USING GEOPHYSICS TO ASSIST AN INTERNAL EROSION/SEEPAGE INVESTIGATION AT THE TVA CHATUGE DAM

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The Tennessee Valley Authority's (TVA) Chatuge Dam (CTH) is located on the Hiwassee River in Clay County, North Carolina in the Blue Ridge physiographic province. The dam foundation consists of residual, alluvial, and colluvial soils which overlie metamorphic and igneous rocks of the Carolina Gneiss formation. CTH is an earthen embankment about 3,000 feet in length originally constructed in 1942 for flood storage and flow regulation for the Hiwassee Dam further downstream with a single hydropower generating unit added in 1954. Visual evidence of seepage, standing water, and subsidence have been documented at CTH since construction but of particular concern is an area on the left abutment that has exhibited persistent seepage in recent years. Historical investigations have been performed by TVA, and we previously performed a limited geophysical exploration in 2014 using the Electrical Resistivity Tomography (ERT) and Spontaneous Potential (SP) methods. In 2016, TVA requested that a more comprehensive supplemental geophysical exploration be conducted to assist them in assessing current and future risks associated with internal erosion/seepage with particular focus on the left embankment. For the 2016 exploration, we performed (1) a multi-depth Frequency Domain Electromagnetic (FDEM) survey over an approximate 26 acre area to identify conductive features potentially related to increased moisture and/or buried structures that may be an influence on the other geophysical techniques, (2) a SP grid within the left half of the dam to identify areas of potential fluid movement through the underlying media, and (3) additional ERT survey lines and a Seismic Refraction (SR) survey to focus on the phreatic surface and top of bedrock. Several correlating features were identified and ultimately the geophysical survey results, along with spatial data such as wells, borings, CPTs, bedrock and ground surfaces, etc., were used in the development of a three-dimensional conceptual site hydro-geologic model.