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Coal Combustion Residue Impoundment
Round 11 - Dam Assessment Report

John Sevier Fossil Plant

Ash Basin Dikes
Tennessee Valley Authority
Rogersville, Tennessee

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

Dewberry Consultants LLC
Fairfax, Virginia

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INTRODUCTION, SUMMARY CONCLUSIONS AND RECOMMENDATIONS

The release of over five million cubic yards of coal combustion residue from the Tennessee Valley Authority's Kingston, Tennessee facility in December 2008, which flooded more than 300 acres of land and damaged homes and property, is a wake-up call for diligence on coal combustion residue disposal units. A first step toward this goal is to assess the stability and functionality of the ash impoundments and other units, then quickly take any needed corrective measures.

This assessment of the stability and functionality of the John Sevier Fossil Plant Ash Basin Dikes is based on a review of available documents and on the site assessment conducted by Dewberry personnel on September 13, 2011. We found the supporting technical documentation adequate (Section 1.1.3).

In summary, the John Sevier Fossil Plant Bottom Ash Disposal Area 2 management unit, and the Dry Fly Ash Stack impoundment dike are **SATISFACTORY** for continued safe and reliable operation.

PURPOSE AND SCOPE

The U.S. Environmental Protection Agency (EPA) is investigating the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant, or High Hazard Potential ranking (for Classification, see pp. 3-8 of the 2004 Federal Guidelines for Dam Safety).

In early 2009, the EPA sent letters to coal-fired electric utilities seeking information on the safety of surface impoundments and similar facilities that receive liquid-borne material that store or dispose of coal combustion residue. This letter was issued under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104(e), to assist the Agency in assessing the structural stability and functionality of such management units, including which facilities should be visited to perform a safety assessment of the berms, dikes, and dams used in the construction of these impoundments.

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EPA requested that utility companies identify all management units including surface impoundments or similar diked or bermed management units or management units designated as landfills that receive liquid-borne material used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Utility companies provided information on the size, design, age and the amount of material placed in the units.

The purpose of this report is **to evaluate the condition and potential of residue release from management units and to determine the hazard potential classification**. This evaluation included a site visit. Prior to conducting the site visit, a two-person team reviewed the information submitted to EPA, reviewed any relevant publicly available information from state or federal agencies regarding the unit hazard potential classification (if any) and accepted information provided via telephone communication with the management unit owner. Also, after the field visit, additional information was received by Dewberry & Davis LLC about the John Sevier Fossil Plant Ash Basin Dike(s) that were reviewed and used in preparation of this report.

This report presents the opinion of the assessment team as to the potential of catastrophic failure and reports on the condition of the management unit(s).

Note: The terms "embankment", "berm", "dike" and "dam" are used interchangeably within this report, as are the terms "pond", "basin", and "impoundment".

<u>LIMITATIONS</u>

The assessment of dam safety reported herein is based on field observations and review of readily available information provided by the owner/operator of the subject coal combustion residue management unit(s). Qualified Dewberry engineering personnel performed the field observations and review and made the assessment in conformance with the required scope of work and in accordance with reasonable and acceptable engineering practices. No other warranty, either written or implied, is made with regard to our assessment of dam safety.

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit, September 13, 2011, and review of technical documentation provided by the Tennessee Valley Authority.

1.1.1 Conclusions Regarding the Structural Soundness of the Management Unit(s)

The dike embankments and spillways appear to be structurally sound based on Dewberry engineers' observations during the site visit. Calculations of Factors of Safety under static and seismic conditions for the Bottom Ash Disposal Area 2 and the Dry Fly Ash Stack impounding embankments by TVA and its contractors show the embankments meet the minimum Factors of Safety. Dewberry engineers noted that different shear strength values were used in static and seismic analyses for factors of safety for Bottom Ash Disposal Area 2.

1.1.2 Conclusions Regarding the Hydrologic/Hydraulic Safety of the Management Unit(s)

Hydrologic and hydraulic analyses provided to Dewberry indicate adequate impoundment capacity to pass the Probable Maximum Precipitation 6-hour design storm without overtopping the embankment.

The hydrologic and hydraulic data indicate the Dry Fly Ash Stack West Sediment Pond can pass the one-percent probability (i.e., the 100-year storm) in a given year precipitation without overtopping the embankment. The East Sediment Pond can pass the 25-year storm event without overtopping the perimeter.

The hydrologic and hydraulic data indicate the Bottom Ash Disposal Area 2 and Dry Fly Ash Stack West Sediment Pond meet the minimum US Army Corps of Engineers recommended design criteria. However, the Dry Fly Ash Stack East Sediment Pond does not meet the recommended design criteria. Based on the relatively small size of the pond, its location away from the Holston River, and the minimal amount of ash in the pond, not meeting the design requirements in not considered a major issue for ash release.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation is adequate. Although the documentation provided did not include an assessment of the potential for liquefaction, a qualitative analysis conducted by Dewberry indicates that the soils identified in the boring logs do not have a significant liquefaction potential at either the Bottom Ash Disposal Area 2 or Dry Fly Ash Stack impoundments. TVA-provided engineering documentation is referenced in Appendix A. The Dewberry liquefaction analysis is in Appendix B, Doc 16.

1.1.4 Conclusions Regarding the Description of the Management Unit(s)

The description of the management unit provided by the owner was an accurate representation of what Dewberry observed in the field.

1.1.5 Conclusions Regarding the Field Observations

Dewberry staff was provided access to all areas in the vicinity of the management units required to conduct a thorough field observation. The visible parts of the embankments and outlet structure were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability. Embankments appear structurally sound. There are no apparent indications of unsafe conditions or conditions needing remedial action.

1.1.6 Conclusions Regarding the Adequacy of Maintenance and Methods of Operation

The current maintenance and methods of operation appear to be adequate for the Bottom Ash Disposal Area 2 and Dry Fly Ash Stack Impoundment management units. There was no evidence of significant embankment repairs or prior releases at the Bottom Ash Disposal Area 2 impoundment observed during the field inspection.

There was no evidence of recent releases from the Dry Fly Ash Stack impoundment. Although there was little visible indication of recent construction, the condition of the Dry Fly Ash Stack impoundment embankments were consistent with design improvements recommended in the February 8, 2010 geotechnical report.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program appears to be adequate. The management unit dikes are instrumented. Both piezometers and inclinometers have been placed within the embankments and are monitored weekly.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The Bottom Ash Disposal Area 2 and Dry Fly Ash Stack impoundment embankments are rated SATISFACTORY for continued safe and reliable operation.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding Structural Stability

The Draft report recommended that the Bottom Ash Disposal Area 2 static and seismic slope stability analyses be revisited to calibrate the different shear strength values used in the static and seismic models. Based on Dewberry's recommendation TVA's consultant (Stantec) reviewed the slope stability analyses and determined that the appropriate shear strengths were used, (See Doc 18 Appendix C). Based on the information provided no recommendations are warranted.

1.2.2 Recommendations Regarding the Supporting Technical Documentation

No recommendations warranted.

1.2.3 Recommendations Regarding Continued Safe and Reliable Operation

No recommendations warranted.

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

Shannon Bennett, Tennessee Valley Authority
John Dizer, Tennessee Valley Authority
Benjamin Phillips, Tennessee Valley Authority
Bill Pritchard, Tennessee Valley Authority
Bronson Reed, Tennessee Valley Authority
Roger Sims, Tennessee Valley Authority
Hugo Aparicio, Stantec
Stanley W. Notestine, Dewberry
Emily Powell, Dewberry
Frederic Shmurak, Dewberry

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on September 13, 2011.

Stanley W. Notestine, P.E.

Frederic M. Shmurak

2.0 DESCRIPTION OF THE COAL COMBUSTION RESIDUE MANAGEMENT UNIT(S)

2.1 LOCATION AND GENERAL DESCRIPTION

The John Sevier Fossil Plant is located near the intersection of Old Highway 70 and TVA Road in Rogersville, TN approximately 15 miles south of the Virginia/Tennessee State Line. The coordinates of the plant site are 36.4658° N and 82.9702° W. The site is just to the south of the Holston River and northeast of Cherokee Lake. The nearest downstream town is Rogersville, Tennessee, which is approximately 1½ miles from the plant. There are three ash disposal areas on-site: Dry Fly Ash Stack; Bottom Ash Disposal Area 2; and Ash Disposal Area J. The Dry Fly Ash Stack no longer impounds water and Ash Disposal Area J was formally closed with the State. Figure 2.1a depicts a vicinity map around the John Sevier Fossil Plant while Figure 2.1b depicts an aerial view of the John Sevier Plant. Table 2.1 presents size information about the active disposal areas.

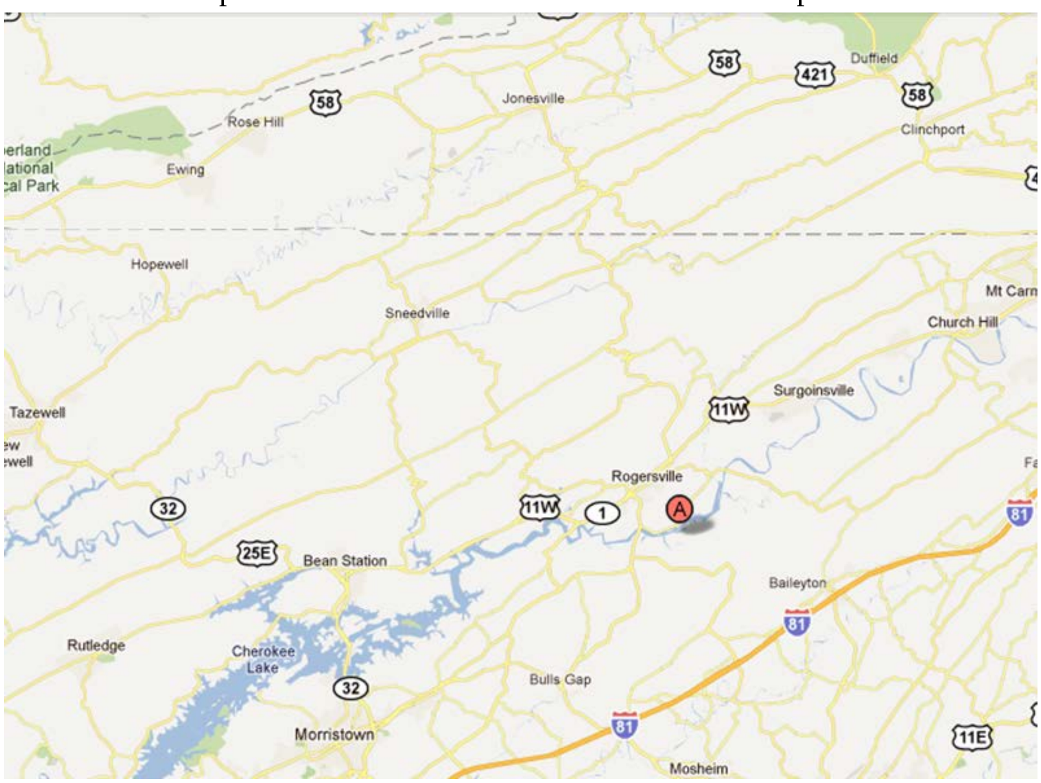

Figure 2.1 a: John Sevier Fossil Plant Vicinity Map

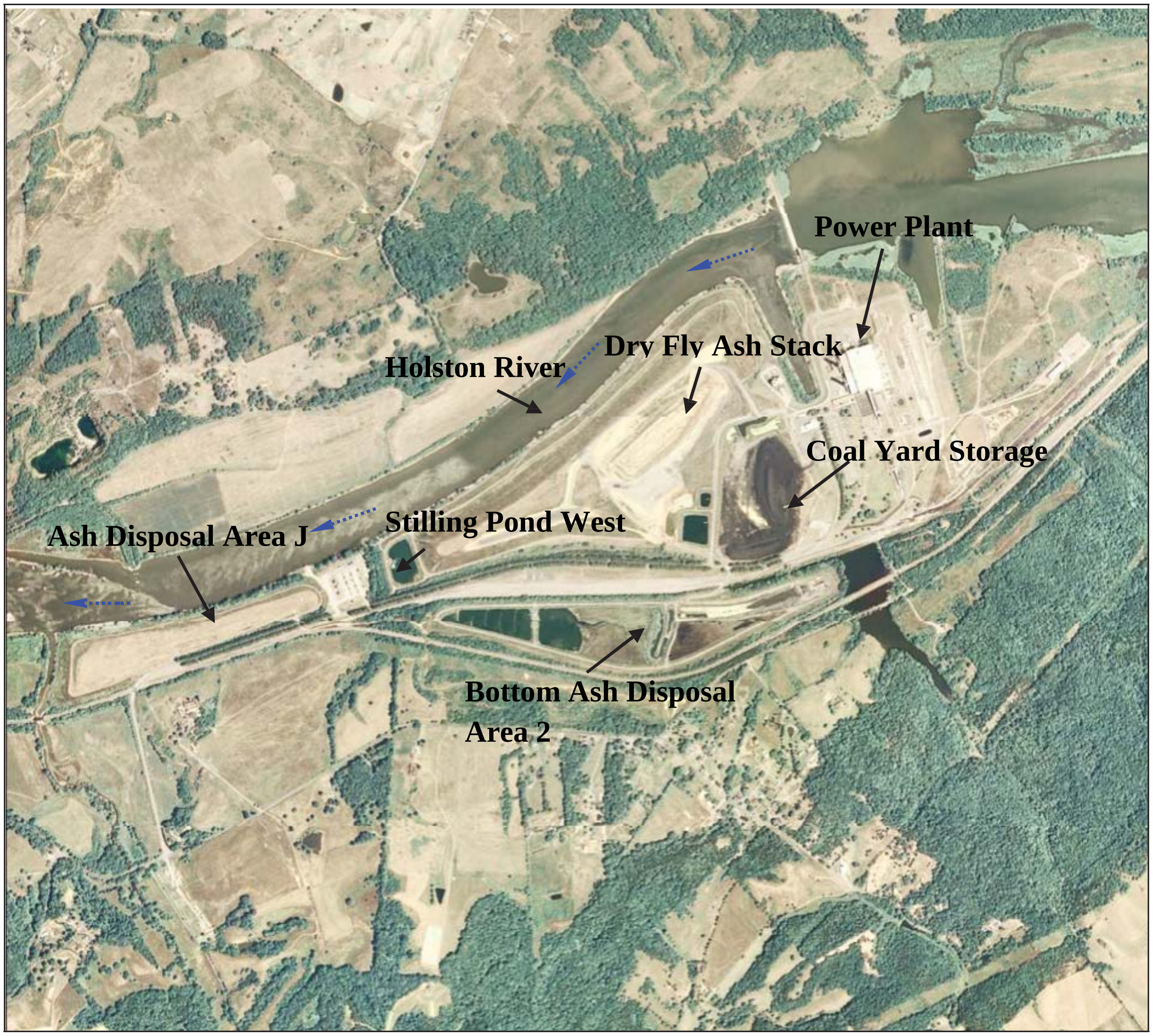

Table 2.1: Summary of Dam Dimensions and Size		
	Bottom Ash Disposal Area 2	**Dry Fly Ash Stack Impoundment Dike**
Dam Height (ft)	37	35
Crest Width (ft)	16	16
Length (ft)	8,600	6,300
Side Slopes (upstream) H:V	2:1	1.5:1
Side Slopes (downstream) H:V	2:1	2:1 to 3:1

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash is collected at the base of the stack by an electrostatic precipitator. The collected ash is stored in hoppers and conveyed pneumatically to a silo (see photo below). From the silo it is hauled via truck to the Dry Fly Ash Stack.

Photograph 2.2.1: Dry Fly Ash Silo

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2.2.2 Bottom Ash

Bottom ash is collected from the furnace and conveyed hydraulically in a pipe to the Bottom Ash Disposal Area 2.

Photograph 2.2.2a: Bottom ash sluice pipes outside plant

Photograph 2.2.2b: Bottom ash sluice pipes at Bottom Ash Disposal Area 2

2.2.3 Boiler Slag

Boiler slag is collected from the boiler and can be sluiced through the same pipe that conveys bottom ash into the ash pond.

2.2.4 Flue Gas Desulfurization Sludge

No Scrubbers are used in this plant so there is no flue gas desulfurization (FGD) process or related waste products to be discharged.

2.3 SIZE AND HAZARD CLASSIFICATION

Based on the size of the Bottom Ash Disposal Area 2 embankment height and impoundment storage capacity, the impoundment would be classified as Small by US Army Corps of Engineers (USACE) criteria.

Based on the Dry Fly Ash Stack impoundment embankment height and initial storage capacity the impoundment would be classified as Intermediate using the USACE criteria. Most of the impoundment has been filled to and above the embankment crest with dry fly ash. Fluid storage is limited to two small ponds, one at each end of the original impoundment. The ponds are designated as West Sediment Pond and East Sediment Pond.

Table 2.2a: USACE ER 1110-2-106
Size Classification

	Impoundment	
Category	**Storage (Ac-ft)**	**Height (ft)**
Small	50 and < 1,000	25 and < 40
Intermediate	1,000 and < 50,000	40 and < 100
Large	> 50,000	> 100

Federal guidelines for dam safety hazard classification use two criteria: potential loss of human life and economic, environmental and lifeline losses. Per the Federal Guidelines for Dam Safety dated April 2004, a Significant Hazard Potential classification applies to those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Based on observations and considering the low probability of loss of life should either the Bottom Ash Disposal Area 2 or Dry Fly Ash Stack impoundment embankments fail, a Federal Hazard Classification of **Significant** is appropriate for these facilities.

Table 2.2b: FEMA Federal Guidelines for Dam Safety Hazard Classification		
	Loss of Human Life	**Economic or Environmental Damage**
Low	None Expected	Low and generally limited to owner site
Significant	None Expected	Yes
High	Probable. One or more expected	Yes (but not necessary for classification)

2.4 AMOUNT AND TYPE OF RESIDUALS CURRENTLY CONTAINED IN THE UNIT(S) AND MAXIMUM CAPACITY

The Bottom Ash Disposal Area 2 impoundment receives sluiced bottom ash and direct precipitation. The Dry Fly Ash Stack impoundment receives dry fly ash, direct precipitation, and stormwater run-off from the adjacent coal pile. Storm water is directed to the West and East Sediment Ponds located inside the original impoundment footprint. Table 2.3 presents capacity information about the active disposal units.

Table 2.3: Maximum Capacity of Unit		
Ash Pond Name	**Bottom Ash Disposal Area 2**	**Dry Fly Ash Stack Impoundment**
Surface Area (acre)	40	90
Current Storage Capacity (cubic yards)	145,509	500,000
Current Storage Capacity (acre-feet)	90	310
Total Storage Capacity (cubic yards)[1]	725,000	3,800,000
Total Storage Capacity (acre-feet)	449	2,355
Crest Elevation (feet)	1138.5	1100.0
Normal Pond Level (feet)	1133.3	N/A

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Bottom Ash Disposal Area 2

The embankments forming the Bottom Ash Disposal Area 2 consist of sandy and gravelly clay underlain by residual clay and shale.

2.5.2 Dry Fly Ash Stack

The embankments containing the Dry Fly Ash Stack are consist of a compacted clay cap and clay fill underlain by alluvial clay, sand and gravel.

2.5.3 Bottom Ash Disposal Area 2

The outlet structure for the Bottom Ash Disposal Area 2 consists of two 48-inch diameter risers, each connected to a 36-inch diameter reinforced concrete outlet pipe.

2.5.4 Dry Fly Ash Stack impoundment

Stormwater drainage in the Dry Fly Ash Stack impoundment is directed to either the East Sediment Pond or the West Sediment Pond. The outlet structure for the East Sediment Pond consists of a 48-inch diameter riser connected to a 36-inch diameter concrete outlet pipe. The outlet structure for the West Sediment Pond consists of two 48-inch diameter risers, each connected to a 36-inch diameter concrete outfall pipes.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

We attempted to locate all critical structures by using aerial photography which might not accurately represent what currently exists down-gradient of the site. Critical infrastructure within 5 miles down-gradient of the John Sevier plan appears to consist of the following:

- Persia Fire Department
- Rogersville Fire Department
- Appalachian Upper Bound Cherokee High School (or Cherokee Comprehensive High School)
- Waste Water Treatment Plant (620 Flora Lane, Rogersville, TN)
- HW 70 Bridge over Holston River

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNITS

TVA provided representative daily, weekly, monthly, and quarterly inspection reports prepared by TVA personnel for the Bottom Ash Disposal Area 2 and Dry Fly Ash Stack impoundments. TVA also provided the 2010 annual inspection report prepared by Stantec Consulting Services.

The Stantec 2010 inspection report, dated July 16, 2010 did not report findings of significance for either the Bottom Ash Disposal Area 2 or Dry Fly Ash Stack impoundments. Recommendations presented in the report were generally related to routine maintenance and monitoring issues including:

- Continued monitoring of identified seepage areas
- Reseeding and erosion controls over areas lacking adequate vegetative cover
- Repair minor erosion rills
- Repair holes in embankments resulting from tree removal, and removal of remaining tree stumps
- Repair animal burrow holes in the embankment.

TVA provided a memorandum prepared by URS Corp. reviewing the piezometer and slope indicator monthly monitoring results for August, 2011. The memorandum concluded that no significant changes had occurred during the monitoring period.

TVA provided copies of several documents addressing the safe operation of the Management Units. These reports include:

- NPDES Permit No. TN0005436, Issued April 29, 2011, Effective May 1, 2011 and Expires June 30, 2014
- *Report of Geotechnical Exploration, Dry Fly Ash Stack, Bottom Ash disposal Area 2, Ash Disposal Area J, John Sevier Fossil Plant, Rogersville, Tennessee*, Stantec Consulting Services, February 8, 2010
- *Report of Hydrologic and Hydraulic Analysis, Stilling Pond, Sediment Pond West, and Sediment Pond East, TVA John Sevier Fossil Plant, Hawkins County, Kentucky* (sic), Stantec Consulting Services, September 30, 2010

- Correspondence "Re: Results of Seismic Slope Stability Analysis, Active CCP Facilities, John Sevier Fossil Plant", September 27, 2011 by Stantec Consulting Services
- *Seepage Action Plan (SAP), John Sevier Fossil Plant, Rogersville, Tennessee,* Stantec Consulting Services, June 25, 2010
- *2010 Annual Inspection Report of Waste Disposal Areas, John Sevier Fossil Plant, Rogersville, Hawkins County, Tennessee,* Stantec Consulting Services, July 16, 2010
- Memorandum, "Subject: August 2011 TVA Instrumentation Readings Comments", September 12, 2011, URS Corp.
- Correspondence, "Re: Results of Pseudostatic Slope Stability Analysis, Active CCP Disposal Facilities, BRF, COF, GAF, JSF, JOF, KIF, PAF, and WCF" February 15, 2012, Stantec Consulting Services
- Correspondence, "Re: Results of Pseudostatic Slope Stability Analysis, Dry Fly Ash Stack, John Sevier Fossil Plant (JSF)", March 30, 2012, Stantec consulting Services

3.2 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

The Bottom Ash Disposal Area 2 and Dry Fly Ash Stack impoundment embankments are not regulated by state or federal authorities.

Discharge from the Bottom Ash Disposal Area 2 impoundment is regulated by the Tennessee Department of Environment and Conservation Division of Water Pollution control and the impoundment has been issued a National Pollutant Discharge Elimination System Permit. Permit No. TN0005436 was issued May 1, 2011 (See Appendix A – Doc 01).

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS

No recent documented spills or releases have been reported for the Bottom Ash Disposal Area 2 or Dry Fly Ash Stack impoundments. There have been sluice line leaks and a rupture of the piping from the plant to the Bottom Ash Disposal Area 2.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The Dry Fly Ash Stack was originally a series of small ash ponds constructed circa 1955. The ponds were identified as "Areas" A through G, with Area A on the east end and Area G on the west end. Originally only Areas A, B and C were active.

The Bottom Ash Disposal Area 2 was placed in service in 1979 to receive sluiced bottom ash and occasional sluiced fly ash. A stilling pond was located at the west end of the impoundment,

4.1.2 Significant Changes/Modifications in Design since Original Construction

In the early 1980s an oval-shaped containment was constructed in the eastern portion of the Dry Fly Ash Stack impoundment and began receiving dredged bottom ash in 1984. The Dry Fly Ash Stack impoundment Area G is the approximate location of the West Sediment Pond.

Significant changes or modifications have not been made to the Bottom Ash Disposal Area 2.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

No significant repairs or rehabilitation have been made to the Bottom Ash Disposal Area 2.

The Dry Fly Ash Stack impoundment embankment was repaired following the 1973 failure in Area E. Based on the results of the 2010 slope stability analysis by Stantec, sections of the Dry Fly Ash Stack embankment were improved by the addition of a subsurface drainage system and rip-rap reinforcement near the embankment toe.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

Original operation procedures for both the Bottom Ash Disposal Area 2 and the Dry Fly Ash Stack impoundment consisted of sluicing coal combustion residuals into impoundments designed for reservoir sedimentation.

4.2.2 Significant Changes in Operational Procedures and Original Startup

In 1971 Areas A, B and C were abandoned and ash was sluiced to Areas D, E and F. In 1973, an embankment failure in Area E resulted in the cessation of sluicing to Areas D, E, and F and opening two new areas, designated Areas H and I at the southeast corner of the impoundment, near the coal pile. In 1974 Areas A, B, C, D, E, and F received dredged bottom ash. In 1976 Area G was activated to receive sluiced fly ash and areas H and I received sluiced bottom ash.

All sluicing to the Dry Fly Ash Stack impoundment was halted in 1979 when the Bottom Ash Disposal Area 2 impoundment was placed into service. At that time Areas A through F, H, and I were designated to receive dry fly ash. Area G was filled and abandoned.

In 1990, all plant bottom ash began being sluiced to the bathtub area. In 1993 dry ash began being stacked in the impoundment, including the oval-shaped area. Dry ash was stacked over Areas A through E, and H.

The Dry Fly Ash Facility was constructed in 1987. Bottom Ash was sluiced to the “BathTub” (part of the Dry Stack) which was located northwest of the Chem. Ponds. The bottom ash sluice water left the “BathTub” and discharged into the south ditch to the west stilling pond and discharged into Polly’s Branch as a permitted NPDES outfall.

4.2.3 Current Operational Procedures

The Bottom Ash Disposal Area 2 currently receives bottom ash, intermittent fly ash, and stormwater run-off from the coal yard.

The Dry Fly Ash Stack receives CCR material transported to the management unit by truck from storage silos at the plant.

4.2.4 Other Notable Events since Original Startup

There have been no notable events, other than events described in the preceding sections. Plant closure is anticipated within the next few years.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Frederic Shmurak, P.E., Stanley W. Notestein, P.E. and Emily Powell, P.E. accomplished a site visit on 13, September, 2011 in company with the participants.

The site visit began at 9:00 AM. The weather was initially foggy and cool, but turned sunny and warm later in the morning. Photographs were taken of conditions observed. Please refer to the Dam Inspection Checklist in Appendix B for additional information. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit.

The overall visual assessment of the dam slopes was that the dikes are in satisfactory condition and no significant findings were noted.

5.2 BOTTOM ASH DISPOSAL AREA 2

5.2.1 Crest

Overall, there were no signs of rutting, depressions, tension cracking, or other indications of settlement or shear failure and the crest appeared to be in satisfactory condition (see Figure 5.2.1-1).

Figure 5.2.1-1 Crest around Bottom Ash Disposal Area 2

5.2.2 Upstream/Inside Slope

No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed (see Figure 5.2.2-1).

Figure 5.2.2-1 Inside Slope

5.2.3 Downstream/Outside Slope and Toe

Several seeps were clearly marked for monitoring. Several feet below the crest a horizontal discontinuity in the slope was observed; however it was not deemed an indicator of slope instability. No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed (see Figure 5.2.3-1).

Note: Stantec prepared a Seepage Action Plan dated June 25, 2010 (Figure 5.2.3-2 shows a seep area).

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Figure 5.2.3-1 Outside Slope

Figure 5.2.3-2 Typical Seep Area, Downgradient Slope, Bottom Ash Disposal Area 2

5.2.4 Abutments and Groin Areas

Bottom Ash Disposal Area 2 is a raised embankment system; therefore, no abutments are present. Groins were found to be in satisfactory condition.

5.3 DRY FLY ASH STACK IMPOUNDMENT

5.3.1 Crest

The impoundment crest is gravel covered and used to access the Dry Fly Ash Stack. The crest is designated the Upper Perimeter Road, Overall, there were no signs of rutting, depressions, tension cracking, or other indications of settlement or shear failure and the crest appeared to be in satisfactory condition (see Figure 5.3.1-1).

Figure 5.3.1-1 Crest Around Dry Fly Ash Stack

5.3.2 Upstream/Inside Slope

As a result of conversion of the impoundment to a storage facility for dry fly ash, the stored ash stack typically begins at or near the inside edge of the impounding embankment crest and extends well above the embankment. As a result, the inside slope of the embankment is generally covered by stored ash. Where visible, the inside slope is generally covered with various grasses and low weeds (See Figure 5.3.1-1).

The interior slopes of the West Sediment Pond are vegetated with sparse grass and low weeds (See Figure 5.3.2-1)

Figure 5.3.2-1 Dry Fly Ash Stack West Sediment Pond Embankment Inside Slope)

5.3.3 Downstream/Outside Slope and Toe

No scarps, sloughs, depressions, bulging or other indications of slope instability or signs of erosion were observed (see Figure 5.3.3-1).

Figure 5.3.3-1 Outside Slope, Dry Fly Ash Stack

5.3.4 Abutments and Groin Areas

The Dry Fly Ash Stack is a raised structure without abutments or groins.

5.4 OUTLET STRUCTURES

5.4.1 Overflow Structure

The Bottom Ash Disposal Area 2 contains two 48-inch diameter reinforced concrete risers that serve as an outlet structure (see Figure 5.4.1-1).

Figure 5.4.1-1 Overflow Risers, Bottom Ash Disposal Area 2

Stormwater runoff from the western portion of the Dry Fly Ash Stack is directed towards the West Sediment Pond, formerly Area G of the impoundment. The West Sediment Pond overflow structure consists of two 48-inch diameter reinforced concrete risers. (see Figure 5.4.1-2).

Figure 5.4.1-2 Dry Fly Ash Stack West Sediment Pond Risers

Stormwater from the eastern portion of the Dry Fly Ash Stack drains to the East Sediment Pond which was incised into the southeast corner of the impoundment in the late 1990s or early 2000s. The discharge structure for the East Sediment Pond consists of a single 48-inch diameter riser.

5.4.2 Outlet Conduit

The Bottom Ash Disposal Area 2 outlet conduit consists of two 36-inch diameter reinforced concrete pipes that discharge to a rip-rap lined ditch that flows to a diffuser structure and into the Holston River (see Figure 5.4.2-1).

Figure 5.4.2-1 Bottom Ash Disposal Area 2 Outfall

The discharge outlet from the Dry Fly Ash Stack West Sediment Basin consists of two 36-inch diameter, reinforced concrete pipes that discharge through a diffuser structure to the Holston River.

The discharge outlet from the Dry Fly Ash East Sediment Basin is a 36-inch diameter, reinforced concrete pipe that discharges to a rip-rap lined ditch upstream from the Bottom Ash Disposal Area 2 discharge outlet location.

5.4.3 Emergency Spillway

Neither the Bottom Ash Disposal Area 2 impoundment, nor the Dry Fly Ash Stack sediment ponds have emergency spillways.

5.4.4 Low Level Outlet

Low level outlets were not observed at Bottom Ash Disposal Area 2 impoundment, or either of the Dry Fly Ash Stack sediment ponds.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation has been provided about the flood of record.

6.1.2 Inflow Design Flood

According to FEMA Federal Guidelines for Dam Safety, the current practice in the design of dams is to use the Inflow Design Flood (IDF) that is deemed appropriate for the hazard potential of the dam and reservoir, and to design spillways and outlet works that are capable of safely accommodating the flood flow without risking the loss of the dam or endangering areas downstream from the dam to flows greater than the inflow. The recommended IDF or spillway design flood for a significant hazard, small-sized structure (See section 2.2) in accordance with the USACE Recommended Guidelines for Safety Inspection of Dams ER 1110-2-106 criteria is the 100 year storm to ½ Probable Maximum Flood (PMF) (See Table 6.1.2).

Table 6.1.2: USACE Hydrologic Evaluation Guidelines Recommended Spillway Design Floods

Hazard	Size	Spillway Design Flood
Low	Small	50- to 100-year frequency
	Intermediate	100-year to ½ PMF
	Large	½ PMF to PMF
Significant	Small	100-year to ½ PMF
	Intermediate	½ PMF to PMF
	Large	PMF
High	Small	½ PMF to PMF
	Intermediate	PMF
	Large	PMF

The Probable Maximum Precipitation (PMP) is defined by the American Meteorological Society as the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. The National Weather Service (NWS) further states that in consideration of our limited knowledge of the complicated processes and interrelationships in storms, PMP values are identified as estimates. The NWS has published application procedures that can be used with PMP estimates to develop spatial and temporal characteristics of a Probable Maximum Storm (PMS). A PMS thus developed can be used with a precipitation-runoff simulation model to calculate a PMF hydrograph. The 6 hour, 10-square mile PMP depth corresponding to the site location is 36 inches.

6.1.3 Spillway Rating

Based on the Stantec Report of Hydrologic and Hydraulic Analysis dated September 30, 2010, the Bottom Ash Disposal Area 2 is capable of passing the PMP event without overtopping.

The analyses indicate the Dry Fly Ash Stack West Sediment Pond is capable of passing the 100-year storm event without overtopping, but not the PMP event. The Dry Ash Stack East Sediment Pond is indicated as capable of passing the 25-year storm event, but not the 50-year event.

6.1.4 Downstream Flood Analysis

No downstream flood analysis was provided.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation reviewed by Dewberry is adequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

Adequate capacity and freeboard to safely pass the probable maximum design storm has been demonstrated for Bottom Ash Disposal Area 2. Stilling Pond West, which receives surface water runoff from the Dry Fly Ash Stack, is able to safely pass the 100-year design storm. Both satisfy the recommended design criteria.

The Dry Fly Ash Stack East Sediment Pond can only pass the 25-year storm event, which does not meet the recommended design criteria for small impoundments rated as significant hazards. Even allowing the hazard rating to be amended to "Low" for the East Sediment Pond, the recommended spillway flood design criteria is the 50- to 100-year storm frequency which the existing spillway also fails to meet. However, given its small size of less than 5 acres, its location in the far corner of the Dry Fly Ash Stack management unit, and the minimal amount of ash expected in this sedimentation pond, any overflow during a 50- to 100-year flood would be inconsequential.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

Stantec performed a geotechnical exploration of the Bottom Ash Disposal Area 2 as well as the Dry Fly Ash Stack. The purpose of the exploration was to perform a general engineering assessment of the stability of the disposal areas. Results of the exploration and assessment are contained in the Stantec Report of Geotechnical Exploration dated February 8, 2010; Results of Seismic Slope Stability Analysis dated September 27, 2011; and Stantec Results of Pseudostatic[1] Slope Stability Analysis dated February 15, 2012. Relevant information from the reports is summarized in the following sections.

7.1.2 Design Parameters and Dam Materials

The static slope stability analyses included eight cross-sections in the Dry Fly Ash Stack impoundment and a single cross-section in the Bottom Ash Disposal Area 2 impoundment.

The Dry Fly Ash Stack seismic analysis was conducted on the static cross-section having the lowest slope stability safety factor. The Bottom Ash Disposal Area 2 seismic analysis was conducted on the same cross-section as the static analysis. The long term, static analyses used drained shear soil shear strength parameters. The seismic loading analyses used undrained shear strength parameters. The material properties used in the analyses are shown in Table 7.1

[1] The pseudostatic method is a simplified method for determining seismic slope stability that is based on the same approach (i.e., limit equilibrium) used in analyzing static slope stability. In current practice, the pseudostatic method of analysis is used primarily as a screening tool to help assess whether an embankment dam or slope requires a more detailed seismic slope analysis. The pseudostatic method ignores cyclic loading of the earthquake, but accounts for seismicity by applying an equivalent static force on the slope. In the limit equilibrium approach bearing capacity and stress-strain relationship of the soil is not considered, so the method should not be used for sensitive clays and other materials that lose shear strength during an earthquake or loose soils located below the groundwater table subject to liquefaction.

Table 7.1: Material Properties for Granular Materials

(

Table 7.1: Summary of Soil Properties Used in Stability Analyses						
Bottom Ash Disposal Area 2 Impoundment						
Soil Strata	Static Analysis			Seismic Analysis[1]		
	Unit Weight γ' (pcf)	Cohesion c' (psf)	Friction Angle Ø' (degrees)	Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle (Ø - degrees)
Dike Clay	123	0	33	126	715	10.6
Residual Clay	121	0	33	120	1000	11.1
Shale						
Dry Fly Ash Stack Impoundment Embankment: Cross-Section C-C'						
Clay Fill	125	0	32	125	715	10.6
Reconstructed Clay Dike	126	0	31	126	715	10.6
Alluvial Clay	120	0	31	120	1000	11.6
Compacted Fly Ash	110	0	30	110	610	13.6
Sluiced Fly Ash	105	0	24	105	200	13.6
Sand	139	0	37	139	0	37
Rip-rap	115	0	40	115	0	40

The following figures (Figures 7.1.2a and 7.1.2b) depict soil strata utilized in the slope stability analyses.

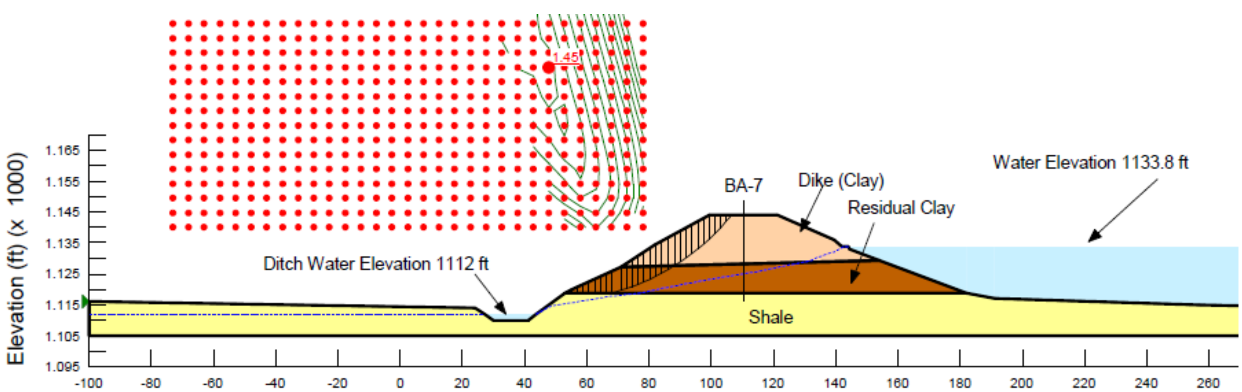

Figure 7.1.2a: Bottom Ash Disposal Area 2 Cross Section
(Source: Stantec Report of Geotechnical Exploration dated February 8, 2010)

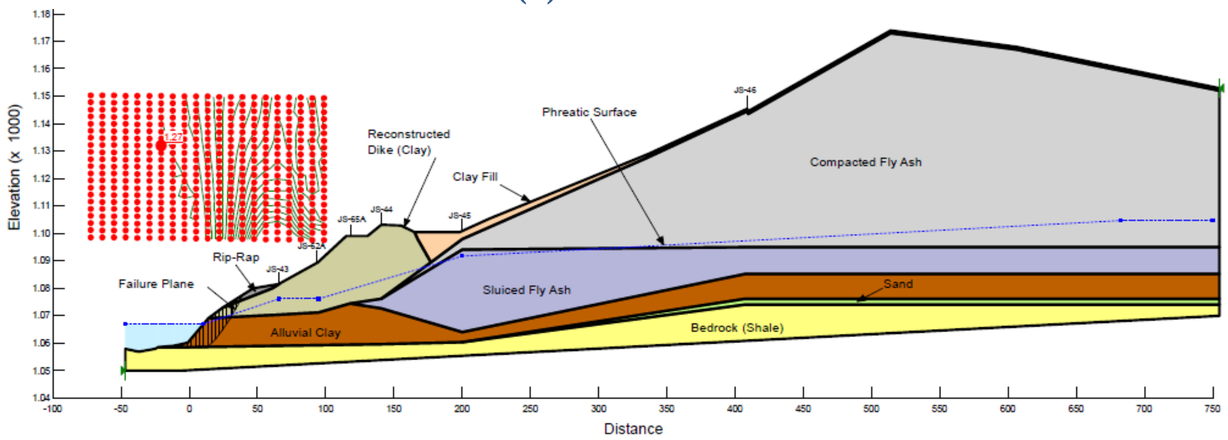

Figure 7.1.2b: l Dry Fly Ash Stack Impoundment Cross Section C-C'
(Source: Stantec Report of Geotechnical Exploration dated February 8, 2010)

7.1.3 Uplift and/or Phreatic Surface Assumptions

Uplift and phreatic surface assumptions were based on the results of the geotechnical exploration performed by Stantec as well as piezometer readings obtained post exploration. These assumptions appear reasonable and are consistent with generally accepted engineering practices.

7.1.4 Factors of Safety and Base Stresses

The following are the calculated factors of safety for the referenced base stress for the Bottom Ash Disposal Area 2 and the Dry Fly Ash Stack impoundment. Steady state seepage is based on a normal pool elevation at the Bottom Ash Disposal Area 2. The analysis for the Dry Fly Ash Stack impoundment was based on the low pool elevation of the adjacent Holston River at the time of the analysis. The seismic analyses are based on a return period of 2% probability of exceedance in 50 years (2,500-year Return Period Event) with a corresponding horizontal seismic coefficient of 0.115g.

Table 7.1.4 Calculated Factors of Safety for John Sevier Fossil Plant				
Location	Long Term Static Loading		Seismic Loading[1]	
	Required Safety Factor (US Army Corps of Engineers)	Computed Minimum Safety Factor	Required Safety Factor (US Army Corps of Engineers)	Computed Minimum Safety Factor
Bottom Ash Disposal Area 2	1.5	1.5	>1.0	2.2
Dry Fly Ash Stack; Section C-C: Rip-rap added	1.5	1.5	>1.0	1.1

Table 7.1.4: Slope Stability Factors of Safety

It is noted that the computed slope stability of the Bottom Ash Disposal Area 2 embankment is lower for the static loading than for seismic loading. Although uncommon, it is not unreasonable and is expected to reflect the difference in soil strength parameters used in the analysis. The static loading case assumed the embankment clay and the residual clay were cohesionless soils. The resulting computed failure surface was relatively shallow, but with a safety factor equal to the required minimum value. The result of shallow failure surface is typical of slopes modeled as cohesionless. The seismic analysis used a more rigorous approach and included a reasonable cohesive component for soil shear strength.

As the static and seismic analyses were conducted nearly 18 months apart, and the individual results seemed acceptable, the potential discrepancy was not recognized by the TVA analysts. Although it is not expected to impact the overall assessment of the embankment, it is recommended that the analyses be reviewed to calibrate the results.

7.1.5 Liquefaction Potential

The documentation reviewed by Dewberry did not include an evaluation of liquefaction. Soils indicated in the boring logs provided in the geotechnical reports do not appear susceptible to liquefaction.

7.1.6 Critical Geological Conditions

There are no critical geological conditions at the John Sevier Fossil Plant Site. The following general site geology is excerpted from the Stantec Geotechnical Report dated February 8, 2010.

> *"The John Sevier Fossil Plant is located in the eastern portion of Tennessee along the southern flank of the Holston River just east (upstream) of the confluence of the river and Dodson Creek. This portion of Tennessee is underlain by sedimentary rock formations which were folded and fractured by ancient tectonic events. More specifically, the general area of the plant is underlain by two distinct formations, the Sevier Shale and the Newala Formation of the Knox Dolomite Group. It is probable that the contact between these formations occurs along or just north of where the Holston River crosses the plant area, with the Sevier Shale outcropping south of the river.*
>
> *Most of the plant reservation was developed on a floodplain of the Holston River. As such, much of the site is underlain by alluvium and terrace deposits varying in thickness from less than 5 feet along the tributary stream banks to more than 30 feet adjacent to the river. Typical of alluvium in this region of the state, these soils consist of sands, silts, and gravels with few interspersed cobbles. The underlying bedrock consists of the Ordovician age Sevier Shale Formation which consists of bluish gray, a silty to sandy calcareous shale with thin limestone layers and lenses of siltstone and sandstone."*

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Structural stability documentation is adequate to support the results and conclusions provided. In April 2012 (Appendix B, Doc. 17) Dewberry confirmed the static and seismic slope stability analyses for the Bottom Ash Disposal Area 2 embankments used the proper soil properties.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability of the Bottom Ash Disposal Area 2 embankment appears to be **SATISFACTORY**.

Overall, the structural stability of the Dry Fly Ash Stack impoundment embankment appears to be **SATIFACTORY.**

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The Bottom Ash Disposal Area 2 was designed and operated for reservoir sedimentation and sediment storage of ash. Coal combustion residue is discharged into the reservoir. Inflow water is treated through gravity settling and deposition, and the treated process water and stormwater runoff is discharged through a non adjustable type overflow outlet structure which is part of the NPDES Permit.

Since 1993 the Dry Fly Ash Stack has received only dry ash transported by trucks from silos at the plant site.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance generally is limited to mowing grass when needed.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on assessments from received documents and the site visit, operating procedures appear to be adequate.

8.3.2 Adequacy of Maintenance

Based on assessments from received documents and the site visit, maintenance procedures appear to be adequate.

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

Normal plant surveillance procedures consist of weekly, monthly quarterly and annual inspections.

9.2 INSTRUMENTATION MONITORING

The Bottom Ash Disposal Area 2 and the Dry Fly Ash Stack contain piezometers to measure phreatic surface and inclinometers to indicate movement. Readings are taken weekly and recorded to observe trends or indications of slope instability.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

Based on the data reviewed by Dewberry, including observations during the site visit, the inspection program is adequate.

9.3.2 Adequacy of Instrumentation Monitoring Program

Based on the data reviewed by Dewberry, including observations during the site visit, the monitoring program is adequate.

APPENDIX A

Document 1

Tennessee NPDES Permit No. TN0005436

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

DIVISION OF WATER POLLUTION CONTROL
401 CHURCH STREET
L & C ANNEX 6TH FLOOR
NASHVILLE TN 37243

April 29, 2011

Mr. Phil Ball
Plant Manager
US TVA John Sever Fossil Plant
611 Old Highway 70
Rogersville, TN 37857

Subject: **NPDES Permit No. TN0005436**
TVA - John Sevier Fossil Plant
Rogersville, Hawkins County, Tennessee

Dear Mr. Ball:

In accordance with the provisions of the Tennessee Water Quality Control Act, Tennessee Code Annotated (T.C.A.), Sections 69-3-101 through 69-3-120, the Division of Water Pollution Control hereby issues the enclosed NPDES Permit. The continuance and/or reissuance of this NPDES Permit is contingent upon your meeting the conditions and requirements as stated therein.

Please be advised that a petition for permit appeal may be filed, pursuant to T.C.A. Section 69-3-105, subsection (i), by the permit applicant or by any aggrieved person who participated in the public comment period or gave testimony at a formal public hearing whose appeal is based upon any of the issues that were provided to the commissioner in writing during the public comment period or in testimony at a formal public hearing on the permit application. Additionally, for those permits for which the department gives public notice of a draft permit, any permit applicant or aggrieved person may base a permit appeal on any material change to conditions in the final permit from those in the draft, unless the material change has been subject to additional opportunity for public comment. Any petition for permit appeal under this subsection (i) shall be filed with the board within thirty (30) days after public notice of the commissioner's decision to issue or deny the permit.

If you have questions, please contact the Division of Water Pollution Control at your local Field Office at 1-888-891-TDEC; or, at this office, please contact Miss Julie Harse at (615) 532-0682 or by E-mail at *Julie.Harse@tn.gov.*

Sincerely,

Vojin Janjić
Manager, Permit Section
Division of Water Pollution Control

Enclosure

cc/ec: DWPC, Permit Section & Johnson City Environmental Field Office
Ms. Connie A. Kagey, EPAR4, Kagey.Connie@epamail.epa.gov
Mr. Aaron Isherwood, aaron.isherwood@sierraclub.org
Mr. Abel Russ, aruss@environmentalintegrity.org
Mr. Josh Galperin, josh@cleanenergy.org
Ms. Stephanie Matheny, stephanie@tcwn.org
Ms. Karrie-Jo Robinson Shell, Environmental Engineer, EPA Region 4, shell.karrie-jo@epa.gov

STATE OF TENNESSEE

NPDES PERMIT

No. TN0005436

Authorization to discharge under the
National Pollutant Discharge Elimination System (NPDES)

Issued By

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street
6th Floor, L & C Annex
Nashville, Tennessee 37243-1534

Under authority of the Tennessee Water Quality Control Act of 1977 (T.C.A. 69-3-101 et seq.) and the delegation of authority from the United States Environmental Protection Agency under the Federal Water Pollution Control Act, as amended by the Clean Water Act of 1977 (33 U.S.C. 1251, et seq.)

Discharger:	**TVA - John Sevier Fossil Plant**
is authorized to discharge:	**chemical and non-chemical metal cleaning wastewaters (IMP 005); coal pile runoff, low volume wastes, sanitary wastewater, miscellaneous equipment cooling and lubricating water, storm water runoff, and landfill leachate collection system wastewater (IMP 008); ash transport water from Outfall 001; intake screen backwash water (IMP 004); pump cavitation relief flows (IMP 002A), main condenser cooling water, non-process wastewater, boiler blowdown, and storm water runoff from Outfall 002; water treatment effluent, main cycle sample drain, misc. non-oily drains, cooling tower blowdown, misc. cooling water, low volume wastes, RO reject from demineralization treatment from Outfall 003**
from a facility located:	**in Rogersville, Hawkins County, Tennessee**
to receiving waters named:	**Polly Branch to the Holston River (Outfall 001), Holston River at mile 106.7 (Outfall 002), and Holston River at mile 107.0 (Outfall 003)**

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective on:	**May 1, 2011**
This permit shall expire on:	**June 30, 2014**
Issuance date:	**April 29, 2011**

Paul E. Davis, Director
Division of Water Pollution Control

CN-0759

RDAs 2352 and 2366

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TABLE OF CONTENTS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

John Sevier Fossil Plant is authorized to discharge treated chemical and non-chemical metal cleaning wastewaters from the two batch treatment ponds through Internal Monitoring Point 005 and subsequently Outfall 001. The discharge at Internal Monitoring Point 005 shall be limited and monitored by the permittee as specified below:

PERMIT LIMITS

INTERNAL MONITORING POINT 005
Chemical & Nonchemical Metal Cleaning Wastewater

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		Report (MGD) *		1/Batch	Estimate *
IRON, TOTAL	1.0	--	1.0	--	**	Grab
COPPER, TOTAL	1.0	--	1.0	--	**	Grab

Metal cleaning wastes shall mean any cleaning compounds, rinse waters, or any other waterborne residues derived from cleaning any metal process equipment including, but not limited to, boiler tube cleaning, boiler fireside cleaning, and air preheater cleaning.

* Flow shall be estimated from the difference in beginning and ending pond elevations and reported in Million Gallons per Day (MGD).

** Samples shall be taken at the beginning and end of a discharge event for each batch treated.

The waste stabilization pond effluent shall be monitored by the permittee at Internal Monitoring Point 008 and subsequently Outfall 001 for coal pile runoff, low volume wastes, sanitary wastewater, miscellaneous equipment cooling and lubricating water, storm water runoff, and landfill leachate collection system wastewater as specified below:

PERMIT LIMITS

INTERNAL MONITORING POINT 008
Waste Stabilization Pond Effluent

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) *		--		1/Quarter	**
E.coli	Report	--	Report	--	1/Quarter	Grab***
BOD5	--	--	Report	--	1/Quarter	Grab
TOTAL SUSPENDED SOLIDS (TSS) **	--	--	Report	--	1/Quarter	Grab

* Flow shall be reported in Million Gallons per Day (MGD).

** For the monitoring and reporting of measurements of flow, the "Monthly Average" shall be the total flow volume during the reporting period divided by the number of calendar days in that period. Total flow may determined from appropriate flow measurements or calculated from pump performance curves

*** This outfall receives wastewaters from Outfall IMP 08A, which contains sanitary wastewater influent. See Part I, B., 3. C. of the permit for monitoring procedures and sampling methodology

TVA - John Sevier Fossil Plant is authorized **to discharge** chemical and non-chemical metal cleaning wastewaters (IMP 005); coal pile runoff, low volume wastes, sanitary wastewater, miscellaneous equipment cooling and lubricating water, storm water runoff, and landfill leachate collection system wastewater (IMP 008); ash transport water from Outfall 001 to Polly Branch to the Holston River. These discharges shall be limited and monitored by the permittee as specified in the below paragraphs.

PERMIT LIMITS

OUTFALL 001

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) [1]		Report (MGD) [1]		1/Week	Instantaneous
OIL & GREASE	15.0	--	20.0	--	1/Month	Grab
pH	--	--	Range 6.0 to 9.0		1/Week	Grab [2]
Nitrogen, Ammonia Total (Influent)	--	--	Report	Report	2/Month	Grab
Nitrogen, Ammonia Total (Effluent)	--	--	Report	Report	2/Month	Grab
Nitrogen, Ammonia Total (Net Discharge)	--	--	Report	Report	2/Month	Calculated [3]
TOTAL SUSPENDED SOLIDS [4] (TSS)	29.0	--	99.0	--	2/Month	Grab
MERCURY, TOTAL	--	--	Report	--	1/Month	Grab[5]
METHYL MERCURY	--	--	Report	--	1/Month	Grab[5]
ALUMINUM	--	--	Report	--	1/Month	Grab
Hardness	--	--	Report	--	1/Month	Grab
COPPER, TOTAL	--	--	Report	--	1/Month	Grab
LEAD, TOTAL	--	--	Report	--	1/Month	Grab
SELENIUM, TOTAL (4/1/2011 to 7/31/2013)	Report	--	Report	--	1/Month	Grab
SELENIUM, TOTAL (After 7/31/2013)	0.005	--	0.020	--	1/Month	Grab
ARSENIC, TOTAL (4/1/2011 to 7/31/2013)	Report	--	Report	--	1/Month	Grab
ARSENIC, TOTAL (After 7/31/2013)	0.01	--	0.02	--	1/Month	Grab
CADMIUM, TOTAL	--	--	Report	--	1/Month	Grab
CHROMIUM III	--	--	Report	--	1/Month	Grab
CHROMIUM VI	--	--	Report	--	1/Month	Grab
CHROMIUM, TOTAL	--	--	Report	--	1/Month	Grab
IRON, TOTAL	--	--	Report	--	1/Month	Grab
MANGANESE, TOTAL	--	--	Report	--	1/Month	Grab
SILVER, TOTAL	--	--	Report	--	1/Month	Grab
ANTIMONY	--	--	Report	--	1/Month	Grab
BARIUM	--	--	Report	--	1/Month	Grab
BERYLLIUM	--	--	Report	--	1/Month	Grab
NICKEL	--	--	Report	--	1/Month	Grab
THALLIUM	--	--	Report	--	1/Month	Grab
ZINC	--	--	Report	--	1/Month	Grab
CYANIDE	--	--	Report	--	1/Month	Grab
IC25	Survival, Reproduction, & Growth in 100% Effluent				1/Year	Composite [6]

No discharge of PCBs is allowed.

1 Flow shall be reported in Million Gallons per Day (MGD).

2 pH analysis shall be performed within fifteen (15) minutes of sample collection.

3 If a calculated value for net addition of ammonia as nitrogen exceeds the concentration value of 1.2 mg/L, the permittee should investigate source(s) of ammonia, and proceed with a corrective action(s), as necessary. Furthermore, the Johnson City Environmental Field Office shall be notified within 24 hours from the time the permittee receives results indicating that an action value of 1.2 mg/L NH3-N was exceeded.

4 The permittee shall take reasonable steps to prevent discharge of cenospheres other that in trace amounts from the outfall

5 See Part I. B.,3., for the test methodology. Use Title 40, CFR Part 136, method 1631E.

6 See Part III for the test methodology, measurement frequency and sample type.

John Sevier Fossil Plant is authorized to discharge intake screen backwash water through Internal Monitoring Point 004 to the Holston River via the plant condenser cooling water discharge channel and Outfall 002 without limitations or monitoring requirements. The discharge shall not have any visible oil sheen and reasonable steps shall be taken to prevent the return of unsightly materials to the receiving waters. There shall be no discharge of PCBs through this outfall. This discharge must result in no other materials in concentrations sufficient to be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.

John Sevier Fossil Plant is authorized to discharge intake screen backwash water (IMP 004); pump cavitation relief flows (IMP 002A), main condenser cooling water, non-process wastewater, boiler blowdown, and storm water runoff through Outfall 002 via the plant condenser cooling water discharge channel to the Holston River at approximate: latitude 36 degrees, 22 minutes, 30 seconds and longitude 82 degrees, 58 minutes, and 00 seconds. Outfall 002 shall be limited and monitored by the permittee as specified below:

PERMIT LIMITS

OUTFALL 002

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW (Effluent)	Report (MGD) [1]		Report (MGD) [1]		Continuous	Recorder
Bypass FLOW	Report (MGD) [2]		Report (MGD) [2]		Continuous	Recorder
TEMPERATURE, Intake	Report		Report		Continuous	Recorder
TEMPERATURE, Effluent	36.1°C (97.0°F) Average Daily Value				Continuous	Recorder
TOTAL RESIDUAL OXIDANT (reported as chlorine) [3]	--	--	0.021	--	1 / Week	Grab [3]
TIME OF OXIDANT ADDITION (minutes/day/unit)	--		120 [4]		1 / Day	Log Records
IC25	Survival, Reproduction, & Growth in 88.5% Effluent				See note 5	Composite [5]

No discharge of PCBs is allowed.
See Part I.B.1 for additional monitoring requirements.

(1),(2) Flow shall be reported in Million Gallons per Day (MGD).

(2) See Permit, Part III.K. for the permit limits for bypass flow.

(3) Total Residual Chlorine (TRC) monitoring shall be applicable when chlorine, bromine, or any other oxidants are added. The acceptable methods for analysis of TRC are any methods specified in 40 CFR, Part 136. The method Detection level (MDL) for TRC shall not exceed 0.05 mg/l unless the permittee demonstrates that its MDL is higher. The permittee shall retain the documentation that justifies the higher MDL, and shall have that documentation available for review upon request. In cases where the permit limit is less than the MDL, the reporting of TRC at less than the MDL shall be interpreted to constitute compliance with the permit limit.

(4) Application of a oxidant (bromine/chlorine) beyond the 120 minutes per day will be allowed to facilitate nuisance macroinvertebrate control according to the plan for such activities described in Permit - Part III.

(5) Toxicity tests shall be performed only if biocides are added to the cooling water. See Part III for methodology.

PERMIT LIMITS
Natural Gas Combined Cycle Plant
OUTFALL 003

EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS				MONITORING REQUIREMENTS	
	MONTHLY		DAILY			
	AVG. CONC. (mg/l)	AVG. AMNT. (lb/day)	MAX. CONC. (mg/l)	MAX. AMNT. (lb/day)	MSRMNT. FRQNCY.	SAMPLE TYPE
FLOW	Report (MGD) (1)		Report (MGD)		1/Week	Instantaneous
pH (2)	Range 6.0 - 9.0				1/Week	Grab
TEMPERATURE, Effluent	–	–	36.1 (5)	–	1/Daily	Grab
Oil and Grease	Report	143	Report	190	2/Month	Grab
TOTAL SUSPENDED SOLIDS (TSS)	Report	285	Report	951	2/Month	Grab
TOTAL RESIDUAL OXIDANT (reported as chlorine) [3]	Report	1.9	Report	4.8	2/Month	Grab (2)
Chromium, Total	–	1.9	–	1.9	2/Month	Grab
Zinc, Total	–	9.5	–	9.5	2/Month	Grab
Total Mercury	Report	–	Report	–	1/Quarter	Grab
Total Phosphorous	Report	–	Report	–	2/Month	Grab
48HrLC50	Report				Semi-annual	Composite (4)

(1) Flow shall be reported in Million Gallons per Day (MGD).
(2) pH and TRC analyses shall be performed within fifteen (15) minutes of sample collection.
(3) Total Residual Chlorine (TRC) monitoring shall be applicable when chlorine, bromine, or any other oxidants are added. The acceptable methods for analysis of TRC are any methods specified in 40 CFR, Part 136. The method Detection level (MDL) for TRC shall not exceed 0.05 mg/l unless the permittee demonstrates that its MDL is higher. The permittee shall retain the documentation that justifies the higher MDL, and shall have that documentation available for review upon request. In cases where the permit limit is less than the MDL, the reporting of TRC at less than the MDL shall be interpreted to constitute compliance with the permit limit.
(4) See Part III for methodology.
(5) The daily maximum temperature shall be the average of all the daily temperature measurements.

Additional monitoring requirements and conditions applicable to Outfall 003:

Neither free available chlorine nor total residual chlorine may be discharged from any single generating unit for more than two hours in any one day and not more than one unit in any plant may discharge free available or total residual chlorine at any one time unless the utility can demonstrate to the permitting authority that the units in a particular location cannot operate at or below this level of chlorination.

The federal regulation's (40 CFR 423.15) require that the 126 priority pollutants (See Appendix A of federal regulations) contained in chemicals added for cooling tower maintenance except for chromium and zinc be non-detectable. At the permitting authority's discretion, instead of the monitoring in 40 CFR 122.11(b), compliance with the limitations for the 126 priority pollutants in paragraph (j)(1) of this section may be determined by engineering calculations which demonstrate that the regulated pollutants are not detectable in the final discharge by the analytical methods in 40 CFR part 136.

Additional monitoring requirements and conditions applicable to all outfalls include:

There shall be no discharge of PCBs.

There shall be no distinctly visible floating solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to fish and aquatic life.

The wastewater discharge shall not contain pollutants in quantities that will be hazardous or otherwise detrimental to humans, livestock, wildlife, plant life, or fish and aquatic life in the receiving stream.

Sludge or any other material removed by any treatment works must be disposed of in a manner, which prevents its entrance into or pollution of any surface or subsurface waters. Additionally, the disposal of such sludge or other material must be in compliance with the Tennessee Solid Waste Disposal Act, TCA 68-31-101 et seq. and the Tennessee Hazardous Waste Management Act, TCA 68-46-101 et seq.

B. MONITORING PROCEDURES

1. Representative Sampling

Samples and measurements taken in compliance with the monitoring requirements specified herein shall be representative of the volume and nature of the monitored discharge, and shall be taken at the following location(s):

For Outfall 001, monitoring of the ash pond shall be conducted prior to mixing with any other discharge stream.

- Sample type is grab at a frequency of once per week.

For Outfall 002, monitoring shall be conducted as follows:

- The 316(a) Variance shall continue as in previous permits.
- To demonstrate compliance with Flow and Intake Temperature monitoring requirements, samples shall be taken at the water box inlet to the condensers.
- To demonstrate compliance with Discharge Temperature monitoring requirements, samples shall be taken for the cooling water effluent prior to discharge or mixing with any other waste stream.
- Previous intake (upstream) temperature, plant (discharge flow rate and temperature), bypass flow rates, and downstream right bank monitoring will continue. The DMR will include summaries of maximum daily (average) intake temperature, discharge temperature and flow rate, and minimum hourly bypass flow rate. Additional intake and downstream temperatures and heat output will be stored but not reported.

- To demonstrate compliance with Total Residual Chlorine (TRC), monitoring shall be applicable when chlorine, bromine, or any other oxidants are added. The acceptable methods for analysis of TRC are any methods specified in Title 40 CFR, Part 136 as amended. The method detection level (MDL) for TRC shall not exceed 0.05 mg/l unless the permittee demonstrates that its MDL is higher. The permittee shall retain the documentation that justifies the higher MDL and have it available for review upon request. In cases where the permit limit is less than the MDL, the reporting of TRC at less than the MDL shall be interpreted to constitute compliance with the permit.

For Outfall 003, the monitoring point shall be located after the combined flows of the process pond and thermal quench water.

For Internal Monitoring Point 005, monitoring of the metal cleaning waste treatment pond(s) shall be conducted prior to mixing with any other waste stream.

For Internal Monitoring Point 008, monitoring of the waste stabilization pond effluent shall be conducted after the waste stabilization pond and prior to the ash pond.

2. Sampling Frequency

Where the permit requires sampling and monitoring of a particular effluent characteristic(s) at a frequency of less than once per day or daily, the permittee is precluded from marking the "No Discharge" block on the Discharge Monitoring Report if there has been any discharge from that particular outfall during the period which coincides with the required monitoring frequency, i.e. if the required monitoring frequency is once per month or 1/month, the monitoring period is one month, and if the discharge occurs during only one day in that period then the permittee must sample on that day and report the results of analyses accordingly

3. Test Procedures

a. Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304 (h) of the Clean Water Act (the "Act"), as amended, under which such procedures may be required.

b. Unless otherwise noted in the permit, all pollutant parameters shall be determined according to methods prescribed in Title 40, CFR Part 136, as amended, promulgated pursuant to Section 304 (h) of the Act.

c. Mercury monitoring shall be performed in accordance with Title 40, CFR Part 136, using method 1631E or method 245.7. If another method gets EPA approval in the future that reaches lower detection levels than method 1631E or 245.7, the permittee may use that method.

d. In instances where permit limits established through implementation of applicable water criteria are below analytical capabilities, compliance with those limits will be determined using the detection limits described in the TN Rules, Chapter 1200-4-3-.05(8).

e. The wastewater discharge must be disinfected to the extent that viable coliform organisms are effectively eliminated. The concentration of the E. coli group after disinfection shall not exceed 126 cfu per 100 ml as the geometric mean calculated on the actual number of samples collected and tested for E. coli within the required reporting period. The permittee may collect more samples than specified as the monitoring frequency. Samples may not be collected at intervals of less than 12 hours. For the purpose of determining the geometric mean, individual samples having an E. coli group concentration of less than one (1) per 100 ml shall be considered as having a concentration of one (1) per 100 ml. In addition, the concentration of the E. coli group in any individual sample shall not exceed a specified maximum amount. A maximum daily limit of 487 colonies per 100 ml applies to lakes and Tier II waters. A maximum daily limit of 941 colonies per 100 ml applies to all other recreational waters.

4. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date and time of sampling;

b. The exact person(s) collecting samples;

c. The dates and times the analyses were performed;

d. The person(s) or laboratory who performed the analyses;

e. The analytical techniques or methods used, and;

f. The results of all required analyses.

5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation shall be retained for a minimum of three (3) years, or longer, if requested by the Division of Water Pollution Control.

C. DEFINITIONS

For the purpose of this permit, ***Annually*** is defined as a monitoring frequency of once every twelve (12) months beginning with the date of issuance of this permit so long as the following set of measurements for a given 12 month period are made approximately 12 months subsequent to that time.

A ***bypass*** is defined as the intentional diversion of waste streams from any portion of a treatment facility.

A ***calendar day*** is defined as the 24-hour period from midnight to midnight or any other 24-hour period that reasonably approximates the midnight to midnight time period.

A **Composite Sample**, for the purposes of this permit, is a sample collected continuously over a period of 24-hours at a rate proportional to the flow. Composite sample should be a combination of at least 8 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

Continuous monitoring, for the purposes of this permit, is the measurement of flow, total dissolved solids, and turbidity at a frequency that will accurately characterize the nature of discharges from the site and water in the receiving stream. Samples collected continuously shall be at a frequency of not less than once every fifteen minutes for flow, and not less than once per hour for turbidity and total dissolved solids.

The ***Daily Maximum Amount***, is a limitation measured in pounds per day (lb/day), on the total amount of any pollutant in the discharge by weight during any calendar day.

The ***Daily Maximum Concentration*** is a limitation on the average concentration, in milligrams per liter (mg/L), of the discharge during any calendar day. When a proportional-to-flow composite sampling device is used, the daily concentration is the concentration of that 24-hour composite; when other sampling means are used, the daily concentration is the arithmetic mean of the concentrations of equal volume samples collected during any calendar day or sampling period.

Degradation means the alteration of the properties of waters by the addition of pollutants or removal of habitat.

De Minimis – Alterations, other than those resulting in the condition of pollution or new domestic wastewater discharges, that represent either a small magnitude or a short duration shall be considered a *de minimis* impact and will not be considered degradation for purposes of implementing the antidegradation policy. Discharges other than domestic wastewater will be considered *de minimis* if they are temporary or use less than five percent of the available assimilative capacity for the substance being discharged. If more than one activity has been authorized in a segment and the total of the impacts uses no more than ten percent of the assimilative capacity, available habitat, or 7Q10 low flow, they are presumed to be *de minimis*. Where total impacts use more than ten percent of the assimilative capacity, available habitat, or 7Q10 low flow they may be treated as *de minimis* provided that the division finds on a scientific basis that the additional degradation has an insignificant effect on the resource and that no single activity is allowed to consume more than five percent of the assimilative capacity, available habitat or 7Q10 low flow.

Discharge or "discharge of a pollutant" refers to the addition of pollutants to waters from a source.

Dry Weather Flow shall be construed to represent discharges consisting of process and/or non-process wastewater only.

An ***ecoregion*** is a relatively homogeneous area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables.

The ***geometric mean*** of any set of values is the n^{th} root of the product of the individual values where "n" is equal to the number of individual values. The geometric mean is equivalent to the antilog of the arithmetic mean of the logarithms of the individual values. For the purposes of calculating the geometric mean, values of zero (0) shall be considered to be one (1).

A ***Grab Sample***, for the purposes of this permit, is defined as a single effluent sample of at least 100 milliliters (sample volumes <100 milliliters are allowed when specified per standard methods, latest edition) collected at a randomly selected time over a period not exceeding 15 minutes. The sample(s) shall be collected at the period(s) most representative of the total discharge.

The ***Instantaneous Concentration*** is a limitation on the concentration, in milligrams per liter (mg/L), of any pollutant contained in the discharge determined from a grab sample taken at any point in time.

The ***monthly average amount***, shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

The ***monthly average concentration***, other than for *E. coli* bacteria, is the arithmetic mean of all the composite or grab samples collected in a one-calendar month period.

A ***one week period*** (or ***calendar-week***) is defined as the period from Sunday through Saturday. For reporting purposes, a calendar week that contains a change of month shall be considered part of the latter month.

Pollutant means sewage, industrial wastes, or other wastes.

A **Qualifying Storm Event** is one which is greater than 0.1 inches and that occurs after a period of at least 72 hours after any previous storm event with rainfall of 0.1 inches or greater.

For the purpose of this permit, a ***Quarter*** is defined as any one of the following three month periods: January 1 through March 31, April 1 through June 30, July 1 through September 30, or October 1 through December 31.

A ***rainfall event*** is defined as any occurrence of rain, preceded by 10 hours without precipitation that results in an accumulation of 0.01 inches or more. Instances of rainfall occurring within 10 hours of each other will be considered a single rainfall event.

A ***rationale*** (or "fact sheet") is a document that is prepared when drafting an NPDES permit or permit action. It provides the technical, regulatory and administrative basis for an agency's permit decision.

A ***reference site*** means least impacted waters within an ecoregion that have been monitored to establish a baseline to which alterations of other waters can be compared.

A ***reference condition*** is a parameter-specific set of data from regional reference sites that establish the statistical range of values for that particular substance at least-impacted streams.

For the purpose of this permit, ***Semi-annually*** means the same as "once every six months." Measurements of the effluent characteristics concentrations may be made anytime during a 6 month period beginning from the issuance date of this permit so long as the second set of measurements for a given 12 month period are made approximately 6 months subsequent to that time, if feasible.

A ***subecoregion*** is a smaller, more homogenous area that has been delineated within an ecoregion.

Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

The term, ***washout*** is applicable to activated sludge plants and is defined as loss of mixed liquor suspended solids (MLSS) of 30.00% or more from the aeration basin(s).

Waters means any and all water, public or private, on or beneath the surface of the ground, which are contained within, flow through, or border upon Tennessee or any portion thereof except those bodies of water confined to and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters.

The ***weekly average amount***, shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar week when the measurements were made.

The ***weekly average concentration***, is the arithmetic mean of all the composite samples collected in a one-week period. The permittee must report the highest weekly average in the one-month period.

Wet Weather Flow shall be construed to represent storm water runoff which, in combination with all process and/or non-process wastewater discharges, as applicable, is discharged during a qualifying storm event.

D. ACRONYMS AND ABBREVIATIONS

1Q10 – 1-day minimum, 10-year recurrence interval
30Q20 – 30-day minimum, 20-year recurrence interval
7Q10 – 7-day minimum, 10-year recurrence interval
BAT – best available technology economically achievable
BCT – best conventional pollutant control technology
BDL – below detection level
BOD_5 – five day biochemical oxygen demand
BPT – best practicable control technology currently available
$CBOD_5$ – five day carbonaceous biochemical oxygen demand

CEI – compliance evaluation inspection
CFR – code of federal regulations
CFS – cubic feet per second
CFU – colony forming units
CIU – categorical industrial user
CSO – combined sewer overflow
DMR – discharge monitoring report
D.O. – dissolved oxygen
E. coli – Escherichia coli
EFO – environmental field office
LB(lb) - pound
IC_{25} – inhibition concentration causing 25% reduction in survival, reproduction and growth of the test organisms
IU – industrial user
IWS – industrial waste survey
LC_{50} – acute test causing 50% lethality
MDL – method detection level
MGD – million gallons per day
MG/L(mg/l) – milligrams per liter
ML – minimum level of quantification
ml – milliliter
MLSS – mixed liquor suspended solids
MOR – monthly operating report
NODI – no discharge
NOEC – no observed effect concentration
NPDES – national pollutant discharge elimination system
PL – permit limit
POTW – publicly owned treatment works
RDL – required detection limit
SAR – semi-annual [pretreatment program] report
SIU – significant industrial user
SSO – sanitary sewer overflow
STP – sewage treatment plant
TCA – Tennessee code annotated
TDEC – Tennessee Department of Environment and Conservation
TIE/TRE – toxicity identification evaluation/toxicity reduction evaluation
TMDL – total maximum daily load
TRC – total residual chlorine
TSS – total suspended solids
WQBEL – water quality based effluent limit

E. REPORTING

1. Monitoring Results

Monitoring results shall be recorded monthly and submitted monthly using Discharge Monitoring Report (DMR) forms supplied by the Division of Water Pollution Control or comparable form as provided by the Permittee. Submittals shall be postmarked no later than

15 days after the completion of the reporting period. A completed DMR with an original signature shall be submitted to the following address:

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
ENFORCEMENT & COMPLIANCE SECTION
L & C ANNEX 6TH FLOOR
401 CHURCH STREET
NASHVILLE TN 37243

A copy of the completed and signed DMR shall be mailed to the Johnson City Environmental Field Office (EFO) at the following address:

TENNESSEE DEPT. OF ENVIRONMENT & CONSERVATION
DIVISION OF WATER POLLUTION CONTROL
JOHNSON CITY ENVIRONMENTAL FIELD OFFICE
2305 SILVERDALE ROAD
JOHNSON CITY TN 37601

A copy should be retained for the permittee's files. In addition, any communication regarding compliance with the conditions of this permit must be sent to the two offices listed above.

The first DMR is due on the 15th of the month following permit effectiveness.

DMRs and any other information or report must be signed and certified by a responsible corporate officer as defined in 40 CFR 122.22, a general partner or proprietor, or a principal municipal executive officer or ranking elected official, or his duly authorized representative. Such authorization must be submitted in writing and must explain the duties and responsibilities of the authorized representative.

The electronic submission of DMR data will be accepted only if formally approved beforehand by the division. For purposes of determining compliance with this permit, data approved by the division to be submitted electronically is legally equivalent to data submitted on signed and certified DMR forms.

2. Additional Monitoring by Permittee

If the permittee monitors any pollutant specifically limited by this permit more frequently than required at the location(s) designated, using approved analytical methods as specified herein, the results of such monitoring shall be included in the calculation and reporting of the values required in the DMR form. Such increased frequency shall also be indicated on the form.

3. Falsifying Results and/or Reports

Knowingly making any false statement on any report required by this permit or falsifying any result may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Water Pollution Control Act, as amended, and in Section 69-3-115 of the Tennessee Water Quality Control Act.

4. Outlier Data

Outlier data include analytical results that are probably false. The validity of results is based on operational knowledge and a properly implemented quality assurance program. False results may include laboratory artifacts, potential sample tampering, broken or suspect sample containers, sample contamination or similar demonstrated quality control flaw.

Outlier data are identified through a properly implemented quality assurance program, and according to ASTM standards (e.g. Grubbs Test, 'h' and 'k' statistics). Furthermore, outliers should be verified, corrected, or removed, based on further inquiries into the matter. If an outlier was verified (through repeated testing and/or analysis), it should remain in the preliminary data set. If an outlier resulted from a transcription or similar clerical error, it should be corrected and subsequently reported.

Therefore, only if an outlier was associated with problems in the collection or analysis of the samples and as such does not conform with the Guidelines Establishing Test Procedures for the Analysis of Pollutants (40 CFR §136), it can be removed from the data set and not reported on the Discharge Monitoring Report forms (DMRs). Otherwise, all results (including monitoring of pollutants more frequently than required at the location(s) designated, using approved analytical methods as specified in the permit) should be included in the calculation and reporting of the values required in the DMR form. You are encouraged to use "comment" section of the DMR form (or attach additional pages), in order to explain any potential outliers or dubious results.

F. SCHEDULE OF COMPLIANCE

Full compliance and operational levels shall be attained from the effective date of this permit for the facility with the following exceptions:

1. The chart below lists the compliance schedule for meeting the arsenic and selenium limits listed for Outfall 001. Compliance with permit limits will be obtained by July 31, 2013 unless the facility requests a permit modification for a different course of action (i.e. outfall shutdown, relocation of outfall).

JSF Ash Pond Outfall 001 Compliance Schedule for Arsenic and Selenium Limits					
Task	**Start**	**Finish**	**Months**	**Report Deadline**	**Narrative Description**
1	4/1/2011	10/28/2011	7	11/12/2011	- Phase 1 Study: geo-tech/survey, Prepare Project Proposal Document, alternative methodology review. - Study review, comment and approval.
2	10/28/2011	7/31/2012	9	8/15/2012	Design, Approval, Permitting, Vendor Selection
3	7/31/2012	7/31/2013	12	8/15/2013	Construction

2. The new natural gas fired plant will be commissioned and brought on-line during this permit cycle. The new plant's Outfall 003 shall be in full compliance when the facility has wastewater associated with startup, testing, or operation of electric power generation that is discharged from the effluent pipe into the Holston River.

PART II

A. GENERAL PROVISIONS

1. Duty to Reapply

Permittee is not authorized to discharge after the expiration date of this permit. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit such information and forms as are required to the Director of Water Pollution Control (the "Director") no later than 180 days prior to the expiration date. Such applications must be properly signed and certified.

2. Right of Entry

The permittee shall allow the Director, the Regional Administrator of the U.S. Environmental Protection Agency, or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or where records are required to be kept under the terms and conditions of this permit, and at reasonable times to copy these records;

b. To inspect at reasonable times any monitoring equipment or method or any collection, treatment, pollution management, or discharge facilities required under this permit; and

c. To sample at reasonable times any discharge of pollutants.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Water Pollution Control Act, as amended, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Division of Water Pollution Control. As required by the Federal Act, effluent data shall not be considered confidential.

4. Proper Operation and Maintenance

a. The permittee shall at all times properly operate and maintain all facilities and systems (and related appurtenances) for collection and treatment which are installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes adequate laboratory and process controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems, which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit. Backup continuous pH and flow monitoring equipment are not required.

b. Dilution water shall not be added to comply with effluent requirements to achieve BCT, BPT, BAT and or other technology-based effluent limitations such as those in State of Tennessee Rule 1200-4-5-.09.

5. Treatment Facility Failure

The permittee, in order to maintain compliance with this permit, shall control production, all discharges, or both, upon reduction, loss, or failure of the treatment facility, until the facility is restored or an alternative method of treatment is provided. This requirement applies in such situations as the reduction, loss, or failure of the primary source of power.

6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State, or local laws or regulations.

7. Severability

The provisions of this permit are severable. If any provision of this permit due to any circumstance, is held invalid, then the application of such provision to other circumstances and to the remainder of this permit shall not be affected thereby.

8. Other Information

If the permittee becomes aware that he failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, then he shall promptly submit such facts or information.

B. CHANGES AFFECTING THE PERMIT

1. Planned Changes

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

a. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b); or

b. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR 122.42(a)(1).

2. Permit Modification, Revocation, or Termination

a. This permit may be modified, revoked and reissued, or terminated for cause as described in 40 CFR 122.62 and 122.64, Federal Register, Volume 49, No. 188 (Wednesday, September 26, 1984), as amended.

b. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

c. If any applicable effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established for any toxic pollutant under Section 307(a) of the Federal Water Pollution Control Act, as amended, the Director shall modify or revoke and reissue the permit to conform to the prohibition or to the effluent standard, providing that the effluent standard is more stringent than the limitation in the permit on the toxic pollutant. The permittee shall comply with these effluent standards or prohibitions within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified or revoked and reissued to incorporate the requirement.

d. The filing of a request by the permittee for a modification, revocation, reissuance, termination, or notification of planned changes or anticipated noncompliance does not halt any permit condition.

3. Change of Ownership

This permit may be transferred to another party (provided there are neither modifications to the facility or its operations, nor any other changes which might affect the permit limits and conditions contained in the permit) by the permittee if:

a. The permittee notifies the Director of the proposed transfer at least 30 days in advance of the proposed transfer date;

b. The notice includes a written agreement between the existing and new permittees containing a specified date for transfer of permit responsibility, coverage, and liability between them; and

c. The Director, within 30 days, does not notify the current permittee and the new permittee of his intent to modify, revoke or reissue, or terminate the permit and to require that a new application be filed rather than agreeing to the transfer of the permit.

Pursuant to the requirements of 40 CFR 122.61, concerning transfer of ownership, the permittee must provide the following information to the division in their formal notice of intent to transfer ownership: 1) the NPDES permit number of the subject permit; 2) the effective date of the proposed transfer; 3) the name and address of the transferor; 4) the name and address of the transferee; 5) the names of the responsible parties for both the transferor and transferee; 6) a statement that the transferee assumes responsibility for the subject NPDES permit; 7) a statement that the transferor relinquishes responsibility for the subject NPDES permit; 8) the signatures of the responsible parties for both the transferor and transferee pursuant to the requirements of 40 CFR 122.22(a), "Signatories to permit applications"; and, 9) a statement regarding any proposed modifications to the facility, its operations, or any other changes which might affect the permit limits and conditions contained in the permit.

4. Change of Mailing Address

The permittee shall promptly provide to the Director written notice of any change of mailing address. In the absence of such notice the original address of the permittee will be assumed to be correct.

C. NONCOMPLIANCE

1. Effect of Noncompliance

All discharges shall be consistent with the terms and conditions of this permit. Any permit noncompliance constitutes a violation of applicable State and Federal laws and is grounds for enforcement action, permit termination, permit modification, or denial of permit reissuance.

2. Reporting of Noncompliance

a. 24-Hour Reporting

In the case of any noncompliance which could cause a threat to public drinking supplies, or any other discharge which could constitute a threat to human health or the environment, the required notice of non-compliance shall be provided to the Division of Water Pollution Control in the appropriate regional Field Office within 24-hours from the time the permittee becomes aware of the circumstances. (The regional Field Office should be contacted for names and phone numbers of environmental response personnel).

A written submission must be provided within five calendar days of the time the permittee becomes aware of the circumstances, unless this requirement is waived by the Director on a case-by-case basis. The permittee shall provide the Director with the following information:

i. A description of the discharge and cause of noncompliance;

ii. The period of noncompliance, including exact dates and times or, if not corrected, the anticipated time the noncompliance is expected to continue; and

iii. The steps being taken to reduce, eliminate, and prevent recurrence of the noncomplying discharge.

b. Scheduled Reporting

For instances of noncompliance which are not reported under subparagraph 2.a. above, the permittee shall report the noncompliance on the Discharge Monitoring Report. The report shall contain all information concerning the steps taken, or planned, to reduce, eliminate, and prevent recurrence of the violation and the anticipated time the violation is expected to continue.

3. Sanitary Sewer Overflow

a. "***Sanitary Sewer Overflow***" means the discharge to land or water of wastes from any portion of the collection, transmission, or treatment system other than through permitted outfalls.

b. Sanitary Sewer Overflows are prohibited.

c. The permittee shall operate the collection system so as to avoid sanitary sewer overflows. No new or additional flows shall be added upstream of any point in the collection system, which experiences chronic sanitary sewer overflows (greater than 5 events per year) or would otherwise overload any portion of the system.

d. Unless there is specific enforcement action to the contrary, the permittee is relieved of this requirement after: 1) an authorized representative of the Commissioner of the Department of Environment and Conservation has approved an engineering report and construction plans and specifications prepared in accordance with accepted engineering practices for correction of the problem; 2) the correction work is underway; and 3) the cumulative, peak-design, flows potentially added from new connections and line extensions upstream of any chronic overflow point are less than or proportional to the amount of inflow and infiltration removal documented upstream of that point. The inflow and infiltration reduction must be measured by the permittee using practices that are customary in the environmental engineering field and reported in an attachment to a Monthly Operating Report submitted to the regional TDEC Field Office. The data measurement period shall be sufficient to account for seasonal rainfall patterns and seasonal groundwater table elevations.

e. In the event that more than five (5) sanitary sewer overflows have occurred from a single point in the collection system for reasons that may not warrant the self-imposed moratorium or completion of the actions identified in this paragraph, the permittee may request a meeting with the Division of Water Pollution Control field office staff to petition for a waiver based on mitigating evidence.

4. Upset

a. "***Upset***" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

b. An upset shall constitute an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the permittee demonstrates, through properly signed, contemporaneous operating logs, or other relevant evidence that:

i. An upset occurred and that the permittee can identify the cause(s) of the upset;

ii. The permitted facility was at the time being operated in a prudent and workman-like manner and in compliance with proper operation and maintenance procedures;

iii. The permittee submitted information required under "Reporting of Noncompliance" within 24-hours of becoming aware of the upset (if this information is provided orally, a written submission must be provided within five days); and

iv. The permittee complied with any remedial measures required under "Adverse Impact."

5. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to the waters of Tennessee resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge. It shall not be a defense for the permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

6. Bypass

a. "***Bypass***" is the intentional diversion of wastewater away from any portion of a treatment facility. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities, which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Bypasses are prohibited unless the following 3 conditions are met:

i. The bypass is unavoidable to prevent loss of life, personal injury, or severe property damage;

ii. There are not feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment down-time. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass, which occurred during normal periods of equipment down-time or preventative maintenance;

iii. The permittee submits notice of an unanticipated bypass to the Division of Water Pollution Control in the appropriate environmental assistance center within 24-hours of becoming aware of the bypass (if this information is provided orally, a written submission must be provided within five days). When the need for the bypass is foreseeable, prior notification shall be submitted to the Director, if possible, at least 10 days before the date of the bypass.

c. Bypasses not exceeding limitations are allowed **only** if the bypass is necessary for essential maintenance to assure efficient operation. All other bypasses are prohibited. Allowable bypasses not exceeding limitations are not subject to the reporting requirements of 6.b.iii, above.

7. Washout

a. For domestic wastewater plants only, a "washout" shall be defined as loss of Mixed Liquor Suspended Solids (MLSS) of 30.00% or more. This refers to the MLSS in the aeration basin(s) only. This does not include MLSS decrease due to solids wasting to the sludge disposal system. A washout can be caused by improper operation or from peak flows due to infiltration and inflow.

b. A washout is prohibited. If a washout occurs the permittee must report the incident to the Division of Water Pollution Control in the appropriate regional Field Office within 24-hours by telephone. A written submission must be provided within 5 days. The washout must be noted on the discharge monitoring report. Each day of a washout is a separate violation.

D. LIABILITIES

1. Civil and Criminal Liability

Except as provided in permit conditions for "**Bypassing,**" "**Overflow,**" and "**Upset,**" nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance. Notwithstanding this permit, the permittee shall remain liable for any damages sustained by the State of Tennessee, including but not limited to fish kills and losses of aquatic life and/or wildlife, as a result of the discharge of wastewater to any surface or subsurface waters. Additionally, notwithstanding this Permit, it shall be the responsibility of the permittee to conduct its wastewater treatment and/or discharge activities in a manner such that public or private nuisances or health hazards will not be created.

2. Liability Under State Law

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or the Federal Water Pollution Control Act, as amended.

PART III

OTHER REQUIREMENTS

A. TOXIC POLLUTANTS

The permittee shall notify the Division of Water Pollution Control as soon as it knows or has reason to believe:

1. That any activity has occurred or will occur which would result in the discharge on a routine or frequent basis, of any toxic substance(s) (listed at 40 CFR 122, Appendix D, Table II and III) which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. One hundred micrograms per liter (100 ug/l);

    b. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

    c. Five (5) times the maximum concentration value reported for that pollutant(s) in the permit application in accordance with 122.21(g)(7); or

    d. The level established by the Director in accordance with 122.44(f).

2. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

    a. Five hundred micrograms per liter (500 ug/l);

    b. One milligram per liter (1 mg/L) for antimony;

    c. Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 122.21(g)(7); or

    d. The level established by the Director in accordance with 122.44(f).

B. REOPENER CLAUSE

If an applicable standard or limitation is promulgated under Sections 301(b)(2)(C) and (D), 304(B)(2), and 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked and reissued to conform to that effluent standard or limitation.

C. PLACEMENT OF SIGNS

Within sixty (60) days of the effective date of this permit, the permittee shall place and maintain a sign(s) at each outfall and any bypass/overflow point in the collection system. For the purposes of this requirement, any bypass/overflow point that has discharged five (5) or more times in the last year must be so posted. The sign(s) should be clearly visible to the public from the bank and the receiving stream or from the nearest public property/right-of-way, if applicable. The minimum sign size should be two feet by two feet (2' x 2') with one inch (1") letters. The sign should be made of durable material and have a white background with black letters.

The sign(s) are to provide notice to the public as to the nature of the discharge and, in the case of the permitted outfalls, that the discharge is regulated by the Tennessee Department of Environment and Conservation, Division of Water Pollution Control. The following is given as an example of the minimal amount of information that must be included on the sign for Outfall 001:

TREATED INDUSTRIAL WASTEWATER **TVA - John Sevier Fossil Plant** **(Permittee's Phone Number)** **NPDES Permit NO. TN0005436** **TENNESSEE DIVISION OF WATER POLLUTION CONTROL** **1-888-891-8332 ENVIRONMENTAL FIELD OFFICE - Johnson City**

D. ANTIDEGRADATION

Pursuant to the Rules of the Tennessee Department of Environment and Conservation, Chapter 1200-4-3-.06, titled "Tennessee Antidegradation Statement," and in consideration of the Department's directive in attaining the greatest degree of effluent reduction achievable in municipal, industrial, and other wastes, the permittee shall further be required, pursuant to the terms and conditions of this permit, to comply with the effluent limitations and schedules of compliance required to implement applicable water quality standards, to comply with a State Water Quality Plan or other State or Federal laws or regulations, or where practicable, to comply with a standard permitting no discharge of pollutants.

E. BIOMONITORING REQUIREMENTS, CHRONIC

The permittee shall conduct a 3-Brood *Ceriodaphnia dubia* Survival and Reproduction Test and a 7-Day Fathead Minnow *(Pimephales promelas)* Larval Survival and Growth Test on the same samples of final effluent from Outfall 001 and Outfall 002.

The measured endpoint for toxicity will be the inhibition concentration causing 25% reduction (IC25) in survival, reproduction, or growth of the test organisms. The IC25 shall be determined based on a 25% reduction as compared to the controls. The average reproduction and growth responses will be determined based on the number of *Ceriodaphnia dubia* or *Pimephales promelas* larvae used to initiate the test.

Test shall be conducted and its results reported based on appropriate replicates of a total of five serial dilutions and a control, using the percent effluent dilutions as presented in the following table:

Outfall 001 - Serial Dilutions for Whole Effluent Toxicity (WET) Testing					
Permit Limit (PL)	**0.50 X PL**	**0.25 X PL**	**0.125 X PL**	**0.0625 X PL**	**Control**
% effluent					
100	**50**	**25**	**12.5**	**6.25**	**0**

Test shall be conducted and its results reported based on appropriate replicates of a total of five serial dilutions and a control, using the percent effluent dilutions as presented in the following table:

Outfall 002 - Serial Dilutions for Whole Effluent Toxicity (WET) Testing					
100% Effluent	**(100+PL)/2**	**Permit Limit (PL)**	**0.50 X PL**	**0.25 X PL**	**Control**
% effluent					
100	**94.5**	**89.0**	**44.5**	**22.25**	**0**

The dilution/control water used will be a moderately hard water as described in Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA-821-R-02-013 (or the most current edition). Results from a chronic standard reference toxicant quality assurance test for each species tested shall be submitted with the discharge monitoring report. Reference toxicant tests shall be conducted as required in EPA-821-R-02-013 (or the most current edition). Additionally, the analysis of this multi-concentration test shall include review of the concentration-response relationship to ensure that calculated test results are interpreted appropriately.

Toxicity will be demonstrated if the IC25 is less than or equal to the permit limit indicated for each outfall in the above table(s). Toxicity demonstrated by the tests specified herein constitutes a violation of this permit. However, if raw water intake samples (tested concurrently with the effluent samples) are shown to be toxic enough to represent a test failure (100 percent samples statistically less than controls using t-tests and minnow growth or daphnid reproduction is 25 percent less than controls) and if effluent toxicity is not statistically greater than calculated intake toxicity, the effluent toxicity test in question will be considered invalid. In the event these two above described conditions occur, the toxicity test shall be repeated according to the schedule requirements for test failure. Effluent toxicity that is not consistent with the intake toxicity conditions specified above constitutes a violation of the permit.

All tests will be conducted using a minimum of three 24-hour flow-proportionate composite samples of final effluent (e.g., collected on days 1, 3 and 5). If, in any control more than 20% of the test organisms die in 7 days, the test (control and effluent) is considered invalid and the test shall be repeated within 30 days of the date the initial test is invalidated. Furthermore, if the results do not meet the acceptability criteria of section 4.9.1, EPA-821-R-02-013 (or the most current edition), or if the required concentration-response review fails to yield a valid relationship per guidance contained in Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing, EPA-821-B-00-004 (or the most current edition), that test shall be repeated. Any test initiated but terminated before completion must also be reported along with a complete explanation for the termination.

The toxicity tests specified herein shall be conducted annually (1/Year) for **Outfall 001**. The testing should begin no later than 180 days from the effective date of this permit.

The toxicity tests at **Outfall 002** specified herein will be based on the frequency of using the biocides. The toxicity tests specified above shall be conducted only if biocides are added to the cooling water at a maximum of once per quarter for the first year and once every six months thereafter for the duration of the permit. The first tests shall begin no later than ninety (90) days from the effective date of this permit.

In the event of a test failure, the permittee must start a follow-up test within 2 weeks and submit results from a follow-up test within 30 days from obtaining initial WET testing results. The follow-up test must be conducted using the same serial dilutions as presented in the corresponding table(s) above. **The follow-up test will not negate an initial failed test. In addition, the failure of a follow-up test will constitute a separate permit violation which must also be reported.**

In the event of 2 consecutive test failures or 3 test failures within a 12 month period for the same outfall, the permittee must initiate a Toxicity Identification Evaluation/Toxicity Reduction Evaluation (TIE/TRE) study within 30 days and so notify the division by letter. This notification shall include a schedule of activities for the initial investigation of that outfall. **During the term of the TIE/TRE study, the frequency of biomonitoring shall be once every three months.** Additionally, the permittee shall submit progress reports once every three months throughout the term of the TIE/TRE study. The toxicity must be reduced to allowable limits for that outfall within 2 years of initiation of the TIE/TRE study. Subsequent to the results obtained from the TIE/TRE studies, the permittee may request an extension of the TIE/TRE study period if necessary to conduct further analyses. The final determination of any extension period will be made at the discretion of the division.

The TIE/TRE study may be terminated at any time upon the completion and submission of 2 consecutive tests (for the same outfall) demonstrating compliance. Following the completion of TIE/TRE study, the frequency of monitoring will return to a regular schedule, as defined previously in this section as well in Part I of the permit. **During the course of the TIE/TRE study, the permittee will continue to conduct toxicity testing of the outfall being**

investigated at the frequency of once every three months but will not be required to perform follow-up tests for that outfall during the period of TIE/TRE study.

Test procedures, quality assurance practices, determinations of effluent survival/reproduction and survival/growth values, and report formats will be made in accordance with Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA-821-R-02-013, or the most current edition.

Results of all tests, reference toxicant information, copies of raw data sheets, statistical analysis and chemical analyses shall be compiled in a report. The report will be written in accordance with Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, EPA-821-R-02-013, or the most current edition.

Two copies of biomonitoring reports (including follow-up reports) shall be submitted to the division. One copy of the report shall be submitted along with the discharge monitoring report (DMR). The second copy shall be submitted to the local Division of Water Pollution Control office address:

Environmental Field Office - Johnson City
Division of Water Pollution Control
2305 Silverdale Road
Johnson City, TN 37601

F. BIOMONITORING REQUIREMENTS, ACUTE

The permittee shall conduct a 48-hour static acute toxicity test on two test species on the same samples of final effluent from Outfall 003. The test species to be used are Water Fleas (*Ceriodaphnia dubia)* and Fathead Minnows *(Pimephales promelas*).

The measured endpoint for toxicity will be the concentration causing 50% lethality (LC50) of the test organisms. The LC50 shall be determined based on a 50% lethality as compared to the controls.

Test shall be conducted and its results reported based on appropriate replicates of a total of five serial dilutions and a control, using the percent effluent dilutions as presented in the following table:

Serial Dilutions for Whole Effluent Toxicity (WET) Testing					
100% Effluent	**50% Effluent**	**25% Effluent**	**12.5% Effluent**	**6.25% Effluent**	**Control**
% effluent					
100	**50**	**25**	**12.5**	**6.25**	**0**

The dilution/control water used will be a moderately hard water as described in Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine

Organisms, EPA-821-R-02-012 (or the most current edition). Results from an acute standard reference toxicant quality assurance test for each species tested shall be submitted with the discharge monitoring report. Reference toxicant tests shall be conducted as required in EPA-821-R-02-012 (or the most current edition). Additionally, the analysis of this multi-concentration test shall include review of the concentration-response relationship to ensure that calculated test results are interpreted appropriately.

Toxicity will be demonstrated if the LC50 is less than or equal to the permit limit indicated for each outfall in the above table(s). Toxicity demonstrated by the tests specified herein constitutes a violation of this permit.

Discharges will be conducted using a single grab sample. If, in any control more than 10% of the test organisms die in 48 hours, the test (control and effluent) is considered invalid and the test shall be repeated within 30 days of the date the initial test is invalidated. Furthermore, if the results do not meet the acceptability criteria as defined in Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, EPA-821-R-02-012, or if the required concentration-response review fails to yield a valid relationship per guidance contained in Method Guidance and Recommendations for Whole Effluent Toxicity (WET) Testing, EPA-821-B-00-004 (or the most current edition), that test shall be repeated. Any test initiated but terminated before completion must also be reported along with a complete explanation for the termination.

The toxicity tests specified herein shall be conducted semi-annually (2/Year) for **Outfall 003** and begin no later than 90 days from the initial discharge from the outfall of wastewater associated with startup, testing, or operation of electric power generation. At least one of the biomonitoring tests will be conducted during a time of year when quench water is not being added to the wastewater effluent.

In the event of a test failure, the permittee must start a follow-up test within 2 weeks and submit results from a follow-up test within 30 days from obtaining initial WET testing results. The follow-up test must be conducted using the same serial dilutions as presented in the corresponding table(s) above. **The follow-up test will not negate an initial failed test. In addition, the failure of a follow-up test will constitute a separate permit violation which must also be reported.**

In the event of 2 consecutive test failures or 3 test failures within a 12 month period for the same outfall, the permittee must initiate a Toxicity Identification Evaluation/Toxicity Reduction Evaluation (TIE/TRE) study within 30 days and so notify the division by letter. This notification shall include a schedule of activities for the initial investigation of that outfall. **During the term of the TIE/TRE study, the frequency of biomonitoring shall be once every three months.** Additionally, the permittee shall submit progress reports once every three months throughout the term of the TIE/TRE study. The toxicity must be reduced to allowable limits for that outfall within 2 years of initiation of the TIE/TRE study. Subsequent to the results obtained from the TIE/TRE studies, the permittee may request an extension of the TIE/TRE study period if necessary to conduct further analyses. The final determination of any extension period will be made at the discretion of the division.

The TIE/TRE study may be terminated at any time upon the completion and submission of 2 consecutive tests (for the same outfall) demonstrating compliance. Following the completion of TIE/TRE study, the frequency of monitoring will return to a regular schedule, as defined previously in this section as well in Part I of the permit. **During the course of the TIE/TRE study, the permittee will continue to conduct toxicity testing of the outfall being investigated at the frequency of once every three months but will not be required to perform follow-up tests for that outfall during the period of TIE/TRE study.**

Test procedures, quality assurance practices and determination of effluent lethality values will be made in accordance with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, EPA-821-R-02-012, or the most current edition.

Results of all tests, reference toxicant information, copies of raw data sheets, statistical analysis and chemical analysis shall be compiled in a report. The report shall be written in accordance with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, EPA-821-R-02-012, or the most current edition.

Two copies of biomonitoring reports (including follow-up reports) shall be submitted to the division. One copy of the report shall be submitted along with the discharge monitoring report (DMR). The second copy shall be submitted to the local Division of Water Pollution Control office address:

Environmental Field Office - Johnson City
Division of Water Pollution Control
2305 Silverdale Road
Johnson City, TN 37601

The reasonable potential to cause toxicity in the receiving stream will be evaluated based on the results of the WET testing. At that time, should the results so dictate, the division maintains the authority to institute specific numeric biomonitoring limitations.

G. ASH POND VOLUME

Beginning on the effective date of this permit and lasting until the expiration date, the permittee shall provide and maintain a minimum free water volume in the ash pond of 15.9 million gallons. As needed, the permittee shall remove settled material from the pond, or otherwise enlarge the available storage capacity in order to maintain the required minimum free water volume. The permittee shall certify annually that the required volume is maintained and shall submit the report to the division with the monthly discharge monitoring report once per year. Certification shall be based upon physical surveys conducted every two years and estimates of ash volumes generated/removed in the intervening years.

H. DIKE INSPECTIONS

1. Inspection Procedures

(1) The John Sevier Fossil ash pond shall be inspected in accordance with TVA's Reservoir Operations Dam Safety Program criteria and processes. This program is directed by TVA's Dam Safety Governance Program and is in accordance with the 'Federal

Guidelines for Dam Safety' developed by the Federal Emergency Management Agency (FEMA 93). This document directs TVA to perform inspections scheduled on specific intervals and with qualified personnel. The dikes will also be visually inspected daily during operations by site personnel or designee that are trained in dam safety procedures by TVA's Dam Safety Governance Program. Impoundments shall be inspected annually by a state-registered professional engineer trained and experienced in dam safety inspection procedures. Special inspections by qualified personnel shall be done within 24 hours after intense, large or extended rain events (i.e., 10-year storm or equaling or exceeding the design requirements for managing storm water) or as soon as safely practicable after a significant seismic event approaching or exceeding the design event. The reason for this is to validate structural integrity of the structure following an event that could test the design assumptions.

(2) Daily inspections shall, at a minimum, include observations of dams, dikes and toe areas for erosion, cracks or bulges, subsidence, seepage, wet or soft soil, changes in geometry, the depth and elevation of the impounded water, sediment or slurry, freeboard, changes in vegetation such as overly lush, obstructive vegetation and trees, outlet controls, drains and any other changes which may indicate a potential compromise to impoundment integrity. TVA must prepare a checklist in accordance with proper TVA Dam Safety Governance Program requirements with review and written concurrence from staff responsible for TVA dam safety. The checklist must have space for observation notes to be used by the daily inspectors to ensure comprehensive and consistent inspections. Copies of the daily inspection checklist must be maintained in accordance with the recordkeeping requirements specified below.

(3) Annual and special inspections shall include the minimum observations set forth in (2). In addition these annual and special inspections must also include a review of daily inspection records, operation and maintenance history, instrumentation design and construction. The findings of each inspection along with the specific qualifications of the inspector shall be summarized and documented in the annual report. The permittee shall submit the first annual report no later than 18 months after the effective date of the permit.

(4) *Remediation Measures.* Within 24 hours of discovering changes that indicate a potential compromise to the structural integrity of the impoundment, the permittee shall begin procedures to remediate the problem. Changes such as significant increases in seepage or seepage carrying sediment may be signs of imminent impoundment failure and should be addressed immediately.

Other issues which may have long term impacts on integrity, such as trees growing on the embankment (especially large, dead or tilting trees, with special concern for those at the toes of or within the saturated zones of embankment structures), or vegetation-blocking overflows or spillways, shall be removed according to approved geotechnical engineering practices and instructions.

2. Reporting and Recordkeeping Requirements for Impoundments

(1) Imminent impoundment failure conditions should be reported immediately to TDEC and the Hawkins County Emergency Management Agency, who will report to TEMA.

(2) Within 24 hours of discovering a change in the impoundment that indicates a potential compromise to the structural integrity of the dike (e.g., significant changes in seeps, boils, bulges, or cracks), the permittee must make contact with division personnel describing the findings of the inspection, corrective measures taken or proposed (if known), and expected outcomes. TVA must keep current a list of division personnel complete with after-hours contact information and must speak directly to someone on this list within the 24 hour period. Failure to notify the division within 24 hours will be a violation of this permit. In addition, the permittee must submit a follow-up report within 5 days summarizing the incident, corrective actions taken and outcomes. Additional reports pertaining to the event may be required by the Director.

(3) The permittee shall submit an annual report to the division summarizing findings of all monitoring activities and measurements, inspections, and remediation measures pertaining to the structural integrity, design, construction, and operation and maintenance of all impoundments.

(4) The permittee shall maintain records of all impoundment inspection and maintenance activities, including corrective actions made in response to inspections and all other activities undertaken to repair or maintain the impoundment. The permittee shall also maintain records of any measurements and evaluation of safety factors. All records shall be kept on site and made available to State or Federal inspectors upon request.

(5) All pertinent impoundment permits, design, construction, operation, and maintenance information, including but not limited to: records of the training provided to the daily inspectors, plans, geotechnical and structural integrity studies, copies of permits, associated certifications by qualified, State-registered professional engineer, and regulatory approvals, shall be kept on site and made available to State or Federal inspectors upon request.

I. BIOCIDE/CORROSION TREATMENT PLAN

Previous permits addressed "toxic chemicals", biocide(s), and slimicide(s) use at the site for process and non-process flows in a Best Management Plan (BMP) program. A new program for managing the use of these products shall be developed under a Biocide/Corrosion Treatment Plan (B/CTP). This plan is similar to other major-classed TVA facilities in Tennessee.

The B/CTP shall describe chemical applications and macroinvertebrate controls; include all material feed rates, and proposed monitoring schedule(s) to verify that effluent limitations are being met and water quality is being protected. The permittee shall conduct treatments of intake or process waters under this permit using biocides, dispersants, surfactants, corrosion inhibiting chemicals, or detoxification chemicals in accordance with conditions approved and specified in the previous permit. The permittee shall submit and updated plan for TDEC approval within 90 days of the effective date of the permit.

The permittee shall maintain the B/CTP plan at the facility and make the plan available to the permit issuing authority upon request. The permittee shall amend the B/CTP plan whenever there is a change in the application of the chemical additives or change in the operation of the facility that materially increases the potential for these activities to result in a discharge of significant amounts of pollutants. The division shall also be notified in writing within 30-days of any material-vendor changes that will change the names or quantities used of any such chemical additives.

J. RE-ROUTING FLOWS FOR MAINTENANCE PURPOSES

The permittee shall be allowed to re-route flows past normal monitoring points as a temporary measure for maintenance activities. However, such re-routing shall be done in such a way that permit limitations are still being met in the receiving waters and compliance with permit limitations is monitored and reported on the discharge monitoring reports for the re-routed flows. The receiving waters must be the same for the re-routed flows as for the normal discharges.

K. FISHERIES AND ISSUES RELATING TO AQUATIC HABITAT ENHANCEMENT

At this writing, the Tennessee Valley Authority and the Tennessee Wildlife Resources agency are continuing with an agreement (Contract No. TV-92520v), relating to stocking of appropriate fish species into the Holston River and/or Cherokee Reservoir. The specific provisions of this stocking program are recorded in a memorandum of agreement between the Tennessee Valley Authority and the Tennessee Wildlife Resources Agency. (Refer to Appendix 7 for a copy of the original agreement from March 1994.)

L. MINIMUM BYPASSED FLOW

To the maximum extent practicable (considering only the short and long term availability of water for release from upstream impoundments and alternative sources of generation to meet the public demand for power), not less than 350 cfs nor one-third of the plant cooling water flow, whichever is greater, shall be passed over the dam during the period from June 1 to September 30 at any time the plant is in operation. During the winter months, or during the period of October 1 to May 31, the minimum bypass flow shall be 100 cfs. These are the minimum volumes of cold water to be provided which will ensure the protection of spawning, development and survival of fish eggs, larvae, and fry and to provide living space for fish consistent with classified uses downstream from the diversion dam. Notice of expected need to reduce bypass flow shall be made not less than 30 days prior to implementing action, except in emergency situations, when notification shall be provided as expeditiously as practicable.

M. CERTIFIED OPERATOR FOR THE SANITARY WASTEWATER TREATMENT SYSTEM ASSOCIATED WITH INTERNAL MONITORING POINT 008

The facility's domestic waste treatment facilities shall be operated under the supervision of a Biological natural system operator in accordance with the Water Environmental Health Act of 1984 and the rules promulgated hereunder.

N. ASH POND CLOSURE PLAN

The permittee shall submit for TDEC approval an ash pond closure plan describing the steps to be taken to prevent contamination of surface waters from the inactive site. Within 90 days after the permit effective date, the permittee shall define closure actions to be implemented in conjunction with conversion from wet ash to dry ash handling and discontinued operation of existing ash ponds.

O. EMERGENCY RESPONSE PLAN

For purposes of this NPDES permit, TVA John Sevier Fossil Plant must submit for TDEC approval an emergency response plan which incorporates the recommendations provided in the report titled "Lessons Learned from the TVA Kingston Dredge Cell Containment Facility Failure, TDEC Advisory Board Recommendations for Safe Performance" (November 30, 2009).

P. FACILITY INTAKE WATER QUALITY MONITORING REQUIREMENTS

At a minimum, the permittee shall annually monitor the facility intake water for the following effluent characteristics (in mg/l): Hardness (as CaCO3), TSS, Aluminum, Antimony, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc, and Cyanide. All metals shall be reported as Total Recoverable Metal. All samples reported as "Below Detection Level" shall be analyzed to the Required Detection Level (RDL) specified in Tennessee General Water Quality Criteria, Chapter 1200-4-3-.05(8) except for Mercury which shall be analyzed by EPA Method 1631 or 245.7. Two copies of the monitoring results shall be submitted with the Discharge Monitoring Report in the month following sample collection.

Q. PRIORITY POLLUTANTS FOR OUTFALL 003

Within two (2) years from the effective date on the title page of this permit, the permittee shall submit to the division of Water Pollution Control a completed Application Form 2C - Wastewater Discharge Information, Consolidated Permits Program (EPA Form 3510-2C) for Outfall 003.

R. COAL ASH HANDLING AND TREATMENT BEST MANAGEMENT PRACTICES

In addition to traditional Best Management Practices (BMPs) that are implemented at this particular TVA fossil plant, the facility will develop and incorporate an additional best management practices plan that specifically address controls on toxic metals in ash pond discharges. Each practice must be developed and measured to document the relationship between operations and effluent metals concentrations. The submission of a BMP Plan for division approval shall be within 90 days following the permit effective date.

PART IV

THERMAL VARIANCE UNDER SECTION 316(A) OF THE CLEAN WATER ACT

316(a) alternate thermal variance remains in effect for the duration of the permit cycle. For more detail, refer to the rationale portion of this permit and Title 40, Code of Federal Regulations, §125.73 "Criteria and standards for the determination of iterative effluent limitations under section 316(a)".

Within 90 days of the permit effective date, the permittee shall prepare and submit for approval by the Division and EPA Region 4 a study plan which outlines how the permittee will conduct assessments that will generate information sufficient to support a determination of whether the John Sevier Plant's alternative thermal limit under Section 316(a) can be continued in its next NPDES permit. The proposed study plan shall be designed to supplement information previously provided by the permittee. The permittee shall implement provisions of the plan within 90 days of its approval by the Division.

APPENDIX A

Document 2

Stantec Report of Geotechnical Exploration, dated February 8, 2010

Stantec

Report of Geotechnical Exploration

Dry Fly Ash Stack
Bottom Ash Disposal Area 2
Ash Disposal Area J
John Sevier Fossil Plant
Rogersville, Tennessee

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1409 North Forbes Road
Lexington KY 40511-2050
Tel: (859) 422-3000 • Fax: (859) 422-3100
www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

February 8, 2010

Stantec

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Fax: (859) 422-3100

February 8, 2010 rpt_001_175569038

Mr. Barry Snider
Tennessee Valley Authority
1101 Market Street, LP-5E-C
Chattanooga, Tennessee 37402

Re: Report of Geotechnical Exploration
Dry Fly Ash Stack
Bottom Ash Disposal Area 2
Ash Disposal Area J
John Sevier Fossil Plant
Rogersville, Tennessee

Dear Mr. Snider:

Stantec Consulting Services Inc. (Stantec) has completed a geotechnical exploration of the Dry Fly Ash Stack, Bottom Ash Pond Area 2, and Ash Disposal Area J at the John Sevier Fossil (JSF) Plant. The purpose of the exploration was to perform a general engineering assessment of the stability of the three JSF ash disposal facilities. Our final report, transmitted herewith, includes discussions of general site conditions, scope of work performed, subsurface conditions, results of laboratory testing and our engineering analyses. The report also includes a review of historical documentation provided by TVA, and our conclusions and recommendations relative to the conditions and monitoring of the facilities. These services were performed under Engineering Service Request ESR/TAO 700 in accordance with the terms and provisions established in our System-Wide Services Agreement dated December 22, 2008.

Stantec appreciates the opportunity to provide engineering services for this project. If you have any questions, or if we may be of further assistance, please contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Adam Davis, EIT
Project Engineer

Hugo R. Aparicio, PE
Principal

Don W. Fuller II, PE
Principal

DON W FULLER II
REGISTERED ENGINEER
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STATE OF TENNESSEE

/rdr

Report of Geotechnical Exploration

Dry Fly Ash Stack
Bottom Ash Disposal Area 2
Ash Disposal Area J
John Sevier Fossil Plant
Rogersville, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

February 8, 2010

Report of Geotechnical Exploration

Dry Fly Ash Stack
Bottom Ash Disposal Area 2
Ash Disposal Area J
John Sevier Fossil Plant
Rogersville, Tennessee

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Executive Summary

Stantec has completed a geotechnical exploration of the Dry Fly Ash Stack, Bottom Ash Disposal Area 2, and Ash Disposal Area J at John Sevier Fossil Plant. The scope of work consisted of reviewing pertinent historical documentation provided by TVA, field observations, a geotechnical exploration, engineering analyses and providing conclusions and recommendations relative to the general stability conditions and monitoring of the three ash disposal facilities.

The Dry Fly Ash Stack is approximately 90 acres in area, rises about 110 feet above a nearby river and receives 215,000 tons of dry fly ash annually. The Bottom Ash Disposal Area 2, which receives 20,000 dry tons of sluiced bottom ash annually, is a 40-acre facility enclosed by an 8,600 foot long dike. The dike is the highest along its north side where it measures about 37 feet. Opened in 1955, the dry stack area was originally a series of ash ponds that stored sluiced ash. In 1979 all sluicing to the stack was stopped and the Bottom Ash Disposal Area 2 went online. The original ponds were closed and the stack area received only compacted, dry ash. Ash Disposal Area J, located west of the dry stack area, was the last ash pond to be constructed and operated from 1982 until 1999. It extends over 22 acres enclosed by an earthen dike that is 35 feet high along its north side.

There are reasonably complete design and as-built drawings of the dikes that form the two smaller facilities and the starter dike built originally along the north and east sides of the Dry Fly Ash Stack. However, practically no as-built information is available relative to the vertical expansion of the starter dike of the Dry Fly Ash Stack, which is the only facility where the starter dike was raised. This information is important because wet ash was deposited above the starter dike and dry ash was later stacked on top of the sluiced ash. Design plans for the dry ash stacking are available. Historical documents note a number of cases where disturbance occurred along the lower north dike slope of the Dry Fly Ash Stack before 2008.

The geotechnical exploration consisted of advancing 93 borings at the project site. The subsurface investigation included standard penetration testing (SPT) in most of the borings, and vane shear testing, cone penetration tests (CPT) and undisturbed soil sampling in selected borings. A total of 45 piezometers and 15 slope inclinometers were installed in selected borings. Several of the borings were advanced along the lower west side of the Dry Fly Ash Stack in an effort to obtain more information relative to the upward expansion of the starter dike after finding sluiced ash above the design top elevation of the starter dike.

The stability of the various dikes was evaluated using two-dimensional limit equilibrium methods of analysis, assuming static, long-term and fully drained conditions within the existing dikes. Stability analyses were performed for several cross sections using soil properties selected based on in-situ as well as laboratory testing results and phreatic levels obtained from piezometer readings. This evaluation was limited to existing conditions and does not address future operations.

The slope stability calculations produced factors of safety against sliding predominantly at or above 1.5, the minimum acceptable value that current USACE criteria requires for long-term loading conditions on similar dikes. Less than acceptable factor of safety values were obtained near the toe of the Dry Fly Ash Stack and Ash Disposal Area J north dike slopes. The low factors of safety for the dry stack are a result of high phreatic levels and steep river bank slope conditions. Steep toe slope conditions resulted in low factors of safety along

certain areas of Ash Disposal Area J. In addition, scouring along the river bank has left near vertical surfaces near the toe of the north dike slope of Area J, which in the past has caused slumps of tree areas that separated the toe of the dike from the river bank before the slumping. The slumps occurred toward the west end of the north dike slope. Similar slumps can potentially occur along the rest of the north dike slope of Area J unless corrective measures are implemented.

There are work plans currently being prepared to install a sub-drain along the toe of the Dry Fly Ash Stack north dike slope to lower the high phreatic surface. The sub-drain and placing additional riprap along the river bank should provide acceptable factors of safety for long term loading conditions. It is recommended that sufficient riprap be placed along the scoured river shoreline below Ash Disposal Area J to prevent potential future slumps adjacent to the toe of the dike as well as improve the stability of the dike.

The profile of the cross sections used in the stability analyses of the Dry Fly Ash Stack slopes was prepared based on the limited information exploratory borings provide and assumptions made relative to subsoil horizon boundaries. Understanding how these profiles were prepared is important in formulating measures to monitor the long term stability of the dike slopes located below elevation 1110 feet. It is recommended that the stability of these slopes be evaluated periodically through a rigorous instrumentation monitoring program. Depending on the results of the periodic evaluations and further analyses of corrective measures toward closure of the facilities, it is possible and it should be expected that additional geotechnical work, including installing more instrumentation, will need to be performed.

Report of Geotechnical Exploration

Dry Fly Ash Stack
Bottom Ash Disposal Area 2
Ash Disposal Area J
John Sevier Fossil Plant
Rogersville, Tennessee

1. Introduction

1.1. General

Tennessee Valley Authority (TVA) retained Stantec Consulting Services Inc. (Stantec) to perform facility assessments at eleven (11) active fossil plants and one closed fossil plant near the Watts Bar Nuclear Power plant. Specifically, Stantec was requested to assess the coal combustion by-product (CCB) disposal facilities at these plants. In general the facilities consisted of ash ponds, scrubber sludge (gypsum) ponds, wet ash dredge cells, dry ash stacks and gypsum stacks. A number of facilities were abandoned (having completed their design life), while majority of them were actively receiving by-products at the time of this project.

1.2. Facilities Assessment Project

Stantec's scope of work for the facilities assessment project was divided into four (4) main phases designated as Phases 1 through 4. Phase 1 was sub-divided into two phases, 1A and 1B. A brief description of Stantec's scope of work for each of the phases is presented in the following paragraphs.

- Phase 1A – Review most recent TVA inspection reports, observe critical disposal features accompanied by TVA personnel, develop a list of primary concerns and recommend immediate action or engineering assessment as considered necessary.

- Phase 1B – Review available historical documentation, visit sites for more detailed observations and measurements, complete dam safety checklists adapted from standard dam safety protocols, recommend immediate action as judged necessary and recommend sites/features that should undergo further evaluation.

- Phase 2 – Evaluate TVA facilities based on current dam safety criteria adopted by the state where the plant is located, conduct geotechnical explorations and engineering analyses at sites recommended in Phase 1 as well as prepare conceptual designs to address identified issues.

- Phase 3 – Design of repairs for sites recommended in Phase 2, plans and specifications for construction as well as permit/planning documents.

- Phase 4 – Dam safety training for TVA Staff and preparation of operation manuals.

At the time of this writing, Phase 1 of the assessment was completed at all fossil plants and Phase 2 was being implemented at several facilities located within the different plants. Phase 1 report recommended that Phase 2 evaluations include geotechnical exploration and hydraulic/hydrologic assessment. This report addresses the results of a geotechnical exploration of the Dry Fly Ash stack, Bottom Ash Disposal Area 2 and Ash Disposal Area J of the John Sevier Fossil Plant.

1.3. Facility Layout and Power Generation

The John Sevier Fossil Plant is located in eastern Tennessee along the southern flank of the Holston River near Rogersville. Figure 1 below shows the approximate location of the plant.

Figure 1. Vicinity Map

Construction of the John Sevier Fossil Plant began in 1952 and was completed in 1957. The plant has four coal-fired generating units, consumes approximately 5,700 tons of coal per day and generates 5 billion kilowatt-hours of electricity a year, enough to supply more than 350,000 homes. The winter net dependable generating capacity is 712 megawatts.

There are three disposal facilities which TVA has operated or is currently operating: (1) Dry Fly Ash Stack, (2) Bottom Ash Disposal Area 2 and (3) Ash Disposal Area J (closed). Figure 2 below shows the layout of the three facilities along with other smaller structures.

Approximately 215,000 tons of dry fly ash is collected in silos each year and hauled to an onsite permitted dry stack disposal area (Dry Fly Ash Stack). Approximately 100,000 dry tons of fly ash is marketed offsite to the concrete industry. Approximately 20,000 dry tons per year of bottom ash is wet-sluiced to Bottom Ash Disposal Area 2. At the Bottom Ash Disposal Area 2, bottom ash is collected and sent offsite by Appalachian Products.

Figure 2. Location Map

2. Scope of Work

The scope of the geotechnical exploration was divided into the following tasks.

a. Review of general site geology

b. Review of historical Information

c. Disturbance features observed in 2009

d. Subsurface Exploration

e. Field Instrumentation and Monitoring

f. Surveying

g. Laboratory Testing

h. Engineering Analyses

i. Repair and Maintenance Work Completed in 2009

j. Conclusions and Recommendations

k. Closure

The work performed as part of these tasks is described in the following paragraphs

3. General Site Geology

The John Sevier Fossil Plant is located in the eastern portion of Tennessee along the southern flank of the Holston River just east (upstream) of the confluence of the river and Dodson Creek. This portion of Tennessee is underlain by sedimentary rock formations which were folded and fractured by ancient tectonic events. More specifically, the general area of the plant is underlain by two distinct formations, the Sevier Shale and the Newala Formation of the Knox Dolomite Group. It is probable that the contact between these formations occurs along or just north of where the Holston River crosses the plant area, with the Sevier Shale outcropping south of the river.

Most of the plant reservation was developed on a floodplain of the Holston River. As such, much of the site is underlain by alluvium and terrace deposits varying in thickness from less than 5 feet along the tributary stream banks to more than 30 feet adjacent to the river. Typical of alluvium in this region of the state, these soils consist of sands, silts, and gravels with few interspersed cobbles. The underlying bedrock consists of the Ordovician age Sevier Shale Formation which consists of bluish gray, a silty to sandy calcareous shale with thin limestone layers and lenses of siltstone and sandstone.

According to a description presented in plant historical information (see Reference 10 listed in Table 1), massive shale outcrops in a quarry located southeast of the plant indicate that the folded Sevier Shale dips at angles ranging from 45 to 80 degrees to the southeast. Joints were observed running sub-parallel to the strike and dipping near vertical. Reference 10 also states that the Newala Formation is exposed north of the river where a significant level of solution activity was noted.

Sevier Shale outcrops are visible along the Polly Branch Creek adjacent to the existing Bottom Ash Disposal Area 2 and along the Holston River adjacent to the closed Ash Disposal Area J. Solution activity within the plant reservation south of Holston River was not reported in previous geotechnical studies nor was it encountered during Stantec's geotechnical exploration.

4. Review of Historical Information

4.1. General

During the Phase 1 of the facility assessment, Stantec engineers reviewed all documents provided by TVA pertaining to the development of the different ash disposal facilities. The documents reviewed for this report include mostly design drawings and reports. Other documents reviewed consisted of correspondence (letters, emails and faxes) and photos. A complete list of the documents provided by TVA for review is presented with the Phase 1 Facility Assessment Report. Table 1 presents a list of the documents considered more relevant to the geotechnical study of the different disposal areas as part of Phase 2 of the facility assessment.

Table 1. List of Documents Reviewed for Geotechnical Exploration

Reference No.*	Document Name	Type of Document	Dated	Agency	TVA Reference No.
1	Ash Disposal Area	Design Drawing	April 1953 (revised 1958)	TVA	10N410
2	Ash Disposal Area "E" Dike Repair	Design Drawing	July 1973 (As-Built, March 1975)	TVA	10N290
3	Fly Ash Disposal Area "G"	Design Drawings	February 1974 (As-built, August 1980)	TVA	10N295 10N296
4	Ash Disposal Area No. 2	Design Drawings	August 1977 (As-Built, August 1980)	TVA	10W293 1 through 3
5	Fly Ash Disposal Area "J"	Design Drawings	July 1982 (revised 1984)	TVA	10W286 1 through 7
6	Dry Fly Ash Stack Existing Contours (East)	Design Drawing	September 1994 (revised 1997)	LAW	10H291-3
7	Ash Disposal-Stack Area	Design Drawings	March 2001 (revised 2002)	Parsons	10W206 1 through 11
8	Ash Disposal Area Soils Exploration & Testing	Report	June 1981	TVA	NA
9	Ash Disposal Area Proposed Dry Stacking	Report	July 1986	TVA	NA
10	Report of Hydrogeologic and Engineering Evaluation	Report	October 1994	LAW	NA
11	Dike Exploration and Testing Program	Report	October 1999	LAW	NA
12	Fly Ash Pond Dike Slope Stability Evaluation	Report	December 1999	Parsons	NA

*Presented as attachments in this order in Appendix A

4.2. Development of Disposal Facilities

4.2.1. Dry Fly Ash Stack

The Dry Fly Ash Stack was originally a series of ash ponds when the plant went online in 1955. The ponds were labeled as 'Areas' and lettered from A to G, with Area A being the most eastern pond and Area G being the most western (west half of Area G is now the Stilling Pond West). There is practically no information available relative to the construction of the dikes that divided these areas, except for the construction of Area G as discussed later. Reference Nos. 2 and 3 include a Key Plan of the disposal site showing the relative location of the different areas. This Key Plan is also presented in Figure 3.

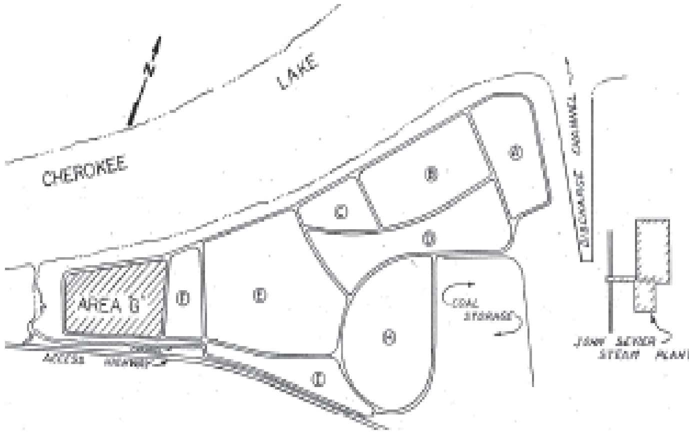


Figure 3. Original Disposal Pond Areas

At the beginning of the plant operations, only Areas A, B and C were active and water was discharged to the river through a spillway in Area C. In 1971, Areas A, B, and C were abandoned and ash was sluiced to Areas D, E and F (spillway in Area F discharged to river).

In 1973, sluicing stopped to Areas D, E, and F due to the dike failure in Area E (though spillway was still active) and Areas H and I were activated (spillway in I to drainage channel along main plant road). In 1974, Areas A, B, C, D, E, and F were used as disposal areas for dredged bottom ash. In 1976, Area G was activated in the west end of the current Dry Fly Ash Stack, and received all sluiced fly ash while Areas H and I received all sluiced bottom ash.

In 1979, the Bottom Ash Disposal Area 2 was activated and all sluicing stopped to the Dry Fly Ash Stack area. At this same time, Areas A through I were designated for dry ash disposal and Area G was filled and abandoned. In 1982, a Bathtub Area was constructed in the eastern portion of the Dry Fly Ash Stack. In 1984, the Bathtub Area began receiving dredged bottom ash from the Bottom Ash Disposal Area 2. In 1990, all bottom ash was sluiced to the Bathtub Area as Bottom Ash Disposal Area 2 was offline. In 1993, dry fly ash began being stacked in the Bathtub Area, which extended approximately over Areas A through E and H. A plan view drawing of the Dry Fly Ash Stack site showing the approximate location of Areas A through I and the Bath Area is presented in Appendix B.

In 2001-2002, the eastern two thirds of the north slope of the Dry Fly Ash Stack, below approximate elevation 1100 feet, were re-graded after surface sliding and tension cracks developed in this area of the slope. A sub-drainage collection system (with two pumps) was constructed in the vicinity of two old clay pipes in the northeast corner in 2000 and expanded as part of the re-grading in 2001-2002. This system is shown on the plan view drawing presented in Appendix B.

4.2.2. Ash Disposal Area J

Ash Disposal Area J went online in late 1982 and was used as a fly ash settlement pond. Ash was sluiced to the east end of the area. The west side of the disposal area acted as a stilling pond and contained two concrete riser structures which discharged into the Holston River. In 1985, riprap was placed along 700 feet of the river bank to protect the toe of the dike on the west end of the north dike slope, after a treed area next to the toe slumped into the river. At the same time the exterior slope of the west side of the dike was changed from 2:1 to 4:1. Sluicing was stopped in 1988 and the pond was dewatered and used as a dry stacking area. Ash Disposal Area J was inactive starting in early 1990's and officially closed in 1999.

4.2.3. Bottom Ash Disposal Area 2

The Bottom Ash Disposal Area 2 came online in 1979 to receive all sluiced bottom ash and infrequent sluiced fly ash. A stilling pond exists in the west end of the area, accessed through a rock weir in an internal dike. Bottom ash was stacked in the southeastern portion of the area starting in 1981. In 1987, sluicing stopped at Area 2 and the ash was dry hauled offsite for disposal. Ash was again sluiced to this area starting sometime between 1990 and 1993. In 1999, a bottom ash collection facility was constructed at the east end of Area 2 and run by Appalachian Products, for offsite marketing of bottom ash. Currently, the Bottom Ash Disposal Area 2 receives sluiced bottom ash, intermittent fly ash (sluiced to separate trench for settlement), and discharges from the Coal Yard Runoff Pond and Chemical Treatment Pond - Iron.

4.3. Design and Record Drawings

4.3.1. Reference No. 1 – Dry Ash Disposal Area Starter Dike

Reference No. 1 (listed in Table 1) is a design drawing titled "*Ash Disposal Area",* originally dated April, 1953 and revised for the third time in April, 1958. This drawing was prepared by TVA and is declared the "Final Field Revision". The drawing is believed to have been used for constructing the starter dike along the northern and eastern edges of the site to form the main barrier of the initial ponds, which is now the location of the existing Dry Fly Ash Stack. This drawing also appears to illustrate the original ground contours prior to any development of the ash disposal facility, as well as the "Begin Dike" and "End of Dike" locations. Based on the "End of Dike" location, it appears the original intent was to end the starter dike short of Area G.

The single page drawing shows several design cross sections of the starter dike. According to these sections, the starter dike was constructed with 3:1 slopes on the river side and 1.5:1 slopes on the ash fill side. The top of the dike was constructed at an elevation of 1087 feet and having varying crest widths. A typical section from reference drawing No. 1 is shown below in Figure 4.

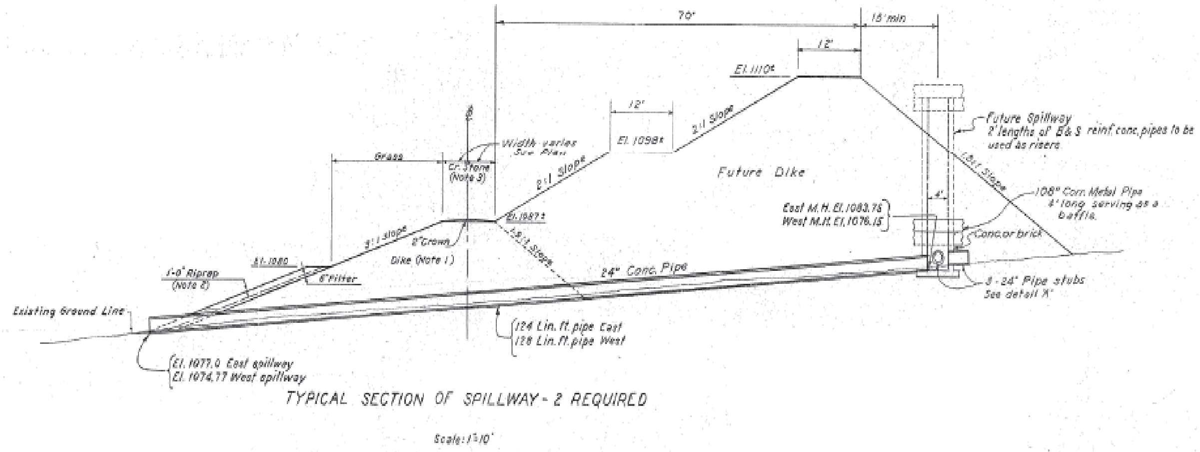


Figure 4. Starter Dike Typical Section 1953 (Revised 1958)

The section in Figure 4 also shows a proposed (future) vertical expansion of the dike which would have raised the top of the starter dike from elevation 1087 feet to elevation 1110 feet±. The expansion was to include 2:1 exterior slopes and a 12-foot wide intermediate bench at elevation 1098 feet±.

4.3.2. Reference No. 2 – Pond "E" Dike Repair (1973)

Reference No. 2 (listed in Table 1) is a drawing titled "Ash Disposal Area "E" - Dike Repair," originally dated July, 1973 and signed," Record Drawing As Constructed" in March, 1975. This drawing, shown in Figure 5, illustrates conditions prior to the May, 1973 dike failure. The break in the northern dike occurred near the divider dike between Areas E and F and was approximately 300 feet long.

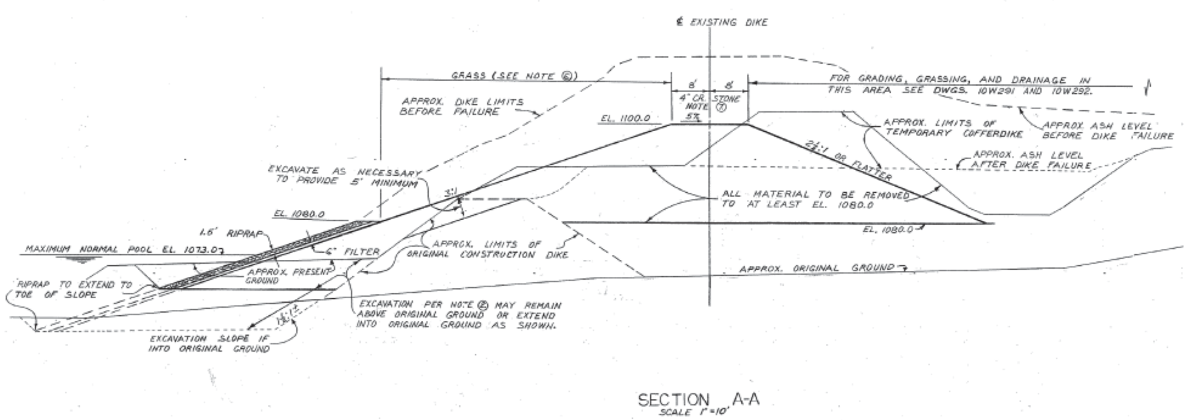


Figure 5. Ash Disposal Area "E" – Dike Repair 1973 (As Built 1975)

The drawing depicts several features not shown in the 1958 typical section (Figure 4). It appears that at least in Area E the original dike was not expanded following the original intended design. The following items provide some insight to the conditions of this area in 1973 and repair work proposed at that time.

- Approximate ash level before the dike failure, with the top of the ash located near elevation 1130 feet+, indicates ash was placed on top of the starter dike and extending into the river bank, with no intermediate benches.

- Ash level after the dike failure at approximately elevation 1098 feet, or a drop of about 40 feet from the top elevation prior to failure.

- Removal of all material to at least elevation 1080 feet as part of the repair work.

- Construction of a temporary coffer-dike and upward expansion of the starter dike by reestablishing the exterior 3:1 slope of the starter dike straight up to elevation 1100 feet.

- Lining the riverbank with an 18-inch thick layer of riprap.

4.3.3. Reference No. 3 – Fly Ash Disposal Area G

According to Reference No. 3, Area G was the last of the contiguous areas developed for sluiced ash disposal purposes. The as-built drawings include notes indicating that changes to Area G were implemented as recently as August, 1980. Figure 6 shows a cross section of Area G dike extracted from Reference No. 3.

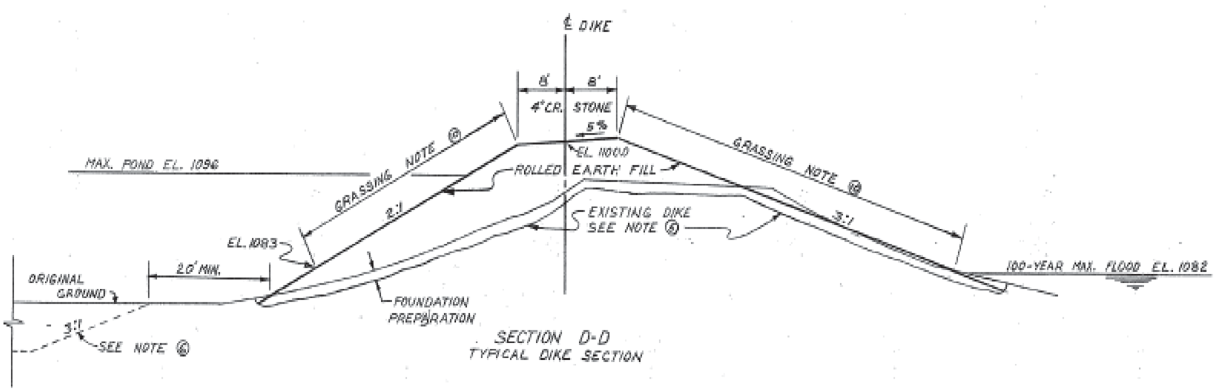


Figure 6. Dry Fly Ash Stack- Typical West Section (As Built 1975)

This cross section appears to indicate that an initial or starter dike had already been extended into Area G and constructed up to near elevation 1090 feet prior to the final development of Area G. The section also shows the Area G dike crest set at elevation 1100 feet.

According to Reference No. 10 (dated October, 1994), the plant disposed ash in a stacking procedure over the western portion first. Consequently, the western portion of the site had risen to approximately 20 feet above the level of the impoundment dikes. These drawings along with historic inspection reports were used to develop the original pond limits for plan drawings presented in Appendix B.

4.3.4. Reference No. 4 – Bottom Ash Disposal Area 2 Dike

Reference No. 4 (listed in Table 1) is a set of design drawings titled "*Ash Disposal Area No. 2",* originally dated August, 1977 and signed as a "Record Drawing as Constructed," August, 1980. These drawings are believed to have been used for constructing the dike along the entire border of what is now the location of the existing Bottom Ash Disposal Area 2. These drawings are believed to illustrate the original ground contours prior to any development of the disposal facility as well as design of the dikes, spillway, and drainage ditches. According to the available tables and sections illustrated on the drawing, the dikes were constructed with slopes varying between 2:1 and 3:1. The top of the dike was constructed at an elevation of 1145 feet and having a uniform width throughout of sixteen feet. A typical dike section from Reference No. 4 is shown below in Figure 7. According to this section, impervious earth fill was placed in a cutoff trench and toe area of interior dike slope to control seepage through the foundation soil.

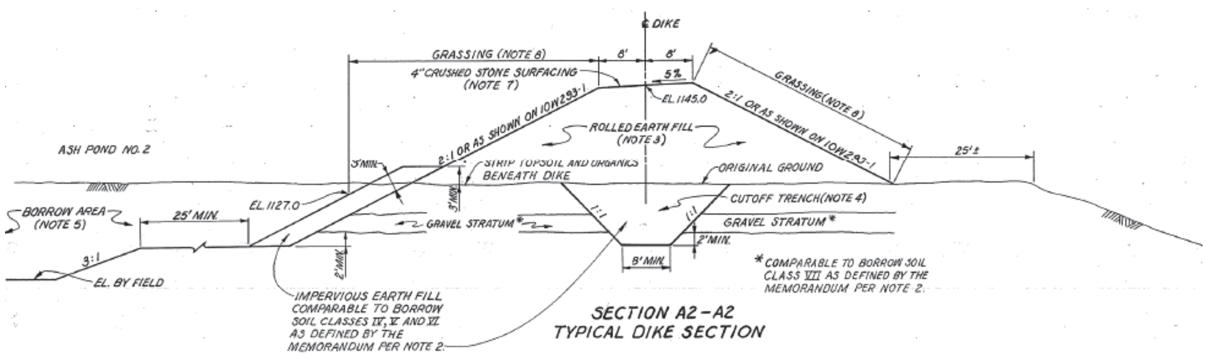


Figure 7. Bottom Ash Disposal Area 2 – Typical Section 1977 (As Built 1980)

4.3.5. Reference No. 5 – Fly Ash Disposal Area "J"

Reference No. 5 (listed in Table 1) is a set of design drawings titled "*Fly Ash Disposal Area J,"* originally dated July, 1982 and revised December, 1984. These drawings are believed to have been used for constructing the dike along the entire border of what was originally Ash Disposal Area "J" and reflect some modifications to the original dike configuration.

These drawings appear to illustrate the original ground contours prior to any development of the disposal facility as well as typical cross sections of the dike, spillway, and drainage ditches. According to these drawings, the dike of Ash Disposal Area "J" was constructed with slopes of 2:1 interior slopes and 2.5:1 exterior slopes. The top of the dike was constructed at an elevation of 1105 feet and a uniform bench width of sixteen feet.

Sheet 4 of the drawings illustrates some repair work performed toward the west end of the north dike slope to stabilize the river bank. A relatively narrow tree area located between the toe of the dike and a steep (near vertical) river bank apparently slumped into the river compromising the toe of the dike. Similar pre-slump conditions currently exist east of this area of the north dike slope. A typical dike cross section from a Reference No. 5 drawing is shown in Figure 8. This section also shows the measures taken to stabilize the river bank area discussed above.

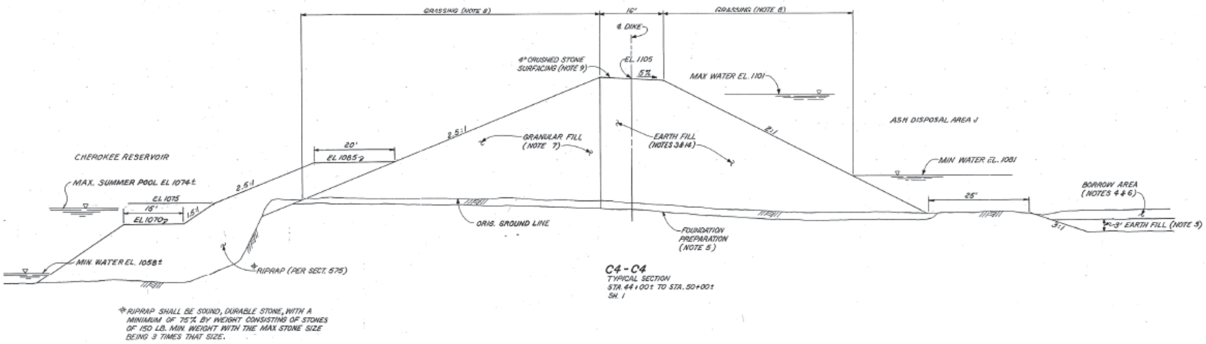


Figure 8. Ash Disposal Area "J" – Typical Section 1984

Sheets 5, 6 and 7 of the drawings in Reference No. 5 also include a closure plan revised in January of 1995.

4.3.6. Reference No. 6 – Dry Fly Ash Stack – Bathtub Area

Reference No. 6 (listed in Table 1) is a drawing created by Law Engineering, Inc. and Tribble & Richardson Inc., titled "Dry Fly Ash Stack Existing Contours," originally dated September, 1994 and revised March, 1997. This drawing illustrates existing 1992 contours including the Bathtub Area. This drawing was used to determine the limits of the Bathtub Area for the drawing titled, "Original Disposal Facilities" presented in Appendix B.

4.3.7. Reference No. 7 – Ash Disposal - Stack Area

Reference No. 7 (listed in Table 1) is a set of design drawings created by Parsons Energy & Chemical Group Inc. In 1999, Parsons conducted a slope stability analysis on a total of seven cross sections through the northern and eastern dikes. The results of the study concluded that the east two-thirds of the north slope of the disposal area was only marginally stable and needed to be repaired. The west one-third of the slope was deemed to have an adequate factor of safety against sliding, therefore it needed no repairs. As a result, the drawings showed 3:1 re-grade slopes to be applied to the marginally stable areas up to the intermediate bench located near elevation 1110 feet.

This set of drawings illustrates previous existing site features as of February, 2001 as well as design plans for re-grading and additions of riprap near the base of the slopes. These drawings were used by Stantec to develop the profile of the river bank area immediately below the toe of the Dry Fly Ash Stack, in preparation of the slope stability analysis. Specifically, the drawings were used to estimate the thickness or geometric configuration of the riprap layer placed along the base of the dike.

4.4. As-Built Drawings

The title blocks for Reference Nos. 2, 3 and 4 drawings contain the description “Record Drawings As Constructed,” and date of original signing. These drawings also include revisions to the original drawings and their corresponding new dates.

The title block of the earliest ash disposal area drawing (Reference No. 1) is dated April 30, 1953. A revision note above the title block for April 23, 1958 reads “Final Field Revision.” The John Sevier Fossil Plant came online in 1955 and therefore, it is assumed that this drawing is also considered an as-built drawing.

4.5. Geotechnical Studies

Historical documentation for review included reports of subsurface investigations, hydro-geologic studies, and dike stability evaluations studies and investigations performed for the fly ash disposal area. Documents in Reference Nos. 8, 9, 10, 11 and 12 include information and data used for review purposes.

4.5.1. Reference No. 10 – Hydrogeologic and Engineering Evaluations (Law 1994)

In 1994, Law Engineering, Inc. based out of Atlanta, Georgia performed a hydrogeologic and engineering evaluation at the John Sevier Fossil Plant in general accordance with requirements of the Tennessee Department of Environment and Conservation. The study utilized previous subsurface explorations to augment its own findings from four (4) soil test borings. Supplemented data came from Reference No. 9, “John Sevier Fossil Plant-Ash Disposal Area-Proposed Dry Stacking,” an internal report produced by TVA. The data collected from all findings provided Law engineers with information to form technical reviews of groundwater recharge, discharge, and flow as well as soil parameters that were used to perform slope stability analysis. The analysis was completed on two typical cross sections, perpendicular to the river and perimeter dike.

4.5.2. Reference No. 11 – Dike Exploration and Testing Program (Law 1999)

In 1999, Law Engineering, Inc conducted a subsurface investigation which included seven (7) soil borings along the top of the existing dike and six (6) soil borings along the perimeter road near the base of the dike. Laboratory testing was conducted on Standard Penetration Test (SPT) samples and undisturbed samples obtained from recovered Shelby tubes. Testing included natural moisture content determinations, Atterberg limits, grain size distribution, and tri-axial shear tests. The exploration was used to supply general subsurface conditions at John Sevier to a third party for purposes of conducting a slope stability analysis.

4.5.3. Reference No. 12 – Fly Ash Pond Dike Slope Stability Evaluation (Parsons 1999)

In 1999, following the Law Engineering report, Parsons Energy & Chemical Group Inc. conducted a dike slope stability evaluation. The evaluation, using data collected from the 1994 and 1999 Law reports, focused on seven (7) widely spaced cross-sections believed to represent typical geometry and conditions along the northern and eastern dikes. Parsons reported existing factors of safety values varying between 0.87 and 1.61, and recommended re-grading the dike sections with a factor of safety less than 1.3 to a uniform slope of 3H:1V.

4.6. O&M Manual

The only operations and management document supplied by TVA is titled "John Sevier Fossil Plant By-Products Operations Manual." Within this document is the Pond & Ash Management JSF.TI.05.014.019 which briefly discusses the duties and obligations of TVA personnel at the plant. Management procedures are broken into Yard Ops Duties, Yard Ops Engineering, Plant Ops Duties, PAE Duties, and Fossil Engineering Services. Procedures include routine inspections which are assumed to be visual only. Fossil Engineering Services is required to prepare, once each year, "a Dike Stability Report based on inspections of all pond dikes (ash, yard drainage, red water & fines) for leaks, erosion, rooted trees and red water seeps."

4.7. Annual and Quarterly Reports

Annual reports reviewed by Stantec include the "JSF-Annual Stability Inspection of Waste Disposal Areas," conducted by Fossil Engineering Services accompanied by plant personnel. Inspections were conducted for the Fly Ash Disposal Area, Ash Disposal Area 2, Ash Disposal Area J, Chemical Treatment Ponds, and Coal Yard Drainage Basin.

Quarterly Reports reviewed by Stantec include the "Quarterly Red Water Seep Inspection," conducted by plant personnel. Visual inspections were conducted for the Ash Stack River Dike, Exterior Slopes-Ash Stacking Area, Pond 2 Active Ash Pond Dike, and J-Pond Inactive Ash Pond Dike.

4.8. Summary of Disturbance Events

The documents listed in Table 2 were used to gain an understanding of key disturbance events that occurred at the John Sevier Fossil Plant facilities. These events were used to identify areas of possible concern. The events listed in Table 2 are in chronological order.

Table 2. Summary of Disturbance Events

Date	Event	Document Source
May 1973	North Dike Failure	1973-Annual Ash Disposal Area Inspection
September 1989	North Dike Toe Slide	1990-Annual Fossil and Hydro Engineering Inspection of the Ash Disposal Areas
December 1990	North Dike Slides	1991-Original Ash Disposal Area – Dike Slope Stability
July 1990	North Dike Tension Cracks	1990-Annual Fossil and Hydro Engineering Inspection of the Ash Disposal Areas
February 1991	North and East Dike Sloughing	1991-Original Ash Disposal Area – Dike Slope Stability
February 1994	Dike Sloughing at Toe of Stilling Pond West	1994-Annual Fossil Engineering Report Inspection of Ash Disposal Areas
April 1995	North Dike Shallow Surface Slide	1995-Annual Fossil Engineering Report Inspection of Ash Disposal Areas
March 1997	Minor Surface Sloughing	1997-Annual Inspection of Waste Disposal Areas
April 1999	Northwest Stack Corner Surface Slide (adjacent to riprap down drain)	2000-Annual Ash Pond Dike Inspection
September 2007	North Dike Sloughing	2008-Annual Stability Inspection of Waste Disposal Areas
November 2007	North Dike Erosion Ditch	2008-Annual Stability Inspection of Waste Disposal Areas

*-All event locations listed are approximate based on Stantec's review of available documents

5. Disturbance Features Observed in 2009

Table 3 presents a summary of disturbance features observed during Phase 1 of the facilities assessment completed in January and February of 2009. Items 3, 4 and 6 through 10 have been addressed through repair and maintenance work performed since the Phase 1 of the assessment was completed, as described in Section 12 of this report.

Items 1 and 2 appear to have been present since prior to 1999. According to the historical documents, and based on recommendations presented in Reference No. 12, the lower east two-thirds of the north slope of the Dry Fly Ash Stack were re-graded to stabilize the area extending from the toe of the starter dike up to elevation 1110 feet. However, the same lower area of the slope located west of the ramp that connects the lower and upper perimeter roads was left unchanged. Today this area has an irregular surface with an apparent slump immediately below the crest of the slope and some isolated humps. In addition, TVA personnel inspecting the plant facilities report periodically the presence of wet areas along the toe of the slope and the lower perimeter road.

Table 3. Disturbance Features Noted during Phase 1 of Facilities Assessment

No.	Structure	Location	Type of Disturbance
1	Dry Fly Ash Stack	North dike exterior slope west of northern access ramp	Slumping approx. 400 FT long
2	Dry Fly Ash Stack	North dike exterior slope west of northern access ramp	Raised area approx. 2 FT above neighboring ground
3	Bottom Ash Pond Area 2	West exterior slope of stilling pond	Minor slumps, slides and depressions.
4	Bottom Ash Pond Area 2	Southwest corner exterior slope of stilling pond	33FT x 51FT area of multiple depressions and mounds
5	Ash Disposal Area J	North river embankment	Several areas of erosion
6	Stilling Pond West	West interior slope near outlet structures	Minor slump
7	Stilling Pond West	East interior slope	Small slumps and depressions
8	Sediment Pond East	North interior slope	Four erosion gullies
9	Iron Chemical Treatment Pond	Northeast corner interior slope	Minor sloughing, irregular slopes, and depression
10	Coal Yard Drainage Pond	Southeast interior bank	Bank erosion

6. Subsurface Exploration

6.1. General

Fieldwork for the geotechnical exploration was performed by Stantec during March 23, 2009 through June 5, 2009. The field work consisted of advancing 93 borings at the project site. Boring locations were chosen by Stantec and staked and surveyed by TVA. The subsurface exploration included standard penetration testing (SPT) in selected borings, the installation of 45 piezometers advanced using 3¼ inch (ID) hollow stem augers, 15 slope inclinometers advanced using 4¼ inch (ID) hollow stem augers, 12 vane shear tests, and 5 cone penetration tests (CPT). The locations of the borings and their corresponding elevations are shown on the boring layout drawing provided in Appendix B.

An automatic hammer was utilized to perform SPT testing in the borings advanced as part of this exploration A standard penetration test consists of dropping a 140-pound hammer to drive a split-barrel sampler 18 inches. The consistency or relative density of the soil material is estimated by the number of blows it takes to drive the split spoon the last 12 inches. This method is typically used to obtain soil samples, estimate the consistency or relative density of the soil and also to estimate the vertical limits of the subsurface soil horizons. In addition, undisturbed samples (Shelby Tubes) were also obtained from selected depth intervals within fly ash and foundation clay. Upon completion of the drilling and sampling procedures, the boreholes were either backfilled with auger cuttings or well backfill materials (cement, sand and/or bentonite) depending on the type of instrumentation the borehole received.

A geotechnical engineer or geologist was present on-site throughout the drilling and sampling operations. The engineer/geologist directed the drill crew, logged the subsurface materials encountered during the exploration, and collected soil samples. Particular attention was given to the subsurface material's color, texture, moisture content and consistency or relative density. Following the field exploration, the SPT samples, Shelby tube and bulk samples were transported to our laboratory. The samples will be available for review up to thirty days following the submittal of this report, at which time the samples will be discarded unless prior arrangements for storage have been made.

6.2. Summary of Borings

Typed boring logs are presented in Appendix C. Results of laboratory testing on selected samples are included in Appendix F. The boring layout is presented on a drawing included in Appendix B. A summary of the boring information is presented in Table 4, where all measurements are expressed in feet.

Table 4. Summary of Borings

Boring No.	Surface Elevation (ft)	Northing (ft)	Easting (ft)	Depth to Bottom of Hole (ft)	Elevation of Bottom of Hole (ft)
BA-1	1145.4	734343.87	2893639.94	39.4	1106.0
BA-2	1145.9	734229.93	2893695.53	50.5	1095.4
BA-3	1145.3	733939.03	2893286.73	37.1	1108.2
BA-4	1145.2	733486.11	2890407.91	42.5	1102.7
BA-5	1144.9	733604.48	2889750.33	56.4	1088.5
BA-6	1145.1	733808.75	2889830.63	48.9	1096.2
BA-7	1144.3	733872.97	2890492.40	39.6	1104.7
BA-8	1145.2	733946.71	2891566.83	40.2	1105.0
BA-9	1144.7	734027.41	2892632.01	41.2	1103.5
JP-1	1105.4	733930.64	2888187.78	36.0	1069.4
JP-2	1105.7	733703.71	2887641.90	36.0	1069.7
JP-3	1105.8	733483.09	2886974.16	35.4	1070.4
JP-4	1105.6	733323.27	2886393.14	47.7	1057.9
JP-4A	1105.3	733325.38	2886401.23	30.0	1075.3
JP-5	1104.5	732679.06	2886045.57	45.7	1058.8
JP-6	1106.3	732862.78	2886526.80	42.0	1064.3
JS-10	1085.0	736877.33	2892782.32	23.2	1061.8
JS-11	1115.3	736817.60	2892703.95	61.0	1054.3
JS-12	1114.8	736796.96	2892666.90	52.5	1062.3
JS-13	1132.5	736741.69	2892570.62	69.0	1063.5
JS-14	Boring Cancelled				
JS-15	1084.1	737186.07	2892539.85	25.5	1058.6
JS-16	1115.7	737079.51	2892528.69	61.5	1054.2
JS-17	1114.5	737004.19	2892496.33	54.5	1060.0
JS-18	1136.3	736848.84	2892429.18	76.5	1059.8
JS-19	1077.3	736913.99	2891993.30	20.0	1057.3
JS-20	1113.8	736826.84	2892070.81	61.5	1052.3
JS-21	1111.0	736784.15	2892107.96	51.8	1059.2
JS-22	1134.7	736662.66	2892209.60	74.7	1060.0
JS-23	1075.1	736562.81	2891652.34	17.1	1058.0
JS-24	1113.4	736463.59	2891743.40	58.7	1054.7
JS-25	1108.1	736417.96	2891781.01	48.5	1059.6
JS-26	1141.8	736300.23	2891894.54	90.0	1051.8

Table 4. Summary of Borings

Boring No.	Surface Elevation (ft)	Northing (ft)	Easting (ft)	Depth to Bottom of Hole (ft)	Elevation of Bottom of Hole (ft)
JS-27	1158.3	736239.87	2891944.24	97.5	1060.8
JS-28	1074.5	736010.84	2891176.23	18.3	1056.2
JS-29	1111.5	735935.78	2891247.73	52.0	1059.5
JS-30	1105.6	735899.72	2891288.23	49.2	1056.4
JS-31	1151.1	735755.45	2891418.56	98.8	1052.3
JS-32	1150.6	735766.70	2891431.00	67.0	1083.6
JS-33A	1152.4	735606.69	2891839.2	72.1	1080.3
JS-33B	1155.3	735313.55	2891533	72.8	1082.5
JS34A	1156.4	735400.64	2891943.1	74.6	1081.8
JS-34B	1156.3	735161.98	2891694.1	72.3	1084.0
JS-34C	1120.4	735045.58	2892079.28	36.9	1083.5
JS-35	1078.9	735547.59	2890689.83	22.3	1056.6
JS-36	1108.5	735478.03	2890742.60	52.0	1056.5
JS-36A	1106.2	735355.98	2890578.53	53.0	1053.2
JS-36B	1110.8	735703.43	2891025.07	56.6	1054.2
JS-37	1103.8	735429.18	2890784.99	43.2	1060.6
JS-37X	1104.4	735425.46	2890782.69	25.0	1079.4
JS-38	1151.5	735263.83	2890906.40	93.0	1058.5
JS-39	1181.3	735175.12	2890973.42	105.5	1075.8
JS-40	1170.2	735048.86	2891066.57	90.2	1080.0
JS-41	1154.6	734877.81	2891195.60	75.2	1079.4
JS-42	1138.2	734710.66	2891295.11	49.5	1088.7
JS-43	1081.5	735279.02	2890354.76	23.8	1057.7
JS-44	1103.2	735219.55	2890399.56	49.0	1054.2
JS-45	1101.3	735171.68	2890440.72	41.4	1059.9
JS-45X	1101.5	735168.74	2890438.03	24.5	1077.0
JS-46	1144.7	735006.11	2890560.28	82.0	1062.7
JS-47	1078.2	735013.36	2890001.65	18.0	1060.2
JS-48	1101.3	734956.57	2890044.99	35.0	1066.3
JS-49	1098.8	734898.66	2890091.75	27.1	1071.7
JS-50	1138.7	734760.24	2890196.57	66.3	1072.4
JS-51	Boring Cancelled				
JS-52	1136.8	734518.95	2890384.61	54.1	1082.7
JS-53	1081.4	734742.01	2889577.25	13.9	1067.5
JS-54	1100.2	734685.87	2889594.68	35.0	1065.2
JS-55	1097.4	734611.13	2889621.92	27.5	1069.9
JS-56	1131.0	734506.50	2889656.35	58.0	1073.0
JS-57	1130.1	734277.92	2889720.99	54.9	1075.2
JS-58	1100.2	734222.32	2889559.16	27.3	1072.9
JS-58X	1100.1	734224.38	2889557.53	27.5	1072.6
JS-59	1099.3	734047.10	2889202.69	31.1	1068.2
CPT-1	1109.5	735528.42	2890809.86	46.2	1063.3
CPT-2	1108.3	735472.49	2890736.90	47.8	1060.5
CPT-3	1107.1	735419.93	2890663.93	43.2	1063.9
CPT-4	1101.8	735439.57	2890778.44	37.8	1064.0
CPT-5	1100.0	735182.18	2890431.15	38.7	1061.3
JS-36-SV	1108.4	735481.63	2890746.85	42.0	1066.4

Table 4. Summary of Borings

Boring No.	Surface Elevation (ft)	Northing (ft)	Easting (ft)	Depth to Bottom of Hole (ft)	Elevation of Bottom of Hole (ft)
JS-37-SV	1102.3	735436.98	2890782.91	37.0	1065.3
JS-36A-SV	1106.4	735359.66	2890582.51	41.5	1064.9
JS-45-SV	1100.1	735181.14	2890438.31	31.5	1068.6
JS-60A	1089.5	736513.29	2891697.31	28.5	1061.5
JS-60B	1089.5	736515.46	2891699.27	28.0	1062.0
JS-61A	1089.7	735980.74	2891206.58	30.0	1059.7
JS-61B	1089.1	735978.47	2891204.07	17.0	1072.1
JS-62A	1090.0	735318.64	2890444.05	30.0	1060.0
JS-62B	1090.0	735316.23	2890442.25	30.0	1060.0
JS-62C	1088.2	735339.49	2890481.47	28.5	1059.7
JS-63A	1089.4	734985.29	2890020.63	27.0	1062.4
JS-63B	1089.4	734987.89	2890023.29	27.0	1062.4
JS-64	1082.3	735402.40	2890528.11	22.5	1059.8
JS-65A	1095.1	735271.28	2890430.29	36.5	1058.6
JS-65B	1094.7	735269.06	2890426.10	15.0	1079.7

6.3. Undisturbed Sampling

A total of thirty-one (31) undisturbed Shelby tube samples were obtained containing the fly ash and clay soils from ten (10) offset borings immediately adjacent to the standard penetration test borings. The undisturbed samples were retrieved using a 2 7/8-inch inside diameter, 30-inch long thin walled tubes and a piston sampler. The undisturbed soil samples were performed in general accordance with the procedures outlined in ASTM D1587, “Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes.”

All Shelby tube samples were sealed with caps in the field and transported to either Stantec’s laboratory in Lexington, Kentucky or Geocomp Corporation/Geotesting Express in Alpharetta, Georgia for testing. Testing of the recovered samples included unconsolidated undrained triaxial tests, consolidated undrained triaxial tests, unconfined compression tests, and falling head permeability tests. An inventory of recovered samples, including sample depth and percent recovery is presented in Table 5 below. Results including unit weight wet, unit weight dry, and normal moisture content are presented in Table 11 of the Laboratory Testing section of this report.

Table 5. Summary of Undisturbed Shelby Tube Samples

Boring No.	Sample	Depth (ft)	Sample Recovery (%)
JS-36-SV	ST-1	18.5-20.5	100
JS-36-SV	ST-2	28.5-30.5	50
JS-36-SV	ST-3	40.0-42.0	100
JS-37-SV	ST-1	18.0-20.0	85
JS-37-SV	ST-2	24.5-26.5	95
JS-37-SV	ST-3	35.0-37.0	65
JS-36A-SV	ST-1	34.5-36.5	100
JS-36A-SV	ST-2	39.5-41.5	85
JS-45-SV	ST-1	18.5-20.5	50
JS-45-SV	ST-2	24.5-26.5	100
JS-45-SV	ST-3	29.5-31.5	100
JS-60B	ST-1	5.0-6.3	65
JS-61B	ST-1	8.0-8.5	25
JS-61B	ST-2	12.0-13.0	50
JS-61B	ST-3	15.0-17.0	100
JS-62B	ST-1	3.0-4.0	50
JS-62B	ST-2	7.0-8.2	60
JS-62B	ST-3	14.0-16.0	100
JS-62B	ST-4	20.0-22.0	100
JS-62B	ST-5	23.0-25.0	100
JS-63B	ST-1	1.0-2.9	95
JS-63B	ST-2	5.0-7.0	100
JS-63B	ST-3	8.0-10.0	100
JS-63B	ST-4	11.0-13.0	100
JS-63B	ST-5	15.0-16.9	95
JS-65A	ST-1	28.5-30.5	100
JS-65B	ST-1	5.0-7.0	100
JS-65B	ST-2	10.0-11.5	75
JS-65B	ST-3	15.0-16.0	50
JP-4A	ST-1	10.0-12.0	100
JP-4A	ST-2	20.0-21.0	50

6.4. Vane Shear Testing

Four (4) vane shear test borings were advanced on the northern side of the Dry Fly Ash Stack adjacent to previously drilled sample borings JS-36, JS-36A, JS-37x, and JS-45x (see boring plan presented in Appendix B). The previous sample logs were used to estimate depths for each target soil horizon to determine where to advance the vane. The tests were performed in accordance with ASTM D 2573-08, "Standard Test Method for Field Vane Shear Test in Cohesive Soil." Each boring had three vane shear tests conducted at various depths. These tests were performed to determine in-situ undrained shear strength of soils determined to be soft during previous standard penetration testing. Upon the conclusion of each vane shear test, an undisturbed Shelby tube sample was obtained below the vane shear test interval to conduct in-situ strength tests. The results from the vane shear tests were compared with laboratory shear strength tests from the undisturbed samples obtained during testing. Vane shear test results are presented on the drawings titled, “Logs of Borings” in Appendix B and on the borings logs in Appendix C. The summary of the vane shear testing is presented below in Table 6.

Table 6. Summary of Vane Shear Testing

Boring	Depth, (ft)	Soil Tested	Maximum Measured Torque, (In-lbs)	Vane Size	Undrained Shear Strength, (psi)	Residual Shear Strength, (psi)	Sensitivity
JS-45-SV	19.0	Sluiced Fly Ash	475	S	16.37	4.48	3.65
	25.0	Sluiced Fly Ash	60	S	2.07	1.38	1.50
	30.0	Sluiced Fly Ash	225	S	7.76	4.31	1.80
JS-36-SV	19.0	Sluiced Fly Ash	340	M	6.10	0.18	34.0
	29.1	Sluiced Fly Ash	480	M	8.62	1.31	6.58
	40.6	Alluvial Clay	620	M	11.13	3.77	2.95
JS-36A-SV	28.5	Sluiced Fly Ash	380	S	13.10	4.31	3.04
	35.0	Alluvial Clay	520	S	17.92	3.79	4.73
	40.0	Alluvial Clay	450	S	15.51	3.79	4.09
JS-37-SV	18.5	Sluiced Fly Ash	420	M	7.54	0.90	8.40
	25.0	Sluiced Fly Ash	390	M	7.00	0.90	7.80
	34.0	Sluiced Fly Ash	>600	M	Unknown	Unknown	Unknown

6.5. Cone Penetration Testing

Five (5) cone penetration test (CPT) borings were performed on the northern side of the Dry Fly Ash Stack adjacent to previously drilled sample borings JS-36, JS-37x, and JS-45x (see boring plan presented in Appendix B.) The previous sample logs were used to estimate/calibrate the depths for each soil horizon as the CPT testing was being performed. The CPT testing was performed in accordance with ASTM Standard D 5778, “Standard Test Method for Performing Electronic Cone and Piezocone Penetration Testing of Soils.” Cone penetration testing is used to determine soil properties and delineate soil stratigraphy by measuring tip resistance, sleeve friction, and dynamic pore pressure. Soil parameters determined by a CPT include, pore pressure, effective angle of internal friction, and undrained shear strength. CPT test results were used to compare to laboratory shear strength test results. The results of the CPT testing can be found in Appendix H.

7. Field Instrumentation and Monitoring

7.1. General

As part of the geotechnical exploration, Stantec devised and implemented a slope monitoring program. The program started by installing instrumentation in the boreholes drilled for the geotechnical exploration. After taking initial or baseline instrumentation readings the monitoring of the dike slope conditions continued by obtaining periodic readings. The monitoring through the information obtained from the readings will continue until actions are implemented to provide adequate long term stability of the structure and beyond. Some of the instrumentation readings were also used to arrive to the results of the engineering analysis presented in this report. The following paragraphs provide additional details regarding the instrumentation and monitoring program.

7.2. Instrumentation

A total of forty three (43) borings were instrumented with 10 foot slotted screen piezometers (PZ) and two (2) borings were instrumented with a 5 foot slotted screen piezometers to monitor pore pressures at the specific depths and locations shown on the piezometer logs in Appendix D and on the graphical boring logs in Appendix B. In general, each piezometer screen was surrounded by an eleven foot thick sand filter pack, followed by a minimum two-foot thick bentonite seal, and then the annulus of the borehole was grouted to the surface with a bentonite/portland cement mix. Piezometer instrumentation logs can be found in Appendix D and piezometer readings can be found in Appendix E. Table 7 represents all piezometers installed at the John Sevier Fossil Plant.

Table 7. Summary of Piezometers Installed

Boring No.	PZ Tip Depth (ft)	PZ Tip Elevation (ft)	Cover Type
BA-1	37.1	1108.3	Flush Mount
BA-2	40.1	1105.8	Flush Mount
BA-3	34.8	1110.5	Flush Mount
BA-5	40.0	1104.9	Flush Mount
BA-8	34.5	1110.7	Flush Mount
JP-3	34.9	1070.9	Flush Mount
JP-4	46.0	1059.6	Flush Mount
JP-5	45.7	1058.8	Flush Mount
JP-6	40.6	1065.7	Flush Mount
JS-10	23.8	1061.2	Steel Riser
JS-12	52.2	1062.6	Steel Riser
JS-13	68.0	1064.5	Steel Riser
JS-15	24.7	1059.4	Flush Mount
JS-17	53.0	1061.5	Steel Riser
JS-18	66.1	1070.2	Steel Riser
JS-19	19.5	1057.8	Flush Mount
JS-21	45.0	1066.0	Steel Riser
JS-22	74.3	1060.4	Steel Riser
JS-23	16.0	1059.1	Flush Mount
JS-25	40.0	1068.1	Steel Riser
JS-27	80.0	1078.3	Temporary
JS-28	16.8	1057.7	Steel Riser
JS-30	30.0	1075.6	Steel Riser

Table 7. Summary of Piezometers Installed

Boring No.	PZ Tip Depth (ft)	PZ Tip Elevation (ft)	Cover Type
JS-32	66.0	1084.6	Temporary
JS-34C	21.5	1098.9	Steel Riser
JS-35	21.5	1057.4	Steel Riser
JS-37	24.0	1079.8	Steel Riser
JS-39	92.5	1088.8	Temporary
JS-42	46.5	1091.7	Flush Mount
JS-43	22.8	1058.7	Flush Mount
JS-45	24.5	1076.8	Steel Riser
JS-47	14.4	1063.8	Flush Mount
JS-49	25.5	1073.3	Steel Riser
JS-50	62.0	1076.7	Steel Riser
JS-52	45.0	1091.8	Steel Riser
JS-53	13.4	1068.0	Flush Mount
JS-55	17.0	1080.4	Steel Riser
JS-56	57.0	1074.0	Steel Riser
JS-57	48.3	1081.8	Steel Riser
JS-58	27.5	1072.7	Steel Riser
JS-59	31.1	1068.2	Flush Mount
JS-60B	27.0	1062.5	Steel Riser
JS-61A	25.5	1064.2	Steel Riser
JS-62B	29.3	1060.7	Flush Mount
JS-63B	24.2	1065.2	Steel Riser

A total of fifteen (15) borings were instrumented with 2.75 inch OD slope inclinometer (SI) casing to monitor potential subsurface lateral movement. Stantec has been taking inclinometer readings once a month since their installation. The displacement curves for the slope inclinometer readings and the maximum displacement observed for each of the slope inclinometers are presented in Appendix E. Table 8 represents all slope inclinometers installed at the John Sevier Fossil Plant.

Table 8. Summary of Slope Inclinometers Installed

Boring No.	Bottom of Casing Depth (ft)	Bottom of Casing Elevation (ft)	Cover Type
JS-11	59.8	1055.5	Flush Mount
JS-16	61.5	1054.2	Flush Mount
JS-20	61.5	1052.3	Flush Mount
JS-24	58.7	1054.7	Flush Mount
JS-26	89.5	1052.3	Steel Riser
JS-29	52.0	1059.5	Flush Mount
JS-31	98.5	1052.6	Steel Riser
JS-36	52.0	1056.5	Flush Mount
JS-36A	53.0	1053.2	Flush Mount
JS-36B	56.6	1054.2	Flush Mount
JS-38	91.5	1060.0	Steel Riser

Table 8. Summary of Slope Inclinometers Installed

Boring No.	Bottom of Casing Depth (ft)	Bottom of Casing Elevation (ft)	Cover Type
JS-44	49.0	1054.2	Flush Mount
JS-46	81.3	1063.4	Steel Riser
JS-48	34.3	1067.0	Flush Mount
JS-54	35.0	1065.2	Flush Mount

7.3. Monitoring of Dike Slope Conditions

Stantec began a monitoring program upon installation of instruments listed above. The purpose of the monitoring program was to obtain periodic water level readings from piezometers and slope movement data from slope inclinometers. Piezometer readings were taken using a water level indicator and slope inclinometer readings were obtained using a portable traversing inclinometer probe designed for this purpose. The first slope inclinometer survey established the initial profile of the casing and subsequent surveys measured changes in the profile of the casing if movement has occurred around the casing.

Stantec's schedule for monitoring program is presented in Table 9. Results of monitoring program are presented in Appendix E in the following order:

- Attachment 1 – PZ Readings, and
- Attachment 2 – SI Readings

Table 9. Monitoring Program Schedule

Reading Number	Date of PZ Reading	Date of SI Reading
1	May 19, 2009	June 4, 2009
2	May 21, 2009	June 16, 2009
3	June 3, 2009	June 29, 2009
4	June 17, 2009	July 13, 2009
5	June 29, 2009	July 31, 2009
6	July 13, 2009	August 12, 2009
7	July 30, 2009	September 8, 2009
8	August 13, 2009	October 13, 2009
9	September 8, 2009	November 11, 2009
10	October 13, 2009	December 12, 2009
11	November 12, 2009	January 12, 2010
12	December 9, 2009	
13	January 12, 2010	

7.4. Slug Testing

In addition to obtaining water level readings at frequent intervals, Stantec also performed slug testing on piezometers. The slug tests were performed in general accordance with ASTM D 4044 titled, "Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers." A pressure transducer with a data recorder manufactured by In-Situ, Inc. was used to collect water level information from wells with a riser pipe of sufficient diameter to accommodate the instrument.

All wells were tested by taking an initial measurement of static water level and then the pressure transducer was placed into the well. Approximately, a half gallon of water was then poured into the well to cause a nearly instantaneous change in the water level. The water levels were then recorded at regular intervals until reaching near static levels. The results were recorded electronically and downloaded into a data collector. Raw data was checked in the field for any discrepancies prior to demobilizing from the site.

The field data, once collected and returned to the office, was entered into AQTESOLV software program to estimate the hydraulic conductivity of the in-situ soils. The software utilized the Bouwer-Rice solution for a slug test in an unconfined aquifer to estimate the hydraulic conductivity of the subsurface soil. The hydraulic conductivity is estimated for the strata of soil that the piezometer screen is set in. Results from the slug testing data are presented in Appendix E.

8. Surveying

8.1. General

Topographic mapping of the John Sevier Fossil Plant (developed from aerial photographs) and contour mapping of the river bank along the plant facility (developed from a hydrographic field survey) were provided by TVA. Stantec's scope of work included a field topographic survey of selected areas located on the Dry Fly Ash Stack and Ash Disposal Area J. A summary of survey data obtained is presented in the following paragraphs.

8.2. Aerial Survey

TVA provided topographic mapping developed by Tuck Mapping Solutions, Inc. of the overall John Sevier Fossil Plant based on aerial photographs taken in March, 2009. The results of aerial survey can be seen on the base map presented in Appendix B.

8.3. Topographic Survey

Stantec requested a field topographic survey in July, 2009 of the north dike of the Dry Fly Ash Stack extending from the river bank to the perimeter road at approximately elevation 1105. A second field topographic survey was completed in October, 2009 of the north dike of the Ash Disposal Area J extending from the river bank to sixty feet south of the existing dike centerline. The objective of this work was to supplement the aerial mapping with a more accurate survey of the following features:

(i) Slopes
(ii) Embankments

(iii) Bench dimensions
(iv) Drainage ditches,
(v) Pipe inverts, and
(vi) Obscured aerial mapping areas

The results of Stantec's topographic surveys were applied to the cross section profiles used for stability analysis. Selected cross sections are presented in Appendix B.

8.4. Hydrographic Survey

At the request of Stantec, TVA Surveying and Project Services also performed a hydrographic survey of the river banks along the Dry Ash Disposal Stack and Ash Disposal Area J in September, 2009 to supplement land and aerial survey data. The combined survey information was used to aid in slope stability analyses and support site repair recommendations.

9. Laboratory Testing

9.1. General

The soil samples obtained during the geotechnical exploration were subjected to laboratory tests by Stantec in Lexington, Kentucky and by GeoComp Corporation/Geotesting Express Inc. in Alpharetta, Georgia. The laboratory tests were performed in accordance with ASTM standard testing procedures. Detailed results of laboratory testing are presented in Appendix F.

9.2. Laboratory Tests Performed

Stantec performed laboratory testing of all materials encountered to estimate their engineering properties. Geotesting Express Inc. was subcontracted by Stantec to assist in performing laboratory testing on specific undisturbed and disturbed soil samples. A summary of laboratory tests performed is presented in Table 10.

Table 10. Laboratory Tests Performed

Group*	Testing for	Standard
1	Natural Moisture Content	ASTM D 2216
2	Classification	ASTM D 2487
	Particle Size Analysis	ASTM D 422
	Density	ASTM D 2937
	Atterberg Limits	ASTM D 4318
	Specific Gravity	ASTM D 854
3	Standard Proctor	ASTM D 699
4	Falling Head Permeability	ASTM D 5084
5	Consolidated Undrained Triaxial (CU)	ASTM D 4767
6	Unconfined Undrained Triaxial (UU)	ASTM D 2850
7	Unconfined Compression Test (UC)	ASTM D 2166

* Results Presented in this order in Appendix F.

9.3. Natural Moisture Content

Natural moisture content tests were performed on all split-spoon samples, disturbed bulk samples, and undisturbed Shelby tube samples. For fly ash samples, an oven drying temperature of 60ºC was used and for all other soils encountered, an oven temperature of 110ºC was used to determine the natural moisture content. The results of moisture content determinations are presented in Attachment 1 of Appendix F.

9.4. Specific Gravity

Specific gravity tests at 20 degrees Celsius were performed on selected undisturbed Shelby tube samples and disturbed bulk samples. The results of these tests were used during soil classification.

9.5. Particle Size Analysis

Particle size distribution tests were performed on seventy one (71) total bulk samples. Fifty one (51) bulk samples of soils encountered at the Dry Fly Ash Stack were analyzed; sixteen (16) bulk samples from auger cuttings of clay were analyzed from the Ash Disposal Area J; and two (2) composite samples from SPT samples of clay were analyzed from the Bottom Ash Disposal Area 2. The tests were performed in accordance with ASTM D 422, "Particle Size Analysis of Soils," using sieve analysis for the soil fraction greater than 0.074 mm (No. 200 sieve size) and hydrometer analysis for the fraction smaller than 0.074 mm. The tests were performed on the predominant soil types to supplement the visual classifications made by the engineer/geologist in the field. The individual grain size distribution curves generated from these tests are presented as Attachment 2 of Appendix F.

9.6. Density

The undisturbed Shelby tube samples obtained from the subsurface exploration were extruded and trimmed into six-inch specimens in the laboratory. The trimmings from each specimen were used to determine the natural moisture content and the sample size and weight. The respective dry density for each sample was then calculated from the total density, the moisture content measurement, and sample dimensions.

9.7. Shear Strength

Thirty six (36) consolidated undrained (CU) triaxial tests were performed on undisturbed Shelby tube samples and disturbed bulk remolded samples from the Dry Fly Ash Stack, five (5) CU triaxial test were performed on undisturbed Shelby tube samples and disturbed bulk samples from the Ash Disposal Area J, and six (6) CU triaxial test were performed on disturbed composite bulk remolded samples from the Bottom Ash Disposal Area No. 2. These tests were performed in accordance with ASTM D 4767. Nine (9) unconsolidated undrained triaxial tests were performed on undisturbed soil specimens from the Dry Fly Ash Stack, in accordance with ASTM D 2850. One (1) unconfined compression test was performed on an undisturbed soil sample from the Dry Fly Ash Stack, in accordance with ASTM D2166. All tests were performed to obtain shear strength parameters for use in stability analysis. The test results are presented in Attachments 5, 6, and 7 of Appendix F. The summary of unit weight and moisture content values obtained from undisturbed Shelby tube samples is presented below in Table 11.

Table 11. Unit Weight and Moisture Content for Undisturbed Shelby Tube Samples

Boring No.	Depth (ft)	Unit Weight Dry (pcf)	Unit Weight Wet (pcf)	Normal Moisture Content (%)
JP-4A	20.0-20.6	96.7	116.7	20.6
JP-4A	11.3-11.9	98.4	122.3	24.3
JP-4A	10.7-11.3	107.0	122.9	14.9
JP-4A	10.1-10.7	119.4	126.9	6.3
JS-36 SV	19.1-19.6	55.4	93.7	69.2
JS-36 SV	29.0-29.5	59.0	94.8	60.7
JS-36 SV	18.5-19.0	70.9	105.1	48.2
JS-36 SV	19.9-20.4	59.3	92.7	56.4
JS-36 SV	40.5-41.0	94.6	121.1	28.0
JS-36 SV	41.0-41.5	89.9	116.5	29.6
JS-36 SV	41.5-42.0	90.1	118.9	32.0
JS-36A SV	40.4-40.9	87.5	116.8	33.5
JS-36A SV	39.7-40.2	86.6	115.3	33.1
JS-36A SV	34.5-35.0	103.9	124.0	19.3
JS-37 SV	35.0-35.5	112.8	132.2	17.2
JS-45 SV	30.6-31.5	57.5	92.0	60.0
JS-45 SV	18.5-19	73.0	106.1	45.3
JS-45 SV	24.5-25	71.8	98.0	36.5
JS-45 SV	25.2-25.7	55.9	92.2	64.9
JS-45 SV	25.8-26.3	51.5	89.4	73.6
JS-45 SV	29.5-30.0	65.8	98.0	49.0
JS-45 SV	30.1-30.6	55.6	94.2	69.4
JS-60B	5.0-5.6	105.0	127.3	21.3
JS-61B	15.5-16.0	99.2	123.9	24.9
JS-61B	16.0-16.5	100.1	126.3	26.2
JS-61B	16.5-17.0	105.4	129.0	22.4
JS-61B	8.0-8.5	114.4	134.8	17.9
JS-62B	14.1-14.7	110.2	131.5	19.4
JS-62B	15.4-16.0	114.2	133.8	17.1
JS-62B	14.8-15.4	114.4	136.1	19.0
JS-62B	24.4-24.9	88.0	116.7	32.7
JS-62B	23.8-24.4	91.9	119.4	30.0
JS-62B	23.3-23.8	99.9	123.4	23.5
JS-62B	20.7-21.3	104.7	128.4	22.6
JS-62B	21.3-21.9	109.2	131.2	20.1
JS-62B	20.1-20.6	111.6	133.0	19.1
JS-62B	7.7-8.2	111.3	131.2	17.9
JS-62B	7.0-7.7	113.1	130.8	15.6
JS-63B	1.7-2.3	104.4	120.6	15.5
JS-63B	5.5-6.0	105.6	126.5	19.8
JS-63B	6.0-6.5	106.8	128.8	20.5
JS-63B	1.2-1.7	109.0	126.3	15.8

Table 11. Unit Weight and Moisture Content for Undisturbed Shelby Tube Samples

Boring No.	Depth (ft)	Unit Weight Dry (pcf)	Unit Weight Wet (pcf)	Normal Moisture Content (%)
JS-63B	6.5-7.0	110.8	131.3	18.5
JS-63B	2.3-2.8	112.1	128.6	14.7
JS-63B	11.3-11.8	103.2	124.4	20.6
JS-63B	8.8-9.4	104.7	126.6	21.0
JS-63B	11.8-12.3	105.0	124.8	18.9
JS-63B	15.1-15.7	107.7	129.4	20.1
JS-63B	12.3-12.9	108.2	128.8	19.1
JS-63B	8.2-8.8	109.1	131.8	20.8
JS-63B	9.4-10.0	109.8	133.6	21.7
JS-65A	28.6-29.2	102.1	127.2	24.6
JS-65A	29.2-29.8	103.7	127.5	23.0
JS-65A	29.8-30.4	105.3	128.1	21.7
JS-65B	5.7-6.3	110.3	131.0	18.7
JS-65B	6.3-6.9	113.6	137.4	20.9
JS-65B	15.1-15.8	102.9	123.8	20.4
JS-65B	10.2-10.8	99.2	120.3	21.2
JS-65B	10.8-11.3	108.4	131.2	21.0

9.8. Permeability

Falling head permeability tests were performed on one undisturbed fly ash sample and one alluvial clay sample from the Dry Fly Ash Stack. The tests were performed in tri-axial cells in general accordance with ASTM D 5084, “Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials using Flexible Wall Permeameter. Confining pressures ranging from 5 to 10 psi were used during the testing and a back pressure of 65 psi was used to achieve saturation. The summary of permeability tests conducted is presented below in Table 12 and complete test results are provided in Attachment 4 of Appendix F.

Table 12. Summary of Falling Head Permeability Test Results

Facility	Boring	Soil Horizon	Test Interval (feet)	Initial Conditions				Coefficient of Permeability Kv (cm/sec)
				Dry Density (pcf)	Moisture Content (%) @ 20° C	Void Ratio, e	Specific Gravity, Gs	
Dry Stack	JS-45-SV	Fly Ash	30.6-31.5	57.5	60.0	1.519	2.32	5.44E-05
Dry Stack	JS-36-SV	Alluvial Clay	41.5-42.0	90.1	32.0	0.864	2.69	3.27E-07

9.9. Classification Testing and Proctor Testing

Soil classification testing consisting of Atterberg limits, particle-size analysis, specific gravity, and standard proctor testing were performed on select undisturbed Shelby tube samples and disturbed bulk samples. These tests are used specifically for classifying the different soil strata. The results can be found in Attachments 2 and 3 of Appendix F.

10. Results of Field Exploration & Laboratory Testing

10.1. Dry Fly Ash Stack

10.1.1. Subsurface Soil Conditions

The subsurface conditions encountered during the geotechnical exploration of the Dry Fly Ash Stack were dependent on the vertical location of the borings. In general, borings advanced above elevation 1110 feet encountered three or more of seven predominant soil types. These included clay fill (cap material), compacted fly ash fill, bottom ash fill, sluiced fly ash fill, alluvial clay, alluvial gravel and alluvial sand. Borings advanced below elevation 1110 feet (upper perimeter road) but above the lower perimeter road encountered a clay fill layer (cap material) underlain by what is believed to be original starter dike clay, alluvial clay, and alluvial gravel and sand. Borings advanced along the lower perimeter road encountered mostly alluvial materials consisting of clay, sand and gravel. Logs of sample borings are presented in Appendix C. Table 13 below presents a summary of laboratory classification test for the Dry Fly Ash Stack.

Clay fill (Soil 1) or cap material, typically located above ash deposits, was visually classified in the field as clay with sand and gravel, light brown to brown, soft to stiff, moist, with occasional silty zones. Bulk samples of this material were classified in the laboratory as sandy lean clay (CL) having an average plasticity index of 14 and specific gravity of 2.6. N-values (determined from SPT blow counts) ranged from 2 to greater than 30. The moisture content (determined from SPT samples) ranged from 11 to 28 percent.

Compacted or dry fly ash (Soil 4) was visually classified in the field as fly ash, gray to dark gray and black, dry to wet, very loose to very dense, with occasional clay seams, gravel, coal fragments, and traces of bottom ash. Bulk samples of this material were classified in the laboratory as silt with sand (ML), non-plastic, having an average specific gravity of 2.4. N-values (determined from SPT blow counts) ranged from less than 4 to greater than 51.

Sluiced fly ash (Soil 5) was found to typically exist below elevation 1095 feet and between the compacted fly ash and alluvial clay soil horizons. Sluiced fly ash was visually classified in the field as very loose and saturated fly ash. N-values for this material were typically less than four (<4) including intervals where only the weight of rod (WOR) or weight of hammer (WOH) were needed to advance the spoon.

Bottom ash (Soil 3) was visually classified in the field as bottom ash, dark gray to black, dry to wet, very loose to very dense, medium to very coarse grained, and angular. Bulk samples were classified in the laboratory as silty sand (SM), non-plastic, having an average specific gravity of 2.4. N-values (determined from SPT blow counts) ranged from less than 4 to greater than 50.

Dike material (Soil 8) was visually classified in the field as lean clay with sand and silt, light brown to brown and gray, medium stiff to very stiff, moist, with traces of gravel and manganese concretions. A bulk sample was classified in the laboratory as lean clay with sand (CL), having a plasticity index of 20 and specific gravity of 2.7. The N-values (determined from SPT blow counts) ranged from 4 to 30 with an average of 14. The moisture content, (determined from SPT samples) ranged from 11 to 25 percent and having an average of 19 percent.

Alluvial clay (Soil 2) was visually classified in the field as clay with sand, brown to tan, soft to stiff, moist to wet, with occasional manganese concretions, silty zones, and gravel. Bulk samples of this material were classified in the laboratory as lean clay with sand (CL), having an average plasticity index of 18 and specific gravity of 2.7. Alluvial clay was also identified as Soil 9 in a limited number of sample borings. This material was visually classified in the field as clay with silt, dark brown to dark gray, very soft to stiff, with occasional manganese concretions and gravel. N-values for alluvial clays (determined from SPT blow counts) ranged from less than 2 to greater than 30. The moisture content (determined from SPT samples) ranged from 16 to 40 percent.

Alluvial sand (Soil 7) and gravel (Soil 6), were typically encountered in thin zones above the shale bedrock. No laboratory classifications were performed on these materials. The sand was visually classified in the field as brown and tan, medium grained, moist, and loose to very dense. The gravel was visually classified in the field as brown and tan, medium grained, dry to wet, loose to very dense, poorly graded with sand. The N-values for both sand and gravel (determined from SPT blow counts) ranged from 4 to greater than 50. No laboratory classifications were performed on these materials.

Table 13. Summary of Laboratory Test Results – Dry Fly Ash Stack

Soil Type	Boring	Depth (feet)	Unified Class	Plasticity Index	Specific Gravity	Gravel & Sand (%)	Silt & Clay (%)
Alluvial Clay (Soil 2)	JS-11	31.5-43.5	CL	20	2.66	38.6	61.4
Alluvial Clay (Soil 2)	JS-12	28.5-46.5	CL	17	2.69	25.2	74.8
Alluvial Clay (Soil 2)	JS-60A	13.5-21.0	CL	17	2.70	26.1	73.9
Bottom Ash (Soil 3)	JS-33A	40.5-46.5	SM	NP	2.21	52.7	47.3
Bottom Ash(Soil 3)	JS-36B	13.5-15.0	SM	NP	2.52	55.1	44.9
Clay Fill (Soil 1)	JS-36A	10.5-18.0	CL	15	2.68	39.9	60.1
Clay Fill (Soil 1)	JS-36B	4.7-7.5	CL	11	2.58	31.2	68.8
Clay Fill (Soil 1)	JS-36B	18.0-27.0	CL	15	2.67	31.3	68.7
Dry Fly Ash (Soil 4)	JS-11	13.5-31.5	ML	NP	2.36	22.2	77.8
Dry Fly Ash (Soil 4)	JS-12	2.8 - 7.5	ML	NP	2.43	21.8	78.2
Dry Fly Ash (Soil 4)	JS-12	13.5 - 18.0	ML	NP	2.25	16.9	83.1
Dry Fly Ash (Soil 4)	JS-13	3.0-9.0	ML	NP	2.38	9.7	90.3
Dry Fly Ash (Soil 4)	JS-13	18.0-21.0	ML	NP	2.32	25.3	74.7
Dry Fly Ash (Soil 4)	JS-16	16.5-22.5	ML	NP	2.32	15.4	84.6
Dry Fly Ash (Soil 4)	JS-17	4.0-13.5	ML	NP	2.37	18.7	81.3
Dry Fly Ash (Soil 4)	JS-17	18.0-22.5	ML	NP	2.25	11.5	88.5
Dry Fly Ash (Soil 4)	JS-20	7.5-22	ML	NP	2.37	24.2	75.8

Table 13. Summary of Laboratory Test Results – Dry Fly Ash Stack

Soil Type	Boring	Depth (feet)	Unified Class	Plasticity Index	Specific Gravity	Gravel & Sand (%)	Silt & Clay (%)
Dry Fly Ash (Soil 4)	JS-21	2.5-7.5	ML	NP	2.33	18.4	81.6
Dry Fly Ash (Soil 4)	JS-25	2.6-11.7	ML	NP	2.43	48.3	51.7
Dry Fly Ash (Soil 4)	JS-25	11.7-21.0	ML	NP	2.30	14.1	85.9
Dry Fly Ash (Soil 4)	JS-30	3.0-7.5	ML	NP	2.41	41.3	58.7
Dry Fly Ash (Soil 4)	JS-30	19.5-24.0	ML	NP	2.23	11.2	88.8
Dry Fly Ash (Soil 4)	JS-31	13.5-18.0	ML	NP	2.44	29.3	70.7
Dry Fly Ash (Soil 4)	JS-31	48.0-51.0	ML	NP	2.37	36.6	63.4
Dry Fly Ash (Soil 4)	JS-33A	0.0-15.0	ML	NP	2.22	11.9	88.1
Dry Fly Ash (Soil 4)	JS-33B	0.0-15.0	ML	NP	2.28	13.3	86.7
Dry Fly Ash (Soil 4)	JS-34A	0.0-15.0	ML	NP	2.27	18.1	81.9
Dry Fly Ash (Soil 4)	JS-34B	0.0-15.0	ML	NP	2.25	22.7	77.3
Dry Fly Ash (Soil 4)	JS-37	4.5-10.0	ML	NP	2.36	26.2	73.8
Dry Fly Ash (Soil 4)	JS-38	7.5-13.8	ML	NP	2.30	14.7	85.3
Dry Fly Ash (Soil 4)	JS-38	45.0-48.0	ML	NP	2.33	33.5	66.5
Dry Fly Ash (Soil 4)	JS-39	22.5-30.0	ML	NP	2.34	15.0	85.0
Dry Fly Ash (Soil 4)	JS-40	0.0-15.0	ML	1	2.51	24.6	75.4
Dry Fly Ash (Soil 4)	JS-41	0.0-15.0	ML	NP	2.29	12.0	88.0
Dry Fly Ash (Soil 4)	JS-42	0.0-15.0	ML	NP	2.43	11.8	88.2
Dry Fly Ash (Soil 4)	JS-45	3.6-7.0	ML	NP	2.39	35.4	64.6
Dry Fly Ash (Soil 4)	JS-46	12.0-18.0	ML	NP	2.41	41.0	59.0
Dry Fly Ash (Soil 4)	JS-50	0.0-24.0	ML	NP	2.37	21.8	78.2
Dry Fly Ash (Soil 4)	JS-52	6.0-18.0	ML	NP	2.71	11.9	88.1
Dry Fly Ash (Soil 4)	JS-56	0.0-18.0	ML	NP	2.41	11.1	88.9
Dry Fly Ash (Soil 4)	JS-57	6.0-13.2	ML	NP	2.31	19.5	80.5
Dry Fly Ash (Soil 4)	JS-58	4.0-15.0	ML	NP	2.36	8.1	91.9
Sluiced Ash (Soil 5)	JS-34C	7.5-13.5	ML	NP	2.38	16.0	84.0
Sluiced Ash (Soil 5)	JS-45	7.0-15.0	ML	NP	2.31	19.9	80.1
Sluiced Ash (Soil 5)	JS-49	12.0-18.0	ML	NP	2.30	13.4	86.6
Dike (Soil 8)	JS-63A	9.0-15.0	CL	20	2.70	18.8	81.2

10.1.2. Bedrock Conditions

Rock coring was performed in two (2) borings advanced during this exploration. All other borings were terminated before encountering auger refusal. The underlying bedrock consists of the Ordovician age Sevier Shale Formation. The shale was visually classified as brown to gray, very thin to laminated bedding on high (45°) dip, with few seams of limestone, and weathered near the bedrock surface.

10.1.3. Subsurface Water

Forty Five (45) borings advanced at the Dry Fly Ash Stack were instrumented with slotted screen piezometers to measure subsurface water conditions over time. The presumed water level reading was initially recorded during the inspection of SPT samples. These depths to water are shown on the boring logs presented in Appendix C. Since their installation, water level readings in the piezometers have been obtained several times as summarized in Table 9, "Monitoring Program Schedule". On average the water elevation along the north side of the dry stack ranges from approximately elevation 1070 feet in the east to elevation 1076 feet in the west. Subsurface water elevations were observed to be higher on the southern side of the stack and ranged from 1086 feet in the east to 1089 feet in the west. This is consistent with the hydro-geological conditions of the site, which are influenced by the location of Holston River.

10.2. Bottom Ash Disposal Area 2

Nine (9) SPT borings were advanced at the Bottom Ash Disposal Area 2 and positioned on top of the existing dike near the exterior crest. The typical top of dike elevation was 1145 feet. These borings encountered two distinct clay zones above shale bedrock. The two clay zones were identified as either dike fill material (Soil 1) or foundation residual clay (Soil 10). Dike material was visually identified in the field as clay with sand and gravel, light brown to brown with occasional gray mottling, medium stiff to hard, moist, with occasional manganese concretions and silty zones. This material was classified in the laboratory as lean clay (CL) having a plasticity index of 26, specific gravity of 2.7, maximum dry density of 106.4 pcf, and an average moisture content (determined from SPT samples) of 22 percent. The N-value (determined from SPT blow counts) ranged from 6 to 43 with an average of 18.

Residual clay material, located below the clay dike, was visually identified in the field as clay, light brown to brown, stiff to hard, moist, to wet, with some manganese concretions. This material was classified in the laboratory as a lean clay (CL) having a plasticity index of 25, specific gravity of 2.7, maximum dry density of 101.5 pcf, and an average moisture content (determined from SPT samples) of 29 percent. The N-value (determined from SPT blow counts) ranged from 10 to 52 with an average of 21. Table 14 below presents a summary of laboratory classification test for the Bottom Ash Disposal Area 2 subsurface soil.

Table 14. Summary of Laboratory Test Results – Bottom Ash Disposal Area 2

Soil Type	Max Dry Density (pcf)	Optimum Moisture (%)	Unified Class	Plasticity Index	Specific Gravity	Gravel & Sand (%)	Silt & Clay (%)
Dike (Soil 1)	106.4	19.7	CL	26	2.70	11.4	88.6
Residual Clay (Soil 10)	101.5	20.5	CL	25	2.70	11.4	88.6

Although rock coring was not performed in borings located at the Bottom Ash Disposal Area 2, samples obtained from auger cuttings and standard penetration tests that penetrated the underlying bedrock suggest this area is underlain by the same shale formation encountered below the Dry Fly Ash Stack. This is confirmed by rock outcrop observed along Polly Branch Creek, which traverses immediately below the north slope of the area. Based on the SPT samples, the upper portion of the shale appears to be weathered to different depths. The top of the weathered zone was described as the top of rock during this geotechnical exploration. The top of rock ranges from elevation 1108 feet near the eastern side of the facility to elevation 1118 feet borings located near the western side of the facility.

Five (5) of the sample borings advanced at the Bottom Ash Disposal Area 2 were instrumented with slotted screen piezometers to measure subsurface water conditions over time. The presumed water level reading was initially recorded during the inspection of SPT samples. These water levels are shown on the boring logs presented in Appendix C. Since their installation, water level in these piezometers has been monitored, as summarized in Table 9, "Monitoring Program Schedule". The water elevation ranges from approximately 1111 feet to 1126 feet.

10.3. Ash Disposal Area J

Six (6) SPT borings were advanced at the Ash Disposal Area J and positioned on top of the existing dike near the exterior crest where the typical ground surface elevation is 1105 feet. These borings encountered four distinct soils above shale bedrock consisting of dike fill material and alluvial clay, sand, and gravel.

Two clay zones were identified as either dike fill material (Soil 1) or alluvial clay (Soil 2). The dike material was visually classified in the field as clay, light brown to brown, tan, with occasional gray mottling, medium stiff to hard, moist, with sand and gravel. This material was classified in the laboratory as a lean clay with sand (CL) having an average plasticity index of 25, specific gravity of 2.7, and an average moisture content (determined from SPT samples) of 18 percent. The N-value (determined from SPT blow counts) ranged from 6 to 43 with an average of 19.

The alluvial clay, one of the dike foundation materials, was visually identified in the field as clay, brown to dark brown, soft to very stiff, moist, with manganese concretions and sand. The material was classified in the laboratory as lean clay with sand (CL) having an average plasticity index of 19, specific gravity of 2.7, and an average moisture content (determined from SPT samples) of 22 percent. The N-value (determined from SPT blow counts) ranged from 4 to 28 with an average of 11.

Granular materials, alluvial sand and gravel, were discovered to typically exist in thin zones above the shale bedrock. No laboratory classifications were performed on these materials. The sand was visually classified in the field as brown and tan, medium grained, dry to wet, and loose to medium dense. The N-value (determined from SPT blow counts) ranged from 5 to 16. The gravel was visually classified in the field as brown and tan, medium grained, medium dense to very dense, poorly graded with sand. The N-value (determined from SPT blow counts) ranged from 20 to 95. Table 15 below presents a summary of laboratory classification tests for samples obtained at the Ash Disposal Area J.

Table 15. Summary of Laboratory Classifications – Ash Disposal Area J

Soil Type	Boring	Depth (feet)	Unified Class	Plasticity Index	Specific Gravity	Gravel & Sand (%)	Silt & Clay (%)
Dike (Soil 1)	JP-1	1.5-7.5	CL	28	2.73	30.3	69.7
Dike (Soil 1)	JP-1	19.5-28.5	CL	26	2.69	17.9	82.1
Dike (Soil 1)	JP-2	0.0-9.0	CH/CL	26	2.77	27.6	72.4
Dike (Soil 1)	JP-2	22.5-24.0	CL	24	2.70	21.6	78.4
Dike (Soil 1)	JP-3	6.5-11.5	CL	18	2.70	21.1	78.9
Dike (Soil 1)	JP-3	26.5-30.0	CL	21	2.67	27.7	72.3
Dike (Soil 1)	JP-4	0.0-11.5	CL	21	2.67	30	70.0
Dike (Soil 1)	JP-4	20.0-25.0	CL	26	2.72	28	72.0
Dike (Soil 1)	JP-5	6.5-16.5	CL	25	2.73	34.1	65.9
Dike (Soil 1)	JP-5	26.5-32.0	CH	33	2.73	42.9	57.1
Dike (Soil 1)	JP-5	36.5-40.0	CL	25	2.68	37	63.0
Dike (Soil 1)	JP-6	6.5-15.0	CH	29	2.76	38.5	61.5
Dike (Soil 1)	JP-6	26.5-34.5	CL	26	2.78	24.1	75.9
Alluvial Clay (Soil 2)	JP-4	25.7-30.0	CL	22	2.69	16.8	83.2
Alluvial Clay (Soil 2)	JP-4	37.5-45.0	CL	16	2.68	23.8	76.2

Rock coring was not performed in borings advanced at the Ash Disposal Area J. However, samples obtained from auger cuttings and standard penetration tests that extended into the underlying bedrock indicate that Area J is underlain by the same formation encountered at the Dry Fly Ash Stack. Also, this shale formation outcrops along the south flank of Holston River, immediately below the northern dike of Area J. The top of the weather zone was described as the top of rock during this geotechnical exploration. The top of rock ranges from approximately elevation 1073 feet along the northeastern side of the facility to elevation 1060 feet at the southwestern end of Area J.

Four (4) of the sample borings advanced at the Ash Disposal Area J were instrumented with slotted screen piezometers to measure subsurface water conditions over time. The presumed water level reading was initially recorded during the inspection of SPT samples. These depths to water are shown on the boring logs presented in Appendix C. Since their installation, the water level in the piezometers has been measured several times as noted in Table 9, "Monitoring Program Schedule". The water elevation ranges on from approximately 1070 feet below the northern dike to 1085 feet below the southwestern dike.

11. Engineering Analyses

11.1. General

Based on the review of available information, results of geotechnical exploration and results of laboratory testing, Stantec performed engineering analyses of the three principal structures at John Sevier Fossil Plant. This included seepage and stability analyses of one

(1) cross section at the Bottom Ash Disposal Area 2 and slope stability analysis of eight (8) cross sections at the Dry Fly Ash Stack and four (4) cross sections of the Ash Disposal Area J. The procedure and results of the analyses are presented in the following paragraphs.

11.2. Seepage Analysis

11.2.1. Background

The objective of the seepage analysis was to understand the total head (and pore water pressure) distribution within a given cross section of the Bottom Ash Disposal Area 2 dike. Seepage analysis was performed using SEEP/W, a numerical software tool developed by Geo-Slope International Inc. SEEP/W is a finite element software product for analyzing groundwater seepage and excess pore-water pressure dissipation problems within porous materials such as soil and rock.

The first step in the seepage analysis was to develop several cross sections of the dike and select a typical one for the analysis. Stantec utilized a combination of boring logs, piezometer data, historic drawings and topographic and hydrographic survey information to estimate the dimensions of the cross section and build its geometry. SEEP/W uses the concept of regions and points to define the geometry of a problem and to facilitate discretization (or meshing) of the problem. Upon defining the geometry of the model (with automatic mesh generation), material properties were assigned using the *Saturated/Unsaturated Model* available in SEEP/W. The next step in the process was to define boundary conditions. All boundary conditions were applied directly on geometry items such as region faces and region lines. Upon defining the boundary conditions, the model was analyzed using the *Steady State* seepage option available in SEEP/W based on the assumption that the boundary conditions are constant over time. Specific details regarding the analysis procedure are presented in the following sections.

11.2.2. Cross Sections

Seepage analysis was performed for existing ground conditions of cross section I-I', where boring BA-7 was advanced (see Figure 9).

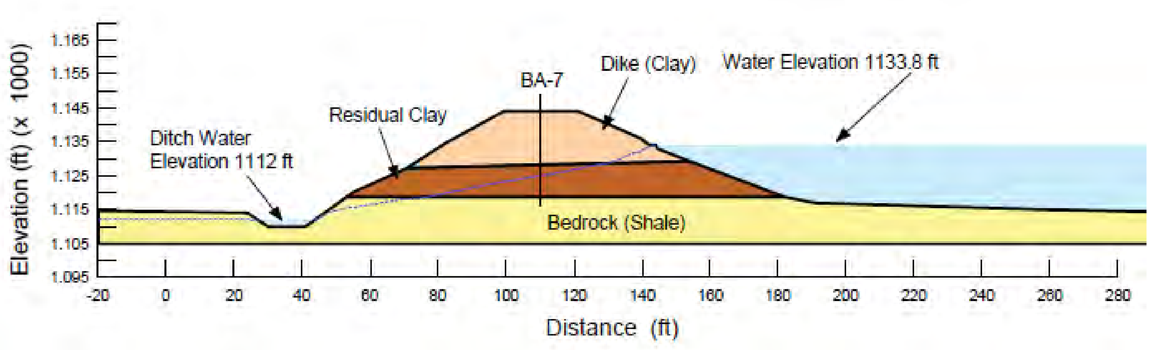


Figure 9. Cross Section I-I'

11.2.3. Material Properties

After developing a representative subsurface profile, material properties were estimated based on available laboratory data, slug testing, and typical values for similar soils. Material properties used in the seepage analysis are summarized below in Table 16.

Significant engineering judgment is needed to select appropriate hydraulic properties for earth materials. Unlike other key properties, hydraulic conductivity can vary over several orders of magnitude for a range of soils, often with substantial anisotropy for seepage in horizontal versus vertical directions. Laboratory test samples often do not represent important variations within a larger soil deposit. For the Bottom Ash Disposal Area 2, an iterative parametric calibration was used to arrive at final seepage design parameters. The results from trial SEEP/W simulations were compared to field data (measured piezometric levels). The material parameters were then varied until the solutions reasonably matched the field data for the representative cross sections.

The ratio of horizontal hydraulic conductivity (k_h) to vertical hydraulic conductivity (k_v) was estimated based on the known depositional environment of the given material and slug test results within the residual lean clay soil horizon. An isotropic material (sands and gravels) would have $k_h/k_v = 1$, while deposits of horizontally layered soils (silt, fly ash) might have values as high as $k_h/k_v = 100$. For the Bottom Ash Pond Area 2, a ratio of 20 was assumed for the lean clay fill and residual lean clay to represent both naturally deposited material and material that would have been placed and compacted in lifts. A ratio of 10 was assumed for the shale bedrock material to represent the tight horizontal bedding planes.

Table 16. Material Properties used for Seepage Analysis

Material	K_h (ft/sec)	K_v/ K_h	K_h/K_v	Gs	e	w-sat (%)	w-res (%)
Dike (Clay) (Soil 1)	1E-8	0.05	20	2.7	0.7	25	2
Residual Clay (Soil 10)	9.234E-7	0.05	20	2.7	0.67	25	2
Bedrock (Shale)	8.166E-6	0.10	10	2.6	0.25	20	1

Where,

- k_v is the vertical hydraulic conductivity
- k_h is the horizontal hydraulic conductivity
- G_s is the specific gravity
- e is the void ratio
- w_{sat} is the saturated water content, and
- w_{res} is the residual water content

Horizontal Hydraulic Conductivity (K_h): The K_h values of Soil 2 (Residual Lean Clay) and Shale materials were estimated using slug test performed on similar soils in proximity to cross section I-I'. Slug testing was performed at all piezometers installed at the Bottom Ash Disposal Area 2. The results of the slug testing are presented in Appendix E. The K_h value for Soil 1-Lean Clay were assumed based on similar soil characteristics examined at another TVA facility. It was thus determined that Soil 1 was approximately two orders of magnitude higher than the underlying Soil 2.

Vertical Hydraulic Conductivity (K_v): The K_v values of all materials were based on the estimated ratio of K_v to K_h. The ratios of K_h to K_v for Soil 1- Lean Clay and Soil 2- Lean Clay were assumed based on similar soil characteristics examined at another TVA facility. The ratio for the shale was selected to be consistent with the general bedding nature of this material.

Specific Gravity (G_s): The G_s values of the two clay materials were estimated based on the laboratory test results presented in Appendix F. The G_s value for shale was assumed based on published values for similar material and upon values used for shale at other TVA facilities.

Void Ratio (e): The *e* values of the two clay materials were estimated based on the laboratory test results presented in Appendix F. The *e* value shale was assumed based upon published values of similar materials and consistent with values used at other TVA facilities.

Saturated Water Content (w-sat): The *w-sat* values of all materials were based upon phase relationships for fully saturated materials augmented by published values for similar materials.

Residual Water Content (w-rest): The *w-res* values of all materials were assumed using the reference Rawls et al.'s "Estimation of Soil Water Properties".

After the initial seepage parameters were estimated, results from the SEEP/W model were compared to pore water pressures measured in a nearby piezometer. Nodes were placed in the model at the same location as the piezometer tip was installed in the field, and then the total head predicted at the node was compared to the piezometer reading.

The material parameters listed in Table 16 vary slightly from the originally assumed values so that the final soil parameters resulted in a general agreement between the measured total head within the piezometer and the total head calculated from SEEP/W/

11.2.4. Results

Detailed results of seepage analysis are presented in Appendix I. A discussion of the results is presented in the following paragraphs.

The total head distribution for cross section I-I' is presented in Figure 10. Table 17 presents a comparison of the SEEP/W results (total head) with the average measurements taken from piezometer BA-8.

Table 17. Total Head Measurements

Cross-Section	Piezometer	Tip Elevation (feet)	Pond Pool Elevation (feet)	Drainage Ditch Pool Elevation (feet)	SEEP/W Phreatic Elevation (feet)	Average Field Measurement Phreatic Elevation (feet)
I-I'	BA-8	1110.7	1133.8	1112.0	1125.5	1126.0

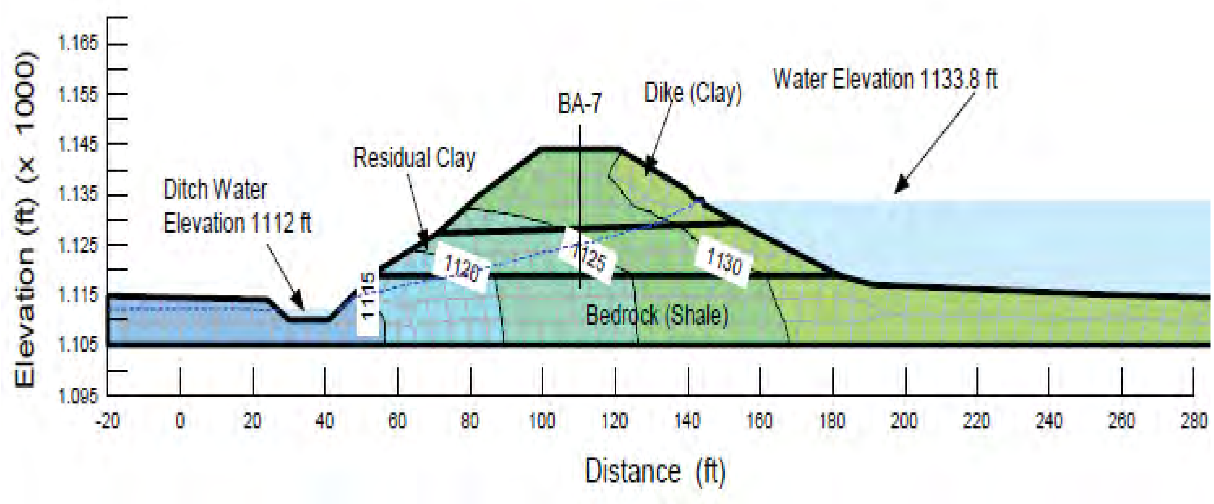


Figure 10. Cross Section I-I' (Total Head Contours in Feet)

The results from the seepage analysis were also examined to identify conditions where piping and erosion of soil might develop due to seepage forces. All earth embankments allow some amount of water to seep through the structure. However, if excessive hydraulic gradients develop through the embankment or foundation soils, then fine particles within the embankment may become transported (piped) out of the embankment. If left unattended, this slow internal erosion could then result in a failure of the earthen structure. Several factors, such as the type of foundation soils, embankment materials, embankment construction, compaction and pipe penetration, can lead to piping issues within earthen structure. Therefore, routine inspections are critical in identifying potential problem areas and arrest any piping issues prior a slope failure.

The model results indicated a shallow phreatic surface (ground water table) at the northern toe of the dike within the shale bedrock. The factor of safety with respect to soil piping (FS_{piping}) was computed for the surficial 3 to 5 feet of soil in this area (see Table 18). The factor of safety with respect to soil piping (FS_{piping}) is defined as:

$$FS_{piping} = \frac{i_{crit}}{i} \qquad \textbf{Eqn. 1}$$

Where:

i = the vertical gradient of a flow vector at a particular node
i_{crit} = is the critical gradient, a material property of the soils at the node

The critical gradient (i_{crit}) is related to the submerged unit weight of the soil and can be computed as:

$$i_{crit} = \frac{\gamma_{sub}}{\gamma_w} = \frac{G_s - 1}{1 + e} \qquad \textbf{Eqn. 2}$$

Where:

γ_{sub} = the submerged unit weight of the soil, γ_w is the unit weight of water,
G_s = the specific gravity of the soil particles

e = the void ratio.

For nearly all soils, the critical gradient is between about 0.6 and 1.4, with a typical value near 1.0.

Where FS_{piping} = 1, the effective stress is zero and the near-surface soils are subject to piping or heaving. Note that Eqn. 1 is valid only for vertical seepage that exits to the ground surface. If the phreatic surface is buried, then the FS_{piping} will be greater than 1.0 even when $i=i_{crit}$.

Table 18. Summary of Computed Exit Gradients and Factors of Safety against Piping

Vertical Gradient (i_v) at Critical Exit Point*	Critical Gradient (i_{crit})	Location of Maximum Vertical Gradient	FS_{piping}
0.2	1.28	Shale	6.4

The United States Army Corps of Engineers (USACE) design criteria (EM 1110-2-1901) indicates factors of safety against piping should be at least 3.0. The vertical gradient contours for cross section I-I' are presented below in Figure 11.

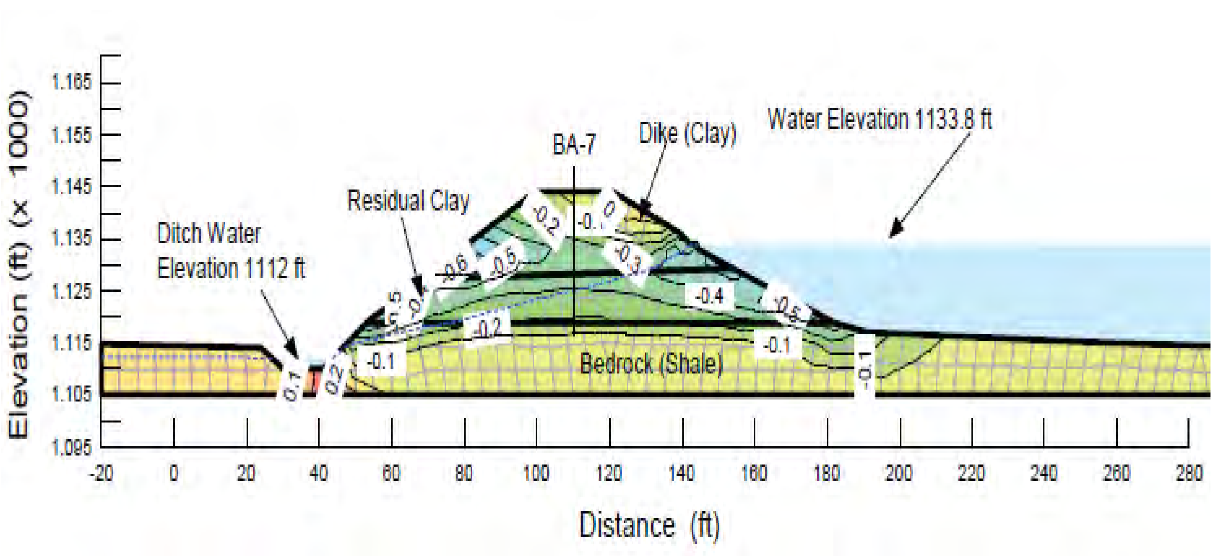


Figure 11. Cross Section I-I' (Vertical Gradient Contours)

11.3. Slope Stability Analysis

11.3.1. Background

The stability of the existing dike slopes was evaluated using two-dimensional limit equilibrium methods of analysis. For conventional, two-dimensional methods of analysis, the slide mass above an assumed failure surface is split into vertical slices and stresses are evaluated along the sides and base of each slice. The factor of safety against a slope failure (FS_{slope}) is defined as:

$$FS_{slope} = \frac{\textit{shear strength of soil}}{\textit{shear stress required for equilibrium}} \qquad \textbf{Eqn. 3}$$

where the strengths and stresses are computed along a defined failure surface, on the base of the vertical slices. The shearing resistance at locations along the potential slip surface are computed, with appropriate strength parameters (cohesion and friction angle), as a function of the total or effective normal stress.

Factors of safety against failure were calculated using Spencer's method of analysis. Spencer's method (1967) satisfies both moment equilibrium and force equilibrium, and uses the method of slices to examine inter-slice normal and shear forces. Circular and translational slip surfaces were used to identify critical surfaces. The resistance to sliding was calculated using effective stresses and shear strength parameters selected based on laboratory testing, standard penetration testing, and using phreatic line conditions obtained from piezometer readings. Slope stability analysis was performed using GeoStudio 2007 Slope/W, a software program developed for examining the stability of earth structures.

11.3.2. Cross Sections

Slope stability analysis was performed for the following cross sections. Profiles of selected cross sections are presented in Appendix B and stability output sections from Slope/W are presented in Appendix I. Typical cross sections of the different structures are presented in Figures 12 through 15

DRY FLY ASH STACK

1) A-A' (cross section through borings JS-53 to JS-57)
2) B-B' (cross section through borings JS-47 to JS-52)
3) C-C' (cross section through borings JS-43 to JS-46)
4) D-D' (cross section through borings JS-35 to JS-42)
5) E-E' (cross section through borings JS-28 to JS-34C)
6) F-F' (cross section through borings JS-23 to JS-27)
7) G-G' (cross section through borings JS-19 to JS-22)
8) H-H' (cross section through borings JS-15 to JS-18)

Bottom Ash Disposal Area No. 2

9) I-I' (cross section through boring BA-7)

Ash Disposal Area J

10) J-J' (cross section through borings JP-4)
11) K-K' (cross section through boring JP-3)
12) M-M' (cross section through boring JP-2)
13) O-O' (cross section through boring JP-1)

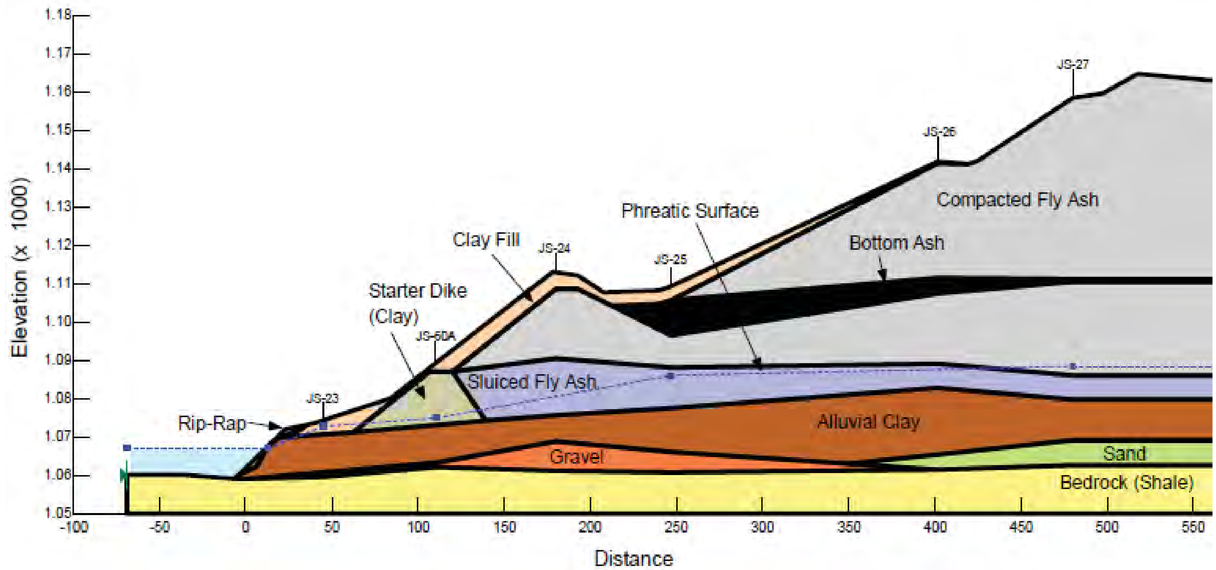


Figure 12. Typical Dry Fly Ash Stack Cross Section

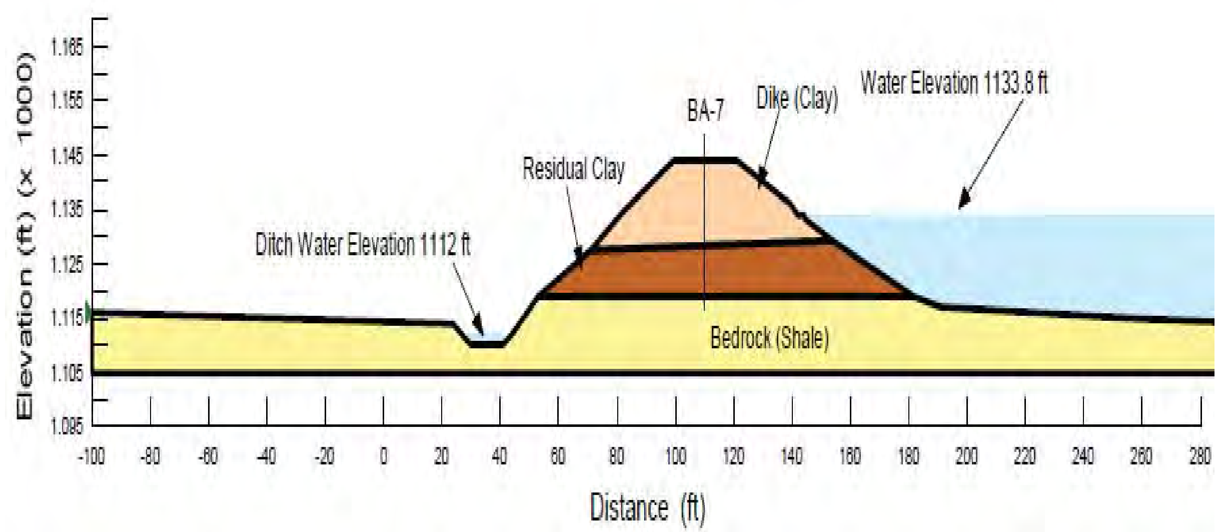


Figure 13. Typical Bottom Ash Disposal Area 2 Cross Section

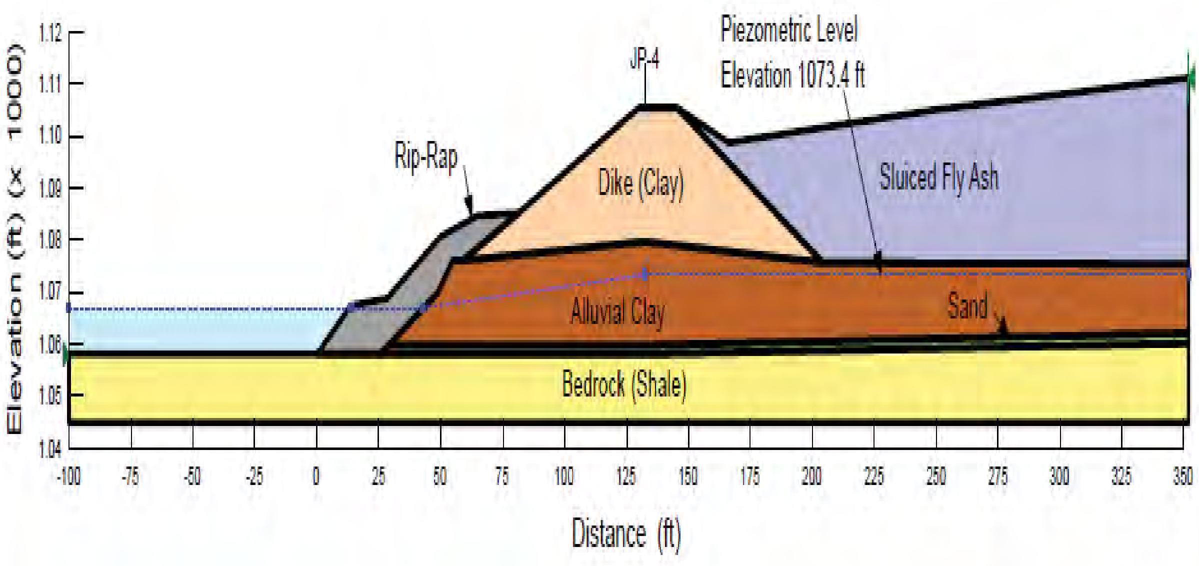


Figure 14. Typical Ash Disposal Area J Cross Section (West)

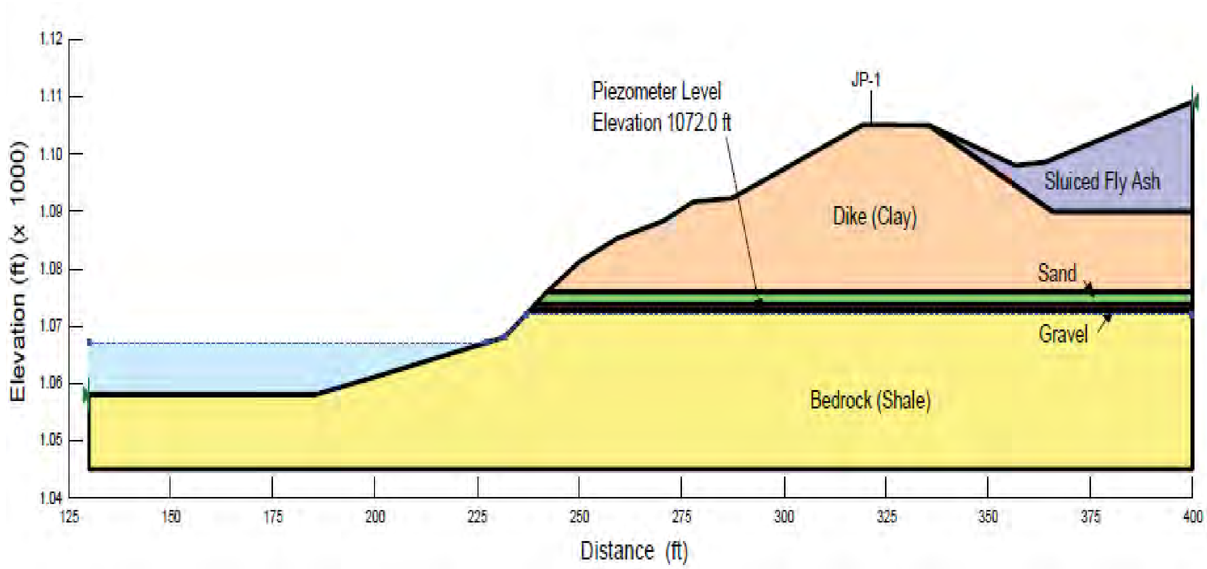


Figure 15. Typical Ash Disposal Area J Cross Section (East)

The above subsurface profiles were developed by combining the information collected from the borings advanced during this geotechnical exploration along with historical documents provided by TVA. Historical drawings provided information regarding original ground surface, original dike positioning and configuration, as well as some previous repairs. The historical drawings of the starter dikes were significantly useful in developing cross sections for the Bottom Ash Disposal Area 2 and Ash Disposal Area J dikes since these structures apparently were not expanded upward. However, this was not the case for the Dry Fly Ash Stack, where the starter dike was expanded but no related design or as-built information was available. Therefore, configuration of the Dry Fly Ash Stack Area upward dike expansion was developed based mainly on the boring information obtained as part of this exploration and assumed interpolations and extrapolations of soil horizon boundaries. Table 19 below lists historical drawings used to develop typical cross sections.

Table 19. Historical Drawings Used for Subsurface Profiles

Section	Reference Drawing	Date of Drawing	Description (Drawing used for developing or determining)
A - H	10N410 R3	4/1958	Original groundline
I	10W293-1 R2	8/1980	Original groundline
J - O	10W286-1 R3	12/1984	Original groundline
A - B & D - H	10N410 R3	4/1958	Starter dike configuration & location
C	10N290	7/1973	Starter dike configuration post 1973 failure
I	10W293-2 R1	4/1978	Starter dike configuration & location
J	10W286-4 R1	7/1985	Starter dike configuration & location
K - O	10W286-1 R3	12/1984	Starter dike configuration & location
A - B	10W206-1 R1	8/2002	Limits of placed riprap
D - F	10W206-2	3/2001	Limits of placed riprap
G & H	10W206-3	3/2001	Limits of placed riprap

11.3.3. Material Properties

Dry Fly Ash Stack

The starter dike was constructed in the late 1950's and has exhibited its current cross-sectional geometry (slopes and crest elevation) for about 9 years since the last construction. Hence, excess pore pressures generated in the underlying soil during construction have had sufficient time to dissipate and steady state seepage conditions have developed within the dike. Additionally, the current analyses will focus only on static conditions (no earthquake or other dynamic loads). For these conditions, only soil unit weights and drained strength parameters (c' and Φ') are needed. If stabilizing berms, flattened slopes, or other geometric modifications are constructed, then undrained, total stress stability analyses will need to be performed.

Drained shear strength (S_d) of the sluiced fly ash soil was determined from effective stress strength parameters using the following equations:

$$S_d = c' + \sigma' \tan \phi' \quad \textbf{Eqn. 4}$$

$$\sigma' = \sigma - u \quad \textbf{Eqn. 5}$$

Where:

c' = the effective cohesion
ϕ' = the effective angle of internal friction
σ' = the effective stress
σ = the total stress and
u = the pore water pressure

Uncemented or Granular Soil

Uncemented soils exhibit no strength at σ'=0, corresponding to c' = 0. In the case of unsaturated fine grained sands, suction results in apparent cohesion, but this component of strength is lost upon saturation. Over a large pressure range, most granular soils have a curved strength envelope. Fitting a straight line through segments of a curved failure envelope can result in c' > 0, but the values are applicable only over the specified range of effective stress.

Several uncemented (granular) soils were encountered during this exploration that were unable to be sampled using undisturbed methods and thus prevented triaxial testing to derive shear strength parameters. Compacted fly ash and bottom ash horizons were the predominant horizons encountered in the Dry Fly Ash Stack, while sand and gravel horizons were encountered at varying thicknesses within the foundation alluvium near the top of bedrock. These soils typically exhibited medium dense to very dense relative density (N-values ranging from 10 to 50+ blows per foot) with damp to moist moisture contents. The strength and unit weight parameters for these soil horizons were determined from published correlations between SP test blow counts (N_{60}), relative density, and effective friction angle Φ'. However, as discussed in Section 6.1 of this report, the SPT testing was performed utilizing an automatic hammer and were corrected prior to applying them in correlations with other soil index properties. The correction for hammer efficiency is a direct ratio of relative efficiencies as follows:

$$N_{60} = N_{80}\left(\frac{80}{60}\right) \qquad \textbf{Eqn. 6}$$

Stantec also corrected standardized N_{60} values resulting from SPT testing within these materials for the effect of overburden pressure prior to using the data in conjunction with correlations for non-cohesive soil parameters. The N_{60} values were normalized to vertical effective overburden stresses of 2,000 pounds per-square foot. This calculation requires an effective unit weight for each soil horizon multiplied by the depth of the soil horizon. The relationship between the correction factor, C_N, and the effective overburden stress, σ', was based on a relationship proposed by Liao and Whitman as referenced in Seed and Harder [1990]:

$$C_N = \frac{1}{\sqrt{\sigma'}} \qquad \textbf{Eqn. 7}$$

Where:

C_N = correction factor for overburden stress
σ' = vertical effective overburden stress (tsf)

Consequently, the standardized corrected N-value, $(N')_{60}$ is equal to:

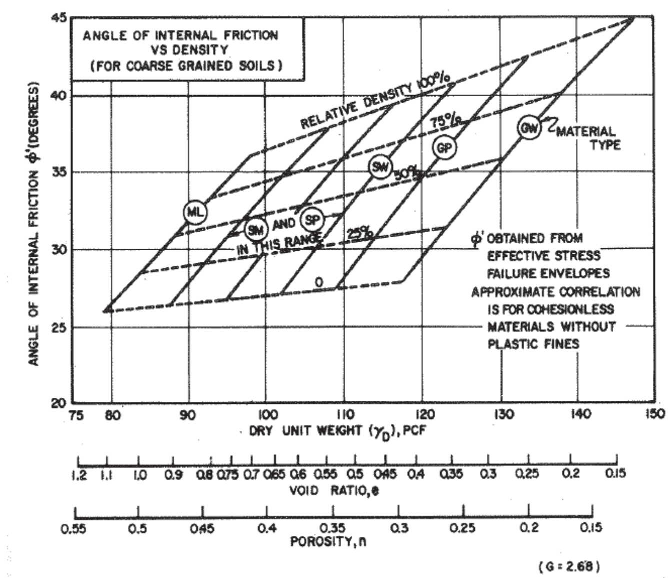
$$(N')_{60} = C_N N_{60} \qquad \textbf{Eqn. 8}$$

Where:

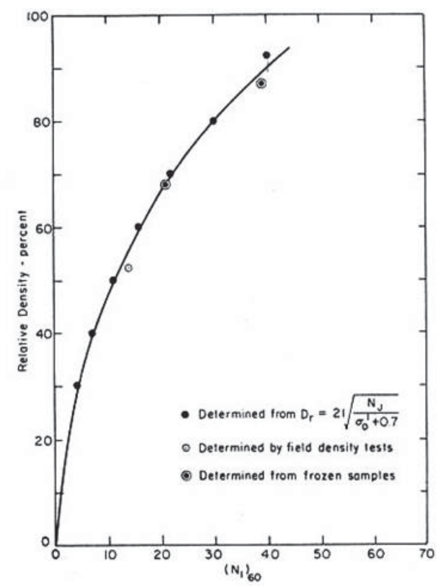
C_N = correction factor for overburden stress
$(N')_{60}$ = standardized N-value

The N-values noted on the graphical boring logs in Appendix B and typed boring logs in Appendix C are calculated based on the actual blowcount obtained in the field. They do not reflect corrections for hammer efficiency or overburden stress.

The N_{60} values were utilized to obtain relative densities based on relationships developed by Tokimatsu and Seed (1988) as shown in Figure 16 below. NAVFAC (1982) presents a relationship using relative density and specific soil types to correlate angle of internal friction, unit weight, and void ratio as shown in Figure 16 below. Soil classifications for the correlations are based on laboratory testing results and visual classifications performed by the on-site geotechnical engineer or geologist during the drilling process. Once the relationships for the angle of internal friction, unit weight, and void ratio were established, the in-situ unit weight was calculated based upon the natural moisture content.



From NAVFAC (1982)



From Tokimatsu and Seed (1988)

Figure 16. Charts used to Correlate N_{60} to ϕ'

Typical N_{60} values for the granular soils described above varied across each section. As such, the unit weight and drained friction angle of every soil horizon was estimated based upon blow counts (N-values) representative from each particular cross-section and using the $2/3^{rd}$ rule. The rule implies that approximately two-thirds of the data points fall above and one-third fall below the chosen parameter. Table 20 below presents soil parameters for granular soils calculated and used for slope stability analyses.

Table 20. Material Properties for Granular Soils

Section	Compacted Fly Ash (Soil 4)		Alluvial Gravel (Soil 6)		Alluvial Sand (Soil 7)		Bottom Ash (Soil 3)	
	Φ'	UW	Φ'	UW	Φ'	UW	Φ'	UW
A	32.0	110.0	39.0	137.0	29.5	132.0	N/A	N/A
B	32.0	110.0	37.5	140.0	N/A	N/A	N/A	N/A
C	30.0	110.0	N/A	N/A	37.0	139.0	N/A	N/A
D	32.5	110.0	36.0	139.0	N/A	N/A	29.0	117.0
E	32.5	110.0	37.0	137.0	30.5	131.0	28.0	106.0
F	30.0	110.0	32.5	137.0	32.0	127.0	32.0	118.0
G	30.0	110.0	34.5	133.0	36.0	130.0	29.0	105.0
H	30.0	110.0	37.0	136.0	N/A	N/A	N/A	N/A

Clay Materials

For normally consolidated, saturated clays, the Mohr-Coulomb failure envelope exhibits c' = 0. At effective stresses below the pre-consolidation pressure, overconsolidated clays have a curved failure envelope that can be represented with a straight line having c' > 0. However, overconsolidated clays in the field are often fissured and the in situ c' is significantly smaller than values determined from testing of small samples in the laboratory. To avoid progressive failures in overconsolidated, stiff fissured clays, remolded soil samples are recommended for testing; this generally results in "fully softened" strengths with c' = 0. Thus, in the absence of particle cementation/bonding, long term (drained) shearing resistance related to c' > 0 is considered unreliable. In routine geotechnical design practice, values of c' = 0 are usually assumed for both normally and overconsolidated saturated clays, and for uncemented granular soils. Detailed testing and characterization of a particular soil, coupled with careful application of the fitted strength envelopes, are necessary where values of c' are used in a stability evaluation. For these analyses, c' = 0 was used for all soils.

When surficial soils have c' = 0, shallow sliding parallel to the ground surface will be the critical failure mechanism (lowest factor of safety) found in a slope stability analysis. However, apparent cohesion in unsaturated soils and/or weak cementation is often sufficient to prevent shallow sliding. This mode of failure, which might require periodic maintenance, is considered to be less critical in a stability analysis. For deep seated failures, the assumption of c' = 0 is routinely used for all soils.

The soil parameters used for the dike, ash stack and existing foundation materials were derived using both current and historical laboratory test data (consolidated undrained triaxial tests, standard penetration testing data, and classification testing data) and Stantec's experience with these materials in similar applications.

An effective friction angle for the Clay Fill (Soil 1), Dike Clay (Soil 8) and Alluvial Clay (Soil 2) was selected based on (1) results of twenty four consolidated undrained triaxial (CU) tests, (2) results of the SPT data and (3) the plasticity index of each soil. A relationship between the plasticity index and peak friction angles for normally consolidated clays is shown in

Figure 17 (from Duncan and Wright, 2005). The unit weight for both soil horizons was selected based on density testing of consolidated undrained triaxial samples. The results of the testing can be found in Appendix F of this report.

Table 5.7 Typical Values of Peak Friction Angle (ϕ') for Normally Consolidated Clays[a]

Plasticity index	ϕ' (deg)
10	33 ± 5
20	31 ± 5
30	29 ± 5
40	27 ± 5
60	24 ± 5
80	22 ± 5

Source: Data from Bjerrum and Simons (1960).
[a] $c' = 0$ for these materials.

Figure 17. Typical Values of Peak Friction Angle (Φ') for Normally Consolidated Clays

Soils 1, 2 and 8 parameters used for slope stability analysis on the Dry Fly Ash Stack are presented below in Table 21.

Table 21. Material Properties for Clay Materials found in Dry Fly Ash Stack

Material	Unit Weight (pcf)	Cohesion (c')	Friction Angle (Φ')
Clay Fill (Soil 1)	125	0	32º
Dike (Soil 8)	126	0	31º
Reconstructed Dike (Soil 8)	126	0	31º
Alluvial Clay (Soil 2)	120	0	31º

Sluiced Fly Ash

Stantec performed twelve (12) consolidated undrained triaxial tests on remolded and undisturbed samples of sluiced fly ash (Soil 5). The results are presented as Attachment 5 of Appendix F of this report. To select the representative strengths for Soil 5, the methodology outlined in the US Army Corps of Engineers Engineer Manual EM 1110-2-1902 was used as a guide. Failure stresses measured in the laboratory tests were expressed in terms of "p'-q" values, $[p' = 0.5(\sigma_1' + \sigma_3'), q = 0.5(\sigma_1' - \sigma_3')]$, then an envelope was conservatively fit through the data. The selected strength parameters represent a failure envelope where approximately two-thirds of the test data falls above the envelope. Strength parameter selection charts using "p'-q" plots are included in Appendix G.

In addition, information obtained at other TVA facilities was reviewed in selecting strength parameters for the sluiced fly ash deposits. For example, as a part of the root cause analyses of the Kingstone failure, AECOM performed 25 tri-axial compression tests with various consolidation techniques on hydraulically placed ash, and Law Engineering, Inc. completed six triaxial tests in 1995, as a part of a testing program on sluiced ash materials in

Dredge Cells I and III of the Kingstone ash disposal area. When plotting these test results on a scatter plot (see Appendix G), the resultant Φ' for the hydraulically placed ash is on the order of 25 degrees.

A friction angle (Φ') of 24 degrees was selected for the sluiced ash encountered under the Dry Fly Ash Stack. The unit weight selected for Soil 5 is 105 pounds per cubic foot.

Bottom Ash Disposal Area 2

As described in Section 10.2 of this report, two predominant soil horizons were encountered in borings drilled at this site, the dike material (Soil 1) and the foundation residual clay (Soil 10). According to historical information, it is believed that residual clay excavated from the interior of the disposal area is the source of the dike material (fill). Therefore, the properties of these two soils should be similar. According to classification testing performed on representative samples, the plasticity index was determined to be 26 and 25 for the dike material and residual clay, respectively. Furthermore, based on in-situ testing (average SPT N-value of 18), both soil horizons have a stiff to very stiff consistency.

An effective friction angle for each soil was selected based on (1) results of six consolidated undrained triaxial (CU) tests performed on remolded samples, (2) results of the SPT data and (3) the plasticity index of each soil as discussed earlier in this section for the Dry Fly Ash Stack. The unit weight for both soil horizons was selected based on density testing of remolded samples. The results of the testing can be found in Appendix F of this report.

Parameters used for slope stability analysis on the Bottom Ash Disposal Area 2 are presented below in Table 22.

Table 22. Material Properties for Clays at the Bottom Ash Disposal Area 2

Material	Unit Weight (pcf)	Cohesion (c')	Friction Angle (Φ')
Dike (Soil 1)	123	0	33.0
Residual Clay (Soil 10)	121	0	33.0

Ash Disposal Area J

Two predominant clay horizons along with several granular soil horizons were encountered during drilling performed at the Ash Disposal Area J. Shear strength parameters used for slope stability analysis on the granular materials were estimated using standard penetration tests and relationships discussed earlier in this section for the Dry Fly Ash Stack. Shear strength parameters for the clay dike and alluvial clay were selected based (1) results of five consolidated undrained (CU) triaxial tests performed on remolded samples, (2) results of the SPT data and (3) the plasticity index of each soil as discussed earlier in this section for the Dry Fly Ash Stack.

The results of classification and CU testing on the Ash Disposal Area J soil samples can be found in Section 10.3 and Appendix F of this report. The plasticity index was determined to be 25 and 19, for the clay dike and alluvial clay, respectively. The unit weight for both cohesive soil horizons was selected based on density testing of undisturbed samples. No borings were advanced inside the dike limits and therefore parameters used for the sluiced fly ash were taken from testing and assumptions made for sluiced ash found at the Dry Fly Ash Stack. Parameters used for slope stability analysis on the Ash Disposal Area J are presented below in Table 23.

Table 23. Material Properties at the Ash Disposal Area J

Material	Unit Weight (pcf)	Cohesion (c')	Friction Angle (Φ')
Dike (Soil 1)	124	0	30.0
Alluvial Clay (Soil 2)	127	0	31.0
Sluiced Ash (Soil 5)	105	0	24.0
Alluvial Sand (Soil7)	118	0	30.0
Alluvial Gravel (Soil 6)	132	0	37.5

11.3.4. Failure Search Modes

The following failure modes were analyzed for all the cross sections.

X) Grid & Radius (circular failure forced through two points)
Y) Translational (non-circular failure forced through three points)
Z) Entry/Exit (circular failure forced through two points)

11.3.5. Phreatic Lines

Laboratory analyses provide effective strength parameters which are best utilized in conjunction with pore water pressure to determine the most accurate critical slip surfaces. Pore water pressure was simulated during slope stability analysis using data collected from piezometers positioned in line with their corresponding cross sections to develop each phreatic line. The phreatic line location in the analyses of the Dry Stack Area and Ash Disposal Area J, for all the cross sections and failure modes, was selected using the highest levels water levels recorded from piezometer readings. The lower end of the phreatic line was connected to the following river pool elevations.

a. Existing Pool (river pool elevation 1067 feet)

b. High Pool (river pool elevation 1073 feet, considered normal high pool elevation)

The existing river pool elevation of 1067 feet was obtained based on observation made throughout the exploratory fieldwork. The high river pool elevation of 1073 feet was assumed to be the normal pool elevation as indicated in the historical drawings. Table 24 lists piezometer data used to determine phreatic conditions for the different cross sections.

Table 24. Summary of Piezometer Information

Cross Section	Piezometer	Tip Elevation (ft)	Highest PZ Reading (ft)	Date of Highest PZ Reading (ft)
A-A’	JS-53	1068.0	1077.23	6/29/09
	JS-55	1080.4	1086.66	5/19/09
	JS-56	1074.0	1080.85	5/19/09
	JS-57	1081.8	1088.95	8/13/09
B-B’	JS-47	1063.8	1075.38	6/3/09
	JS-63B	1062.7	1075.85	10/13/09
	JS-49	1073.3	1081.96	6/3/09
	JS-50	1076.7	1087.89	6/29/09
	JS-52	1091.8	1105.03	6/29/09
C-C’	JS-43	1058.7	1076.20	6/29/09
	JS-45	1076.8	1091.73	6/29/09
D-D’	JS-35	1057.4	1076.69	6/3/09
	JS-37	1079.8	1090.35	6/3/09
	JS-39	1088.6	1098.12	6/17/09
	JS-42	1091.7	1105.74	6/3/09
E-E’	JS-28	1057.7	1077.25	5/19/09
	JS-61A	1060.3	1077.91	10/13/09
	JS-30	1075.6	1087.14	5/21/09
	JS-32	1084.6	1089.90	6/17/09
	JS-34C	1098.9	1110.15	10/13/09
F-F’	JS-23	1059.1	1072.78	6/30/09
	JS-60B	1062.0	1075.40	10/13/09
	JS-25	1068.1	1085.99	8/13/09
	JS-27	1078.3	1088.24	6/17/09
G-G’	JS-19	1057.8	1072.93	5/19/09
	JS-21	1066.0	1079.33	6/29/09
	JS-22	1060.4	1085.11	6/3/09
H-H’	JS-15	1059.4	1071.77	6/3/09
	JS-17	1061.5	1074.20	6/3/09
	JS-18	1070.2	1090.43	6/3/09
I-I’	BA-8	1110.7	1126.48	8/13/09
J-J’	JP-4	1059.6	1073.37	6/3/09
K-K’	JP-3	1070.9	1072.00	6/17/09
M-M’	JP-3	1070.9	1072.00	6/17/09
O-O’	JP-3	1070.9	1072.00	6/17/09

11.3.6. Results of Stability Analyses for Existing Conditions

All cross sections were first analyzed for existing conditions. The analyses for the Dry Stack and Ash Disposal Area J cross sections were performed assuming two river pool elevations as described before. Where the analyses did not result in acceptable factors of safety, the cross sections were analyzed further assuming certain corrective measures would be implemented, as discussed in the following section. Multiple search types were used to determine the lowest factor of safety at each failure location. Failure surfaces were constrained to a minimum depth of 10 feet.

Results of slope stability analyses for existing conditions assuming high pool and existing pool conditions are presented in Table 25. Drawings of the stability analysis are presented in Appendix I.

Slope Geometry	Search Type	High Pool Factor of Safety*	Existing Pool Factory of Safety*	Failure Location
Existing Conditions (as of 7-28-09) Section A-A'	Grid & Rad	1.9	1.9	Below Lower Road
	Entry & Exit	--	1.9	Below Upper Road
Existing Conditions (as of 7-28-09) Section B-B'	Grid & Rad	1.5	1.3	Below Lower Road
	Entry & Exit	--	2.0	Below Upper Road
Existing Conditions (as of 7-28-09) Section C-C'	Grid & Rad	1.5	1.3	Below Lower Road
	Entry & Exit	--	1.7	Below Upper Road
Existing Conditions (as of 7-28-09) Section D-D'	Grid & Rad	1.5	1.4	Below Lower Road
	Entry & Exit	--	1.6	Below Upper Road
Existing Conditions (as of 7-28-09) Section E-E'	Grid & Rad	1.7	1.4	Below Lower Road
	Entry & Exit	--	1.7	Below Upper Road
Existing Conditions (as of 7-28-09) Section F-F'	Grid & Rad	1.7	1.5	Below Lower Road
	Entry & Exit	--	1.7	Below Upper Road
Existing Conditions (as of 7-28-09) Section G-G'	Grid & Rad	2.0	1.6	Below Lower Road
	Entry & Exit	--	1.8	Below Upper Road
Existing Conditions (as of 3-19-09) Section H-H'	Grid & Rad	1.5	1.5	Below Lower Road
	Entry & Exit	--	2.0	Below Upper Road
Existing Conditions (as of 3-19-09) Section I-I'	Grid & Rad	--	1.5	Clay Dike Embankment
Existing Conditions (as of 10-16-09) Section J-J'	Grid & Rad	1.6	1.6	Riprap & Alluvial Clay
Existing Conditions (as of 10-16-09) Section K-K'	Grid & Rad	1.5	1.5	Clay Toe Dike Embankment
Existing Conditions (as of 10-16-09) Section M-M'	Grid & Rad	1.3	1.3	Clay Dike Embankment
Existing Conditions (as of 10-16-09) Section O-O'	Grid & Rad	1.7	1.7	Clay Dike Embankment

***** The US Army Corps of Engineers Engineering Manual EM 1110-2-1902, “Slope Stability” recommends a target minimum factor of safety of 1.5 for long term embankment slope stability.

Stability analysis of existing conditions along sections B-B’, C-C’, D-D’, and E-E’ within the Dry Fly Ash Stack produced factors of safety less that the 1.5 target for slip planes located within the river bank, immediately below the toe of the starter dike. These sections all produced a factor of safety above 1.5 for failure surfaces between the lower (toe of starter dike) and upper perimeter roads. These slips were typically deep seated failures produced by the search type, Entry & Exit. Stability analysis for the Ash Disposal Area J produced factors of safety less than 1.5 for the existing and high pool conditions for section M-M’.

11.4. Results of Slope Stability Analyses for Conditions after Recommended Improvements are implemented

Where the analyses of existing conditions did not result in acceptable factors of safety, the cross sections were analyzed further assuming certain corrective measures would be implemented. In the case of the Dry Fly Ash Stack, the selected corrective measures were a toe sub-drain and placement of additional riprap on the river bank. The corrective measures selected for the Ash Disposal Area J was a buttress or rock berm to protect the toe of the dike.

Slope stability analyses of conditions after recommended improvements are implemented were performed for cross sections B-B', C-C', D-D', E-E', and M-M'. Typical profiles of each section are located in Appendix I.

Further discussion relative to implementation of corrective measures is presented in Section 13, Conclusions and Recommendations. Drawings of additional slope stability analysis are presented in Appendix I. Tables 26 and 27 present the results of stability runs which include the addition of the sub-drain system, riprap and rock buttress mentioned above.

Table 25. Results of Stability Analyses after Corrective Measures are Applied to Dry Fly Ash Stack

Slope Geometry	Search Type	Sub-Drain System	Additional Riprap	Factor of Safety High Pool	Factor of Safety Existing Pool	Failure Location
Existing Conditions (as of 7-28-09) Section B-B'	Grid & Rad	Yes	No	--	1.4	Below Lower Road
	Grid & Rad	Yes	Yes (2.5:1 w/ 5ft bench)	1.8	1.6	Below Lower Road
Existing Conditions (as of 7-28-09) Section C-C'	Grid & Rad	Yes	No	--	1.3	Below Lower Road
	Grid & Rad	Yes	Yes (2.5:1 w/ 5ft bench)	1.7	1.6	Below Lower Road
Existing Conditions (as of 7-28-09) Section D-D'	Grid & Rad	Yes	No	--	1.4	Below Lower Road
	Grid & Rad	Yes	Yes (2.5:1)	1.7	1.6	Below Lower Road
Existing Conditions (as of 7-28-09) Section E-E'	Grid & Rad	Yes	No	--	1.5	Below Lower Road

Table 26. Results of Stability Analyses after Corrective Measures are Applied to Ash Disposal Area J

Slope Geometry	Search Type	Rock Buttress Bench Width	Rock Buttress Grade	Factor of Safety High Pool	Factor of Safety Existing Pool	Failure Location
Existing Conditions (as of 10-16-09) Section M-M’	Grid & Rad	10 feet	2:1	1.5	1.6	Embankment
			2.5:1	1.5	1.6	Embankment
	Grid & Rad	12.5 feet	2:1	1.5	1.6	Embankment

12. Repair and Maintenance Work Completed in 2009

Stantec prepared three work plans to address certain conditions that needed the implementation of repair and maintenance measures. The first work plan, issued May 7, 2009, included the removal of woody vegetation from interior and exterior slopes of the Stilling Pond West, southwest exterior slope of the dry stack, west edge of Bottom Ash Pond Area No. 2 and north and west rim of the coal yard area. As an extension to this work plan, TVA also removed woody vegetation from exterior slopes of the Bottom Ash Pond Area 2, Ash Disposal Area J and Sediment Pond West. The work plan also addressed treatment of animal burrows found on the slopes of the dry stack and the Bottom Ash Pond Area No. 2, protection against wave action along the south side of the Bottom Ash Pond Area No. 2 stilling basin and general slope grading of the northwest side of the Chemical Pond and south side of the Coal Yard Runoff Pond.

The second work plan was issued May 27, 2009 to address recommended measures to protect an exposed pipe along the south side of the Coal Yard Runoff Ponds. The third work plan was issued June 5, 2007 to perform several repair and improvement measures to the interior of the Coal Yard Runoff Ponds. All the construction or maintenance measures included in the work plans mentioned above have been implemented.

13. Conclusions and Recommendations

13.1. Dry Fly Ash Stack Area

13.1.1. Historical Information

The Dry Fly Ash Stack area was originally developed as wet ash disposal area located on the floodplain of the Holston River. The principal feature of the disposal area was a 17-foot tall (approximate height), 4,375-foot long earthen dike constructed along the south flank of the river. A historical drawing (Drawing 10N410, labeled ‘Record Drawing as Constructed’ and dated 1-24-1956) shows the top of dike elevation as 1087 feet±. The disposal area was subdivided for operational purposes into several areas labeled Areas A through I, with the different areas presumably separated by divider dikes.

Drawing 10N410 also shows a future expansion of the dike as depicted in Figure 4 of this report, which would have raised the dike to elevation 1110 feet. However, it is unclear what plans, if any, were followed for this purpose. The next historical drawing available (Drawing

10N410, labeled Ash Disposal Area E Dike Repair and dated 7-26-1973) shows that at least in Area E, material was placed over the starter dike and well above elevation 1110 feet (see Figure 5) following no apparent well defined slope configuration. Based on Figure 5 it appears material placement extended onto the adjacent river bank and the sluiced ash level reached an elevation above 1100 feet.

As summarized in Table 2, there were several areas where the dike slope was disturbed by sloughing, sliding, cracking and erosion. Two of these events appear to have been of more significance in terms of the extent of the work required to repair the disturbance: (1) The 1973 dike failure in Area E and (2) the 1999-2001 instability of the dike face below elevation 1110 feet. In both cases, the repair work consisted in removing material placed over the starter dike slope and grading the dike slope close to the original design slope (3:1). In addition, there appears to have been several efforts to stabilize the river bank area immediately below the toe of the dike by placing riprap over it.

13.1.2. Subsurface Conditions and Slope Stability Analyses

Based on the historical information and the general layout of the dry stack, the main focus of the geotechnical exploration was directed to the lower portion (below elevation 1110 feet) of the dry stack north slope. The most unusual subsurface conditions were encountered along cross section D-D'. In Boring JS-36, advanced near the crest of the slope, the top 6 feet consist of clay deposits which are underlain by 7.5 feet of dense fly ash. A thick horizon of sluiced fly ash was encountered below the dense fly ash from a depth of 13.5 feet (elevation 1095 feet) down to 38.1 feet. The sluiced ash was found on top of soft alluvial deposits. Similar deposits of sluiced fly ash were encountered in Borings JS-37X and JS-38, which were drilled directly uphill of Boring JS-36. This information confirmed that wet fly ash was stored to an elevation well above the top of the starter dike (1087 feet), implying the dike had to be expanded upward to provide containment. Since no reliable historical information is available relative to the vertical expansion of the dike, additional subsurface exploration was conducted along the face of the slope. The additional exploration (Borings JS-60 through JS-65) revealed the presence of clay deposits in front of the sluiced ash, above and below elevation 1087 feet.

Potential less than acceptable stability conditions appear to exist along the toe of the slope where high phreatic levels and steep river bank slopes were encountered. Historical information tends to confirm this assessment. There is a sub-drain system along the east portion of the slope that collects drainage from specific pipe penetrations as well as some toe of slope seepage. Wet areas have been observed along the perimeter road bordering the toe of the slope, both within and outside the area covered by this sub-drain system. Likewise, the historical information documents attempts to stabilize the river bank below the toe of slope using riprap.

As discussed in earlier sections of this report, the degree of stability of the toe of the slope and adjacent river bank area is highly dependant on the river pool elevation, which is known to fluctuate significantly. When the river pool elevation is at 1073 feet, the pool provides toe support and the corresponding factors of safety remain at or above 1.5 in all critical sections. When the river level drops, as was the case this past summer, the toe support is reduced significantly and the factor of safety drops accordingly.

After reviewing different corrective measures, Stantec selected two construction measures to address high phreatic levels encountered at the toe of the slope and steep river bank conditions. One measure consists of installing an under-drain system along the toe of the slope, constructed under the lower perimeter road. Although the under-drain by itself would not raise the factors of safety to acceptable levels, it would control seepage emerging along the toe of the slope and the potential associated piping. In addition, and due to environmental reasons, the water collected by the under-drain will be pumped to the coal yard drainage pond where it will be treated as needed. The second measure consists of placing riprap over the river bank to add toe resistance and attain acceptable long term factors of safety. These measures are discussed in more detailed in a later section of this report.

As stated previously, the main focus of the geotechnical exploration was directed to the lower portion (below elevation 1110 feet) of the dry stack north slope. It is recommended that an appropriate geotechnical evaluation be preformed in conjunction with future built out or closure of the dry stack.

13.2. Bottom Ash Disposal Area 2

13.2.1. Historical Information

This 40-acre structure, in operation since 1979, receives sluiced bottom ash, fly ash (intermittently) and discharges from the Coal Yard Runoff Pond and Chemical Treatment Pond. A stilling pond is located in the west end of the area, separated from the rest of the structure by an internal dike. The structure was formed by constructing an 8,600-foot long earthen dike, measuring approximately 20 feet in height and with a 16-foot wide crest.

Historical information reports the presence of isolated areas where seeps, wetness and soft ground were observed along the exterior slope of the dike. No cases of sliding, sloughing or slumping have been reported.

13.2.2. Subsurface Conditions and Stability Analyses

It appears the dike was constructed using clayey soil excavated from the pool area and adjacent areas outside the dike. The dike and foundation material found in the different borings has a medium stiff to hard consistency based on the results of the standard penetration testing. Accordingly, the stability analyses performed along a cross section (Section I-I') where the slope of the dike is steeper than in most areas has an acceptable factor of safety for long term loading conditions.

13.3. Ash Disposal Area J

13.3.1. Historical Information

The construction of this 22-acre structure was completed in 1982 and thereafter it started receiving sluiced fly ash. In 1984, the west dike of the structure was modified by using a flatter slope and riprap was placed along 700 feet of shoreline next to the west end of the north dike. This last corrective measure was apparently implemented after a narrow tree area between the toe of the dike and steep river bank slumped into the river.

13.3.2. Subsurface Conditions and Stability Analyses

The dikes forming Ash Disposal Area J were apparently constructed with clayey soil excavated from within the pool area and a borrow site located southeast of the disposal area. The consistency of the dike and foundation materials is uniform, ranging from medium stiff to hard, with the exception of a depth interval encountered deep within Boring JP-04 where the foundation soil, probably alluvial material, was found to be very soft. This boring is located above the river bank area repaired as discussed in the previous paragraph.

A review of the events that preceded the 1984 repair of the shoreline suggests that similar conditions may potentially develop along other areas of the shoreline, as demonstrated by Sections K-K', M-M' and O-O'. Even though the stability analyses show that a less than acceptable long term factor of safety against deep failure only occurs at Section M-M', the factors of safety against shallow or maintenance type of failure is less than acceptable in Sections K-K' and O-O'. If the steep river bank is not stabilized, it is possible the tree area below the dike may slump into the river, which could potentially undermine the toe of the dike.

While the stability of dike slope areas represented by Section M-M' can be improved by flattening the slope, the toe of the dike slope still needs to be protected by stabilizing the river bank. A recommended method to stabilize the river bank is discussed in the next section of this report.

13.4. Slope Stability Improvement Measures

13.4.1. Dry Fly Ash Stack Area

At TVA's request, Stantec has started preparing work plans and recommendations to improve the stability of the north slope of the dry stack below elevation 1110 feet. The work plans include two main components: (1) an under-drain along the west two thirds of the stack and (2) re-grading the slope area located west of the ramp connecting the two lower perimeter roads. Additionally, the engineering analyses included the stability analysis of the river bank area below the toe of the slope after riprap is added to achieve an acceptable factor of safety for long term loading conditions.

The under-drain will be constructed along the lower perimeter road by excavating a 5-foot deep trench, lining the bottom and uphill side of the trench with a filter consisting of sand and crushed stone and placing a perforated pipe on crushed stone bedding. The rest of the trench will be backfilled with crushed stone and capped with a layer of clayey soil and a surfacing layer of crushed stone. Water collected by the under-drain will be directed to three manholes. Pumps installed within the manholes will pump the water through 3" diameter pipes to discharge the water into the chemical pond located next to the coal yard.

The re-grading of the slope area west of the ramp connecting the two perimeter roads will consist of flattening the slope slightly with the intent to remove humps and bulges and provide a uniform surface to facilitate its maintenance. The re-grading may require offsetting slightly the upper perimeter road toward the dry stack.

Although the work plans currently in preparation do not include placing riprap to improve the stability of the river bank, the stability analyses indicates that using relatively thin layers of riprap is the most practical way to achieve an acceptable factor of safety for long term loading conditions. A typical geometrical configuration of the rock berm, as derived from the stability analyses of individual cross sections to achieve this goal, is presented in Appendix B. These geometrical configurations can be used as a basis to design more uniform cross sections of the riprap layers in terms of access and constructability. Since new riprap would be placed on top of existing riprap, the only preparatory measures would consist of some clearing and grubbing. A permit from the regulatory agencies will more than likely be required as the proposed work would encroach the floodway of the Holston River.

13.4.2. Ash Disposal Area J

As described before, years of river flow scouring have exposed the top of the bedrock along the south bank of the river, immediately below all but about 700 feet of the Ash Disposal Area J north dike slope. The scouring has left a near vertical slope next to an area moderately vegetated with mature trees. In the past, a similar condition on the west side of the North Slope developed into a slump of the tree area toward the river, apparently compromising the stability of the dike.

It is recommended that a rock berm be constructed along the river bank to protect the tree area and thereby the toe of the dike. The use of a rock berm is needed in some areas to provide an acceptable factor of safety for long term loading conditions. The typical rock berm configuration needed, based on the stability analysis of section M-M' is presented in Appendix B. These geometrical configurations can be used as a basis to design more uniform cross sections of the rock berm in terms of access and constructability.

There are other options TVA can consider to attain long term stability of the north slope of this facility if constructing a rock berm on the river bank is to be avoided. The selection and design of other alternatives would probably require that geotechnical information be obtained along the toe of the North Slope.

13.5. Monitoring and Attaining Long Term Stability of Dike Slopes below Dry Fly Ash Stack Area

As explained earlier, there are historical drawings showing the starter dike configuration and its top elevation being at 1087 feet. Borings advanced during this geotechnical exploration from approximately this elevation (see logs of Borings JS-60 through JS-65) confirmed the presence of clay deposits where the starter dike would have been constructed. Borings advanced from above elevation 1087 feet (up to elevation 1110 feet) also encountered clay deposits, though much thinner, apparently placed above the starter dike; however, no historical information is available relative to the design configuration or construction of the starter dike upward expansion. Therefore, cross sections of the actual dike expansion could only be developed using the boring information, the outline of the starter dike as shown in historical drawings and assumed interpolation and/or extrapolation lines representing horizon boundaries. The configuration of the starter dike expansion is critical in evaluating the stability of the slopes, because both the starter dike and its expansion are barriers holding behind thick deposits of sluiced fly ash. The sluiced ash deposits are in turn the foundation layer supporting most of the tall dry ash stack present at the site.

An understanding of how the different cross section profiles were prepared is important in formulating measures to monitor and attain long term stability of the slopes located below the dry stack (below elevation 1110 feet). Because the engineering analyses reported herein are based on certain assumptions (as described above) and the limited information exploratory borings provide, it is recommended that the stability of these slopes be evaluated periodically through a rigorous instrumentation monitoring program. Depending on the results of the periodic evaluations and further analyses of corrective measures to attain long term stability of the Dry Fly Ash Stack, it is possible and it should be expected that additional geotechnical work, including installing more instrumentation, will need to be performed.

14. Closure

The scope of Stantec's services did not include an environmental assessment or investigation for the presence or absence of wetlands and hazardous or toxic materials in the soil, surface water, groundwater or air, on below or around the project sites. Any statements in this report or on the boring logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of the client.

These conclusions and recommendations are based on data and subsurface conditions from the borings advanced during this investigation using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. The boring logs and related information presented in this report depict approximate subsurface conditions only at the specific boring locations noted and at the time of drilling. Conditions at other locations may differ from those occurring at the boring locations. Also, the passage of time may result in a change in the subsurface conditions at the boring locations.

It should be noted that design plans or construction records indicating the methods used to construct the upward expansion of the starter dike forming the lower north and east slopes of the Dry Fly Ash Stack were not available for review. As a result, it should be understood that some generalizations and assumptions were made in preparing cross section profiles prior to performing the engineering analyses.

The scope of this evaluation was limited to consider only the potential risks to the facilities due to excessive seepage and slope instability under long-term, steady-state seepage loading conditions. This assessment did not consider potential failure modes related to spillway capacity and overtopping or seepage along penetrations through the embankment (including the buried spillway pipes).

15. References

The following is a list of documents referenced in this report and/or used to evaluate the stability of the structures at John Sevier Fossil Plant:

Soil Strength and Slope Stability, pp 49, Duncan, J. Michael, Wright, Stephen G., 2005.

Slope Stability, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-2-1902, October 31, 2003.

Geotechnical Investigations, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-1-1804, January 1, 2001.

Seepage Analysis and Control for Dams CH 1, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-1-1901, April 30, 1993.

Evaluation of settlements in sands due to earthquake shaking, Journal of Geotechnical Engineering, ASCE, Vol. 113, No. 8, August, pp. 861-878. Tokimatsu, K., and Seed, H. B. (1987).

Soil Mechanic Design Manual 7.1, Department of the Navy – Navy Facilities Engineering Command, May 1982.

A Method of Analysis of Embankments assuming Parallel Interslice Forces, Geotechnique, Vol. 17 (1), pp. 11-26, Spencer, E. (1967).

APPENDIX A

Document 3

Stantec Report of Hydrologic and Hydraulic Analysis, dated September 30, 2010

Stantec

Report of Hydrologic and Hydraulic Analysis

Stilling Pond, Sediment Pond West and Sediment Pond East
TVA John Sevier Fossil Plant
Hawkins County, Kentucky

Stantec Consulting Services Inc.
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Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

September 30, 2010

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September 30, 2010 rpt_002_175660008

Ms. Shannon Bennett
Tennessee Valley Authority
1101 Market Street, LP 5E-C
Chattanooga, Tennessee 37402

Re: Report of Hydrologic and Hydraulic Analysis
Stilling Pond, Sediment Pond West and Sediment Pond East
TVA John Sevier Fossil Plant
Hawkins County, Kentucky

Dear Ms. Bennett:

Stantec Consulting Services, Inc. (Stantec) has been assisting TVA with risk assessment and mitigation for a number of facilities associated with its coal combustion processes at various fossil plants. The Ash Pond Stilling Pond, Sediment Pond West and Sediment Pond East at the John Sevier Fossil Plant were identified for Hydrologic and Hydraulic Analysis as a part of our Phase 1 Assessment. The goal of this analysis was to develop a conceptual-level hydrologic and hydraulic model of the area to help assess capacity, freeboard, and hydraulic operation of the Ash Pond Stilling Pond, Sediment Pond West and Sediment Pond East during various hydrologic events. Results of this modeling effort and recommendations are included in the attached report.

The normal freeboard conditions were assessed and found to be adequate (>5 feet) for the three ponds according to TVA guidelines. Storm surge conditions were also assessed. In general, the Ash Pond Stilling Pond and its associated spillway were found to be adequate during the assessed storm events and the pond should be able to pass the PMP storm event. However, sediment Pond East and Sediment Pond West and their associated spillways were found to be potentially problematic during larger storm events with insufficient capacity to convey runoff for the 50-year return period and PMP events respectively. There is a chance these ponds could overtop during larger storm events.

Potential options to improve the operation of Sediment Pond East could include modifying the riser elevation, along with adding additional risers. Potential modifications for Sediment Pond West could include adding a weir to act as an emergency spillway. Additional information from the modeling efforts and an explanation of the potential improvements is included herein.

We appreciate the opportunity to assist TVA with these assessment efforts and look forward to continuing work on other TVA facilities. Please do not hesitate to contact Stantec with any questions, concerns, or clarifications.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Brian Mazzochi, PE
Water Resources Engineer

Erman Caudill, PE, CFM
Project Manager

/cmw

Report of Hydrologic and Hydraulic Analysis

Stilling Pond, Sediment Pond West and Sediment Pond East TVA John Sevier Fossil Plant Hawkins County, Kentucky

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

September 30, 2010

Report of Hydrologic and Hydraulic Analysis

Stilling Pond, Sediment Pond West and Sediment Pond East
TVA John Sevier Fossil Plant
Hawkins County, Kentucky

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Executive Summary

A hydrologic and hydraulic study was conducted for the Ash Pond Stilling Pond, Sediment Pond West and Sediment Pond East at the John Sevier Fossil Plant in Hawkins County, Tennessee. The purpose of the study was to help assess freeboard requirements, capacity, and hydraulic operation of spillway systems in relation to the structural hazard classifications that would be appropriate in Tennessee using the effective size of the facilities. In order to perform the study, site visits were conducted, TVA personnel were interviewed, historical drawings and documents were reviewed, survey data was obtained, and hydrologic/hydraulic (H&H) modeling was performed.

An H&H model was developed to simulate stormwater drainage and runoff from overland areas, process discharges, and pond interconnectivity by spillways based on our understanding of the geometry and design of the drainage and conveyance network. A map showing the hydraulic connectivity is attached as Appendix A. The model was used to assess the performance of the ponds during the 1-, 10-, 25-, 50- and 100-year 24-hour SCS Type II storms as well as the 6-hour PMP (Probable Maximum Precipitation).

Based on the data gathering efforts, collective review of the data available, and the modeling efforts, Stantec noted the following observations:

- Aside from the principal spillway systems, there are no defined emergency spillways or overflow paths. Ponds similar in size and capacity to these typically have emergency spillway systems to prevent overflows.
    - If the principal spillways were to become clogged, or if a heavy rainfall event were to cause any of the ponds to overtop, there are no defined and protected overflow paths to help prevent erosion of the dikes.
- Based on modeling the current conditions, the Ash Pond Stilling Pond appears able to pass the PMP event through the spillway system without overtopping the embankment.
- Based on modeling the current conditions, Sediment Pond West appears unable to pass runoff from the PMP event through the spillway system without overtopping the embankment. It does appear to be able to pass the 100-year storm event.
- Based on modeling the current conditions, Sediment Pond East appears unable to pass the 50 year event through the spillway system without overtopping the embankment. It does appear to be able to pass the 25-year storm event.
- Based on modeling of a potential closure scenario for the Ash Pond, the Ash Pond Stilling Pond appears to pass the 100-year storm event, however it will be unable to pass the PMP event through the spillway system without overtopping the embankment.

Based on the results of the analysis, Stantec recommends TVA consider the following:

- According to the models described herein, there is a potential for overtopping of Sediment Pond East (P-E) during the 50 Year event and larger storms. Overtopping of the pond does not appear to pose an immediate threat to the embankment and may be a minimal risk. Due to its small size, this pond would not normally be a regulated structure; however TVA may want to consider modifications to reduce this risk. One possible solution would be to create an overland flow path from the pond to the downstream drainage ditch. The flow path would include a low spot in the adjacent haul road that allows for controlled overflow.

- According to the models described herein, there is a potential for overtopping of Sediment Pond West (P-W) during the 6 HR PMP event. TVA is recommended to consider the risk of this pond overtopping during its remaining life and modify its configuration if appropriate. A weir type emergency spillway of approximately 200 linear feet would be needed to achieve this level of service. A complete design would need to be performed to determine the exact size and configuration to implement.

- During closure of the Ash Pond the installation of a weir type emergency spillway of approximately 230 linear feet in the Ash Pond Stilling Pond (SP-2) may be necessary and should be considered as a part of that design. A complete design would need to be performed to determine the exact size and configuration to implement.

Stantec recommends that these potential improvements be further evaluated by TVA to determine if they are warranted and can be incorporated into future construction projects at the plant.

Report of Hydrologic and Hydraulic Analysis

Stilling Pond, Sediment Pond West and Sediment Pond East
TVA John Sevier Fossil Plant
Hawkins County, Kentucky

1. Introduction

This study was conducted to help assess capacity and hydraulic operation of spillway systems and freeboard requirements in relation to the structural hazard classifications of the facilities at the John Sevier Fossil Plant in Hawkins County, Tennessee. The ponds evaluated include the Sediment Pond West, Sediment Pond East and the Ash Pond Stilling Pond.

This analysis included field visits, review of historical TVA drawings and discussions with TVA personnel. This report details the assumptions, methodology, and results of the H&H analyses for the ponds analyzed.

Sediment Pond West captures runoff from the western half of the dry fly ash stack. Its principal spillway system consists of 2 concrete risers 4-feet in diameter with 3-foot diameter outlet pipes. Sediment Pond East captures runoff from the eastern half of the dry fly ash stack. Its principal spillway system consists of 1 concrete riser 4-feet in diameter with a 3-foot diameter outlet pipe. Sediment Pond East is an excavated pond, with the adjacent ground elevation as the top of storage. It does not have a constructed dam. The Ash Pond Stilling Pond captures runoff from the active Ash Pond area. Its principal spillway system consists of 2 concrete risers 4-feet in diameter with 3-foot diameter outlet pipes.

2. Modeling Assumptions

a. Pipes are assumed to be flowing freely and are not clogged or leaking. Some of the pipes may, in actuality, be clogged and some of the older pipes may be leaking (especially older corrugated metal pipes). Elevations and flows determined for this analysis may not be applicable in those situations. This assumption is inherent in this type of analysis and is acceptable.

b. Wave action is not considered in this analysis. Overtopping is assumed to occur only when the elevation of the pond rises above the minimum surveyed crest elevation. In actuality, wave action would likely play a role in the overtopping of the ponds. The modeling performed for this work is conceptual in nature. Compensating for wave action is beyond this scope of work and would not change the outcome of the study.

c. The model does not take into account any tailwater effects caused by receiving water bodies because the 100-year water surface of the receiving water body was not high enough to be a limiting factor. A ditch connects Sediment Pond East (P-E) to Sediment Pond West (P-W). The ditch connects to P-W by means of three RCP's. The downstream end of these pipes is fully submerged in the 6-Hr PMP storm resulting in backwater. Detention in the ditch was disregarded. The rating curves can be reviewed in Appendix C.

d. During the initial run for the 50-year event, and all larger storms, the model ended when the water surface elevation (WSEL) in Sediment Pond East (P-E) rose to the top of the pond at an elevation of 1115.00 ft. In this situation, flood water would flow overland to the ditch that carries flow to Sediment Pond West (P-W). The stage-discharge curve was modified to show no significant storage above elevation 1115.00 and modeled to convey water directly to the receiving channel.

e. NRCS/SCS TR-55 methodology was used for runoff calculations. Wherever ash existed in the drainage area, it was treated as a Hydrologic Group C soil. The water surfaces of the ponds are considered to be impervious, in order to model 100% of the rainfall being captured in the pond.

f. As a result of the large opening between the Bottom Ash Disposal (BAD-2) and the Ash Pond Stilling Pond (SP-2), these impoundments were modeled as one.

g. It should be noted, that this was an uncalibrated model and sufficient data from actual storms was not available to calibrate it. Stantec tested the sensitivity of the model to input parameters and found the overall general results of the model consistent throughout. This model is suitable for planning purposes, but it should not be used for simulation of actual storm events without further calibration efforts involving actual storm discharge and stage measurements. This model is suitable as a screening and planning tool, however Stantec would discourage its use beyond the current scope of work and the context described in this report.

3. Methodology

Rainfall-runoff relationships were determined using methods described by the NRCS in "Part 630-Hydrology" of the National Engineering Handbook (NEH4). SCS Curve Number Unit Hydrograph methods were used to generate runoff hydrographs for routing through the ponds in lieu of the more complex methods described in Chapter 21 of NEH4 and commonly implemented in NRCS TR-60 based methods.

A HEC-HMS model was developed and used to simulate runoff from the probable maximum precipitation (PMP) event in accordance with TVA design guidance. SCS Type II rainfall depth for the 1, 10, 15, 50, and 100-year storm events were taken from NOAA Atlas 14 for Rogersville, TN. Rainfall depth for the 6-HR PMP event was taken from NOAA HMR-56. From Figure 23 *"6 hr 1-mi^2 PMP (in.) – eastern half of Tennessee River Watershed"* of HMR-56, the 6-HR PMP rainfall depth for the John Sevier site was estimated to be 36.0 in.

The PMP event was formatted using the distribution chart included in NRCS TR-60, Figure 2-4 "*Dimensionless design storm distribution, auxiliary spillway and freeboard.*" A formatted 6-HR PMP chart was developed using Excel and can be found in Appendix C. This allows the PMP event to be formatted in a distribution matching TR-60 Figure 2-4 and also calculates a dataset that can be entered into HEC-HMS.

The wastewater flow schematic provided by TVA titled "JSF Flow Schematic 1-10.pptx" depicts the plant flows. This information, included in the current NPDES permit, references a plant process flow of 5.772 MGD (8.93 cfs). This value is used as a constant flow source in the model and is included in Appendix E.

4. Input Data

4.1. Watershed Parameters

It is our understanding that process water enters the Ash Pond. The Ash Pond discharges to the Stilling Pond through an adjustable weir structure. Drawings utilized to develop the connectivity which was used in the creation of the hydrologic model are included in Appendix A. The following table lists the main hydrologic parameters of the watersheds draining to the ponds. The impervious area is a separate entry into the model and the curve numbers listed below are for the pervious sections of the drainage areas only.

Table 1. Watershed Parameters

Name	Drainage Area (acres)	Receiving Pond	Curve Number	*Percent Impervious	Estimated Lag Time (min)
P-W-DA	53	Pond-West	73	3.8	26
P-E-DA	40	Pond East	77	3	5
Ash Pond Stilling Pond DA	76	Ash Pond Stilling Pond	76	65	3
Ash Pond Stilling Pond DA @ Closeout	76	Ash Pond Stilling Pond	73	36	3

*The amount of impervious area is not reflected in the Curve Number.

A potential closure scenario was also modeled assuming the Ash Pond Stilling Pond would function as it currently does, but act as a settling basin for the to-be closed Ash Pond prior to discharge. The Ash Pond Area was assumed to be filled and regraded to drain positively to the stilling pond and all the process water was routed through the Stilling Pond. Although the exact configuration may change during design, this assumption appears to be sufficient for this concept level model.

4.2. Rainfall Data

SCS Type II rainfall depth for the 1, 10, 15, 50, and 100-year storm events were taken from NOAA Atlas 14 for Rogersville, TN.

Rainfall depth for the 6-Hr PMP event was taken from NOAA HMR-56. From Figure 23 *"6 hr 1-mi^2 PMP (in.) – eastern half of Tennessee River Watershed"* of HMR-56, the 6-hr PMP rainfall depth for the John Sevier Fossil Plant site is estimated at 36.0 in.

From NRCS TR-60, Figure 2-4 "*Dimensionless design storm distribution, auxiliary spillway and freeboard*", the PMP event was formatted using this distribution and can be found in Appendix D.

Rainfall depths were taken from NOAA Atlas 14 for the storm events evaluated. The PMP event was formatted using the distribution chart included in NRCS TR-60, Figure 2-4 "*Dimensionless design storm distribution, auxiliary spillway and freeboard.*" Rainfall depths used in the HMS model are summarized below in Table 2.

Table 2. Rainfall Depths

Storm Event	Rainfall Depth (inches)
1-year 24-hour	2.28
10-year 24-hour	3.63
25-year 24-hour	4.17
50-year 24-hour	4.59
100-year 24-hour	5.00
6-hour PMP	36.0

4.3. Spillway Data

"TVA drawings 10H291-10" depicts the riser structure in the Sediment Pond East (P-4), elsewhere referred to as P-E. The riser structure was located and verified during the field visit. Data shall be used from this drawing in the H&H analysis.

TVA survey conducted on July 19, 2010 provided in the files named "RKQ934.xlsx" and "RKQ934_PLOTS.pdf," top of riser elevation and outfall elevation for Sediment Pond East (P-E), Sediment Pond West (P-W) and Ash Pond Stilling Pond (SP-2). This file also provided elevations for supplementary 0.5 foot diameter openings in the risers in SP-2, and the elevation of the inverts of the 36 inch diameter RCP's leaving those riser pipes.

The data gathered from these files were compiled to create the rating curves. See Appendix C.

Table 3. Existing Principal Spillway Data

Pond	Weir/Orifice Structure	Weir Length (ft)	Weir Elevation (ft)	Orifice Opening (ft^2)	Orifice Invert (ft)	Data Source
Pond East	Pond East	48	1113.52	36	1105.51	TVA drawings 10H291-10 & RKQ934.xlsx, RKQ934_PLOTS.pdf
Pond West	North Riser	48	1096.79	36	1088.09	TVA drawings RKQ934.xlsx & RKQ934_PLOTS.pdf
Pond West	South Riser	48	1094.89	36	1088.09	TVA drawings RKQ934.xlsx & RKQ934_PLOTS.pdf
Ash Pond Stilling Pond	East Riser	48	1133.16	36	1118.62	TVA drawings RKQ934.xlsx & RKQ934_PLOTS.pdf

Table 3. Existing Principal Spillway Data

Pond	Weir/Orifice Structure	Weir Length (ft)	Weir Elevation (ft)	Orifice Opening (ft^2)	Orifice Invert (ft)	Data Source
Ash Pond Stilling Pond	West Riser	48	1133.11	36	1117.99	TVA drawings RKQ934.xlsx & RKQ934_PLOTS.pdf

4.4. Pond Overflow and Normal Pool

Table 4 shows the embankment elevation and the assumed normal pool elevations at each pond. The normal pool elevations were assumed to be equal to the principal riser elevation in the pond.

Table 4. Pond Overflow Elevation

Pond Name	Embankment Elevation (feet)	Normal Pool Elevation (feet)
Pond-East (P-E)	1115	1108.8
Pond-West (P-W)	1100	1089.7
Ash Pond Stilling Pond (SP-2)	1144	1133.8

4.5. Stage Storage Data

Stage storage curves were developed for each pond based on data provided by TVA. For the Ash Pond Stilling Pond, P-W and P-E the stage storage data came from AutoCAD files: 69038c-jsf-cb03-27-09.dwg and MAP.dwg. Stage storage curves are included in Appendix C for each pond. Survey data utilized can be found in Appendix D.

4.6. Spillway Rating Curves

Rating curves for the spillway systems were developed based on the geometric data available and weir, orifice, and culvert discharge relationships. Weir equations and coefficients were based on guidance provided in “Open Channel Hydraulics,” V.T. Chow, 1959. Orifice equations and coefficients were based on guidance provided in “Handbook of Hydraulics,” E. F. Brater and H.W. King, 1976. Culvert discharge ratings were developed using procedures outlined in “Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (HDS-5),” U.S. Department of Transportation Federal Highway Administration (FHWA) 1985.

The model does not take into account any tailwater effects caused by receiving water bodies because the 100-year water surface of the receiving water body was not high enough to be a limiting factor. Rating curves for each pond are attached in Appendix C.

4.7. Plant Process Flow

The wastewater flow schematic provided by TVA titled "JSF Flow Schematic 1-10.pptx" depicts the plant plows. This information, included in the current NPDES permit, references a plant process flow of 5.772 MGD (8.93 cfs). This value is used as a constant flow source in the model.

5. Results

Results are summarized in the following sections for the capacity/freeboard analysis. The results shown are based on the assumptions described herein and should be considered approximate.

5.1. Capacity and Freeboard Results

Estimated peak pool elevations for the storms analyzed are shown in Table 5. Table 6 shows the estimated peak pond inflows associated with each event and Table 7 shows estimated peak pond outflows associated with each event.

Table 5. Estimated Peak Pool Elevations – Existing Conditions

Pond Name	1-year 24-hour storm (ft)	10-year 24-hour storm (ft)	25-year 24-hour storm (ft)	50-year 24-hour storm (ft)	100-year 24-hour storm (ft)	6-hr PMP storm (ft)
P-E	1114.0	1114.6	1114.9	OVERTOP	OVERTOP	OVERTOP
P-W	1089.5	1091.6	1092.6	1093.4	1094.2	OVERTOP
SP-2	1134.0	1134.3	1134.4	1134.4	1134.5	1139.3

Table 6. Estimated Peak Inflow – Existing Conditions

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hr PMP storm (cfs)
P-E	39	99	125	OVERTOP	OVERTOP	OVERTOP
P-W	27	91	123	173	239	OVERTOP
SP-2	185	318	372	415	458	2019

Table 7. Estimated Peak Outflow – Existing Conditions

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hr PMP storm (cfs)
P-E	13	48	65	OVERTOP	OVERTOP	OVERTOP
P-W	2.0	3.4	4	4	5	OVERTOP
SP-2	70	100	112	122	132	300

5.2. Ash Pond Closure Scenario Results

A separate H&H basin model for the closure scenario was created. For the closure scenario, the Ash Pond Stilling Pond was found to be sufficient to pass the 100-year storm, but not the PMP. See Tables 8, 9 and 10 for a summary of the results.

Table 8. Estimated Peak Pool Elevations – Ash Pond Closure Scenario

Pond Name	1-year 24-hour storm (ft)	10-year 24-hour storm (ft)	25-year 24-hour storm (ft)	50-year 24-hour storm (ft)	100-year 24-hour storm (ft)	6-hr PMP storm (ft)
Ash Pond Stilling Pond	1133.7	1134.1	1134.3	1134.4	1134.6	OVERTOP

Table 9. Estimated Peak Pond Inflow – Ash Pond Closure Scenario

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hr PMP storm (cfs)
Ash Pond Stilling Pond	116	236	288	329	370	OVERTOP

Table 10. Estimated Peak Pond Outflow – Ash Pond Closure Scenario

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hr PMP storm (cfs)
Ash Pond Stilling Pond	31	77	99	118	138	OVERTOP

6. Conclusions and Recommendations

Based on the data gathering efforts, collective review of the data available, and the modeling efforts, Stantec noted the following observations:

- Aside from the principal spillway systems, there are no defined emergency spillways or overflow paths. Ponds similar in size and capacity to these typically have emergency spillway systems to prevent overflows.
    - If the principal spillways were to become clogged, or if a heavy rainfall event were to cause any of the ponds to overtop, there are no defined and protected overflow paths to help prevent erosion of the dikes.
- Based on modeling the current conditions, the Ash Pond Stilling Pond appears able to pass the PMP event through the spillway system without overtopping the embankment.

- Based on modeling the current conditions, Sediment Pond West appears unable to pass runoff from the PMP event through the spillway system without overtopping the embankment. It does appear to be able to pass the 100-year storm event.

- Based on modeling the current conditions, Sediment Pond East appears unable to pass the 50 year event through the spillway system without overtopping the embankment. It does appear to be able to pass the 25-year storm event.

- Based on modeling of a potential closure scenario for the Ash Pond, the Ash Pond Stilling Pond appears to pass the 100-year storm event, however it will be unable to pass the PMP event through the spillway system without overtopping the embankment.

Based on the results of the analysis, Stantec recommends TVA consider the following:

- According to the models described herein, there is a potential for overtopping of Sediment Pond East (P-E) during the 50 Year event and larger storms. Overtopping of the pond does not appear to pose an immediate threat to the embankment and may be a minimal risk. Due to its small size, this pond would not normally be a regulated structure; however TVA may want to consider modifications to reduce this risk. One possible solution would be to create an overland flow path from the pond to the downstream drainage ditch. The flow path would include a low spot in the adjacent haul road that allows for controlled overflow.

- According to the models described herein, there is a potential for overtopping of Sediment Pond West (P-W) during the 6 HR PMP event. TVA is recommended to consider the risk of this pond overtopping during its remaining life and modify its configuration if appropriate. A weir type emergency spillway of approximately 200 linear feet would be needed to achieve this level of service. A complete design would need to be performed to determine the exact size and configuration to implement.

- During closure of the Ash Pond the installation of a weir type emergency spillway of approximately 230 linear feet in the Ash Pond Stilling Pond (SP-2) may be necessary and should be considered as a part of that design. A complete design would need to be performed to determine the exact size and configuration to implement.

Stantec recommends that these potential improvements be further evaluated by TVA to determine if they are warranted and can be incorporated into future construction projects at the plant.

7. References

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Appendix A

Connectivity Map

SaveDate: 2010/08/31 4:51 PM Login: Gaskill, CW
u:\175660008\h&h\analysis\john_sevier\drawing\da.dwg

Stantec

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
Tel. 859.422.3000
Fax. 859.422.3100
www.stantec.com

Legend

Notes

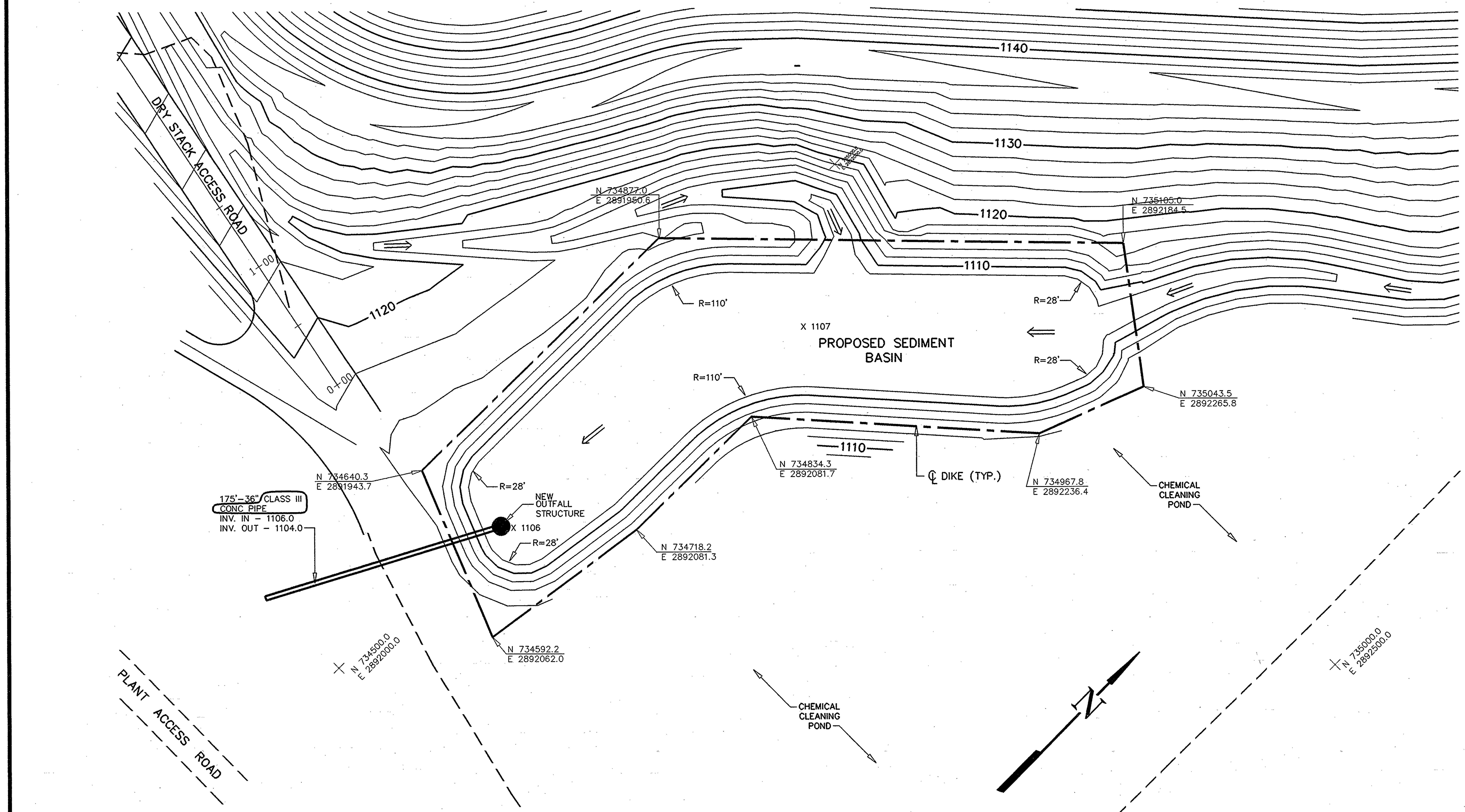
Client/Project
TVA
JOHN SEVIER H&H

Figure No.

Title

Appendix B

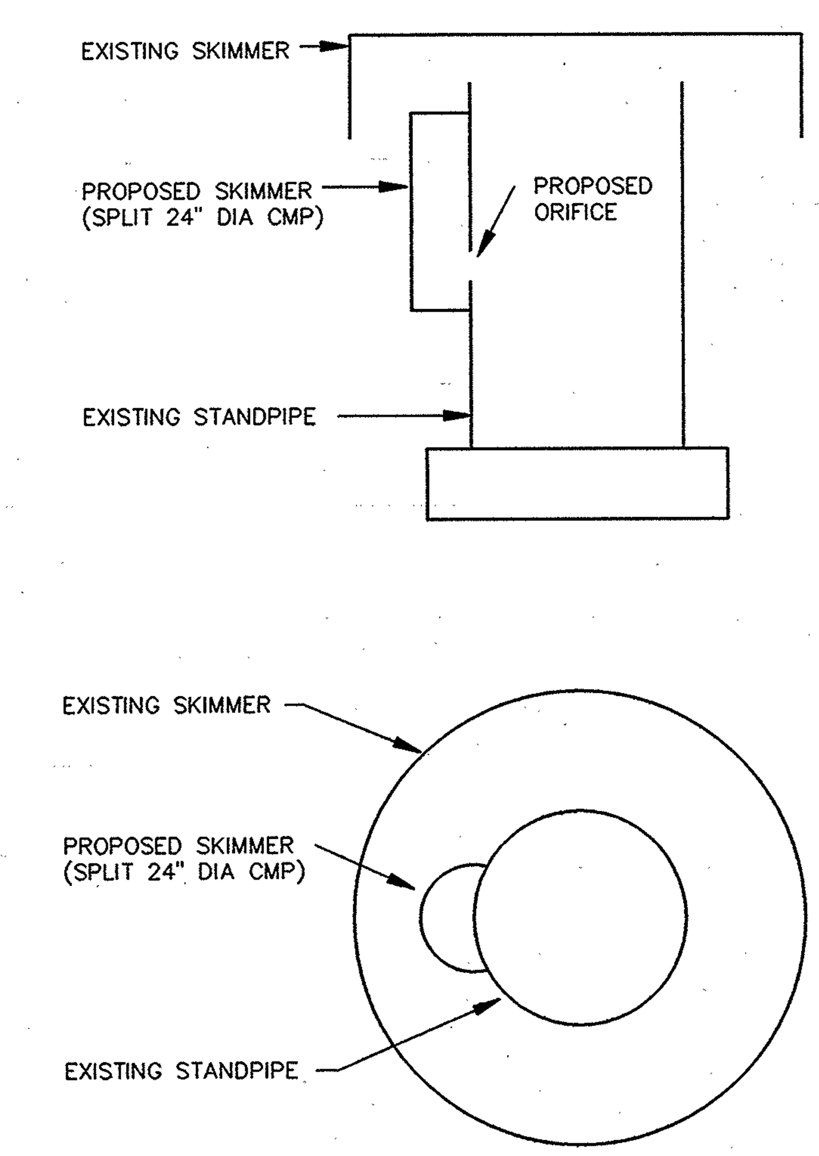
TVA Historical Drawings

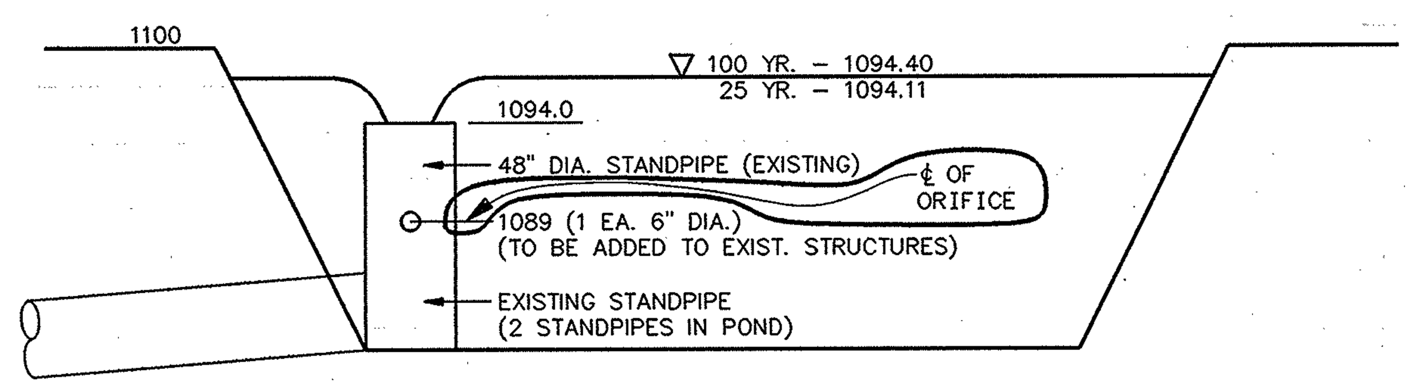


NOTES:

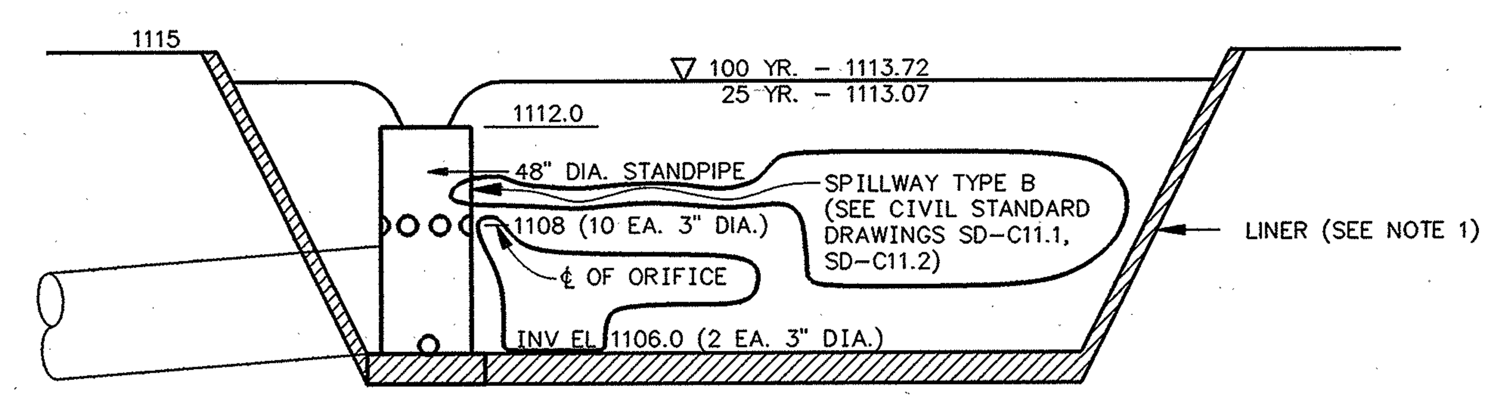
1. PROPOSED SEDIMENT BASIN SHALL BE EXCAVATED TO 3' BELOW FINAL GRADE AND LINED WITH 3' SOIL COMPACTED TO ACHIEVE MAXIMUM PERMEABILITY OF 1×10^{-7} CM/SEC.

2. SKIMMER EXTENSIONS WILL BE ADDED TO THE EXISTING STANDPIPES IN THE EXISTING DETENTION/SEDIMENTATION POND TO HELP PREVENT FLOATING SOLIDS FROM ESCAPING THROUGH THE PROPOSED ORIFICES. THESE EXTENSIONS MAY BE CONSTRUCTED USING 24" CMP SPLIT DOWN THE MIDDLE AND FASTENED TO THE SIDE OF THE EXISTING STANDPIPE WITH FIELD FABRICATED ANGLE CLIPS AND WEDGE ANCHOR BOLTS. THE TOP OF THE SKIMMER EXTENSION SHOULD EXTEND AT LEAST 6" ABOVE THE BOTTOM OF THE EXISTING SKIMMER. THE BOTTOM OF THE SKIMMER EXTENSION SHOULD BE AT ELEVATION 1088.0. (SEE SKETCH BELOW)



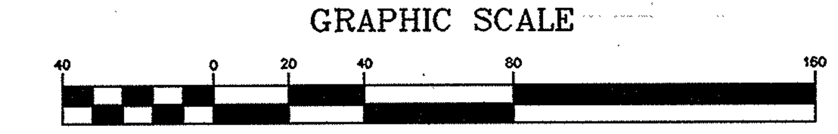


EXISTING DETENTION/SEDIMENTATION POND



PROPOSED SEDIMENTATION BASIN (100'x500')

GRAPHIC SCALE



(IN FEET)
1 inch = 40 ft.

R 1	3-7-95	CLM	MGH	JLG	JLG	KWB	RGJ	WDH	5125		D
REVISED 36" CMP TO 36" CLASS III CONC PIPE AND MINOR REVISIONS.											
R 0		BNC	BNC	MSD	MSD	KWB	RGJ	WDH	5125		D
INITIAL ISSUE FROM TRIBBLE & RICHARDSON AND LAW ENG. PROJ. NO. 3822-014 SH 10 OF 11.											
REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD

DISCIPLINE INTERFACE

SCALE: 1" = 40' EXCEPT AS NOTED

TRIBBLE & RICHARDSON
LAW ENGINEERING PROJ. NO. 3822-014

MF R1

DRY FLY ASH STACK
POND LAYOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
BNC	BNC	MSD	MSD	K.W.BURNETT	R.G.JOHNSON	W.D.HALL

LAW ENGINEERING
GEOTECHNICAL ENVIRONMENTAL & CONSTRUCTION MATERIALS CONSULTANTS

Tribble & Richardson Inc.

JOHN SEVIER FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R12	DATE 3-7-95	41	C	10H291-10	R 1

LAW ENG. AND TRIBBLE & RICHARDSON INC. 4/2/92
TASK COMPLETED BY:

PLOT FACTOR:40
H_TVA
FILENAME: JS291-10.DWG

C.A.D. DRAWING DO NOT ALTER MANUALLY

Appendix C

Rating Curves

Figure 2-4 Dimensionless design storm distribution, auxiliary spillway and freeboard

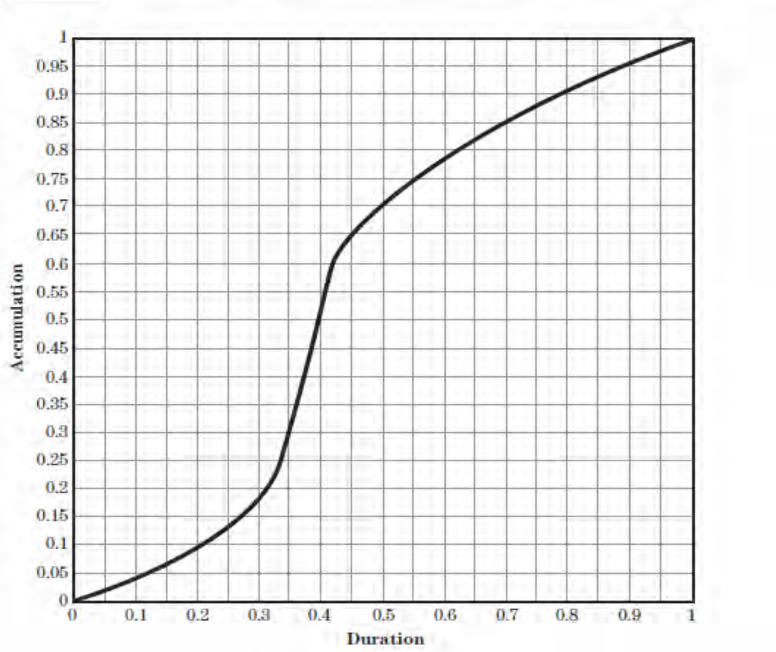
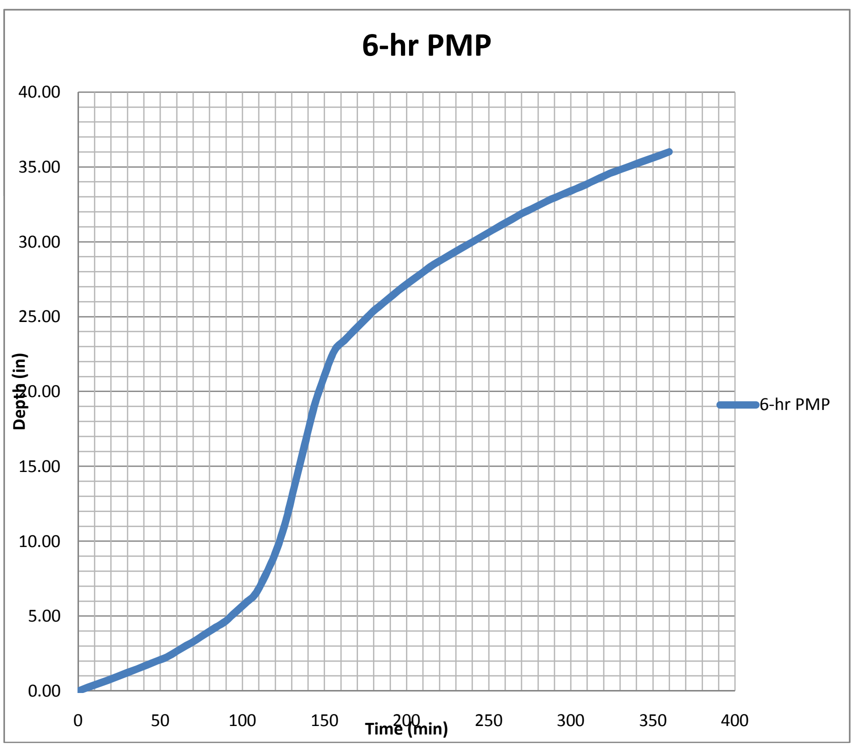


Fig 2-4 NRCS TR-60 - Eath Dams and Reseviors, July 2005



SEDIMENT POND EAST (P-E)

	Pond Elev. (ft)	Pond Area (ac)	Incremental Volume (ft^3)	Cummulative Volume (ft^3)	Cummulative Volume (gal)	
	1107	0.13	0	0	0	Base
	1108	0.37	10,434	10,434	78,052	
5.2 Feet of Freeboard	1108.8	0.51	15,253	25,687	192,151	Water Surface
	1109	0.86	5,896	31,583	236,254	
	1110	0.97	39,794	71,376	533,931	
	1111	1.2	47,127	118,503	886,463	
	1112	1.21	52,437	170,940	1,278,720	
	1114	1.4	113,477	284,417	2,127,590	Lowest Elevation at Top of Dike

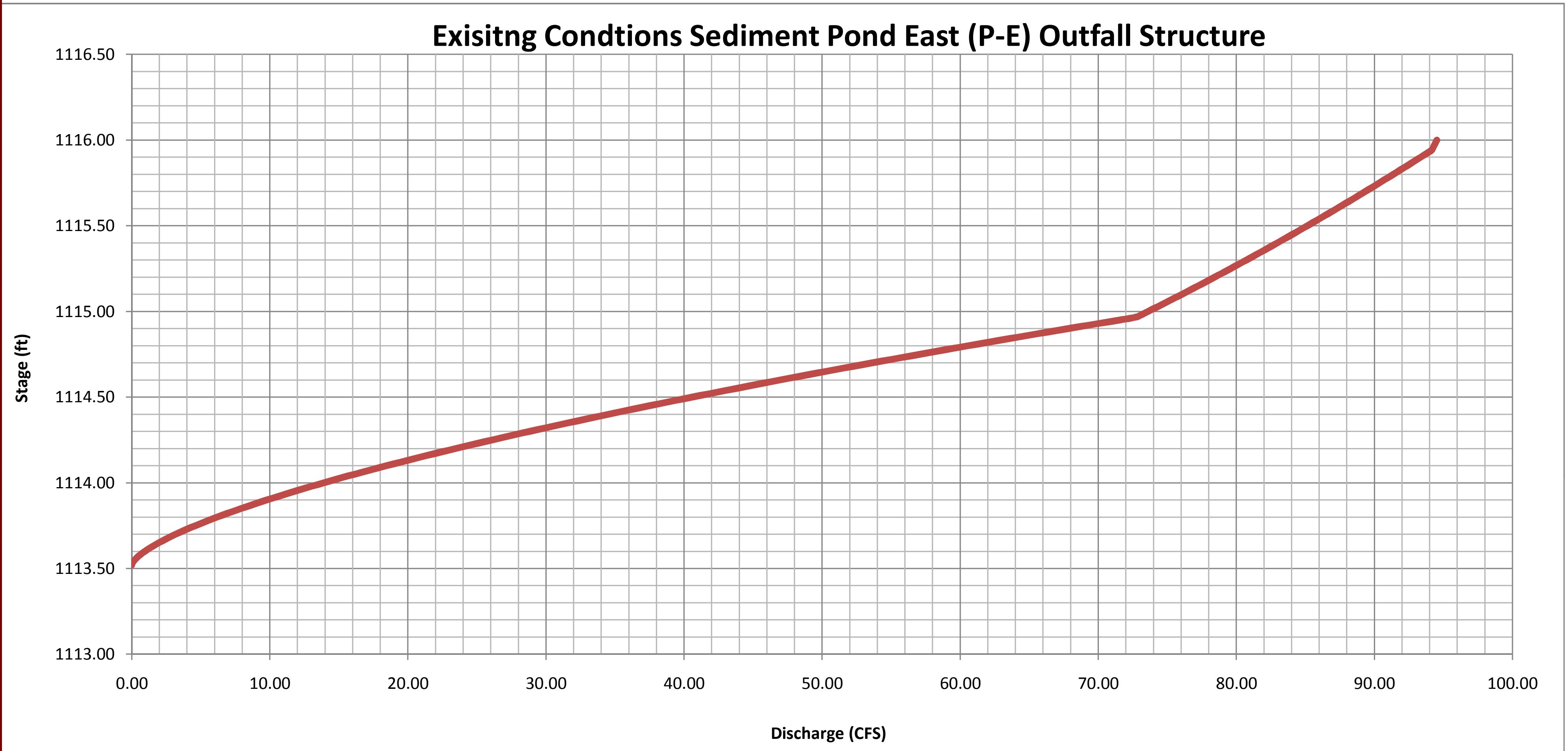
SEDIMENT POND WEST (P-W)

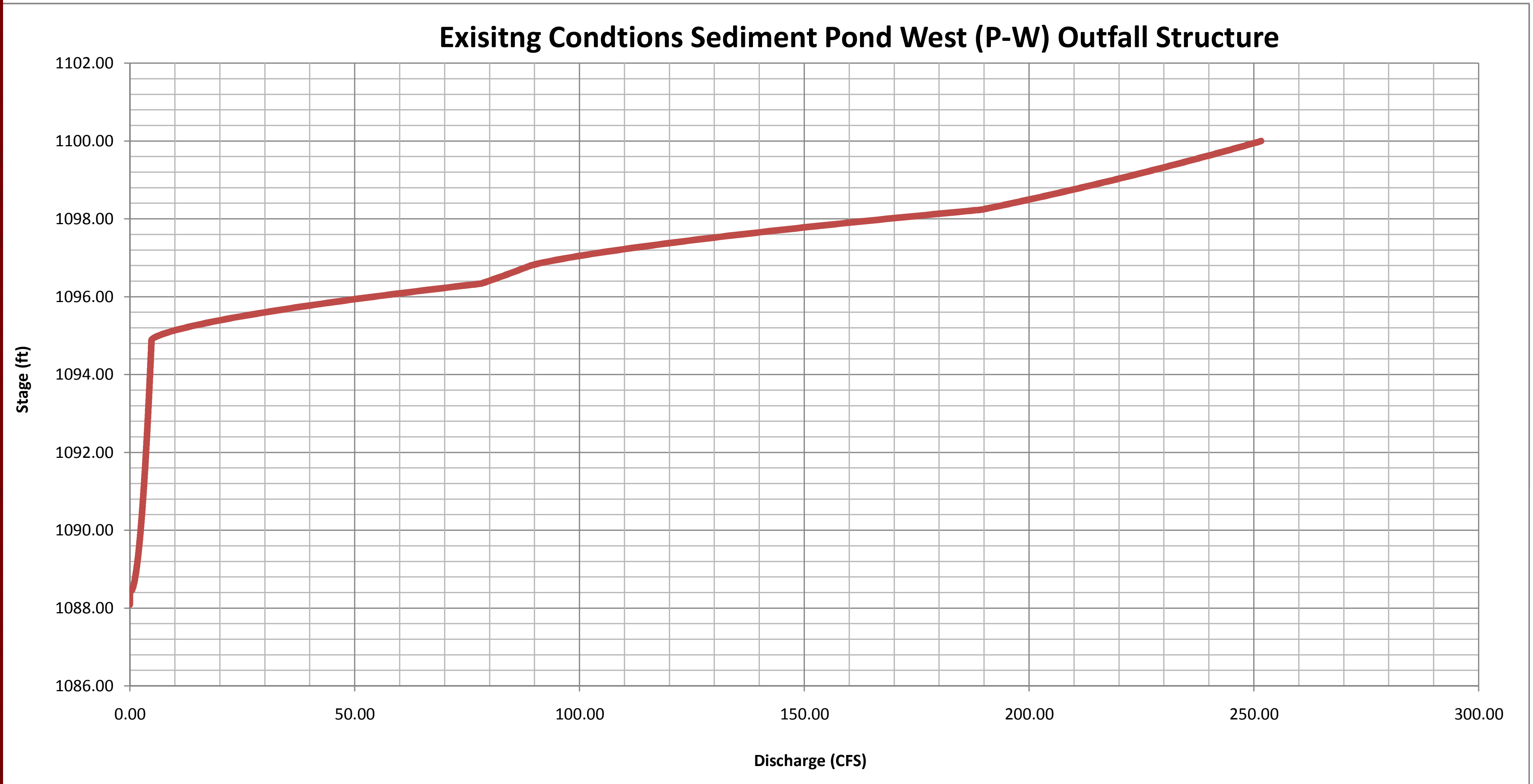
	Pond Elev. (ft)	Pond Area (ac)	Incremental Volume (ft^3)	Cummulative Volume (ft^3)	Cummulative Volume (gal)	
10.3 Feet of Freeboard	1089.7	2.39	0	0	0	Water Surface
	1090	2.44	31,527	31,527	235,839	
	1092	2.6	219,286	250,813	1,876,212	
	1094	2.74	232,351	483,164	3,614,320	
	1096	2.88	244,537	727,701	5,443,585	
	1098	3.02	256,723	984,424	7,364,005	
	1100	3.17	269,340	1,253,765	9,378,812	Lowest Elevation at Top of Dike

STILLING POND AREA 2 (SP-2)

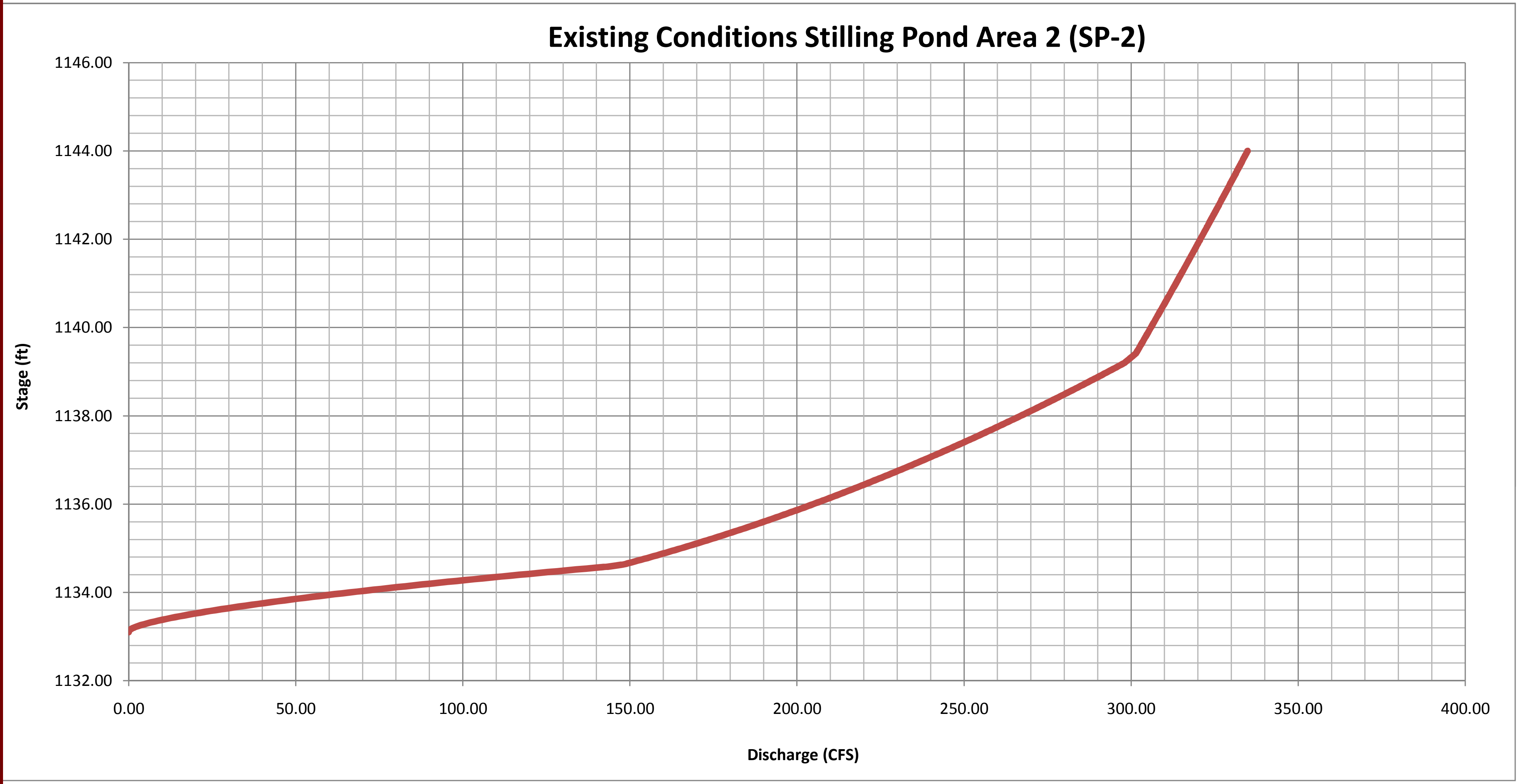
	Pond Elev. (ft)	Pond Area (ac)	Incremental Volume (ft^3)	Cummulative Volume (ft^3)	Cummulative Volume (gal)	
	1112	0.18	0	0	0	
	1113	0.61	16,266	16,266	121,677	
	1114	1.36	41,788	58,054	434,271	
	1115	1.96	71,841	129,894	971,678	
	1116	2.30	92,591	222,486	1,664,310	
	1117	2.58	106,122	328,608	2,458,156	
	1118	2.86	118,312	446,920	3,343,195	
	1119	3.29	133,704	580,624	4,343,369	
	1120	3.78	153,707	734,331	5,493,180	
	1121	4.58	181,620	915,952	6,851,795	
	1122	5.12	210,946	1,126,897	8,429,779	
	1123	5.56	232,312	1,359,209	10,167,593	
	1124	5.98	251,034	1,610,244	12,045,461	
	1125	6.45	270,390	1,880,634	14,068,121	
	1126	6.77	287,616	2,168,250	16,219,635	
	1127	7.14	302,621	2,470,871	18,483,398	
	1128	7.51	318,724	2,789,595	20,867,620	
	1129	7.90	335,258	3,124,853	23,375,527	
	1130	8.31	352,663	3,477,516	26,013,630	
	1131	8.71	370,291	3,847,807	28,783,598	
	1132	9.04	386,186	4,233,993	31,672,471	
	1133	9.34	399,898	4,633,892	34,663,919	
10.2 Feet of Freeboard	1133.8	5.03	246,294	4,880,185	36,506,325	Lowest Water Surface #1
	1134	5.05	43,865	4,924,050	36,834,455	
	1134.1	11.37	34,810	4,958,860	37,094,848	
	1135.3	2.61	338,167	5,297,027	39,624,513	
	1136	24.16	352,449	5,649,475	42,261,011	
	1138	26.27	2,193,893	7,843,369	58,672,476	
	1140	29.44	2,422,992	10,266,360	76,797,713	
	1142	34.74	2,789,705	13,056,066	97,666,159	
	1144	37.34	3,135,985	16,192,050	121,124,955	Lowest Elevation at Top of Dike

	Total Free Water Volume	Storage Capacity	Total Capacity
Sediment Pond East (P-E) (gal)	192,151	1,935,440	2,127,590
Sediment Pond West (P-W) (gal)	0	9,378,812	9,378,812
Stilling Pond Area 2 (SP-2) (gal)	36,506,325	84,618,630	121,124,955
Total (gal)	36,698,476	95,932,881	132,631,357
Permit Requirement (gal)	17,404,000		


Exisitng Condtions Sediment Pond East (P-E) Outfall Structure
Stage (ft)
1116.50
1116.00
1115.50
1115.00
1114.50
1114.00
1113.50
1113.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (CFS)



Exisitng Condtions Sediment Pond West (P-W) Outfall Structure
Stage (ft)
1102.00
1100.00
1098.00
1096.00
1094.00
1092.00
1090.00
1088.00
1086.00
0.00
50.00
100.00
150.00
200.00
250.00
300.00
Discharge (CFS)



Existing Conditions Stilling Pond Area 2 (SP-2)
1146.00
1144.00
1142.00
1140.00
1138.00
1136.00
1134.00
1132.00
Stage (ft)
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
Discharge (CFS)

Closeout Condtions Stilling Pond Area 2 (SP-2) Outfall Structure
1146.00
1144.00
1142.00
1140.00
1138.00
1136.00
1134.00
1132.00
Stage (ft)
0.00
500.00
1000.00
1500.00
2000.00
2500.00
Discharge (CFS)

Appendix D

TVA Survey Data

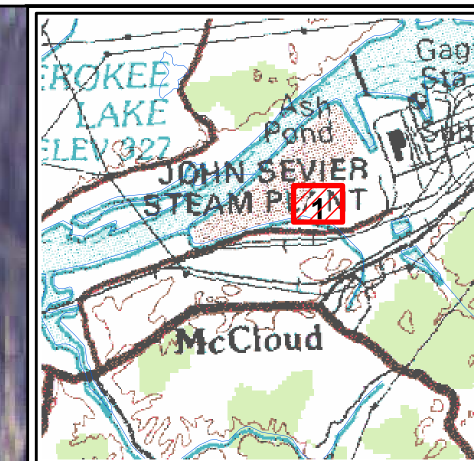
TVA SPILLWAY DATA
CONCRETE TOP SURVEY

NOTE: SURVEY IS OF THE TOP OF THE CONCRETE OF THE SPILLWAY

	Spillway #	Delta	Approx. EL	Invert EL.	Approx. Height	Comment
ALF	EAST	NO DATA	229.47	216.00	13.47	
ALF	WEST	NO DATA	229.47	216.00	13.47	
ALF	OVERFLOW #1	NO DATA	230.43	216.00	14.43	
ALF	OVERFLOW #2	NO DATA	230.30	216.00	14.30	
SHF	1	0.13	345.41	314.10	31.31	
SHF	2	0.03	345.41	314.10	31.31	
SHF	3	0.12	345.43	314.10	31.33	
SHF	4	0.09	345.49	314.10	31.39	
SHF	5	0.07	345.39	314.10	31.29	
COF	A	0.06	452.42	430.00	22.42	
COF	B	0.09	452.38	430.00	22.38	
COF	C	0.16	452.39	430.00	22.39	
COF	D	0.09	452.32	430.00	22.32	
PAF - FLY	A	0.16	403.65	397.00	6.65	
PAF - FLY	B	0.03	403.66	397.00	6.66	
PAF - FLY	C	0.08	403.59	397.00	6.59	
PAF - BOT	A	NO DATA	405.63	---		Invert elevation not listed on dwg 10W3214.
PAF - BOT	B	NO DATA	405.62	---		Invert elevation not listed on dwg 10W3214.
PAF - BOT	C	NO DATA	405.62	---		Invert elevation not listed on dwg 10W3214.
GAF	A	0.07	456.08	449.60	6.48	See dwg 10N274 about change in pipe and elevation (451.5)?
GAF	B	0.08	456.05	449.60	6.45	See dwg 10N274 about change in pipe and elevation (451.5)?
GAF	C	0.03	456.05	449.60	6.45	See dwg 10N274 about change in pipe and elevation (451.5)?
GAF	D	0.02	456.03	449.60	6.43	See dwg 10N274 about change in pipe and elevation (451.5)?
OF	NORTH	NO DATA	386.49	351.00	35.49	
OF	MIDDLE	NO DATA	387.60	351.00	36.60	
OF	SOUTH	NO DATA	386.49	351.00	35.49	
SF	WEST	0.03	1133.09	1120.00	13.09	
SF	EAST	0.07	1133.04	1120.00	13.04	
CUF	A	NO DATA	383.87	361.00	22.87	
CUF	B	NO DATA	383.97	361.00	22.97	
CUF	C	NO DATA	383.86	361.00	22.86	
CUF	D	NO DATA	384.00	361.00	23.00	

TVA SPILLWAY DATA
CONCRETE TOP SURVEY

BRF	NORTH	0.03	805.53	793.00	12.53	This outfall pipe was repaired a couple of years ago due to joint separation
BRF	MIDDLE	0.05	805.58	793.00	12.58	
BRF	SOUTH	0.09	805.55	793.00	12.55	Tree has roots growing in South Outfall pipe
KIF	A - Overflow	0.07	756.54	746.00	10.54	
KIF	B	0.06	754.48	746.00	8.48	
KIF	C	0.07	754.44	746.00	8.44	
KIF	D	0.03	754.43	746.00	8.43	
KIF	E	0.05	754.45	746.00	8.45	
KIF	F	0.06	754.42	746.00	8.42	
WCF - Upper Ash	A	NO DATA	631.75	595.00	36.75	Spillways were noted in 2004 as having an 1.5" gap in the joints 12 feet down
WCF - Upper Ash	B	NO DATA	631.72	595.00	36.72	Spillways were noted in 2004 as having an 1.5" gap in the joints 12 feet down
WCF - Upper Ash	C	NO DATA	631.57	595.00	36.57	Spillways were noted in 2004 as having an 1.5" gap in the joints 12 feet down
WCF - Upper Ash	D	NO DATA	631.68	595.00	36.68	Spillways were noted in 2004 as having an 1.5" gap in the joints 12 feet down
WCF - Upper Ash	E	NO DATA	631.74	595.00	36.74	Spillways were noted in 2004 as having an 1.5" gap in the joints 12 feet down
WCF - Stilling	1	NO DATA	610.47	591.00	19.47	Dwgs 10N8223 (597.0) and 10N7424 (591.0) disagree about the invert elevation.
WCF - Stilling	2	NO DATA	610.43	591.00	19.43	Dwgs 10N8223 (597.0) and 10N7424 (591.0) disagree about the invert elevation.
WCF - Stilling	3	NO DATA	610.11	591.00	19.11	Dwgs 10N8223 (597.0) and 10N7424 (591.0) disagree about the invert elevation.
WCF - Stilling	4	NO DATA	610.44	591.00	19.44	Dwgs 10N8223 (597.0) and 10N7424 (591.0) disagree about the invert elevation.
WCF - Stilling	5	NO DATA	610.42	591.00	19.42	Dwgs 10N8223 (597.0) and 10N7424 (591.0) disagree about the invert elevation.



LEGEND

- Topographic Data (07/23/2010)
- Sounding Data (07/23/2010)
- Water's Edge (07/23/2010)

This Is A Draft Plot
For Visual Representation Only

TVA

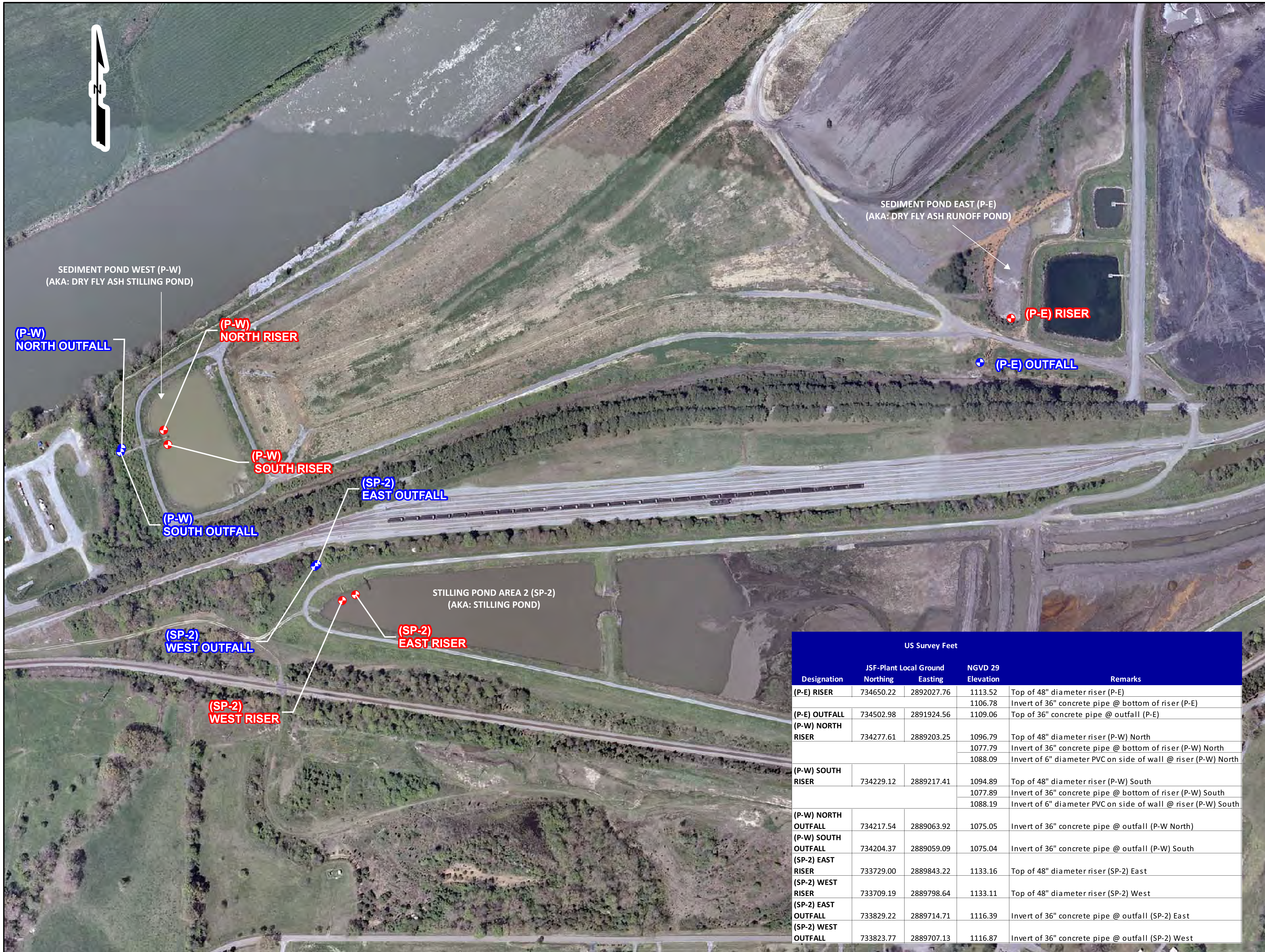
JOHN SEVIER FOSSIL PLANT

BY-PRODUCTS DISPOSAL
HYDROLOGIC & HYDRAULIC ANALYSIS (STANTEC)
23 JULY 2010
PROJECT: BPJSF1008 TASK ID: RKQ934
FILE: RKQ934A.XYZ

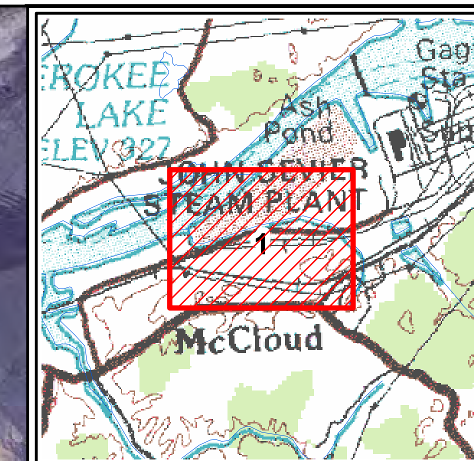
80 40 0 80
Feet

Last Updated: Jul 23, 2010

Sheet 1 of 1



Designation	JSF-Plant Local Ground Northing (US Survey Feet)	JSF-Plant Local Ground Easting (US Survey Feet)	NGVD 29 Elevation (US Survey Feet)	Remarks
(P-E) RISER	734650.22	2892027.76	1113.52	Top of 48" diameter riser (P-E)
			1106.78	Invert of 36" concrete pipe @ bottom of riser (P-E)
(P-E) OUTFALL	734502.98	2891924.56	1109.06	Top of 36" concrete pipe @ outfall (P-E)
(P-W) NORTH RISER	734277.61	2889203.25	1096.79	Top of 48" diameter riser (P-W) North
			1077.79	Invert of 36" concrete pipe @ bottom of riser (P-W) North
			1088.09	Invert of 6" diameter PVC on side of wall @ riser (P-W) North
(P-W) SOUTH RISER	734229.12	2889217.41	1094.89	Top of 48" diameter riser (P-W) South
			1077.89	Invert of 36" concrete pipe @ bottom of riser (P-W) South
			1088.19	Invert of 6" diameter PVC on side of wall @ riser (P-W) South
(P-W) NORTH OUTFALL	734217.54	2889063.92	1075.05	Invert of 36" concrete pipe @ outfall (P-W North)
(P-W) SOUTH OUTFALL	734204.37	2889059.09	1075.04	Invert of 36" concrete pipe @ outfall (P-W) South
(SP-2) EAST RISER	733729.00	2889843.22	1133.16	Top of 48" diameter riser (SP-2) East
(SP-2) WEST RISER	733709.19	2889798.64	1133.11	Top of 48" diameter riser (SP-2) West
(SP-2) EAST OUTFALL	733829.22	2889714.71	1116.39	Invert of 36" concrete pipe @ outfall (SP-2) East
(SP-2) WEST OUTFALL	733823.77	2889707.13	1116.87	Invert of 36" concrete pipe @ outfall (SP-2) West



LEGEND

- Outfall
- Riser

This Is A Draft Plot
For Visual Representation Only

TVA

JOHN SEVIER FOSSIL PLANT

BY-PRODUCTS DISPOSAL
HYDROLOGIC & HYDRAULIC ANALYSIS (STANTEC)
19 JULY 2010
PROJECT: BPJSF1008 TASK ID: RKQ934
FILE: RKQ934.XLSX

300 150 0 300
Feet

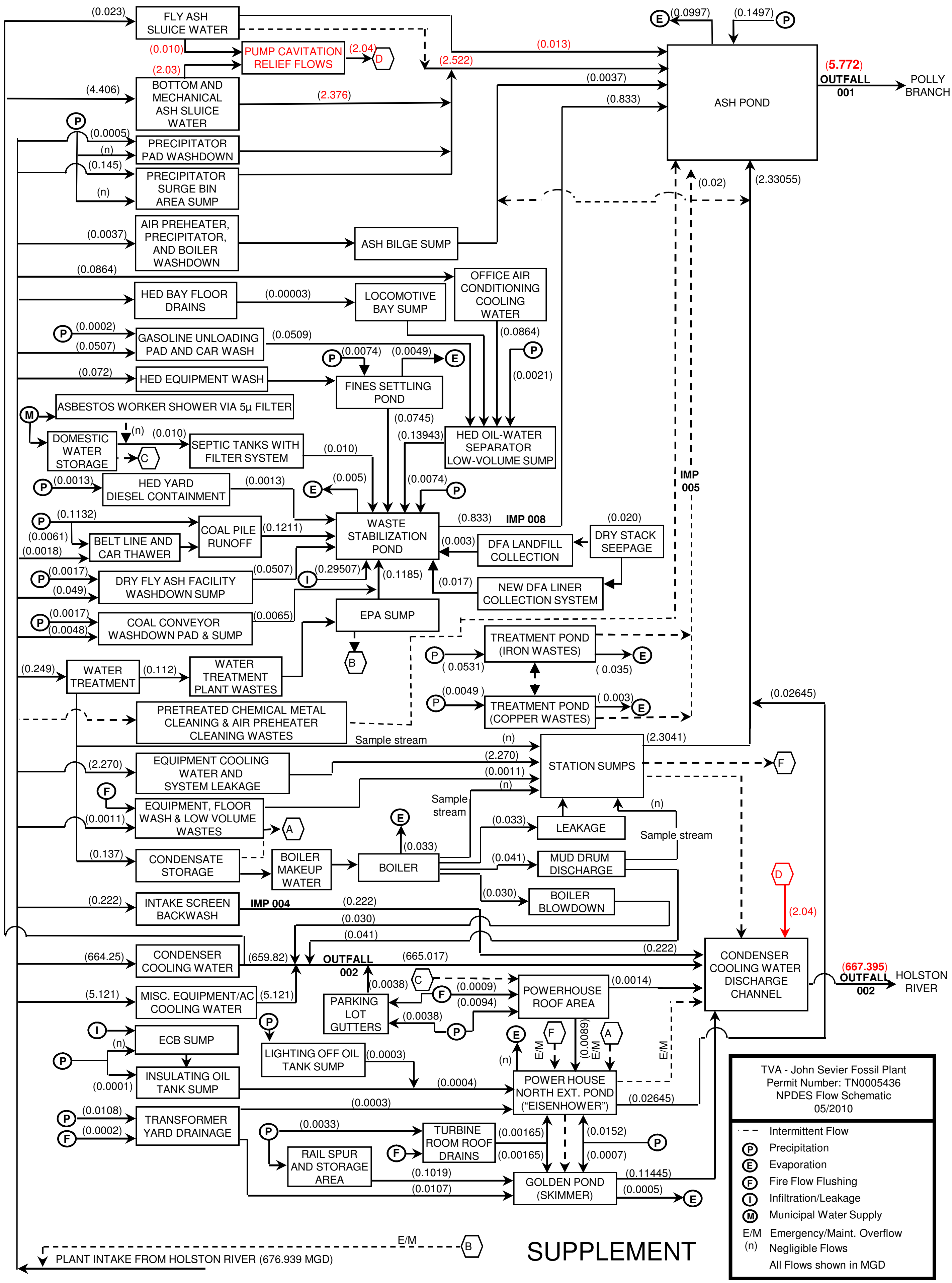
Last Updated: Jul 23, 2010

Sheet 1 of 1

US EPA ARCHIVE DOCUMENT

Appendix E

Wastewater Flow Schematic



FLY ASH SLUICE WATER
PUMP CAVITATION RELIEF FLOWS
BOTTOM AND MECHANICAL ASH SLUICE WATER
PRECIPITATOR PAD WASHDOWN
PRECIPITATOR SURGE BIN AREA SUMP
AIR PREHEATER, PRECIPITATOR, AND BOILER WASHDOWN
ASH BILGE SUMP
ASH POND
(5.772) OUTFALL 001
POLLY BRANCH
IMP 005
OFFICE AIR CONDITIONING COOLING WATER
HED BAY FLOOR DRAINS
LOCOMOTIVE BAY SUMP
GASOLINE UNLOADING PAD AND CAR WASH
HED EQUIPMENT WASH
FINES SETTLING POND
ASBESTOS WORKER SHOWER VIA 5µ FILTER
DOMESTIC WATER STORAGE
SEPTIC TANKS WITH FILTER SYSTEM
HED OIL-WATER SEPARATOR LOW-VOLUME SUMP
HED YARD DIESEL CONTAINMENT
WASTE STABILIZATION POND
IMP 008
COAL PILE RUNOFF
BELT LINE AND CAR THAWER
DFA LANDFILL COLLECTION
DRY STACK SEEPAGE
DRY FLY ASH FACILITY WASHDOWN SUMP
NEW DFA LINER COLLECTION SYSTEM
COAL CONVEYOR WASHDOWN PAD & SUMP
EPA SUMP
WATER TREATMENT
WATER TREATMENT PLANT WASTES
TREATMENT POND (IRON WASTES)
TREATMENT POND (COPPER WASTES)
PRETREATED CHEMICAL METAL CLEANING & AIR PREHEATER CLEANING WASTES
Sample stream
STATION SUMPS
EQUIPMENT COOLING WATER AND SYSTEM LEAKAGE
EQUIPMENT, FLOOR WASH & LOW VOLUME WASTES
LEAKAGE
CONDENSATE STORAGE
BOILER MAKEUP WATER
BOILER
MUD DRUM DISCHARGE
BOILER BLOWDOWN
INTAKE SCREEN BACKWASH
IMP 004
CONDENSER COOLING WATER
OUTFALL 002
CONDENSER COOLING WATER DISCHARGE CHANNEL
(667.395) OUTFALL 002
HOLSTON RIVER
MISC. EQUIPMENT/AC COOLING WATER
PARKING LOT GUTTERS
POWERHOUSE ROOF AREA
ECB SUMP
LIGHTING OFF OIL TANK SUMP
INSULATING OIL TANK SUMP
POWER HOUSE NORTH EXT. POND ("EISENHOWER")
TRANSFORMER YARD DRAINAGE
TURBINE ROOM ROOF DRAINS
RAIL SPUR AND STORAGE AREA
GOLDEN POND (SKIMMER)
PLANT INTAKE FROM HOLSTON RIVER (676.939 MGD)
SUPPLEMENT
TVA - John Sevier Fossil Plant
Permit Number: TN0005436
NPDES Flow Schematic
05/2010
Intermittent Flow
P Precipitation
E Evaporation
F Fire Flow Flushing
I Infiltration/Leakage
M Municipal Water Supply
E/M Emergency/Maint. Overflow
(n) Negligible Flows
All Flows shown in MGD

APPENDIX A

Document 4

Stantec Results of Seismic Slope Stability Analysis, dated September 27, 2011

Stantec

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Louisville, KY 40223-5301
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September 27, 2011 ltr_003_175551015

Mr. Michael S. Turnbow
Tennessee Valley Authority
1101 Market Street, LP 2G-C
Chattanooga, Tennessee 37402-2801

Re: Results of Seismic Slope Stability Analysis
Active CCP Disposal Facilities
John Sevier Fossil Plant

Dear Mr. Turnbow:

As requested, Stantec Consulting Services Inc. (Stantec) has conducted seismic slope stability analyses to support the U.S. Environmental Protection Agency's assessment of TVA's CCP disposal facilities. The results for John Sevier Fossil Plant (JSF) are presented in this letter.

1. Introduction

The U.S. Environmental Protection Agency is undertaking a nationwide effort to assess coal combustion product (CCP) disposal facilities. These assessments are now underway for facilities at TVA's fossil plants. To support TVA, Stantec has conducted seismic stability analyses for JSF's active disposal facilities, which include the Bottom Ash Pond and the Dry Fly Ash Stack.

The seismic slope stability analyses results presented in this letter employ a pseudostatic approach and are representative of current conditions. For seismic assessment in upcoming closure design of these facilities, TVA will undertake a comprehensive risk/consequences-based approach, with design and mitigation decisions being based on the likelihood and consequences of failure. This approach is described in the document presented in Enclosure A. For JSF, closure of the Bottom Ash Complex is currently planned for 2020, and closure of the Dry Fly Ash Stack is currently planned for 2015 – 2016.

2. Seismic Stability Analysis Approach

Seismic slope stability has been performed for current conditions using pseudostatic stability methods, where the added inertial load from an earthquake is represented by a simple horizontal pseudostatic coefficient which provides an approximate representation of the dynamic loads imposed by an earthquake. Specifics related to the analyses/approach are as follows:

- Subsurface data was obtained from Stantec's geotechnical report entitled Report of Geotechnical Exploration; Dry Fly Ash Stack, Bottom Ash Disposal Area 2, Ash Disposal Area J; John Sevier Fossil Plant; Rogersville, Tennessee; February 8, 2010.

- SLOPE/W software (from GEO-SLOPE International, Inc.) was used to perform the calculations.

- One existing SLOPE/W cross-section model per disposal facility was selected for analysis. The selected sections are representative of the facility's lowest current static (long-term) factor of safety, with consideration given to proper representation of a release/breach. The selected SLOPE/W models were updated to reflect any significant mitigations or operational changes that have occurred since completion of Stantec's geotechnical studies.

- Undrained shear strength parameters were used.

- Ground motion level corresponding to a return period of 500 years (or approximate exceedance probability of 10% in 50 years) was used for selection of horizontal seismic coefficients. This return period is consistent with seismic stability analysis guidance provided by Tennessee's dam safety regulations Chapter 1200-5-7, "Rules and Regulations Applied to the Safe Dams Act of 1973". The peak ground acceleration (or seismic coefficient) for a 500 year return period was selected from Table 18 of TVA's March 28, 2011 region-specific seismic hazard study performed by AMEC Geomatrix, Inc.

- A target factor of safety (FS) of 1.0 was considered for comparing results.

3. Results

The results of the pseudostatic stability analyses indicate factors of safety of 2.6 for the Bottom Ash Pond and 1.4 for the Dry Fly Ash Stack, which exceed the target of 1.0. Enclosure B contains a summary spreadsheet, SLOPE/W cross-sections, and plan views showing cross-section locations.

Stantec appreciates the opportunity to provide these services. If you have questions, or if we can provide additional information, please let us know.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Randy L. Roberts, PE
Principal

Enclosures

/cdm

Enclosure A

White Paper - Seismic Risk Assessment Closed CCP Storage Facilities

Seismic Risk Assessment
Closed CCP Storage Facilities
Tennessee Valley Authority Fossil Plants

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Seismic Risk Assessment
Closed CCP Storage Facilities
Tennessee Valley Authority Fossil Plants

This document outlines proposed engineering analyses to estimate seismic failure risks at wet storage facilities for coal combustion products, following closure, at various TVA fossil power plants. The specific details outlined in this document are subject to future discussion and modification by the project team.

OVERVIEW

Tennessee Valley Authority (TVA) operates storage facilities for coal combustion products (CCPs) at eleven fossil power generating stations. As TVA transitions to dry systems for handling these materials, 18 to 25 wet storage facilities (CCP ponds, impoundments, dredge cells, etc.) will be closed (drained and capped). The CCP storage facilities are currently operated in accordance with state and federal regulations, but previously issued permits have not required evaluations for seismic performance. Moreover, the existing permits do not require seismic qualification for the storage facilities in their closed configurations.

TVA recognizes there is a potential for strong earthquakes to occur within the region, and there is a tangible risk for seismic failure at each closed CCP facility. These risks, including both the likelihood of failure and the consequences, must be understood to effectively manage TVA's portfolio of byproduct storage sites. This white paper summarizes the methodology that will be used to estimate these risks at the CCP storage facilities following closure.

Seismicity in the TVA service area is attributed to the New Madrid fault and smaller, less concentrated crustal faults. These two earthquake scenarios generate significantly different seismic hazards at each locality and will be considered independently within the risk assessment. At each closed byproduct facility, potential seismic failure modes will be evaluated in sequence. Instability due to soil liquefaction, slope instability due to inertial loading, and other potential failure mechanisms will be addressed. Seismic performance will be evaluated for differing earthquake return periods until a limiting (lowest return period) event that would cause failure is obtained. The probability of seismic failure will then correspond to the probability of this limiting earthquake event. The assessment of risk will also include estimates of potential consequences, as well as costs to mitigate the risks, that reflects the unique setting of the individual storage facilities after closure.

Following the same general methodology, seismic risks will be estimated in two phases. The near-term "Portfolio Seismic Assessment" will provide a rough estimate of seismic risks. The likely performance of each facility will be evaluated using simplified analyses, empirical methods, and the judgment of experienced engineers. The results will establish a ranking of the relative risks across the closure portfolio and also provide a preliminary picture of overall seismic risk. For the subsequent "Facility Seismic Assessments", seismic performance will be judged on the basis of site-specific data and detailed engineering analyses, which will be completed during the closure design process for individual facilities.

SEISMIC RISKS

This white paper provides an overview of the engineering methods proposed by Stantec for estimating seismic risks at TVA's closed byproduct storage sites. For each facility, four specific questions must be answered quantitatively:

(1) What is the approximate probability that a strong earthquake will occur?

Several seismic source zones could produce earthquakes large enough to impact these TVA sites. Very large magnitude earthquakes have occurred within the New Madrid seismic zone, which is located along the western boundaries of Tennessee and Kentucky. Because of their observed large magnitude and frequency of occurrence, New Madrid events contribute substantially to the seismic risks at all TVA sites. Ground motions from a New Madrid earthquake would attenuate with distance toward the east, such that local area sources also contribute significantly to site-specific seismic hazards.

Seismicity across the Tennessee Valley was previously characterized by AMEC/Geomatrix (2004), in a probabilistic study that focused on TVA dam sites. The same seismogenic model can be applied in evaluating earthquakes that would impact other TVA sites. Accordingly, probabilistic seismic hazards obtained from the 2004 AMEC/Geomatrix model will be used in the seismic risk assessment of the closed CCP storage facilities.

(2) Will a given earthquake cause failure in the closed facility?

Many of the TVA byproduct storage facilities are underlain by a substantial thickness of loose, saturated, alluvial soils (silts and sands). Some facilities will have layers of ash or other uncemented CCPs that remain saturated following closure. These materials, especially sluiced fly ash, are prone to liquefaction in a strong earthquake, as cyclic motions cause a build up of pore water pressure and a consequent loss of effective stress and shearing resistance. Extensive liquefaction in a foundation or CCP deposit under a storage facility would be expected, in most cases, to result in lateral spreading and massive slope movements (failure). Even without liquefaction, large slope deformations or failures may be triggered by lateral inertial loads during an earthquake. Liquefaction and dynamic loading of slopes are the most likely failure mechanisms, but other seismic failure modes, which may be unique to a particular closed storage facility, must also be evaluated.

(3) What are the potential consequences of a failure?

In addition to understanding the probability of failure, a risk assessment should consider the potential consequences. A failure is likely to have economic costs associated with clean-up and restoration of the site. Depending on the local site conditions, failure of a closed CCP facility may or may not cause significant impacts on the environment, waterways, transportation routes, buried or overhead utilities, or other infrastructure. Substantial economic costs would result if power generation is interrupted. Failure consequences may also include the potential loss of human life at some sites.

In this proposed seismic risk assessment, the definition of "failure" will be constrained to mean the displacement of stored materials to a distance beyond the permitted boundary of the facility. While smaller deformations in a closed storage facility could cause economic damages, the resulting consequences for TVA should be manageable. Hence, this risk assessment will focus on potential "failures" where stored materials could move past the permitted boundary.

(4) What are the approximate costs to mitigate the risks of a seismic failure?

With an understanding of the probability and consequences of failure, the potential risks can be quantified and understood, possibly leading to decisions to mitigate seismic risks in the closure of certain facilities. Mitigation measures might include ground improvement to reduce liquefaction potential (stone columns, deep soil mixing, jet grouting, or other appropriate technology), stabilization of slopes by flattening or buttressing, enhanced drainage features, or some other engineered solution. The potential cost of these risk mitigation strategies are needed to make appropriate management decisions.

PORTFOLIO AND FACILITY ASSESSMENTS

Seismic evaluations will be completed for each of the CCP storage facilities that TVA has slated for closure; a tentative list is given in Table 1. The assessment of seismic risks will be accomplished in two phases:

A. Portfolio Seismic Assessment

In this first phase, the seismic risk assessment will be carried out using general site information, simplified analyses, empirical methods, and the judgment of experienced engineers. A team of four to five engineers will complete this evaluation for the entire portfolio, with assistance from the engineering teams currently working on each facility. After the probabilistic seismic hazards are defined, this phase of the work can be completed in a relatively short timeframe.

Given the level of effort and the simplified engineering analyses to be employed, the seismic risk estimates from the Phase A assessment will be approximate. Rather than attempting to compute precise risk numbers, Phase A will focus on capturing the relative risks between the different closed facilities. The key to successfully meeting this objective will be the consistent application of the assessment process across the portfolio.

This effort will result in a ranked list of sites that can be used to illustrate where seismic risks are greatest within the portfolio. The results will also provide some insight for understanding and communicating the magnitude of potential risks associated with seismic loading of the closed CCP facilities.

As a secondary objective, the Phase A assessment team will also consider the potential for failure of the active storage facilities, due to an earthquake occurring prior to closure. The seismic risks associated with the operating facility will not be estimated, but the Phase A assessment process provides an opportunity to identify potential failure mechanisms that should be addressed in the short term. This information may suggest the need to re-prioritize the closure schedule. Prior to closure, many of the wet CCP storage facilities retain large pools of water and are thus more susceptible to uncontrolled releases in an earthquake. TVA has already made the decision to close these wet storage facilities to manage these risks, so the effort in Phase A will focus on identifying sites that may have unusually high seismic risks and deserve more study or higher priority in the closure program.

B. Facility Seismic Assessment

In this subsequent phase of work, more detailed engineering analyses will be carried out using site-specific geometry, subsurface conditions, material parameters, and results from static slope stability analyses. Simplified, state-of-the-practice methods of engineering analysis will be used; more complex analytical methods will be generally impractical for this risk assessment.

This phase of the work will be accomplished for individual facilities as part of the closure design, after the completion of other engineering analyses. The risks will be quantified by the design team, with assistance from the portfolio seismic assessment team. Significant, detailed effort will be required to assess each closed facility.

Compared to Phase A, the risk estimates obtained at this stage will be more reliable and better represent the actual risks for seismic failure. While it will be impossible to know how accurately the risks have been characterized at the completion of Phase B, the objective is to obtain results that are within perhaps ± 30% of the "actual" risk numbers. TVA expects to use the Phase B results to decide if the risks are acceptable, or if the closure design should be modified to mitigate risks for a seismic failure.

The engineering methodology (described below) to be followed in the Phase A and B evaluations will not characterize all of the uncertainties with respect to seismic performance. The uncertainties in the soil parameters and in the liquefaction, stability, and deformation analyses will not be quantified and carried through the risk assessment. Consequently, the estimated risk numbers will be approximate, but the results will be sufficiently accurate to support TVA decisions regarding prioritization for closure or the need for seismic mitigation. At most sites, the risks are expected to be high enough or low enough that further refinement in the risk numbers would not change these decisions. More detailed analysis beyond Phase B would be unjustified in these cases.

This assessment plan does not preclude the possibility that more detailed risk evaluations could be undertaken in subsequent phases of work. The Phase B results might reveal a subset of closed facilities with marginal risks, where a more rigorous and complete calculation of the risks would be needed to support a management decision. Hence, at the conclusion of the Phase B assessments, a "Phase C" evaluation may be needed for select sites and facilities, wherein uncertainties in the soil parameters and performance analyses would be quantified and carried through the risk assessment.

RESULTS AND APPLICATION

The results from the Phase A Portfolio Assessment will be presented in a table, like Table 1. For each facility evaluated, the estimated annual probability of failure due to a seismic event, the expected consequences (economic costs and potential loss of life), and the mitigation costs (design features to reduce risks) will be tabulated. The same parameters, but more accurate numbers, will be reported from the more in-depth Phase B assessments. A qualitative description of the data quality (based on the number of borings, test data on key soil properties, etc.) will also be included, to indicate how well the site conditions were characterized at the time of the Phase A or B assessment.

In both Phase A and B, the evaluation teams will prepare a discussion of significant issues driving the seismic risks at each site. This summary will include knowledge gaps, likely failure mechanisms, unique consequences, suggested approaches for risk mitigation, and other key information. The Phase A evaluation of a facility may point out the need for additional data to support later seismic analyses in Phase B; needed field or laboratory testing could then be accomplished and documented as part of the facility closure design effort.

In the short term, TVA will utilize the Phase A results to better plan budgets and schedules for managing the closure process over the next several years. The Phase A assessment will also be used as an opportunity to identify operating facilities with especially high seismic risks. While these risks will not be quantified for conditions prior to closure, the consideration of potential seismic failure modes may prompt additional study and reconsideration of priorities. Where justified, the priorities for closure may be changed to more quickly address sites with higher seismic risks.

More accurate risk estimates will be obtained from the Phase B assessments, which will be completed as part of the closure design process. Those results will be used, within TVA's existing decision making framework, to judge if seismic mitigation is needed. For context, the criteria in Tables 2 and 3 represent the risk-based framework TVA uses to guide enterprise-level decisions. This framework relies upon broad, qualitative scoring of consequences and risks for the organization. For managing the seismic risks at the closed CCP facilities, complete probabilistic calculations of risk are not needed; approximate estimates of seismic risk will be sufficient to support TVA decisions.

The risks computed in Phase A and B will not be compared to a prescribed threshold or design risk level. Criteria for tolerable seismic risk in these closed CCP storage facilities has not been defined in the existing permits, in TVA policy, or in TVA design guidance.

METHODOLOGY

The same general methodology, outlined in ten steps below and in Figures 1 through 4, will be used to evaluate seismic risk in both the Phase A Portfolio Assessments and the Phase B Facility Assessments. While advanced engineering analyses may be required to demonstrate acceptable seismic performance in a design situation, simplified analyses will be used here, consistent with the goal of estimating the probability of failure.

In Step 1, seismic hazard parameters will be defined for each site; the results will be used as inputs for both the Phase A and Phase B assessments. Then, the evaluation of a particular facility will begin with a review of existing site information (Step 2), followed by engineering analyses for seismic performance. As described in Steps 3 through 7 below, the engineering analyses in Phase B will be more detailed than the simplified estimates in Phase A. The analyses will commence with an initial selection of an earthquake return period and evaluation for seismic performance. Steps 3 through 7 will be repeated until the limiting (lowest) earthquake return period expected to cause failure is obtained. Flowcharts summarizing Steps 1 through 7 in the Phase A and B seismic performance assessments are given in Figures 3 and 4, respectively. The earthquake event with the lowest return period that causes failure will then be used to compute the probability of failure in Step 8. The potential consequences and mitigation costs will be estimated in Steps 9 and 10.

Step 1 – Define Seismic Input Parameters

Seismic hazards at TVA dam sites were quantified in a 2004 study by AMEC/Geomatrix. The New Madrid fault zone and several area source zones contribute to the seismicity of the region, as represented schematically in Figure 1. The New Madrid seismic zone is characterized by a large linear, combined reverse/strike-slip fault. Earthquakes in the area source zones are more diffuse (less concentrated in clusters) and tend to occur in zones of weakness of large crustal extent rather than along narrow, well-defined faults. Earthquakes occurring within the New Madrid Seismic Zone and in area sources outside of it will be considered in developing seismic input parameters for each CCP facility. However, only seismic source zones that contribute significantly to the ground motion hazard at a particular site will be used to develop seismic input parameters.

The national USGS seismic hazard model will not be used in these seismic risk assessments; instead, TVA will ask AMEC/Geomatrix to compute the site-specific seismic hazards for each closed CCP facility. The needed information can be obtained from the existing seismogenic model, but will need to separately consider the hazards associated with the New Madrid events and all other seismic sources (Figure 2), hereafter referred to in this white paper as the "earthquake scenarios". The following parameters are needed for each earthquake scenario:

- Uniform hazard spectra for frequencies from 0.25 to 100 Hz (100 Hz value is equivalent to peak ground acceleration, PGA) at the top of rock for a range of return periods from 100 to 2,500 years.
- De-aggregation for relevant ground motion frequencies (one or more of the following: 0.5, 1.0, 2.5, 5.0, and 100 Hz) at each return period. The de-aggregation results will be used to select appropriate, representative earthquake parameters (magnitude and distance from the site), from which inputs needed for liquefaction analyses can be developed.

In the Phase A effort, the project team (including seismologists designated by TVA) will meet to consider the earthquake hazard data produced by the AMEC/Geomatrix model for each site. The team will reach consensus on the appropriate parameters (return period, earthquake magnitude, and peak ground acceleration) to be used in evaluating each facility, before proceeding with work on subsequent steps of the analysis. The seismic parameters to be tabulated (Table 4) will then be used in both the Phase A and Phase B assessments.

Ground motion time histories will be needed for the detailed Phase B calculations, and TVA will need to ask AMEC/Geomatrix to provide:

- Representative acceleration time histories (two orthogonal components), representing ground motions at the top of the rock profile for the specified earthquake return periods.

Given the results of the Phase A assessment, the Phase B analyses will focus on a narrower range of possible earthquakes. Hence, acceleration time histories will not be needed for every seismic event listed in Table 4.

Step 2 – Review Site and Facility Information

To meet the requirements for closure of TVA ash storage facilities, the closed condition may involve placement of compacted ash behind a strengthened dike, drainage of pond water to the levels of the surrounding groundwater table, and capping of the area with native soils. The collection of available site information for each facility will be reviewed from a seismic performance perspective. For the Phase B assessment, this information will be augmented with new data that becomes available during the closure design process.

The project information needed for each storage facility includes:

- Planned geometry of the closed storage facility, as needed to meet current design criteria and regulatory requirements.
- Geologic mapping and related information about the site geology.
- Historical records and other information related to site development.
- Boring logs, SPT data, CPT data, shear wave velocities, etc. from field explorations.
- Laboratory data from testing of site materials, including classification, Atterberg limits, moisture content, particle size, specific gravity, unit weight, compaction tests, and other relevant test data.
- Laboratory data on measured strength properties, for both drained and undrained conditions.
- Previously completed slope stability analyses, where available, will be modified for calculations in the risk assessments.

Step 3 - Evaluate Potential for Soil Liquefaction

The potential for soil liquefaction may be the greatest contributor to failure risk at many of the TVA storage sites. Liquefaction will thus be considered first in the assessment of seismic performance at each closed facility (Figures 3 and 4).

The Phase A assessment will utilize empirical charts and back-of-the-envelope calculations to judge if liquefaction would be likely for a given earthquake scenario. For example, Ambraseys (1988) compiled magnitude, epicentral distance, and whether or not liquefaction was observed in past earthquakes, and then suggested a threshold boundary (in terms of magnitude and epicentral distance) where liquefaction might occur in natural soil deposits. Selected, parametric calculations with the simplified procedure outlined by Youd et al (2001) will also be useful in judging what earthquakes would cause liquefaction in the Phase A Portfolio Assessments. These empirical methods may be unconservative for evaluating saturated CCPs, which are often more prone to liquefaction than a sandy soil, but the results will still provide useful guidance in the Phase A assessment.

For the Phase B liquefaction evaluations, detailed engineering analyses will be undertaken to obtain estimates of cyclic loading, soil resistance, and factor of safety as described below. Potentially liquefiable soils include saturated alluvial soils, loose granular fills, and sluiced ash. The detailed analyses will focus on critical cross sections of the closed facilities; liquefaction safety factors will not be computed for all boring locations at a site.

(a) Soil Loading from Earthquake Motions

The magnitude of the cyclic shear stresses induced by an earthquake are represented by the cyclic stress ratio (CSR). The simplified method proposed by Seed and Idriss (1971) will be used to estimate CSR in the Phase A parametric analyses (ground response analyses will not be completed in Phase A).

In Phase B, the CSR at specific locations (borings and depths where in situ penetration resistance are measured) will be computed using one-dimensional, equivalent-linear elastic methods as implemented in the ProSHAKE software. Using an acceleration time history at the top of rock (obtained from the seismic hazards study in Step 1), the computer program will model the upward propagation of the ground motions through a one-dimensional soil profile. For cases where the one-dimensional assumption is inadequate, the calculations can be accomplished using QUAKE, a two-dimensional finite element program that implements the same dynamic modulus reduction curves and damping relationships as used in ProSHAKE.

The cyclic stresses imparted to the soil will be estimated from the earthquake parameters described in Step 1, representing earthquakes on the New Madrid fault and local crustal events.

(b) Soil Resistance from Correlations with Penetration Resistance

The resistance to soil liquefaction, expressed in terms of the cyclic resistance ratio (CRR), will be assessed using the NCEER empirical methodology (Youd et al. 2001). Updates to the procedure from recently published research will be used where warranted. The analyses will be based on the blowcount value (N) measured in the Standard Penetration Test (SPT) or the tip resistance (q_c) measured in the Cone Penetration Test (CPT). In Phase A, typical or representative values will be used in parametric hand calculations; detailed data from site-specific explorations will be analyzed in Phase B.

The NCEER procedure involves a large number of correction factors. Based on the site-specific conditions and soil characteristics, engineering judgment will be used to select appropriate correction factors consistent with the consensus recommendations of the NCEER panel (Youd et al. 2001). To avoid inappropriately inflating the CRR, the NCEER fines content adjustment will not be applied where zero blowcounts ("weight of hammer" or "weight of rod") are recorded. The magnitude scaling factor (MSF) is used in the empirical liquefaction procedure to normalize the representative earthquake magnitude to a baseline 7.5M earthquake. The earthquake magnitude (M) considered to be most representative of the liquefaction risk will be determined by applying the MSF to the de-aggregation data (from Step 1) for each selected earthquake return period.

Saturated fly ash, where it remains following closure, is likely to be more susceptible to liquefaction than indicated by these empirical methods. Values of CRR determined via the NCEER procedure are related to the observation of liquefaction in natural soils, mostly silty sands. Given the spherical particle shape and uniform, small grain size of fly ash, the NCEER procedure may give CRR values that are too high for saturated fly ash.

Lacking better methods of analysis, the lower-bound, "clean sand" base curve (Youd et al. 2001) will be assumed to apply for fly ash in the Phase A assessment. Within the liquefaction calculations, this will be accomplished for these materials by neglecting the fines content adjustment to the normalized penetration resistance. For Phase B, published and unpublished data from cyclic laboratory testing on similar materials will be sought to augment the indications of liquefaction resistance obtained from in situ penetration tests.

(c) Factor of Safety Against Liquefaction

The factor of safety against liquefaction (FS_{liq}) is defined as the ratio of the liquefaction resistance (CRR) over the earthquake load (CSR). Following TVA design guidance and the precedent set by Seed and Harder (1990), FS_{liq} is interpreted as follows:

- Soil will liquefy where $FS_{liq} \leq 1.1$.
- Expect substantial soil softening where $1.1 < FS_{liq} \leq 1.4$.
- Soil does not liquefy where $FS_{liq} > 1.4$.

Using this criteria for guidance, values of FS_{liq} computed throughout a soil deposit or cross section (at specific CPT-q_c and SPT-N locations) will be reviewed in aggregate. Occasional pockets of liquefied material in isolated locations are unlikely to induce a larger failure, and are typically considered tolerable. Instead, problems associated with soil liquefaction are indicated where continuous zones of significant lateral extent exhibit low values of FS_{liq}. Engineering judgment, including consideration for the likely performance in critical areas, will be used for the overall assessment of each facility. A determination of "extensive" or "insignificant" liquefaction will then lead to the appropriate stability analyses in the next stage of the evaluation, as indicated in Figures 3 and 4.

Step 4 – Characterize Post-Earthquake Soil Strengths

The post-earthquake shearing resistance of each soil and CCP will be estimated, with consideration for the specific characteristics of that material. The full, static shear strength will be assigned to unsaturated soils. Excess pore pressures will not develop in an unsaturated soil during seismic loading, so drained strength parameters can be used. The undrained strengths of saturated soils will be decreased to account for the softening effects of pore pressure buildup during the earthquake. Specifically:

- In saturated clays and soils with $FS_{liq} > 1.4$, 80% of the static undrained strength will be assumed.
- In saturated, low-plasticity, granular soils with $1.1 < FS_{liq} \leq 1.4$, a reduced strength will be assigned, based on the excess pore pressure ratio, r_u (Seed and Harder 1990).

Typical relationships between FS_{liq} and r_u have been published by Marcuson and Hynes (1989).

- In saturated, low-plasticity, granular soils with $FS_{liq} \leq 1.1$, a residual (steady state) strength (S_{us}) will be estimated for the liquefied soil. Values of S_{us} can be obtained from the empirical correlations published by Seed and Harder (1990), Castro (1995), Olson and Stark (2002), Seed et al. (2003), and Idriss and Boulanger (2008).

Subsequent stability and deformation analyses will be accomplished using these reduced strength parameters. No attempt will be made to model the cyclic reduction in soil shear strength during an earthquake. In the deformation analyses, the fully reduced strengths will be assumed at the start of cyclic loading, which will yield conservative estimates of slope displacements.

Step 5 – Analyze Slope Stability

The next step in the performance evaluation (Figures 3 and 4) will consider slope stability, for conditions with or without significant liquefaction. Slope stability will be evaluated using two-dimensional, limit equilibrium, slope stability methods. Reduced soil strengths (from Step 4), conservatively representing the loss of shearing resistance due to cyclic pore pressure generation during the earthquake, will be used in the stability calculations. The analyses will be accomplished using Spencer's method of analysis, as implemented in the SLOPE/W software, considering both circular and translational slip mechanisms.

Input files for static stability calculations, where previously completed for a particular facility, will be updated to represent seismic conditions. These stability analyses may be not available, or the closure geometry may be undefined, for the Phase A assessment of some sites. In those cases, simplified or approximate geometries will be developed for approximate analysis in Phase A. Engineering experience will also be useful in judging likely seismic stability. For example, a complete failure is likely if liquefaction undermines the foundation of the outslope. In the absence of liquefaction, a slope that exhibits adequate safety factors under static conditions is unlikely to fail in an earthquake. Back-of-the-envelope hand calculations can be useful in assessing stability where extensive liquefaction occurs in the saturated materials within or below CCPs retained by a stable perimeter dike. Detailed slope stability calculations, which accurately represent the planned closure geometry, will be used in the Phase B facility assessments.

(a) Slope Stability if Extensive Liquefaction

If extensive liquefaction is indicated, stability will be evaluated for the static conditions immediately following the cessation of the earthquake motions. Residual or steady state strengths will be assigned in zones of liquefied soil, with reduced strengths that account for cyclic softening and pore pressure build up assumed in non-liquefied soil. In both Phase A and B, complete failure (large, unacceptable displacements) will be assumed if the safety factor (FS_{slope}) computed in this step is less than one (Figures 3 and 4).

For slopes where the post-earthquake $FS_{slope} \geq 1$, deformations will be estimated in the Phase B assessment (Step 6 and Figure 4). Slope deformations will not be estimated in the Phase A portfolio assessment, where ground motion time histories will not be available. In Phase A, slopes exhibiting $FS_{slope} \geq 1$ with liquefaction will be assumed stable with tolerable deformations; this condition may exist, for example, where liquefied ash at the base of a closed storage facility is contained within a stable perimeter dike.

Note that pseudostatic stability analyses are not useful for evaluating a factor of safety where extensive liquefaction is expected, because appropriate pseudostatic coefficients can not be defined.

(b) Slope Stability if No Significant Liquefaction

If no significant liquefaction is expected, seismic stability will be analyzed in Phase A using approximate, pseudostatic stability methods (Figure 3). The added inertial loads from the earthquake will be represented with a simple, horizontal pseudostatic coefficient (k_h), which provides an approximate representation of the dynamic loads imposed by an earthquake. The horizontal pseudostatic coefficient will be set to one-tenth of the peak ground acceleration in rock ($k_h = 0.1 \cdot PGA_{rock}$). In Phase A, tolerable deformations (less than about 5 meters) will be assumed if the pseudostatic $FS_{slope} \geq 1$, and failure will be assumed if the pseudostatic $FS_{slope} < 1$.

This approach and criteria are based on the work of Hynes-Griffin and Franklin (1984). They performed Newmark deformation analyses, integrated over 350 ground motion time histories, used an amplification factor of three to represent peak accelerations at the base of an earth embankment, and assumed a displacement of 1 meter would be tolerable for an embankment dam. For a typical CCP facility, assuming no pool is retained following closure, "failure" would imply displacements significantly greater than 1 meter. A tolerable displacement of about 5 meters will be assumed here, for the Phase A risk assessments. From the upper bound curve plotted by Hynes-Griffin and Franklin (1984), a displacement of 5 meters would correspond to a yield acceleration of about 0.03 times the peak acceleration along the slip surface. Then, assuming an amplification factor of 3 for the ground motions at the base of the embankment, this suggests $k_h = 0.1 \cdot PGA_{rock}$ can be used conservatively in the pseudostatic analysis to judge failure, as described above.

Pseudostatic factors of safety will not be computed in the Phase B assessment. Instead, where a liquefaction failure is not predicted, potential slope displacements will be computed as described in Step 6.

Step 6 – Predict Deformations

In the Phase A Portfolio Assessment, closed facilities that are expected to remain stable (pseudostatic $FS_{slope} \geq 1$ with no liquefaction, or post-earthquake $FS_{slope} \geq 1$ with liquefaction) will be assumed to have tolerable displacements. Dynamic slope deformations are difficult to estimate without detailed analysis; the available empirical or approximate methods do not represent the conditions of interest, or the level of effort is not consistent with the goals of the first phase of risk assessments. In addition, earthquake ground motion time histories will not be available for the Phase A analyses.

In the Phase B Facility Assessments, the potential deformation of stable slopes will be evaluated as indicated in Figure 4. Conventional methods of analysis will be implemented to estimate potential slope displacements that accumulate during earthquake shaking; movements are assumed to stop when the earthquake ends, consistent with a post-earthquake safety factor greater than one. The acceleration time histories obtained from the ground response analyses in Step 3a will be used as inputs for computing deformations with one of the following simplified methods:

- Newmark's (1965) method involves double integration of accelerations greater than the yield acceleration (k_y), which will be determined from a succession of pseudostatic slope stability analyses in which k_h is varied. The value of k_h where the pseudostatic FS_{slope} = 1.0 corresponds to the yield acceleration.
- The Makdisi-Seed (1978, 1979) procedure, which better accounts for the dynamic response of embankments. This procedure was developed based on parametric numerical simulations for earthen dams. The procedure is iterative, considers the fundamental periods of the embankment response, and can be completed in steps using published charts. Results from QUAKE can also be used as input in this procedure.

The slope deformations predicted in Phase B will be conservative, because the yield acceleration will be computed based on reduced, post-earthquake soil strengths. In reality, the yield acceleration declines in successive cycles of seismic loading, as pore pressures accumulate and saturated soils become weaker. The analysis outlined in Figure 4 assumes reduced strengths and, where liquefaction is predicted, residual strengths at the start of the earthquake. Detailed numerical simulations can be used to track the progressive softening and liquefaction of soil within an embankment during an earthquake; such analyses are expensive and time consuming. Rigorous analyses of this type will not be justified except in a "Phase C" analysis, or where performance in a given seismic design event must be demonstrated. Note that the logic in Figure 4 might appear to assume a slope will be stable if there is no significant liquefaction; however, the deformation analysis will indicate unlimited deformations and certain failure if $FS_{slope} < 1$ for static, post-earthquake conditions.

Step 7 – Consider Other Potential Failure Modes

For most of the closed facilities, soil liquefaction, slope instability, and slope deformations will be the most likely seismic failure modes. However, depending on the unique configuration of each CCP facility, other potential failure modes may contribute significantly to the seismic risks. For example, the loss of critical drainage structures or retaining walls could lead to a failure condition. Other potential failure modes will be identified and evaluated quantitatively in this step.

As a secondary objective of the Phase A effort, the assessment team will consider the potential for failure of the active storage facilities, due to an earthquake occurring prior to closure. Many of the wet CCP storage facilities retain large pools of water, so this assessment will need to consider additional failure modes such as seepage and embankment cracking. The objective here will be to identify operating facilities that may have unusually high seismic risks, and might deserve more study or higher priority in the closure program.

Step 8 – Estimate Annual Probability of Seismic Failure

As indicated in the flowcharts in Figures 3 and 4, the assessments of seismic performance (in both the Phase A and Phase B efforts) will consider a range of potential earthquakes with differing return periods. The analyses will be repeated until the limiting (lowest) earthquake return period (from the candidate events defined in Step 1) that predicts failure of a particular CCP storage facility is obtained. Interpolation may be used, as appropriate, to narrow the definition of the limiting earthquake.

The return period for each earthquake scenario (Table 4) represents the annual probability of exceedance for the associated ground motion parameter. Hence, for each earthquake scenario, the event with the smallest return period that causes failure represents a limiting case, where all events having longer return periods would also cause failure. The inverse of the limiting return period thus represents the annual probability of seismic failure due to that earthquake scenario.

Step 9 – Estimate Potential Consequences of Failure

The potential consequences of a failure at each closed facility will be estimated in this step. The potential consequences will be unique to each site, but may include any of the following:

- restoration of the site and storage facility,
- clean-up to address environmental impacts,
- off-site disposal of released materials,
- damages and loss of use for transportation routes, including buried or overhead utilities,
- damages to buildings and other infrastructure,
- economic losses from the possible shutdown of power generation, and
- loss of human life (expected to be unlikely at most sites following closure).

Except for the potential loss of life, the failure consequences will be expressed in terms of present day costs. Detailed cost estimates of the potential consequences of failure will not be attempted in the Phase A assessments; instead, the potential magnitude of total consequence costs will be estimated using broad categories (< $100K, < $500K, < $1M, < $5M, < $10M, < $50M, < $100M). Cost estimates that better reflect the local site conditions will be produced by the closure design teams during the Phase B assessments.

Step 10 – Estimate Possible Mitigation Costs

The final step in the process will involve estimating the costs to mitigate seismic risks, perhaps by altering the closure design to withstand stronger earthquakes. Examples of possible mitigation measures include:

- ground improvements to reduce liquefaction potential (stone columns, deep soil mixing, jet grouting, or other appropriate technology),
- altering the geometry of outslopes (setbacks, benches, or flatter slopes) to improve

stability,

- adding buttresses or other supporting structures at the toe of slopes,
- enhanced drainage features, and
- relocation of infrastructure or people away from potential impact zones.

These mitigation approaches generally involve higher construction costs, which can be quantified in terms of present dollars. As with the consequence costs, detailed estimates of mitigation costs will not be attempted in the Phase A assessments. The potential magnitude of mitigation will be estimated in categories (< $100K, < $500K, < $1M, < $5M, < $10M, < $50M, < $100M). Mitigation cost estimates that better reflect the local conditions and facility layout will be developed by the closure design teams during the Phase B assessments.

Table 1. Expected Results from the Phase A and B Seismic Risk Assessments

TVA Facility	Prob. Failure	Econ. Costs	Loss of Life	Mitigat. Costs	Data Quality
ALF East Ash Disposal					
ALF East Stilling Pond					
BRF Dry Fly Ash Disposal					
BRF Fly Ash Pond And Stilling Basin Area 2					
BRF Bottom Ash Disposal Area 1					
BRF Gypsum Disposal Area 2a					
COF Disposal Area 5					
COF Ash Pond 4					
CUF Dry Ash Stack					
CUF Ash Pond					
CUF Gypsum Storage Area					
GAF Fly Ash Pond E					
GAF Bottom Ash Pond A					
GAF Stilling Pond B, C & D					
JSF Dry Fly Ash Stack					
JSF Bottom Ash Disposal Area 2					
JOF Ash Disposal Area 2					
KIF Dike C					
PAF Scrubber Sludge Complex					
PAF Peabody Ash Pond					
PAF Slag Areas 2a & 2b					
SHF Consolidated Waste Dry Stack					
SHF Ash Pond					
WCF Ash Pond Complex					
WCF Gypsum Stack					

Prob Failure = Annual probability of failure due to earthquakes
Econ. Costs = Economic costs resulting from a failure
Loss of Life = Potential loss of life resulting from a failure
Mitigat. Costs = Costs to mitigate seismic risks in closure design
Data Quality = Qualitative indication of how well conditions in the facility are characterized

Table 2. Risk Severity Scoring (Draft) used by TVA

as of 4/22/2009

TVA Risk Event Consequence Rating Scale (Work-In-Progress)						
Strategic Objective	Success Factor	5 Worst Case	4 Severe	3 Major	2 Moderate	1 Minor
Customer	Public Image	International media attention; nearly unanimous public criticism	National media attention; federal, state officials, and customers publicly critical	Regional / local media attention; customers voice concern	Minimal media attention; letters / emails to executive leadership voicing concern	No media attention; sparse criticism
	Rate Impact	Average total retail rate increases by 15%, relative to peers	Average total retail rate increases by 10%-15%, relative to peers	Average total retail rate increases by 5%-10%, relative to peers	Average total retail rate increases by 2%-5%, relative to peers	Average total retail rate increases by 0-2%, relative to peers
People	Safety	Fatalities	Wide spread injuries	Major injuries	Significant injuries	Minor injuries
	Employee Confidence	Widespread departures of key staff with scarce skills or knowledge	Sharp, sustained drop in CHI results; departures of key staff with scarce skills or knowledge	Sharp decline in CHI results	Modest decline in CHI results	No effect on CHI results
Financial	Cash Flow Impact	>$500M	$100M - $500M	$25M - $100M	$5M - $25M	<$5M
	Credit Worthiness	Credit rating downgrade to below investment grade	Credit Rating Downgrade	TVA put on credit watch	TVA put on negative outlook	Credit rating agencies and bondholders express concern
Assets and Operations	LNS (Load not served)*	10% of System Daily Sales (48,000 MWhrs)	1% of System Daily Sales (4,800 MWhrs)	0.1% of System Daily Sales (480 MWhrs)	0.05% of System Daily Sales (240 MWhrs)	140 MWhrs
	CPI (Connection Point Interruptions)	10% of CPs are down simultaneously	5% of CPs are down simultaneously	CPI totaling 10% of current CP count (124 for FY09)	CPI totaling 7.5% of current CP count (93 for FY09)	CPI totaling 5% of current CP count (62 for FY09)
	Duration (in Hours) of Service Interruption	3,000 cumulative hours for CPs	1,000 cumulative hours for CPs	500 cumulative hours for CPs	150 cumulative hours for CPs	50 cumulative hours for CPs
	Delivered Cost of Power	Sustained increase in delivered cost of power >1 year	Increase in delivered cost of power <1 year	Increase in delivered cost of power <1 month	Increase in delivered cost of power <1 week	Delivered cost of power not effected
	Damage to environment; type and magnitude of contamination / discharge	Major coal, nuclear plant accident or dam failure	Significant hazardous waste discharged; nuclear plant accident; dam integrity failure resulting in drawdown of pool elevation	Hazardous materials / waste discharge; clean up / remediation time takes approximately two weeks	Localized environmental damage, no impact to wildlife, clean up / remediation time less than two weeks	Minimal environmental damage, no hazardous discharge; clean up time takes a few days

Table 3. Risk Likelihood Scoring used by TVA

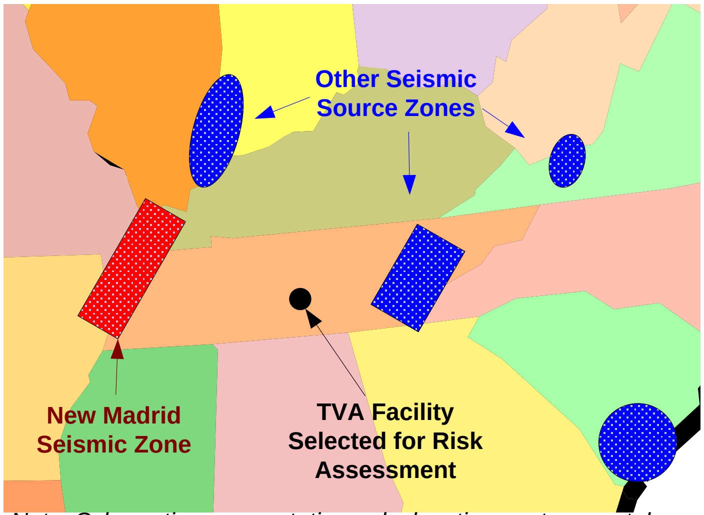
TVA Risk Event Probability Rating Scale		
Score	Rating	Description
5	Virtually Certain	95% probability that the event will occur in the next 3 years /10 years
4	Very Likely	75% probability that the event will occur in the next 3 years/10 years
3	Even Odds	50% probability that the event will occur in the next 3 years/10 years
2	Unlikely	25% probability that the event will occur in the next 3 years/10 years
1	Remote	5% probability that the event will occur in the next 3 years/10 years

- *The 3-year timeframe will be the primary focus for the business unit risk maps*
- *The 10-year risks will be collected by the ERM organization and charted separately for the enterprise*

Table 4. Seismic Hazard Input Data for Probabilistic Assessment of TVA Facilities

Seismic Sources	Return Period (years)	Annual Probability of Exceedance	Peak Ground Acceleration (g)	Earthquake Magnitude
New Madrid Seismic Zone	2,500 1,000 500 250 100	0.0004 0.001 0.002 0.004 0.01	*Values to be determined from the seismic hazard curves*	*Values to be determined from the hazard de-aggregation data**
All Other Seismic Sources	2,500 1,000 500 250 100	0.0004 0.001 0.002 0.004 0.01		

** Representative magnitude corresponding to the maximum contribution to the seismic hazard for liquefaction, as determined from the de-aggregation data weighted by the magnitude scaling factor (maximum PGA / MSF)*



Note: Schematic representation only, locations not accurately depicted, some sources omitted.

Figure 1. Schematic Representation of Seismic Source Model for TVA Facilities

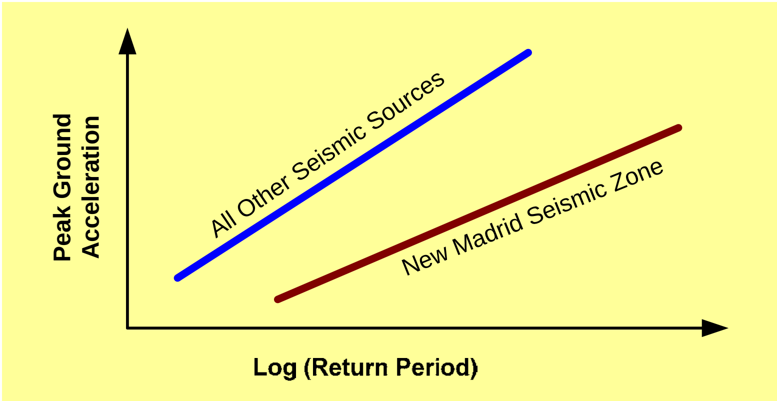


Figure 2. Typical Seismic Hazard Curves for Proposed Probabilistic Assessment of TVA Facilities

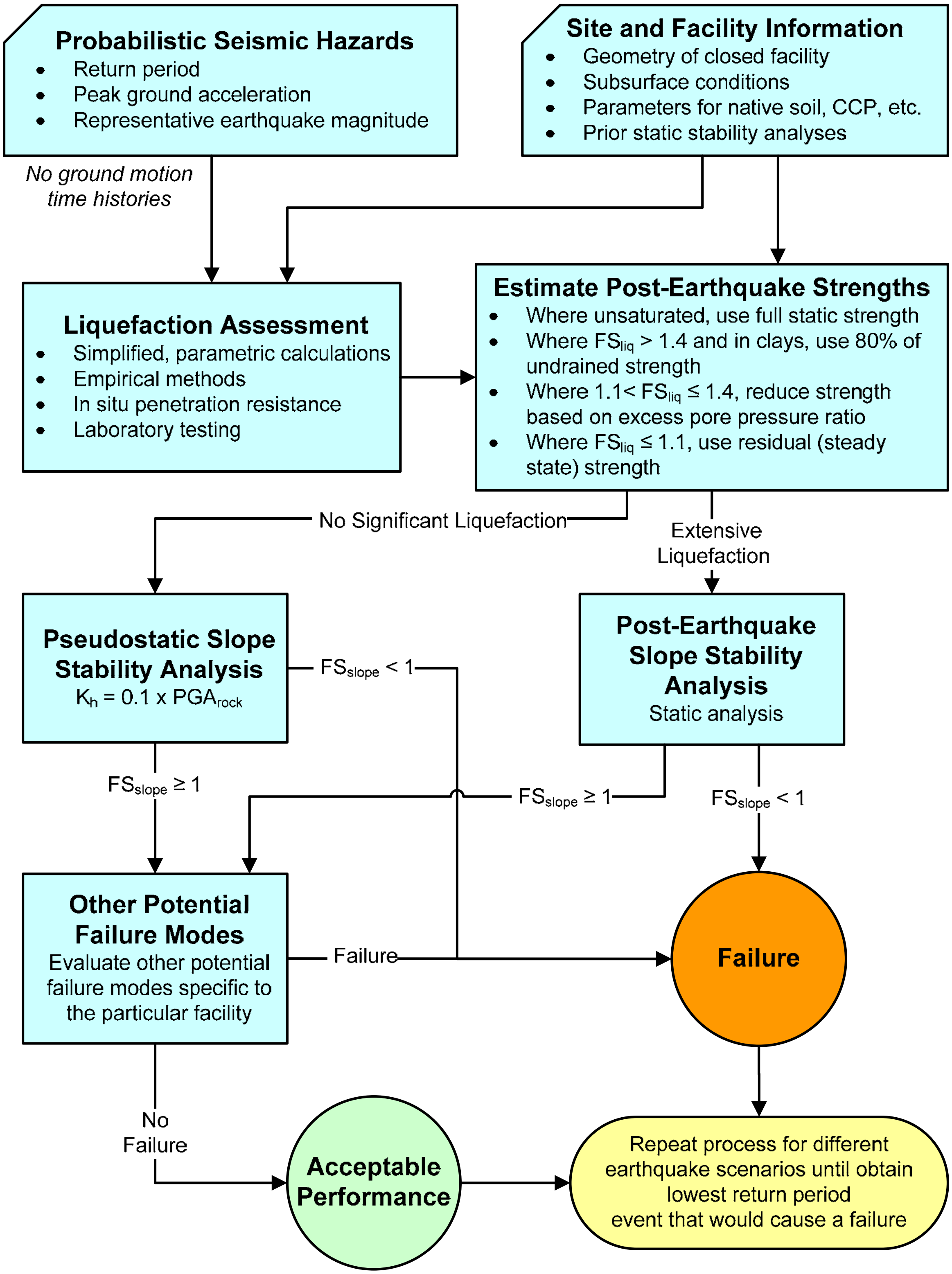


Figure 3. Simplified Flowchart for Assessing Facility Performance During a Probabilistic Seismic Event in Phase A

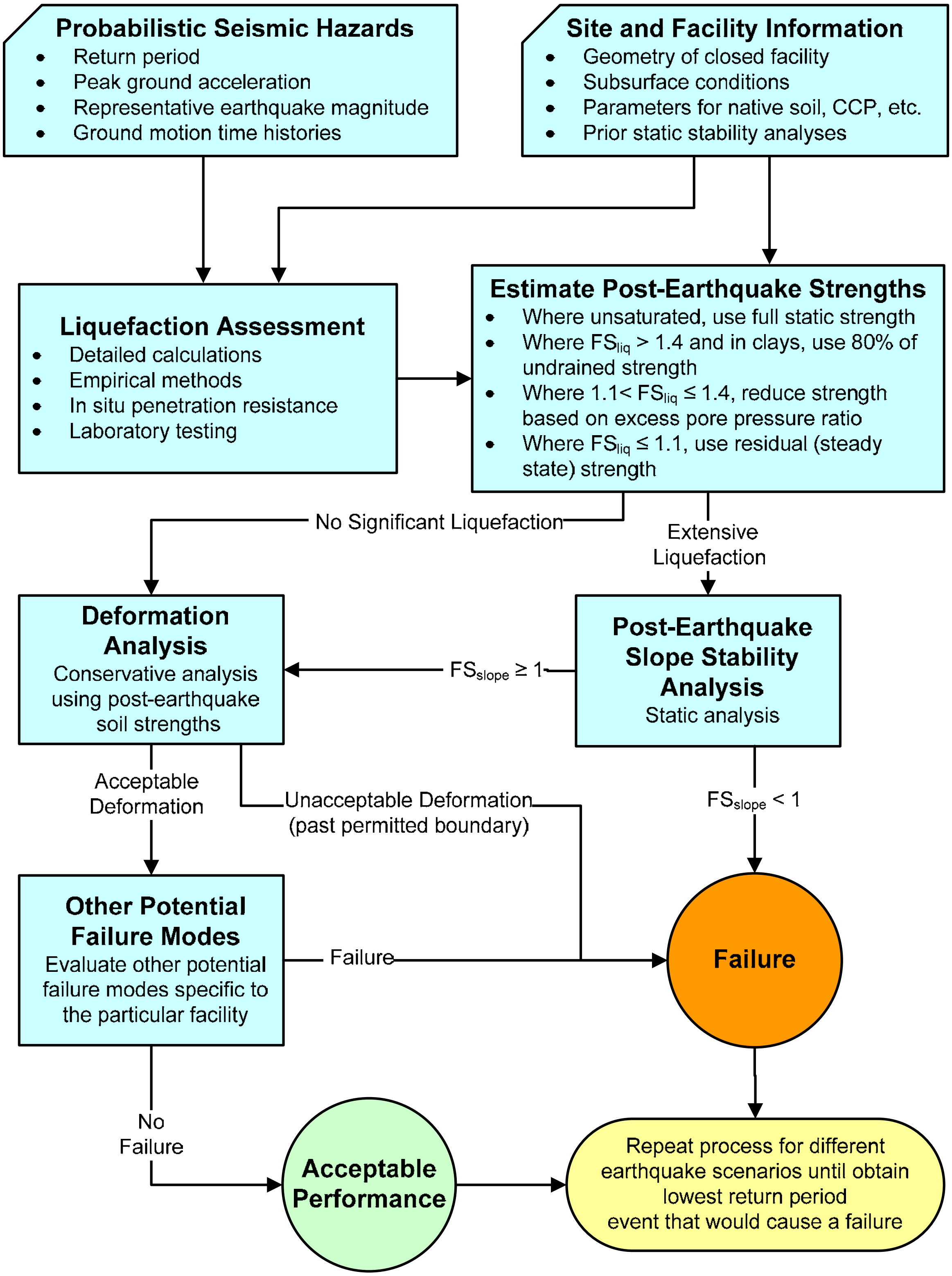


Figure 4. Simplified Flowchart for Assessing Facility Performance During a Probabilistic Seismic Event in Phase B

Enclosure B

Pseudostatic Analysis
Results

John Sevier Fossil Plant - Pseudostatic Stability Analysis Summary

CCP Disposal Facility		Cross-Section Information		500 yr Return		Mitigation and Improvement Activities Since January 2009 As-Found Conditions
Name	Type	Section Analyzed	Section Location	PGA (g) for COF	Factor of Safety	
Bottom Ash Pond	Impoundment	I	North Side	0.039	2.6	No mitigation activities were necessary at Bottom Ash Pond. As-found static FS was sufficient. Section I represents current and as-found conditions.
Dry Fly Ash Stack	Stack	C	Northwest Side		1.4	Construction was recently completed for a toe drain seepage collection system along the northwest side of the Dry Fly Ash Stack. However, piezometers have not yet been re-installed to collect data to check the change in phreatic surface resulting from the installation. Therefore, the toe drain was not modeled for this analysis. Section C represents as-found conditions.

Notes:

1) Acceleration are from March 28, 2011 TVA region-specific sesismic hazard study performed by AMEC Geomatrix, Inc. (total hazard).
2) Refer to layout plan for locations of cross-sections.
3) Stability models reflect current ground lines and conditions.
4) Liquefaction was not considered in this analysis.

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section I - Bottom Ash Pond
John Sevier Plant
Rogersville, Tennessee

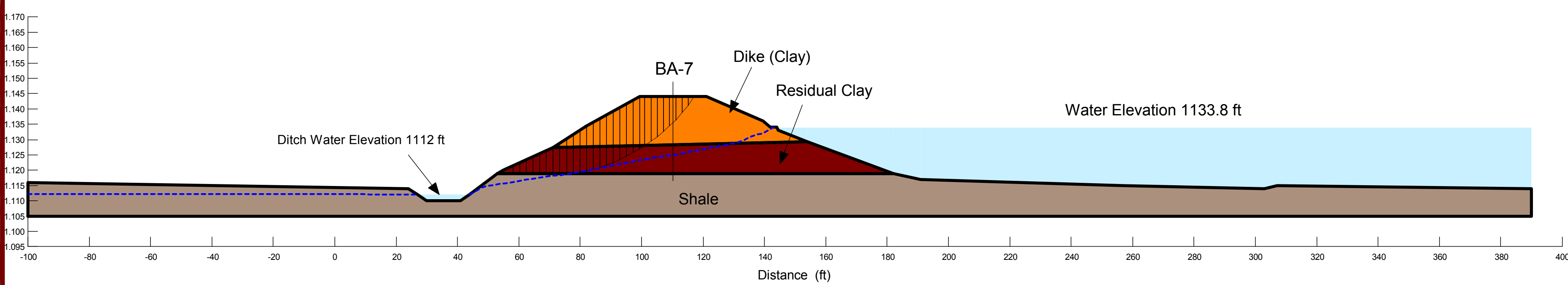
Stantec

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results, and approximate soil properties. No warranties can be made regarding the continuity of subsurfacea conditons betweeen the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Dike (Clay)	126 pcf	715 psf	10.6 °
Residual Clay	120 pcf	1000 psf	11.6 °
Bedrock (Shale)	N/A	N/A	N/A

Factor of Safety: 2.58

Horizontal Seismic Coefficient Kh = 0.039 g
500-year Return Period Event



e of Assessment - 09/09/2011

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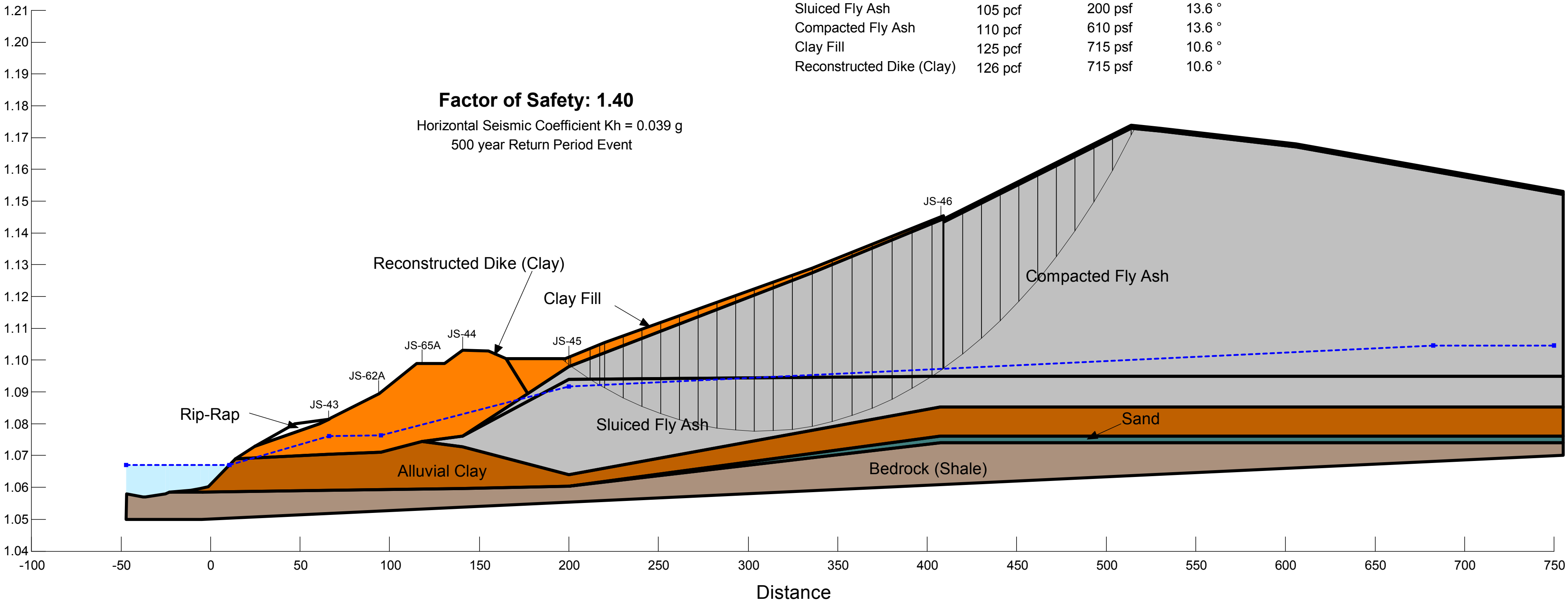
Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section C - Dry Fly Ash Stack
John Sevier Fossil Plant
Rogersville, Tennessee

Stantec

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results, and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditons betweenthe borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Rip-Rap	115 pcf	0 psf	40 °
Alluvial Clay	120 pcf	1000 psf	11.6 °
Sand	139 pcf	0 psf	37 °
Sluiced Fly Ash	105 pcf	200 psf	13.6 °
Compacted Fly Ash	110 pcf	610 psf	13.6 °
Clay Fill	125 pcf	715 psf	10.6 °
Reconstructed Dike (Clay)	126 pcf	715 psf	10.6 °



Date of Assessment - 09/14/2011

Project No. 175551015

41	C	10W507-01

BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)	BORING TYPE
BA-1	734,343.87	2,893,639.94	1,145.4	Sample / Piezometer
BA-2	734,229.93	2,893,695.53	1,145.9	Sample / Piezometer
BA-3	733,939.03	2,893,286.73	1,145.3	Sample / Piezometer
BA-4	733,486.11	2,890,407.91	1,145.2	Sample
BA-5	733,604.48	2,889,750.33	1,144.9	Sample / Piezometer
BA-6	733,808.75	2,889,830.63	1,145.1	Sample
BA-7	733,872.97	2,890,492.40	1,144.3	Sample
BA-8	733,946.71	2,891,566.83	1,145.2	Sample / Piezometer
BA-9	734,027.41	2,892,632.01	1,144.7	Sample
JP-1	733,930.64	2,888,187.78	1,105.4	Sample
JP-2	733,703.71	2,887,641.90	1,105.7	Sample
JP-3	733,483.09	2,886,974.16	1,105.8	Sample / Piezometer
JP-4	733,323.27	2,886,393.14	1,105.6	Sample / Piezometer
JP-4A	733,325.38	2,886,401.23	1,105.3	Shelby Tubes
JP-5	732,679.06	2,886,045.57	1,104.5	Sample / Piezometer
JP-6	732,862.78	2,886,526.80	1,106.3	Sample / Piezometer
JS-10	736,877.33	2,892,782.32	1,085.0	Sample / Piezometer
JS-11	736,817.60	2,892,703.95	1,115.3	Sample/ Slope Inclinometer
JS-12	736,796.96	2,892,666.90	1,114.8	Sample / Piezometer
JS-13	736,741.69	2,892,570.62	1,132.5	Sample / Piezometer
JS-15	737,186.07	2,892,539.85	1,084.1	Sample / Piezometer
JS-16	737,079.51	2,892,528.69	1,115.7	Sample/ Slope Inclinometer
JS-17	737,004.19	2,892,496.33	1,114.5	Sample / Piezometer
JS-18	736,848.84	2,892,429.18	1,136.3	Sample / Piezometer
JS-19	736,913.99	2,891,993.30	1,077.3	Sample / Piezometer
JS-20	736,826.84	2,892,070.81	1,113.8	Sample/ Slope Inclinometer
JS-21	736,784.15	2,892,107.96	1,111.0	Sample / Piezometer
JS-22	736,662.66	2,892,209.60	1,134.7	Sample / Piezometer
JS-23	736,562.81	2,891,652.34	1,075.1	Sample / Piezometer
JS-24	736,463.59	2,891,743.40	1,113.4	Sample/ Slope Inclinometer
JS-25	736,417.96	2,891,781.01	1,108.1	Sample / Piezometer
JS-26	736,300.23	2,891,894.54	1,141.8	Sample / Slope Inclinometer
JS-27	736,239.87	2,891,944.24	1,158.3	Sample / Temporary Piezometer
JS-28	736,010.84	2,891,176.23	1,074.5	Sample / Piezometer
JS-29	735,935.78	2,891,247.73	1,111.5	Sample/ Slope Inclinometer
JS-30	735,899.72	2,891,288.23	1,105.6	Sample / Piezometer
JS-31	735,755.45	2,891,418.56	1,151.1	Sample/ Slope Inclinometer
JS-32	735,766.70	2,891,431.00	1,150.6	Temporary Piezometer
JS-33A	735,606.69	2,891,839.21	1,152.4	Sample
JS-33B	735,313.55	2,891,533.03	1,155.3	Sample
JS-34A	735,400.64	2,891,943.07	1,156.4	Sample
JS-34B	735,161.98	2,891,694.15	1,156.3	Sample
JS-34C	735,045.58	2,892,079.28	1,120.4	Sample / Piezometer
JS-35	735,547.59	2,890,689.83	1,078.9	Sample / Piezometer
JS-36	735,478.03	2,890,742.60	1,108.5	Sample/ Slope Inclinometer
JS-36-SV	735,481.63	2,890,746.85	1,108.4	Shear Vane Test/Shelby Tubes
JS-36A	735,355.98	2,890,578.53	1,106.2	Sample/ Slope Inclinometer
JS-36A-SV	735,359.66	2,890,582.51	1,106.4	Shear Vane Test/Shelby Tubes
JS-36B	735,703.43	2,891,025.07	1,110.8	Sample/ Slope Inclinometer
JS-37	735,429.18	2,890,784.99	1,103.8	Piezometer
JS-37-SV	735,436.98	2,890,782.91	1,102.3	Shear Vane Test/Shelby Tubes
JS-37X	735,425.46	2,890,782.69	1,104.4	Sample
JS-38	735,263.83	2,890,906.40	1,151.5	Sample/ Slope Inclinometer
JS-39	735,175.12	2,890,973.42	1,181.3	Sample / Temporary Piezometer
JS-40	735,048.86	2,891,066.57	1,170.2	Sample
JS-41	734,877.81	2,891,195.60	1,154.6	Sample
JS-42	734,710.66	2,891,295.11	1,138.2	Sample / Piezometer
JS-43	735,279.02	2,890,354.76	1,081.5	Sample / Piezometer
JS-44	735,219.55	2,890,399.56	1,103.2	Sample/ Slope Inclinometer
JS-45	735,171.68	2,890,440.72	1,101.3	Piezometer
JS-45-SV	735,181.14	2,890,438.31	1,100.1	Shear Vane Test/Shelby Tubes
JS-45X	735,168.74	2,890,438.03	1,101.5	Sample
JS-46	735,006.11	2,890,560.28	1,144.7	Sample/ Slope Inclinometer
JS-47	735,013.36	2,890,001.65	1,078.2	Sample / Piezometer
JS-48	734,956.57	2,890,044.99	1,101.3	Sample/ Slope Inclinometer
JS-49	734,898.66	2,890,091.75	1,098.8	Sample / Piezometer
JS-50	734,760.24	2,890,196.57	1,138.7	Sample / Piezometer
JS-52	734,518.95	2,890,384.61	1,136.8	Sample / Piezometer
JS-53	734,742.01	2,889,577.25	1,081.4	Sample / Piezometer
JS-54	734,685.87	2,889,594.68	1,100.2	Sample/ Slope Inclinometer
JS-55	734,611.13	2,889,621.92	1,097.4	Sample / Piezometer
JS-56	734,506.50	2,889,656.35	1,131.0	Sample / Piezometer
JS-57	734,277.92	2,889,720.99	1,130.1	Sample / Piezometer
JS-58	734,222.32	2,889,559.16	1,100.2	Piezometer
JS-58X	734,224.38	2,889,557.53	1,100.1	Sample
JS-59	734,047.10	2,889,202.69	1,099.3	Sample / Piezometer
JS-60A	736,513.29	2,891,697.31	1,089.5	Sample
JS-60B	736,515.46	2,891,699.27	1089.5	Shelby Tubes / Piezometer
JS-61A	735,980.74	2,891,206.58	1,089.7	Sample / Piezometer
JS-61B	735,978.47	2,891,204.07	1089.1	Shelby Tubes
JS-62A	735,318.64	2,890,444.05	1,090.0	Sample
JS-62B	735,316.23	2,890,442.25	1,090.0	Shelby Tubes / Piezometer
JS-62C	735,339.49	2,890,481.47	1,088.2	Sample
JS-63A	734,985.29	2,890,020.63	1,089.4	Sample
JS-63B	734,987.89	2,890,023.29	1089.4	Shelby Tubes / Piezometer
JS-64	735,402.40	2,890,528.11	1,082.3	Sample
JS-65A	735,271.28	2,890,430.29	1,095.1	Sample / Shelby Tubes
JS-65B	735,269.06	2,890,426.10	1,094.7	Shelby Tubes
CPT-1	735,528.42	2,890,809.86	1,109.5	Cone Penetration Test
CPT-2	735,472.49	2,890,736.90	1,108.3	Cone Penetration Test
CPT-3	735,419.93	2,890,663.93	1,107.1	Cone Penetration Test
CPT-4	735,439.57	2,890,778.44	1,101.8	Cone Penetration Test
CPT-5	735,182.18	2,890,431.15	1,100.0	Cone Penetration Test

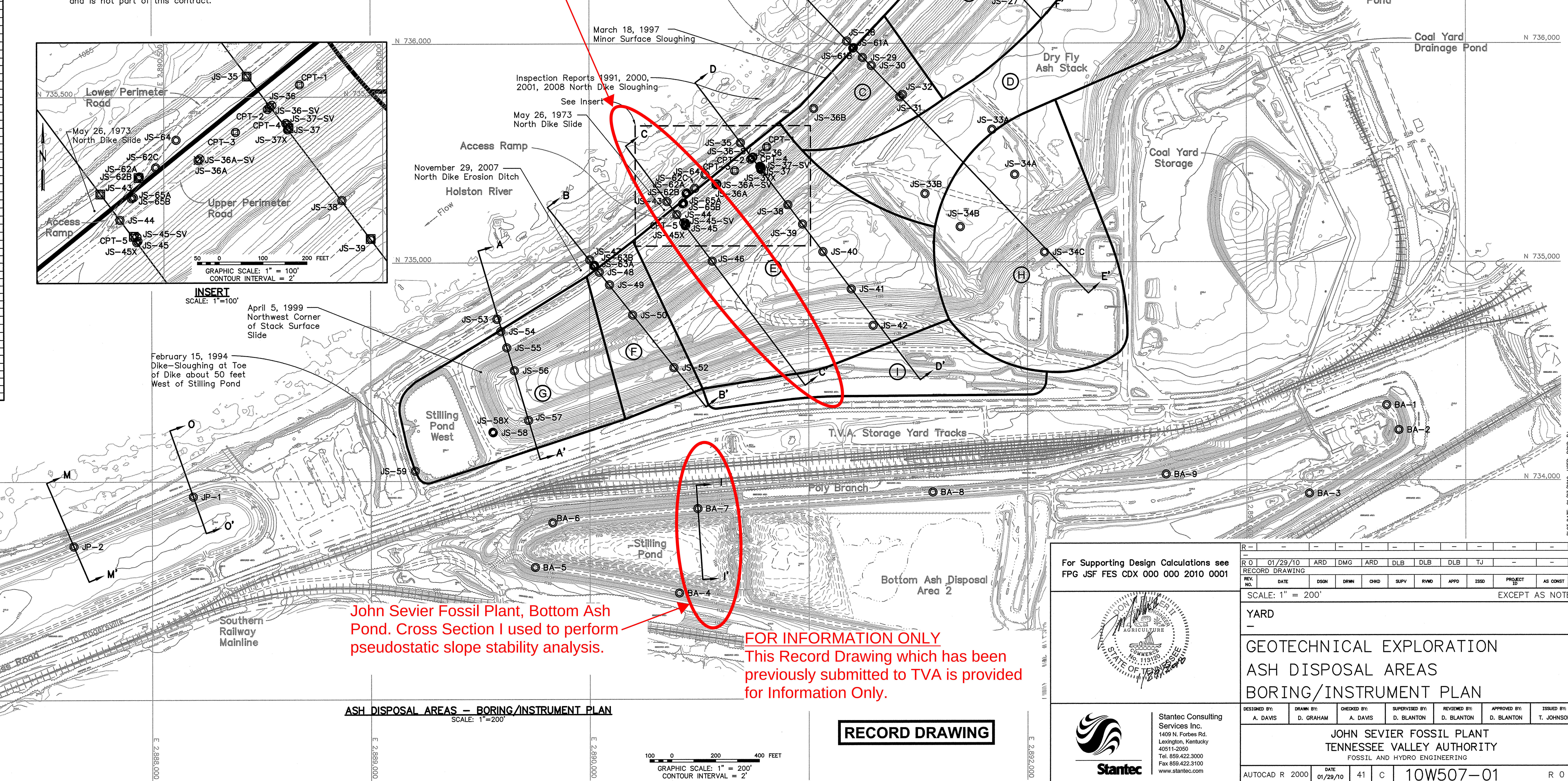
LEGEND

- Edge of River Pool
- Assumed Limits of Original Disposal Ponds
- (A) Original Disposal Pond Designation
- Soil Boring With Standard Penetration Tests
- Soil Boring With Standard Penetration Tests (Piezometer Installed)
- Soil Boring With Standard Penetration Tests (Slope Inclinometer Installed)
- Cone Penetration Test
- Shear Vane Test

NOTES:

1. Topographic mapping was developed by Tuck Mapping Solutions, Inc. on March 19, 2009.
2. The Tennessee Valley Authority Surveying and Project Services performed a hydrographic survey on the Holston River on September 17, 2009 and on the Bottom Ash Disposal Area 2 on January 12, 2006.
3. The location of shown areas of past disturbance are approximations based on previous inspection reports.
4. The limits of the Original Disposal Ponds were approximated using drawing 10N295 and previous inspection reports.
5. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.

John Sevier Fossil Plant, Dry Fly Ash Stack. Cross Section C used to perform pseudostatic slope stability analysis.



ASH DISPOSAL AREAS – BORING/INSTRUMENT PLAN
SCALE: 1"=200'

John Sevier Fossil Plant, Bottom Ash Pond. Cross Section I used to perform pseudostatic slope stability analysis.

FOR INFORMATION ONLY
This Record Drawing which has been previously submitted to TVA is provided for Information Only.

RECORD DRAWING

For Supporting Design Calculations see FPG JSF FES CDX 000 000 2010 0001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	01/29/10	ARD	DMG	ARD	DLB	DLB	DLB	TJ	–	–	–

RECORD DRAWING

SCALE: 1" = 200' EXCEPT AS NOTED

YARD
–

GEOTECHNICAL EXPLORATION ASH DISPOSAL AREAS BORING/INSTRUMENT PLAN

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
A. DAVIS	D. GRAHAM	A. DAVIS	D. BLANTON	D. BLANTON	D. BLANTON	T. JOHNSON

JOHN SEVIER FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

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www.stantec.com

DON W. FULLER II, STATE OF TENNESSEE, AGRICULTURE, COMMERCE, No. 113120, 1/29/2010

AUTOCAD R 2000 | DATE 01/29/10 | 41 | C | 10W507-01 | R 0

DISCIPLINE INTERFACE

PLOT DATE: 01/27/2010

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

APPENDIX A

Document 5

Stantec Seepage Action Plan, dated June 25, 2010

Stantec

Seepage Action Plan (SAP)

John Sevier Fossil Plant
Rogersville, Tennessee

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1409 North Forbes Road
Lexington, KY 40511-2050
Tel: (859) 422-3000 • Fax: (859) 422-3100
www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

June 25, 2010

Seepage Action Plan (SAP)

John Sevier Fossil Plant
Rogersville, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

June 25, 2010

Seepage Action Plan (SAP)

John Sevier Fossil Plant
Rogersville, Tennessee

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Seepage Action Plan (SAP)

John Sevier Fossil Plant
Rogersville, Tennessee

1. Potential Seepage Areas

For readers not familiar with seepage through dams, refer to Appendix B, "Possible Seepage Problems and Recommendations" for more illustrative details. Seepage through an impoundment dam can typically be found on the lower third of the slope and extending beyond the toe approximately fifty feet. Figure 1 below displays the typical area on a cross section that should be reviewed during the seepage inspection for the Dry Fly Ash Stack, Bottom Ash Pond and J-Pond. However, other seepage areas may exist, and the field inspector should be familiar with previous inspection reports and observations. Based on geotechnical analysis, plan views illustrating low factors of safety in terms of seepage have been prepared and are included in Appendix A. The areas identified, along with any other area previously identified during inspections, should be reviewed on a regular basis as identified in this document.

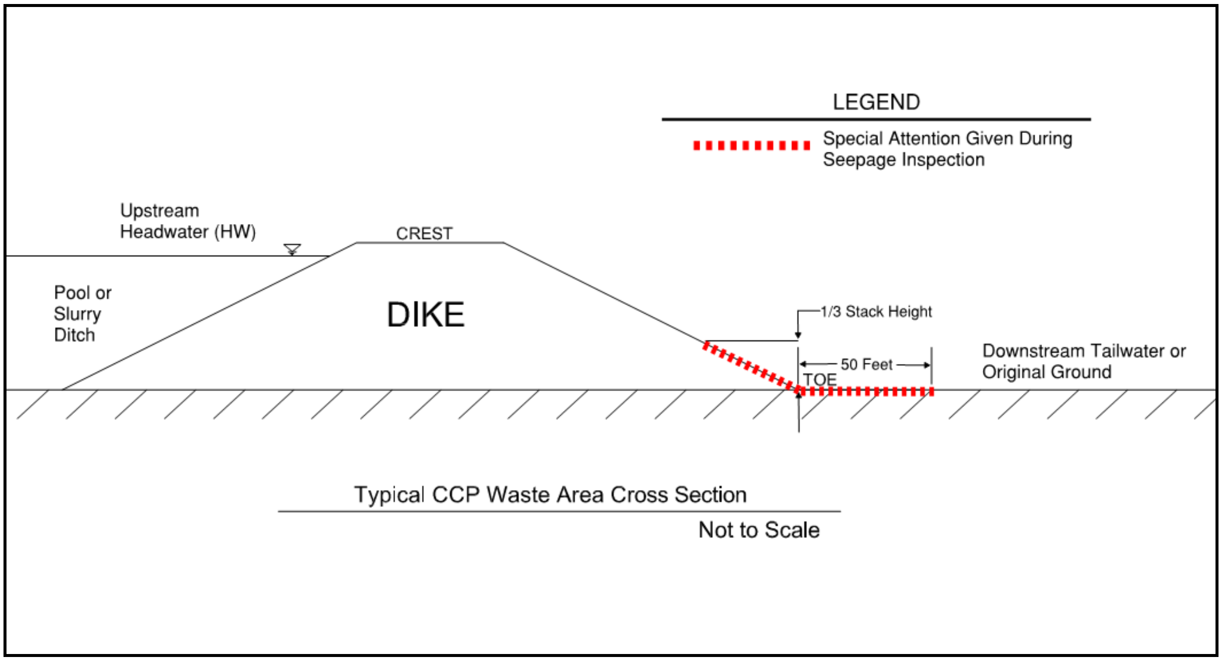


Figure 1. Seepage Inspection Location

2. Basic SAP Data

2.1. Purpose

The purpose of this SAP is to describe potential seepage action levels, and provide seepage short term management measures and actions in the event these action levels are observed.

2.2. Potential Impacted Area

Seepage related issues impact the integrity of earthen embankments. Seepage can lead to internal erosion of the embankment, known as piping, which has been the cause of many catastrophic failures in the past. Piping is a process where soil particles slowly carried out from inside the dam, eventually creating a tunnel or pipe. If the pipe forms all the way to the reservoir, the embankment will fail rapidly. Since the embankments at John Sevier Fossil Plant serve as an impoundment for Coal Combustion Products (CCP), it is imperative to maintain the embankments and prevent any possible failure from occurring. If a failure were to occur, the Coal Combustion Products (CCP) mixture could potentially contaminate John Sevier Fossil Plant and the Holston River.

2.3. Primary Responsibility and Frequency of Dike Safety Inspections

1. TVA RHO&M Field Supervisor for John Sevier Fossil Plant (**Field Supervisor**)

2. TVA RHO&M East Region Construction Manager

3. TVA RHO&M Program Manager for John Sevier Fossil Plant

Documented inspections should occur at a minimum of once per month. Additionally, there are two criteria which warrant an inspection. A documented inspection should occur following a significant precipitation event (0.5 inches of rain, 4 inches of snow), as well as following a change in the operation of the wet stack, pond, or other CCP wet waste area (switching between east/west ditch, switching ponds, raising pool elevations, etc.). A documented inspection involves inspecting the potential seepage areas noted on the plan views in Appendix A, paying particular attention to areas of concern previously identified. The **Seepage Log** should be updated to include new descriptions and photographs of any new areas of concern or <u>changes</u> to previously identified areas. Random inspections can occur on a more frequent basis if deemed necessary by the **Field Supervisor**.

3. Seepage Action Level Determination

For the purpose of this plan, three seepage action levels have been identified. The levels are based on potential risk associated with progressive erosion due to seepage and resulting breach of the embankment or impoundment.

Action Level 1 – Non-Flowing

- Wet areas
- Ponded Water

Action Level 2 – Flowing Seepage – No Erosion

- Non turbid (clear water) flow

Action Level 3 – Flowing Seepage – Active Erosion

- Turbid Flow
- Deposition of Sediment from Dike or Dam
- Boils (Ground Surface/ Underwater)
- Upstream Collapse or Sinkhole

3.1. Action Level 1 – Non Flowing

Seepage occurs in all earthen dams and dikes. The key is to properly collect and control seepage in a manner that does not cause damage to the embankment. Seepage that is not flowing but is evident by damp areas or ponded water does not generally represent an imminent threat to the embankment in terms of erosion (see Figure 2). However, if left unattended this seepage can lead to slope instabilities. Therefore, this should be noted so that it can be observed for changing conditions both at the downstream observation point and immediately upstream along the interior slopes.

Figure 2. Example of Action Level 1 – Non-Flowing – Wet Area

3.2. Action Level 2 – Flowing Seepage – No Erosion

Action Level 2 involves observations of flowing seepage, but evidence of erosion is not noted. Evidence of erosion can be in the form of turbid (muddy water) flow, sediment deposition, obvious hole or soil “pipe”. Evidence of erosion can be subtle and as a result, any flowing seepage should be carefully reviewed and monitored at least monthly. A picture of flowing seepage water showing no evidence of erosion is depicted in Figure 3. Note that a seep does not need to be continuously turbid for a piping situation to be forming.

Figure 3. Example of Action Level 2 – Clear Flowing – Seepage Boil

3.3. Action Level 3 – Flowing Seepage – Active Erosion

Left unmitigated seepage demonstrating active erosion can lead to progressive failure of the embankment and catastrophic loss of the impoundment. Evidence of erosion can be in the form of turbid flow, sediment deposition, boil, obvious hole or soil “pipe”. Evidence of erosion can be subtle and as a result, any flowing seepage should be carefully reviewed and monitored frequently. Careful attention should be given to seepage below water such as a stilling pond, creek or river (see Figure 6). This type of seepage is difficult to observe and determine if soil erosion is occurring. In moving water, evidence of seepage boils conveying embankment soil/ash materials will likely be (partially) washed away. Examples of active erosion are shown in Figures 4 thru 5.

Figure 4. Example of Action Level 3 – Turbid Flowing – Seepage Boil

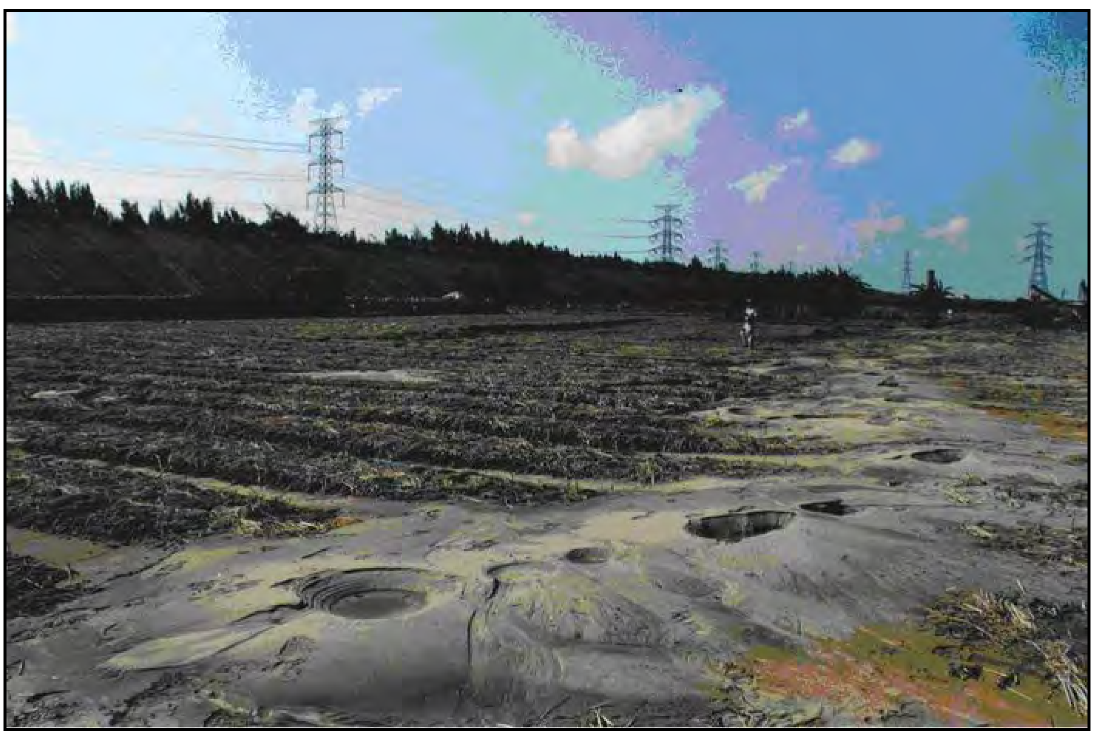


Figure 5. Example of Action Level 3 – Deposition of Sediment from Dike

Figure 6. Example of Action Level 3 – Underwater Turbid Flowing – Seepage Boil

4. Intermediate Corrective Measures

For each action level a typical corrective measure is listed below.

4.1. Action Level 1 – Non Flowing

- **Field Supervisor** should document the seepage area into the **Seepage Log** (see below).
- All observers should pay particular attention to conduits through the embankments.
- **Field Supervisor** should record the date, time, size of area, location, and photographs in the **Seepage Log**.

The **Seepage Log** should be kept at the Shift Operation Supervisor's (SOS) office such that inspectors (TVA, geotechnical consultant, or others) can document event triggers (date, time, location, pool level, etc.) and the site conditions observed for each seepage event. The **Seepage Log** shall function as a "living document" and be part of an ongoing monitoring program (to be controlled by TVA). As the monitoring program progresses, the **Seepage Log** will allow inspectors to summarize the historical conditions observed and provide a baseline of events to compare with future readings.

4.2. Action Level 2 – Flowing Seepage – No Erosion

- **Field Supervisor** should carefully inspect the area for outflow quantity, any transported material, and take photographs.
- If the seepage involves a conduit penetration associated with a spillway pipeline, storm culvert, or underdrain pipeline, the observer(s) should carefully inspect the

area by probing and /or carefully shoveling to see if the cause can be determined, determine if embankment materials are being transported, evident by turbid or cloudy water, and determine quantity of flow.

- Contact team members in accordance with Figure 8.
- Send photographs to the RHO&M Regional Construction Manager and CCP Program Manager for distribution.
- Geotechnical consultant, with concurrence of the TVA Program Manager and CCP Engineering Manager, should determine a plan of action within four hours of notification
- **Field Supervisor** should record the date, time, size of area, location, and photographs in the **Seepage Log**.

4.3. Action Level 3 – Flowing Seepage – Active Erosion

- **Field Supervisor** should carefully inspect the area for outflow quantity and transported material.
- **Field Supervisor** should determine if piping has occurred and extent by observing locations of seepage exits, take photographs, and contact team members in accordance with Figure 9.
- Geotechnical consultant, TVA Program Manager, and CCP Engineering Manager should determine a plan of action within four hours of notification such as lowering the pool, constructing a reverse graded filter, or sand bagging
- A typical reverse graded filter will consist of the following:
  - One foot of Concrete Sand (TDOT Concrete Sand)
  - One foot of TDOT No. 68 Stone
  - Two feet of TDOT Machine Rip Rap Class A-3
  - Silt Fence as required by guidance provided in the Best Management Practices for Erosion Prevention and Sediment Control
- An example of sandbagging is provided in Figure 7.
- **Field Supervisor** should record the date, time, size of area, location, and photographs in the **Seepage Log**.

Figure 7. Sand Bag Treatment (Temporary)

5. Materials On-Site

In case an emergency situation is observed during the inspection of the potential seepage areas, it is necessary to have materials readily available on-site to correct the situation. Table 1 below lists the materials to be stockpiled on-site and the quantity of each material.

Table 1. Stockpile Material Quantities

Material	Tons	Cubic Yards
Concrete Sand	90	60
TDOT No. 68 Stone	90	60
TDOT Machine Rip-Rap Class A-3	180	120
Sandbags (filled)	300 (total)	NA
30" Diameter HDPE Pipe	100 feet	NA

The amount of materials to be stockpiled is based on a production rate of 60 cubic yards per hour for a 2.5 CY long reach excavator assuming a material unit weight of 110 PCF.

The materials should be stockpiled along the western edge of the Coal Yard. The following earthwork equipment and qualified operator(s) should be located to place the material in case of an emergency:

- Long Reach Excavator
- Dump Truck
- Compactor, Bulldozer, Bobcat, any other nearby equipment which aids in the emergency

6. The SAP Process

6.1. Step 1 – Dike Observation or Event Detection

This step describes the detection of an unusual observation or emergency event and provides information to assist the John Sevier RHO&M **Field Supervisor** or appropriate personnel in determining the appropriate emergency level for the observation or event. These observations could be made by inspectors during routine inspections of the embankments, or by everyday personnel.

6.2. Step 2 – Emergency Level Determination

Following an unusual observation or emergency event detection, the **Field Supervisor** is responsible for classifying the event into one of the following three emergency levels:

6.2.1. Action Level 1 – Non Flowing

Observation is routine to other observations and a similar established plan of action for minor repair or continued observation will be required. If a Level 1 Emergency is identified, the following steps should be taken:

- Update maps and **Seepage Log**
- Inform JSF personnel if repairs are needed
- Determine if other work activities need to be made aware of observation.

6.2.2. Action Level 2 – Flowing – No Erosion

A change in condition or a condition that has not been previously identified and discussed with the geotechnical engineers. If a Level 2 Emergency is identified, the following steps should be taken:

- Inform individuals in accordance with the flowchart in Figure 8.
- Update map and **Seepage Log**
- Inform JSF personnel if repairs are needed
- Determine if other work activities need to be made aware of new conditions.

6.2.3. Action Level 3 – Flowing – Active Erosion

A change in condition that is drastic and could rapidly lead to failure of the embankment if not corrected. If a Level 3 Emergency is identified, the following steps should be taken:

- Inform plant SOS, who will initiate TVA plant-specific Emergency Action Plan (see Figure 9).
- Inform geotechnical consultant
- Develop safe plan of action for repair with geotechnical consultants
- Initiate repairs once plan has been approved by site safety and geotechnical consultant
- Update map and **Seepage Log**.

6.3. Step 3 – Notification and Communication

6.3.1. Notification

Following the determination of a possible seepage situation, it is necessary to notify the appropriate personnel discussed below for the required action to occur.

6.3.2. Communication

In case of an Action Level 2 emergency, the flowchart presented in Figure 8 should be followed to ensure the proper personnel are contacted. In an Action Level 3 emergency, the flowchart presented in Figure 9 should be followed.

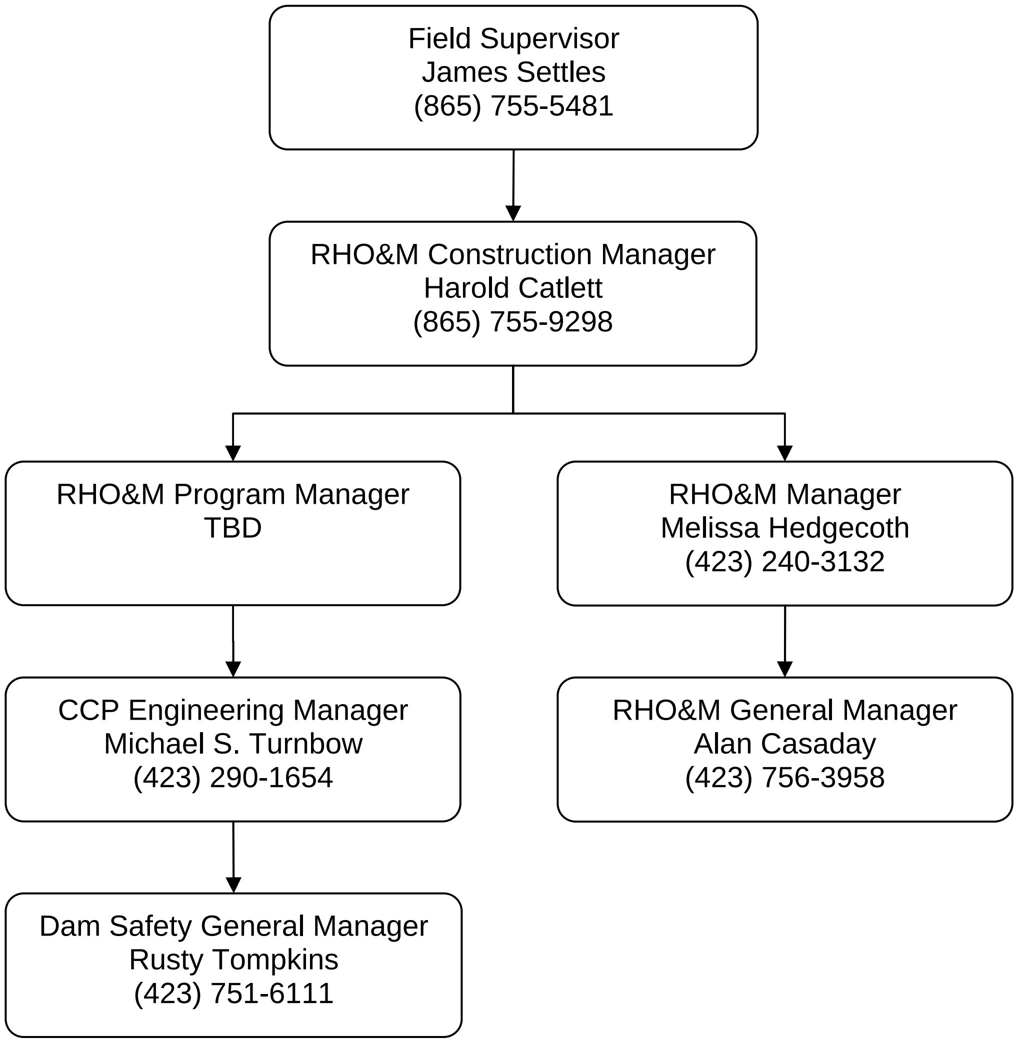


Figure 8. Level 2 Emergency Contact Flowchart

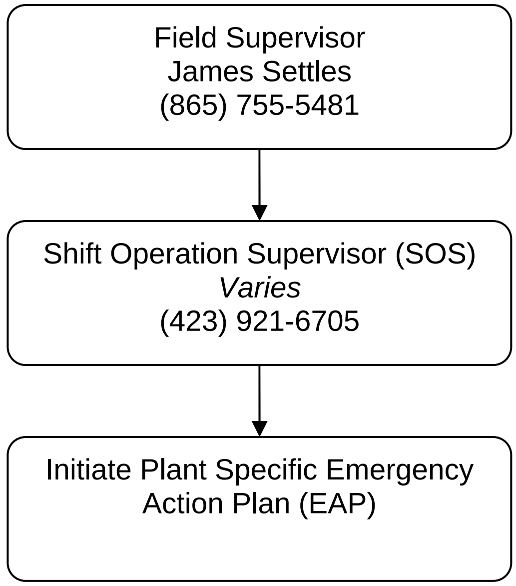
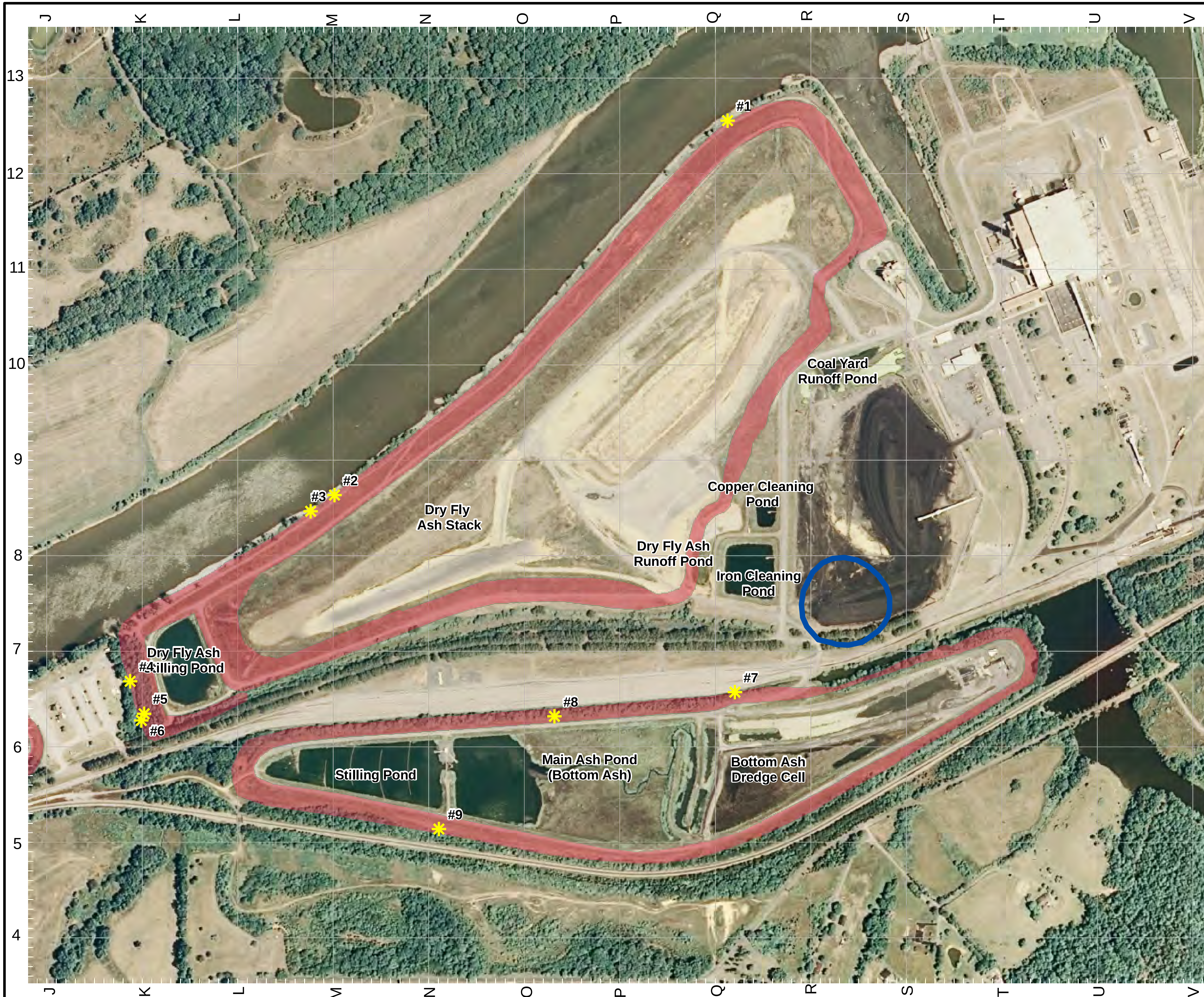


Figure 9. Level 3 Emergency Contact Flowchart

Appendix A

Dry Fly Ash Stack,
Bottom Ash Pond and
J-Pond Site Plans



Notes:
1. The areas identified on this drawing should not be considered as the only areas where seepage might occur. Therefore, a complete inspection of the dike should be performed annually as outlined in Stantec's Dam Safety Training Presentation dated August, 2009.
2. Grid spacing is 500 feet.

LEGEND

N

Areas of Concern

Stockpile Location

Potential Seepage Zone

Feet
0 250 500

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Seepage Action Plan

Tennessee Valley Authority
John Sevier Fossil Plant
Rogersville, Hawkins County, Tennessee

PROJECT NO.	175560021
DATE	APRIL 2010
DRAWN BY	AMG
CHECKED BY	
CHECKED BY	
SCALE	1" = 500'
REVISED	
1.	
2.	
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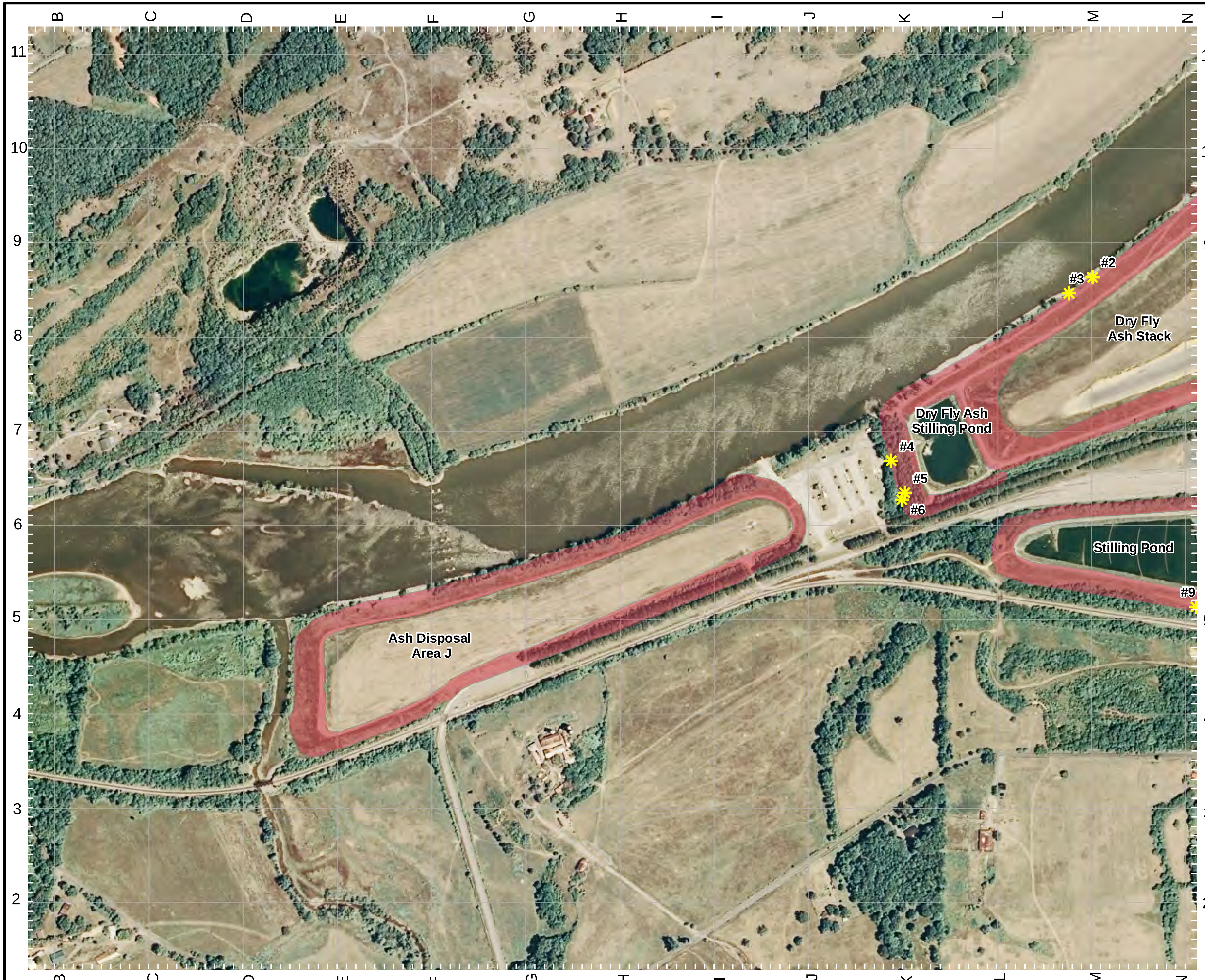
SHEET

1 OF 2



Notes:
1. The areas identified on this drawing should not be considered as the only areas where seepage might occur. Therefore, a complete inspection of the dike should be performed annually as outlined in Stantec's Dam Safety Training Presentation dated August, 2009.
2. Grid spacing is 500 feet.

LEGEND

N

Areas of Concern

Potential Seepage Zone

Feet
0 250 500

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Seepage Action Plan

Tennessee Valley Authority
John Sevier Fossil Plant
Rogersville, Hawkins County, Tennessee

PROJECT NO.	175560021
DATE	APRIL 2010
DRAWN BY	AMG
CHECKED BY	
CHECKED BY	
SCALE	1" = 500'
REVISED	
1.	
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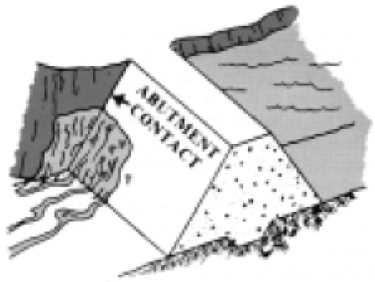
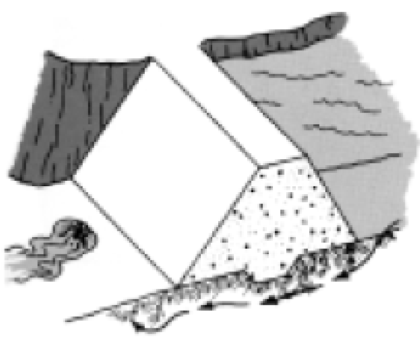
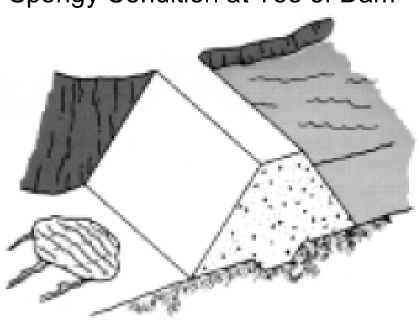
SHEET

2 OF 2

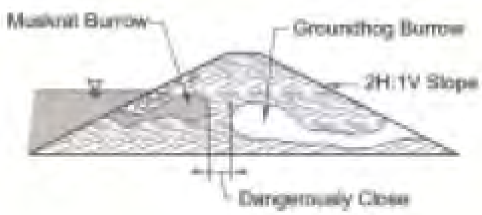
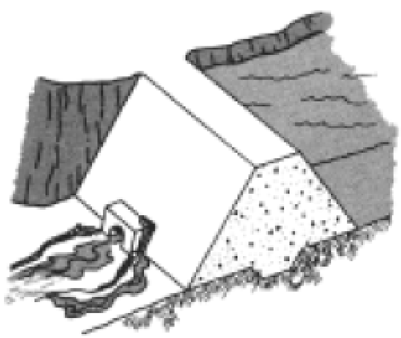
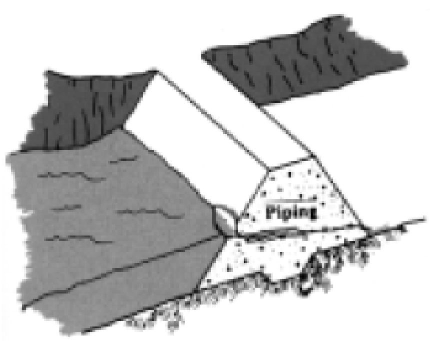
Appendix B

Possible Seepage Problems and Recommendations

Appendix B – Possible Problems and Recommendations

Seepage Problem	Recommendations
Seepage Water Exiting at Abutment Contact 	Study leakage area to determine quantity of flow and extent of saturation. Stake out the saturated area and monitor for growth or shrinkage. Inspect frequently for slides. Water level in the impoundment may be lowered to increase embankment safety. A QUALIFIED ENGINEER should inspect the conditions and recommend further actions to be taken.
Seepage Water Exiting as a Boil in the Foundation 	Examine boil for transportation of foundation materials, evidenced by discoloration. If soil particles are moving downstream, create a sand bag or earth dike around the boil. This is a temporary control measure. The pressure created by the water level within the dike may control flow velocities and prevent further erosion. If erosion continues, lower the reservoir level. A QUALIFIED ENGINEER should inspect the condition and recommend further actions to be taken.
Spongy Condition at Toe of Dam 	Carefully inspect the area for outflow quantity and any transported material. A QUALIFIED ENGINEER should inspect the condition and recommend further actions to be taken.

Appendix B – Possible Problems and Recommendations

Seepage Problem	Recommendations
Rodent Activity 	Control rodents to prevent more damage. Determine exact location of digging and extent of tunneling. Remove rodents and backfill existing holes.
Seepage Water Exiting from a Point Adjacent to the Outlet 	Investigate the area by probing and/or carefully shoveling to see if the cause can be determined. Determine if leakage water is carrying soil particles evidenced by discoloration. Determine quantity of flow. If flow increases, or is carrying embankment materials, reservoir level should be lowered until leakage stops. A QUALIFIED ENGINEER should inspect the condition and recommend further actions to be taken.
Sinkhole 	Inspect other parts of the dam for seepage or more sinkholes. Identify exact cause of sinkholes. Check seepage and leakage outflows for dirty water. A QUALIFIED ENGINEER should inspect the conditions and recommend further actions to be taken.

Appendix B – Possible Problems and Recommendations

Seepage Problem	Recommendations
Trees and Brush 	Remove all trees and shrubs on and within 25 feet of the embankment. Properly backfill void with compacted material. A QUALIFIED ENGINEER may be required.

Source: Connecticut Department of Environmental Protection, Guidelines for Inspection and Maintenance of Dams, September 2001.

Appendix C

Seepage Log

JSF Seepage Log

John Sevier Fossil Plant
Rogersville, TN
Updated June 22, 2010 Rev. 1

Area of Concern	Coordinate Location (Northing/Easting)		Date Initially Observed	Time	Approximate Size (Linear Feet)	SAP Level	Description	Mitigation Status/ Future Plans
1	737038.68	2892149.1	Prior to 2009	N/A	-	1	Potential seep-Initially observed by TVA prior to 2009.Determined to be a wet area due to a leak in a pipe. SAP Level 1	No remediations necessary.The area should be monitored for future changes.
2	735135.06	2890157.14	2006	N/A	10	1	Seep-Initially observed by TVA in 2006. Located near toe of exterior slope of the dry fly ash stack near the lower perimeter road. SAP level 1.	Recommended toe drain in Workplan #4 issued 5/2010 should remediate the issue. Observe the area and document
3	735050.9	2890055.79	2009	N/A	3 to 10	1	Seep-Initially observed by TVA in 2009. Located near toe of exterior slope of the dry fly ash stack in the lower perimeter road. SAP Level 1.	Recommended toe drain in Workplan #4 issued 5/2010 should remediate the issue. Observe the area and document
4	734160.39	2889056.36	2008	N/A	5	1	Seep-Initially observed by TVA in 2008. Located approximately 50 feet away from the toe of the exterior west slope of the dry fly ash stack & 10 feet east of Polly Creek. SAP Level 1.	No remediations necessary.The area should be monitored for future changes.
5	734008.83	2889115.36	2002	N/A	3	1	Potential seep - Initially observed by TVA in 2002. Located near toe of west exterior slope of the dry fly ash stack. Was not observed to be wet during 2010 Annual Inspection on 6/16/2010. SAP Level 1.	No remediations necessary.The area should be monitored for future changes.
6	733950.8	2889093.31	2002	N/A	10	1	Seep-Initially observed by TVA in 2002. Located adjacent to Polly Creek. SAP level 1.	No remediations necessary.The area should be monitored for future changes.
7	734103.34	2892213.28	2009	N/A	-	1	Potential red water seep-Initially observed by TVA in 2009. Located near toe of north exterior slope of the bottom ash dredge cell. Seep location was not apparent during Annual inspection on 6/16/2010. SAP Level 1.	No remediations necessary.The area should be monitored for future changes.

JSF Seepage Log

John Sevier Fossil Plant
Rogersville, TN
Updated June 22, 2010 Rev. 1

Area of Concern	Coordinate Location (Northing/Easting)		Date Initially Observed	Time	Approximate Size (Linear Feet)	SAP Level	Description	Mitigation Status/ Future Plans
8	733967.13	2891265.38	Jul-09	N/A	2	1	Red water seep- Initially observed by Stantec/TVA in 7/2009 during maintenance and tree removal. Located at the toe of the north exterior slope of the main ash pond. Seep Level 1.	No remediations necessary. The area should be monitored for future changes.
9	733365.16	2890631.79	Prior to 2008	N/A	-	1	Potential seep-Initially observed by TVA prior to 2008. Seep area has not been observed in last two years.	No remediations necessary. The area should be monitored for future changes.

Note: Initial Seepage Log was developed based on Stantec's understanding of known issues from Phase 1 and Phase 2 assessments and the 2010 Annual Inspection. No field visit was conducted to verify current seepage areas of concern.

Area of Concern 1

Potential seep initially observed by TVA prior to 2009.Determined to be a wet area due to a leak in a pipe. SAP Level 1.

NO PHOTO

Area of Concern 2

5/29/2010
Seep Initially observed by TVA in 2006. Located near toe of exterior slope of the dry fly ash stack near the lower perimeter road. SAP Level 1.

Area of Concern 3

2009
Seep initially observed by TVA in 2009. Located near toe of exterior slope of the dry fly ash stack in the lower perimeter road. SAP Level 1.

Area of Concern 3
6/16/2010
Seep initially observed by TVA in 2009. Located near toe of exterior slope of the dry fly ash stack in the lower perimeter road. SAP Level 1.

Area of Concern 4

2009
Seep initially observed by TVA in 2008. Located approximately 50 feet away from the toe of the exterior west slope of the dry fly ash stack and 10 feet east of Polly Creek. SAP Level 1.

Area of Concern 4

6/16/2010
Seep initially observed by TVA in 2008. Located approximately 50 feet away from the toe of the exterior west slope of the dry fly ash stack and 10 feet east of Polly Creek. SAP Level 1.

Area of Concern 5
6/16/2010
Potential seep initially observed by TVA in 2002. Located near toe of west exterior slope of the dry fly ash stack. Was not observed to be wet during 2010 Annual Inspection on 6/16/2010. SAP Level 1.

Area of Concern 6

6/16/2010
Seep initially observed by TVA in 2002. Located adjacent to Polly Creek. SAP Level 1.

NO PHOTO

Area of Concern 7

6/16/2010
Potential red water seep initially observed by TVA in 2009. Located near toe of north exterior slope of the bottom ash dredge cell. Seep location was not apparent during Annual inspection on 6/16/2010. SAP Level 1.

Area of Concern 8
6/16/2010
Red water seep initially observed by Stantec/TVA in 7/2009 during maintenance and tree removal. Located at the toe of the north exterior slope of the main ash pond. Seep Level 1.

Area of Concern 8

6/16/2010
Red water seep initially observed by Stantec/TVA in 7/2009 during maintenance and tree removal. Located at the toe of the north exterior slope of the main ash pond. Seep Level 1.

NO PHOTO

Area of Concern 9

6/16/2010
Potential seep initially observed by TVA prior to 2008. Seep area has not been observed in last two years.

Appendix D

JSF CCP Emergency
Action Plan

APPENDIX A

Document 6

Stantec Annual Inspection

Stantec

2010 Annual Inspection of Waste Disposal Areas

John Sevier Fossil Plant
Rogersville, Hawkins County, Tennessee

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1409 North Forbes Road
Lexington, KY 40511-2024
Tel: (859) 422-3000 • Fax: (859) 422-3100
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Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

July 16, 2010

Stantec

Stantec Consulting Services Inc.
11687 Lebanon Road
Cincinnati, OH 45241
Tel: (513) 842-8200
Fax: (513) 842-8250

July 16, 2010 rpt_008_175550002

Mr. Michael S. Turnbow
Tennessee Valley Authority
1101 Market Street
LP 2G-C
Chattanooga, Tennessee 37402-2801

Re: 2010 Annual Inspection of Waste Disposal Areas
John Sevier Fossil Plant
Rogersville, Hawkins County, Tennessee

Dear Mr. Turnbow:

Stantec Consulting Services Inc. (Stantec) has completed the 2010 annual inspections for the Waste Disposal Areas at the John Sevier Fossil Plant (JSF). Facilities reviewed included:

- Dry Fly Ash Stack Area
- Bottom Ash Disposal Area 2
- Sediment Pond East
- Sediment Pond West
- Coal Yard Runoff Pond
- Chemical Treatment Pond - Copper
- Chemical Treatment Pond - Iron
- Ash Disposal Area J

The field work was executed on June 15 and 16, 2010. The results of the work along with facility-specific recommendations for maintenance or other activities are included on the enclosed documents. The results of the TVA Third Quarter Facility Inspection have been included in Enclosure L. Portions of that inspection report have been included within the annual report where appropriate.

The following general plant-wide recommendations and comments are offered:

- It is recommended that vegetation maintenance continue. If lack of vegetation is observed during these operations, reseeding should be performed as soon as possible. If vegetation establishment difficulties continue in any areas, then TVA should consider refining existing procedures or developing site specific specifications which address topsoil, fertilizing, seed mixtures, etc.

- It is recommended that TVA catalog, assign a responsible party and due date, and track the completion of the facility-specific recommendations provided herein.

- Note that this scope did not include a review of the current Operations and Maintenance Manual (O&M) for JSF.

- It is recommended that TVA personnel continue dike inspections/monitoring to look for changes or conditions that might affect dike integrity. The frequency and procedures for inspections should be consistent with TVA's newly implemented inspection program. Particular emphasis should be placed on reviewing and monitoring the seepage areas for changed or worsened conditions, and identifying and repairing other maintenance items such as animal burrows, erosion, and lack of vegetation.

Stantec appreciates the opportunity to provide continued engineering services for the fossil plants. If you have any questions, or if we may be of further assistance, feel free to contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Hugo R. Aparicio, PE
Principal

Donald L. Blanton
Senior Associate

James R. Swindler Jr., EIT
Project Engineer

/lp

Enclosures

Enclosure A

Dry Fly Ash Stack Area

1. General Facility Information

Facility Status: Active

Surface Area: 90 acres (estimated) **Maximum Height (toe to top of stack):** 120 feet (estimated)

2. Site Visit Information

Stantec Inspection Team: Donald L. Blanton and James R. Swindler Jr.

TVA Staff Present: Roy Quinn, Jake Booth, Jason Hill, Mike Huslander, Shannon Bennett, and Tonya Bailey

Field Inspection Date: June 16, 2010

Weather/Site Conditions: Mostly Sunny, 85F

3. History/Current and Future Operations

History: The Dry Fly Ash Disposal Area was originally a series of ash ponds when the plant went online in 1955. The ponds were lettered from A to G with A being the most eastern pond and G being the most western (west half of Area G is now the Sediment Pond West). At the beginning of the plant operations, only Areas A, B and C were active and water was discharged to the river through a spillway in Area C. In 1971, Areas A, B, and C were abandoned and ash was sluiced to Areas D, E and F (spillway in F discharged to river). In 1973, sluicing stopped to areas D, E, and F due to a dike failure in E (though spillway still active) and areas H and I were activated (spillway in I to drainage channel along main plant road). Other significant slides and sloughs have occurred after the area was transformed to a dry ash disposal area, but none of these released material offsite. The most notable of these were reported in 1989, 1990, 1997, and 2007 inspection reports. In 1974, areas A, B, C, D, E, and F were used as disposal areas for dredged bottom ash. In 1976, Area G was activated in the west end of the current Dry Fly Ash Disposal Area, and received all sluiced fly ash while Areas H and I received all sluiced bottom ash. In 1979, the Bottom Ash Disposal Area 2 was activated and all sluicing stopped to the Dry Fly Ash Disposal Area. At this same time, Areas A through I were designated for dry ash disposal and Area G was filled and abandoned. In 1982, a bathtub area was constructed in the eastern portion of the Dry Fly Ash Disposal Area. In 1984, the bathtub area began receiving dredged bottom ash from the Bottom Ash Disposal Area 2. In 1990, all bottom ash was sluiced to the bathtub area as Bottom Ash Disposal Area 2 was offline. In 1993, dry fly ash began being stacked in the bathtub area, in addition to stacking done in Areas A through I. An operations manual was developed in 1999 for the dry fly ash stacking facility by Tribble & Richardson (along with Law Engineering). In 2001-2002, the eastern two-thirds of the north dike was regraded to provide better stability to the dike. A seepage collection system (with two pumps) was constructed in the vicinity of two old clay pipes in the northeast corner in 2000 and expanded as part of the regrading in 2001-2002.

Current Operations: Currently approximately 215,000 tons of dry fly ash is collected in silos each year and hauled to an onsite permitted dry stack disposal area (Dry Fly Ash Disposal Area). Approximately 100,000 dry tons of fly ash is marketed offsite to the concrete industry.

Future Planned Operational Changes: None planned.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing. The TVA Quarterly Facility Inspection results for the third quarter are located in Enclosure L. Portions of that report pertaining to the Dry Fly Ash Disposal Area have been incorporated within this annual inspection report.

4.1. Exterior Slopes and Benches

Vegetation: Open stack on the top with ash sides surrounded by a clay berm, slopes below ash stack are vegetated with grass (see Photo 3) and light brush, some trees near the river bank on the north and east sides.

Sparse vegetation was observed on the upper exterior slope on the northwest corner of the area (see Photo 4, TVA Item No. 35), on the lower exterior slope on the north side of the area (see Photo 20, TVA Item No. 9), on the upper exterior slope on the north side of the area (see Photo 18, TVA Item No. 37 and Photo 21, TVA Item No. 8), on the lower exterior slope on the east side of the area (see Photo 22, TVA Item No. 7), on the upper exterior slope on the east side of the area (see Photo 25, TVA Item No. 4), and on the upper exterior slope on the south side of the area (see Photo 5, TVA Item No. 64;

Photo 7, TVA Item No. 62; Photo 8, TVA Item No. 60; and Photo 9, TVA Item No. 59).

Exposed ash was observed on the lower exterior slope on the south side of the area (see Photo 12, TVA Item No. 57; Photo 13, TVA Item No. 56; Photo 14, TVA Item No. 55; and Photo 15, TVA Item No. 54), on the upper exterior slope on the north side of the area (see Photo 19, TVA Item No. 67), and in the upper slope on the interior of the area (see Photo 17, TVA Item No. 30).

Trees: Dense trees noted on lower slopes near river bank on the east side of the area. There are isolated trees on the river side of the lower access road on the north side of the area.

Erosion: Erosion was observed on the upper exterior slope on the west end of the area (see Photo 3, TVA Item No. 34), on the interior of the area (see Photo 16, TVA Item No. 31), and on the bench on the east side of the area (see Photo 27, TVA Item No. 2).

Instabilities: None observed.

Uniform Appearance Generally, the uniform appearance is good.

Tire rutting was observed on the upper exterior slope on the south side of the area (see Photo 6, TVA Item No. 63).

Low areas were observed on the bench on the east side of the area (see Photo 26, TVA Item No. 3 and Photo 28, TVA Item No. 1).

Benches: Two main benches, mostly along the north side that also serve as access roads (see Photo 21, TVA Item No. 8). First bench from stack is the perimeter road (15 feet wide) with main drainage ditch (50 feet wide). Second bench, at the toe of the slope, is below the first bench and contains the access road (10 feet wide).

Slope: 2.7H:1V (from clay berm to perimeter road)
3H:1V (from perimeter road to access road)
2H:1V and steeper (from access road to the river)

Height: 120 feet from the top of the stack to the river (measured on the north side of the area).

Other: Standing water was observed at the west end of the exterior upper slope of the area (see Photo 1, TVA Item No. 65) and on the upper exterior slope on the south side of the area (see Photo 11, TVA Item No. 33).

Animal burrows were observed on the upper exterior slope on the north side (see Photo 10, TVA Item No. 36) and on the lower exterior slope on the east side of the area (see Photo 23, TVA Item No. 6 and Photo 24, TVA Item No. 5).

Three locations of seepage have been noted in past inspections. ND-E1 was near the toe of the exterior embankment on the north side of the area (not seen during this inspection), ND-2 was located on the access road near the toe of the exterior slope on the north side of the area (see Photo 30), and ND-3 was also located on the access road near the toe of the exterior slope on the north side of the area (see Photo 29).

4.2. Perimeter Drainage Ditches and Down-Drains

Vegetation:	Grass was observed in drainage ditches surrounding the area (see Photo 11, TVA Item No. 33).
Rip-Rap Channel Lining:	Rip-rap is present near the outlet to Sediment Pond West.
Erosion:	None observed.
Sedimentation in Ditches:	None observed.
Standing Water in Ditches or on Benches:	Moisture was observed in a drainage ditch at the northwest corner of the area (see Photo 2, TVA Item No. 66).
Silted/Impeded Drainage Pipes:	None observed.
Other:	

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

The following repairs and mitigation have occurred since the previous annual inspection:

- Work Plan 3, Pipe Grouting and Abandonment, (JSF-100323-WP-3) has been issued for construction.
- Work Plan 4, Toe Drain and Slope Regrading, (JSF-100518-WP-4)R01 has been issued for construction. This project should remediate seeps ND-2 and ND-3.
- Work Plan 7, Soft Areas (JSF-100416-WP-7) has been issued for construction to

repair soft areas and areas where the intermediate cover is thin.

- A new lined pond has been constructed southeast of the Dry Fly Ash Stack, north of Chemical Treatment Pond Copper (see Photo 31). Leachate from the lined Phase 1 and Phase 2 areas of the Dry Fly Ash Stack (where ash is actively being placed) is collected and directed to this lined pond. From the lined pond the leachate is directed to the Coal Yard Runoff Ponds.

6. Recommendations

The following recommendations are offered for the Dry Flay Ash Stack. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the areas of sparse vegetation observed on the exterior slopes (see Photo 4, TVA Item No. 35; Photo 5, TVA Item No. 64; Photo 7, TVA Item No. 62; Photo 8, TVA Item No. 60; Photo 9, TVA Item No. 59; Photo 18, TVA Item No. 37; Photo 20, TVA Item No. 9; Photo 21, TVA Item No. 8; Photo 22, TVA Item No. 7; and Photo 25, TVA Item No. 4) be reworked and/or reseeded to support vegetation growth consistent with the remainder of the slopes. (Priority 4)
- It is recommended that the areas of exposed ash observed on the exterior slopes (see Photo 12, TVA Item No. 57; Photo 13, TVA Item No. 56; Photo 14, TVA Item No. 55; Photo 15, TVA Item No. 54; Photo 17, TVA Item No. 30; and Photo 19, TVA Item No. 67) be reworked and/or reseeded to support vegetation growth consistent with the remainder of the slopes. (Priority 4)
- It is recommended that the areas of erosion observed on the exterior slopes (see Photo 3, TVA Item No. 34; Photo 16, TVA Item No. 31; and Photo 27, TVA Item No. 2) be repaired. It is expected that rip-rap may be needed to protect the embankment. (Priority 4)
- Areas of rutting (see Photo 6, TVA Item No. 63) should be repaired and reseeded, as conditions warrant. Special care should be taken, if possible, to not perform maintenance on the slopes of the pond during conditions that could result in rutting. (Priority 5)
- The low areas observed along the bench (see Photo 26, TVA Item No. 3 and Photo 28, TVA Item No. 1) should be graded to drain. (Priority 4)
- The animal burrows observed during the inspection on the exterior slope (see Photo 10, TVA Item No. 36; Photo 23, TVA Item No. 6; and Photo 24, TVA Item No. 5) should be repaired in accordance with the guidelines given in Enclosure J. (Priority 4)
- The locations where standing water and/or moisture was observed on the area (see Photo 1, TVA Item No. 65 and Photo 11, TVA Item No. 33) or within drainage ditches (see Photo 2, TVA Item No. 66) should be graded to drain. (Priority 4)
- It is recommended that the areas of seepage observed near the toe of the exterior

slope during past inspections (see Photo 29 and Photo 30) continue to be monitored as indicated in the Seepage Action Plan dated June 25, 2010. It is anticipated that these seeps will be remediated upon construction of Work Plan 4 (JSF-100518-WP-4)R1.

Photo 1 (TVA Item No. 65)

Standing water observed at the west end of the exterior upper slope of the area.

Photo 2 (TVA Item No. 66)

Moisture observed in ditch on the northwest corner of the area.

Photo 3 (TVA Item No. 34)

Erosion and multiple rills located on the west end of the upper exterior slope of the area.

Photo 4 (TVA Item No. 35)

Sparse vegetation located on the upper exterior slope on the northwest corner of the area.

Photo 5 (TVA Item No. 64)

Sparse vegetation located on the upper exterior slope on the south side of the area.

Photo 6 (TVA Item No. 63)

Tire rutting observed on the upper exterior slope on the south side of the area.

Photo 7 (TVA Item No. 62)

Sparse vegetation located on the upper exterior slope on the south side of the area.

Photo 8 (TVA Item No. 60)

Sparse vegetation located on the upper exterior slope on the south side of the area.

Photo 9 (TVA Item No. 59)

Sparse vegetation located on the upper exterior slope on the south side of the area.

Photo 10 (TVA Item No. 36)

Animal burrow located on the upper exterior slope on the north side of the area.

Photo 11 (TVA Item No. 33)

Standing water observed on the upper exterior slope on the south side of the area.

Photo 12 (TVA Item No. 57)

Exposed ash observed on the lower exterior slope on the south side of the area.

Photo 13 (TVA Item No. 56)

Exposed ash observed on the lower exterior slope on the south side of the area.

Photo 14 (TVA Item No. 55)

Exposed ash observed on the lower exterior slope on the south side of the area.

Photo 15 (TVA Item No. 54)

Exposed ash observed on the lower exterior slope on the south side of the area.

Photo 16 (TVA Item No. 31)

Erosion observed on the interior of the area, approximately 200 feet long.

Photo 17 (TVA Item No. 30)

Exposed ash in drainage ditch observed on the interior of the area.

Photo 18 (TVA Item No. 37)

Sparse vegetation observed on the upper exterior slope on the north side of the area.

Photo 19 (TVA Item No. 67)

Exposed ash observed on the upper exterior slope on the north side of the area.

Photo 20 (TVA Item No. 9)

Sparse vegetation observed on the lower exterior slope on the north side of the area.

Photo 21 (TVA Item No. 8)

Sparse vegetation observed on the upper exterior slope in ditch line on the north side of the area.

Photo 22 (TVA Item No. 7)

Sparse vegetation observed on the lower exterior slope on the east side of the area.

Photo 23 (TVA Item No. 6)

Animal burrow observed on the lower exterior slope on the east side of the area.

Photo 24 (TVA Item No. 5)

Animal burrow observed on the lower exterior slope on the east side of the area.

Photo 25 (TVA Item No. 4)

Sparse vegetation observed on the upper exterior slope on the east side of the area.

Photo 26 (TVA Item No. 3)

Low spot observed on the bench on the east side of the area.

Photo 27 (TVA Item No. 2)

Erosion observed near the bench on the east side of the area.

Photo 28 (TVA Item No. 1)

Low spot observed on the bench on the east side of the area.

Photo 29

Location of Seep ND-3 on the lower perimeter road on the south side of the area.

Photo 30

Location of Seep ND-2 on the lower perimeter road on the south side of the area.

Photo 31

New lined pond constructed on the southeast side of the Dry Fly Ash Stack, north of the Chemical Treatment Pond – Copper.

STANTEC CONSULTING SERVICES INC.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200

Stantec

Plan View - JSF 2010 Annual Inspection - Dry Fly Ash Stack

Tennessee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
DATE	JULY 2010
DRAWN BY	ANP
CHECKED BY	JRS
CHECKED BY	SAH
SCALE	AS SHOWN
REVISED	
1	
2	
3	
4	
5	
6	
7	
8	

SHEET

1 OF 1

Enclosure B

Bottom Ash Disposal Area 2

1. General Facility Information

Facility Status:	Active	**NID Identification:**	TN07311
Surface Area (inside dikes):	41 Acres (estimated)	**TVA Hazard Classification:**	Not known
Maximum Height (toe to top of dike):	25 feet (measured on the north side)	**Dike Length:**	8600 feet (estimated)
Plant Discharge to Facility:	6.4 MGD	**Current Pool Elevation:**	1133 feet (estimated)

2. Site Visit Information

Stantec Inspection Team:	Donald L. Blanton and James R. Swindler Jr.
TVA Staff Present:	Roy Quinn, Jake Booth, Jason Hill, Mike Huslander, Shannon Bennett, and Tonya Bailey
Field Inspection Date:	June 16, 2010
Weather/Site Conditions:	Mostly Sunny, 85F

3. History/Current and Future Operations

History: The Bottom Ash Disposal Area 2 came online in 1979 to receive all sluiced bottom ash and infrequent sluiced fly ash. A stilling pond exists in the west end of the area, accessed through a rock weir in an internal dike. Bottom ash was stacked in the southeastern portion of the area, starting in 1981. In 1987, sluicing stopped at Area 2 and the ash was dry hauled offsite for disposal. Ash was again sluiced to this area starting sometime between 1990 and 1993. In 1999, a bottom ash collection facility was constructed in the eastern part of the site and run by Appalachian Products, for offsite marketing of bottom ash.

Current Operations: Currently, the Bottom Ash Disposal Area 2 receives sluiced bottom ash, intermittent fly ash (sluiced to separate trench for settlement), and discharges from the Coal Yard Runoff Pond and Chemical Treatment Pond - Iron. Approximately 20,000 dry tons per year of bottom ash is wet-sluiced to the Bottom Ash Disposal Area 2.

Future Planned Operational Changes:	None planned.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing. The TVA Quarterly Facility Inspection results for the third quarter are located in Enclosure L. Portions of that report pertaining to Bottom Ash Disposal Area 2 have been incorporated within this annual inspection report.

4.1. Interior Slopes

Vegetation:	Most of the slopes are heavily vegetated with grass and brush. Exposed ash was observed on the south side of the pond (see Photo 27, TVA Item No. 43; Photo 28, TVA Item No. 44; and Photo 29, TVA Item No. 45).
Trees:	None observed.
Wave Wash Protection:	Rip-rap was observed in the northwest corner of the Stilling Pond (average diameter 12 to 18 inches). Area had past slope instability (2007). Wave wash protection was observed along the southwestern slope.
Erosion:	The internal ash dike that separates the inactive dredge area and the ash pond has numerous erosion gullies (see Photo 22, TVA Item No. 38; Photo 23, TVA Item No. 39; Photo 24, TVA Item No. 40; Photo 25, TVA Item No. 41; and Photo 26, TVA Item No. 42). Erosion due to wave action was observed on the south side of the pond (see Photo 32, TVA Item No. 48).
Instabilities:	Minor sloughing was observed at the northeast corner of the pond (see Photo 12, TVA Item No. 17).
Animal Burrows:	An animal burrow was located on the north side of the pond (see Photo 2, TVA Item No. 68).
Freeboard:	Measured: 7 feet on the north side of the pond, east end 12 to 14 feet on the north, west and south sides adjacent to the Stilling Pond. Design: 18 feet
Encroachments:	Southeast portion of the pond has become an inactive

bottom ash dredge cell. The internal dike was constructed out of ash to separate this area from the pond.

Slope: Measured: 2H:1V
Design: 2H:1V

4.2. Crest

Crest Cover and Slope: Gravel road with grass shoulders, relatively level.

Erosion: None observed.

Alignment: Good.

Settlement/Cracking: None observed.

Bare Spots/Rutting: None observed.

Width: Measured: 15-20 feet
Design: 16 feet

4.3. Exterior Slopes

Vegetation: Most slopes are heavily vegetated with grass. Exposed ash was observed on the north side of the pond (see Photo 9, TVA Item No. 16) and on the south side of the pond (see Photo 15, TVA Item No. 23 and Photo 21, TVA Item No. 29).

Trees: A small cluster of trees was observed near the toe on the exterior slope on the northeast side of the pond (see Photo 13, TVA Item No. 20). Stumps from previous tree growth were observed on the south side of the pond (see Photo 19, TVA Item No. 27).

Erosion: Erosion was observed on the north slope of the pond (see Photo 4, TVA Item No. 11; Photo 7, TVA Item No. 14; and Photo 8, TVA Item No. 15).

Rutting due to mowing operations was observed near the toe on the north slope of the pond (see Photo 10, TVA Item No. 18 and Photo 11, TVA Item No. 19).

Instabilities: Minor sloughing was observed on the north slope of the pond in multiple locations (see Photo 7, TVA Item No. 14 and Photo 8, TVA Item No. 15).

Uniform Appearance:	Good. The north slope is steeper than the south slope.
Seepage:	Three locations of seepage have been noted in past inspections. BAP-SD1 was near the toe of the slope, south of the Stilling Pond (not seen during this inspection), BAP-N2 was near the toe of the slope, north of the Pond (see Photo 1, TVA Item No. 69), and BAP-N1 was near the toe of the slope, north of the pond (not seen during this inspection).
Benches:	None observed. A flat area (natural ground) was observed on the south side at the toe of the slope prior to reaching the wooded area. Width varies from 38 to 55 feet.
Foundation Drains, and Seepage Collection Systems:	None observed.
Instrumentation:	None observed.
Animal Burrows:	Multiple animal burrows were observed on the slopes during the inspection. These include a burrow observed at midslope on the north side of the pond (see Photo 3, TVA Item No. 10), burrows located near the toe on the north side of the pond (see Photo 5, TVA Item No. 12 and Photo 6, TVA Item No. 13), a burrow located at the southeast corner of the pond (see Photo 14, TVA Item No. 21), multiple burrows located on the south side of the pond (see Photo 16, TVA Item No. 24; Photo 17, TVA Item No. 25; Photo 18, TVA Item No. 26; Photo 20, TVA Item No. 28; Photo 30, TVA Item No. 46; Photo 31, TVA Item No. 47; Photo 33, TVA Item No. 49; Photo 34, TVA Item No. 50; Photo 35, TVA Item No. 51; Photo 36, TVA Item No. 52; and Photo 37, TVA Item No. 53) and a burrow located at the southwest corner of the pond (see Photo 38, TVA Item No. 70).
Slope:	Measured: 1.7H:1V (north side) 2H:1V to 3H:1V (south side) Design: 2H:1V
Height:	Measured: 20 to 37 feet (north side) 2.5 to 18 feet to bench (south side) Design: 22 feet (crest to original ground at spillway

section)

4.4. Spillway Weirs/Riser Inlets

Number:	Two – located in northwest corner of the Stilling Pond.
Size, Type and Material:	48-inch concrete riser pipe with skimmer.
Height of Riser Inlets:	7 feet.
Access:	None.
Joints:	Unable to observe.
Mis-Alignment:	Unable to observe.
Closed/Abandoned Conduits:	None observed.

4.5. Outlet Pipes

Number:	Two – discharging into Polly Branch to the northwest of the Stilling Pond.
Size, Type and Material:	42-inch concrete pipes.
Headwall:	None.
Joint Separations:	None observed.
Mis-Alignment:	None observed.
Closed/Abandoned Conduits:	None observed.

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

The following repairs and mitigation have occurred since the previous annual inspection:

- Removal of trees on the north exterior slopes.
- Work Plan 5, Wooden Weir Replacement, (JSF-100707-WP-5) has been issued for construction.
- Work Plan 6, Slope and Animal Burrow Repairs, (JSF-100412-WP-6), has been issued for construction to address slope repairs, wave action erosion on the interior slope of the pond, and animal burrows.
- Work Plan 9, Slope Repair Spillway Outlets, (JSF-100528-WP-9), has been issued

for construction to address the irregular slopes at spillway outlets.

6. Recommendations

The following recommendations are offered for Bottom Ash Disposal Area 2. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the areas of exposed ash observed on the interior slopes (see Photo 27, TVA Item No. 43, Photo 28, TVA Item No. 44; and Photo 29, TVA Item No. 45) and on the exterior slopes (see Photo 9, TVA Item No. 16; Photo 15, TVA Item No. 23; and Photo 21, TVA Item No. 29) be reworked and/or reseeded to support vegetation growth. (Priority 4).
- It is recommended that the areas of erosion observed on the interior slopes (see Photo 22, TVA Item No. 28; Photo 23, TVA Item No. 39; Photo 24, TVA Item No. 40; Photo 25, TVA Item No. 41; Photo 26, TVA Item No. 42; and Photo 32, TVA Item No. 48) and on the exterior slopes (see Photo 4, TVA Item No. 11; Photo 7, TVA Item No. 14; and Photo 8, TVA Item No. 15) be repaired. It is expected that rip-rap will be needed on interior slopes to protect the embankment (Priority 4).
- Areas of tire rutting (see Photo 10, TVA Item No. 18 and Photo 11, TVA Item No. 19) observed during the inspection should be repaired and reseeded. Special care should be taken, if possible, to not perform maintenance on the slopes of the ponds during conditions that could result in rutting. (Priority 5)
- It is recommended that the areas of minor sloughing observed on the interior slope (see Photo 12, TVA Item No. 48) and on the exterior slope of the pond (see Photo 7, TVA Item No. 14 and Photo 8, TVA Item No. 15) be repaired to maintain a uniform appearance along the embankment. (Priority 4)
- It is recommended that the areas of seepage observed near the toe of the exterior slope (see Photo 1, TVA Item No. 69) during the inspection and in past inspections continue to be monitored as indicated in the Seepage Action Plan dated June 25, 2010.
- The animal burrows observed during the inspection on the interior slope (see Photo 2, TVA Item No. 68) and on the exterior slope of the pond (see Photo 3, TVA Item No. 10; Photo 5, TVA Item No. 12; Photo 6, TVA Item No. 13; Photo 14, TVA Item No. 21; Photo 16, TVA Item No. 24; Photo 17, TVA Item No. 25; Photo 18, TVA Item No. 26; Photo 20, TVA Item No. 28; Photo 30, TVA Item No. 46; Photo 31, TVA Item No. 47; Photo 33, TVA Item No. 49; Photo 34, TVA Item No. 50; Photo 35, TVA Item No. 51; Photo 36, TVA Item No. 52; Photo 37, TVA Item No. 53; and Photo 38, TVA Item No. 70) be repaired in accordance with the guidelines given in Enclosure J. (Priority 4)
- It is recommended that the group of trees observed on the northeast corner (see

Photo 13, TVA Item No. 20) and the tree stumps observed on the south slope (see Photo 19, TVA Item No. 27) of the exterior of the pond be removed in accordance with the guidelines shown in Enclosure I. (Priority 4)

Photo 1 (TVA Item No. 69)

Seepage area located on the north side of the pond; documented seep “BAP-N2”.

Photo 2 (TVA Item No. 68)

Animal burrow located on the interior slope on the north side of the pond.

Photo 3 (TVA Item No. 10)

Animal burrow located on the exterior slope on the north side of the pond.

Photo 4 (TVA Item No. 11)

Erosion observed on the exterior slope on the north side of the pond.

Photo 5 (TVA Item No. 12)

Location of three animal burrows near the toe on the north exterior slope of the pond.

Photo 6 (TVA Item No. 13)

Animal burrow located near the toe on the exterior slope on the north side of the pond.

Photo 7 (TVA Item No. 14)

Slough/erosion observed on the exterior slope north of the pond.

Photo 8 (TVA Item No. 15)

Slough/erosion observed on the exterior slope north of the pond. A large piece of iron is also present, 6 feet long and 2 feet wide.

Photo 9 (TVA Item No. 16)

Exposed ash observed on the exterior slope on the north side of the pond.

Photo 10 (TVA Item No. 18)

Rutting observed (beginning) near the toe of the exterior slope on the north side of the pond.

Photo 11 (TVA Item No. 19)

Rutting observed (end) near the toe of the exterior slope on the north side of the pond.

Photo 12 (TVA Item No. 17)

Slough observed on the exterior slope on the northeast interior corner of the pond.

Photo 13 (TVA Item No. 20)

Tree and stump observed near the toe on the exterior slope on the northeast side of the pond.

Photo 14 (TVA Item No. 21)

Animal burrow located on the exterior slope on the southeast side of the pond.

Photo 15 (TVA Item No. 23)

Area of sparse vegetation on exterior slope on the south side of the pond.

Photo 16 (TVA Item No. 24)

Location of two animal burrows on the exterior slope on the south side of the pond.

Photo 17 (TVA Item No. 25)

Animal burrow located on the exterior slope on the south side of the pond.

Photo 18 (TVA Item No. 26)

Animal burrow located on the exterior slope on the south side of the pond.

Photo 19 (TVA Item No. 27)

Tree stump observed on the exterior slope on the south side of the pond.

Photo 20 (TVA Item No. 28)

Animal burrow located on the exterior slope on the south side of the pond.

Photo 21 (TVA Item No. 29)

Exposed ash observed on the exterior slope on the south side of the pond.

Photo 22 (TVA Item No. 38)

Erosion observed on the slope of the interior embankment (divider dike) of the pond.

Photo 23 (TVA Item No. 39)

Erosion observed on the slope of the interior embankment (divider dike) of the pond.

Photo 24 (TVA Item No. 40)

Erosion observed on the slope of the interior embankment (divider dike) of the pond.

Photo 25 (TVA Item No. 41)

Erosion observed on the slope of the interior embankment (divider dike) of the pond.

Photo 26 (TVA Item No. 42)

Erosion observed on the slope of the interior embankment (divider dike) of the pond.

Photo 27 (TVA Item No. 43)

Exposed ash on the interior slope of the south side of the pond.

Photo 28 (TVA Item No. 44)

Exposed ash on the interior slope of the south side of the pond.

Photo 29 (TVA Item No. 45)

Exposed ash on the interior slope of the south side of the pond.

Photo 30 (TVA Item No. 46)

Animal burrow located on the exterior slope of the south side of the pond.

Photo 31 (TVA Item No. 47)

Animal burrow located on the exterior slope of the south side of the pond.

Photo 32 (TVA Item No. 48)

Wave erosion located on the embankment of the interior slope on the south side of the pond.

Photo 33 (TVA Item No. 49)

Animal burrow located on the exterior slope of the south side of the pond.

Photo 34 (TVA Item No. 50)

Animal burrow located on the exterior slope of the south side of the pond.

Photo 35 (TVA Item No. 51)

Animal burrow located on the exterior slope of the south side of the pond.

Photo 36 (TVA Item No. 52)

Animal burrow located on the exterior slope of the south side of the pond.

Photo 37 (TVA Item No. 53)

Animal burrow located on the exterior slope of the south side of the pond.

Photo 38 (TVA Item No. 70)

Animal burrow located on the exterior slope of the southwest corner of the pond.

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Plan View - JSF 2010 Annual Inspection - Bottom Ash Disposal Area and Stilling Pond

Tennessee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
DATE	JULY 2010
DRAWN BY	ANP
CHECKED BY	JRS
CHECKED BY	SAH
SCALE	AS SHOWN
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Enclosure C

Sediment Pond East

1. General Facility Information

Facility Status:	Active	**NID Identification:**	N/A
Surface Area (inside dikes):	1.2 acres	**TVA Hazard Classification:**	N/A
Maximum Height (toe to top of dike):	10 feet (estimated)	**Dike Length:**	360 feet (shared with Chemical Treatment Pond - Iron) 125 feet (shared with Chemical Treatment Pond - Copper)
Plant Discharge to Facility:	N/A	**Current Pool Elevation:**	1102 feet (estimated)

2. Site Visit Information

Stantec Inspection Team:	Donald L. Blanton and James R. Swindler Jr.
TVA Staff Present:	None
Field Inspection Date:	June 15, 2010
Weather/Site Conditions:	Partly Cloudy, 90F

3. History/Current and Future Operations

History: Sediment Pond East went online in 1997 to receive storm water runoff from the Dry Fly Ash Disposal Area.

Current Operations: The pond is a depressed structure with no main embankments. It shares a dike with Chemical Treatment Pond - Iron and Copper to the east. It discharges to a drainage ditch along the main plant road through a concrete riser pipe with skimmer. The riser pipe has 3 inch diameter orifice holes located four feet from the top of the riser for normal outflow operations. The outflow discharges into the drainage ditch and flows to the Sediment Pond West.

Future Planned Operational Changes: None planned.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing.

4.1. Interior Slopes

Vegetation: The south and east slopes were vegetated (see Photo 1). The north and west slopes were not as densely vegetated (see Photo 3). Areas of sparse vegetation were also observed at the southeast corner of the pond (see Photo 2).

Trees: None observed.

Wave Wash Protection: None observed.

Erosion: Erosion was observed in a drainage ditch at the north corner of the pond (see Photo 4).

Instabilities: None observed.

Animal Burrows: None observed.

Freeboard: Measured: 8 feet (all sides)
Design: 3 feet (minimum top of riser structure)
7 feet (typical centerline of orifice holes)

Encroachments: None observed.

Slope: Measured: 2.2H:1V (east side)
3H:1V (north, south, and west sides)

4.2. Crest

Crest Cover and Slope: Grass (shared embankments on the east side with Chemical Treatment Pond – Iron and Chemical Treatment Pond –Copper)

Erosion: None observed.

Alignment: Good.

Settlement/Cracking: None observed.

Bare Spots/Rutting: None observed.

Width: Measured: 20 feet (shared embankments on the east side).

4.3. Exterior Slopes

Vegetation:	Grass (shared embankments on the east side).
Trees:	None observed.
Erosion:	None observed.
Instabilities:	None observed.
Uniform Appearance:	Good.
Seepage:	None observed.
Benches:	None observed.
Foundation Drains, and Seepage Collection Systems:	None observed.
Instrumentation:	None observed.
Animal Burrows:	None observed.
Slope:	Measured: 2.6H:1V (shared embankments on the east side).
Height:	Measured: 15 feet (shared embankments on the east side).

4.4. Spillway Weirs/Riser Inlets

Number:	1 (see Photo 1) – discharging into a drainage channel along the main road to Sediment Pond West.
Size, Type and Material:	48-inch concrete riser structure (with skimmer) with 3-inch diameter orifice holes (10 total) located four feet below the top of the riser.
Height of Riser Inlets:	Six feet above grade.
Access:	Along the south slope.
Joints:	Could not adequately inspect.
Mis-Alignment:	None observed.

Closed/Abandoned Conduits: None observed.

4.5. Outlet Pipes

Number: One – discharging into drainage channel along the main plant road.

Size, Type and Material: 36-inch concrete pipe.

Headwall: None observed.

Joint Separations: None observed.

Mis-Alignment: None observed.

Closed/Abandoned Conduits: None observed.

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

The following repair has been made since the last annual inspection:

- The excess ash has been cleaned out. The interior slopes have been repaired and revegetated.

6. Recommendations

The following recommendations are offered for the Sediment Pond East. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the areas of sparse vegetation on the north and west slopes (see Photo 3) and at the southeast corner of the pond (see Photo 2) be reseeded to be consistent with the rest of the slopes. (Priority 4)
- It is recommended that the erosion observed at the north end of the pond be repaired (see Photo 4). It is expected that rip-rap may be needed to line a portion of the ditch. (Priority 4)
- It is recommended that sediment accumulated at the north end of the pond be removed. (Priority 4)

Photo 1

Floating boom located at the southeast corner of the pond.

Photo 2

Sparse vegetation observed on the interior slope at the southeast corner of the pond.

Photo 3

Sparse vegetation observed on the interior slope along the west slope of the pond.

Photo 4

Erosion and sedimentation in drainage ditch at the north corner of the pond.

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Plan View - JSF 2010 Annual Inspection - Sediment Pond East

Tennessee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
DATE	JULY 2010
DRAWN BY	ANP
CHECKED BY	JRS
CHECKED BY	SAH
SCALE	AS SHOWN
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Enclosure D

Sediment Pond West

1. General Facility Information

Facility Status:	Active	**NID Identification:**	Not known
Surface Area (inside dikes):	3 acres	**TVA Hazard Classification:**	Not known
Maximum Height (toe to top of dike):	20 feet (estimated north end crest to reservoir)	**Dike Length:**	1500 feet (estimated)
Plant Discharge to Facility:	N/A	**Current Pool Elevation:**	1090 feet (estimated)

2. Site Visit Information

Stantec Inspection Team:	Donald L. Blanton and James R. Swindler Jr.
TVA Staff Present:	None
Field Inspection Date:	June 15, 2010
Weather/Site Conditions:	Partly Cloudy, 90F

3. History/Current and Future Operations

History: This pond was named Area G and began operation in 1976 and received all sluiced fly ash from the plant. It was abandoned in 1979, but the spillways remained active. In 1984, construction began on turning the west portion of Area G into a stilling pond for the bathtub area of dry fly ash stack.

Current Operations: Sediment Pond West currently takes runoff from the Dry Fly Ash Disposal Area from three concrete pipes in the northeast corner of the pond. Outflow from Sediment Pond East is directed to the pond via a ditch along the south and through pipe(s) located on the south western corner of the pond. Discharge is to the Holston River through two 36-inch concrete riser spillways.

Future Planned Operational Changes: None planned.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing.

4.1. Interior Slopes

Vegetation:	The interior slopes are heavily vegetated with grass (see Photo 1). An area of sparse vegetation was observed along the east interior slope (see Photo 3).
Trees:	Tree stumps were observed along the east interior slope (see Photo 3).
Wave Wash Protection:	Rip-rap protection was observed on the slopes at the location of inlet pipes on the northeast corner of the pond (see Photo 5).
Erosion:	None observed.
Instabilities:	None observed.
Animal Burrows:	None observed.
Freeboard:	Measured: 10 feet Design: 4 feet (maximum pond elevation)
Encroachments:	None observed.
Slope:	Measured: 1.5H:1V to 1.9H:1V Design: 2H:1V

4.2. Crest

Crest Cover and Slope:	Gravel road with grass shoulder.
Erosion:	None observed.
Alignment:	Good.
Settlement/Cracking:	None observed.
Bare Spots/Rutting:	None observed.
Width:	Measured: 15 feet Design: 16 feet

4.3. Exterior Slopes

Vegetation: Grass on the south and west sides, grass with rip-rap at the river bank on the north side, and grass on the east side (shared with the Dry Fly Ash Stack).

Trees: None observed.

Erosion: None observed.

Instabilities: None observed.

Uniform Appearance: Good.

Seepage: Red water seeps have been noted in the past along the west slope (see Photo 7 for Seep WD-1, Photo 8 for Seep WD-2, and Photo 9 for Seep WD-3).

Benches: None observed. (Ramp down to lower perimeter road on the northwest corner).

Foundation Drains, and Seepage Collection Systems: None observed.

Instrumentation: None observed.

Animal Burrows: None observed.

Slope: Measured: 1.7H:1V on the south side and 2.5H:1V on the north side.
Design: 3H:1V

Height: Measured: 44 feet on the north end, crest to reservoir.
Design: 18 feet on the north end, crest to reservoir.

4.4. Spillway Weirs/Riser Inlets

Number: Two (see Photo 5 and Photo 6), in the west end of the pond.

Size, Type and Material: 36-inch diameter concrete riser structures.

Height of Riser Inlets: None observed.

Access: Unable to access.

Joints: None observed.

Mis-Alignment:	None observed.
Closed/Abandoned Conduits:	None observed.

4.5. Outlet Pipes

Number:	Two, discharging into the Holston River via a diffuser system constructed in the summer of 2009.
Size, Type and Material:	36-inch reinforced concrete into the diffuser system via a 18-inch PVC and 16-inch DIP
Headwall:	At outfall of emergency overflow.
Joint Separations:	None observed.
Mis-Alignment:	None observed.
Closed/Abandoned Conduits:	None observed.

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

The following repairs and mitigation have been performed since the last annual inspection:

- As part of Work Plan 1 dated May 7, 2009, trees and brush were removed from the west exterior slope and revegetated. Trees and brush were also removed from the interior slopes.
- Work Plan 8, Stilling Pond West (JSF-100527-WP-8) has been issued for construction to address drainage issues.

6. Recommendations

The following recommendations are offered for the Sediment Pond West. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the area of sparse vegetation observed along the east interior slope of the pond (see Photo 3) be reseeded to be consistent with the rest of the slope. (Priority 4)
- It is recommended that the tree stumps observed along the east interior slope of the pond (see Photo 2) be removed in accordance with the guidelines shown in Enclosure I. (Priority 4)
- It is recommended that the red water seeps observed from past inspections along

the west slope (see Photo 7 for Seep WD-1, Photo 8 for Seep WD-2, and Photo 9 for Seep WD-3) continue to be monitored as indicated in the Seepage Action Plan dated June 25, 2010.

Photo 1

Floating boom located at the southeast corner of the pond.

Photo 2

Tree stump observed on the east interior slope of the pond.

Photo 3

Sparse vegetation observed along the east interior slope of the pond.

Photo 4

Floating boom located at the northeast corner of the pond.

Photo 5

North riser on the west side of the pond.

Photo 6

South riser on the west side of the pond.

Photo 7

Location of Seep WD-1 on the west side of the pond near Polly Creek.

Photo 8

Location of Seep WD-2 on the west side of the pond near the toe of the embankment.

Photo 9

Location of Seep WD-3 on the west side of the pond near Polly Creek.

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Plan View - JSF 2010 Annual Inspection - Stilling Pond West

Tennesee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
DATE	JULY 2010
DRAWN BY	ANP
CHECKED BY	JRS
CHECKED BY	SAH
SCALE	AS SHOWN
REVISED	
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Enclosure E

Coal Yard Runoff Pond

1. General Facility Information

Facility Status:	Active	**NID Identification:**	Not known
Surface Area (inside dikes):	2.5 acres	**TVA Hazard Classification:**	Not known
Maximum Height (toe to top of dike):	15 feet (estimated)	**Dike Length:**	1700 feet (estimated)
Plant Discharge to Facility:	Not known	**Current Pool Elevation:**	Not known

2. Site Visit Information

Stantec Inspection Team: Donald L. Blanton and James R. Swindler Jr.

TVA Staff Present: None

Field Inspection Date: June 15, 2010

Weather/Site Conditions: Partly Cloudy, 90F

3. History/Current and Future Operations

History: The pond was constructed with the original plant.

Current Operations: The pond accepts stormwater runoff from the Coal Storage Yard, leachate from the Dry Fly Ash Stack, and red water via the force main from Pumps A and B (north of the Dry Fly Ash Stack).

Future Planned Operational Changes: None planned.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing.

4.1. Interior Slopes

Vegetation: The interior slopes surrounding the pond are vegetated with tall grass from crest to midslope (see Photo 7). There are access roads on the inside of the pond that

	have sparse vegetation growth (see Photo 1).
Trees:	None observed.
Wave Wash Protection:	The interior slopes surrounding the pond have rip-rap protection from the toe to mid-slope (see Photo 3).
Erosion:	Erosion was observed on the access road at the east end of the pond (Photo 1) and on the access road on the interior of the pond (see Photo 2, Photo 4, and Photo 5).
Instabilities:	A minor slough was observed on the north interior slope that surrounds the pond (see Photo 7) due to excavation at the toe.
Animal Burrows:	An animal burrow was observed on the north interior slope that surrounds the pond (see Photo 6).
Freeboard:	10 feet (estimated)
Encroachments:	None observed.
Slope:	Measured: 1.5H:1V and steeper

4.2. Crest

Crest Cover and Slope:	No crest, pond is a depression.
Erosion:	N/A
Alignment:	N/A
Settlement/Cracking:	N/A
Bare Spots/Rutting:	N/A
Width:	N/A

4.3. Exterior Slopes

Vegetation:	No exterior slopes, pond is a depression.
Trees:	N/A
Erosion:	N/A
Instabilities:	N/A
Uniform Appearance:	N/A

Seepage:	N/A
Benches:	N/A
Foundation Drains, and Seepage Collection Systems:	N/A
Instrumentation:	N/A
Animal Burrows:	N/A
Slope:	N/A
Height:	N/A

4.4. Spillway Weirs/Riser Inlets

Number:	None (outlet structure is a pump platform with two pumps located at the east side of the pond).
Size, Type and Material:	N/A
Height of Riser Inlets:	N/A
Access:	N/A
Joints:	N/A
Mis-Alignment:	N/A
Closed/Abandoned Conduits:	N/A

4.5. Outlet Pipes

Number:	1 - discharges to Bottom Ash Disposal Area 2.
Size, Type and Material:	12-inch cast iron pipe.
Headwall:	N/A
Joint Separations:	None observed.
Mis-Alignment:	None observed.
Closed/Abandoned Conduits:	None observed.

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

The following repairs and/or mitigations have been performed since the last annual inspection:

- Work Plan 2 (Drawing #10W506-01) has been completed since the last annual inspection. A summary of the repairs is as follows: placed rip-rap along the slopes, placed stone along the interior dikes and access roads, extended the existing RCP, and replaced a leaking pipe.

6. Recommendations

The following recommendations are offered for the Coal Yard Runoff Pond. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the erosion observed on the access road at the east end of the pond (Photo 1) and on the access road on the interior of the pond (see Photo 2, Photo 4, and Photo 5) be repaired. It is expected that the repair can utilize bottom ash or crushed stone. (Priority 4)
- It is recommended that the minor slough observed on the north interior slope that surrounds the pond (see Photo 7) be repaired. (Priority 4)
- It is recommended that the animal burrow observed on the north interior slope that surrounds the pond (see Photo 6) be repaired in accordance with the guidelines given in Enclosure J. (Priority 4)
- A silted pipe inlet was observed on the north slope of the pond (see Photo 3). It is recommended that the debris within the pipe be cleared in order to promote proper drainage into the pond. (Priority 4)
- Sedimentation build-up was observed on the west end at the base of the pond (see Photo 8). It is recommended that this area be monitored for additional sediment accumulation and continue to be removed as conditions warrant.
- It is recommended that maintenance mowing of interior slopes be performed more frequently to allow proper inspection of surfaces. (Priority 4)

Photo 1

Erosion observed at the east end of the interior dike access road that crosses the pond.

Photo 2

Erosion observed along the interior dike access road that crosses the pond.

Photo 3

Silted pipe inlet was observed on the north slope of the pond.

Photo 4

Erosion observed along the interior dike access road that crosses the pond.

Photo 5

Erosion observed along the interior dike access road that crosses the pond.

Photo 6

Animal burrow observed on the north slope of the pond.

Photo 7

Slough observed on the north slope of the pond due to excavation of the toe.

Photo 8

Sedimentation build-up at the base of the pond was observed at the west end.

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Plan View - JSF 2010 Annual Inspection - Coal Yard Drainage Pond

Tennessee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
DATE	JULY 2010
DRAWN BY	ANP
CHECKED BY	JRS
CHECKED BY	SAH
SCALE	AS SHOWN
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Enclosure F

Chemical Treatment Pond
- Copper

1. General Facility Information

Facility Status:	Active	**NID Identification:**	Not known
Surface Area (inside dikes):	0.9 Acres (estimated)	**TVA Hazard Classification:**	Not known
Maximum Height (toe to top of dike):	17 feet (estimated on the west side)	**Dike Length:**	780 feet (estimated)
Plant Discharge to Facility:	Not known	**Current Pool Elevation:**	Not known

2. Site Visit Information

Stantec Inspection Team:	Donald L. Blanton and James R. Swindler Jr.
TVA Staff Present:	None
Field Inspection Date:	June 15, 2010
Weather/Site Conditions:	Partly Cloudy, 90F

3. History/Current and Future Operations

History: Chemical Treatment Pond - Copper was constructed with the original plant.

Current Operations: Currently, it receives effluent from the plant chemical cleaning processes and discharges to the Chemical Treatment Pond - Iron. The Chemical Treatment Pond - Iron in turn discharges to the Bottom Ash Disposal Area 2.

Future Planned Operational Changes: The pond will be closed; however, the schedule is unknown at this time.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing.

4.1. Interior Slopes

Vegetation: The interior slopes are heavily vegetated with grass. There was one area of sparse vegetation cover observed

	at the northeast corner of the pond (Photo 4).
Trees:	Tree growth was observed in the rip-rap protection at the southeast corner of the pond (see Photo 3). Stumps from previous trees were also observed along the west slope (see Photo 1).
Wave Wash Protection:	Some rip-rap protection was observed at the pool elevation (see Photo 3).
Erosion:	None observed.
Instabilities:	None observed.
Animal Burrows:	An animal burrow was observed at midslope on the west side of the pond (Photo 2).
Freeboard:	Measured: 9 feet (east and north sides) 13 feet (south side) 15 feet (west side)
Encroachments:	None observed.
Slope:	2H:1V (crest to bench) and 3H:1V (bench to pond) on the east side. 2H:1V on the north side. 2:5H:1V on the south and west sides.

4.2. Crest

Crest Cover and Slope:	Paved road with grass shoulder on the east side, grass on the north side, grass on the west side (shared with Sediment Pond East), and grass on the south side (shared with Chemical Treatment Pond - Iron).
Erosion:	None observed.
Alignment:	Good.
Settlement/Cracking:	None observed.
Bare Spots/Rutting:	None observed.
Width:	Measured: 40 feet on the east side. 20 feet on the west and south sides.

4.3. Exterior Slopes

Vegetation:	Grass on the south side (shared with Chemical Treatment Pond -Iron). Light brush and grass on the west side (shared with Sediment Pond East).
Trees:	None observed.
Erosion:	None observed.
Instabilities:	None observed.
Uniform Appearance:	Good.
Seepage:	None observed.
Benches:	None observed.
Foundation Drains, and Seepage Collection Systems:	None observed.
Instrumentation:	None.
Animal Burrows:	None observed.
Slope:	2.5H:1V on the south side (shared with Chemical Treatment Pond - Iron). 2H:1V on the west side (shared with Sediment Pond East).
Height:	Measured: 7 feet on the south and west sides.

4.4. Spillway Weirs/Riser Inlets

Number:	None (outlet structure is a pump platform to a 10-inch fiberglass reinforced pipe)
Size, Type and Material:	N/A
Height of Riser Inlets:	N/A
Access:	N/A
Joints:	N/A
Mis-Alignment:	N/A

Closed/Abandoned Conduits: N/A

4.5. Outlet Pipes

Number: One, outlet pipe to Chemical Treatment Pond - Iron, with a recirculating pipe branch back to the pond.

Size, Type and Material: 10-inch fiberglass reinforced.

Headwall: None.

Joint Separations: None observed.

Mis-Alignment: None observed.

Closed/Abandoned Conduits: None observed.

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

No repairs, mitigation, or construction activities have occurred at the Chemical Treatment Pond - Copper site since the last annual inspection.

6. Recommendations

The following recommendations are offered for the Chemical Treatment Pond - Copper sites. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the sparse area observed at the northeast corner of the pond (see Photo 4) be reseeded in order for the vegetation growth to be consistent with the rest of the slope. (Priority 4)
- It is recommended that the tree growth observed in the rip-rap protection at the southeast corner of the pond (see Photo 3) and the tree stump observed on the west interior slope of the pond (see Photo 1) be removed in accordance with the guidelines shown in Enclosure I. (Priority 4)
- It is recommended that the animal burrow observed at the midslope on the west side of the pond be repaired in accordance with the guidelines given in Enclosure J. (Priority 4)

Photo 1

Tree stump observed on the west interior slope of the pond.

Photo 2

Animal burrow observed on the west interior slope of the pond.

Photo 3

Tree growth observed in rip-rap protection at the southeast corner of the pond.

Photo 4

Sparse vegetation observed at the northeast corner of the pond.

STANTEC CONSULTING SERVICES INC.

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Plan View - JSF 2010 Annual Inspection - Chemical Treatment Pond - Copper

Tennessee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
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CHECKED BY	JRS
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SCALE	AS SHOWN
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1 OF 1

Enclosure G

Chemical Treatment Pond
- Iron

1. General Facility Information

Facility Status:	Active	**NID Identification:**	Not known
Surface Area (inside dikes):	2.7 acres (estimated)	**TVA Hazard Classification:**	Not known
Maximum Height (toe to top of dike):	10 feet (estimated)	**Dike Length:**	1390 feet (estimated)
Plant Discharge to Facility:	Not known	**Current Pool Elevation:**	Not known

2. Site Visit Information

Stantec Inspection Team: Donald L. Blanton and James R. Swindler Jr.

TVA Staff Present: None

Field Inspection Date: June 15, 2010

Weather/Site Conditions: Partly Cloudy, 90F

3. History/Current and Future Operations

History: The Chemical Treatment Pond - Iron was constructed with the original plant.

Current Operations: The pond receives effluent from the plant chemical cleaning processes and effluent from the Chemical Treatment Pond - Copper. Effluent is pumped from the pond to the Bottom Ash Disposal Area 2.

Future Planned Operational Changes: The pond will be closed; however, the schedule is unknown at this time.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing.

4.1. Interior Slopes

Vegetation: The interior slopes are heavily vegetated with grass (see Photo 5).

Trees:	Tree growth was observed on the south interior slope (see Photo 1) of the pond.
Wave Wash Protection:	Some rip-rap protection was observed along the entire slope at pool elevation.
Erosion:	Toe erosion was observed at the southeast corner of the pond (see Photo 2).
Instabilities:	Minor sloughing was observed in the northeast corner of the pond (see Photo 5).
Animal Burrows:	Two animal burrows were observed on the northeast corner of the interior of the pond (see Photo 3).
Freeboard:	Measured: 10 feet (estimated) from the top of the road on the east side.
Encroachments:	None observed.
Slope:	Measured: 2.5H:1V on all sides.

4.2. Crest

Crest Cover and Slope:	Road with grass cover on the east side, grass on the north side (shared with Chemical Treatment Pond - Copper), grass on the west side (shared with Sediment Pond East), and gravel parking area with grass on the south side.
Erosion:	None observed.
Alignment:	Good.
Settlement/Cracking:	None observed.
Bare Spots/Rutting:	None observed.
Width:	Measured: 40 feet on the east side, 20 feet on the north and west sides.

4.3. Exterior Slopes

Vegetation:	The exterior slopes (east, north, and west sides) are heavily vegetated with grass.
Trees:	None observed.

Erosion:	None observed.
Instabilities:	None observed.
Uniform Appearance:	Good.
Seepage:	None observed.
Benches:	None observed.
Foundation Drains, and Seepage Collection Systems:	None observed.
Instrumentation:	None observed.
Animal Burrows:	None observed.
Slope:	Measured: 2.5H:1V on the north and east sides. 1.3H:1V on the west side.
Height:	Measured: 6 feet on the east side. 13 feet on the north side. 11 feet on the west side.

4.4. Spillway Weirs/Riser Inlets

Number:	None (outlet structure is pump platform, going to Bottom Ash Disposal Area 2).
Size, Type and Material:	N/A
Height of Riser Inlets:	N/A
Access:	N/A
Joints:	N/A
Mis-Alignment:	N/A
Closed/Abandoned Conduits:	N/A

4.5. Outlet Pipes

Number:	One, outlet pipe to Bottom Ash Disposal Area 2. Also has a recirculation pipe flowing back into the pond.
Size, Type and Material:	10-inch fiberglass reinforced.

Headwall: None, pipe was from pump station on the east side.

Joint Separations: None observed.

Mis-Alignment: None observed.

Closed/Abandoned Conduits: None observed.

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

No repairs, mitigation, or construction activities have occurred at Chemical Treatment Pond-Iron since the last annual inspection.

6. Recommendations

The following recommendations are offered for Chemical Treatment Pond-Iron. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the tree growth observed on the south interior slope (see Photo 1) be removed in accordance with the guidelines shown in Enclosure I. (Priority 4)
- It is recommended that the toe erosion observed at the interior southeast corner of the pond (see Photo 2) be repaired. It is expected that rip-rap will be needed to protect the embankment (Priority 4).
- It is recommended that the minor sloughing observed in the northeast corner of the pond be repaired (see Photo 5). (Priority 4)
- It is recommended that the two animal burrows observed at the northeast corner of the pond (see Photo 3 and Photo 4) be repaired in accordance with the guidelines given in Enclosure J. (Priority 4)
- It is recommended that maintenance mowing of heavily vegetated grass be performed more frequently to allow proper inspection of surfaces. (Priority 4)

Photo 1

Tree growth observed on the south interior slope of the pond.

Photo 2

Toe erosion observed at the southeast corner of the pond.

Photo 3

Animal burrow observed at the northeast corner of the pond.

Photo 4

Animal burrow observed at the northeast corner of the pond.

Photo 5

Minor sloughing in the embankment observed at the northeast corner of the pond.

STANTEC CONSULTING SERVICES INC.
11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200

Stantec

Plan View - JSF 2010 Annual Inspection - Chemical Treatment Pond - Iron

Tennessee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
DATE	JULY 2010
DRAWN BY	ANP
CHECKED BY	JRS
CHECKED BY	SAH
SCALE	AS SHOWN
REVISED	
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Enclosure H

Ash Disposal Area J

1. General Facility Information

Facility Status: Inactive

Surface Area: 22 acres

Maximum Height (toe to top of stack): 50 feet (estimated)

2. Site Visit Information

Stantec Inspection Team: Donald L. Blanton and James R. Swindler Jr.

TVA Staff Present: None

Field Inspection Date: June 15, 2010

Weather/Site Conditions: Partly Cloudy, 85F

3. History/Current and Future Operations

History: Ash Disposal Area J went online in late 1982, early 1983 and was used as a fly ash settlement pond. Ash was sluiced to the east end of the area. The west side of the disposal area acted as a stilling pond and contained two concrete riser structures which discharged into the Holston River. Sluicing was stopped in 1988 and the pond was dewatered and used as a dry stacking area. Ash Disposal Area J was inactive starting in the early 1990's and officially closed in 1999.

Current Operations: Ash Disposal Area J is a former ash pond and dredge cell. It has been closed and filled to its banks and capped. Therefore, other than short slopes that form the crest/access road, there are no interior slopes associated with this area. No active stacking is occurring.

Mowing and removal of excess vegetation on the ponds and dry stacks are done once per year in late summer, early fall. Other maintenance work is done on an as-needed basis.

The spillway and detention pond on the northwest corner of the area appear to be in good condition (see Photo 10). The outlet structure consists of two concrete riser structures, a 48-inch inlet with 36-inch outlet. The outlet discharges to the north into the Holston River, but pipes do not reach the river and discharge along the bank.

Future Planned Operational Changes: None.

4. Stantec Field Observations

See attached Photos and Site Plan Drawing.

4.1. Exterior Slopes and Benches

Vegetation: The slopes are heavily vegetated with grass and some brush.

Trees: One tree was observed at the midslope of the north slope (see Photo 8). Multiple small trees were observed growing in the rip-rap channels on the south side of the area (see Photo 12).

Stumps from previously removed trees (see Photo 19) were observed on the north side of the area.

Erosion: None observed.

Instabilities: None observed.

Uniform Appearance Good.

Benches: Two benches were observed. The first bench is an access road around the area, approximately two feet below the top of area, 15 feet wide on all sides. The second bench is on the north and west sides located 21 feet below the access road on the north side and 29 feet below the access road on the west side. The width is 10 feet on the north side and 18 feet on the west side.

Slope: 2.5H:1V on the east and south exterior slopes of the pond.
4H:1V crest to bench, 2H:1V bench to river on the west exterior slope of the pond.
2.5H:1V crest to bench 1H:1V bench to river on the north exterior slope of the pond.

Height: 18 feet above the parking lot at the east end of the pond.
50 feet above the river along the north side of the pond.
41 feet above the river at the west end of the pond.
28 feet above the road along the western portion on the south side of the pond.
15 feet above the road along the eastern portion on the south side of the pond.

Other: Circular depressions (see Photo 1) and settled boring holes (see Photo 6) were observed at various locations along the access road on the bench near the crest of the area.

Tire rutting was observed at various locations within the area. The locations included:

- Along the access road on the bench near the crest on the northeast (see Photo 2), north (see Photo 6), west (see Photo 11), and south (see Photo 17) sides of the area;
- On the crest on the north (see Photo 5 and Photo 7) and south (see Photo 14) sides of the area.

Four animal burrows were observed during the inspection:

- Three were located on the north slope near the crest (see Photo 3, Photo 4, and Photo 9);
- The fourth was located on the south slope near the crest (see Photo 16).

4.2. Perimeter Drainage Ditches and Down-Drains

Vegetation:	Downed tree limbs and vegetation (see Photo 21) were observed in the drainage ditch on the south side of the area.
Rip-Rap Channel Lining:	Rip-rap was observed below the outlet of selected drainage pipes (see Photo 13) on the north and south sides of the area.
Erosion:	None observed.
Sedimentation in Ditches:	None observed.
Standing Water in Ditches or on Benches:	Standing water was observed at the toe of the embankment (see Photo 20) in the drainage ditch on the south side of the area.
Silted/Impeded Drainage Pipes:	One pipe was damaged at its outlet (see Photo 15).
Other:	Tire rutting was observed in a drainage ditch near a rip-rap channel (see Photo 13) on the south side of the area. Damage to a drainage pipe underlying an access road on the east end of the pond was observed (see Photo 18).

5. Repairs/Mitigation/New Construction Activities Since Last Annual Inspection

The following repairs and/or mitigation were conducted since the previous annual inspection:

- Trees and shrubs were removed from the south exterior slope and revegetated during the summer of 2009. In addition, several old stumps were removed along the north exterior slope.

6. Recommendations

The following recommendations are offered for the Ash Disposal Area J site. Priority codes are included in parenthesis and described in Enclosure K.

- It is recommended that the tree observed on the exterior north slope (see Photo 8), the trees observed in the rip-rap on the exterior south slope (see Photo 12), and the tree stumps observed on the exterior north slope (see Photo 19) be removed in accordance with the guidelines shown in Enclosure I. (Priority 4)
- It is recommended that the circular depressions (see Photo 1) and the boring holes that have settled (see Photo 6) along the access road on the bench near the crest be repaired. The path is used as a recreation trail for the public and these holes could be a trip hazard. (Priority 4)
- It is recommended that the rutting observed on the bench near the crest (see Photo 2, Photo 11, and Photo 17), the rutting observed on the interior of the pond near the crest (see Photo 5, Photo 7, and Photo 14), and the rutting observed in the drainage ditches along the perimeter of the area be repaired and vegetation reestablished in these location when applicable. (Priority 5) It is recommended that mowing operations be conducted at times that will not cause rutting of the surface.
- It is recommended that the three animal burrows observed on the exterior north slope (see Photo 3, Photo 4, and Photo 9) and the animal burrow observed on the exterior south slope (see Photo 16) be repaired in accordance with the guidelines given in Enclosure J. (Priority 4)
- It is recommended that the drainage ditches on the perimeter of the area be cleaned of downed tree limbs (see Photo 21) to allow proper drainage in the ditches during a rain event. (Priority 4)
- It is recommended that the drainage ditches along the perimeter of the area should be regraded to promote positive drainage and eliminate standing water (see Photo 20). (Priority 4)
- It is recommended that the inlets and outlets of the pipe structures within the area be monitored and repaired as conditions warrant. Damage to the pipes was observed on the south side of the area (see Photo 15) and beneath an access road to the crest of the area on the southeast end of the area (see Photo 18).

Photo 1

Circular holes observed in the top of the access road near the crest on the northeast corner of the area.

Photo 2

Rutting observed in the top of the access road near the crest on the northeast corner of the area.

Photo 3

Animal burrow observed on the exterior north slope above the access road near the crest, on the east end of the area.

Photo 4

Animal burrow observed on the exterior north slope above the access road near the crest, on the east end of the area.

Photo 5

Rutting observed in the top of the exterior slope above the access road near the crest on the north side of the area.

Photo 6

Settlement of boreholes observed on the access road near the crest on the north side of the area.

Photo 7

Rutting/sparse area observed on the exterior north slope above the access road near the crest of the area.

Photo 8

Tree observed on the north exterior slope of the area.

Photo 9

Animal burrow observed on the exterior north slope above the access road near the crest of the area.

Photo 10

Spillway location on the northwest corner of the area.

Photo 11

Rutting observed on the access road near the crest on the west end of the area.

Photo 12

Trees observed in rip-rap on the south exterior slope of the area.

Photo 13

Damp area and rutting observed near drainage outlet at the toe of the exterior slope on the south side of the area.

Photo 14

Rutting observed on the exterior south slope near the crest of the area.

Photo 15

Damaged Corrugated Metal Pipe (CMP) on the exterior slope on the south side of the area.

Photo 16

Animal burrow observed on the exterior south slope near the crest of the area.

Photo 17

Rutting observed on the access road near the crest on the south side of the area.

Photo 18

Bent pipe observed near the drainage ditch on the east side of an access road on the east end of the area.

Photo 19

Tree stump observed on the north exterior slope of the area.

Photo 20

Standing water was observed at the toe of the exterior embankment on the south side of the area.

Photo 21

Downed trees and sediment observed in the drainage ditch on the south side of the area.

STANTEC CONSULTING SERVICES INC.

11687 Lebanon Rd.
Cincinnati, Ohio
45241-2012
513-842-8200

Plan View - JSF 2010 Annual Inspection - Ash Disposal Area J

Tennessee Valley Authority
John Sevier Fossil Plant
Rodgersville, Hawkins County, Tennessee

PROJECT NO.	175550002
DATE	JULY 2010
DRAWN BY	ANP
CHECKED BY	JRS
CHECKED BY	SAH
SCALE	AS SHOWN
REVISED	
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Enclosure I

General Guidelines for Tree Removal and Maintenance of Vegetation

General Guidelines for Tree Removal on Slopes at TVA Fossil Plants

Identification

Trees and heavy brush growth should be controlled on TVA dams and dikes. If left in place, trees can result in the creation of seepage paths within the embankment. Allowing vegetation to become overgrown restricts the level of inspection that can be performed on the structure. General guidelines for removal of trees and maintenance of vegetation are provided below. Evaluations other than those outlined below shall be made by a geotechnical engineer in consultation with facility representatives on a case-by-case basis.

Guidelines for Tree Removal and Maintenance of Vegetation

Tree Removal

At locations where it is not reasonable to remove trees by a mowing them with a bush hog or with similar mowing equipment:

- All trees shall be cut using a handsaw or chainsaw and the cut tree and branches discarded.
- Remove the remaining tree trunk, stump, and rootwad.
- Grub any remaining roots of the tree so that only 2 inches or smaller roots are left in place.
- The resulting cavity from removal of the rootwad shall be cleaned of loose soil and debris.
- The cavity shall then be backfilled with cohesive soil and compacted and the area seeded to re-establish vegetation. If the tree has been removed from along the upstream or downstream face of a slope, benches shall be cut into the slope face where the cavity is to be backfilled. This will allow for a proper bond between the existing dike and the backfill being used to reform the slope. If benches are needed, bench heights shall not exceed 4 to 5 feet in height.

Maintenance of Vegetation

- Mowing is recommended at regular intervals to allow for appropriate inspection of embankment slopes.
- If areas lacking vegetation are observed during mowing and clearing operations or subsequent inspections, the areas should be seeded to re-establish vegetation as soon as practicable.

Enclosure J

General Guidelines for
Repair of Animal Burrows

General Guidelines for Repair of Animal Burrows at TVA Fossil Plants

Identification

Animal burrows are relatively common along slopes of dams and dikes. If left untreated, these burrows can result in the creation of seepage paths through the embankment. Additionally tunnels may eventually collapse resulting in surface irregularities in the embankment. General guidelines for repair of animal burrows are provided below. However, if the burrow extends more than three (3) feet below the embankment surface or extends across a dam, the repair of these features should be evaluated by a geotechnical engineer on a case-by-case basis so that appropriate recommendations can be made.

Guidelines for Burrow Repair

It is recommended that shallow animal burrows (up to 3 feet) shall be repaired with surface treatment methods as follows:

- Animals shall be captured and removed from the area. It is recommended that a local conservation representative be consulted prior to this action.
- The animal burrow shall be excavated and cleaned of excess soil along its pathway up to a depth of 3 feet. With this type of repair, an isolated excavated area of the embankment is exposed.
- The excavated area shall be backfilled with compacted cohesive material.
- If the burrow extends more than three feet into the embankment, a geotechnical engineer shall further evaluate the burrow depth and recommend a deep burrow treatment method or other exploratory methods.
- One possible method which may be recommended to treat a deep burrow can consist of a special grout (flowable fill) pumping system with a hose inserted into the burrow.

Ultimately, these repairs will not prevent rodents from creating new burrows within dam embankments. Accordingly, continual efforts must be made to discourage rodent activity. Mowing of vegetation on the slopes / crest of the embankment and trimming of water-side vegetation at regular intervals will tend to discourage rodents from re-establishing burrows along the dike and will allow timely observation of new activity if it occurs.

Enclosure K

Dam Safety Priorities

Dam Safety Priorities

	Description
1	Urgent - Correct Immediately
2	Complete Within 1 Week of inspection
3	Complete Within 1 Month (30 days) of Inspection
4	Complete Within 6 Months of Original Entry Date
5	Complete Within 1 Year of Original Entry Date
6	Complete Within 3 Years of Original Entry Date
7	Complete Within 5 Years of Original Entry Date
8	Work During Scheduled Outage - Blank Until Outage is Scheduled

Enclosure L

TVA Third Quarter Facility Inspection

ITEM NO.	DESCRIPTION	PICTURE NO.	POINT NO.	NORTHING	EASTING	COMMENT
1	Low area (75ft long - typical on this bench)	102	2000	735563.75	2892328.42	
2	Erosion (10ft long)	103	2001	735698.40	2892303.68	Repair
3	Low area (typical on this bench)	104	2002	735999.31	2892439.50	Previously Identified
4	No vegetation (20ft x 75ft)	105	2003	736008.77	2892583.62	Previously Identified
5	Animal burrow (1ft dia x 2ft deep)	106	2004	736461.84	2892871.39	Repair burrow
6	Animal burrow (0.5ft dia x 1ft deep)	107	2005	736469.92	2892870.62	Repair burrow
7	Poor vegetation (30ft x 50ft)	108	2006	736689.67	2892841.96	Revegetate
8	Poor vegetation/rutting (typical in ditch line)	109	2007	736584.54	2891920.22	Revegetate
9	Poor vegetation (50ft x 100ft)	110	2008	736477.57	2891681.19	Revegetate
10	Animal burrow	111	2009	734112.04	2892802.67	Previously Identified
11	Erosion	112	2010	734144.76	2892972.77	Previously Identified
12	Animal burrow	113-115	2011	734207.78	2893061.98	Previously Identified
13	Animal burrow	116	2012	734219.81	2893097.50	Previously Identified
14	Slough/erosion	117	2013	734225.11	2893200.74	Previously Identified
15	Slough/erosion/large piece of iron (6ft x 2ft)	118	2014	734238.14	2893252.85	Repair and remove iron
16	Exposed ash (10ft x 5ft)	119	2015	734334.60	2893502.06	Repair
17	Slough	120	2016	734363.27	2893642.29	Previously Identified
18	Rutting (beginning)	121	2017	734400.81	2893588.01	Repair
19	Rutting (end)	122	2018	734398.22	2893626.89	Repair
20	Tree and stump in toe of dike	123	2019	734417.84	2893640.68	Remove tree and stump
21	Animal burrow (1ft dia x 2ft deep)	124	2020	734247.30	2893716.37	Repair
22	Exposed ash (10ft x 25ft)	-	2021	734166.52	2893696.23	Repair
23	No vegetation (5ft x 10ft)	125	2022	734127.83	2893645.37	Revegetate
24	(2)Animal burrows	126-127	2023	734100.64	2893609.95	Previously Identified
25	Animal burrow	128	2024	734064.21	2893530.11	Repair burrow
26	Animal burrow	129	2025	734017.76	2893457.21	Repair burrow
27	Small stump	130	2026	733891.38	2893240.30	Remove stump
28	Animal burrow (0.8ft dia)	131	2027	733788.35	2893029.36	Repair burrow
29	Exposed ash?	132	2028	733551.80	2892614.03	Repair
30	Exposed ash in ditch	880	3000	734765.98	2891153.61	Regrade
31	Erosion (beginning - 200ft long)	881-882	3001	734954.53	2891000.27	Repair
32	Erosion (end)	-	3002	734820.60	2890900.53	Repair
33	Low area/standing water	883	3003	734573.84	2890510.56	
34	Erosion/multiple rills	884	3004	734368.37	2889674.84	Repair
35	No vegetation	885	3005	734489.31	2889682.73	Revegetate
36	Animal burrow	886	3006	734728.63	2890203.59	Repair burrow
37	No vegetation	887	3007	735158.49	2890871.18	Revegetate
38	Erosion	889	3008	733640.05	2892103.55	Previously Identified
39	Erosion	890	3009	733577.73	2892089.25	Previously Identified
40	Erosion	891	3010	733533.90	2892075.37	Previously Identified
41	Erosion	892	3011	733465.00	2892052.37	Previously Identified
42	Erosion	893	3012	733420.53	2892041.49	Previously Identified
43	Exposed ash	894	3013	733272.79	2891767.19	Repair
44	Exposed ash	895	3014	733275.62	2891622.02	Repair
45	Exposed ash	896	3015	733283.90	2891512.09	Repair
46	Animal burrow	897	3016	733355.61	2890944.99	Repair burrow
47	Animal burrow	898	3017	733369.65	2890880.64	Repair burrow
48	Wave erosion	899	3018	733445.70	2890783.59	Repair
49	Animal burrow	900	3019	733475.99	2890386.53	Repair burrow
50	Animal burrow	901	3020	733502.79	2890241.20	Repair burrow
51	Animal burrow	902	3021	733556.39	2889927.06	Repair burrow
52	Animal burrow	903	3022	733570.43	2889852.78	Repair burrow
53	Animal burrow	904	3023	733573.92	2889838.38	Repair burrow
54	Exposed ash	1024	4000	734668.59	2890863.92	Repair
55	Exposed ash	1025	4001	734639.74	2890818.97	Repair
56	Exposed ash (south side, lower slope)	1026	4002	734623.55	2890785.23	Repair
57	Exposed ash (south side, lower slope)	1027	4003	734573.57	2890661.34	Repair
58	Erosion (south side, lower slope)	-	4004	734469.62	2890342.88	Repair
59	Poor vegetation	1028	4005	734446.21	2890247.88	Revegetate
60	Poor vegetation	1029	4006	734390.34	2890046.76	Revegetate
61	Exposed ash	-	4007	734333.35	2890031.61	Repair
62	Poor vegetation	1030	4008	734337.89	2889956.04	Revegetate
63	Tire depression	1031	4009	734373.53	2889940.41	Repair
64	Poor vegetation	1032	4010	734254.92	2889813.29	Revegetate
65	Standing water	1033	4011	734432.58	2889451.40	Need engineering recommendation
66	Flat ditch	1034	4012	734526.27	2889427.62	Need engineering recommendation
67	Exposed ash	1037	4013	736091.09	2891654.54	Repair
68	Animal burrow (4ft down bank)	1036	4014	733917.45	2891509.75	Repair burrow
69	Seep	1038	4015	733967.42	2891259.78	Need engineering recommendation
70	Animal burrow	1040	4016	733613.47	2889666.57	Repair burrow

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APPENDIX A

Document 7

TVA Daily Inspection

RHO&M Daily Field Report

Date	09/05/11	Plant	JSF	Partner	CHARAH/AMS

Project No.		Weather Conditions :	light rain	High: 82	Low :58	Rain Gauge Reading:

Daily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

none

Who Was Notified of Deficiency:	N/A	Date & Time of Notification:	N/A

	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
Near Misses	0	0	Near Misses	0	0
First Aides	0	0	REE's	0	0
Recordable	0	0	NOV's	0	0
Interventions & Observations	0	62	Interventions & Observations	0	0
Safety Coaching	0	0	Safety Coaching	0	0

Safety / Environmental Explanation: N/A

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
Silo "Marketable"	0	0	0	0	0	no work performed
Silo "Disposable"	0	0	0	0	0	
Silo "C"	N/A	N/A	N/A	N/A	N/A	
Silo "D"	N/A	N/A	N/A	N/A	N/A	

Daily Production / Materials Handled

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours	Loc 1	Loc 2	Loc 3	Comments
Bottom Ash	0	0	0	0				
Fly Ash	0	0	0	0				
Pyrites Hauled	0	0	0	0				
Gypsum Dipped	0	0	0	0				
Boiler Slag	0	0	0	0				
Coal Fine Haul	0	0	0	0				
Coal Fine Blend	0	0	0	0				
Dirt	0	0	0	0				
Sand	0	0	0	0				
Rock	0	0	0	0				
Water/Dust Cont	0	0	0	0				
Dredging	0	0	0	0				
CYROP	0	0	0	0				
Cenospheres	0		0					

Materials / Equipment Delivered

Description: no materials delivered

Plant / Visitor Interface:		Completed By:	RUSSELL BYRNE

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
J.Davis-Oper		Dozer	D085		
A.Swiney-oper		water truck/compactor	WT434/DR775		
J.Lane		haul truck	artic		
P.Jarvis		haul truck	MT525		
B.Harrell-oper		excavator	lb722		
M.Mcamis-oper		water truck/compactor	WT434/DR775		
J.Helton oper		backhoe	BH884		
J.Reed-team		MT526	MT526		
D.Brown-operator		compactor	Dr775		

Activity Descriptions: no work performed

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
B. Harrell	0		excavator	0	
J.Reed-team		haul truck	MT526	0	
A.swiney-oper		dozer		0	
J.Helton-oper	0	skid steer	skid steer	0	
L.Poindexter-lab	0	labor	labor	0	
E.Webb-labor	0			0	
J.Lane-team	0	haul truck	artic	0	
D.Brown-oper	0			0	
M.McAmis-oper	0	excavator	rental	0	

Daily Activity Description: no extra work performed

RHO&M Daily Field Report

Date	09/06/11	Plant	JSF	Partner	CHARAH/AMS

Project No.		Weather Conditions :	cloudy	High 85	Low 65	Rain Gauge Reading:2.3" rain

Daily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

None

Who Was Notified of Deficiency:	N/A	Date & Time of Notification:	N/A

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
Near Misses	0	0	Near Misses	0	0
First Aides	0	0	REE's	0	0
Recordable	0	0	NOV's	0	0
Interventions & Observations	0	62	Interventions & Observations	0	0
Safety Coaching	0	0	Safety Coaching	0	0

Safety / Environmental Explanation: none

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
Silo "Marketable"	4.9	4.8	0	0	0	
Silo "Disposable"	5.3	3	25	0	4	
Silo "C"	N/A	N/A	N/A	N/A	N/A	
Silo "D"	N/A	N/A	N/A	N/A	N/A	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours	Loc 1	Loc 2	Loc 3	Comments
Bottom Ash	4	100	0	0.5				
Fly Ash	25	750	0	4				
Pyrites Hauled	1	6.19	0	1				
Gypsum Dipped	0	0	0	0				
Boiler Slag	0	0	0	0				
Coal Fine Haul	0	0	0	0				
Coal Fine Blend	0	0	0	0				
Dirt	0	0	0	0				
Sand	0	0	0	0				
Rock	0	0	0	0				
Water/Dust Cont	0	0	0	0				
Dredging	0	0	0	0				
CYROP	0	0	0	0				
Cenospheres	0		0					

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Materials / Equipment Delivered

Description:none

Plant / Visitor Interface:	None	Completed By:	RUSSELL BYRNE

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
J.Davis-oper	8	dozer	D085	6.5	
B.Harrell-oper		excavator	LB722		
M.Mcamis-oper		water truck/compactor	WT434		
P.Jarvis-team	8	haul truck	MT525	6.5	
J.Lane-team		haul truck	rental		
A.Swiney-oper	8	water truck/compactor	WT434	6.5	
J.Reed-team	8	haul truck	MT526	6.5	
D.Brown-oper	8	compactor	DR775	6.5	
J.Helton-oper		compactor	DR775		

Activity Descriptions: routine ash handling. Haul from BAS pond to landfill.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
J.Davis-oper		dozer	d085		
B.Harrell-oper	8	dozer	rental	6.5	
M.Mcamis-oper	8	excavator	EX246	6.5	
J.Helton-oper	8	skid steer	rental	6.5	
J.Reed-team		haul truck	MT525		
L.Poindexter-lab	8	laborer		6.5	
E.Webb laborer	8	laborer		6.5	
J.Lane-team	8	haul truck	rental	6.5	
D.Brown-oper		compactor	DR775		
J.Wallen-oper	training			6.5	
A.Swiney-oper		water truck	WT434		

Daily Activity Description: South slope repair.

RHO&M Daily Field Report

Date	09/07/11	Plant	JSF		Partner	CHARAH/AMS
Project No.		Weather Conditions :	sunny	High 77	Low 60	Rain Gauge Reading: 0.3"rain

Daily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

None

Who Was Notified of Deficiency:	N/A	Date & Time of Notification:	N/A

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
Near Misses	0	0	Near Misses	0	0
First Aides	0	0	REE's	0	0
Recordable	0	0	NOV's	0	0
Interventions & Observations	2	64	Interventions & Observations	0	0
Safety Coaching	0	0	Safety Coaching	0	0

Safety / Environmental Explanation: None.

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
Silo "Marketable"	4.4	4.4	0	0	0	no fly ash haul at the request of the plant. Silo levels low. Near empty. Haul from BAS pond.
Silo "Disposable"	3.1	3.2	0	0	0	
Silo "C"	N/A	N/A	N/A	N/A	N/A	
Silo "D"	N/A	N/A	N/A	N/A	N/A	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours	Loc 1	Loc 2	Loc 3	Comments
Bottom Ash	32	800	0	6.5				
Fly Ash	0	0	0	0				
Pyrites Hauled	0	0	0	0				
Gypsum Dipped	0	0	0	0				
Boiler Slag	0	0	0	0				
Coal Fine Haul	0	0	0	0				
Coal Fine Blend	0	0	0	0				
Dirt	0	0	0	0				
Sand	0	0	0	0				
Rock	0	0	0	0				
Water/Dust Cont	0	0	0	0				
Dredging	0	0	0	0				
CYROP	0	0	0	0				
Cenospheres	0		0					

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Materials / Equipment Delivered

Description:

Plant / Visitor Interface:		Completed By:	RUSSELL BYRNE

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
J.Davis-oper	8	dozer/compactor	D085	6.5	
B.Harrell-oper			DR775		
M.Mcamis-oper	8	water truck/compactor	WT434	6.5	
P.Jarvis	8	haul truck	MT525	6.5	
J.Lane-team		haul truck	MT526		
A.Swiney-oper		dozer/compactor	DR775		
J.Reed-team	8	haul truck	MT526	6.5	
J.Helton-oper		dozer/compactor	D085		
D.Brown-oper	8	compactor		6.5	
E.Brown-labor					

no fly ash haultoday. Haul from BAS pond.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
B.Harrell-oper	8	excavator	rental	6.5	
D.Brown-oper	8	compactor		6.5	
E.Webb-labor	8			6.5	
J.Helton-oper	8	skidsteer	rental	6.5	
J.Reed-team		haul truck	MT526		
P.Jarvis-team					
L.Poindexter-lab	8	labor	n/a	6.5	
J.Lane-team	8	haul truck	rental	6.5	
j.Davis-oper		dozer	D085		
J.Wallen-oper	8	compactor	Dr775	6.5	
M.McAmis-oper		water truck	WT434	6.5	

Daily Activity Description: South slope repair work.

RHO&M Daily Field Report

Date	09/08/11		Plant	JSF		Partner	CHARAH/AMS

Project No.		Weather Conditions :	cloudy	High: 76	Low 58	Rain Gauge Reading: 0

Daily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

None

Who Was Notified of Deficiency:	N/A	Date & Time of Notification:	N/A

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
Near Misses	0	0	Near Misses	0	0
First Aides	0	0	REE's	0	0
Recordable	0	0	NOV's	0	0
Interventions & Observations	0	64	Interventions & Observations	0	0
Safety Coaching	0	0	Safety Coaching	0	0

Safety / Environmental Explanation None

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
Silo "Marketable"	4.4	4.4	0	0	0	no fly ash haul
Silo "disposable"	3.5	3.8	0	0	0	
Silo "C"	N/A	N/A	N/A	N/A	N/A	
Silo "D"	N/A	N/A	N/A	N/A	N/A	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours	Loc 1	Loc 2	Loc 3	Comments
Bottom Ash	0	0	0	0				
Fly Ash	0	0	0	0				
Pyrites Hauled	0	0	0	0				
Gypsum Dipped	0	0	0	0				
Boiler Slag	0	0	0	0				
Coal Fine Haul	0	0	0	0				
Coal Fine Blend	0	0	0	0				
Dirt	0	0	0	0				
Sand	0	0	0	0				
Rock	0	0	0	0				
Water/Dust Cont	0	0	0	0				
Dredging	0	0	0	0				
CYROP	0	0	0	0				
Cenospheres	0		0					

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Materials / Equipment Delivered

Description:

Plant / Visitor Interface:	None	Completed By:	RUSSELL BYRNE

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
J.Davis	8	dozer/compactor	D085/DR775	6.5	
A.Swiney	6	compactor	dr775	6.5	
M.Mcamis-oper		haul truck	Wt434		
P.Jarvis-team	8	haul truck	MT525	6.5	
J.Lane-team					
J.Helton oper		compactor			
J.Reed team	8	haul truck	MT526	6.5	
B.Harrell-oper		water truck	Wt434		
D.Brown-oper	8	compactor	dr775	6.5	

Activity Descriptions: routine handling.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
L.Poindexter-lab	10	labor	laborer	8.5	
E.webb-labor	10			8.5	
B.Harrell-oper	10	excavator	LB722	8.5	
J.Helton	10	backhoe	BH884	8.5	
J.Reed-team	2	MT526		2	
J.Lane-team	10	haul truck	haul truck	8.5	
D.Brown	2	compactor		2	
J.Wallen-operator	10	water truck	DR775	8.5	
M.McAmis-0per	10	excavator	ex246	8.5	
J.Davis-oper	2	dozer		2	
P.Jarvis-team	2	haultruck	MT525	2	

Daily Activity Description: South slope repair project.

RHO&M Daily Field Report

Date	09/09/11	Plant	JSF	Partner	CHARAH/AMS

Project No.		Weather Conditions :	sunny	High: 77	Low 60	Rain Gauge Reading: 0

Daily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

None

Who Was Notified of Deficiency:	N/A	Date & Time of Notification:	N/A

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
Near Misses	0	0	Near Misses	0	0
First Aides	0	0	REE's	0	0
Recordable	0	0	NOV's	0	0
Interventions & Observations	0	64	Interventions & Observations	0	0
Safety Coaching	0	0	Safety Coaching	0	0

Safety / Environmental Explanation N/A

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
Silo "Marketable"	4.7	4.7	0	0	0	no fly ash haul
Silo "Disposable"	3.4	3.4	20	0	0	
Silo "C"	N/A	N/A	N/A	N/A	N/A	
Silo "D"	N/A	N/A	N/A	N/A	N/A	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours	Loc 1	Loc 2	Loc 3	Comments
Bottom Ash	0	0	0	0				
Fly Ash	0	0	0	0				
Pyrites Hauled	0	0	0	0				
Gypsum Dipped	0	0	0	0				
Boiler Slag	0	0	0	0				
Coal Fine Haul	0	0	0	0				
Coal Fine Blend	0	0	0	0				
Dirt	0	0	0	0				
Sand	0	0	0	0				
Rock	0	0	0	0				
Water/Dust Cont	0	0	0	0				
Dredging	0	0	0	0				
CYROP	0	0	0	0				
Cenospheres	0		0					

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Materials / Equipment Delivered

Description:

Plant / Visitor Interface:		Completed By:	RUSSELL BYRNE

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
J. Davis-opper	8	dozer	D085	6.5	
M. Mcamis-oper		water truck/compactor	WT434/Dr775		
A.Swiney	4.5	compactor	DR775	4	
P. Jarvis-team	8	haul truck	MT525	6.5	
J. lane-team					
J.Reed-team	8	haul truck	MT526	6.5	
D.Brown-oper	8	compactor	DR775	6.5	
B.Harrell-oper		water truck/compactor	WT434/Dr775		

Activity Descriptions: no fly ash haul

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
J.Lane-team	10	artic truck		8.5	
J.Wallen-oper	10	training		8.5	
L.Poindexter-lab	10	labor		8.5	
B.Harrell	10	excavator	LB722		
M.Mcamis	10			8.5	
J.Reed-team	2			2	
J.Helton-oper	10	skidsteer	rental	8.5	
D.Brown-oper		backhoe	BH884		
10	8			8.5	

Daily Activity Description: south slope repair work. Perimeter road grading,

RHO&M Daily Field Report

Date	09/10/11	**Plant**	JSF	**Partner**	CHARAH/AMS

Project No.		**Weather Conditions :**	**High**	**Low**	**Rain Gauge Reading:**

Daily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

DID NOT WORK THIS DAY

Who Was Notified of Deficiency:		**Date & Time of Notification:**	

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
Near Misses	0	0	Near Misses	0	0
First Aides	0	0	REE's	0	0
Recordable	0	0	NOV's	0	0
Interventions & Observations	0	64	Interventions & Observations	0	0
Safety Coaching	0	0	Safety Coaching	0	0

Safety / Environmental Explanation

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
Silo "Marketable"						
Silo "Disposable"						
Silo "C"	N/A	N/A	N/A	N/A	N/A	
Silo "D"	N/A	N/A	N/A	N/A	N/A	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours	Loc 1	Loc 2	Loc 3	Comments
Bottom Ash	0	0	0	0				
Fly Ash	0	0	0	0				
Pyrites Hauled	0	0	0	0				
Gypsum Dipped	0	0	0	0				
Boiler Slag	0	0	0	0				
Coal Fine Haul	0	0	0	0				
Coal Fine Blend	0	0	0	0				
Dirt	0	0	0	0				
Sand	0	0	0	0				
Rock	0	0	0	0				
Water/Dust Cont	0	0	0	0				
Dredging	0	0	0	0				
CYROP	0	0	0	0				
Cenospheres	0		0					

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Materials / Equipment Delivered

Description:

Plant / Visitor Interface:		**Completed By:**	RUSSELL BYRNE

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

Activity Descriptions: DID NOT WORK THIS DAY

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

Daily Activity Description:

RHO&M Daily Field Report

Date	09/11/11		Plant	JSF		Partner	CHARAH/AMS

Project No.		Weather Conditions :		High	Low	Rain Gauge Reading:

Daily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

DID NOT WORK THIS DAY

Who Was Notified of Deficiency:		Date & Time of Notification:	

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
Near Misses	0	0	Near Misses	0	0
First Aides	0	0	REE's	0	0
Recordable	0	0	NOV's	0	0
Interventions & Observations	0	64	Interventions & Observations	0	0
Safety Coaching	0	0	Safety Coaching	0	0

Safety / Environmental Explanation

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
Silo "Marketable"						
Silo "Disposable"						
Silo "C"	N/A	N/A	N/A	N/A	N/A	
Silo "D"	N/A	N/A	N/A	N/A	N/A	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours	Loc 1	Loc 2	Loc 3	Comments
Bottom Ash	0	0	0	0				
Fly Ash	0	0	0	0				
Pyrites Hauled	0	0	0	0				
Gypsum Dipped	0	0	0	0				
Boiler Slag	0	0	0	0				
Coal Fine Haul	0	0	0	0				
Coal Fine Blend	0	0	0	0				
Dirt	0	0	0	0				
Sand	0	0	0	0				
Rock	0	0	0	0				
Water/Dust Cont	0	0	0	0				
Dredging	0	0	0	0				
CYROP	0	0	0	0				
Cenospheres	0		0					

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Materials / Equipment Delivered

Description:

Plant / Visitor Interface:		Completed By:	RUSSELL BYRNE

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

Activity Descriptions: DID NOT WORK THIS DAY

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

Daily Activity Description:

SUMMARY PAGE

Weekly Material Summary for Week Ending :	9/11/11	PLANT:	JSF																	
	Bottom Ash				Fly Ash				Gypsum								Boiler Slag				Coal Fine Haul			
									Pyrites Hauled				Gypsum Dipped											
	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours
Monday	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tuesday	4	100	0	0.5	25	750	0	4	1	6.19	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Wednesday	32	800	0	6.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thursday	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Friday	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Saturday	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	**36**	**900**	**0**	**7**	**25**	**750**	**0**	**4**	**1**	**6.19**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Safety Statics Summary

	Near Misses		First Aides		Recordables		nterventions & Observation		Safety Coaching	
	WK	YTD	WK	YTD	WK	YTD	WK	YTD	WK	YTD
Monday	0	0	0	0	0	0	0	62	0	0
Tuesday	0	0	0	0	0	0	0	62	0	0
Wednesday	0	0	0	0	0	0	2	64	0	0
Thursday	0	0	0	0	0	0	0	64	0	0
Friday	0	0	0	0	0	0	0	64	0	0
Saturday	0	0	0	0	0	0	0	64	0	0
Sunday	0	0	0	0	0	0	0	64	0	0
TOTALS	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**64**	**0**	**0**

Environmental Statics Summary

	Near Misses		REE's		NOV''s		nterventions & Observation		Safety Coaching	
	WK	YTD	WK	YTD	WK	YTD	WK	YTD	WK	YTD
Monday	0	0	0	0	0	0	0	0	0	0
Tuesday	0	0	0	0	0	0	0	0	0	0
Wednesday	0	0	0	0	0	0	0	0	0	0
Thursday	0	0	0	0	0	0	0	0	0	0
Friday	0	0	0	0	0	0	0	0	0	0
Saturday	0	0	0	0	0	0	0	0	0	0
Sunday	0	0	0	0	0	0	0	0	0	0
TOTALS	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY PAGE

Coal Fine Blend				Dirt				Sand				Rock				Water/Dust Cont				Dredging				CYP	
Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul	CY/TN Dipped	Hours	Loads	CY/TN Haul
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

SUMMARY PAGE

OP		Cenospheres		Silo Load
CY/TN Dipped	Hours	Loads	CY/TN	Loads
0	0	0	0	0
0	0	0	0	25
0	0	0	0	0
0	0	0	0	0
0	0	0	0	20
0	0	0	0	0
0	0	0	0	0
0	**0**	**0**	**0**	**45**

APPENDIX A

Document 8

TVA Weekly Inspection

TVA FGD&C Weekly Facility Observation Form

1. Site Name: JSF
2. Date & Start Time of Observation 09/06/2011 1200
3. Operator Name: AMS
4. Observation Method: ☐ Walk ☒ Ride ☐ Both
5. Observer's Name(s): Benjamin Phillips
(KNOWN KEY DEFICIENCIES MUST BE INSPECTED)
6. Current Weather Conditions 73 / sunny
7. Prior Weather Conditions, if notable

CHECK ALL BOXES WHERE DEFICIENCIES ARE KNOWN AND MAKE APPROPRIATE COMMENTS, OBSERVATIONS, AND/OR ACTIONS TAKEN. NOTE LOCATIONS OF DEFICIENCIES ON AERIAL PHOTO.

8. Type(s) of Facilities Observed	Name of Facility	Minimum Freeboard	Current Freeboard
☐ Wet Fly Ash Pond		FT	FT
☐ Wet Gypsum Pond		FT	FT
☒ Wet Bottom Ash Pond	Bottom Ash Pond	3 FT	8 FT
☒ Dry Ash Stack	DFAS		
☐ Dry Gypsum Stack			
☒ Other	Stilling Pond		

	YES	NO	N/A	COMMENTS
9 .Pre-Job Safety Briefing Performed	☒	☐	☐	
10. Activity / Construction on/ at facility	☒	☐	☐	Routine, South Slope Regrade and cover, Ditch

11. DIKE CREST	☐ Transverse or Longitudinal Cracks or bulges ☐ Settlement ☐ Displacement ☐ Rutting
12. DIKE SLOPES	☐ Erosion ☐ Cracks or Bulges ☐ Slides/Sloughs ☐ Subsidence ☐ Seepage (muddy water, new or flow increasing over time) ☐ Wet or soft spot ☐ Changes in geometry, depth and elevation ☐ Changes in freeboard ☐ Vegetation (excessive/ sparse) ☐ Animal Burrows ☐ Sinkholes ☐ Rutting ☐ Trees
13. DIKE TOE AREAS	☒ Seepage Areas ☐ Boils ☐ Equipment Rutting ☐ Perimeter Ditches Properly Draining ☐ Sinkholes
14. SPILLWAY WEIR SYSTEM (Only visibly accessible features checked)	☐ Discharge Channel Erosion ☒ Riser Vertical Alignment ☐ Riser/Outlet Pipe Joint Leakage/Separation ☐ Headwall Condition ☒ Box Weir/Skimmers Operating Properly ☐ Vegetation blocking overflow
15. SEEPAGE COLLECTION SYSTEM	☒ Check Flow and Water Clarity ☒ Check For Blockages

16. DEFICIENCIES	YES	NO	N/A	COMMENTS
A. Prior Key Deficiencies Checked	☒	☐	☐	Riverside Seep was dry and monitoring will continue
B. New Deficiencies Identified / Flagged	☐	☒	☐	
C. Immediate Actions Taken (Note Below)	☐	☒	☐	
D. Photographs Taken / Attached	☐	☒	☐	

17. **DESCRIPTIONS OF NEWLY IDENTIFIED AND DEGRADING EXISTING KEY DEFICIENCIES/ACTIONS TAKEN/COMMENTS**

18. **Who was Notified of New Key Deficiency:** (Date & Time)

19. **PA(E) Notified of New Key Deficiency:** (Date & Time)

20. **I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.**

Period Covered

From: 09/03/2011 **To:** 09/09/2011 **Signature** **Date** 09/07/2011

APPENDIX A

Document 9

TVA Monthly Inspection

TVA FGD&C Monthly /Quarterly/Special Facility Inspection Form

1. Site Name: JSF 2. Facility Name: John Sevier 3. Date & Start Time of Inspection: 8/23/11 2:50 PM
4. Operator Name: AMS 5. Inspection Method: ☐ Walk ☒ Ride ☐ Both
(KNOWN KEY DEFICIENCIES MUST BE INSPECTED)
6. Inspector's Name(s): Russell Byrne / Rick Norville 7. Hazard Classification: ☐ High ☐ Significant ☐ Low ☐ N/A
8. Inspection Frequency: ☒ MONTHLY ☐ QUARTERLY (MUST BE WALKED) ☒ SPECIAL (after significant rain or earthquake event)
9. Current Weather Conditions: sunny clear Prior Weather Conditions, if notable ____

Check the appropriate box below. If not applicable, record "N/A". Provide comments when appropriate. Any other areas that should be brought to the attention of the Program Manager should also be noted in the "Comments" section. Indicate the locations of any areas identified, and photograph and attach to the form. Previous observation forms should be reviewed and any NEW observations or degradation of pervious conditions should be reported on this inspection form. (NOTE - ONE FORM PER FACILITY)

	Yes	No	N/A
10. Pre-Job Safety Briefing Performed	☒	☐	☐
11. Activity / Construction on/ at facility	☒	☐	☐
12. DIKE CREST			
A. Settlement / Cracking	☐	☒	☐
B. Rutting	☐	☒	☐
C. Lateral Displacement	☐	☒	☐
D. Erosion	☐	☒	☐
13. INTERIOR / EXTERIOR DIKE SLOPES			
A. **Minimum Freeboard**	4 ft		
B. **Current Freeboard**	8 ft		
C. Instabilities (Sloughs or Slides)	☐	☒	☐
D. Erosion	☐	☒	☐
E. Sinkholes/Depressions ○ New ○ Existing	☐	☒	☐
F. Vegetation / Brush / Trees	☐	☐	☐
○ Heavy/(Adequate)/Sparse/Bare	☐	☐	☐
G. Animal Burrows ☒ New ○ Existing	☐	☒	☐
H. Seepage ○ New ☒ Existing	☐	☐	☐
○ (Clear)/Cloudy/Red/Muddy	☐	☐	☐
○ Flow Increased/Decreased/(Same)	NONE gpm		
○ Ash or Clay Deposits Below Seep Outlet	☐	☒	☐
I. Seep around Drain Pipe(s)	☐	☒	☐
○ Clear/Cloudy/Red/Muddy			
14. DEFICIENCIES			
A. Prior Key Deficiencies Checked	☒	☐	☐
B. New Deficiencies Identified / Flagged	☐	☐	☒
C. Immediate Actions Taken (Note Below)	☐	☐	☒
D. Photos of deficiencies attached	☐	☐	☒

	Yes	No	N/A
15. DIKE TOE AREAS			
A. Seepage ○ New ☒ Existing	☐	☐	☐
○ (Clear)/Cloudy/Red/Muddy	CLEAR		
○ Flow Increased / Decreased/(Same)	NONE gpm		
○ Aquatic Vegetation Growing	☐	☒	☐
○ Ash or Clay Deposits Below Seep Outlet	☐	☒	☐
B. Boils ○ New ○ Existing	☐	☒	☐
○ Clear/Cloudy/Red/Muddy	N/A		
○ Flow Increased / Decreased/Same	N/A gpm		
○ Growing in Size	☐	☐	☒
C. Sinkholes/Depressions ○ New ○ Existing	☐	☐	☒
16. SEEPAGE COLLECTION SYSTEM			
A. Estimated Flow Measurement	gpm		
B. Increased Flow	☐	☒	☐
C. Emitting Clear or Dirty Water	☐	☐	☒
17. SPILLWAY WEIRS & OUTLETS			
A. Decant Riser Misaligned	☐	☒	☐
B. Decant Pipe Joints	☐	☒	☐
○ Leaking	☐	☐	☒
○ Separated	☐	☐	☒
C. Headwall In Good Condition	☒	☐	☐
18. OPERATIONS & MAINTENANCE			
A. Routine O&M Performed	☒	☐	☐
B. Weekly Observations Performed	☒	☐	☐
C. Any Changes in Operations	☐	☒	☐

19. Major adverse changes in these items could cause instability and should be reported to the Program Manager as soon as possible for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, etc.) in the space below and on the backside of this sheet if needed.
NOTE: Quarterly Inspection Deficiencies to be documented on spreadsheet with applicable latitude and longitude coordinates referenced. SHOW ALL QUARTERLY INSPECTION DEFICIENCIES ON AERIAL PHOTOS.

Item #	Comments/New Observations/Action Taken:
	no new deficiencies observed

20. **PA(E) was Notified of New Key Deficiency:** (Date & Time)
21. **Who else Notified of New Key Deficiency:** (Date / Time)
23. **I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.**

Period Covered:
From: 2:50 PM **To:** 3:40 PM **Signature** Russell Byrne **Date** 8/23/11

TVA 20611 [08-10-2011]

APPENDIX A

Document 10

TVA Quarterly Inspection

TVA Monthly /Quarterly/Special Facility Inspection Form

Form Date 6-01-10

1. Site Name: JSF 2. Facility Name: Dry Ash Stack 3. Date and Start Time of Inspection: 06/09/2011

4. Operator Name: Charah 5. Inspection Method: X Walk ☐ Ride ☐ Both
(KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

6. Inspector's Name(s): Benjamin Phillips, others 7. Hazard Classification: X Not Rated

8. Inspection Frequency: ☐ MONTHLY X QUARTERLY (MUST BE WALKED) ☐ SPECIAL (after significant rain or earthquake event)

9. Current weather conditions 85 degrees F. Partly Cloudy Prior Conditions, if notable

Check the appropriate box below. If not applicable, record "N/A". Provide comments when appropriate. Any other areas that should be brought to the attention of the Program Manager should also be noted in the "Comments" section. Indicate the locations of any areas identified, and photograph and attach to the form. Previous observation forms should be reviewed and any NEW observations or degradation of pervious conditions should be reported on this inspection form.
(NOTE - ONE FORM PER FACILITY)

	Yes	No
10. Pre-Job Safety Briefing Performed	X	
11. Activity / Construction on/ at facility	X	
12. DIKE CREST		
A. Settlement / Cracking		X
B. Rutting		X
C. Lateral Displacement		X
D. Erosion		X
13. INTERIOR / EXTERIOR DIKE SLOPES		
A. Minimum Freeboard	N/A	
B. Current Freeboard	N/A	
C. Instabilities (Sloughs or Slides)		X
D. Erosion	X	
E. Sinkholes/Depressions ○ New ○ Existing	Existing	
F. Vegetation / Brush / Trees		
○ Heavy/Adequate/Sparse/Bare	Mostly Adequate	
G. Animal Burrows ○ New ○ Existing	Both	
H. Seepage ○ New ○ Existing		X
○ Clear/Cloudy/Red/Muddy	N/A	
○ Flow Increased/Decreased/Same	N/A	
○ Ash or Clay Deposits Below Seep Outlet		N/A
I. Seep around Drain Pipe(s)		X
○ Clear/Cloudy/Red/Muddy	N/A	
14. DEFICIENCIES		
A. Prior Key Deficiencies Checked	X	
B. New Deficiencies Identified / Flagged	X	
C. Immediate Actions Taken (Note Below)		X
D. Photos of deficiencies attached	X	

	Yes	No
15. DIKE TOE AREAS		
A. Seepage ○ New ○ Existing	Both	
○ Clear/Cloudy/Red/Muddy	Clear	
○ Flow Increased / Decreased/Same	Same gpm	
○ Aquatic Vegetation Growing		X
○ Ash or Clay Deposits Below Seep Outlet		X
B. Boils ○ New ○ Existing		X
○ Clear/Cloudy/Red/Muddy	N/A	
○ Flow Increased / Decreased/Same	N/A	
○ Growing in Size		N/A
C. Sinkholes/Depressions ○ New ○ Existing		X
16. SEEPAGE COLLECTION SYSTEM - Not Installed		
A. Estimated Flow Measurement	N/A	
B. Increased Flow		N/A
C. Emitting Clear or Dirty Water	N/A	
17. SPILLWAY WEIRS & OUTLETS		
A. Decant Riser Misaligned		N/A
B. Decant Pipe Joints		N/A
○ Leaking		N/A
○ Separated		N/A
C. Headwall In Good Condition		N/A
18. OPERATIONS & MAINTENANCE		
A. Routine O&M Performed	X	
B. Weekly Observations Performed	X	
C. Any Changes in Operations		X

19. Major adverse changes in these items could cause instability and should be reported to the Program Manager as soon as possible for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, etc.) in the space below and on the backside of this sheet if needed.

NOTE: Quarterly Inspection Deficiencies to be documented on spreadsheet with applicable latitude and longitude coordinates referenced. SHOW ALL QUARTERLY INSPECTION DEFICIENCIES ON AERIAL PHOTOS

Item #	Comments/New Observations/Action Taken:
N/A	

20. PA(E) was Notified of New Key Deficiency: (Date / Time) N/A

21. Who else Notified of New Key Deficiency: (Date / Time) N/A

22. I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.

Period Covered:

From: March 2011 To: June 2011 Signature: Benjamin Phillips Date: 06/10/2011

TVA Monthly /Quarterly/Special Facility Inspection Form — Form Date 6-01-10

1. Site Name: JSF 2. Facility Name: Bottom Ash Pond 3. Date and Start Time of Inspection: 06/09/2011

4. Operator Name: Charah 5. Inspection Method: X Walk ☐ Ride ☐ Both
(KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

6. Inspector's Name(s): Benjamin Phillips, others 7. Hazard Classification: ☐ High X Significant ☐ Low

8. Inspection Frequency: ☐ MONTHLY X QUARTERLY (MUST BE WALKED) ☐ SPECIAL (after significant rain or earthquake event)

9. Current weather conditions 85 degrees F. Partly Cloudy Prior Conditions, if notable

Check the appropriate box below. If not applicable, record "N/A". Provide comments when appropriate. Any other areas that should be brought to the attention of the Program Manager should also be noted in the "Comments" section. Indicate the locations of any areas identified, and photograph and attach to the form. Previous observation forms should be reviewed and any NEW observations or degradation of pervious conditions should be reported on this inspection form. (NOTE - ONE FORM PER FACILITY)

	Yes	No
10. Pre-Job Safety Briefing Performed	X	
11. Activity / Construction on/ at facility	X	
12. DIKE CREST		
A. Settlement / Cracking		X
B. Rutting		X
C. Lateral Displacement		X
D. Erosion		X
13. INTERIOR / EXTERIOR DIKE SLOPES		
A. Minimum Freeboard	3 - 4 ft.	
B. Current Freeboard	> 4 ft.	
C. Instabilities (Sloughs or Slides)		X
D. Erosion	X	
E. Sinkholes/Depressions ○ New ○ Existing		X
F. Vegetation / Brush / Trees		
○ Heavy/Adequate/Sparse/Bare	Mostly Adequate	
G. Animal Burrows ○ New ○ Existing	Both	
H. Seepage ○ New ○ Existing		X
○ Clear/Cloudy/Red/Muddy	N/A	
○ Flow Increased/Decreased/Same	N/A	
○ Ash or Clay Deposits Below Seep Outlet		N/A
I. Seep around Drain Pipe(s)		X
○ Clear/Cloudy/Red/Muddy	N/A	
14. DEFICIENCIES		
A. Prior Key Deficiencies Checked	X	
B. New Deficiencies Identified / Flagged	X	
C. Immediate Actions Taken (Note Below)		X
D. Photos of deficiencies attached	X	

	Yes	No
15. DIKE TOE AREAS		
A. Seepage ○ New ○ Existing	X	
○ Clear/Cloudy/Red/Muddy	Clear	
○ Flow Increased / Decreased/Same	Same gpm	
○ Aquatic Vegetation Growing		X
○ Ash or Clay Deposits Below Seep Outlet		X
B. Boils ○ New ○ Existing		X
○ Clear/Cloudy/Red/Muddy	N/A	
○ Flow Increased / Decreased/Same	N/A	
○ Growing in Size		N/A
C. Sinkholes/Depressions ○ New ○ Existing		X
16. SEEPAGE COLLECTION SYSTEM - Not Installed		
A. Estimated Flow Measurement	N/A	
B. Increased Flow		N/A
C. Emitting Clear or Dirty Water	N/A	
17. SPILLWAY WEIRS & OUTLETS - Unable to Inspect		
A. Decant Riser Misaligned		N/A
B. Decant Pipe Joints		N/A
○ Leaking		N/A
○ Separated		N/A
C. Headwall In Good Condition		N/A
18. OPERATIONS & MAINTENANCE		
A. Routine O&M Performed		X
B. Weekly Observations Performed	X	
C. Any Changes in Operations		X

19. Major adverse changes in these items could cause instability and should be reported to the Program Manager as soon as possible for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, etc.) in the space below and on the backside of this sheet if needed.

NOTE: Quarterly Inspection Deficiencies to be documented on spreadsheet with applicable latitude and longitude coordinates referenced. SHOW ALL QUARTERLY INSPECTION DEFICIENCIES ON AERIAL PHOTOS

Item #	Comments/New Observations/Action Taken:
N/A	

20. PA(E) was Notified of New Key Deficiency: (Date / Time) N/A

21. Who else Notified of New Key Deficiency: (Date / Time) N/A

22. I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.

Period Covered:

From: March 2011 To: June 2011 Signature: Benjamin Phillips [signature] Date: 06/10/2011

LOCATION: John Sevier Fossil Plant -3rd Quarter Dike Inspection FY2011
WEATHER: 85 degrees F, Cloudy
INSPECTION BY: Ben Phillips, Jacob Horton, Mike Hulslander, Bronson Reed, Marty Helton, Jake Booth, and Anthony Loomis, and Allen Sharriet
DATE: 06/09/2011

ITEM NO.	DESCRIPTION	PICTURE NO.	POINT NO.	NORTHING	EASTING	COMMENT
1	Depression (3' x 5')	1033	2000	734704.69	2891726.32	Repair in accordance with the General Guidelines
2	No vegetation (15' x 60')	1034	2001	734636.19	2890824.85	Repair in accordance with the General Guidelines
3	No vegetation (15' x 60')	1035	2002	734323.70	2889945.77	Repair in accordance with the General Guidelines
4	Animal burrow	1036	2003	734494.76	2889195.39	Previously Identified (3rd quarter, PT# 4012) Workplan is being developed for repair.
5	Animal burrow	1037	2004	734515.38	2889237.22	Will be addressed in partial closure plan
6	Monitoring well without casing or bollard	1039	2005	734988.10	2890023.50	Previously Identified (FY11 - 1st quarter, PT# 1000) Repair in accordance with the General Guidelines
7	Tree stump	2310	3000	733867.74	2890881.01	Previously Identified (FY11 - 1st quarter, PT# 3009)Remove in accordance with the General Guidelines
8	No vegetation (20' x 20')	2311	3001	736483.24	2891696.05	Previously Identified (FY11 - 1st quarter, PT# 3008)Remove in accordance with the General Guidelines
9	Tree stump	2312	3002	735040.11	2892289.46	Previously Identified (FY11 - 1st quarter, PT# 3001)Remove in accordance with the General Guidelines
10	Tree stump	5591	5000	734948.17	2892426.45	Remove in accordance with the General Guidelines
11	Tree stump	5592	5001	735107.10	2892396.45	Remove in accordance with the General Guidelines


DSCN5591.JPG


IMG_1033.jpg


IMG_1034.jpg


IMG_1035.jpg


IMG_1036.jpg


IMG_1037.jpg


IMG_1038.jpg


IMG_2310.jpg


IMG_2311.jpg


IMG_2312.jpg


3001
2005
5001
3000
5000
2000
2001
2003
2004
2002
3002

APPENDIX A

Document 11

URS August 2011 Instrument Readings Review Memorandum, dated September 12, 2011

Memorandum

Date: September 12, 2011

To: Email Distribution Recipients

From: Jeff Wild, P.E.

Subject: **August 2011 TVA Instrumentation Readings Comments**

This memorandum and attachments present the August 2011 RHO&M instrumentation readings performed by URS for WCF, JSF, BRF, and COF TVA facilities. This memorandum is commenting only on obvious inclinometer movement and piezometric level changes of more than approximately 1 foot, or readings outside the historical data range. URS' assigned RHO&M work scope does not include interpretation of what constitutes a critical or actionable quantity of inclinometer movement or a trigger level, critical, or actionable water level elevation change in any piezometer. URS submits this data in an organized manner to facilitate review and interpretation by others that deemed the inclinometer and piezometer installations, and ongoing monitoring, necessary to assess pond and ash stack stability.

To assist in review of the piezometer data, plots of the water level readings are included with this memorandum. Because of the plots, and to improve clarity and reduce document/file size, we are only including the last set of piezometer water level tables for each site (generally the last three to five months' worth of readings), with the exception of COF. It should be noted that, again for presentation clarity, we had already been pairing-down the inclinometer readings to include only the last six data sets. The August 2011 inclinometer readings included with this memorandum continue this data reporting methodology.

Important Note: As a result of a detailed review of the current piezometers location and elevation data for determining the trigger points at each of the piezometers, URS found that several of the piezometer riser pipes have been modified over the last year because of construction. It is likely that recent water level measurements referenced incorrect stick-up heights, and resulted in our reporting inaccurate water level elevations (see August 2011 WCF data). During September data collection URS will measure well riser heights relative to the referenced ground surface elevation at BRF, COF, JSF and WCF and report all of the piezometer stick-up heights with the September 2011 data.

Because of the substantial investment TVA will make in having URS establish trigger elevations for piezometer water levels, it makes sense that well elevations should be confirmed. Therefore, URS requests TVA survey the piezometers at the four facilities for horizontal and vertical location at ground level and at the top of the piezometer pipe. The elevations should be measured using a surveyor's level, not the roving GPS units the RHO&M field technicians commonly work with. These GPS units may not be accurate enough for vertical control.

Widows Creek (WCF)

1. **Piezometers:** As a result of a detailed review of the current piezometers location and elevation data, URS has measured the stick-up heights of the piezometers during the August 2011 readings event on-site. Several of the heights are currently different from the historical heights being utilized for reporting water level elevations. These are shown in red text in the readings table attached.

With the resulting calculated water levels in the piezometers based on the revised stick-up heights, a comparison to historical data prior to the August readings is not practical. URS will resume comparisons to historical data during and after the September 2011 readings event.

2. **Inclinometers:** SI-31 continues to show displacement consistent with Gypsum Stack settlement. To-date, this inclinometer exhibits a total cumulative displacement of approximately ¾-inch, but shows negligible additional displacement since the previous month's readings.

   URS has requested TVA surveyors measure the elevation of the top of inclinometer casing (TOC) monthly (current measurements shown below). This data will be reviewed to assess downward change (indicating settlement) at SI-31 to compare with the inclinometer displacement. The elevation measurements collected to-date are summarized below:

Date of Elevation Measurement	TOC Elevation (ft., NGVD)	Elevation Change (ft.)
6/2/2011	674.93	-
6/24/2011	674.86	-0.07

   The other inclinometers show little to nearly no additional displacement.

John Sevier (JSF)

1. **Piezometers**: The majority of piezometer water levels decreased during August 2011.

   21 of the piezometer water levels remained level, or decreased only slightly (< 1 ft.) during the month.

   None of the piezometer water levels increased during the month.

   No obvious concerns are noted with the monthly readings.

2. **Inclinometers:** SI-31 located on the upper bench, immediately north of the active fill area continues to display signs of displacement consistent with settlement of the stack, and also likely due to ongoing stacking adjacent to this inclinometer. However, the cumulative displacement graph for SI-31 does not show any additional movement since last month.

   URS has requested TVA surveyors measure the elevation of the top of inclinometer casing (TOC) monthly (current measurements shown below). This data is being reviewed to assess downward change (indicating settlement) at SI-31. The elevation measurements collected to-date are summarized below:

Date of Elevation Measurement	TOC Elevation (ft., NGVD)	Elevation Change (ft.)
2/23/2011	1156.07	-
3/1/2011	1155.88	-0.19
3/22/2011	1155.78	-0.10
4/26/2011	1155.92	+0.14
5/25/2011	1155.91	-0.01
6/23/2011	1155.91	0.00

The remaining inclinometers show little to nearly no displacement since last month.

No obvious concerns are noted with the monthly readings.

Bull Run (BRF)

1. **Piezometers:** The majority of piezometer water levels (33) remained level, or increased or decreased only slightly (< 1 ft.) during the month.

   Piezometers STN-77 and STN-85 decreased in water level more than 1 ft. over the month.

   22 of the piezometer water levels remained level, or decreased only slightly (< 1 ft.) during the month.

   11 of the piezometer water levels remained level, or increased only slightly (< 1 ft.) during the month.

   Piezometers PZ-5, PZ-33, PZ-39 and PZ-47 were dry this month.

   No obvious concerns are noted with the monthly readings.

   Inclinometers: The inclinometers show negligible displacement since last month.

   No other obvious concerns are noted with the monthly readings.

Colbert (COF)

1. **Piezometers:** Ash Disposal Area 5 – The majority of piezometer water levels decreased during August 2011.

   All of the piezometer water levels remained level, or increased or decreased only slightly (< 1 ft.) during the month.

   24 piezometer water levels decreased during the month, with none decreasing more than 1 ft.

   4 piezometer water levels increased during the month, with none increasing more than 1 ft.

   Piezometers STN-5-12, STN-5-18, STN-103B, STN-109, STN-5-121B, and STN-122 were dry this month.

   No obvious concerns are noted with the monthly readings.

   Ash Pond 4 – The majority of piezometer water levels decreased during August 2011. 19 of the piezometer water levels remained level, or increased or decreased only slightly (< 1 ft.) during the month.

   6 piezometers increased in water level, with none increasing more than 1 ft.

   13 piezometer water levels decreased during the month, with none decreasing more than 1 ft.

No obvious concerns are noted with the monthly readings.

Gallatin (GAF)

1. **Piezometers:** No automated piezometer water level readings (all are automated) were transmitted to URS from TVA for the month of August.

APPENDIX A

Document 12

Stantec Results of Pseudostatic Slope Stability Analysis, dated February 15, 2012

Stantec Consulting Services Inc.
10509 Timberwood Circle Suite 100
Louisville, KY 40223-5301
Tel: (502) 212-5000
Fax: (502) 212-5055

February 15, 2012 ltr_002_175551015

Mr. Michael S. Turnbow
Tennessee Valley Authority
1101 Market Street, LP 2G-C
Chattanooga, Tennessee 37402-2801

Re: Results of Pseudostatic Slope Stability Analysis
Active CCP Disposal Facilities
BRF, COF, GAF, JSF, JOF, KIF, PAF, and WCF

Dear Mr. Turnbow:

As requested, Stantec Consulting Services Inc. (Stantec) has conducted pseudostatic slope stability analyses for ground motion levels corresponding to a return period of 2,500 years to support the U.S. Environmental Protection Agency's assessment of TVA's CCP disposal facilities. The results for Bull Run (BFR), Colbert (COF), Gallatin (GAF), John Sevier (JSF), Johnsonville (JOF), Kingston (KIF), Paradise (PAF), and Widows Creek (WCF) are provided in this letter.

Approach

The analyses were performed for current conditions using pseudostatic stability methods, where the added inertial load from an earthquake is assumed to be represented by a simple horizontal pseudostatic coefficient. Specifics related to the analyses/approach are as follows:

- Subsurface data was obtained from the Stantec's recent geotechnical studies performed in 2009 and 2010 time frame.
- SLOPE/W software (from GEO-SLOPE International, Inc.) was used to perform the calculations.
- One existing SLOPE/W cross-section model per disposal facility was selected from the previous studies for analysis. For simplicity and conservatism, the selected sections represent the facility's lowest current static (long-term) factor of safety. The SLOPE/W models were updated to reflect any significant mitigations or operational changes that have occurred since completion of Stantec's geotechnical studies.
- Undrained shear strength parameters were used.
- Ground motion levels corresponding to a return period of 2,500 years (or approximate exceedance probability of 2% in 50 years) was used for selection of a horizontal seismic coefficient. For simplicity, the horizontal seismic coefficient was selected to equal the total hazard peak ground acceleration (rock) for 2,500 year return periods as shown in plant-

specific tables (Tables 13 through 23) of TVA's March 28, 2011 region-specific seismic hazard study performed by AMEC Geomatrix, Inc.

- A target factor of safety (FS) of 1.0 was considered for comparing results.

Results

The results of the pseudostatic stability analyses are enclosed (summary spreadsheet, SLOPE/W cross-sections, and plan views showing cross-section locations). The results indicate factors of safety greater than or equal to the target of 1.0.

Stantec appreciates the opportunity to provide these services. If you have questions, or if we can provide additional information, please let us know.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Randy L. Roberts, PE
Principal

Enclosures

/cdm

Pseudostatic Stability Analysis Summary - TVA Active CCP Disposal Facilities

BRF, COF, GAF, JSF, JOF, KIF, PAF, WCF

Plant	CCP Disposal Facility		Cross-Section	2,500 yr Return	
	Name	Type		PGA (g)	Factor of Safety
BRF	Gypsum Disposal Area 2A	Wet Stack	I	0.131	1.0
	Fly Ash Disposal Area 2	Impoundment	S		1.4
	Bottom Ash Disposal Area 1	Stack	D		1.1
COF	Disposal Area 5 Stack	Stack	I	0.138	1.0
	Disposal Area 5 Stilling Basin	Impoundment	J		1.2
	Ash Pond 4	Impoundment	D		1.0
GAF	Ash Pond A	Impoundment	K	0.108	1.0
	Ash Pond E	Impoundment	B		1.3
JSF	Bottom Ash Pond	Impoundment	I	0.115	2.2
JOF	Ash Disposal Area 2	Impoundment	K	0.254	1.0
KIF	Stilling Pond	Impoundment	132+37	0.115	1.0
PAF	Slag Ponds 2A and 2B	Impoundment	Typical	0.157	1.1
	Scrubber Sludge Complex	Impoundment	G		1.0
	Peabody Ash Pond	Impoundment	A		1.0
WCF	Gypsum Stack	Wet Stack	F	0.1	1.5
	Dredge Cell (Old Scrubber Sludge Pond)	Impoundment	D		1.1
	Main Ash Pond	Impoundment	J		1.4

John Sevier Fossil Plant
(JSF)

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section I - Bottom Ash Pond
John Sevier Plant
Rogersville, Tennessee

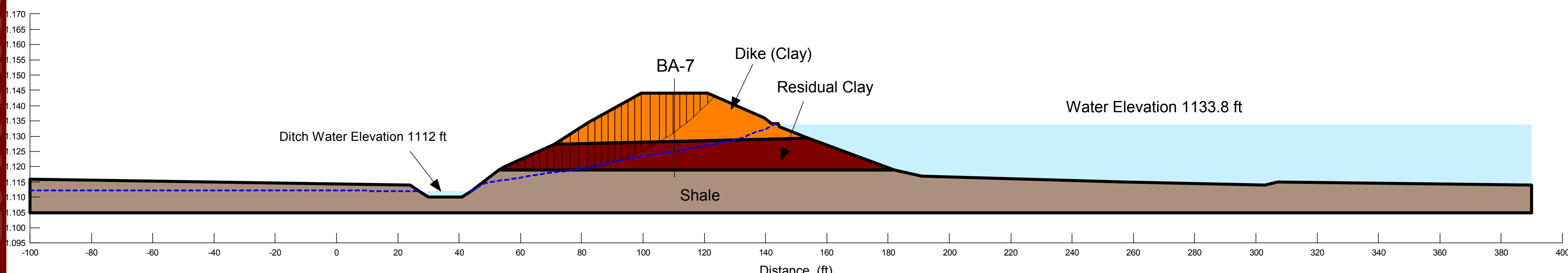
Stantec

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results, and approximate soil properties. No warranties can be made regarding the continuity of subsurfacea conditons betweeen the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Dike (Clay)	126 pcf	715 psf	10.6 °
Residual Clay	120 pcf	1000 psf	11.6 °
Bedrock (Shale)	N/A	N/A	N/A

Factor of Safety: 2.2

Horizontal Seismic Coefficient Kh = 0.115 g
2500-year Return Period Event



e of Assessment - 11/4/2011

Project No. 175551015

BORING LOCATION TABLE

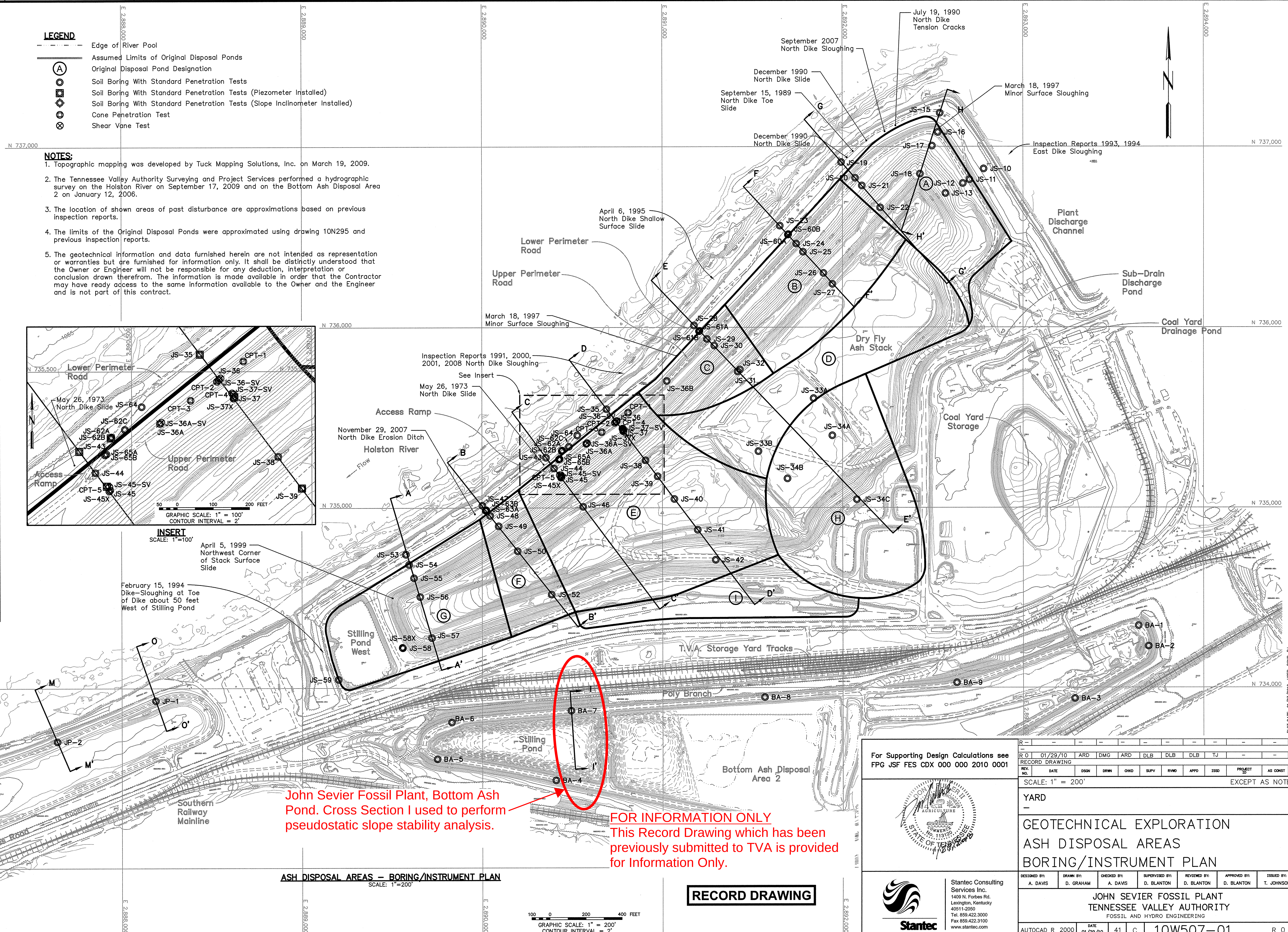
BORING	NORTHING	EASTING	ELEV. (FT.)	BORING TYPE
BA-1	734,343.87	2,893,639.94	1,145.4	Sample / Piezometer
BA-2	734,229.93	2,893,695.53	1,145.9	Sample / Piezometer
BA-3	733,939.03	2,893,286.73	1,145.3	Sample / Piezometer
BA-4	733,486.11	2,890,407.91	1,145.2	Sample
BA-5	733,604.48	2,889,750.33	1,144.9	Sample / Piezometer
BA-6	733,808.75	2,889,830.63	1,145.1	Sample
BA-7	733,872.97	2,890,492.40	1,144.3	Sample
BA-8	733,946.71	2,891,566.83	1,145.2	Sample / Piezometer
BA-9	734,027.41	2,892,632.01	1,144.7	Sample
JP-1	733,930.64	2,888,187.78	1,105.4	Sample
JP-2	733,703.71	2,887,641.90	1,105.7	Sample
JP-3	733,483.09	2,886,974.16	1,105.8	Sample / Piezometer
JP-4	733,323.27	2,886,393.14	1,105.6	Sample / Piezometer
JP-4A	733,325.38	2,886,401.23	1,105.3	Shelby Tubes
JP-5	732,679.06	2,886,045.57	1,104.5	Sample / Piezometer
JP-6	732,862.78	2,886,526.80	1,106.3	Sample / Piezometer
JS-10	736,877.33	2,892,782.32	1,085.0	Sample / Piezometer
JS-11	736,817.60	2,892,703.95	1,115.3	Sample/ Slope Inclinometer
JS-12	736,796.96	2,892,666.90	1,114.8	Sample / Piezometer
JS-13	736,741.69	2,892,570.62	1,132.5	Sample / Piezometer
JS-15	737,186.07	2,892,539.85	1,084.1	Sample / Piezometer
JS-16	737,079.51	2,892,528.69	1,115.7	Sample/ Slope Inclinometer
JS-17	737,004.19	2,892,496.33	1,114.5	Sample / Piezometer
JS-18	736,848.84	2,892,429.18	1,136.3	Sample / Piezometer
JS-19	736,913.99	2,891,993.30	1,077.3	Sample / Piezometer
JS-20	736,826.84	2,892,070.81	1,113.8	Sample/ Slope Inclinometer
JS-21	736,784.15	2,892,107.96	1,111.0	Sample / Piezometer
JS-22	736,662.66	2,892,209.60	1,134.7	Sample / Piezometer
JS-23	736,562.81	2,891,652.34	1,075.1	Sample / Piezometer
JS-24	736,463.59	2,891,743.40	1,113.4	Sample/ Slope Inclinometer
JS-25	736,417.96	2,891,781.01	1,108.1	Sample / Piezometer
JS-26	736,300.23	2,891,894.54	1,141.8	Sample / Slope Inclinometer
JS-27	736,239.87	2,891,944.24	1,158.3	Sample / Temporary Piezometer
JS-28	736,010.84	2,891,176.23	1,074.5	Sample / Piezometer
JS-29	735,935.78	2,891,247.73	1,111.5	Sample/ Slope Inclinometer
JS-30	735,899.72	2,891,288.23	1,105.6	Sample / Piezometer
JS-31	735,755.45	2,891,418.56	1,151.1	Sample/ Slope Inclinometer
JS-32	735,766.70	2,891,431.00	1,150.6	Temporary Piezometer
JS-33A	735,606.69	2,891,839.21	1,152.4	Sample
JS-33B	735,313.55	2,891,533.03	1,155.3	Sample
JS-34A	735,400.64	2,891,943.07	1,156.4	Sample
JS-34B	735,161.98	2,891,694.15	1,156.3	Sample
JS-34C	735,045.58	2,892,079.28	1,120.4	Sample / Piezometer
JS-35	735,547.59	2,890,689.83	1,078.9	Sample / Piezometer
JS-36	735,478.03	2,890,742.60	1,108.5	Sample/ Slope Inclinometer
JS-36-SV	735,481.63	2,890,746.85	1,108.4	Shear Vane Test/Shelby Tubes
JS-36A	735,355.98	2,890,578.53	1,106.2	Sample/ Slope Inclinometer
JS-36A-SV	735,359.66	2,890,582.51	1,106.4	Shear Vane Test/Shelby Tubes
JS-36B	735,703.43	2,891,025.07	1,110.8	Sample/ Slope Inclinometer
JS-37	735,429.18	2,890,784.99	1,103.8	Piezometer
JS-37-SV	735,436.98	2,890,782.91	1,102.3	Shear Vane Test/Shelby Tubes
JS-37X	735,425.46	2,890,782.69	1,104.4	Sample
JS-38	735,263.83	2,890,906.40	1,151.5	Sample/ Slope Inclinometer
JS-39	735,175.12	2,890,973.42	1,181.3	Sample / Temporary Piezometer
JS-40	735,048.86	2,891,066.57	1,170.2	Sample
JS-41	734,877.81	2,891,195.60	1,154.6	Sample
JS-42	734,710.66	2,891,295.11	1,138.2	Sample / Piezometer
JS-43	735,279.02	2,890,354.76	1,081.5	Sample / Piezometer
JS-44	735,219.55	2,890,399.56	1,103.2	Sample/ Slope Inclinometer
JS-45	735,171.68	2,890,440.72	1,101.3	Piezometer
JS-45-SV	735,181.14	2,890,438.31	1,100.1	Shear Vane Test/Shelby Tubes
JS-45X	735,168.74	2,890,438.03	1,101.5	Sample
JS-46	735,006.11	2,890,560.28	1,144.7	Sample/ Slope Inclinometer
JS-47	735,013.36	2,890,001.65	1,078.2	Sample / Piezometer
JS-48	734,956.57	2,890,044.99	1,101.3	Sample/ Slope Inclinometer
JS-49	734,898.66	2,890,091.75	1,098.8	Sample / Piezometer
JS-50	734,760.24	2,890,196.57	1,138.7	Sample / Piezometer
JS-52	734,518.95	2,890,384.61	1,136.8	Sample / Piezometer
JS-53	734,742.01	2,889,577.25	1,081.4	Sample / Piezometer
JS-54	734,685.87	2,889,594.68	1,100.2	Sample/ Slope Inclinometer
JS-55	734,611.13	2,889,621.92	1,097.4	Sample / Piezometer
JS-56	734,506.50	2,889,656.35	1,131.0	Sample / Piezometer
JS-57	734,277.92	2,889,720.99	1,130.1	Sample / Piezometer
JS-58	734,222.32	2,889,559.16	1,100.2	Piezometer
JS-58X	734,224.38	2,889,557.53	1,100.1	Sample
JS-59	734,047.10	2,889,202.69	1,099.3	Sample / Piezometer
JS-60A	736,513.29	2,891,697.31	1,089.5	Sample
JS-60B	736,515.46	2,891,699.27	1089.5	Shelby Tubes / Piezometer
JS-61A	735,980.74	2,891,206.58	1,089.7	Sample / Piezometer
JS-61B	735,978.47	2,891,204.07	1089.1	Shelby Tubes
JS-62A	735,318.64	2,890,444.05	1,090.0	Sample
JS-62B	735,316.23	2,890,442.25	1,090.0	Shelby Tubes / Piezometer
JS-62C	735,339.49	2,890,481.47	1,088.2	Sample
JS-63A	734,985.29	2,890,020.63	1,089.4	Sample
JS-63B	734,987.89	2,890,023.29	1089.4	Shelby Tubes / Piezometer
JS-64	735,402.40	2,890,528.11	1,082.3	Sample
JS-65A	735,271.28	2,890,430.29	1,095.1	Sample / Shelby Tubes
JS-65B	735,269.06	2,890,426.10	1,094.7	Shelby Tubes
CPT-1	735,528.42	2,890,809.86	1,109.5	Cone Penetration Test
CPT-2	735,472.49	2,890,736.90	1,108.3	Cone Penetration Test
CPT-3	735,419.93	2,890,663.93	1,107.1	Cone Penetration Test
CPT-4	735,439.57	2,890,778.44	1,101.8	Cone Penetration Test
CPT-5	735,182.18	2,890,431.15	1,100.0	Cone Penetration Test

LEGEND

- Edge of River Pool
- Assumed Limits of Original Disposal Ponds
- (A) Original Disposal Pond Designation
- Soil Boring With Standard Penetration Tests
- Soil Boring With Standard Penetration Tests (Piezometer Installed)
- Soil Boring With Standard Penetration Tests (Slope Inclinometer Installed)
- Cone Penetration Test
- Shear Vane Test

NOTES:

1. Topographic mapping was developed by Tuck Mapping Solutions, Inc. on March 19, 2009.
2. The Tennessee Valley Authority Surveying and Project Services performed a hydrographic survey on the Holston River on September 17, 2009 and on the Bottom Ash Disposal Area 2 on January 12, 2006.
3. The location of shown areas of past disturbance are approximations based on previous inspection reports.
4. The limits of the Original Disposal Ponds were approximated using drawing 10N295 and previous inspection reports.
5. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.



ASH DISPOSAL AREAS – BORING/INSTRUMENT PLAN
SCALE: 1"=200'

RECORD DRAWING

For Supporting Design Calculations see FPG JSF FES CDX 000 000 2010 0001

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	01/29/10	ARD	DMG	ARD	DLB	DLB	DLB	TJ	–	–

RECORD DRAWING

SCALE: 1" = 200' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
ASH DISPOSAL AREAS
BORING/INSTRUMENT PLAN

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
A. DAVIS	D. GRAHAM	A. DAVIS	D. BLANTON	D. BLANTON	D. BLANTON	T. JOHNSON

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
Tel. 859.422.3000
Fax 859.422.3100
www.stantec.com

JOHN SEVIER FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 01/29/10 | 41 | C | 10W507-01 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

APPENDIX A

Document 13

Stantec Pseudostatic Slope Stability Analysis, Dry Fly Ash, dated March 30, 2012

Stantec Consulting Services Inc.
10509 Timberwood Circle Suite 100
Louisville, KY 40223-5301
Tel: (502) 212-5000
Fax: (502) 212-5055

March 30, 2012 ltr_003_175551015

Mr. Michael S. Turnbow
Tennessee Valley Authority
1101 Market Street, LP 2G-C
Chattanooga, Tennessee 37402-2801

Re: Results of Pseudostatic Slope Stability Analysis
Dry Fly Ash Stack
John Sevier Fossil Plant (JSF)

Dear Mr. Turnbow:

As requested, Stantec Consulting Services Inc. (Stantec) has conducted pseudostatic slope stability analysis for the referenced facility for ground motion corresponding to a return period of 2,500 years. This is to support the U.S. Environmental Protection Agency's assessment of TVA's CCP disposal facilities.

The approach is identical to that described in the previous submittal for 2,500 year analyses dated February 15, 2012, which included the Bottom Ash Pond at JSF.

The results of the pseudostatic stability analysis are enclosed (SLOPE/W cross-section and plan view showing cross-section location). The results indicate a factor of safety of 1.1, which is greater than the target of 1.0.

Stantec appreciates the opportunity to provide these services. If you have questions, or if we can provide additional information, please let us know.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Randy L. Roberts, PE
Principal

Enclosures

/cdm

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section C - Dry Fly Ash Stack
John Sevier Fossil Plant
Rogersville, Tennessee

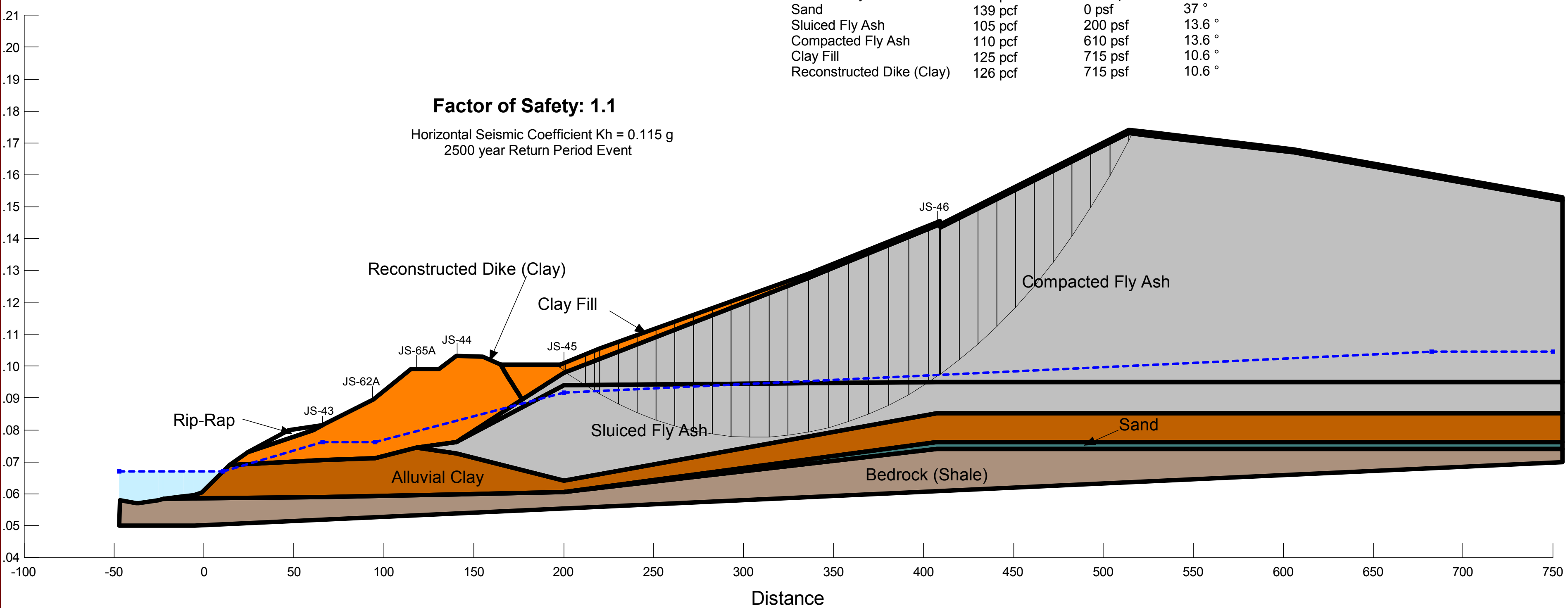
Stantec

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results, and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditons betweenthe borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Rip-Rap	115 pcf	0 psf	40 °
Alluvial Clay	120 pcf	1000 psf	11.6 °
Sand	139 pcf	0 psf	37 °
Sluiced Fly Ash	105 pcf	200 psf	13.6 °
Compacted Fly Ash	110 pcf	610 psf	13.6 °
Clay Fill	125 pcf	715 psf	10.6 °
Reconstructed Dike (Clay)	126 pcf	715 psf	10.6 °

Factor of Safety: 1.1

Horizontal Seismic Coefficient Kh = 0.115 g
2500 year Return Period Event



Date of Assessment - 03/30/2012

Project No. 175551015

41 | C | 10W507-01

BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)	BORING TYPE
BA-1	734,343.87	2,893,639.94	1,145.4	Sample / Piezometer
BA-2	734,229.93	2,893,695.53	1,145.9	Sample / Piezometer
BA-3	733,939.03	2,893,286.73	1,145.3	Sample / Piezometer
BA-4	733,486.11	2,890,407.91	1,145.2	Sample
BA-5	733,604.48	2,889,750.33	1,144.9	Sample / Piezometer
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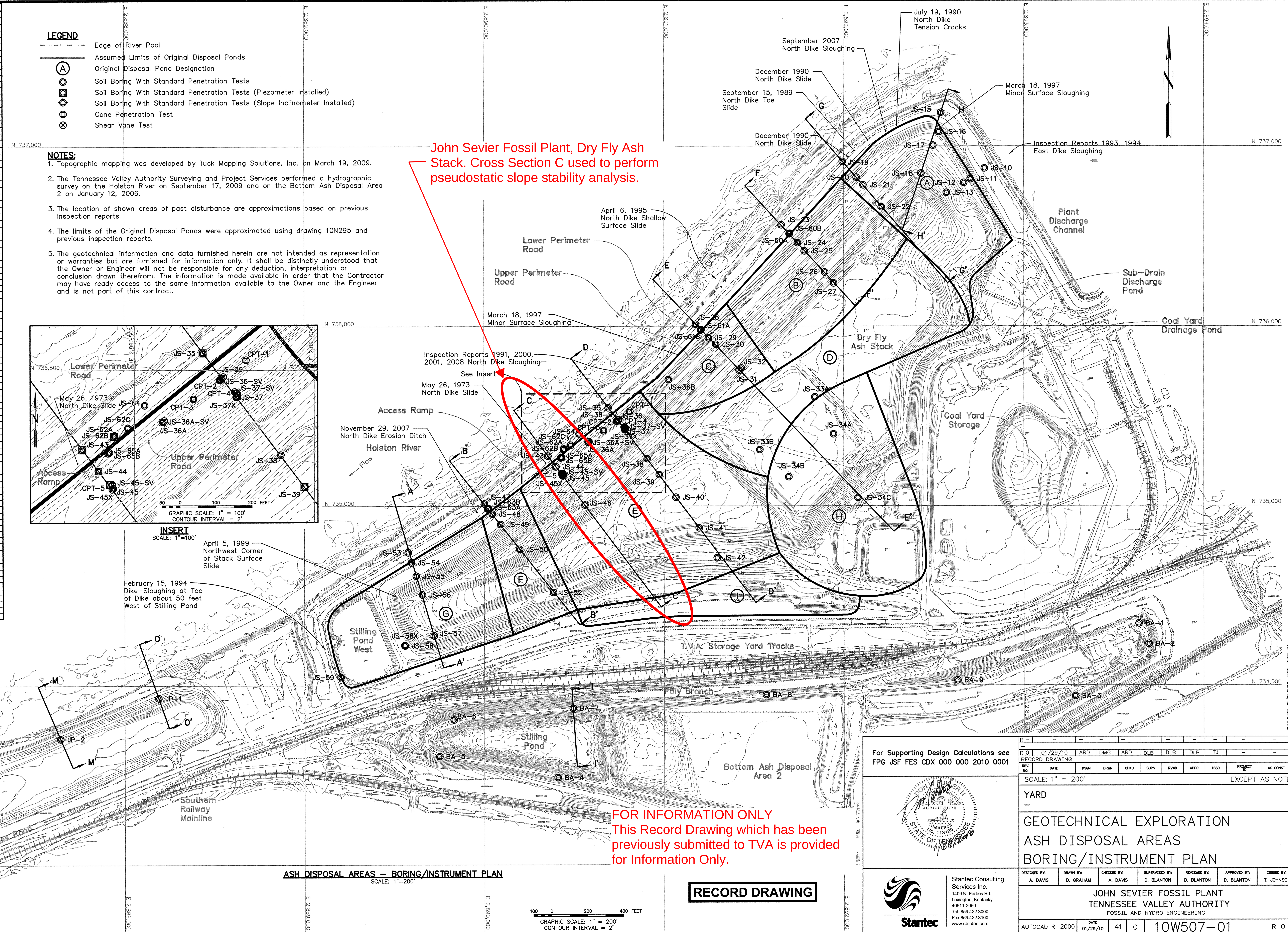
BA-7	733,872.97	2,890,492.40	1,144.3	Sample
BA-8	733,946.71	2,891,566.83	1,145.2	Sample / Piezometer
BA-9	734,027.41	2,892,632.01	1,144.7	Sample
JP-1	733,930.64	2,888,187.78	1,105.4	Sample
JP-2	733,703.71	2,887,641.90	1,105.7	Sample
JP-3	733,483.09	2,886,974.16	1,105.8	Sample / Piezometer
JP-4	733,323.27	2,886,393.14	1,105.6	Sample / Piezometer
JP-4A	733,325.38	2,886,401.23	1,105.3	Shelby Tubes
JP-5	732,679.06	2,886,045.57	1,104.5	Sample / Piezometer
JP-6	732,862.78	2,886,526.80	1,106.3	Sample / Piezometer
JS-10	736,877.33	2,892,782.32	1,085.0	Sample / Piezometer
JS-11	736,817.60	2,892,703.95	1,115.3	Sample/ Slope Inclinometer
JS-12	736,796.96	2,892,666.90	1,114.8	Sample / Piezometer
JS-13	736,741.69	2,892,570.62	1,132.5	Sample / Piezometer
JS-15	737,186.07	2,892,539.85	1,084.1	Sample / Piezometer
JS-16	737,079.51	2,892,528.69	1,115.7	Sample/ Slope Inclinometer
JS-17	737,004.19	2,892,496.33	1,114.5	Sample / Piezometer
JS-18	736,848.84	2,892,429.18	1,136.3	Sample / Piezometer
JS-19	736,913.99	2,891,993.30	1,077.3	Sample / Piezometer
JS-20	736,826.84	2,892,070.81	1,113.8	Sample/ Slope Inclinometer
JS-21	736,784.15	2,892,107.96	1,111.0	Sample / Piezometer
JS-22	736,662.66	2,892,209.60	1,134.7	Sample / Piezometer
JS-23	736,562.81	2,891,652.34	1,075.1	Sample / Piezometer
JS-24	736,463.59	2,891,743.40	1,113.4	Sample/ Slope Inclinometer
JS-25	736,417.96	2,891,781.01	1,108.1	Sample / Piezometer
JS-26	736,300.23	2,891,894.54	1,141.8	Sample / Slope Inclinometer
JS-27	736,239.87	2,891,944.24	1,158.3	Sample / Temporary Piezometer
JS-28	736,010.84	2,891,176.23	1,074.5	Sample / Piezometer
JS-29	735,935.78	2,891,247.73	1,111.5	Sample/ Slope Inclinometer
JS-30	735,899.72	2,891,288.23	1,105.6	Sample / Piezometer
JS-31	735,755.45	2,891,418.56	1,151.1	Sample/ Slope Inclinometer
JS-32	735,766.70	2,891,431.00	1,150.6	Temporary Piezometer
JS-33A	735,606.69	2,891,839.21	1,152.4	Sample
JS-33B	735,313.55	2,891,533.03	1,155.3	Sample
JS-34A	735,400.64	2,891,943.07	1,156.4	Sample
JS-34B	735,161.98	2,891,694.15	1,156.3	Sample
JS-34C	735,045.58	2,892,079.28	1,120.4	Sample / Piezometer
JS-35	735,547.59	2,890,689.83	1,078.9	Sample / Piezometer
JS-36	735,478.03	2,890,742.60	1,108.5	Sample/ Slope Inclinometer
JS-36-SV	735,481.63	2,890,746.85	1,108.4	Shear Vane Test/Shelby Tubes
JS-36A	735,355.98	2,890,578.53	1,106.2	Sample/ Slope Inclinometer
JS-36A-SV	735,359.66	2,890,582.51	1,106.4	Shear Vane Test/Shelby Tubes
JS-36B	735,703.43	2,891,025.07	1,110.8	Sample/ Slope Inclinometer
JS-37	735,429.18	2,890,784.99	1,103.8	Piezometer
JS-37-SV	735,436.98	2,890,782.91	1,102.3	Shear Vane Test/Shelby Tubes
JS-37X	735,425.46	2,890,782.69	1,104.4	Sample
JS-38	735,263.83	2,890,906.40	1,151.5	Sample/ Slope Inclinometer
JS-39	735,175.12	2,890,973.42	1,181.3	Sample / Temporary Piezometer
JS-40	735,048.86	2,891,066.57	1,170.2	Sample
JS-41	734,877.81	2,891,195.60	1,154.6	Sample
JS-42	734,710.66	2,891,295.11	1,138.2	Sample / Piezometer
JS-43	735,279.02	2,890,354.76	1,081.5	Sample / Piezometer
JS-44	735,219.55	2,890,399.56	1,103.2	Sample/ Slope Inclinometer
JS-45	735,171.68	2,890,440.72	1,101.3	Piezometer
JS-45-SV	735,181.14	2,890,438.31	1,100.1	Shear Vane Test/Shelby Tubes
JS-45X	735,168.74	2,890,438.03	1,101.5	Sample
JS-46	735,006.11	2,890,560.28	1,144.7	Sample/ Slope Inclinometer
JS-47	735,013.36	2,890,001.65	1,078.2	Sample / Piezometer
JS-48	734,956.57	2,890,044.99	1,101.3	Sample/ Slope Inclinometer
JS-49	734,898.66	2,890,091.75	1,098.8	Sample / Piezometer
JS-50	734,760.24	2,890,196.57	1,138.7	Sample / Piezometer
JS-52	734,518.95	2,890,384.61	1,136.8	Sample / Piezometer
JS-53	734,742.01	2,889,577.25	1,081.4	Sample / Piezometer
JS-54	734,685.87	2,889,594.68	1,100.2	Sample/ Slope Inclinometer
JS-55	734,611.13	2,889,621.92	1,097.4	Sample / Piezometer
JS-56	734,506.50	2,889,656.35	1,131.0	Sample / Piezometer
JS-57	734,277.92	2,889,720.99	1,130.1	Sample / Piezometer
JS-58	734,222.32	2,889,559.16	1,100.2	Piezometer
JS-58X	734,224.38	2,889,557.53	1,100.1	Sample
JS-59	734,047.10	2,889,202.69	1,099.3	Sample / Piezometer
JS-60A	736,513.29	2,891,697.31	1,089.5	Sample
JS-60B	736,515.46	2,891,699.27	1089.5	Shelby Tubes / Piezometer
JS-61A	735,980.74	2,891,206.58	1,089.7	Sample / Piezometer
JS-61B	735,978.47	2,891,204.07	1089.1	Shelby Tubes
JS-62A	735,318.64	2,890,444.05	1,090.0	Sample
JS-62B	735,316.23	2,890,442.25	1,090.0	Shelby Tubes / Piezometer
JS-62C	735,339.49	2,890,481.47	1,088.2	Sample
JS-63A	734,985.29	2,890,020.63	1,089.4	Sample
JS-63B	734,987.89	2,890,023.29	1089.4	Shelby Tubes / Piezometer
JS-64	735,402.40	2,890,528.11	1,082.3	Sample
JS-65A	735,271.28	2,890,430.29	1,095.1	Sample / Shelby Tubes
JS-65B	735,269.06	2,890,426.10	1,094.7	Shelby Tubes
CPT-1	735,528.42	2,890,809.86	1,109.5	Cone Penetration Test
CPT-2	735,472.49	2,890,736.90	1,108.3	Cone Penetration Test
CPT-3	735,419.93	2,890,663.93	1,107.1	Cone Penetration Test
CPT-4	735,439.57	2,890,778.44	1,101.8	Cone Penetration Test
CPT-5	735,182.18	2,890,431.15	1,100.0	Cone Penetration Test

LEGEND

- Edge of River Pool
- Assumed Limits of Original Disposal Ponds
- (A) Original Disposal Pond Designation
- Soil Boring With Standard Penetration Tests
- Soil Boring With Standard Penetration Tests (Piezometer Installed)
- Soil Boring With Standard Penetration Tests (Slope Inclinometer Installed)
- Cone Penetration Test
- Shear Vane Test

NOTES:

1. Topographic mapping was developed by Tuck Mapping Solutions, Inc. on March 19, 2009.
2. The Tennessee Valley Authority Surveying and Project Services performed a hydrographic survey on the Holston River on September 17, 2009 and on the Bottom Ash Disposal Area 2 on January 12, 2006.
3. The location of shown areas of past disturbance are approximations based on previous inspection reports.
4. The limits of the Original Disposal Ponds were approximated using drawing 10N295 and previous inspection reports.
5. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.



ASH DISPOSAL AREAS – BORING/INSTRUMENT PLAN
SCALE: 1"=200'

GRAPHIC SCALE: 1" = 200'
CONTOUR INTERVAL = 2'

RECORD DRAWING

For Supporting Design Calculations see FPG JSF FES CDX 000 000 2010 0001

R 0 | 01/29/10 | ARD | DMG | ARD | DLB | DLB | DLB | TJ
RECORD DRAWING

SCALE: 1" = 200' — EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
ASH DISPOSAL AREAS
BORING/INSTRUMENT PLAN

DESIGNED BY: A. DAVIS | DRAWN BY: D. GRAHAM | CHECKED BY: A. DAVIS | SUPERVISED BY: D. BLANTON | REVIEWED BY: D. BLANTON | APPROVED BY: D. BLANTON | ISSUED BY: T. JOHNSON

Stantec Consulting Services Inc.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
Tel. 859.422.3000
Fax 859.422.3100
www.stantec.com

JOHN SEVIER FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 01/29/10 | 41 | C | 10W507-01 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

APPENDIX B

Document 14

Dam Inspection Check List Form Bottom Ash Disposal Area 2

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	John Sevier Fossil Plant	**Date:**	2011. 09. 13
Unit Name:	Bottom Ash Disposal Area 2	**Operator's Name:**	TVA
Unit I.D.:		**Hazard Potential Classification:**	High ☐ Significant ☑ Low ☐
	Inspector's Name:	Stan Notestine, Frederic Shmurak, Emily Powell	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No
1. Frequency of Company's Dam Inspections?	Daily, Monthly, Annually, Yearly & as needed	
2. Pool elevation (operator records)?	1133.3	
3. Decant inlet elevation (operator records)?	1133.0	
4. Open channel spillway elevation (operator records)?	N/A	✓
5. Lowest dam crest elevation (operator records)?	1138.5	
6. If instrumentation is present, are readings recorded (operator records)?	Piezometers Monthly ✓	
7. Is the embankment currently under construction?		✓
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓
10. Cracks or scarps on crest?		✓
11. Is there significant settlement along the crest?		✓
12. Are decant trashracks clear and in place?	✓	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓
14. Clogged spillways, groin or diversion ditches?		✓
15. Are spillway or ditch linings deteriorated?		✓
16. Are outlets of decant or underdrains blocked?		✓
17. Cracks or scarps on slopes?	✓	
18. Sloughing or bulging on slopes?		✓
19. Major erosion or slope deterioration?		✓
20. Decant Pipes:		
Is water entering inlet, but not exiting outlet?		✓
Is water exiting outlet, but not entering inlet?		✓
Is water exiting outlet flowing clear?	✓	
21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
From underdrain?		N/A
At isolated points on embankment slopes?		✓
At natural hillside in the embankment area?		✓
Over widespread areas?		✓
From downstream foundation area?	✓	
"Boils" beneath stream or ponded water?		✓
Around the outside of the decant pipe?		✓
22. Surface movements in valley bottom or on hillside?		✓
23. Water against downstream toe?		✓
24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Issue #	Comments
17	Small tension-like cracks along D/S slope near crest of N slope.
21	Several clearly identified seeps (monitored)
–	Brushy vegetation along N. D/S slope towards stilling pond area.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit TN0005436 **INSPECTOR** DEWBERRY

Date APRIL 29, 2011

Impoundment Name

Impoundment Company

EPA Region IV

State Agency TN DEC

(Field Office) Address

Name of Impoundment

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☐ **Update** ☑

	Yes	No
Is impoundment currently under construction?	☐	☑
Is water or ccw currently being pumped into the impoundment?	☑	☐

IMPOUNDMENT FUNCTION: Storage & DEPOSITION of BOTTOM ASh

Nearest Downstream Town Name: Rogersville

Distance from the impoundment: 1½ mile

Location:

Latitude	36	Degrees	22	Minutes	10	Seconds	**N**
Longitude	82	Degrees	58	Minutes	12	Seconds	**W**

State TN **County** HAWKINS

	Yes	No
Does a state agency regulate this impoundment?	☑	☐

If So Which State Agency? TN DEP Through NPDES Permit; NOT Dam Safety.

HAZARD POTENTIAL *(In the event the impoundment should fail, the following would occur):*

☐ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

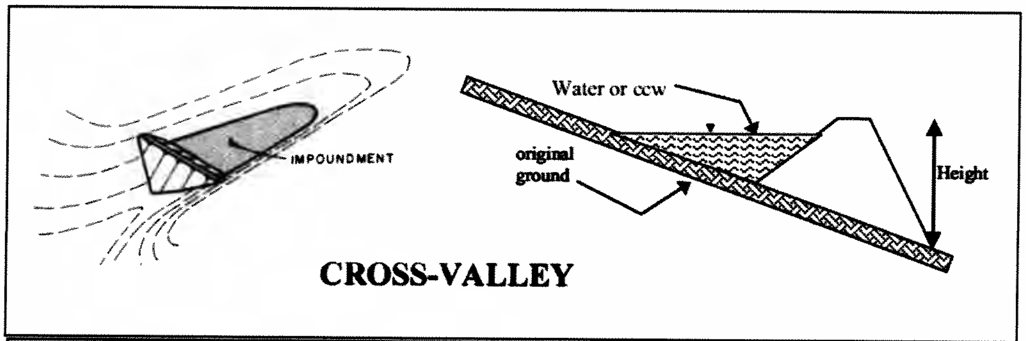
☐ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

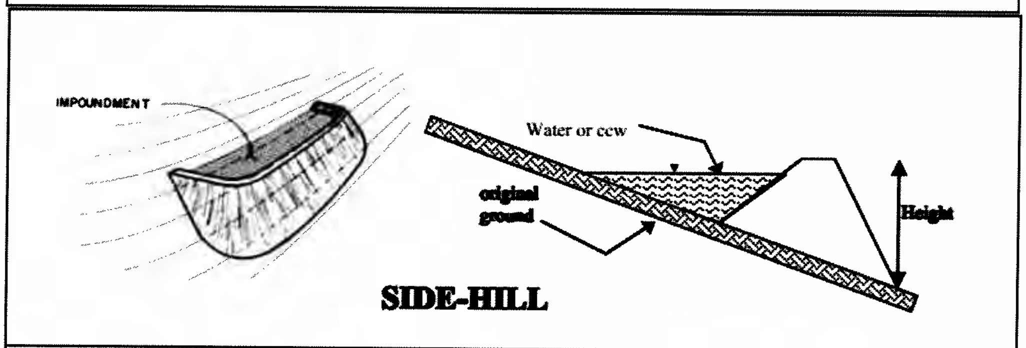
☑ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

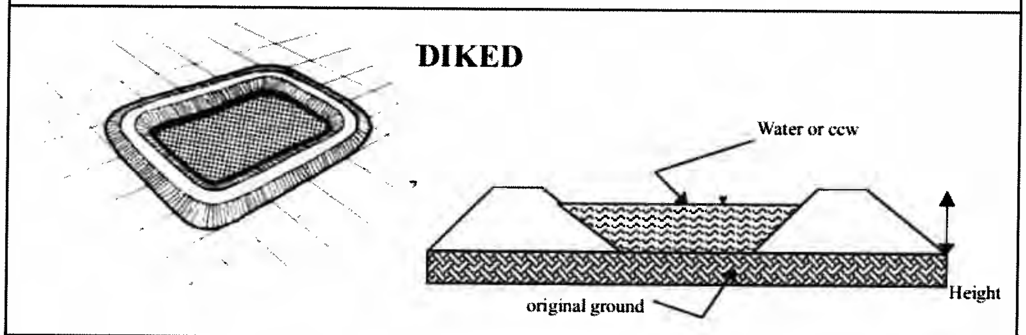
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

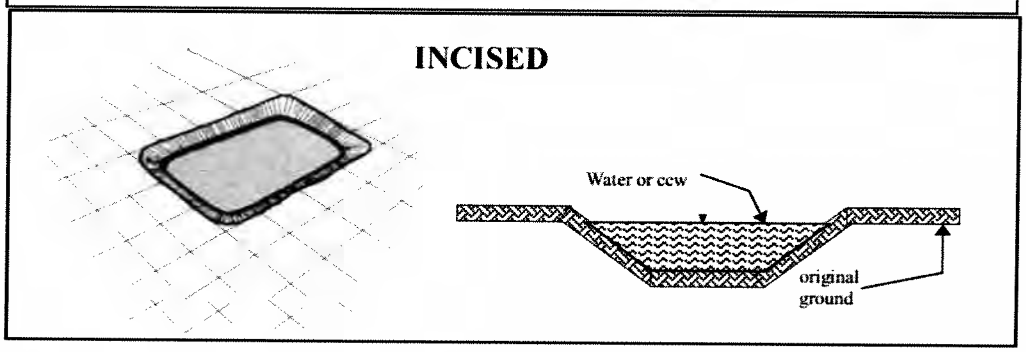
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

CONFIGURATION:









☐ Cross-Valley ☐ Side-Hill ☑ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft)	37	**Embankment Material**	CLAYEY NATIVE SOILS
Pool Area (ac)	40	**Liner**	NONE
Current Freeboard (ft)	5.2	**Liner Permeability**	N/A

TYPE OF OUTLET (Mark all that apply)

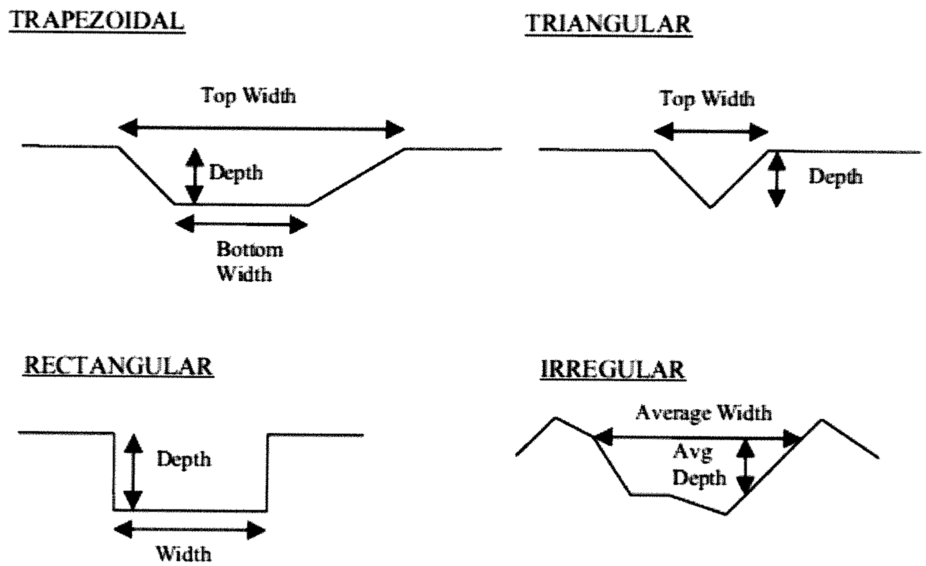
☐ **Open Channel Spillway**

- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

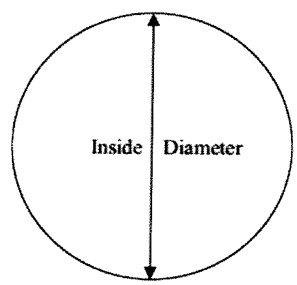
average bottom width (ft)

top width (ft)



☑ **Outlet** DUAL 48" CONCRETE RISER W/ 36"ϕ RCP OUTLET

~~18" inside diameter~~
~~(SDR 17 – smooth lined – 19.5" OD)~~



Material

- ☐ corrugated metal
- ☐ welded steel
- ☑ concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☑	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By ~~**AEP – in house personnel**~~ TVA

	Yes	No
Has there ever been a failure at this site?	☐	☑

If So When?

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	☑
If So When?		

If So Please Describe :

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☐	☑
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

NO

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

NO

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

NO

APPENDIX B

Document 15

Dam Inspection Check List Form Dry Fly Ash Stack

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	John Sevier Fossil Plant	Date:	2011.09.13
Unit Name:	DRY FLY ASH STACK	Operator's Name:	TVA
Unit I.D.:		Hazard Potential Classification:	High ☐ Significant ☑ Low ☐
		Inspector's Name:	STAN NOTESTINE, Frederic Shmurak, Emily Powell

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No
1. Frequency of Company's Dam Inspections?	DAILY/WEEKLY/QTRLY/YEARLY & AS NEEDED	
2. Pool elevation (operator records)?	1087.9	
3. Decant inlet elevation (operator records)?	1088.1	
4. Open channel spillway elevation (operator records)?	N/A	✓
5. Lowest dam crest elevation (operator records)?	1100	
6. If instrumentation is present, are readings recorded (operator records)?	✓	
7. Is the embankment currently under construction?		✓
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		N/A
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓
10. Cracks or scarps on crest?		✓
11. Is there significant settlement along the crest?		✓
12. Are decant trashracks clear and in place?	✓	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓
14. Clogged spillways, groin or diversion ditches?		✓
15. Are spillway or ditch linings deteriorated?		✓
16. Are outlets of decant or underdrains blocked?		✓
17. Cracks or scarps on slopes?	✓	

	Yes	No
18. Sloughing or bulging on slopes?		✓
19. Major erosion or slope deterioration?		✓
20. Decant Pipes:		
Is water entering inlet, but not exiting outlet?		✓
Is water exiting outlet, but not entering inlet?		✓
Is water exiting outlet flowing clear?	✓	
21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
From underdrain?	✓	
At isolated points on embankment slopes?		✓
At natural hillside in the embankment area?		✓
Over widespread areas?		✓
From downstream foundation area?		✓
"Boils" beneath stream or ponded water?		✓
Around the outside of the decant pipe?		✓
22. Surface movements in valley bottom or on hillside?		✓
23. Water against downstream toe?	✓	
24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Issue #	Comments
17	Evidence of past scarps; no active scarps observed
20	Outlet pipes submerged; not observed.
21	Pumped underdrain system installed
23	Holston River along D/S toe.

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit TN 0005436 **INSPECTOR** DEWBERRY

Date APRIL 29, 2011
Impoundment Name

Impoundment Company
EPA Region IV

State Agency TN
(Field Office) Address
Name of Impoundment

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☐ **Update** ☑

	Yes	No
Is impoundment currently under construction?	☐	☑
Is water or ccw currently being pumped into the impoundment?	☐	☑

IMPOUNDMENT FUNCTION: DRY Storage of FLY Ash.

Nearest Downstream Town Name: RoGersville

Distance from the impoundment: 1 ½ mile

Location:

Latitude	36	Degrees	22	Minutes	25	Seconds	**N**
Longitude	82	Degrees	58	Minutes	22	Seconds	**W**

State TN **County** HAWKINS

	Yes	No
Does a state agency regulate this impoundment?	☑	☐

If So Which State Agency? TN PER NPDES; NOT FOR Dam Safety

HAZARD POTENTIAL *(In the event the impoundment should fail, the following would occur):*

☐ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

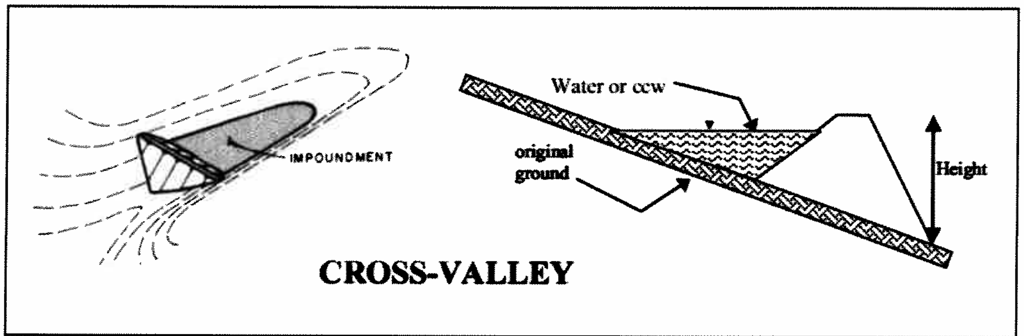
☐ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

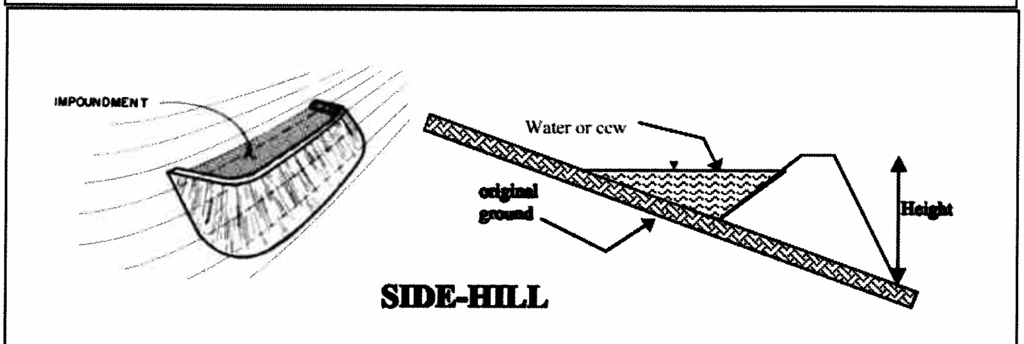
☑ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

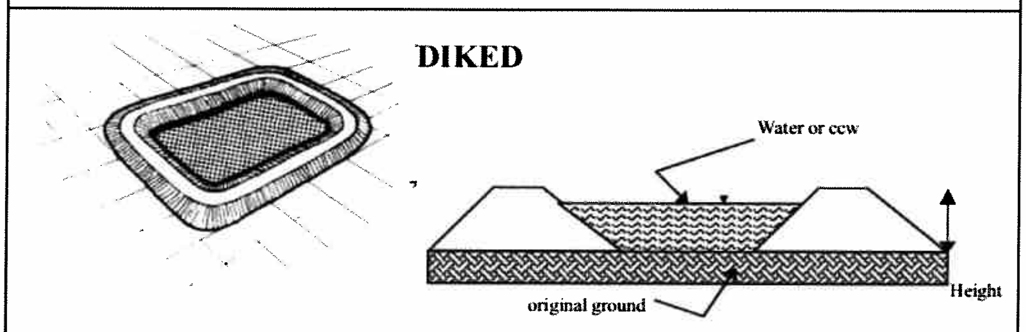
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

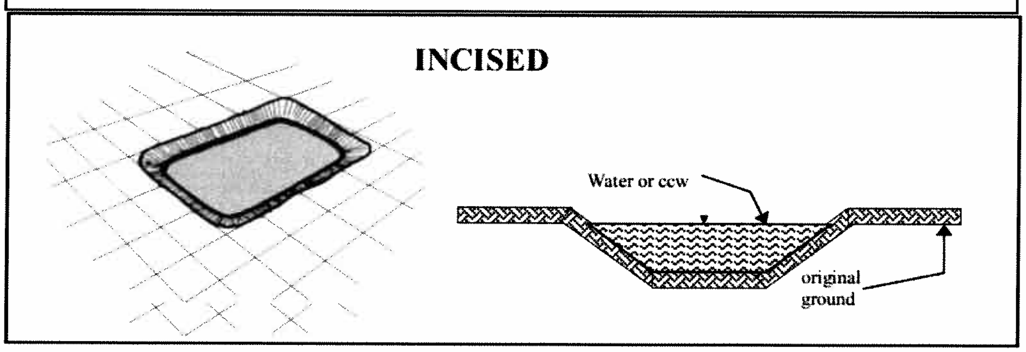
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

CONFIGURATION:









- [ ] Cross-Valley
- [ ] Side-Hill
- [x] Diked
- [ ] Incised (form completion optional)
- [ ] Combination Incised/Diked

Embankment Height (ft) 110

Pool Area (ac) 90

Current Freeboard (ft) 12.1

Embankment Material CLAYEY SOILS underlined by SLUICED FLYASH & Alluvium

Liner NONE

Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

☐ Trapezoidal

☐ Triangular

☐ Rectangular

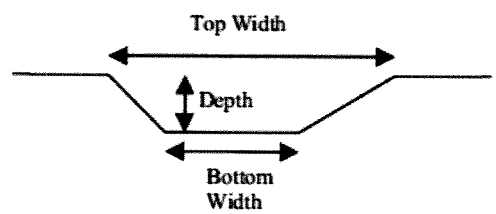
☐ Irregular

depth (ft)

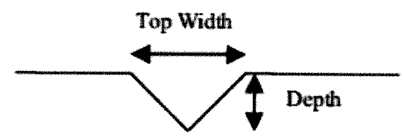
average bottom width (ft)

top width (ft)

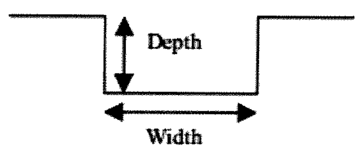
TRAPEZOIDAL



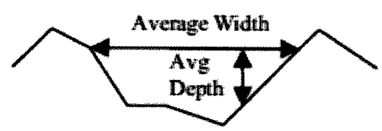
TRIANGULAR



RECTANGULAR



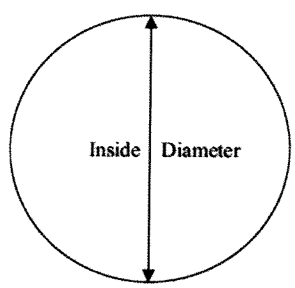
IRREGULAR



☑ **Outlet** DUAL 48" RISER W/ 36" RCP OUTLETS

~~18" inside diameter~~

(~~SDR 17 – smooth lined – 19.5" OD~~)



Material

☐ corrugated metal

☐ welded steel

☑ concrete

☐ plastic (hdpe, pvc, etc.)

☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☑	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By ~~AEP – in house personnel~~ TVA

	Yes	No
Has there ever been a failure at this site?	☑	☐

If So When? 1973; 1999-2001

If So Please Describe : Several Areas of The dike slope was disturbed by sloughing, sliding, cracking & erosion.

	Yes	No
Has there ever been significant seepages at this site?	☑	☐

If So When?

If So Please Describe : TOE DRAIN installed TO Remediate

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☑	☐
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :
pumped TOE DRAIN INSTALLED; PIEZOMETERS INSTALLED

ADDITIONAL INSPECTION QUESTIONS

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

YES - Sluiced FLY ASh and Alluvial SOILS.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

NO.

From the site visit or from photographic documentation, was there evidence of prior releases, failures, or patchwork on the dikes?

NO; Historical data indicates past slope failures.

APPENDIX B

Document 16

Qualitative Assessment Liquefaction Potential Memo Dated May 25, 2012

Memorandum

To: Stephen Hoffman, USEPA
Through: Jerry Strauss
From: Joe Klein
Date: May 25, 2012
Re: Qualitative Assessment
Liquefaction Potential
TVA Fossil Plant CCR Impoundments
Dewberry Project No, 50047151

This memorandum provides the results of a qualitative assessment of CCR impoundment embankment susceptibility to liquefaction at eight of the TVA fossil fuel plants assessed by Dewberry. The plants are: Bull Run; Colbert; Cumberland; Gallatin; John Sevier; Johnsonville; Kingston, and Widows Creek. We have not included Watts Bar (small pond, inactive for 30 years, minimal potential ash release), and Allen (TVA continuing deformation analyses, awaiting data and report)

TVA has indicated that a formal assessment of liquefaction susceptibility is underway; a completion date has not been provided. In prior rounds of the EPA CCR program, Dewberry has provided a preliminary indication of the presence of soils susceptible to liquefaction based on the geotechnical data provided with the slope stability analysis. The purpose of this assessment is to include similar information as a component of our reports to EPA, and to provide a uniform approach to the remaining plant sites.

Generally the geotechnical review looks at the soil stratification beneath both the embankments and impoundments to identify soil types considered susceptible to liquefaction; i.e., fine to medium grain sands, and some silts with Standard Penetration Resistance, or N-Values of less than 15 blows per foot[1]. That criterion, is an accepted industry standard for first level reviews.

Because several of the embankments had been constructed to their current configuration in stages, and because the raised sections were typically constructed by extending embankments in the *upstream* direction, most of TVA raised dikes are supported in part on stored bottom ash and/or fly ash. As bottom ash and fly ash are both known to be somewhat susceptible to liquefaction, an assessment of the potential impact on loss of subgrade support to the raised dike sections is a key consideration in the assessments.

For most of the other management units I have visited, the impoundments were expanded by *building out* on the downstream side of the dikes, eliminating the situation of building on the existing ash layer. The one site that did expand inward conducted a liquefaction analysis which indicated a potential for liquefaction in the ash at certain groundwater elevations. In that case the utility combined a groundwater monitoring system and construction schedule in an effort to prevent groundwater elevation

[1]Winterkorn, H.F., and Fang, H., *Foundation Engineering Handbook, Van Nostrand Reinhold, Ltd., New York, NY, 1975, pg. 268*

increases. If the approach proved to be unsuccessful, the utility had a drainage system design ready to be installed to stabilize the embankment against a potential liquefaction failure.

Because the assessments are qualitative rather than quantitative, I elected not to consider the results as indicative of either SATISFACTORY or UNSATISFACTORY. The assessed liquefaction condition at each impoundment is presented as either NO CONCERN or CONCERN. Each impoundment is assessed based on the natural foundation soils at the site, and the supporting material of raised dike sections. A composite rating is provided as described below.

The evaluations are based on the embankment cross-sections used in the recent (February 2012 and April 2012) pseudo static slope stability analyses conducted by Stantec Consulting Services for TVA.

Foundation Rating

Foundation soils are rated not only on the presence of liquefaction susceptible soils, but also the depth and thickness of the stratum, the slope of the base of the stratum, and whether the stratum extends beneath the base dike, or is restricted to the impoundment area. A CONCERN rating indicates the presence of soils susceptible to liquefaction at a relatively shallow depth below the embankment, and sufficiently thick to result in substantial deformations to the embankment in the event liquefaction occurs.

Dike Rating

Dikes were rated based on the presence of bottom ash, fly ash or other CCR material underlying raised dike sections. If the CCR material supported 50 percent or more of the raised dike, the dike received a CONCERN rating.

Composite Ratings

Composite ratings are based on a judgment of deformations that may occur to the embankments in the event of liquefaction of materials supporting the initial and/or raised dikes, The rating reflects the potential volume of material released in the event of an embankment failure, and the nature of the adjoining area expected to receive the outflow. In most cases, the controlling parameter for each perimeter dike is the potential failure of raised dikes supported in part by CCR material. Conversely, the controlling factor for interior dikes is the foundation rating.

Results

Table 1 presents a summary of the results of this assessment.

Plant	Impoundment	Liquefaction Stability Rating		
		Foundation	Dikes	Composite
Bull Run	Disposal Area 2A	NO CONCERN	CONCERN	**CONCERN**
	Disposal Area 2	NO CONCERN	NO CONCERN	NO CONCERN
	Bottom Ash Disposal Area 1	NO CONCERN	CONCERN	**CONCERN**
Colbert	Ash Pond 4	CONCERN	CONCERN	**CONCERN**
	Ash Pond 5	NO CONCERN	NO CONCERN	NO CONCERN
Cumberland	Ash Pond	NO CONCERN	NO CONCERN	NO CONCERN
Gallatin	Ash Pond A	NO CONCERN	CONCERN	NO CONCERN
	Ash Pond E	NO CONCERN	CONCERN	NO CONCERN
John Sevier	Bottom Ash Pond	NO CONCERN	NO CONCERN	NO CONCERN
	Ash Disposal Area J	NO CONCERN	NO CONCERN	NO CONCERN
Johnsonville	Ash Disposal Area 2	NO CONCERN	CONCERN	**CONCERN**
Kingston	Ash Pond Dike C	CONCERN	CONCERN	**CONCERN**
	Gypsum Stack	NO CONCERN	NO CONCERN	NO CONCERN
Widows Creek	Main Ash Pond Complex	NO CONCERN	CONCERN	**CONCERN**
	Gypsum Stack	NO CONCERN	NO CONCERN	NO CONCERN

The embankment composite ratings at Gallatin Fossil Plant are the exception to the general case of the dike rating being the controlling factor. Gallatin Ash Pond A embankment is an interior dike separating Ash Pond A and Stilling Pond B. Failure of the embankment due to liquefaction of the supporting ash would result in an intermingling of ash and decant water within the impoundment, a release from the impoundment would not be expected to occur.

Gallatin Ash Pond E is supported on an underlying layer of ash that extends beyond the toe of the embankment to a natural slope, expected to be the excavation limits for the original impoundment area. Failure of the Ash Pond E due to liquefaction of the underlying material is not expected to result in a significant release beyond the boundaries of the current impoundment,

Conclusions

Based on the results of this review, the stability of six impoundments is rated as CONCERN relative to potential liquefaction during a seismic event.

As previously discussed, the embankment stability ratings are based on a qualitative review of the current geotechnical data. More rigorous analytical assessments may arrive at different results. Such analyses should evaluate both the likelihood of liquefaction occurring from susceptible soils in the event of the design earthquake, and the effects of liquefaction on the embankments. The second phase of analyses is important to assess the risk posed by potential liquefaction of (or beneath) the CCR impoundment embankments.

Limitations

Our assessment of the stability of CCR impoundment embankments includes evaluation of many variables, including liquefaction potential. Most of the other variables have data developed with significantly more technical rigor than this qualitative assessment. *Therefore, I caution against using the results of this assessment as a primary determinant on the overall rating of a CCR impoundment.* Although reasonable judgment was used throughout the evaluation, uncertainties were evaluated using the most conservation assumptions.

Further, it is likely that the geotechnical data provided by TVA is "inconsistent" with the data (i.e., procedure) used in the Foundation Engineering Handbook (Footnote 1) to develop correlations with liquefaction susceptibility and N-values. That is, information in the TVA geotechnical reports indicate that the Standard Penetration Tests were conducted using an automatic hammer to drive the sampler. Research has shown that automatic hammers impart a significantly higher percentage of the theoretical maximum hammer to the drive anvil energy than achieved by traditional manual methods using a rope and cathead to raise and release the hammer. The result is that TVA's recorded N-values can be expected to be lower than those achieved by manual hammers in use at the time the industry-practice (i.e., Handbook) liquefaction correlations were developed.

Further, the sand strata encountered at TVA sites were below the ground water level. The boring logs indicated borings were advanced using a hollow stem auger. Hollow stem augers are a standard method for advancing soil borings, and comply with ASTM requirements. However, it is difficult to maintain the required hydrostatic head inside the augers while inserting and removing the sampler. If the hydrostatic head is not maintained, an upward gradient can develop at the tip of the auger which also reduces the N-value below the theoretical value.

It is for these reasons that the results of this assessment should not be used as the primary determinate of the overall rating for an embankment.

APPENDIX B

Document 17

Dewberry Memorandum dated April 2, 2012, Findings of Review

MEMORANDUM

USEPA Round 11 Findings of Review – John Sevier Plant

TO: Stephen Hoffman, USEPA

FROM: Stanley W. Notestine, P.E.

cc: Jerry Strauss, Dewberry Program Manager

Date: April 2, 2012

SUBJECT: CLIN 006, John Sevier Fossil Plant

Q1. Were conservative assumptions used in the TVA evaluation?

R1. Not initially, however the latest analyses used the 2%, 50-year occurrence period for steady state seismic loading conditions for the Bottom Ash Disposal Area 2 impoundment. The peak ground acceleration [0.115g], soil strength parameters, hydrologic and hydraulic analyses were consistent, conservative assumptions.

Q2. Were sound engineering assumptions used in the analysis?

R2. Not initially. Input data and engineering assumptions based on a 10%, 50 year occurrence for the steady state seismic loading conditions was not the proper period for the Bottom Ash Disposal Area 2 impoundment. A 2%, 50-year occurrence was subsequently provided for the impoundment. This represents a sound engineering assumption. Sound engineering assumptions for the remainder of the analyses were consistent with data and information for this site.

Q3. Does the analysis meet sound engineering practice?

R3. Yes, the model used by Stantec [SLOPE/W from GEO-SLOPE International, Inc.] and interpretation of model results appear to represent sound engineering practice.

Q4. Does the analysis confirm Acceptable Factors of Safety for the impoundment(s)?

R4. Yes. The Factor of Safety for the Dry Fly Ash Stack and Bottom Ash Disposal Area under steady state static loading conditions were both 1.5, which is equal to the (minimum) acceptable Factor of Safety for static conditions. The Factor of Safety for the Bottom Ash Disposal Area under steady state with seismic loading conditions was 2.2, which is greater than 1.0 for a 2%, 50-year occurrence period. The Factor of Safety for the Dry Fly Ash Stack under steady state with seismic loading conditions was 1.1, which is greater than 1.0 for a 2%, 50-year occurrence period.

Signed: *[signature]* and sealed:

[Name of Lead Site Engineer]

STANLEY W. NOTESTINE
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
STATE OF TENNESSEE

4/2/2012

APPENDIX C

Document 18

Stantec, Response to Recommendations, October 16, 2012

Stantec

Stantec Consulting Services Inc.
1901 Nelson Miller Parkway
Louisville KY 40223-2177
Tel: (502) 212-5000
Fax: (502) 212-5055

October 3, 2012 let_003_175551015_rev_0

Mr. John Kammeyer
Vice President
Tennessee Valley Authority
1101 Market Street, LP 5G
Chattanooga, Tennessee 37402

Re: Response to Recommendations
USEPA CCR Impoundment Assessment DRAFT Report
John Sevier Fossil Plant (JSF)
Rogersville, Tennessee

Dear Mr. Kammeyer:

As requested, Stantec has reviewed the DRAFT report *Coal Combustion Residue Impoundment Dam Assessment Report, John Sevier Fossil Plant, Tennessee Valley Authority, Rogersville, Tennessee,* dated August 2012 prepared by Dewberry and Davis, LLC (Dewberry) for the United States Environmental Protection Agency (USEPA). Dewberry's recommendations and Stantec's corresponding response is listed below.

Dewberry Report Section 1.2.1 – Bottom Ash Disposal Area 2: *It is recommended that the Bottom Ash Disposal Area 2 static and seismic slope stability analyses be revisited to calibrate the different shear strength values used in the static and seismic models.*

Stantec Response: For this facility, the resulting factors of safety against slope stability are greater than the target values of 1.5 and 1.0 for static (long-term) and seismic (pseudostatic) loading conditions, respectively. Stantec reviewed the slope stability analyses and determined that appropriate shear strengths were used. Stantec used drained shear strength parameters for static analysis (long-term) and undrained shear strength parameters for seismic analysis (pseudostatic). This approach to shear strength selection is appropriate for clay materials and is consistent with Stantec's static vs. pseudostatic analysis at TVA's other plants and facilities. No further stability analysis or shear strength evaluation is judged to be necessary.

We appreciate the opportunity to provide this response. If you have any questions or need additional information, please call.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Stephen H. Bickel, PE
Senior Principal

Randy L. Roberts, PE
Principal

/db/cmw

c: Roberto L. Sanchez, PE
Michael S. Turnbow