Hydro-chemical evaluation of shallow ground water in alluvial aquifers

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Abstract

Groundwater represents a valuable source of water due to its good quality, availableness, and the least requirements for storage and transmission underground structure. In this study, a local groundwater flow model is developed for Al-Mansourieh area within the governance of Diyala. The aim of the study is to determine the safe pumping in the area of study using a mathematical model and to assess the suitability groundwater for drinking and irrigation uses. The model is run as three dimensional in both steady and unsteady states applied in an unconfined aquifer.

Within the scope of the study, data collection is conducted for (244) wells existing in the area of study located very close distances to obtain the groundwater levels in these wells before starting the pumping. These data are necessary for getting a hydraulic head distribution map as the initial condition for model calibration by using different values of hydraulic properties within the range of the region geology. The calibration process is done to achieve a good matching between the calculated head and observed head. After

calibration process, the different scenarios applied to solve groundwater problems in the area of study by change daily operation period as 12,8 and 6 hour/day. Then a sensitivity analysis for input parameters has been performed to know how they affect the output parameters. The results of sensitivity analysis indicated that the hydraulic conductivity is more sensitive than storage coefficient.

The results of simulation of groundwater flow model indicated that the water balance and safe pumping occur when reducing the discharge of pumping wells in the area of study by determining the daily operation period as 6 hour/day with the same discharge rates currently used. This situation can be achieved also by the alternating in operating pumping wells in both daily operation period 8 hour/day and 12 hour/day.

As result of reaching the safe pumping, a simulation can be achieved to propose a new agricultural land for an area of 26.25 Km^2 in sites of high groundwater levels and area of 16.25 Km^2 in another site of low drawdown in groundwater levels by drilling 21 wells at first site and 12 wells at the second site with discharge rates of 600m^3/day located at regular distances.

Finally, the assessment of groundwater quality is done by comparing the physical and chemical parameters for samples of the groundwater with the world and Iraqi standard specifications to show the groundwater suitability for irrigation and drinking uses. The results of this assessment indicate that the groundwater for most wells in the study area is suitable for irrigation purpose, but not all of them are suitable for drinking purpose.