ABSTRACT

Water is the prime natural resources, a basic human need and a precious national asset. It is indeed required in all aspects of life and health for producing food, industrial activities, energy generation and maintenance of environment and sustenance of life and development. Water is invariably polluted in all countries. India is no exception to this phenomenon. Groundwater is the cheapest and most practical means of providing water to small communities. In India, more than 80% of the rural populations depend on groundwater. Once the groundwater is contaminated, its quality cannot be restored by stopping the pollutants from the source. It therefore becomes essential to regularly monitor the quality of groundwater and to device ways and means to protect it.

In TamilNadu, there has been a phenomenal increase in the development of groundwater during the post independence period. Consequently, declining trend in water table condition is noticed in almost all places and this creates concern among the all water users. This is true in the case of Erode district also. Hence in this research work, groundwater potential in Erode district and its useablity for drinking and irrigation purposes is determined.

Erode district has an aerial extent of about 8161.91 km^2. The present study covers all plain area of the district excluding hilly and reserved forest areas (5492.19km^2). The study area is located between $10^0$35' and $12^0$0' North latitude and $76^0$50' and $77^0$50' East longitude and 171.91 meters above mean sea level. It is positioned in Northwestern part of Tamil Nadu. The average rainfall in Erode district is 660.10 mm.

The study area base map was generated from the Survey of India (SOI) Toposheets. The slope and drainage maps were also generated from SOI Toposheets on 1:50,000 scale. Then drainage density was also estimated. The other thematic maps like geology, soil, geomorphology and lineament are generated from the maps published by Surface Water Resources Data Centre, Tamil Nadu and all the maps were digitized using ArcGIS 9.1 software. The Land use / Land cover map was derived from IRS-ID LISS-III standard FCC, which was geo-referenced with SOI Toposheets of 1:50,000 scale.

The rainfall and water level data were collected from Surface Water Resources Data Centre, Tamil Nadu for the period from 1997 to 2010 and determined the relationship between them.

To determine the quality of groundwater in the study area, 144 samples were collected randomly in premonsoon (May) and postmonsoon (February) of the year 2007.The samples were analyzed by standard methods (APHA, 1998) and the observed values are compared with Indian Standard (IS) 10500-1991 to determine the suitability for drinking purpose in both the monsoons. The suitability for irrigation purpose was determined by Doneen, Sodium Absorption Ratio (SAR), Wilcox and USSL classification. The major influencing cations and anions were identified by various statistical analyses, Piper and Gibbs diagram.

The groundwater prospects were identified by weighted overlay analysis of various thematic maps like geology, geomorphology, soil, slope, drainage density, lineament density and land use/land cover. Vertical Electrical Sounding (VES) method is used for finding groundwater potential prospect. In this method, based on the resistivity, groundwater potential prospects were estimated in the study area.

The physico-chemical analysis of groundwater revealed that most of the samples are unsuitable for drinking in premonsoon and postmonsoon. As per Doneen (1964) classification, most of the groundwater samples are good for irrigation in both premonsoon (94 %) and postmonsoon (99%) seasons. Based on SAR values, 94% and 90% of samples in the study area could be classified under 'excellent' category of water for irrigation in the pre and postmonsoon respectively. In premonsoon and postmonsoon the Wilcox's classification has revealed that out of 144 samples, 19% and 1 7% of samples fall under excellent to good category. The U.S salinity laboratory classification of groundwater in premonsoon and postmonsoon revealed that 80% and 78% of samples are good water for irrigation. From the WQI, 17% and 5% of the samples come under good type for drinking in premonsoon and postmonsoon.

The statistical analysis of water quality parameter reveals that, there is no considerable change in the correlation pattern among premonsoon water quality parameters and among the postmonsoon water quality parameters. Some of the parameters have higher values of standard deviation during both seasons. It can be concluded that the factors controlling the concentrations of these parameters are not uniform at all the sample locations of the study area.

The groundwater potential map, according to weighted overlay analysis, indicates that 48% of the area comes under good groundwater potential.

According to the identification of the groundwater potential zone by weighted overlay of weathered layer and depth to basement maps in the study area, most of the area come under moderate category (47%) followed by moderate to good (37%).

Based on the weighted overlay of the Lineament density and depth to basement maps, it is seen that the groundwater potential is moderate (84%) in many parts of the study area. The weighted overlay of weathered layer, depth to basement and Lineament density maps reveal that the groundwater potential in the study area is predominantly in moderate category (69%) followed by moderate to good category (20%).

The isoresistivity contour maps show that the groundwater potential is good to very good along the major river basins. The potential is moderate to good in some places at western central portion of the study area. The groundwater potential maps were compared with the bore well yield data.

Visual Modflow is used to develop a regional groundwater flow model for the study area by incorporating various field measured data like twenty three observation well data, meteorological data, pumping rate, aquifer properties, boundary conditions, 12 bore hole lithological data and quality parameters. The model is identified by better correlation between observed and predicted value of groundwater level fluctuation from 1997 to 2010 through calibration and validation process.

The developed model is further used to assess the recharging well location and the quality parameters for drinking and irrigation suitability. From the result the model performs well in the prediction level. Five recharging wells are proposed in well No.5, well No.8 (Bhavani region) well No.9 (Kangayam), well No. 22 and well No.19 are impacted zones under quality parameter consideration. The recharging well perform considerable amount in purification of these wells.