



Evaluation of groundwater artificial recharge management scenario for sustainable water resources development in Gaza Strip

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The water resources in Gaza Strip are currently facing extreme over-exploitation which has led to a sharp decline of the groundwater level in this Mediterranean coastal aquifer overtime. Salinity of the groundwater is very high as a result of subsequent seawater intrusion of the aquifer. The contamination of the Gaza Strip groundwater by seawater has wide-ranging effects on the regional economy as well as agricultural productivity. In order to guarantee the sustainability of regional development, which requires the access to clean water, groundwater artificial recharge (AR) is being considered as a potential solution to this current water resources problem. The objective of the present study is to analyze several strategies for the implementation and management of AR in Gaza Strip and their potential impacts on agriculture, environment, and the socio-economy. Based on the water policy on wastewater reclamation and reuse (Yr. 2005 – 2025), six AR management strategies were developed in close cooperation with the local stakeholder community. These scenarios take into consideration the development of the new North Gaza Wastewater Treatment Plant and were also judged with respect to a base-line scenario, otherwise known as the “Do Nothing Approach.” Multi-Criteria Decision Analysis (MCDA) on ranking of the AR management scenarios was used. Twenty-one criteria ranging over a wide spectrum and four categories (Environmental, Public Health, Social, and Economical) were defined to ensure sound evaluation of each of the six AR management scenarios. A detailed geo-database was prepared to analyze all the related spatial, non-spatial, and temporal data. Socio-economic studies, field surveys, mathematical modeling, and GIS analysis were used for the criteria quantification. In the MCDA, Analytical Hierarchy Method (AHP) combined with weighted Linear Combination (WLC) and Composite Programming (CP) was employed. The six AR management strategies were thus compared to the “Do Nothing Approach” based on the defined environmental, health, social, and economical criteria, the most important being related to the environment and the economy. The robustness of the achieved ranking of AR management options has been tested by changing the selected criteria, criteria importance and criteria structure. The final analysis shows that all six AR management strategies are better than “doing nothing”. The implementation of groundwater artificial recharge with maximum possible infiltration of secondary treated effluent in conjunction with sustainable reuse of the recharged water for agricultural development is the most effective AR solution to the water resources problems of the Gaza Strip.