

Time-lapse resistivity investigation of salinity changes at an ex-promontory land: a case study of Carey Island, Selangor, Malaysia

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Abstract Time-lapse resistivity measurements and groundwater geochemistry were used to study salinity effect on groundwater aquifer at the ex-promontory-land of Carey Island in Malaysia. Resistivity was measured by ABEM Terrameter SAS4000 and ES10-64 electrode selector. Relationship between earth resistivity and total dissolved solids (TDS) was derived, and with resistivity images, used to identify water types: fresh ($\rho_e > 6.5 \Omega \text{ m}$), brackish ($3 \Omega \text{ m} < \rho_e < 6.5 \Omega \text{ m}$), or saline ($\rho_e < 3 \Omega \text{ m}$). Long-term monitoring of the studied area's groundwater quality via

measurements of its time-lapse resistivity showed salinity changes in the island's groundwater aquifers not conforming to seawater-freshwater hydraulic gradient. In some aquifers far from the coast, saline water was dominant, while in some others, freshwater 30 m thick showed groundwater potential. Land transformation is believed to have changed the island's hydrogeology, which receives saltwater pressure all the time, limiting freshwater recharge to the groundwater system. The time-lapse resistivity measurements showed active salinity changes at resistivity-image bottom moving up the image for two seasons' (wet and dry) conditions. The salinity changes are believed to have been caused by incremental tide passing through highly porous material in the active-salinity-change area. The study's results were used to plan a strategy for sustainable groundwater exploration of the island.

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