

Attachment A - Summary of the Geotechnical Exploration and Stability Analyses

General practice is to analyze the stability of the downstream slope of a dam for steady-state seepage conditions with the pool at its normal operating elevation, since this is the loading condition the embankment would experience most. This condition is called steady seepage with maximum storage pool (USACE) and normal operating condition (TVA). Both USACE and TVA practices for this loading condition indicate the minimum acceptable safety factor is 1.5. Based on the results of these stability analyses, over the majority of its length, the perimeter dike exhibits a safety factor that is less than the accepted minimum.

Summary of the Geotechnical Exploration and Stability Analyses

The geotechnical exploration and stability analyses included:

- Protocols and guidelines established by USACE.
- A review of TVA's design drawings for comparison with existing conditions.
- Twenty-eight soil test borings advanced by Stantec at 13 separate stability cross sections. These borings provide primary information for the stability analyses. Borings averaged from 50 to 60 feet total depth. Continuous sampling was performed.
- Piezometers for monitoring water levels were installed in separate borings drilled at these locations.
- Twenty-one soil test borings were advanced by Stantec for supplemental geotechnical data. These borings averaged about 30 feet in depth.
- Sixty-eight boring logs, developed during previous geotechnical studies, were reviewed for supplementary data.
- A laboratory testing program with 14 sets of consolidated undrained triaxial compression tests.
- Laboratory test results from earlier geotechnical studies were reviewed. Where applicable, these results were also used in establishing parameters for the analyses.
- Stability cross sections were surveyed by TVA's survey crews.
- Eight cross sections were selected for formal slope stability analyses, and the long-term steady-state seepage condition was analyzed at each.

Results of Exploration and Stability Analyses

The results from the geotechnical exploration indicate that the active ash storage area perimeter dike is comprised of clay and silty clay. The dike was raised once in 1978 using the upstream method of construction; therefore, the upper dike's interior slopes are over sluiced ash.

The dike is underlain by fill materials that were dredged and sluiced in place to raise the land above the level of Kentucky Reservoir. In general, this material is not well-compacted,

and it contains zones of higher permeability that transmit seepage from the ash storage area.

Beneath these materials, alluvial clays and silts, which grade into sand/gravel river deposits were encountered in the borings.

The results from the stability analyses indicate that the perimeter dike does not exhibit an acceptable safety factor of 1.5 for the long-term steady-state seepage condition. Safety factors ranging from a low value of 1.16 (at Stability Section C1 on the east dike) to a high value of 1.53 (at Stability Section I on the west dike) were calculated. In general, lower safety factors were calculated on the northeast and southeast sections of the perimeter dike. The slope stability at each stability section was analyzed using Geo-Slope's Slope/W computer program. The long-term steady-state seepage conditions were analyzed using Spencer's method. Circular failure surfaces with optimization were conducted. This can result in the minimum safety factor being calculated on noncircular surface.