

Groundwater management in the Darb El Arbaein, Southwestern Desert, Egypt

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Abstract Groundwater is the only water resource in the Darb El Arbaein area of Egypt. The aquifer system extends from Palaeozoic-Mesozoic to Upper Cretaceous sandstone rocks. These overlay the basement rocks and the aquifer is confined. The hydrogeological and hydrogeochemical data of 94 groundwater samples were obtained from the GARPAD authority and used in this paper. In the northern and southern Darb El Arbaein, the hydrogeology did not match with hydrogeochemistry, due to structural elements. Processing using the Modflow Windows (PMWIN) program one can estimate the future out-coming of the hydrogeological environment of Nubian sandstone aquifer, which is a non-renewable groundwater resource in the arid zone. The calibration was made and adjusted to within acceptable hydrogeological characteristics ranges. The model was used to study the water balance elements and to forecast the effect of low to high pumping rates (increase by 25, 50, 100, 200, and 300%) on the water balance and on hydrogeological features. In the northern Darb El Arbaein, the maximum drop of hydraulic head by pumping was in the northwestern part, due to a maximum initial water depth. The hydraulic head dropping was high in the southeastern part, attributed to the lowest transmissivity of the aquifer system. The minimum potentiometric level drop was in the southwestern and northeastern part, because of geographic position relative to regional recharge and local recharge from the surrounding aquifers. In the southern Darb El Arbaein, the minimum hydraulic head dropping was in the southern part, due to the increased aquifer thickness and hydrogeological characteristics values. There is also minimum drop in potentiometric level in the central-northern part, caused by high concentration of faults that receive more groundwater recharge through high hydraulic conductivity. The proposed locations of pumping wells for more irrigation and urbanization were established and concentrated in the minimum potentiometric level drop areas.

Key words Nubian sandstone aquifer; statistical; AquaChem; PMWIN programs