CENTER FOR TRANSPORTATION INFRASTRUCTURE AND SAFETY

GEOPHYSICAL INVESTIGATION, LAKE SHERWOOD DAM SITE, EAST-CENTRAL MISSOURI

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16. Abstract

Electrical resistivity and self potential (SP) data were acquired across selected segment of the Lake Sherwood earth-fill dam and in designated areas immediately adjacent to the dam.

The 2-D electrical resistivity profile data were acquired with the objectives of imaging the subsurface to depths on the order of 60 ft and identifying constructed keyway. The SP data were acquired with the objective of identifying active seepage/flow pathways in the subsurface.

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EXECUTIVE SUMMARY

Electrical resistivity and self potential (SP) data were acquired across selected segments of the Lake Sherwood earth-fill dam and in designated areas immediately adjacent to the dam.

The 2-D electrical resistivity profile data were acquired with the objectives of imaging the subsurface to depths on the order of 60 ft and identifying constructed clay keyway. The SP data were acquired with the objective of identifying active seepage/flow pathways in the subsurface.

The top of bedrock is interpreted as the 80 ohm-m contour interval below elevation 130 feet. Above elevation 130 feet, contour interval values greater than 80 ohm-m are interpreted as grouted soils or very dry soil. The most significant feature on resistivity profiles 1-2 is the zone of anomalously low resistivity centered between stations 126 and 142 feet on profile 1 and between stations 118 and 134 feet on profile 2. This anomaly is consistent with current thoughts regarding the most probable location of the constructed keyway. Bedrock on resistivity profile 2 beneath to the northeast of the interpreted “clay key location” is characterized by low resistivities, especially at depths on the order of 60+ ft. This same feature is observed, but is not so pronounced, on profile 1. The zone of low resistivity at the base of the interpreted key could represent a flow pathway.

Anomalously high SP readings (negative values) were recorded at observation locations along the abutment several hundred feet from the upstream face of the dam. These zones possibly represent inlet points for the higher temperature waters that exit the downstream face of the dam at the site denoted as the “waterfall”.

1. SCOPE OF WORK

Electrical resistivity and self potential (SP) data were acquired across selected segment of the Lake Sherwood earth-fill dam and in designated areas immediately adjacent to the dam.

The 2-D electrical resistivity profile data were acquired with the objectives of imaging the subsurface to depths on the order of 60 ft and identifying constructed keyway. The SP data were acquired with the objective of identifying active seepage/flow pathways in the subsurface.

2. ELECTRICAL RESISTIVITY DATA

Three electrical resistivity profiles were acquired at the Lake Sherwood dam site on June 11th 2008 (Figure 1).

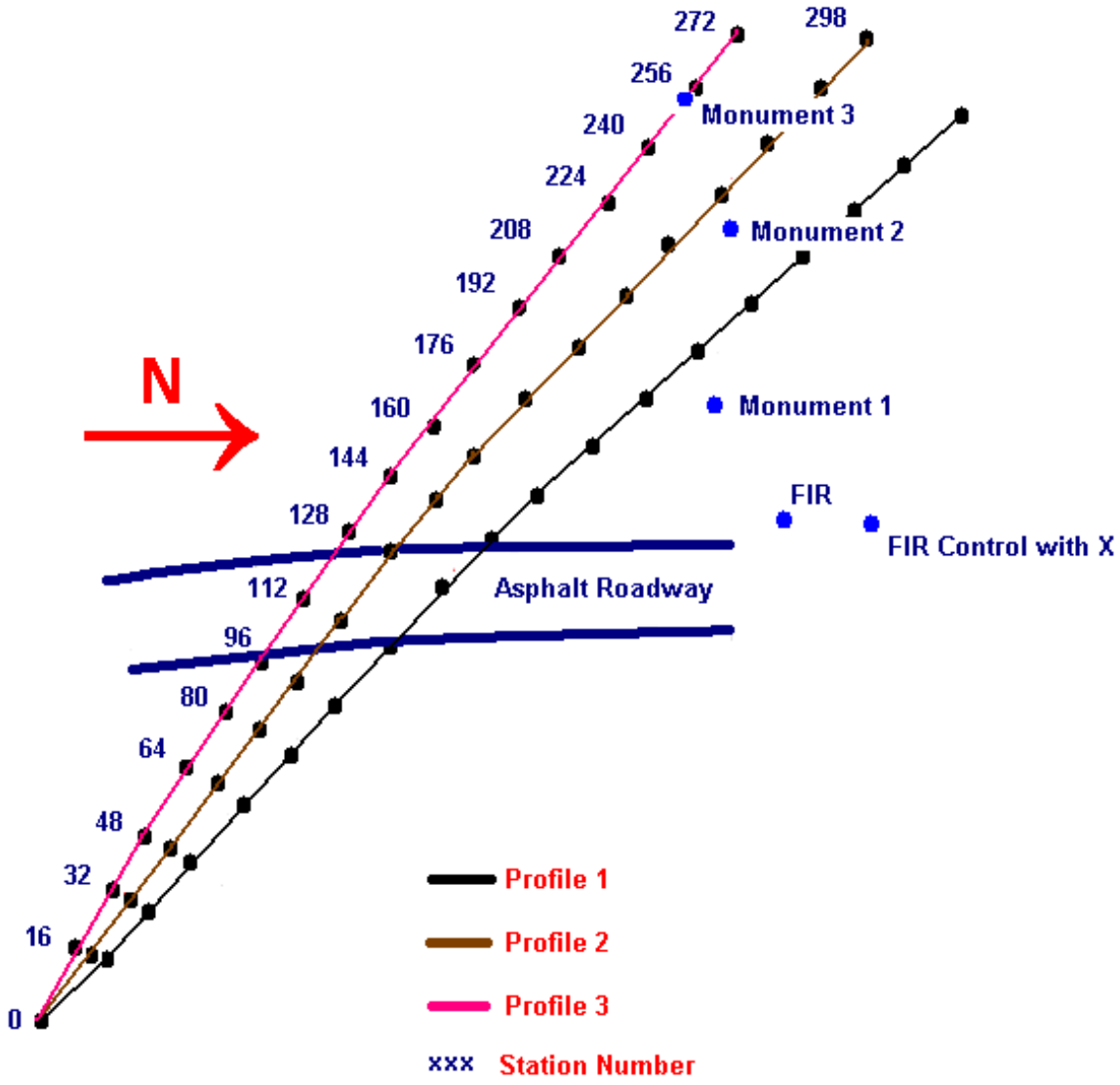

Figure 1: Locations of electrical resistivity profiles 1, 2 and 3.

The three electrical resistivity profiles acquired on June 11th were recorded using a SuperSting R8 resistivity unit equipped with 72 electrodes centered along the western edge of the asphalt roadway across the dam using a dipole-dipole array configuration and an electrode spacing of 4 feet (Figures 1 and 2). These survey parameters provided for depths of investigation on the order of 60 ft. Note that station 0 is at the southeast end of the resistivity profiles (Figures 1 and 2). Only two of the three resistivity profiles are shown in this report. Unfortunately, half of the third data set was contaminated by noise (probably because a cable connection on the roadway was inadvertently wetted).

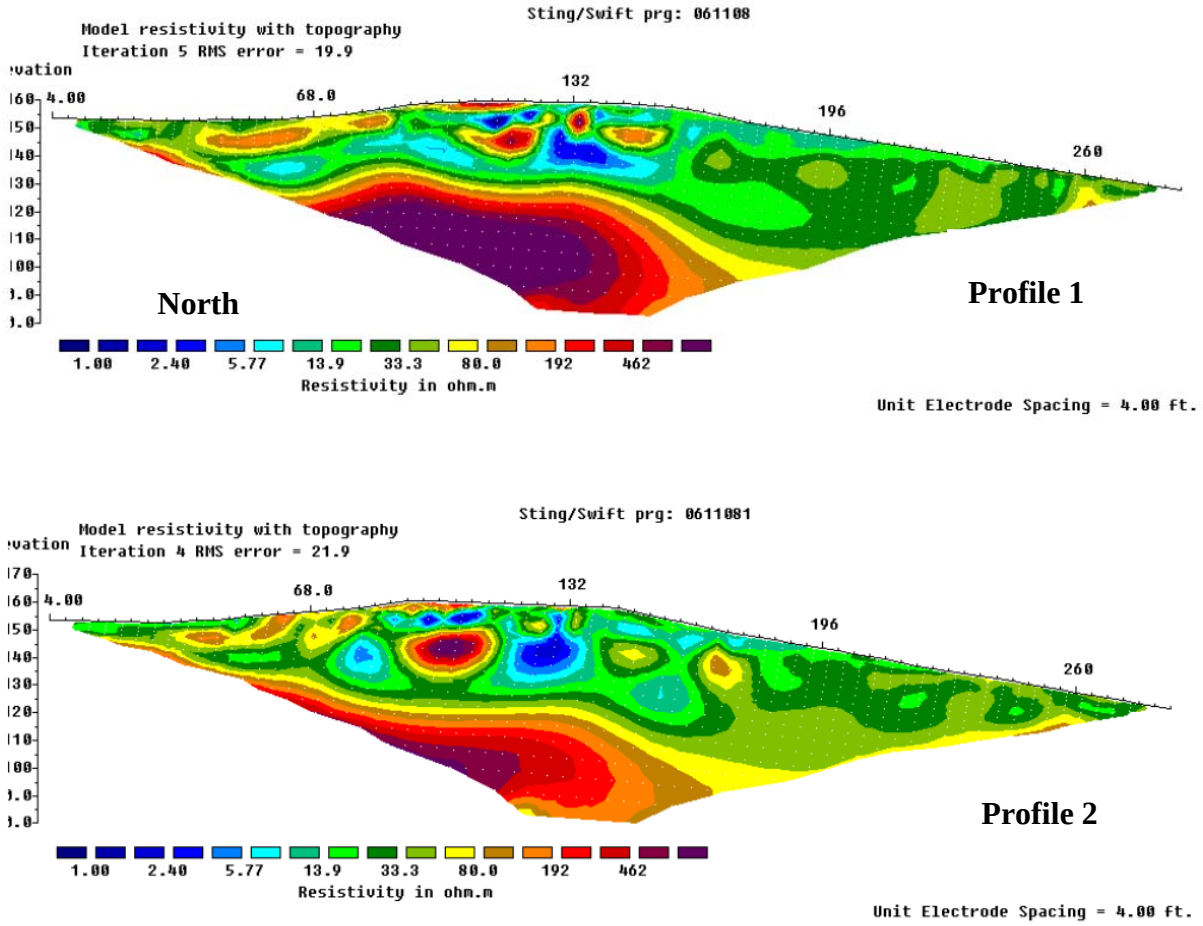

Figure 2: Electrical resistivity profiles 1-2.

The top of bedrock is thought to correlate reasonably well with the 80 ohm-m contour interval below elevation 130 feet. Above elevation 130 feet, contour intervals with values greater than 80 ohm-m are interpreted as grouted soils or very dry soils. The most significant feature on resistivity profiles 1-2 is the zone of anomalously low resistivity (<5 ohm-m) centered between stations 126 and 142 feet on profile 1 and between stations 118 and 134 feet on profile 2.

This zone of anomalously low resistivity is interpreted as indicative of “moist clay” and is consistent with current thoughts regarding the most probable location of the constructed keyway. This “zone of anomalously low resistivity” does not extend below the interpreted top of bedrock. We suspect this is because 1) the resistivity traverses do not cross the key at right angles, 2) more “smoothing” occurs at

depths greater than 40 feet than at depths less than 40 feet, and 3) some grout may have been injected into the clay key.

We note however, that bedrock on profile 2 beneath and to the northeast of the interpreted "clay key location" is characterized by low resistivities, especially at depths on the order of 60+ ft. This same feature is observed, but is not so pronounced, on profile 1. The zone of low resistivity at the base of the interpreted key could represent a flow pathway.

3. SELF POTENTIAL (SP) DATA

Self potential (SP) data were acquired at multiple test locations on and immediately adjacent to the Lake Sherwood dam. The trailing electrode was coupled to the base station; located more than 100 ft from the water's edge; the lead electrode was coupled to the ground at each test location (Figure 3).

Figure 3: Non-polarizable Model #920 023 SP electrodes.

The SP tool is unique because it is the only geophysical method that responds directly to the presence of flowing/seeping water (into the subsurface). Locations where water is flowing/seeping into the ground are typically characterized by prominent negative anomalies; locations where water is flowing/seeping out of the ground are normally characterized by prominent positive anomalies (FHWA, 2005).

Figure 4 shows SP profiles acquired along the southerly shore line of Lake Sherwood. Station 0 feet being the easterly end, station 200 feet being the westerly end and station 240 feet being the northerly end. Though the profile is shown as a linear feature, at station 200 feet, the physical layout of the land turns north. Four docks are constructed along this shore line with the first eastern dock centered at station

6 feet, the second centered at station 54 feet, the third one centered at station 113 feet and the fourth and the most westerly one centered at station 173 feet.

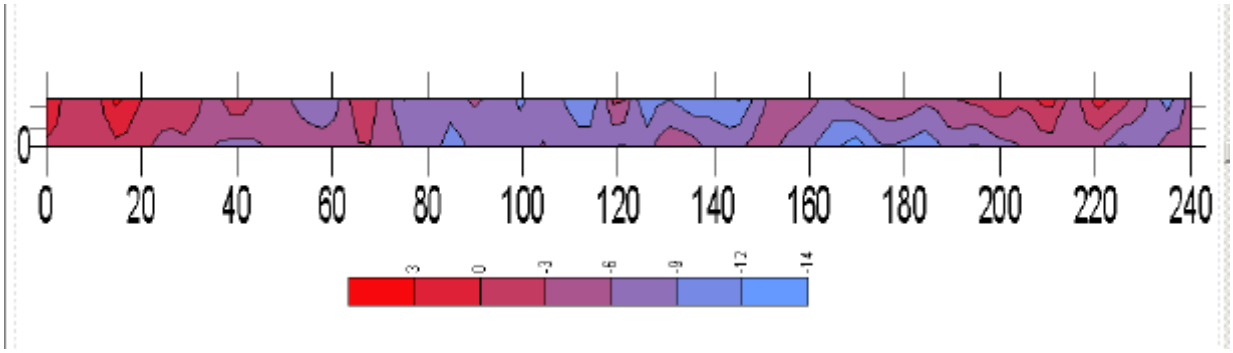

Figure 4: Lake Sherwood SP profile

4. RECOMMENDATIONS

In our opinion, the zone of anomalously low resistivity (<5 ohm-m) centered between stations 126 and 142 feet on profile 1 and between stations 118 and 134 feet on profile 2 is probably indicative of "moist clay" and is consistent with current thoughts regarding the most probable location of the constructed keyway. We note that bedrock on profile 2 beneath and to the northeast of the interpreted "clay key location" is characterized by low resistivities, especially at depths on the order of 60+ ft. This same feature is observed, but is not so pronounced, on profile 1. The zone of low resistivity at the base of the interpreted key could represent a flow pathway.

In our opinion, the zone of anomalously low (negative) SP readings represents possible inlet points for the higher temperature waters that exit the downstream face of the dam at the site denoted as the "waterfall". This interpretation should be considered by any geotechnical engineers involved in ongoing mitigation efforts.

5. REFERENCES

FHWA, 2005, Application of Geophysical Methods to Highway Related Problems: http://www.cflhd.gov/agm/index.htm