Demarcation of groundwater potential zones in Karak region using an integrated approach of geospatial and geophysical techniques

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Groundwater resource management is a difficult challenge everywhere due to the rising demand for water from various sectors, including domestic, industrial, and agricultural, as well as the depletion of available supplies. There are several options that may be taken into consideration to solve the abovementioned groundwater management challenges. In Pakistan, areas including the semi-arid and arid regions of South KP are facing water scarcity issues because of the depletion or decline of groundwater levels. The literature review suggests that single remote sensing and GIS methods were used for the identification of water potential zones, but due to the certain limitations of each odel, it is difficult to point out the groundwater potential zones using a single technique. Therefore, this present research study intends to integrate remote sensing and a geophysical approach to identify the groundwater potentiality in Karak region, Khyber Pakhtunkhwa, Pakistan. A weighted overlay analysis (Multi-influence-factor) approach has been carried out using seven thematic layers, namely: geology, rainfall, lineament density, slope, fracture density, land use, land cover, and soil type. It is interpreted that the southern portion of the Karak region is comprised of moderate and poor potential zones, the northeast is composed of high potentiality, and the northwest region is comprised of moderate to high potential. Vertical electrical sounding (VES) ID geophysical has been conducted at three different locations to support the Geospatial data that helps in the precise demarcation of groundwater potential zones.

The interpretation of geospatial and resistivity data reveals that both data sets have similar findings, i.e., at VES point-01, the water level is interpreted at 30 meters, while the same zone is considered a high potential zone by the MIF model; the water depth at VES point-02 is recognized at 170 meters, while a poor zone is marked by the MIF; and at VES point-03, the water surface is found at a depth of 137 meters, while the same zone appeared moderate to poor by the MIF model. The aforementioned interpretation is validated with the well data that has been collected from a local perspective and that depicts the 85 percent accuracy of both data sets. It is concluded that the integration of geospatial and ground geophysical approaches is an efficient way to delineate the groundwater potential zones.

Keywords: Vertical Electrical Sounding (VES); Multi-Influence-Factor (MIF); rainfall; lineament density; fracture density; Groundwater Potential Zones