# WATER RESOURCES MANAGEMENT AT THE UNIVERSITY OF ALICANTE FOR LANDSCAPE IRRIGATION FROM GROUNDWATER DESALINATION

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**Abstract**

The southeastern part of the Iberian Peninsula is an area of water resources scarcity and important seasonal demand. Moreover, aquifers with low quality water for consumption due to salinity also exist precluding its further use. However, since the important concern of water shortage has been growing, possible exploitation of low quality groundwater has been taken into consideration. An example of sustainable use of the treated saline water developed by University of Alicante (UA) is presented, where pumped groundwater from the in campus existing aquifer is applied for landscape irrigation after RO desalination by the existing plant.

Key words: Integrated Water Resources Management, desalinated water, University of Alicante, groundwater

## Introduction

Alicante province (SE Spain) is characterised by a semi-arid Mediterranean climate, low precipitation (300 mm/y) distributed along several unevenly events and important water demand. Perennial streams do not exist, being groundwater the most important component of water resources. The University of Alicante campus, located 5 kilometres North of Alicante city, extends over a area of approximately 90 ha vegetated land of typical Mediterranean and non-Mediterranean plants located on top of an unconfined quaternary aquifer of detrital origin..

The aquifer material is composed by silty and sandy materials with some presence of clays, overlying the impervious loam materials of Cretacic origin. The geology of the region is rather complex, which include presence of some outcrops of gypsum, leading to poor quality of groundwater. Electric conductivity values greater than 6000µS, and $SO_4$, Cl and Na concentration of around 1800 mg/l, 1500 mg/l, and 1200mg/l respectively are common. Due to chemical characteristics of water exploitation from wells does not exist. Aquifer outflow is produced through some existing springs (i.e. Ovejas creek) and in the

abandoned open pits produced by mining activities in the late sixties. According to previous studies carried out by the Spanish Geological Survey (IGME), volume of water that reaches the surface in springs represents more than 90% of the volume of natural recharge. Regional groundwater flow direction is from northwest to southeast.

Due to the lack of water resources (MIMAN, 2000) and the need to maintain the landscape, irrigation water is provided by the two existing wells located in the University (Fig. 1) after a RO desalination process taking the advantage of the in place desalination plant developed at the university in 1997 (Prats et al., 1997; Prats et al., 2001). Rejected brine is dumped into the Ovejas creek, but little information has been found on the present compounds on the water applied and brines and its effects on the porous media and aquifer (Daughton and Ternes, 1999; Einavet et al., 2002; Lattemann and Hopner, 2008; Al-Faifi et al., 2010) and recharge estimation from irrigation (Jimenez-martinez et al., 2009).

A case study on water desalinated reuse for landscape irrigation at the University of Alicante is presented.

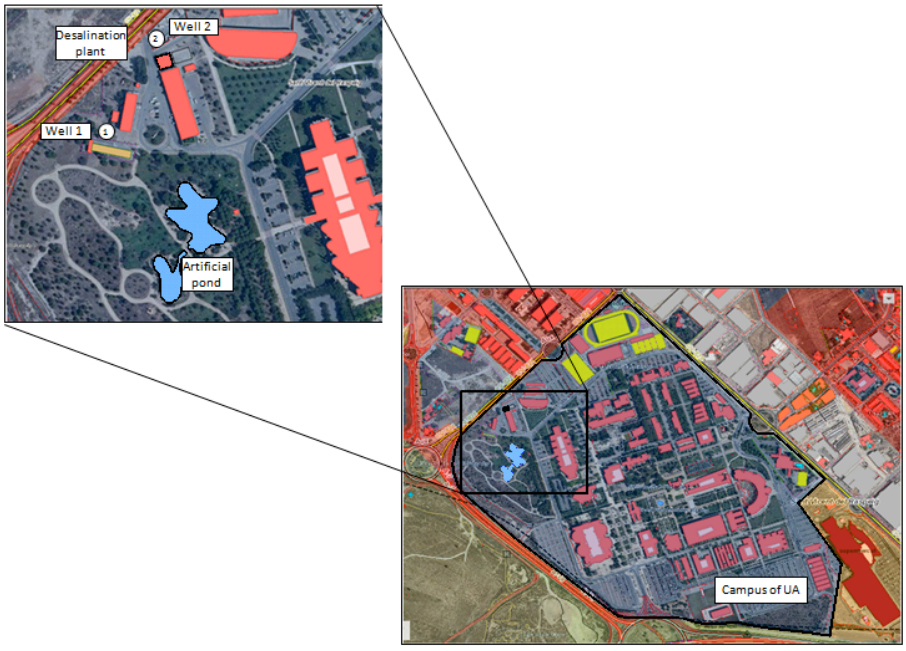


Figure 1. Aerial view of the University of Alicante campus. Location of the desalination plant, wells and ponds.

## Methodology

Currently water for irrigation is pumped from well number 2 and directly conveyed to the desalination plant. After desalination, $Ca(OH)_2$ is added to water in order to increase the low pH (6) and finally stored in a deposit prior to its final use. After pumped to an artificial pond which acts as a regulation deposit, water is ready for irrigation, being distributed through the irrigation supply system in campus. During the summer season and when demand increases, well number 1 comes into functioning while water from well number 2 is directly pumped into the pond, bypassing the desalination process.

In order to improve the efficiency of the system, both drip and sprinkler irrigation is applied. The first-one is used for trees watering and the second one for grass, which extends over most of the cultivated land.

## Conclusions

In this work, an efficient model of irrigation water management for a wide area in a region where water scarcity is a common feature has been presented. Although the groundwater quality renders the aquifer not suitable for its use, water desalination from the university experimental plant has proved to enhance water resources for recreational demand

Despite of the accurate irrigation schedule and the continuous effort to improve the efficiency of the system, the irrigation return flow to the aquifer accounts for a substantial portion of the total aquifer recharge. However, the effects and extent along the unsaturated zone and aquifer of the desalinated water reuse is not known. Moreover, presence of a range of compounds, such as heavy metals, emerging contaminants (PPCPs, i.e., anti-inflammatory drugs, antiscalants, antimicrobial agents etc) which may be present in the applied water and rejected brines is still unknown and is being investigated.

## Acknowledgements

This work has been developed within the Project CGL2010-22168-C03-02 and CONSOLIDER-TRAGUA (MICINN, Spain). Gratitude is expressed to MF Chillón-Arias from the Technical Service (Universidad de Alicante).

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