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Application of Electromagnetic and Electrical Geophysical Investigation Techniques for Groundwater Potential Evaluation of a Complex Geological Transition Terrain

Thirty-five VLF-EM profiles, 140 VES and relevant hydrogeological data were acquired along regular grids/profiles for detailed terrain/subsurface mapping of Ijebu-Ode which is situated within a problematic transition zone, between the Precambrian Basement rocks and Cretaceous sediments of Dahomey Basin, in southwestern Nigeria, where unique geological structures, complex coexistence of different rock types and poorly defined basal/lateral contacts make groundwater development very challenging. Obtained data were filtered, inverted and enhanced and the resultant current density and geoelectric parameters were employed to generate terrain conductivity distribution and subsurface geophysical models.
Conductivity distribution identified three layers in the Basement Complex terrain which comprised lateritic topsoil, weathered and fresh basement rocks. The five layers encountered in the sedimentary terrain were top-soil, lateritic unit, dry sandy unit, saturated sandy unit and fresh basement rocks. Hydraulic conductivity of thick lateritic unit was determined to be 1.32 x 10-5 mm/sec, while that of the underlying sandy units, averaged 1.36 x 10-3 mm/sec. The low groundwater resource potential around Ijebu-Ode is due to less permeable lateritic overburden which overlaid more permeable rock units that prevents adequate recharge during/immediately after rainfall as well as rugged/undulating basement topography that controls the distribution and storage of the limited recharged water.

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