STUDENT-LED HYDROGEOLOGICAL CHARACTERIZATION OF COLORADO RIVER ALLUVIAL TERRACES NEAR AUSTIN, TEXAS USING INTEGRATED GEOPHYSICAL METHODS

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Students in the University of Texas at Austin's Hydrogeophysics field course deployed several geophysical instruments at Commons Ford Ranch Metropolitan Park, a small (0.9 km2) public park on the Colorado River, in the karstic hill country west of Austin, Texas. Goals were to (a) become familiar with the theory, operation, and application of near-surface geophysical instruments, and (b) use these instruments in an Austin-area hydrogeological investigation. The field site has diverse hydrogeologic features including at least three Quaternary alluvial terraces, a nearby historic spring on the Colorado River that was flooded when the river was dammed, and stacked aquifer systems. Our four-day field campaign during the Fall 2017 semester employed electromagnetic, electrical resistivity, seismic, ground-penetrating radar, and airborne LiDAR methods. These surveys reveal that the lowest-elevation terrace, adjacent to the Colorado River, is a mainly flat, 8-10 m thick layer of sandy alluvium within which the water saturation increases with depth. Adjacent to this terrace is a second, raised terrace composed of alluvium that is more electrically resistive and drier. An electrical resistivity transect across these two terraces reveals a stair-stepped flood-plain thickness that is consistent with the erosional contact with underlying Cretaceous Glen Rose Limestone bedrock. GPR data acquired using 50-, 100-, and 200-MHz antennas revealed intra-alluvial and likely bedrock reflectors where bedrock is shallow. Frequency-domain EM data revealed apparent conductivity variations caused by differences in lithology (alluvium and bedrock) and water saturation. Direct and critically refracted arrivals in seismic data were used to determine water-table depths and alluvial thickness on the lowest terrace. Results from time-domain EM measurements and resistivity surveys were used to estimate alluvial thicknesses within the lower and intermediate terraces. TDEM soundings also detected a deeper conductive layer that is interpreted to be the top of Paleozoic metasedimentary rocks shed from the Ouachita orogenic belt.