

Mathematical modeling of bara groundwater system – central Sudan

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Groundwater has proved to be a major resource in Northern Kordofan State (NKS) in the development plans of water supply, irrigation as well as industrial sectors. Drinking water supply in the state relies on groundwater for more than 65% of the total consumption. In Bara Basin, Cretaceous sediments extend underlying the Umm Ruwaba sediments. Bara and Umm Ruwaba Provinces are located in NKS within the Eastern Kordofan Groundwater basin; both provinces are considered as the most important provinces as far as the natural resources are concerned. The main purpose of this study is to assess the potential of the aquifer to satisfy the Bara well field needs. The designed model would predict the possible drawdown for 25 years due to planned groundwater development in the project area. The scenario assessed by the study was continuous pumping at the current rate of abstraction from Bara well field and other wells tapping the basin. The current abstraction was estimated at 100m³/d for the shallow aquifer and 300m³/d from wells tapping the lower aquifer. There is no regional movement of groundwater in hard rock's with a transmissivity less than 100 m²/d. In addition to the slow movement of water, the groundwater gradient in hard rock aquifers is dominated by the topography with groundwater movement mainly towards the nearest valley. The main aquifer extends vertically from a depth of 181m to 480m, with high penetration rate from 265m to 338m. According to the model water budget, inflow from the neighbouring aquifer environments is estimated at ~ 26,000 m³/day. The safe yield of the lower confined aquifer is linked to a dynamic water level on top of this aquifer i.e. less than 181m. Safe yield of the lower aquifer can be estimated from the presented model results. In confined aquifer conditions, safe yield is the volume abstracted without aquifer dewatering (piezometric levels decline below the deep aquifer top (320 to 465 m NN)). Thus according to the model calculated drawdown, after 20 years under the current rate of abstraction the aquifer remains under confined conditions with an average dynamic water level of more than 25 m above the top of the deep aquifer. Future Water Demand: groundwater demand projections for Domestic and Livestock Supplies (2007-2027). To cope with the peace agreement, and to cover the transitional periods (2007-2027) future water demands for the rural and urban sectors were calculated accordingly and with 2005 as a base year.

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