



## Control the Effect of Groundwater Rising Using GIS and Multi-Criteria Decision Making Techniques in Zubair, Southern of Iraq

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### Abstract

A hybrid model of two multi-criteria decision making techniques specifically, the analytical hierarchy process method and the technique for order preference by similarity to an ideal solution method was proposed to select the best site for constructing an underground dam to control the groundwater table rising or water-logging in the center of Al-Zubair city, southern Iraq. Six influencing factors were selected and prepared depending on the nature of the problem to be resolved the siting of the underground dam, and data availability. These are elevation, slope, curvature, aquifer transmissivity and specific yield, and distance to the water-logging body. Applying the hybrid system proved that approximately 50% of the study area is suitable for constructing the underground dam. Due to the expected high cost of constructing an underground dam in the study area as well as the technical challenges in implementing the project, the proposed design is digging a trench with limited width (meter or half a meter) and shallow depth (not more than 5 m) and fill the hole with an impermeable material (clay for example). It is preferred to drill wells in the headwater of the dam for pumping excess water and used it for another usage.

**Keywords:** Groundwater rising; Water-logging phenomenon; GIS software; Analytic hierarchy process; Underground dam

### 1. Introduction

Despite its geographical location and its containment of the largest produced oil fields in Iraq, the Zubair district suffers from environmental problems and dilapidated infrastructure, which lead to the emergence of many problems including the recent phenomenon of groundwater rising in the Al-Jahza and Hi Al-Shuhida areas. This issue has caused great pressure on the citizens living in these two areas, forcing some of them to sell their homes and migrate from the region while the others remained in difficult circumstances. These water-logged areas are located at a lower level than the neighboring areas. Therefore, all the sewage water and the percolated water from human activity or naturally from water rainfall entering these areas and cause the water-logging phenomena. Although the average depth of groundwater in the city center is almost 2 m, it fluctuates seasonally to reach a depth of 1 m in the rainy seasons. The water-logging occurs when the rise of groundwater levels coincides with the abundance of water leaking into these two areas. Several hazards lead to damage in the building and urban environments owing to the effects of the groundwater rising (Emhanna et al. 2020) Obviously, this is a difficult decision that includes many criteria and determines the best ones based on a number of available alternatives (Safari et al. 2012). Therefore, siting of groundwater dam is a multi-criteria decision-making problem (MCDM). The MCDM is a set of processes which is assigning values to the alternative that is DOI: [10.46717/igj.54.1D.8Ms-2021-04-28](https://doi.org/10.46717/igj.54.1D.8Ms-2021-04-28)