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Integrated subsurface water solutions for coastal environments through integrated pump&treat and aquifer storage and recovery (ASR) schemes

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Coastal wetlands in semi-arid regions, as in Circum-Mediterranean, are considered important ecosystems that provide valuable services to human population and the environment, such as: flood protection, erosion control, wildlife habitat, water quality, recreation and carbon sequestration. Un-managed surface and groundwater exploitation in these areas usually leads to deterioration of such sensitive ecosystems by means of water resources degradation and/or increased salinity. Groundwater usually plays a vital role for the sustainability of these hydrological systems, as the underlying aquifers operate as regulators for both quantity and quality of their waters. Multi-layer and multi-objective Managed Aquifer Recharge (MAR) systems can be proved effective groundwater engineered solutions for the restoration of deteriorated coastal wetlands in semi- and arid regions.

The plain of Marathon is a typical Mediterranean environment that hosts a naturally occurring –and today degraded– coastal wetland with the characteristics of a distinct ecosystem linked to a typical coastal hydrogeological system of a semi-arid region; and therefore can serve as a model for similar systems world-wide. The geo-hydrological setting of the area involves a multi-layer aquifer system consisting of (i) an upper un-consolidated formation of depositional unit dominated mostly by fluvial sediments and (ii) the surrounding and underlying karstified marbles; both being linked to the investigated wetland and also subjected to seawater encroachment.

A smart engineered MAR system via an optimised Pump & Treat system integrated with an Aquifer Storage and Recovery (ASR) scheme in this area would include the abstraction of brackish groundwater from the deeper karst aquifer at a location close to the shoreline and direct treatment with Reverse Osmosis (RO). for desalination. Two-fold re-use scheme of the purified effluent can then be engineered for (i) the restoration of the coastal wetland; and (ii) managed aquifer recharge of the upper un-consolidated formation to sustain irrigation at the upstream area for agriculture. This facility will demonstrate how MAR can be used to sustain groundwater dependent ecosystems (and/or prevent their further degradation), while at the same time safeguarding water supply.

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