



Using flood water in Managed Aquifer Recharge schemes as a solution for groundwater management in the Cornia valley (Italy)

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The lower Cornia valley aquifer system (Tuscany, Italy) provides the only source of water for drinking, irrigation, industrial purposes and it also contributes to the water needs of the nearby Elba island. Since 60 years, intensive exploitation of groundwater resulted in consistent head lowering and water balance deficit, causing subsidence, reduction of groundwater dependent ecosystems, and salinization of freshwater resources. Rebalancing the water budget of the hydrologic system is the main objective of the LIFE REWAT project (sustainable WATER management in the lower Cornia valley through demand REDuction, aquifer Recharge and river REstoration; <http://www.liferewat.eu>). Here, five demonstration measures (river restoration; Managed Aquifer Recharge; reuse of treated wastewater for irrigation; high irrigation efficiency scheme; leakage management in water distribution systems) are set in place for promoting water resource management, along with capacity building and participatory actions. A pilot Managed Aquifer Recharge (MAR) infiltration basin for using flood-water was designed and set in operation in Suvereto, testing the new-issued Italian regulation on artificial recharge of aquifers (DM 100/2016).

The infiltration basin is located at a pre-existing topographical low near the Cornia River. The river, having intermittent flow, provides the recharge water during high flow periods, including floods, and when discharge is above the minimum ecological flow. The infiltration basin is set in a groundwater recharge area where the aquifer is constituted by gravel and sands.

A preliminary project and an executive one were prepared and discussed with the relevant authorities, following one-year long monthly monitoring of surface- and ground-water. The project was supported by a groundwater flow modelling-based approach using the FREEWAT platform (www.freewat.eu).

The facility consists of the following elements: i) intake work on the River Cornia; ii) the inlet structure control system, managed by quality (mass spectrometer defining surface water spectral signature) and level probes, and allowing pumping into the facility at predefined head and chemical quality thresholds; iii) a sedimentation basin; iv) the infiltration area (less than 1 ha large); v) the operational monitoring system, based on a network of piezometers where both continuous data (head, T, EC, DO) are gathered and discrete measurements/sampling performed. The cost of construction of the plant is about 300000 € well below the cost of a surface water reservoir for a similar storage.

Depending on the climatic conditions, the estimated volume of diverted surface water may vary between 300000 m³/year and 2 Mm³/year. Being the facility a pilot one, diverted water discharge ranges between 20 to 50 l/s. Minimal site development and modification was required, resulting in a no-impact water-work, while providing ecosystem benefits by reconnecting and inundating former abandoned riverbeds. The effectiveness of such pilot may demonstrate the potential for Flood-MAR schemes to increase water availability in scarcity prone areas.

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