# Soil-Aquifer Treatment as a passive solution to enhance treated wastewater quality

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**Abstract**
Water scarcity episodes are being experienced in many parts of the Mediterranean Basin as a result of changes in rainfall intensity and duration, causing more intense extreme events, like droughts and river floods. Adaptive and innovative water management strategies, such as the storage of reclaimed water or excess water from different sources in Managed Aquifer Recharge (MAR) schemes, can greatly increase the groundwater availability and therefore help addressing water scarcity challenges. Besides, water quality can be improved during transport of the infiltrated water through the unsaturated and saturated zone, together with Soil-Aquifer-Treatment (SAT) systems, due to chemical and biological reactions, linking water reclamation, water reuse, and water resources management (González *et al.*, 2015).

This paper presents the results of a DEMO scale experiment made in S. Bartolomeu de Messines (SBM) Waste Water Treatment Plant (WWTP), where SAT basin systems were built. The SAT systems aimed to improve the treated effluent water quality prior to its discharge in Ribeiro Meirinho, that later infiltrates in an important karstic aquifer along the river influent sections. The water quality enhancement was obtained using the soil's ability to reduce the concentrations of contaminants, namely pharmaceutical compounds and nutrients, through natural processes (e.g. particle retention, adsorption and biodegradation). Prior to this, soil-column experiments were conducted aiming to reproduce optimal SAT conditions using different soil mixtures as depuration media (Martins, 2016; Martins *et al.*, 2016). The soil physico-chemical conditions were optimized in terms of permeability, organic matter content, and aerobic / anaerobic conditions. The results obtained showed an improvement of water infiltrated through SAT, for several pharmaceuticals and nutrients.

This research was carried out under MARSOL project (Demonstrating Managed Aquifer Recharge as a Solution to Water Scarcity and Drought), whose main objective was to demonstrate that MAR is a sound, safe and sustainable strategy that can be applied with great confidence and therefore offering a key approach for tackling water scarcity in Southern Europe.

**Keywords**
Wastewater reuse; water quality improvement; Soil-Aquifer Treatment (SAT); reactive layer; SB Messines

## INTRODUCTION

The study area is located in a rural region in Algarve, located in the south of Portugal (Figure 1). The main water quality stressors are related to agricultural activity, SB Messines wastewater treatment plant (WWTP), septic tanks and livestock production units (Leitão *et al.*, 2014). The WWTP facility is working since 2004. It receives mainly urban effluent from São Bartolomeu de Messines town, covering an average of 4 228 inhabitants, an aged population where consumption of pharmaceuticals is relatively high.