United States Department of Agriculture
Soil Conservation Service
Northeast NTC
160 East 7th Street
Chester, PA 19013

Subject: GPR - Site Investigation Brodhead Watershed; September 8-10, 1987
Date: September 17, 1987

To: James H. Olson
State Conservationist
Soil Conservation Service
Harrisburg, PA

File code:

Purpose:

To use GPR techniques to search for indications of dam deterioration associated with seepage processes and to establish grid line and initial radar profiles for continued surveillance and monitoring.

Participants:

Bruce Benton, Geologist, SCS, Harrisburg, PA
James Doolittle, Soil Specialist (GPR), SCS, Chester, PA
David Faerber, Construction Engineer, SCS, Harrisburg, PA

Equipment:

The radar system is the SIR System-8. Components of the SIR System-8 include the Model 4800 control unit, the ADTEK DT-6000 tape recorder, and the ADTEK Model 8004H graphic recorder. The 120 MHz antenna was used with the Model 705DA transceiver. The scanning time was set at 140 nanoseconds.

Activities:

A grid had been established across the dam prior to the arrival of the GPR. The grid covered the entire dam and was irregular in outline. Observation flags had been set in the embankment at 50 foot (parallel with the face of the dam) by 25 foot (perpendicular with the dam) intervals. All transects were conducted by hand towing the antenna to the left (looking downstream) of each observation flag across and perpendicular to the dam structure. The GPR completed sixteen transect. Transect lines varied in length from 125 to 625 feet. Eleven additional transects were conducted in areas suspected of having underlying internal problems.

Results:

The search effort attempted to establish the possible occurrence and location of seepage and solution feature within the embankment given constraints of time, manpower, and cost. The GPR provides a rapid, nondestructive, economical method for locating major solution or seepage features manifested in the upper 8 to 11 feet of embankment materials. However, grid spacing dictated the probability of detection.

No major solution features were apparent on the graphic profiles. However, a major zone of subsurface seepage was inferred from the radar profiles. This zone occurs on the downstream side of the embankment between observation flags 7 and 11 on transect lines 4+00 and 4+50. The potential seepage zone was inferred from the exceptionally high and localized levels of background noise and signal reverberations. Background noise and signal reverberation increases with the conductivity of earthen materials. Conductivity increases with clay, water, and salt contents or concentrations. It is assumed from the excessive levels of background noise and signal reverberation that soil moisture is higher in this zone as a result of seepage.

The radar search failed to detect any major subsurface anomaly. It is therefore assumed that the integrity of the dam is, at this time, intact. However, subsurface seepage is suspected in a specified area and continued monitoring with the GPR should be planned. This survey has established benchmark radar profiles upon which future profiles can be compared to detect progressive changes, if any, in the fabric and integrity of the dam embankment.

I wish to recommend that GPR surveys be periodically repeated, especially in the zone of suspected seepage, at Brodhead Dam. With the aid of an All-Terrain Vehicle (ATV), this task could be completed in one day by two people.

All graphic profiles of the Brodhead Dam have been returned to Bruce Benton under a separate cover letter. These profiles should be filed for future comparative field work.

JAMES A. DOOLITTLE
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cc:
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