

Deep Injection Wells for Flood Prevention and Groundwater Management

Authors : Mohammad R. Jafari, Francois G. Bernardeau

Abstract : With its arid climate, Qatar experiences low annual rainfall, intense storms, and high evaporation rates. However, the fast-paced rate of infrastructure development in the capital city of Doha has led to recurring instances of surface water flooding as well as rising groundwater levels. Public Work Authority (PWA/ASHGHAL) has implemented an approach to collect and discharge the flood water into a) positive gravity systems; b) Emergency Flooding Area (EFA) – Evaporation, Infiltration or Storage off-site using tankers; and c) Discharge to deep injection wells. As part of the flood prevention scheme, 21 deep injection wells have been constructed to discharge the collected surface and groundwater table in Doha city. These injection wells function as an alternative in localities that do not possess either positive gravity systems or downstream networks that can accommodate additional loads. These injection wells are 400-m deep and are constructed in a complex karstic subsurface condition with large cavities. The injection well system will discharge collected groundwater and storm surface runoff into the permeable Umm Er Radhuma Formation, which is an aquifer present throughout the Persian Gulf Region. The Umm Er Radhuma formation contains saline water that is not being used for water supply. The injection zone is separated by an impervious gypsum formation which acts as a barrier between upper and lower aquifer. State of the art drilling, grouting, and geophysical techniques have been implemented in construction of the wells to assure that the shallow aquifer would not be contaminated and impacted by injected water. Injection and pumping tests were performed to evaluate injection well functionality (injectability). The results of these tests indicated that majority of the wells can accept injection rate of 200 to 300 m³ /h (56 to 83 l/s) under gravity with average value of 250 m³ /h (70 l/s) compared to design value of 50 l/s. This paper presents design and construction process and issues associated with these injection wells, performing injection/pumping tests to determine capacity and effectiveness of the injection wells, the detailed design of collection system and conveying system into the injection wells, and the operation and maintenance process. This system is completed now and is under operation, and therefore, construction of injection wells is an effective option for flood control.

Keywords : deep injection well, flood prevention scheme, geophysical tests, pumping and injection tests, wellhead assembly

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