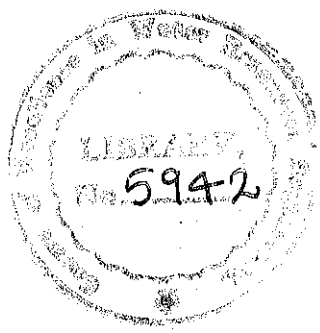
THESIS

TUBEWELL DEVELOPMENT CRITERIA IN SALINE GROUNDWATER USING A NUMERICAL MODEL



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ABSTRACT

TUBEWELL DEVELOPMENT CRITERA IN SALINEGROUNDWATER USING A NUMERICAL MODEL

Irrigated agriculture plays an important role in the economy of Pakistan. To meet the irrigation water requirements groundwater is being pumped through private and public tubewells. In certain areas groundwater resources consist of fresh groundwater layers overlying saline groundwater formation. It has been estimated that approximately 200 billion cubic meters (Bm^3) of fresh groundwater layers exist which are thick near the rivers and their thickness reduces towards center of the doabs. There are other areas in Pakistan where fresh groundwater layers exists in shallow pockets. These hydrogeological settings demand proper design of tubewells with respect to depth of abstraction, rate of abstraction and operation factor to avoid vertical upconing of saline groundwater into fresh groundwater layers. Recently government of Pakistan has decided to privatize the SCRAP tubewells and encourage private sector tubewell development. This will shift the pumpage from deep scarp tubewells to relatively shallow private tubewells. Numerical models were used for the proper design and analysis of this intensive groundwater pumpage.

For the simulation purposes modular three dimensional finite-difference groundwater flow model MODFLOW of the U.S. Geological Survey (McDonald et al., 1988), and the solute transport model MT3D (Zheng, 1990) have been used for the determination of depth of abstraction, rate of abstraction and operation factor of private

and skimming wells. The model solves flow and solute transport equations to find the solute movement and composite quality of tubewell water.

It has been observed for the tubewells of capacity 0.014 and 0.028 m^3/sec penetration ratio should be less than 0.69 and 0.46 respectively in aquifers having 39.5 m thick fresh water layer. At the same time operation factor should not be more than 0.30 and 0.15 for the 0.014 and 0.028 m^3/sec tubewells respectively while, keeping the duration of operation five years.

It has been concluded from this study that this numerical model can serve as a tool for the proper groundwater development and regulation in critical groundwater areas where shallow layer of freshwater overlies poor quality water. In such areas, good quality groundwater can be pumped with out danger of deterioration of fresh groundwater resources if proper depth of abstraction, rate of pumping and operation is designed using the above said flow and solute transport models.

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