



Evaluation of Managed Aquifer Recharge Scenarios using Treated Wastewater: a Case study of the Zarqa River Basin, Jordan

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Jordan is an arid country, facing great challenges due to limited water resources. The shortage of water resources constrains economy, especially agriculture that consumes the largest amount of available water (about 53 % of the total demand). According to the Jordan Water Strategy 2008 - 2022, groundwater is twice greater than the recharge rate. Therefore, the government charged the planners to consider treated wastewater (TWW) as a choice in the water resources management and development strategies. In Jordan, there are 31 TWW plants. Among them, As Samra plant serving the two major cities, Amman and Zarqa, is the largest, with projected maximum capacity of 135 Million m³/year. This plant is located upstream of the Zarqa River basin that accepts all TWW discharges. The Zarqa River is considered the most important source of surface water in Jordan and more than 78 % of its current is composed of TWW.

The main objectives were to develop a conceptual model for a selected part of the Zarqa River basin, including the As Samrapant, and to provide insights to water resources management in the area using TWW. The groundwater flow model was developed using MODFLOW 2005 and used to assess changes in the aquifer and the Zarqa River under a set of different increments in discharge rates from the As Samra plant and different groundwater pumping rates.

The results show that the water table in the study area underwent an average water table decline of 29 m prior to the As Samra plant construction, comparing with the current situation (with annual TWW discharge of 110 Million m³). The analysis of the TWW rate increase to 135 million m³/year (maximum capacity of the As Samra plant) shows that the average groundwater level will rise 0.55 m, compared to the current conditions. We found that the best practices require conjunctive use management of surface- and groundwater. The simulated scenarios highlight the significant role of TWW in augmenting the aquifer storage, improving water availability, and better farming activities in the Zarqa River valley.

Keywords: Managed Aquifer Recharge, Treated Wastewater, Zarqa River Basin, Jordan, MODFLOW 2005

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