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ASSESSMENT OF HYDROGEOLOGICAL CONDITIONS USING RESISTIVITY DATA: A CASE STUDY IN MORAGAHAKANDA AREA, SRI LANKA

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A resistivity survey was carried out to determine resistivity based hydrogeological properties of sub-surface for a selected Precambrian Terrain in Highland Complex of Sri Lanka. Vertical Electrical Soundings (VES) were carried out using Schlumberger Electrode Array (SEA) and drilling was carried out at selected locations up to 40-60 m depths. Subsurface conditions and lithology were determined using borehole logging. The resistivity method is a reliable alternative in surveying shallow depth for geotechnical investigations. The SEA was adopted for resistivity surveys. Calibration of resistivity data was done corresponding to the findings from boreholes. Interpretation of the VES and borehole data indicates the presence of various rock conditions, overburden depth, groundwater level and an idea about the yield. The lithology of the area is charnokitic gneiss, quartzite and karstic marble. Resistivity values and borehole drilling data were compared and correlated. VES yields a straightforward interpretation of the subsurface structures and these results helped in positioning a trench for fault characterization and identification of subsurface condition. The electrical resistivity of the subsurface materials was dependent on porosity, permeability, mineral composition, weathering state of the bedrock and moisture content. To analyze sub-surface layering and groundwater quality, density maps were prepared using ArcGIS 10.3. The thickness of soil layer is greater in the southern and central parts of the study area. Groundwater yield of the hard rock aquifer is high in the central and western parts of the area. Groundwater level is comparatively shallow along the North South running belt across the central parts of the area which mostly underlain by marble. Electrical conductivity, alkalinity and hardness show almost the same geographic distribution. Geographic distribution of Fe in groundwater is different and an iron rich East West running belt is shown across the central parts of the area. Although, marble rock shows low formation resistivity ranges, rock type specific resistivity range cannot be established using VES alone.

Keywords: Vertical Electrical Soundings, Schlumberger array, Porosity, Permeability.