

## MID-TERM EVALUATION CONSENSUS REPORT

### MANAGED AQUIFER RECHARGE: ADDRESSING THE RISKS OF RECHARGING REGENERATED WATER (MARadentro)

Name of Coordinator: Dr. Silvia Diaz Cruz

Project code: WaterWorks2017-MARadentro

Duration of project: 36 months

Start date: 17 May 2019

End date: 16 May 2022

### FOLLOW-UP GROUP

Please include the data of the FG members reviewing the report

Name	Organisation
Mario Schirmer	Eawag - Swiss Federal Institute of Aquatic Science and Technology (CH)
Olga Covaliova	Institute of Chemistry, Republic of Modavia

#### 1. Scientific and technological progress *(Maximum 250 words)*

Despite COVID-19 pandemic related difficulties, the MARadentro project is progressing well. The consortium provided suitable MAR types, along with a study case from a target site in Spain. The fate of major microbial and chemical contaminants was reviewed together with processes affecting their transport and fate in MAR. The review has controlled the design of laboratory and pilot experiments to improve the overall performance of the system, with a focus on processes and impacts of microbial and chemical contamination transport and fate.

The methodology for the batch experiments was established and validated. More than 200 batch experiments were performed to test the sorption of different materials (sand, clay, woodchips, compost, zeolite etc.). Different parameters have been tested, such as the contact time between the water and the sediment, the sediment granulometry (crushed vs. natural), the water/soil ratio, and the water composition. The team found out that the soil composition is the most important parameter on the sorption efficiency.

The industrial partner Aqualia looked for the best location for the real field scale MAR prototype installation and decided on a site. Also the modelling work is progressing well. The partner UPC started to produce the basis of the numerical models by constructing and verifying the conceptual model using data available prior to MARadentro.

#### 2. Collaboration, coordination and mobility within the Consortium *(Maximum 250 words)*

Several MARadentro partners have successfully collaborated for years, and thus, it can be regarded as an extension of previous collaborations and as the consolidation of established connections among partners. Some laboratory and field tasks were designed to be carried out by students from every partner, thus ensuring a continuous interaction among partners, which has been realized in the sampling campaigns. Some exchanges of researchers among the partners, mostly to perform laboratory experiments were foreseen. So far only one student is performing a Postdoc stay. Senior researchers and PhD students had not the chance to carry out research stays as a consequence of the COVID-19 situation. Mobility has been affected. However, online

meetings have been organized to plan and manage the water chemistry data and the protocol for column experiments.

Clearly, the project has a transnational nature. Initial MAR studies at a laboratory scale are performed in France by CNRS. The pilot MAR system (managed by CSIC and UPC) and the real-scale MAR (managed by the industrial partner Aqualia) are located in Spain, where chemical analysis is performed. Microbial communities' studies (SLU), as well as microbiological analysis (IRSA-CNR), are carried out in Sweden and Italy, respectively. MARadentro clearly meets the required transnational nature and its added value.

### **3. Coordination with other international project funded by WaterWorks2015, or other instruments** (Maximum 250 words)

CNRS partner as well as CSIC, are part of another JPI project funded in the 2018 joint call named URBANWAT. They jointly developed the methodology for batch experiments at Montpellier (France). MARadentro is connected with the Spanish project ROUSSEAU (<http://rousseauproject.es>). Both projects are coordinated by the same coordinator and thus, a smooth collaboration was established from the beginning of MARadentro. The ROUSSEAU project aims to fill in current knowledge gaps in the reuse of regenerated water in agricultural irrigation (wastewater reuse after further treatment). To this end, the propagation of waterborne biological and chemical emerging contaminants to soil, plants, and ultimately humans are investigated in different types of crops, water reclamation techniques, irrigation systems, and study sites. The regenerated water produced by the WWTP secondary effluent infiltration through reactive barriers in MARadentro is used to irrigate vegetables grown in two agricultural plots located by the MAR pilot in Palamos. Results to date show that MAR water significantly decreases the transfer of chemical and biological contaminants to vegetables in comparison with the WWTP outflow.

MARadentro also collaborates with the Catalonian project RESTORA (<https://restora.h2ogeo.upc.edu/>). This project focuses on the use of organic substrates to accelerate water re-naturalization in MAR. In this case, emphasis lies on Antibiotic resistance genes and chaotic mixing.

### **4. Coverage of the themes and sub-themes of the call** (Maximum 250 words)

MARadentro contributes to a large range of themes and sub-themes of the call. This research covers Sub-theme 1.2. Integrative management by implementing Natural Water Retention Measures (NWRM) such as Managed Aquifer Recharge (MAR). Furthermore, the project strengthens socio-economic approaches to water management (Theme 2) and especially to Sub-theme 2.3. Connecting science to society and Sub-theme 2.4. Promoting new governance and knowledge management approaches. In this regard, the project aims at developing innovative water management tools and approaches suitable for decision-making based on an analysis of the limitations of current practices. In addition, MARadentro contributes to Theme 3. Supporting tools for sustainable integrative management of water resources and complements the actions developed under the European Strategy Forum for Research Infrastructures (ESFRI) and other European initiatives.

### **5. Stakeholder/industry engagement** (Maximum 250 words)

The visibility of the MARadentro project is large. This was strengthened through the end-users meeting in Barcelona in December 2019). There the project established cooperation with several

water agencies and actors in the field. Now the team collaborates with the Catalan Water Agency (ACA) which funded the project RESTORA - Managed recharge of aquifers and use of organic substrates to accelerate water re-naturalization. They also signed an agreement with Consorcio Costa Brava (CCB) which is supporting the implementation of MARadentro within the Palamos WWTP. The research team is also involved as the coordinator of COMAIGUA S.L, a management of integrated water cycle company in the project proposal LIFE-REMAR: Reactive barriers for water re-naturalization during managed aquifer recharge in the Baix Camp region in Spain. Furthermore, the company Mejoras Energeticas S.A. is also involved as an industrial partner. Finally, a Research Technical Support contract was signed between CSIC and Consorci Besos-Tordera (CBT) a management of integrated water cycle company.

**6. Recommendations for improvements/amendments of the report** (Please complete Table below)

Page	Modification	Rationale for change
	none	

**7. Recommendations/ problems and risks** (Maximum 250 words)

The main problems that affected the project implementation activities were: Covid 19 pandemic and lack of active funds at national level in case of the partner from Italy. In addition, Project Coordinator from IRSA-CNR have been substituted, and final acceptance was not received. As mentioned by the Project Consortium, one of the most efficient measures to completely reach the project milestones and deliverables, would be requesting for the project period extension for several months.