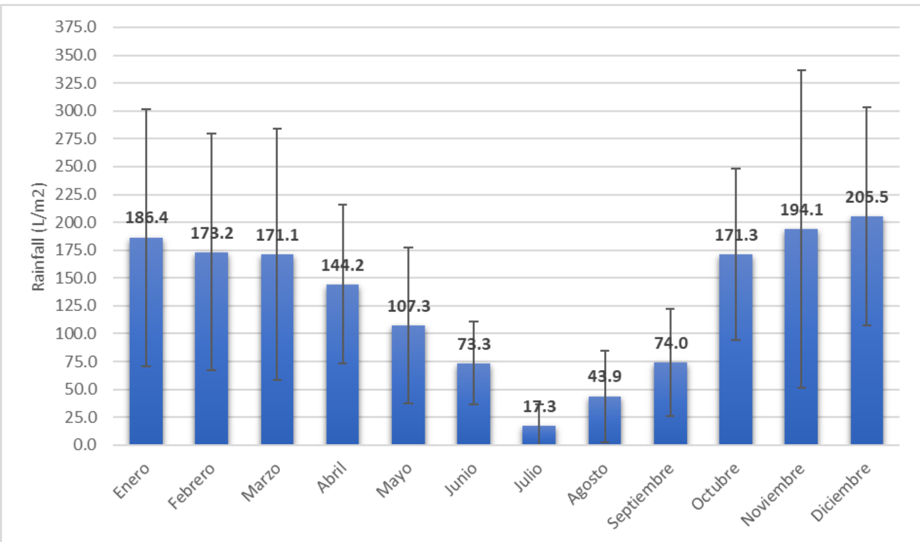

Figure 2: Total month precipitation average (2014-2024) in Santiago de Compostela – San Lázaro Meteorological station. Source: www.meteogalicia.gal

[1] EEA Biogeographical Regions -version 2016. https://www.eea.europa.eu/en/datahub/datahubitem-view/11db8d14-f167-4cd5-9205-95638dfd9618

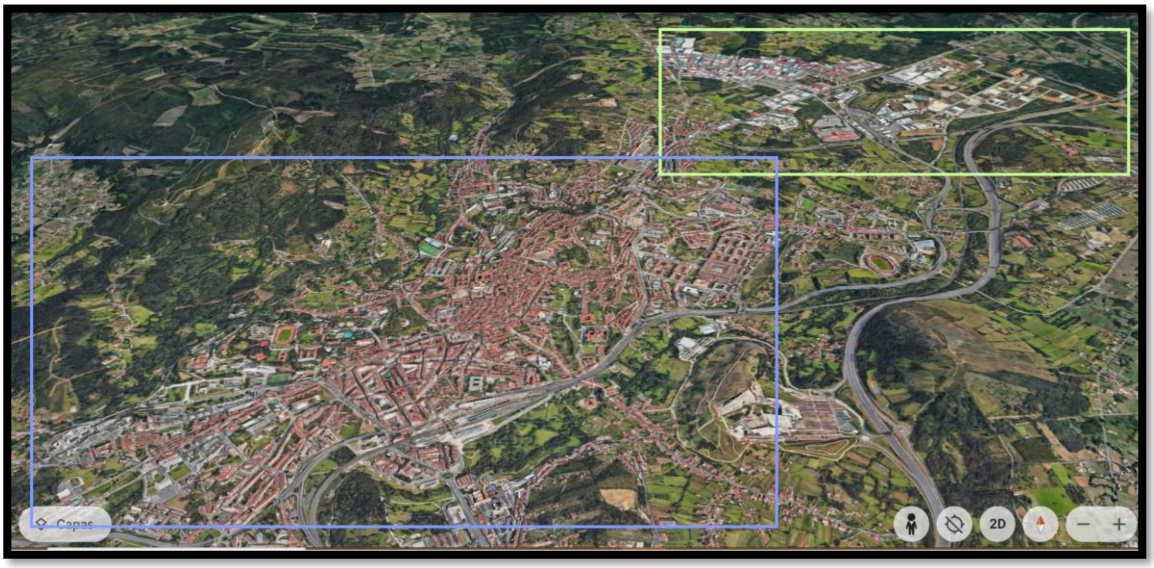

Figure 3: Aerial View of Santiago de Compostela city (blue rectangle area) and the Industrial Park area (yellow rectangle). Source: Google Earth

During these rainy periods, Santiago de Compostela has witnessed severe torrential rainfall events and sudden flooding episodes. These intense precipitation occurrences, which typically concentrate large volumes of water within very short timeframes, have resulted in waterlogging issues both in urban areas and in the vicinity of the Sionlla Industrial Park. The recurrence of such extreme weather phenomena highlights the catchment area's susceptibility to peak runoff flows, thereby emphasizing the critical importance of developing innovative approaches for stormwater management and water reuse initiatives that can benefit the territory during periods of water scarcity.

In this regard, according to Meteogalicia (Regional Weather Agency), Galicia presented reduction of the average annual precipitation by 7% last years in comparison with the average of the period 1981-2010. Additionally, the average annual temperature (14.9 ^{o}C) was above the climate target and considered an extremely warm temperature (positive anomaly of +1.2 ^{o}C – higher evapotranspiration). This data led to an alert of drought during the summer with water use restrictions in the area for irrigation of public spaces and a dramatic decrease in water reservoirs.

The forecast in the Galician Strategy for Climate Change and Energy 2050 shows an increasing trend of maximum temperature between 3-4^{o}C with a 20-30% increase of warm nights (2061-2090). The annual accumulated rainfall will decrease 10-15% inland with a deficit during the summer higher than 35%. According to the trends, climate change is affecting the water resources of Galicia by a progressive increase in evapotranspiration, greater in the inland and southern areas of the region, which could lead to greater demands for water for irrigation. In the case of periods of droughts, this could increase the stress on the hydrological system. Variables such as soil moisture, aquifer recharge and groundwater volume suggest that the magnitude of the impact of climate change on Galicia's water resources could be with a sustained increase over time in the period of draughts. The Galicia Costa River Basin management plan 2021- 2027 (includes Santiago de Compostela area) forecasts for 2039 a reduction of 8,61% of the water runoff to surface water and a decrease of groundwater recharge of 7,36%.

This climate scenario in the area suggests the need to find alternative water resources to reduce surface/groundwater abstraction. The main resource is rainwater since the trend doesn't show a significant decrease in the rainfall average for the short term. Treated rainwater could be an additional resource for irrigation (public areas and agriculture) and private use in the industrial park to diminish the surface/groundwater abstraction in Santiago area.

In this context, the Demo Case is installed in an industrial Park (A Sionlla). The area selected to study for collecting the water has a surface of 51 ha, one of the main catchment areas of in the Sionlla Industrial Park. The rainwater from this catchment is currently collected separately (stormwater network) and is discharge to River Sar in the surrounding area. Generally, the Sionlla catchment area experiences consistent activity throughout the year, with minimal variation between months. However, there's a notable decrease in activity during July and August. Weekdays (Monday to Friday) it is appreciated a steady traffic from cars, trucks, and buses. On weekends, the commercial area keeps the activity on Saturdays being reduced on Sundays and public holydays. All the industrial park presents separative stormwater networks, thus all the rainwater is collected and conducted to two stormtanks before medium discharge. Thus, the only treatment of the diffuse pollution from this stormwater runoffs is the suspended solids sedimentation in the stormtanks. Besides the poor treatment, there are no reuse treatment plans in the industrial park nowadays.

This industrial state combines commercial stores and industrial activity with a construction (in operation and under construction), and green areas. According to technical documents done for the construction, Sionlla Industrial Park present a 0.39 ha of green areas and 18.31 ha of plots which are expected to be occupied by new facilities in the next years. Therefore, the sealed surface is expected to increase in the following years, and the green areas are not infiltrations zones, thus the water runoff management will be even more complex.

Table 1: Percentage of occupation in Sionlla catchment in 2024.

Occupied area	63.5%
Parcels unoccupied area	35.7%
Green Areas	0.8 %

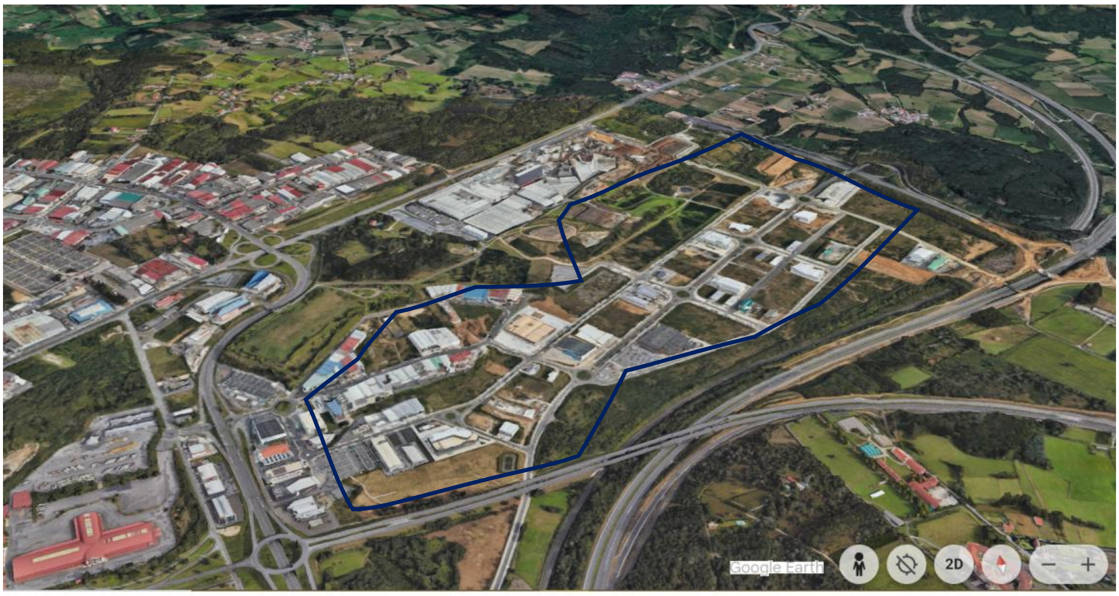

Figure 4: Sionlla Industrial Park aerial view (blue line circle to the catchment where the demo case is working). Source Google Earth – Dec 2024.

Furthermore, due to the hydrogeographic characteristics of the area, the infiltration of groundwater in the separative network is continuous, demanding the necessity to deal with higher flow of water runoff and pollutant dilution.

I.2 Challenges / needs

The regional climate found in Galicia has been always associated with high pluviosity along the spring, winter and autumn with relative dry months in the summer. In the case of Santiago, the distribution of precipitations showed in Figure 2 confirm this trend. Nevertheless, from the last decade the situation observed in Galicia has activated some alerts in the water bodies authorities due to the changing tendency and the unusual long dry periods registered. It leaded to elaborate since 2022 a Special Drought Plan for The Galicia-Costa Hydrographic catchment[2].

Inicio	Fin	SPI	Intensidad de sequía
01/1976	10/1976	-1,70	SEVERA
12/1988	11/ 1989	-2.18	SEVERA
02/1992	11/1992	-1,93	SEVERA
01/2002	10/2002	-1,72	SEVERA
12/2004	01/2006	-2,02	SEVERA
10/2011	11/2012	-2,19	SEVERA
12/2016	01/2018	-2,26	SEVERA

Figure 5: Table of registration of periods of SEVERE drought (Intesidad de sequía: SEVERA) in different data. Standardised Precipitation Index (SPI) used by the calculation of the intensity of the drought. Source: Special Drought Plan for the Galicia-Costa Hydrographic Catchment[3].

In general, water storage levels in Galicia have decreased over the past decade. This decline highlights the growing stress on existing water resources, caused by reduced precipitation and increased demand. Figure 6 illustrates this situation, showing both the average water volume in dams and the distribution of water demand among different user groups in Galicia.

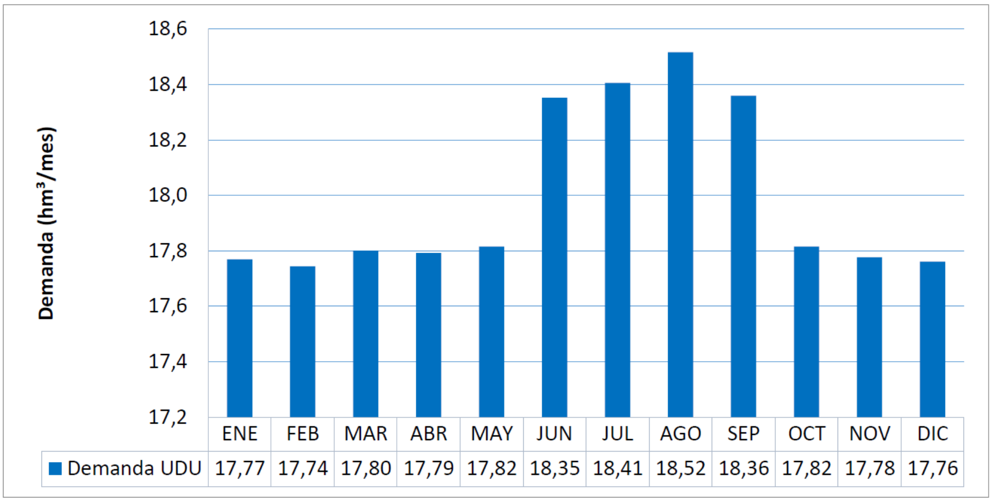

Figure 6: Temporal distribution of the demand of water resources by the Galician citizens in Galica- Costa demarcation all over the year. Source Special Drought Plan for The Galicia-Costa Hydrographic catchment [3].

As it was mentioned before, the mix of sectors reflects its role as both an industrial and commercial hub in the city, attracting activities requiring efficient connectivity and space for expansion. This is challenging in terms of high traffic activity management that also causes a lot of soil depositions (hydrocarbons microplastics, heavy metals) which becomes in diffuse pollution. Besides, the rain variability makes very

[2] Plan especial de Sequía para la demarcación hidrográfica de Galicia-Costa. 2022 https://augasdegalicia.xunta.gal/c/document_library/get_file?file_path=/ portal-augas-de-galicia/plans/Plan%20de%20Seca/Plan_Especial_Sequia_DHGC_V_00_01_es.pdf

[3] Special Drought Plan for the Hydrographic Demarcation of the River Basin District of Galicia-Costa. 2022 https://augasdegalicia.xunta.gal/c/document_library/get_file?file_path=/ portal-augas-de-galicia/plans/Plan%20de%20Seca/Plan_Especial_Sequia_DHGC_V_00_01_es.pdf

difficult the stormwater management. The main water uses in the industrial park are the tap water use in the commercial buildings and the industrial uses such as the water uses on heat towers of a wood processing factory. There are other potential uses that are not implemented yet since there are no water reusing schemes, for example the irrigation of green areas that are dry in summer or the street washing application.

I.3 Water resources and management

According to the current situation of the water and precipitation in Santiago area, it is mandatory to establish a plan for water use by the different agents responsible for water management. One of the most important aspects concerns the use of alternative water sources since the traditional ones are starting to be over exploited as explained in section I.2. Urban and industrial areas can consider rainwater, stormwater, and, where feasible, groundwater as alternative water sources. Nevertheless, the first concern with using these sources is the “quantity“ which could be provided. This aspect is essential for water management due to these sources (rainwater, stormwater) are characterized to have large flows in short periods. Additionally, these water sources should be more abundant in rainy periods, which means periods in which the water is not so necessary.

Secondly, these water sources also content pollutants resulting from human activities. In the case of rainwater and stormwater, contamination can occur due to atmospheric emissions and deposition and the traffic-related pollutants and industrial processes. These pollutants such as heavy metals, microplastics, PAH, nutrients or pathogens can be deposited on surfaces or released into the soil, affecting the quality of collected rainwater and stormwater.

Therefore, the necessity of the reduction of traditional water sources is clear. In order to manage this approach, public bodies, research agents and citizens should move for a change in the alternative water and ensure their use is safety for human health and the environment. As a part of this change, the necessity to use new infrastructure with a greener approach should appear as a solution to regenerate these waters and to make them available for reuse in safe conditions of health and environmental.

I.4 Existing infrastructure in the demo case

As it was mentioned before, the industrial park presents separative stormwater networks, thus all the rainwater is collected and conducted to two stormtanks before medium discharge. In the following figure is marked the pipes stormwater network:

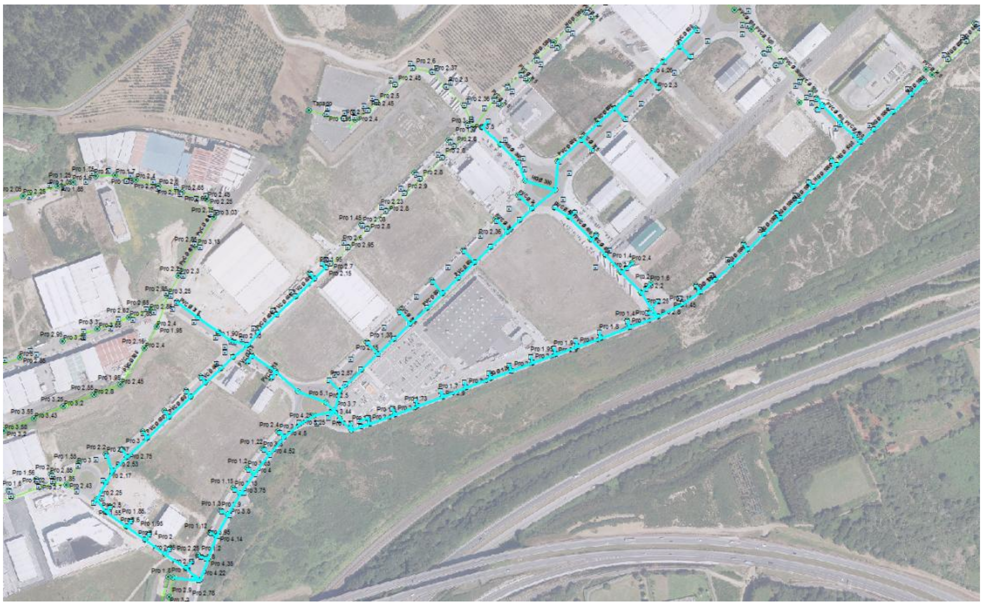

Figure 7: Representation of the catchment separative stormwater pipe network

The rainwater/stormwater collected in the separative network are carried to a settle pond located in A Sionlla industrial park. These settling ponds have a volume of 800 m3 and a high variability hydraulic retention time since the rains are also very variable, this causes an insufficient treatment, especially with heavy rains. Finally, water is discharged to a water stream next to industrial park (Sar River).

I.5 Assessment of required upgrade/additions

Currently, in the area, there is not a lack of water but forecasts envisage shortages for the future, that's why a novel system based on NBS is going to be tested to remove pollutants from runoff as well as to test the system to guess if it is able to provide reclaimed water as an alternative water resource to decrease water abstraction from natural sources.

The particular focus of this unit is the treatment of the water runoff before the discharge to a near river. The constructed wetland is designed to remove microplastics, hydrocarbons, suspended solids, organic matter, nitrogen and phosphorous compounds. Thus, despite this treatment is mandatory to obtain a high-quality reusable water is not enough to fulfil the Spanish legal requirements of wastewater reuse which requires a final disinfection step (See Section II.3 for further details).

II Technical description of the upgrades/ construction plan—scope

II.1 Designs (if available)/ flow chart of the final treatment loop/ water loop

A pilot plant constructed under the framework of WATERUN project (HE – G.A: 101060922) will be used. AWARD project is focused on treated rainwater/stormwater reuse (quality and uses) while WATERUN deals with water run-off management and sources of pollutants. WATERUN project runs in parallel with AWARD but with different objectives. WATERUN aims at treating urban water runoff with NBS to comply with the revised Urban Wastewater Treatment Directive (Directive (EU) 2024/301) while AWARD benefits from this infrastructure to evaluate if the outlet is suitable as an alternative water resource for reuse according to EU and national legislation.

The demo case is located in A Sionlla industrial park and consists of a wetland treatment unit designed to treat a maximum precipitation of 20 m^3/d which is composed of a vertical flow wetland (combining physical and biological treatment to reduce microplastics and suspended solids in water) followed by a free water surface pond (to remove biologically pollutants presents and retain pathogens and fine particles). Both treatments discharge to a water stream next to the pilot. This pilot aimed at obtaining data on the performance of nature based solutions to treat runoff and stormwater and depending on the final quality achieved, to plan the kind of water reuse in the surrounding area. This application is a novel one in this regional context in Galicia where water shortages are increasing progressively due to climate change. That's why to test in advance a system to treat rainwater runoff to remove pollutants such as PAHs (Polycyclic Aromatic Hydrocarbons), heavy metals, microplastics, nutrients or pathogens will help to plan the use of NBS to climate adaptation and to assess their performance to provide water to reuse complying with the quality standards in national and European legislation.

The system has not been designed strictly to provide reclaimed water. During the validation phase (starting autumn 2025), after evaluating the performance of the treatment to remove different kind of pollutants, a final disinfection step will be designed and commissioned (second reporting period) to optimise the potential use of reclaimed water in the area. At this current stage, we cannot predict the classification of t of the quality of water we are going to achieve. The intended applications will arise from this future step. On the other hand, according to the Spanish legislation (RD 1485/2024), the most likely use could be for industrial purposes (Table 6 and Table 7) such as irrigation of private gardens, flushing of sanitary appliances (Class A+), publicly accessible ornamental ponds and circulating water features (Class A), street cleaning, irrigation of urban green areas, firefighting systems or Industrial vehicle washing (Clas B) or ornamental ponds and circulating water features not accessible to the public (Class C)

It is not on the scope of DC#4 to test reclaimed water within the project but to provide potential uses according to the final results.

The infrastructure consists of a settling tank followed by a constructed wetland (See flow diagram in Figure 10). The inflow system has a submersible electric pump that will raise the water to the inlet of the vertical flow wetland. A pulse counter will be installed to regulate the pump feeding of the NBS with an input flow of 20 m^3/d for a maximum pumping time of 4 hours per day (7.300 m^3/year). Water filtration is carried out in a cascade: the water is treated in the upper part (vertical wetland) and continues to the horizontal wetland.

Vertical Wetland: Once the water is raised by the electric pump, it is poured through Ø75mm PVC irrigation pipes with Ø8mm perforations. Every 20 cm on each side of this first biofilter is made with a 30 cm thick foundation slab and 20 cm thick walls with a water-repellent mass. The filter material of this first biofilter is made of 3 layers that are described below from bottom to top (Figure 8 and Figure 9):

i) Coarse gravel, Ø15/30 mm, from a granite quarry in a layer of 21.5 cm average thickness.
ii) Medium gravel, Ø8/15 mm, from a granite quarry in a layer of 40 cm average thickness
iii) Fine gravel, Ø4/8 mm, from a granite quarry in a layer of 40 cm average thickness. The outlet is left 10 cm higher so that there is always an accumulation of 10 cm of water. In the upper part of the biofilter, *Phragmites australis* will be planted, a plant used for restorations, landscaping, revegetation and as a green decontaminant in wastewater purification.

Horizontal Wetland: The objective of this treatment is twofold: First to save and store water that always has a level of 50 cm. And second for flood protection. Here a horizontal flow of water will pass through 2 barriers of granite walls 40 cm high, leaving 10 cm to the upper level which leads to stagnation of matter at the bottom. Once the water exceeds the outlet level, it flows through a surface channel to the municipal network discharge well. This biofilter is made with a waterproof PVC sheet on geotextile. At the head of the intermediate barriers, *Phragmites australis* and *Rumex hydrolapathum* will be planted (Figure 8 and Figure 9).

The **water reclamation setup** will be designed during the next reporting period to meet the requirements of the National legislation in Spain. Thus, it will be included in the second version of the deliverable.

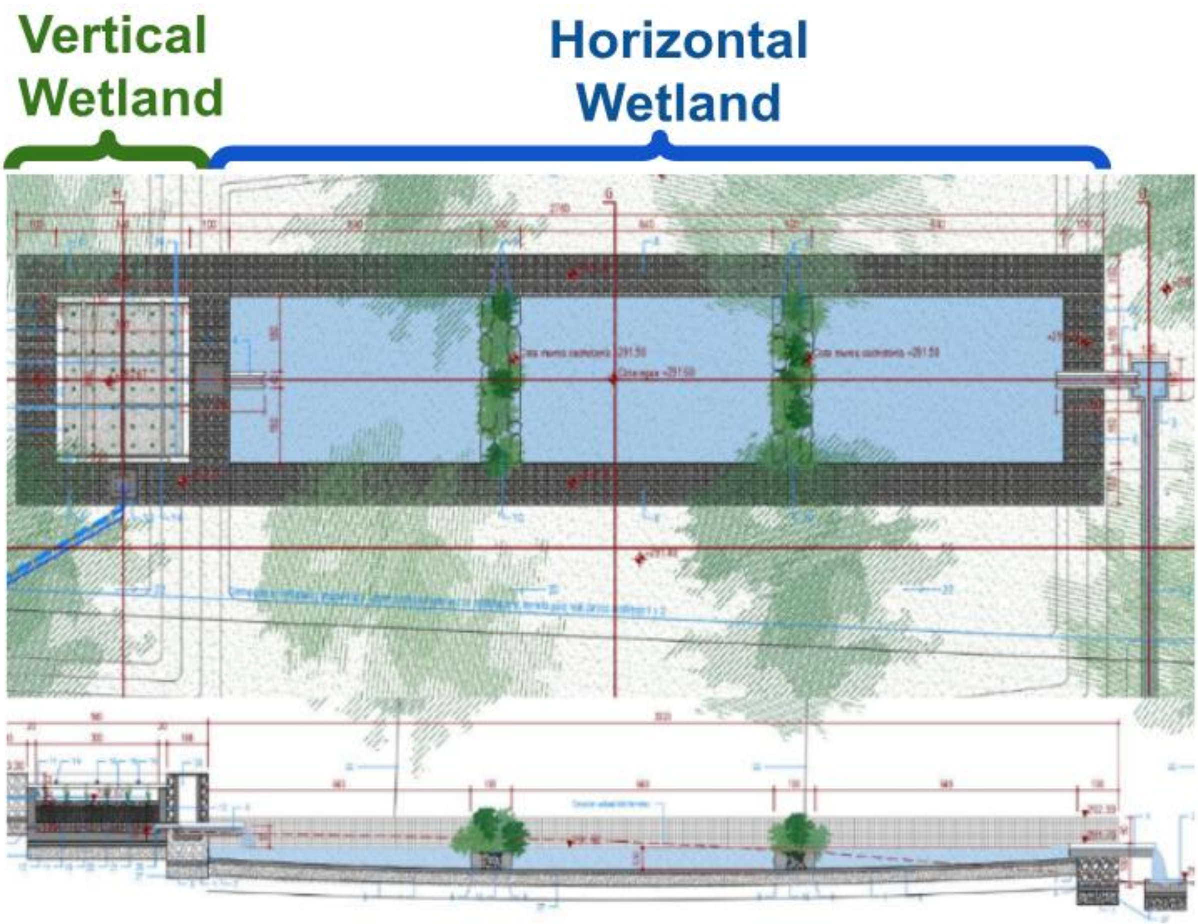

Figure 8: Image of the design of the constructed wetland

Figure 9: Images of the infrastructure: top right: vertical wetland; top left: horizontal wetland; bottom: complete infrastructure.

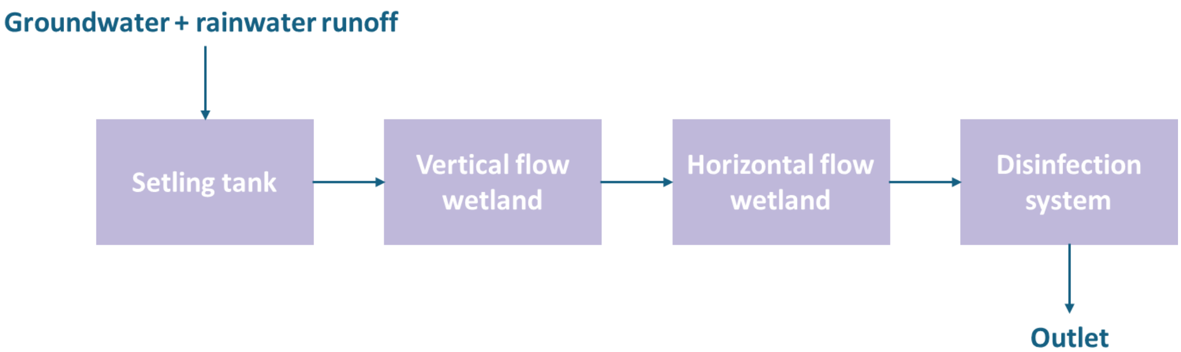

Figure 10: Flow diagram of the system

II.2 Description of the construction works/ interventions

See explanation in the previous section.

The disinfection system will be designed and implemented during the second monitoring period.

III Operation

III.1 Start-up/ Operation plan

Following the achievement of construction, the pilot wetland treatment system entered its initial operational phase, which focused on verifying the integrity and functionality of all components. As a new infrastructure, the system required a period of adjustment to identify and resolve potential issues such as leaks, connection faults and biological adaptation periods.

The first step involved ensuring that water flowed correctly through the designated pipes and treatment units, reaching the outlet as intended. During the initial pumping tests, a leak was detected in the feeding pipes of the vertical wetland. This issue was attributed to terrain stabilization and pipe misalignment. The problem was resolved by draining the system and repairing the affected area, a task facilitated by a period of dry weather, which allowed for quick intervention within three days.

Another challenge emerged with the energy supply for the feeding pump. Although the generator provided sufficient nominal power (1700W) compared to the pump's requirement (500W), the actual startup demand was higher due to the need to lift water from a well and overcome internal pressure. This discrepancy led to the temporary use of a submersible pump, which could be manually installed for each feeding cycle. Both pumps delivered a similar flow rate of approximately 4 m^3/h, ensuring consistent operation regardless of the pump used.

With these adjustments, the pilot plant was able to begin functioning effectively, allowing the team to proceed with the next stages of system startup.

Initial Operational Parameters and Feeding Strategy

The early operational phase was designed with caution to support the biological development of the treatment system. Conservative hydraulic and organic loading rates were applied to prevent issues such as biomass washout, erosion and clogging. Key parameters were established:

- **Total useful volume** of the system was calculated at **43.6 m^3**, distributed as follows:
  - **Settling tank**: 4 m^3 (empty, though future sediment accumulation may reduce capacity).
  - **Vertical wetland**: 3 m^3 useful volume, based on a total volume of 9 m^3 and a media porosity of 35%.
  - **Pond (horizontal wetland)**: 36.6 m^3 useful volume, after accounting for internal barriers and porosity.
- **Inlet flow** was set at a nominal **4 m^3/h**, consistent with pump capacity. However, actual flow rates varied between 3.5 and 4.3 m^3/h due to normal operational fluctuations and solids content. A flowmeter was installed to monitor both instantaneous and cumulative flow into the wetland.

Water was distributed in the vertical wetland through perforated pipes. Flow rates from individual holes ranged between **0.014 and 0.018 L/s** in an irregular manner. The central and distal sections of the pipes delivered more water, while areas near the settling tank received less, with one corner experiencing no flow at all—a so-called "blind area." This was likely caused by slight slope variations in the pipe layout. Despite this, the area with reduced flow still had vegetation planted nearby, and due to the plants' natural ability to capture water, it was not expected to have any water problem. Moreover, this area presents an opportunity for future optimization. If clogging occurs in other zones, the currently underutilized area could be activated by adjusting pipe slopes to redirect flow, thus extending the system's operational flexibility.

The operation parameters for this first step are described in Table 2:

Table 2: Operation parameters for the start-up of wetlands

PARAMETER			COMMENTS
Settle tank - volume	Volume (m^3)	4	
Vertical Treatment	Surface (m^2)	12.96	
	Total Volume (m^3)	9.07	
	Useful Volume (m^3)	3.05	Considering media porosity average 35%
Free-Surface Pond	Surface (m^2)	75.6	
	Total Volume (m^3)	37.8	Considering water layer only could reach 0.5 m
	Useful volume (m^3)	36.6	Reducing volume occupied by barriers.
Inlet Flow	Flow Range (m^3/h)	3.5 - 4	In both pumps: portable submersible and installed one.
Flow by hole (vertical wetland)	Flow Range (L/h)	50 – 64.2	
Number holes (vertical wetland)	-	60	
Initial Infiltration velocity Vertical wetland)	Velocity (m/s)	$5.1 \cdot 10^{-3} \pm 9 \cdot 10^{-4}$	Empirical data
Hydraulic Retention time Vertical Wetland	Time (h)	2.2	
Hydraulic Retention time Pond	Time (h)	9.45	HRT during Pumping time. At no-pumping periods the water can remain hour or days (depending on the next event or next scheduled feeding)

III.2 Monitoring plan

The monitoring and maintenance plan was also established to ensure the system's proper functioning and to guide future adjustments as the pilot evolves. Monitoring was divided into two main categories (Table 3 and Table 4):

1. **Global System Status Monitoring**
   This involved frequent checks of key parameters that reflect the overall health and performance of the wetland:
   a. **Inlet flow**: Monitored via a flowmeter to prevent hydraulic overload.
   b. **Plant condition**: Visual inspections to detect signs of stress, toxicity, or drought.
   c. **Feeding pipe blockages**: Manual inspections to ensure even water distribution across the vertical wetland and pond.
   d. **Infiltration velocity**: Used to identify potential clogging in the vertical wetland.
   e. **Water quality probes**: Turbidity, pH, and electrical conductivity (EC) will be monitored semi-continuously to assess system performance.

f. **Sludge accumulation**: Regular checks in the settling tank and pond to anticipate maintenance needs.
g. **Power & pumps**: Regular checks to ensure all the electrical devices works properly.
h. **External interferences**: Floating elements or rubbish in the area

2. **Water Quality Monitoring at Key Points**
To evaluate treatment performance, water samples were taken from four strategic locations (Figure 11):
   a. **Point A (System Inlet)**: Receives runoff and groundwater from the industrial park via the separative network. Automatic sampler will be installed to monitor the inlet.
   b. **Point B (Settling Tank Outlet)**: Represents pretreated water entering the vertical wetland. Manual sampling.
   c. **Point C (Vertical Wetland Outlet)**: Indicates the quality of water entering the pond, with expected reductions in solids and organic matter. Manual sampling.
   d. **Point D (System Outlet)**: Represents the final treated water, which should be safe for discharge into natural water bodies. Automatic sampler will be installed to monitor the outlet.

Figure 11: Sampling points selected for the water quality monitoring in the wetland treatment unit.

Parameters to be monitored in all the sampling points will be at least the ones with threshold values in EU and national legislation (See Table 5 and Table 6) whenever a rainfall event occurs.

Table 3: Summary of monitoring plan for the global system

GLOBAL SYSTEM STATUS MONITORING					
MONITORING POINTS	MONITORING EQUIPMENT	MONITORING PARAMETERS	FRECUENCY	INTERVENTIONS TO BE IMPLEMENTED IN AWARD	CONTRIBUTION TO KPIs TARGETED BY THE GRANT AGREEMENT
Inlet flow	On-site flowmeter	Flow	Weekly	None	Implementation of the 4 Demo Cases (DC#4)
Plant condition (Vegetation)	Visual	Plants' aspect and status Undesired vegetation Plant pruning	Weekly Weekly during warm periods, biweekly in winter Annually	None	Implementation of the 4 Demo Cases (DC#4)
Feeding pipe blockages	Visual	Main pipes and holes in the vertical flow wetland General pipes status	Weekly	None	Implementation of the 4 Demo Cases (DC#4)
Water quality probes	Semi continuous on-site probes	Turbidity pH EC	Weekly	None	Implementation of the 4 Demo Cases (DC#4)
Sludge on settling tank and ponds	Visual	Aspect and thickness of the sludge layer in the settling tank and pond.	Weekly/Annually if the thickness is considerable high and needs mechanical methods to remove	None	Implementation of the 4 Demo Cases (DC#4)
Power & pumps	Visual Flowmeter	Pumps not blocked Flow in a normal range Probes connected and registering data. Electrical connections	Monthly or after unusual events Weekly Weekly	None	Implementation of the 4 Demo Cases (DC#4)
External interferences	Visual	Floating elements and rubbish removal from the wetlands	Weekly	None	Implementation of the 4 Demo Cases (DC#4)

*Table 4: Summary of water monitoring plan in the pilot plant in A Sionlla industrial Park (Santiago)**

WATER QUALITY MONITORING IN THE PILOT PLANT					
MONITORING POINTS	MONITORING EQUIPMENT	MONITORING PARAMETERS	FRECUENCY	INTERVENTIONS TO BE IMPLEMENTED IN AWARD	CONTRIBUTION TO KPIs TARGETED BY THE GRANT AGREEMENT
System inlet (A)	Automatic sampler with EC probe. Probe for turbidity, pH and EC.	pH, EC, COD, TSS, Turbidity, Total N, Total P, Oil & grease. Total coliforms, *E. coli*, Intestinal nematodes, Bacteriophage, Legionella	Rainwater event.	None	Implementation of the 4 Demo Cases (DC#4)
Settling Tank outlet (B)	Manual sampling	pH, EC, COD, TSS, Turbidity, Total N, Total P, Oil & grease. Total coliforms, *E. coli*, Intestinal nematodes, Bacteriophage, Legionella	Rainwater event	None	Implementation of the 4 Demo Cases (DC#4)
Vertical wetland outlet (C)	Manual sampling	pH, EC, COD, TSS, Turbidity, Total N, Total P, Oil & grease. Total coliforms, *E. coli*, Intestinal nematodes, Bacteriophage, Legionella	Rainwater event	None	Implementation of the 4 Demo Cases (DC#4)
System outlet (D)	Automatic sampler with EC probe. Probe for turbidity, pH and EC.	pH, EC, COD, TSS, Turbidity, Total N, Total P, Oil & grease. Total coliforms, *E. coli*, Intestinal nematodes, Bacteriophage, Legionella	Rainwater event	None	Implementation of the 4 Demo Cases (DC#4)

* Frequency and monitoring parameters could vary during the validation step.

These monitoring efforts provide a comprehensive understanding of the system's operational status and treatment efficiency, guiding future improvements and ensuring environmental safety. Monitoring frequency is linked to rainfall events but it could be changed during the validation period.

The monitoring of the water quality will be followed by comparing the results with those indicated by the legislation for water reusing. As the main objective of the Pilot Plant is double: Reduce pollution in water runoff and regenerate this water into useful water for other purposes, it will be considered two laws: Directive (EU) 2024/3019 on Urban Wastewater Treatment and Spanish Royal Decree 1085/2024 – Regulation on Water Reuse.

Directive (EU) 2024/3019 on Urban Wastewater Treatment

Article 5 indicates to cover the treatment of runoff and stormwater. It states that if the water is contaminated, it must be treated, though no further details are provided.

Also, in Annex V establishes the next points:

- The collection of rainwater is necessary to prevent overflow.
- Similarly, it is important to avoid discharges of contaminated urban runoff into watercourses or receiving waters.
- Green and blue infrastructure should be created or adapted to collect, store, and treat urban wastewater.

Table 5 shows the threshold values for different parameters required by this law:

Table 5: Parameters established by Directive (EU) 2024/3019 of the European Parliament and of the Council of 27 November 2024 concerning urban wastewater treatment

REGULATION	PARAMETER	MAX CONCENTRATION ALLOWED	
EU Direct. 2024/3019 Wastewater	COD	15	mg COD/L
	TOC	37	mg C/L
	TSS	35	mg/L
	P total	0.5	mg P /L
	N total	8	mg N/L
	EOC	TBC	ug/L

Spanish Royal Decree 1085/2024 – Regulation on Water Reuse

This Royal Decree explicitly excludes the use of rainwater runoff in sustainable urban drainage systems. The only point which has been determined is that the rainwater runoff could be evaluated according to the quality standards outlined in this law.

Therefore, even if not required, meeting these quality standards facilitates its use in the applications allowed for each quality level. The standard required depends on the final use. Additionally, each use allows four categories according to the quality.

Annex I and Annex II of the referenced law outline various options for water use. As an example, two potential uses are included among the categories listed in these annexes (extracted from Royal Decree 1085/2024):

Table 6: Parameters established by Spanish RD 1085/2024

	Urban Use	Class (Quality) A+	Class A	Class B	Class C
Spanish RD1085 /2024 Water Reuse	E.coli (CFU/100 mL)	0	10	100	1000
	Turbidity (NTU)	5	5	-	-
	TSS (mg/L)	10	10	35 (DARU)	35 (DARU)
	intestinal Nematodes (egg/10 L)	1	1	-	-
	Bacteriophage	100	100	-	-
	Legionella (CFU/L)	1.00E+05	1.00E+05	1.00E+05	1.00E+05
	EOC	TBC	TBC	TBC	TBC
	Agricultural Use	**Class A**	**Class B**	**Class C**	**Class D**
	E.coli (CFU/100 mL)	10	100	1000	10000
	Turbidity (NTU)	5	-	-	-
	TSS (mg/L)	10	35 (DARU)	35 (DARU)	35 (DARU)
	DBO5 (mg/L)	10	25 (DARU)	25 (DARU)	25 (DARU)
	Intestinal Nematodes (egg/10 L)	1	1	1	1
	Legionella sp. (CFU/L)	1000	1000	1000	1000
	Taenia solium (egg/L)				
	EOC	TBC	TBC	TBC	TBC

The following tables shows the potential urban use (Table 7) and agricultural use (

Table 8) according to RD 1085/2024 that will be evaluated once the validation period of the pilot plant in DC#4 is completed and the optimal performance will be known. Given that the pilot plant is located within an industrial park, urban water reuse is the most likely and practical application

Table 7: Urban use of reclaimed water depending on water quality (RD 1085/2024)

	WATER QUALITY			
	A+	A	B	C
URBAN USE	Irrigation of private gardens Flushing of sanitary appliances (e.g., toilets	Publicly accessible ornamental ponds and circulating water features (e.g.; Fountains, artificial streams or ponds	Street cleaning Irrigation of urban green areas Firefighting systems Industrial vehicle washing	Ornamental ponds and circulating water features not accessible to the public

Table 8: Agricultural use of reclaimed water depending on water quality (RD 1085/2024)

AGRICULTURAL USE		
WATER QUALITY	IRRIGATION METHOD	CROP CATEGORY
A	All irrigation methods	• Food crops eaten raw in which the edible part is in direct contact with reclaimed water • Root crops eaten raw
B	All irrigation methods	• Food crops eaten raw where the edible part is produced above ground level and is not in direct contact with reclaimed water • Processed food crops • Non-food crops, including crops used to feed meat or milk-producing animals. • Woody crops that prevent contact between reclaimed water and fruits consumed by humans • Ornamental flower crops, nurseries, greenhouses without direct contact between reclaimed water and the produce
C	Drip irrigation or another irrigation method that avoids direct contact with the edible part of the crop	
D	All irrigation methods	• Crops intended for non-food industry, energy production, and seed production

Monitoring results during Autum/winter 2024/2025

During the autumn and winter of 2024/2025, a characterization of the collected water runoff was carried out, focusing on the first flush of rain events. This runoff primarily consisted of rainwater washing over the industrial area, which carried pollutants deposited on the soil surface. The water was collected through a culvert representing a 250 m² surface area, corresponding to the nearest inlet point. This approach was specifically designed to prevent mixing with groundwater, ensure accurate identification of pollutant sources, and preserve the integrity of runoff data.

Table 9 collects the results obtained in the different samplings with the legislation references included:

Table 9: Sampling campaign of runoff and groundwater inlet to de pilot (Autumn/Winter 2024/2025)

Water type	Date	pH	Electric Conductivity (EC)- (uS/cm)	COD - mg/L	TSS (mg/L)	Turbidity (NTU)	T.N (mg/L)	T.P. (mg/L)	Oil & Grease	Total Coliforms (CFU/100 mL)	*E. coli* (CFU/100 mL)	Intestinal Nematodes (egg/10 L)	Bacteriophage	Legionella (CFU/L)
EU Direct. 2024/3019 Wastewater Directive				*15*	*35*		*8*	*0.5*						
Spanish RD 1085/2024 - Water Reuse - Urban Class A					*10*	*5*					*10*	*1*	*100*	*100000*
Spanish RD 1085/2024 - Water Reuse - Urban Class B					*35*	-					*100*	-	-	*100000*
Spanish RD 1085/2024 - Water Reuse - Urban Class C					*35*	-					*1000*	-	-	*100000*
Groundwater	**Groundwater average**	7.8	123	**6.5**	**77.25**	*N.A.*	1	n.d	0.92	39				
Water runoff	**08/11/2024**	6.62	624	**126**	**107**	**174**	5.2	n.d	13	70000	n.d	*N.A.*	*N.A.*	*N.A.*
Water runoff	**22/11/2024**	6.88	18440	**138**	**248**	**29.7**	**23.5**	n.d	3.3	33000	n.d	*N.A.*	*N.A.*	*N.A.*
Water runoff	**07/12/2024**	6.52	2307	**80**	**112**	**45**	3.9	1.35	1.1	30000	n.d	*N.A.*	*N.A.*	*N.A.*
Water runoff	**18a/02/2025**	7.25	45	**80**	**262**	**42.4**	4.6	n.d	3.7	20000	n.d			
Water runoff+ groundwater	**18b/02/2025**	7	258	2	11	**8.9**	**8.5**	**1.4**	1.3	300	n.d	n.d	n.d	n.d
Water runoff+ groundwater (not rainy event)	**31/03/2025**	6.5	199	3	3.2	1.2	**11**	n.d	*N.A.*	52.5	3	n.d	n.d	n.d
Water runoff+ groundwater (light rainy event)	**25/04/2025**	6.53	260	**16**	1	4.6	**11.2**	n.d	*N.A.*	218	1	n.d	n.d	n.d
Water runoff+ groundwater	**05/04/2025**	7.6	116	**49**	34	**8.5**	4.9	n.d.		>1.00E+03	**244**	*N.A.*	*N.A.*	*N.A.*

N.A – Not analysed; **n.d**.- Not detected – **Bold characters:** Values above the thresholds of EU/National legislation

These results indicate the necessity of treating the rainwater collected before reusing in most of the cases. The particularity of the groundwater infiltration is not replicable in other sites; therefore the study of the water runoff independently provided a real approach to the quality of the water obtained from this Alternative water resource.

In the next graph (Figure 12) is represented an average value for the different types of water:

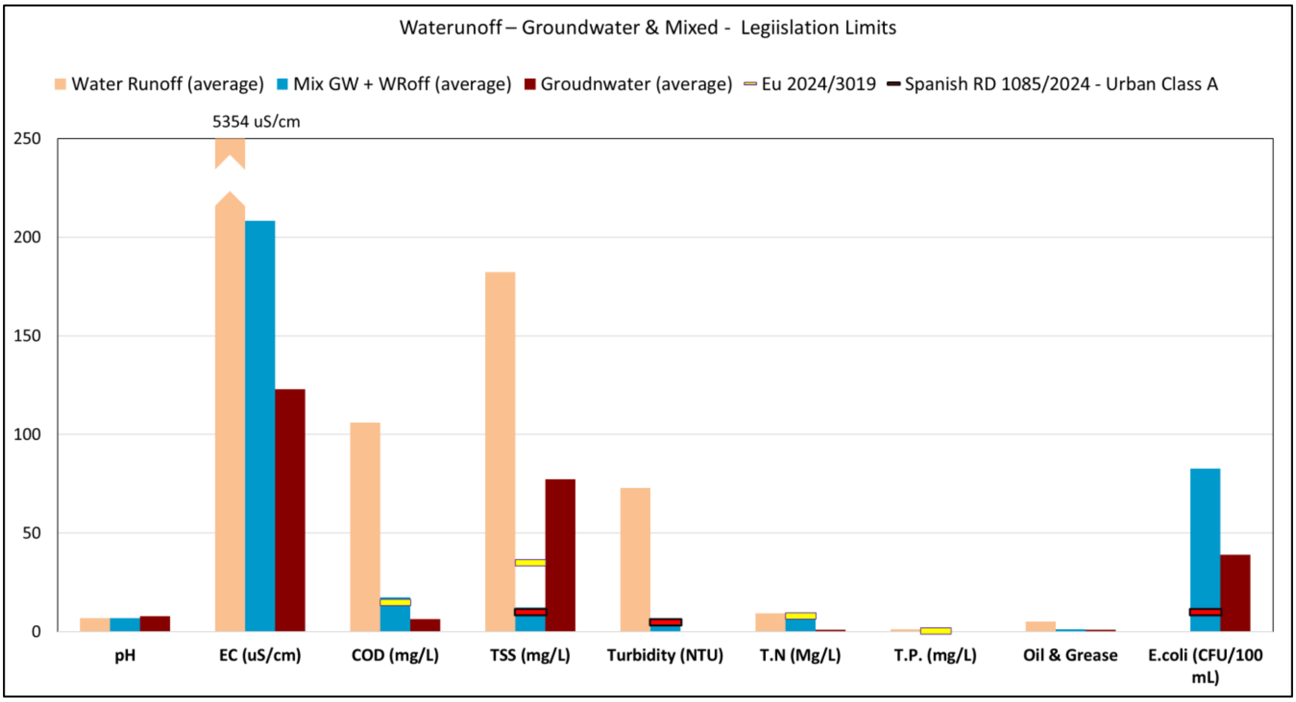

Figure 12: Average values of water quality parameters and comparison with thresholds of EU and Spanish legislation

As is depicted, the parameters measured in the water runoff provided by rainwater are the highest of the all the samples. Especially remarkable are the elevated concentration of Chemical Oxygen Demand (COD) and Total Suspended Solids (TSS), as well as the Electric Conductivity (EC) and Turbidity. Also, the average of the values of Total Nitrogen is close to the limits marked by legislations. Regarding the Ground water, the values are significantly lower than the water runoff, although some parameters as EC and TSS are higher than expected. Also, the parameter relative to pathogens (*E.coli*) is above the limits. Finally, the water which will be treated in the next months in the DC#4 in Santiago de Compostela is represented by a mix of both waters described previously. These mixed waters provide an average concentration of pollutants between runoff water and groundwater, creating the latter a dilution effect on the former.

As a conclusion, the use of rainwater as alternative water resource according to their quality requires a treatment to guarantee the less risky conditions for health and the environment. The use of a Nature base solution will ensure a quality regeneration in terms of pollutants as organic matter, nitrogen content, turbidity and salt content (EC) but it will be needed a specific treatment of disinfection to reduce the pathogens content to comply with Spanish legislation for reclaimed water (RD 1085/2024). The design and implementation will be done during the second monitoring period once performance operation data of the system will be available.

III.3 Problems faced

The main problem faced by DC#4 during this reporting period is related to the delays in the construction of the pilot plant in the framework of WATERUN project. AWARD is taking advantage of this infrastructure with the aim of treating the water runoff (rainwater and stormwater) to reuse.

Reasons of construction delay in the Sionlla pilot plants in DC#4:

The anticipated completion date for the construction of Sionlla pilot site was mid-July 2024 with the NBS (wetlands). By that time, the NBS elements required only a few additional weeks to reach completion.

However, on 9th July 2024, CETAQUA (on behalf of VIAQUA) received an official notification from the Spanish Ministry of Transport, Mobility and Urban Agenda mandating the immediate suspension of all construction activities at the site.

With this scenario the works stopped at Sionlla site and a letter with allegations was prepared remarking that the works were made in the framework of a European project with scientific purposes.

After several negotiations, 8 months later (February 2025) the Spanish Ministry of Transport, Mobility and Urban Agenda accepted the allegations, but they said that some changes must be performed like reducing the heigh of the gabions (in yellow) that were near to the highway as it is shown in the following image:

Figure 13: Modifications required to get permits after the Spanish Ministry of Transport, Mobility and Urban Agenda communication. As a consequence, it became necessary to carry out additional unplanned works, which introduced further delays to the overall timeline. The pilot units became operational in in March 2025 for the constructed wetland.

Modifications were only finished by June 2025 and the pilot. By the moment, the unit is during starting -up phase adjusting operational parameters to start with full operation in autumn/winter 2025-2026.

Summer 2025 has been very dry (no significant rain events) but according to the experience of the team a number of at least 10 to 15 rainfall events during the remaining monitoring period until the end of the project, will be the minimum enough for evaluating the performance. The delay of the pilot startup also delayed the design and operation of the disinfection system, since the effluent analytical results are necessary to know the disinfection requirements. Thus, in the following months (winter 2025) the system will be designed and implemented.

In the meantime, while there is no rain events, the wetland treatment unit pumped feeding system using continuous water flow (groundwater) during dry periods to maintain microbiome activity and plants growth. AIMEN is studying the optimal feeding frequency – independently of rain events- to support the continuous supply of water and nutrients to keep the system on optimal conditions. Also, the water from the events is being fed.

IV Social activities within DC#

As a Demo Case in Santiago de Compostela, we have developed and promoted various activities and initiatives in coordination with the work package leaders of WP2, WP3, and WP4. These coordinated efforts have contributed to the advancement of AWARD's objectives through multiple interconnected actions that will be described in detail below.

Regarding WP2 - Socio-political support and engagement for AWRs management, led by BDG, CETAQUA successfully disseminated a survey that gathered 112 responses, aiming to increase social awareness and accountability on AWRs. A key finding of this survey revealed a significant gap in public participation, with 87% of citizens reporting no previous involvement in decision-making processes regarding water and other environmental issues. This finding highlights the importance of enhancing public engagement in water resource management.

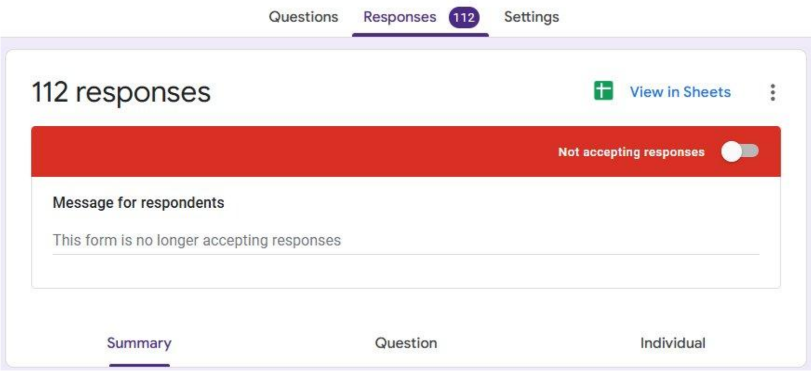

Figure 14: Number of responses to survey

Align with the project objectives and giving response to the challenge mentioned, we organized and implemented the Local Water Forum, strategically scheduled on June 5th, World Environment Day. The event brought together 13 participants representing diverse sectors including public administration, academia, the business community, and the water sector. The forum was officially opened with remarks from the City Councillor for Environmental Sustainability and the Executive Director of Viaqua, emphasizing the institutional support for sustainable water management initiatives.

The forum's methodology combined formal presentations with participatory activities designed to maximize engagement and knowledge transfer. Following an introductory session that covered Alternative Water Resources, the AWARD project and its demonstrators, and the project's digital twin platform, participants engaged in a collaborative dynamic titled "Dreaming AWR in our territory." This innovative approach utilized printed maps of Santiago de Compostela, allowing participants to work in pairs to identify potential uses and locations for AWR based on their individual experiences and expertise.

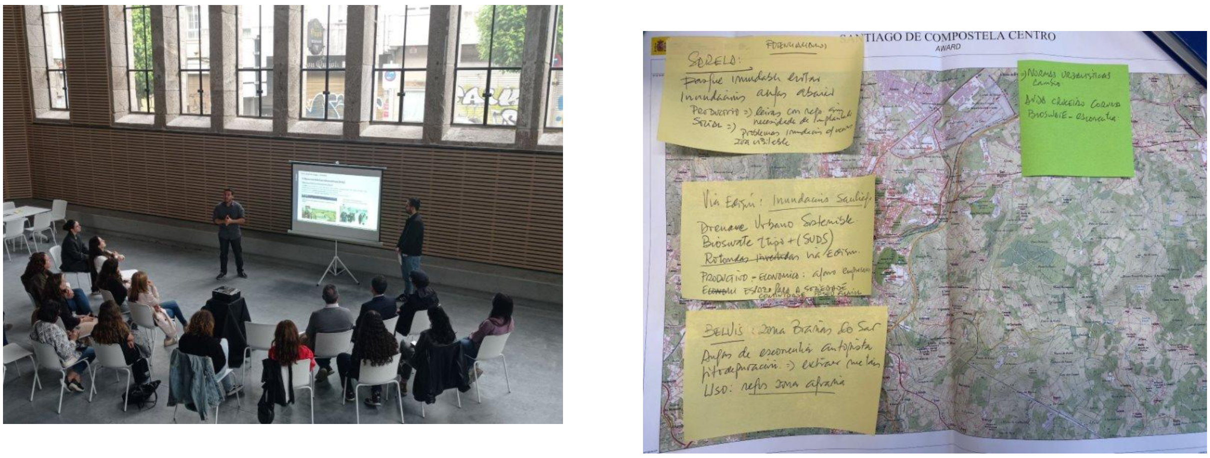

Figure 15: Pictures of the Local Water Forum (05.06.2025) in Santiago

The participatory exercise was structured around three key thematic blocks: envisioning the replication of Alternative Water Resources throughout the territory, identifying sector-specific knowledge contributions to enhance AWR success, and recognizing potential barriers and limitations to implementation. This methodology generated concrete proposals for sustainable water management solutions across urban and peri-urban areas of Santiago de Compostela.

Participants identified significant environmental, social, and health benefits of these proposals, including summer temperature reduction through green space strategies and biodiversity promotion. However, they also recognized important barriers encompassing social, economic, and regulatory dimensions, such as the lack of awareness and social acceptance regarding reclaimed water, insufficient technical knowledge among the general public, potential legal and administrative constraints, funding difficulties, and the need for adequate physical space for infrastructure implementation.

The forum's effectiveness was rigorously measured through comprehensive pre and post-event surveys involving all participants. The initial diagnosis revealed that while most participants had partial knowledge of Santiago's water situation and limited understanding of Alternative Water Resources, they demonstrated strong environmental commitment through responsible water behaviours in their daily lives. The post-event evaluation demonstrated remarkable success with significant increases in knowledge and engagement levels. Most participants reported considerably expanded understanding of both Santiago's water situation and Alternative Water Resources, expressing strong willingness to share their learning with others, creating a valuable multiplier effect.

Notably, all participants expressed interest in attending future Local Water Forums, confirming the initiative's success in building sustained engagement and laying the groundwork for a committed local community focused on sustainable water management. The forum's outcomes perfectly aligned with AWARD's objectives of providing evidence-based knowledge and fostering social innovation and collaboration in water resource management, while successfully creating a space for dialogue, awareness-raising, and engagement among diverse local stakeholders.

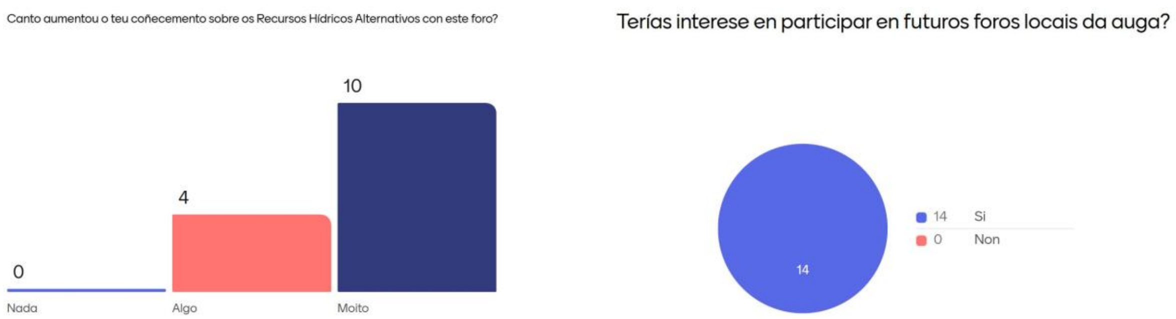

Figure 16: Outcomes of the Local Water Forum in Santiago

Regarding Work Package WP3 - Patrimonial framework for AWRs assessment, led by Université Paris-Saclay, we collaboratively designed an interview agenda that was implemented during the last week of January, successfully conducting 11 interviews with over 14 specialized stakeholders. These interviews included representatives from water management companies, social and technical experts from the University of Santiago, neighbourhood associations, environmental groups, business associations, and regional water authorities. Our contribution involved providing local knowledge and contacts, as well as hosting these interviews at our facilities. Additionally, we organized a visit to the ongoing pilot project. Lastly, during May and June 2025, we participated in the review and validation of the DC4 diagnosis document structure and evaluated proposed scenarios and action plans for heritage water management, focusing on knowledge and transfer aspects. This work included defining iteration steps for workshop preparation and stakeholder strategy to present, assess, and complete these scenarios starting from September.

Figure 17: Visit of Université Paris-Saclay to Santiago demo case

V Final goal/Expected results

The Demo Case demonstrates the technical feasibility of rainwater reuse through nature-based infrastructure and promotes social innovation and stakeholder involvement in water resource planning.

AIMEN and CETAQUA will keep collaborating in demo case 4 in the following months during the validation period of the wetlands to evaluate the performance and the potential of the reduction of pollutants to obtain a treated effluent below the thresholds of EU and national legislation for waste reduce. According to the results the integration of a disinfection stage will be evaluated to meet legal standards.

Another Local Water Forum will be organised in Santiago to deepen community involvement in alternative water resources and to engage industrial park tenants to explore on-site reuse opportunities.

@AWARD_HEU

https:/www.awardproject.eu/

contact@awardproject.eu

Funded by
the European Union

AWARD has received funding from the European Union's under Horizon Europe programme, Grant agreement n° 101136987