GROUNDWATER FLOW MODELING OF THE LAHORE CITY AND SURROUNDINGS

by

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ABSTRACT

The inhabitants of Lahore city have always been dependent for their water supply on the withdrawal of groundwater. The city has expanded much in the past and is expanding now too, very rapidly. The abstraction of groundwater of 2.8 m^3/s in 1960 has increased to 18.4 m^3/s in 1990 and will increase in future to 48.3 m^3/s (estimated) by the year 2020 due to increasing demands for domestic and industrial use. The increased abstraction of groundwater in concentrated manner has caused a decline of 15.5 meters in water table since 1960. Saline water exists in the south of the city in the areas of Raiwind and Kasur which due to continued decline in water table may rush into the city area. The evaluation of groundwater resource of the aquifer in Lahore area was necessary because of the danger of large decline in water table crossing the economical limit and the saline water encroachment. The United States Geological Survey standardized package "Modular Three Dimensional Finite Difference Groundwater Flow Model" was used for this purpose. The model was calibrated against several historic observed water table contour maps of the aquifer using input data from 1960 to 1990 (31 years). Sensitivity analysis approach was used in the calibration process. Forecasts by the model were made for the period of 1991 to 2020. The pattern of tube wells configuration which is presently in use and has tube wells in some what clustered fashion was given the title as "Existing Pattern of Groundwater Development" in this study. A pattern of groundwater development consisting of (1) narrow spaced tube wells along the bank of river Ravi and (2) widely spaced tube wells in the rest of the model area was proposed for adoption in future. In this thesis, this pattern was given the name as "Proposed Pattern of Groundwater Development". The effects on groundwater regime by the continuously increasing abstraction of groundwater according to the existing and proposed patterns of groundwater development in the normal environment of natural recharge and discharge were determined. The effects of artificial recharge were also tested. If the present pattern of groundwater exploitation is adhered to in future, then, according to the model, the results would be quite alarming. The depth to water table in the center of the cone of depression in the years 2000, 2010 and 2020 will be 29.8, 41.8 and 57 meters respectively. The adoption of proposed pattern of groundwater exploitation will raise the water table making the depth to water table in the years 2000, 2010 and 2020 equal to 8.5, 19.2 and 34.1 meters respectively. Simulations of the artificial recharge of 5.27 and 6.17 m^3/s applied to the existing and proposed patterns of groundwater development respectively resulted in hydraulic heads raised by 3.8 to 5.1 meters in the most stressed area and caused a reduction in seepage from Ravi up to 4.5 m^3/s.