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Integrated Geophysical methods to map geological structures and characterize groundwater potential

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Groundwater, being a crucial resource for domestic use due to its minimal treatment requirements, necessitates comprehensive characterization for sustainable management. This study investigates the hydrogeological structures and aquifer potential of the Meki to Alemtena area, integrating vertical electrical sounding (VES) and magnetic methods for a multidisciplinary approach to groundwater delineation. VES interpretations identified five to seven lithological layers with aquifer thicknesses ranging from 40 to 70 meters, primarily comprising fractured and weathered ignimbrite, sand, and alluvial deposits. Magnetic analysis revealed lithological trends predominantly oriented northeast-southwest (NE-SW) along the northern and southern margins and deep-seated structures trending east-west (E-W), which significantly influence groundwater flow directions. Key anomalies detected through 3D Euler deconvolution and 2D magnetic modeling correspond to deep geological features that impact groundwater movement. The integrated geophysical approach enabled precise delineation of aquifer boundaries, estimation of thickness, and evaluation of storage capacity, providing critical insights into groundwater flow dynamics. These findings contribute to improved groundwater resource management, facilitating sustainable utilization and conservation strategies.

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