HYDROLOGIC MODELING AND ENVIRONMENTAL MANAGEMENT OF GROUNDWATER RESOURCES WADI EL FARIGH AREA EGYPT

Submitted By

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B. Sc. of Pure Math. & Computer Sciences, Faculty of Sciences, Ain Shams University, 1990

Master in Environmental Sciences, Institute of Environmental Studies and Research, Ain Shams University, 2011

A thesis submitted in Partial Fulfillment

of

The Requirement for the Doctor of Philosophy Degree

In

Environmental Science

Department of Environmental Basic Science

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APPROVAL SHEET

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TO

My Father, Mother, Husband, daughter and sons,

Asmaa, Ahmed and Hazem

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ABSTRACT

Wadi El Farigh area is considered as one of the most important areas in the North of the Western Desert of Egypt. It depends on groundwater of Lower Miocene aquifer as the main source for agricultural and human resources development. However, due to an imbalance of groundwater regime in lower Miocene aquifer, the current study has been conducted. The minimum and maximum temperature, average relative humidity, wind speed, precipitation, degree of aridity and evaporation are estimated. Also, a calculation of groundwater recharge and groundwater extraction rates was carried out, as well as the determination of the groundwater movement and evapotranspiration estimation of the planted areas using known scientific methods.

The main goals are to protect and manage the groundwater resources in the Lower Miocene aquifer in the studied area, and to prevent the lowering in the groundwater level which may lead to deterioration in groundwater quality. These goals are attained by developing a mathematical model that represents the hydrogeological conditions of the area through which thirteen scenarios are conducted for predicting the hydrological situations at different hydrological stresses in the next ten and twenty years. The obtained results indicate that

the hydraulic conductivity varies from 0.1 m/day to 25 m/day, the transmissivity coefficient varies between 1000 m^2/day to 7000 m^2/day, and the specific yield varies from 0.011 to 0.32. In the current study, the amount of groundwater extracted from the Lower Miocene aquifer in the studied area as well as the loss in the amount of groundwater storage were estimated during a hydrological year and for the next ten and twenty years

Some alternative investment plans of groundwater resources in the area, other than the current situation were proposed to predict future environmental situation in case of further development in the studied area. The scenario representing a discharge rate amounts to 98.83×10^6 m^3/year has been chosen to be the best scenario for investment. It represents a total amount of groundwater extraction from the Lower Miocene aquifer in the studied area which is nearly equals the safe yield of the groundwater extraction (97.73×10^6 m^3/year). The scenario that represents a discharge rate amounts to 289.35×10^6 m^3/year has been chosen to be the worst scenario for investment. It shows an example of bad exploitation plans of the groundwater resources in the area, where environmental damages may result from such destructive strategies.

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