GEOPHYSICAL INVESTIGATION OF ST. CATHERINES ISLAND USING ELECTRICAL RESISTIVITY AND GROUND PENETRATING RADAR

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St. Catherines Island is a barrier island experiencing saltwater intrusion via structural pathways that may include joints, faults, or sag structures. This study used geophysical methods of electrical resistivity (ER) and ground penetrating radar (GPR) to locate and determine the modes of transportation of the saltwater. The geophysical study was conducted in November of 2016 near a shallow (6-7 m deep) aquifer well traverse that has shown recent spikes in chloride concentration. Three geophysical transects where collected using ER and GPR. The ER data were collected using 56 electrodes with either 2 m or 3 m spacing. A dipole-dipole array with a strong gradient was used for data collection and then inverted using EarthImager 2D (Advanced Geosciences, Inc.). The GPR data were collected along the same transects as the ER data using a 100 MHz shielded antenna set at a shallow time window and a 250 MHz shielded antenna set at a deep time window. The GPR profiles were processed using Object Mapper (MALA). The ER data show a low resistivity layer at 1-6 m depth that correlates with the sandy surficial aquifer, a higher resistivity layer at 6-13 m depth that may represent a clay aquitard, and a low resistivity layer from 13-26 m depth that may represent a deeper aquifer. The GPR data suggest lateral and vertical variation in water saturated porosity of the sandy surficial aquifer and a sharp reflector below the aquifer that is interpreted as the top of the clay aquitard. The geophysical data correlate and will be combined to investigate structures causing the saltwater intrusion. This research will allow us to gain a better understanding of the hydrogeology of St. Catherines Island and how it may be impacted by rising sea level, along with the other barrier islands along the Georgia coast.

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