ABSTRACT

The future of the world depends on the sound management of natural resources, such as, water, soil, forest etc. Presently major sources of water for the rural population in India are surface waters, such as, tanks and ponds, and shallow waters available in dug wells. This often results in shortage of available water during dry season as well as in other seasons if there is failure in rainfall. Development of a stable water resource is, therefore, an essential task not only to mitigate water shortage, but also to fulfill the rising demand of water. In this task, Remote Sensing and Geographical Information System are rapidly emerging as very suitable and cost effective techniques.

In the present study, an attempt has been made to delineate various groundwater potential zones in a hard rock terrain, for an overall assessment of groundwater potentiality using an integrated remote sensing, geophysical and GIS approach. Six digital satellite imagery, viz., IRS 1B LISS-II, IRS 1D LISS –III, Landsat MSS, Landsat TM and Landsat ETM+ have been used in this study. The area selected for this study is a part of Bargarh district of Orissa, India lying between 21^0 08' - 21^0 33' North latitudes and 83^0 23' - 83^0 48' East longitudes, covering an area of about 1152 sq km. The study area falls in the Survey of India Toposheets, Nos. 64 O/7, 64 O/11, 64 O/12, 64 O/15 and 64 O/16.

Satellite digital data, selective field study and other collateral data have been used to prepare various thematic maps (layers), viz., lithology, lineament, geomorphology, drainage, soil, land use/land cover and elevation. Secondary thematic maps, namely, slope, drainage density, lineament density and river course gradient maps were generated from elevation, drainage and lineament maps. Saaty's Analytical Hierarchical Process (AHP) was used in assigning weight to each of the thematic layers and rankings to each of the units of individual thematic layers, according to their contributions towards groundwater prospect in an area. All the layers with their weightages and corresponding rankings of units within each layer were integrated in GIS. Based on this assessment, the study area could be divided into six groundwater potential zones, viz., very poor, poor, moderate, good, very good and excellent.

Vertical electrical resistivity sounding following Schlumberger configuration have been carried out at seventy one locations, covering each of the demarcated groundwater potential zones for unraveling subsurface layer parameters, namely, thicknesses and resistivities. On correlating this data with lithologs, the depths and thicknesses of aquifers could be estimated. It is observed that there are three to four layers including top layer in the subsurface; weathered and fractured zones in the subsurface are the water bearing formations. Besides, pumping test data providing yield at eighteen locations obtained from concerned agencies were analysed. It has been found that groundwater potential zones delineated from integration of thematic layers in GIS have good agreement with resistivity and pumping test results. Regions delineated as excellent, have thicker aquifers providing maximum yield of groundwater, while very poor zones have few aquifers giving lower yield.

Further, groundwater from thirty five locations have been collected for chemical quality assessment in order to find the suitability of groundwater in the area for drinking and agricultural purposes. Results show that groundwater in the study area is safe for drinking and irrigation except at a few places. Finally, the total annual groundwater reserve, taking into account the precipitation data as well as draft, has been evaluated in the study area, which shows that recharge is more than the discharge at present.