

Assessing the Development of Unconventional (Brackish and Saline) Water Resources in the West of Hormozgan Province

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Extended Abstract

Introduction: Being located in an arid and semi-arid region, Iran has always faced with limited water resources. As groundwater extraction has now exceeded the permitted limits all over Iran and the country faces considerable constraints in developing groundwater resources, severe water crisis looms large in the horizon. In this regard, a quick solution should be considered to supply water from non-conventional water resources (brackish and saline waters, rainwater harvesting, cloud seeding, etc.). Therefore, this study sought to investigate the status of water in Fatuyeh-Todroyeh plain in Bastak city, Hormozgan province, and the possibility of supplying water from unconventional resources, especially the brackish and saline waters, for agricultural purposes.

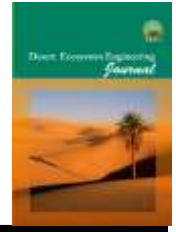
Materials and methods: In the first step, the required maps of the study area including the groundwater electrical conductivity (EC) map were prepared, using ArcGIS software. Then, chemical analysis of the Fatuyeh-Todroyeh aquifer's water quality was performed by AqQA software on the data gathered through three rounds of sampling from the wells, followed by the calculation of water quality index (WQI). In the next step, the the study plain's hydro-climatic balance was measured via Budyko conceptual model, taking changes in storage into account. Then, to investigate the economic justification

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of using inland water desalination plants in the region, the cost-benefit ratio of the cucumber greenhouse cultivation, and the investment's return rate for the installation of water desalination plants and greenhouse sites were calculated. Finally, having decided on appropriate criteria and options, the hierarchical analysis method (AHP) was applied for comparing different management options and offering the best plan for supplying unconventional water resources for the agricultural, drinking, and industrial sectors of the study region, using Expert Choice software.

Results and Discussion: The results of water resources quality surveillance showed that the Fatuyeh-Todroyeh plain's groundwater samples ranged from acceptable to completely unpleasant in terms of drinkability according to Schuler diagram, and that its dominant water type was something between chloride and sulfate according to Piper diagram. Moreover, based on Wilcox diagram, the suitability of groundwater resources for irrigation purposes ranged from doubtful to unsuitable. In other words, there were no groundwater resources in the plain with low and medium EC and low to high SAR risks. Furthermore, the highest coefficient of variation belonged to sodium ion which was equal to 0.67 over the study plain. In general, according to WQI quality index, 75% of the water in Fatuyeh-Todroyeh plain's wells have very poor quality, being inappropriate for agriculture and drinking.

Calculations of the plain's water balance indicated that the decline in storage changes was 2.4 million cubic meters annually, making the development and extraction of groundwater impossible. The results of the investigation of the economic justification revealed that according to the cost-benefit ratio which was found to be greater than one in all years of a five-year period and the investment's return rate which was greater than the current bank interest rate, the construction of inland water desalination plant and the establishment of greenhouses in the study region is economically justified. The results of AHP calculations suggested that based on the criteria set for unconventional water management in the agricultural sector of the study area, implementing the optimal cultivation pattern was the best choice in this regard, followed by the option of constructing a desalination plant. As for drinking purposes, the highest score belonged to the option of constructing water desalination plants, and for the industrial purposes, the highest score related to the option of prohibiting wastewater discharge into the river protection area.

Conclusion: the study's findings showed that there were no facilities for the development of groundwater extraction in the region. However, constructing a dam in a suitable place, controlling the rainwater runoff (which is of very poor quality), and desalinating the stored water by a desalination system could help use the plain water acquired for drinking and agricultural purposes in Fatuyeh-Todroyeh plain.

Keywords: Brackish and saline waters, Development plan, Hormozgan province, Management alternatives, Non-conventional water resources.