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Coal Combustion Residue Impoundment
Round 11 - Dam Assessment Report

Bull Run Fossil Plant (#002)

CCR Impoundment Areas 1, 2, 2A
Tennessee Valley Authority
Clinton, Tennessee

Prepared for:

United States Environmental Protection Agency
Office of Resource Conservation and Recovery

Prepared by:

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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 Bottom Ash Disposal Area (Area 1), the Gypsum Disposal Area (Area 2A) and the Fly Ash Pond Area (Area 2) is based on a review of available documents and on the site assessment conducted by Dewberry personnel on September 14, 2011. We found the supporting technical documentation adequate (Section 1.1.3). As detailed in Section 1.2.1, there are two recommendations, one addressing the lack of a liquefaction analysis, and the other based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Area 2 CCR management unit is **Satisfactory**, and the Area 1, and Area 2A CCR management units are **FAIR** for continued safe and reliable operation, with no recognized existing management unit safety deficiencies. We recommend evaluations of soils liquefaction potential and impacts from non-global failures of the dikes to improve the ratings for the two FAIR units.

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 (See Appendix C).

The purpose of this report is **to evaluate the condition and potential of residue release from management units and to determine 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 Area 1, Area 2 and Area 2A management units that was 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".

LIMITATIONS

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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APPENDIX B

1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

Conclusions are based on visual observations from a one-day site visit, September 14, 2011, and review of technical documentation provided by Tennessee Valley Authority.

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

The dike embankments for Area 1, Area 2 and Area 2A and spillway for Area 2A and Area 2 appear to be structurally sound based on a review of the engineering data provided by the owner's technical staff and Dewberry engineers' observations during the site visit. Remediation was complete for several dikes in each area that had shown potential failures (major sloughing) under static conditions in a 2010 study, and were subsequently improved to meet minimum Factors of Safety.

No liquefaction evaluation was performed for the current dikes of Area 1, Area 2 or Area 2A. TVA plans on performing such analyses upon closure of the units. A qualitative analysis by Dewberry indicates possible liquefaction from ash underlying the Area 1 and Area 2A management units (see Appendix B, Doc 17). Without information concerning releases of CCR as a result of liquefaction under seismic conditions, the dike ratings cannot be rated Satisfactory.

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

A hydrologic and hydraulic analysis provided to Dewberry indicates adequate impoundment capacity to contain the 1 percent probability/Probable Maximum Precipitation design storm without overtopping the dikes.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation is inadequate; due to the lack of quantitative analysis of liquefaction potential Engineering documentation reviewed is referenced in Appendix A.

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

The description of the management units 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 embankment dikes and outlet structures were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability although visual observations were hampered by the presence of thick vegetation in some areas. 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 management units. As previously mentioned, there was active construction and/ or repairs to each disposal area at the time of the site assessment.

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 with piezometers, inclinometers, staff gauges and monitoring wells.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

One CCR management unit (Fly Ash Pond, Area 2) is rated SATISFACTORY and two (Bottom Ash Disposal, Area 1 and Gypsum Disposal, Area 2A) are rated FAIR for continued safe and reliable operation based on visual assessment and the pertinent technical documentation provided. Implementation of the recommendations described in 1.2 would help improve the ratings.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

Maintain frequent inspections of the management unit embankments for the Bottom Ash Disposal Area (Area 1), Fly Ash Pond (Area 2) and the Gypsum Disposal Area (Area 2A) to ensure the recently completed construction and repairs to ensure structural stability, as recommended by Stantec, are adequate.

An analysis of the impact of potential liquefaction of materials within and under all three management units is recommended to be performed now rather than upon closure of the units.

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1.2.2 Recommendations Regarding Continued Safe and Reliable Operation

It is anticipated that all three management units would be considered Satisfactory for continued safe and reliable operation upon:

- **A determination of liquefaction potential for soils and materials for the three management units, particularly Bottom Ash Disposal Area 1 and the Gypsum Disposal Area 2A under the design seismic event.**

1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

John Dizer, Tennessee Valley Authority
E&T
Scott Turnbow, Tennessee Valley Authority
Senior Manager, CCP Engineering
Andy Powell, Tennessee Valley Authority
Construction Manager, CCP Construction FGD&C
Rachel Combs, Tennessee Valley Authority
CCP Engineering
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Geotechnical Consultant
James Filson, P.E. Senior Associate, Dewberry
Hydraulic Engineer
Stanley W. Notestine, P.E., Dewberry
Geotechnical Engineer

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein has been assessed on September 14, 2011.

____
Stanley W. Notestine, P.E.

____
James Filson, P.E.

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

2.1 LOCATION AND GENERAL DESCRIPTION

The Bull Run Fossil Plant, owned and operated by the Tennessee Valley Authority (TVA), is located within Anderson County, in Clinton, TN. The plant facilities are located along two watercourses in the Melton Hill Reservoir; Clinch River runs along the western most part of the plant facilities and Bull Run Creek, a tributary to Clinch River, runs along the southern portion of the plant facilities. See Figure 2.1-1 Location Map and Figure 2.1-2 Aerial Photograph.

Bull Run Fossil Plant functions as a coal fired generating unit. The construction of the plant commenced in 1962 and it began commercial operations in 1967. The facility operates under one 950 megawatt generating unit. The plant has four active CCR storage facilities; the Bottom Ash Disposal Area (Area 1), Gypsum Disposal Area (Area 2A), Fly Ash Pond (Area 2) and Dry Ash Disposal Area. The Dry Ash Disposal Area is not considered for purposes of this report because it does not impound water and its failure would not impact an ash surface impoundment. A fifth disposal facility, the East/West Dredge Cell has remained inactive since its closure in 1995.

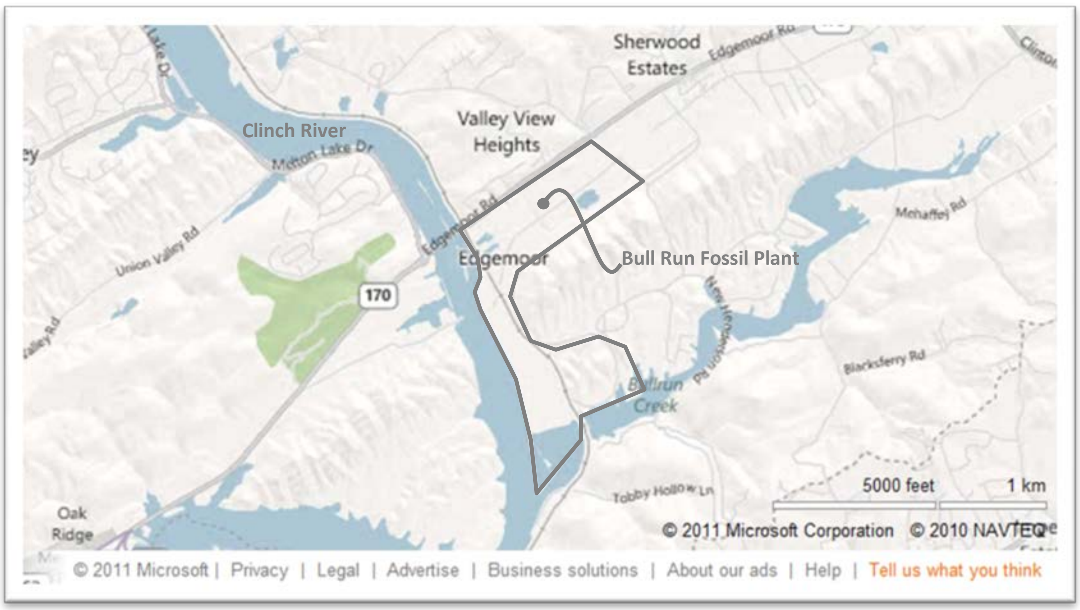

Figure 2.1-1: Location Map (Lat: 36° 1'15.53"N; Long: 84° 9'24.95"W)

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Figure 2.1-2: Aerial Photograph

Table 2.1 presents the size dimensions for the three CCR disposal facilities evaluated in this report.

Table 2.1: Summary of Dam Dimensions and Size			
	Bottom Ash Disposal (Area 1)	**Fly Ash Pond (Area 2)**	**Gypsum Disposal (Area 2A)**
Dam Height (ft)	44	10-15	43
Crest Width (ft)	20[1]	25[1]	12-25[1]
Length (ft)	3599[1]	4138[1]	3887[1]
Side Slopes (upstream) H:V	1.5-3:1	3.5:1/2:1	1.5-3:1
Side Slopes (downstream) H:V	1.5-2:1	2:1	2:1

[1] Approximate, measured based on scalable aerial photograph and USGS topography through Terrain Navigator v8.71.

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash generated through the coal combustion process is collected and handled by way of precipitator hoppers and hydroveyors. Fly ash is piped from air separator tanks and silos to the Fly Ash Pond, Area 2.

2.2.2 Bottom Ash

Bottom ash generated at this facility is collected in bottom ash hoppers located indoors, and handled by way of jet pumps. Eventually bottom ash in ash transfer tanks is piped to the Bottom Ash Disposal area (Area 1). On one occasion in the 1970s soon after startup, an ash collection system overflow resulted in a small release of bottom ash. The release, however, was associated with the bottom ash collection system and not directly to Area 1 impoundment dikes.

2.2.3 Boiler Slag

Boiler slag is not a byproduct of the coal combustion process at this facility.

2.2.4 Flue Gas Desulfurization Sludge

Flue gas desulfurization sludge (FGD) is collected and handled through limestone preparation facilities, absorbers and recycle pumps; all of which are located indoors. Eventually FGD sludge is piped to the gypsum stack, Area 2A. Small releases due to FGD piping gasket leaks have occurred in the past.

2.3 SIZE AND HAZARD CLASSIFICATION

According to documentation provided by TVA, Area 1 has a maximum capacity of 543.3 acre-feet with a maximum design height for storage of 44 feet. Area 2 has a maximum capacity of approximately 1,673.6 acre-feet with a maximum design height of 15 feet. Area 2A has a maximum capacity of 1,700.2 acre-feet with a maximum design height for storage of 43 feet. Based on Table 2.2a, Area 1 is classified as an intermediate sized impoundment considering dam height and small size considering storage capacity. Area 2 is classified as an intermediate sized impoundment considering storage capacity and as a small sized impoundment considering dam height. Area 2A is classified as an intermediate sized impoundment considering both storage capacity and dam height.

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

For Area 1, loss of human life is not expected as a result of a failure at this location, however economic and environmental losses would be expected. Although a breach analysis at Area 2A was considered, the anticipated location of failure was along the south dike that separates Area 2 from Area 2A. An impact zone considering a failure at its perimeter dike along the Clinch River was not considered. A failure along the Area 2A perimeter dike would result in economic and environmental losses, although no loss of human life would be expected. Stantec's *Dam Breach Analysis and Inundation Maps* dated May 5, 2010 provides a dam breach analysis of existing and future conditions for both a 'Sunny Day' and 'Probable Maximum Precipitation (PMP) Event' scenario for Area 2. In the analysis, a breach to Area 2 along the Bull Run Creek perimeter dike was considered. The results of the detailed analysis indicate no structures or bridges are within the impact zone of either scenario. While loss of life would not be expected if a failure were to occur, economic and environmental damages would be expected. For these reasons and based on FEMA Federal Guidelines for Dam Safety, all three areas (Area 1, Area 2 and Area 2A) have a Significant Hazard Classification (see Table 2.2b).

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

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

Area 1 and Area 2 primarily receive bottom ash residuals; on occasion some fly ash is sluiced into the pond. The Area 2A impoundment receives scrubber gypsum via sluicing pipes. The volume of residuals stored in the Area 1, Area 2 and Area 2A impoundments was not available at the time of inspection. Table 2.1 summarizes the storage capacity of the each area.

Table 2.3: Maximum Capacity of Unit			
	Bottom Ash Disposal (Area 1)	**Fly Ash Pond (Area 2)**	**Gypsum Disposal (Area 2A)**
Maximum Pool Surface Area (acre)	32	50	42
Maximum Capacity (cubic yards)	876,500	2,700,000	2,743,000
Maximum Capacity (acre-feet)	543.3	1673.6	1700.2
Top of Dam (feet)[1]	839	810	838
Normal Pool (feet)	806.5	801	825

[1] Approximate, based on BRF_DIKECREST.CSV

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

According to a Stantec's *Report of Geotechnical Exploration* dated April 12, 2010, the CCR disposal area was originally built as two areas (Area 1 and Area 2) separated by a drainage channel (WOUS). Each area was developed by continuous side hill dikes, along Clinch River and the drainage channel for Area 1 and along Clinch River, Bull Run Creek and the drainage channel for Area 2. Subsequently a splitter dike was constructed within Area 2 to form Area 2A. The original earthen embankments, built in 1960s, were constructed of light brown to dark brown, sometimes sandy, lean clay to an elevation of approximately 800 feet. The original dikes have since been raised in each area to reach current crest elevations.

For Bottom Ash Disposal Area 1, raises to the dike were composed of very loose to medium, light brown to red-brown, clayey sand (SC) and clayey gravel (GW). Additionally, some light brown, medium stiff to stiff, variably sandy, lean clay (CL) could also be found in the upper dike along with variably thick intervals of moist to saturated sluiced ash material, underlain by alluvial material. Ash material with a two to three foot capping of lean clay appears to compose the majority of the dike above 810 feet.

For Fly Ash Pond Area 2, raises to the dike were composed of light brown to red-brown, medium stiff to very stiff, variably sandy, lean clay (CL) in the top ten feet. Underlying this fill is two to three feet of clayey gravel or compacted bottom ash, that subsequently overlays alluvial clays and sands.

The lower perimeter dikes for the Gypsum Dry Stack Area 2A, both on the west and north sides, are composed of material similar to that found in Area 1 and Area 2. Raises to the original dike were found to be composed primarily of compacted bottom ash material with co-mingled fly ash. This is the case for the ash dike tiers at elevations 825 and 835 feet. For dike raises along the west and north side of Area 2A, tier ash dikes were constructed partially atop the previous dike tier. For dike raises along the east and south side of Area 2A, raises were constructed over sluiced ash material. Area 2A dikes were found to impound material consisting of bottom ash with lesser quantities of fly ash.

2.5.2 Outlet Structures

Coal combustion residues are piped along with process water flows and pumped stormwater flows to a sluice ditch that runs adjacent to Area 1 and Area 2A before outfalling into Area 2. Discharge from Area 2A outfalls directly through its southern dike to Area 2. Consequently, the primary outlet structure for all disposal areas is located in the southwestern corner of the Area 2 stilling pond. This primary outlet structure consists of three 52-inch diameter steel circular weirs mounted on 48-inch diameter reinforced concrete riser pipes. From each riser a 36-inch RCP outlet pipe discharges to the Clinch River through the west perimeter dike.

The outlet for Area 2A consists of dual 24-inch pipes located near the south western corner. Each 24-inch HDPE pipe is encased by a 30-inch corrugated metal pipe with concrete sleeve.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

Critical infrastructure located downstream of Area 1, Area 2 and Area 2A includes the West Knoxville Utility. This downstream water intake is located at a distance of approximately 1000 feet (0.2 miles). In the case of a breach of the perimeter dike of each area, finely graded suspended ash particles and dissolved metals would flow into the Clinch River. Stantec's *BRF Ash Pond Breach Analysis – TDEC Comments Response* letter (see Appendix A, Doc 2) addresses the potential for impacts to this downstream utility indicating it is unlikely that the intake for the utility would be blocked by mudflow from a breach of the impoundment.

The nearest downstream town is Oak Ridge, TN at a distance of approximately 10 miles.

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3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

The dam for Bottom Ash Disposal Area 1, the Fly Ash Pond Area 2 and the Gypsum Dry Stack Area 2A is not currently permitted by a regulating agency.

The Tennessee Department of Environment and Conservation, Division of Solid Waste Management requires the facility to maintain a Solid Waste Operating Permit. The Tennessee Valley Authority Bull Run Fossil Plant was issued a registration number, IDL 01-0208, in January 11, 2006, for handling solid waste (see Appendix A, Doc 9).

Discharge from the Area 2 impoundment is regulated by the Tennessee Department of Environment & Conservation, Division of Water Pollution Control. The impoundment has been issued a National Pollutant Discharge Elimination System Permit; Permit No. TN0005410. The permit was issued November 1, 2010, and expires November 1, 2013.

3.2 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry did not indicate any spills, unpermitted releases, or other performance related problems with Area 1 and Area 2 perimeter dikes over the last 10 years.

Stantecs' *Report of Geotechnical Exploration* dated April 12, 2010 (see Appendix A, Doc 5) makes mention of sloughing along the exterior toe of the Area 2A south dike. Sloughing was attributed to seeps that developed in 2007. Although changes were made to the under-drain features originally installed along the south dike in 2008, sloughing reappeared in October of 2009.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The CCR disposal area was originally built as two areas (Area 1 and Area 2) separated by a drainage channel (WOUS). Each area was developed by continuous side hill dikes. Area 1 was diked along the Clinch River and the WOUS and Area 2 was diked along the Clinch River, Bull Run Creek and the WOUS. During the initial construction of the areas and in an effort to increase the size of Area 2, the Bull Run Creek tributary was relocated to its current location. The original spillway of Area 2 was located in the south end of the pond and discharged into Bull Run Creek. Area 2A was not constructed as part of the original configuration.

4.1.2 Significant Changes/Modifications in Design since Original Construction

The two original dikes were built to a crest elevation of 800 feet. At this elevation, the dikes had a height of about 15 feet. The dikes were later raised to elevation 810 feet. In 1971 a sluice ditch was constructed to link Area 1 and Area 2. This sluiced ditch has riprap-lined side slopes where it extends along Area 2A. A splitter dike was constructed within Area 2, in 1976, to create the stilling pond in the southwest corner. Water now enters the stilling pond through a rock weir near the south end of the splitter dike and outfalls to the Clinch River through its west dike. Area 2A was created in 1981, through the construction of a second splitter dike within Area 2. Area 2A was constructed to discharge into Area 2 through the splitter dike that was constructed over sluiced ash deposits extending into Area 2. The dike's construction included the installation of manufactured sand columns into the ash deposits of Area 2. An extensive under-drain system was also installed as part of the Area 2A construction. Since 1985, Area 1 has been filled with Bottom Ash. Its ash stack rises above the upper dikes to elevations near 850. In 2008, Area 2A became a gypsum disposal area, requiring the need for additional construction and improvements such as raising the dike elevation to 835 feet and installing perimeter and finger underdrains to control seepage. In general, the slopes for Area 2A are 3:1 up to elevation 835 feet with a 20 foot intermediate bench at elevation 825 feet.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

In 1981, evidence of slippage and settlement along the south dike of Area 1 was observed. Additionally, several slides along the upper dike were observed and recorded in 1998. Details regarding the extent or location of slides and means of repair could not be found.

Seepage was observed along the west dike of Area 2 from 1976 to 1979. In 1995 soft and wet areas along the toe of the south slope were also noted. A slump of the south dike on the downstream slope was repaired in early 2009 by use of stone rip rap. Abandoned pipes that penetrate the perimeter dikes in Area 2 were fully grouted in 2010.

Sloughing near the toe of the Area 2A south slope required additional changes to the underdrain control system along the dike. As part of an effort to properly control seepage along the Area 2A south dike, an extensive bottom drainage system was installed within the pool area to collect water through a header pipe that in turn outfalls through the Area 2A spillway. In addition to slumping of the dike, erosion around the outlet conduit was caused by leakage through openings in the pipe joints. The existing 30-inch CMP's were slip-lined using 24-inch HDPE's. In 2007, some of the original under-drainage pipe system was cutoff or plugged as well. In 2008, thirteen crushed stone pocket drains were installed along the exterior toe of the embankment to further control seepage. Some locations along both the south and west lower dikes exhibit wet conditions that are presumably caused by seepage through the dikes. Erosion after significant storm events has steepened the exterior slopes along the dikes in certain locations. Some sloughing and erosion was observed along the middle bench of the north dike. Temporary repairs have been implemented to correct all these findings until more permanent measures can be implemented. In the summer of 2011, Area 2A slopes were regraded to improve surface drainage. The west slope in particular was re-graded to increase slope stability factors. French drains were also constructed on the north, east and west sides of Area 2A to help increase slope stability factors. The toe and slope of the south dike have been buttressed using crushed stone.

Documents provided to Dewberry, included Stantec's *Seepage Action Plan (SAP)* dated June 25, 2010. Included in the plan is a seepage log and exhibit of possible seepage problems and recommendations for Area 1, Area 2 and Area 2A as identified in Stantec's field inspection as well as through plant records. The log lists the different areas of concern, the date each was observed, a description of the concern and a mitigation status or future plans related to the concern.

There was active construction and/ or repairs to each disposal area at the time of the site assessment. As previously stated, a riprap buttress is being installed and/or repaired along the entire length of the perimeter dikes for all areas to improve dike stability. Side slopes for Area 1 are being re-graded to reduce slope steepness and increase the embankment safety factor. Area 2 is currently being dredged to remove accumulated ash and maintain freewater volumes. The area 2 water surface has been reduced from 806.5 feet to 801.0 feet to reduce the phreatic surface within dikes and to increase available freeboard. It is TVA's intent to maintain the operating water surface elevation at 801.0 feet.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

Area 1 and Area 2 were originally constructed in 1966 to serve as sluiced ash disposal facilities. In 1981 an interior dike was constructed in Area 2 to form Area 2A. Area 2A received sluiced ash until 1989.

4.2.2 Significant Changes in Operational Procedures and Original Startup

Area 1 was used for different dry and wet ash disposal activities starting in 1980. The Area 1 impoundment had its own separate discharge to the Clinch River. A major portion of Area 1 was diked to receive dredged fly ash from Area 2. In 1981 the pond discharge was relocated to the sluice ditch that extends parallel to its east dike. In 1985 the Area 1 impoundment was no longer used for receiving sluiced ash and was filled with bottom ash. Since 2004 disposal activities in Area 1 consist of receiving all bottom ash not sold offsite.

Although constructed in 1966, Area 2 was not used for sluice ash disposal until 1971, when the sluice ditch was constructed. In general, Area 2 operational procedures remain unchanged.

As previously mentioned, Area 2A received sluiced ash until 1989 where it then became a dry bottom ash disposal area for bottom ash from Area 1. Area 2A became inactive as an ash disposal facility in 2004. In 2008 Area 2A was converted to a Gypsum Disposal Area.

4.2.3 Current Operational Procedures

Area 1 is a bottom ash stack adjacent to the sluice ditch that receives all sluiced bottom ash. It does not currently impound water.

Area 2 currently receives sluiced bottom ash from the sluice ditch that extends along Area 1 and Area 2. It also receives discharges from Area 2A, the coal yard runoff and the chemical treatment pond.

Approximately 240,000 dry tons of scrubber gypsum are transported to Area 2A via wet sluicing each year. Byproducts are sold to off-site sources.

4.2.4 Other Notable Events since Original Startup

No additional information was provided to Dewberry concerning notable events impacting the operation of ash disposal activities.

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5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Stanley W. Notestine, P.E. and James Filson, P.E. performed a site visit on September 14, 2011, in company with the participants listed in Section 1.3.1.

The site visit began at 9:00 AM. The weather was partly cloudy with a high of 85°F. Photographs were taken of conditions observed. Please refer to the Dam Inspection Checklists in Appendix B for additional impoundment information. Selected photographs are included here for ease of visual reference. All pictures were taken by Dewberry personnel during the site visit.

The overall assessment of the impoundments was that it was in satisfactory condition and no significant findings were noted.

5.2 AREA 1, BOTTOM ASH DISPOSAL

5.2.1 Crest

The crest of the embankment had no signs of significant depressions, tension cracks or other indications of settlement or shear failure. Figure 5.2.1-1 and Figure 5.2.1-2 shows the typical crest conditions along the embankment.

Figure 5.2.1-1: Crest of Area 1 Lower South Dike (original dike), East. Drainage channel (WOUS) to the right.

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Figure 5.2.1-2: Crest of Area 1 Lower West Dike (original dike), Northwest. Clinch River to left.

5.2.2 Upstream/Inside Slope

Area 1 is primarily composed of bottom ash stack. The Area 1 stack is adjacent to a portion of the sluice ditch that receives and transports sluiced ash to Area 2. The interior slopes of the sluice ditch (where it extends parallel to the Area 1 stack) as well as the Area 1 stack interior slopes appear stable and maintained, despite the lack of vegetative cover or riprap lining. The stack is covered with what appeared to be a lining of topsoil. The operating pool elevation for the sluiced ditch is 806.5 ft, consequently only 7-8 ft of the inside slope was visible during the site visit. There were no observed scarps, sloughs, bulging, cracks, depressions or other indications of slope instability. Figures 5.2.2-1 and 5.2.2-2 show a section of the Area 1 stack and sluice ditch inside slope.

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Figure 5.2.2-1: Upstream slope of Area 1 Stack/Sluice Ditch, South.

Figure 5.2.2-2: Upstream slope of Area 1 Stack/Sluice Ditch, West.

5.2.3 Downstream/Outside Slope and Toe

The outside slope of the embankment appeared to have a fairly well maintained cover of grasses/weeds. The lower portion of the outside slope is covered with a riprap blanket. Trees and shrubs are growing on these lower portions of the outside slope, along both the west and south slopes. Maintenance work to remove trees and replenish riprap blanket was under way at the time of the site visit. A gravel access road wraps around the middle outside slope, inside stack slope and crest of the embankment. No scarps, sloughs, bulging, cracks,

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depressions or other indications of slope instability were observed along the slope. Figures 5.2.3-1 through 5.2.3-3 show representative sections of the embankment.

Figure 5.2.3-1: Downstream slope of Area 1 showing gravel perimeter access road, Southwest. Note trees and shrubs along lower portions of the slope.

Figure 5.2.3-2: Lower portion of Area 1 downstream slope, Southwest. Note riprap blanket along slope.

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Figure 5.2.3-3: Downstream slope of Area 1 West Dike, East. Drainage channel (WOUS) to right. Note trees and shrubs along lower portions of the slope.

5.2.4 Abutments and Groin Areas

All groins and abutments were well maintained. There were no observed scarps, sloughs, bulging, cracks, depressions or other indications of slope instability. Figure 5.2.4-1 shows an outside groin for Area 1.

Figure 5.2.4-1: Outside groin for Area 1 South Dike, East.

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5.3 AREA 2, FLY ASH POND

5.3.1 Crest

A gravel access road wraps around the embankment perimeter dike. No depressions, tension cracks or other indications of settlement or shear failure were observed on the crest of the middle or lower dike. Figure 5.3.1-1 shows typical crest conditions along the embankment.

Figure 5.3.1-1: Crest of Area 2, East.

5.3.2 Upstream/Inside Slope

The interior slopes of Area 2 are partly riprap lined and partly covered with a good stand of grass/weeds. The slopes appear stable and well maintained. The operating pool elevation was 801.00 ft, consequently only 9 ft of the inside was visible during the site visit. There were no observed scarps, sloughs, bulging, cracks, depressions or other indications of slope instability. Figures 5.3.2-1 shows a section of the Area 2 inside slope.

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Figure 5.3.2-1: Inside slope of Area 2, South.

5.3.3 Downstream/Outside Slope and Toe

The outside slope of the embankment was covered with a good stand of grass/weeds. The lower portion of the outside slope is covered with a riprap blanket to protect against wave action. No scarps, sloughs, bulging, cracks, depressions or other indications of slope instability were observed along the slope. Figures 5.3.3-1 and 5.3.3-2 shows representative sections of the outside slopes and toe.

Figure 5.3.3-1: Area 2 downstream slope, South. Clinch River to right.

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Figure 5.3.3-2: Area 2 downstream toe of slope, East. Bull Run Creek to right.

5.3.4 Abutments and Groin Areas

There were no observed scarps, sloughs, bulging, cracks, depressions or other indications of slope instability at dike abutments and groin areas of Area 2; see Figures 5.3.4-1 and 5.3.4-2.

Figure 5.3.4-1: Area 2 outside groin area, East.

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Figure 5.3.4-2: Area 2 inside groin area, West.

5.4 AREA 2A, GYPSUM DISPOSAL AREA

5.4.1 Crest

The crest of the Area 2A embankment had no signs of significant depressions, tension cracks or other indications of settlement or shear failure. The entire crest is gravel covered. Figure 5.4.1-1 shows the typical crest conditions along the embankment.

Figure 5.4.1: Crest of Area 1 South Dike, East.

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5.4.2 Upstream/Inside Slope

Area 2A is primarily composed of the gypsum disposal stack, however it impounds water directly along its south dike. The interior slopes of Area 2A are riprap lined and appear stable and maintained. There were no observed scarps, sloughs, bulging, cracks, depressions or other indications of slope instability. Figures 5.4.2 shows a section of the Area 2A inside slope.

Figure 5.4.2: Upstream slope of Area 2A, North.

5.4.3 Outside Slope and Toe

The outside slope of the Area 2A embankment appeared to have a satisfactorily maintained cover of grasses/weeds. Portions of the outside slope are covered with a riprap blanket. Trees and shrubs are growing on these lower portions of the outside slope along the west and north slopes. Maintenance work to remove trees and replenish riprap blanket was under way at the time of the site visit. A gravel access road wraps around the middle outside slope and crest of the embankment. No scarps, sloughs, bulging, cracks, depressions or other indications of slope instability were observed along the slope. Figure 5.4.3-1 and Figure 5.4.3-2 show representative sections of the embankment.

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Figure 5.4.3-1: Downstream slope of Area 2A showing gravel perimeter access road, North. Note trees and shrubs along lower portions of the west slope.

Figure 5.4.3-2: Lower portion of Area 2A downstream slope, West. Note riprap blanket along toe of south slope.

5.4.4 Abutments and Groin Areas

There were no observed scarps, sloughs, bulging, cracks, depressions or other indications of slope instability at dike abutments and groin areas of Area 2A.

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5.5 OUTLET STRUCTURES

5.5.1 Overflow Structure

All three disposal areas share the same primary overflow structures located in the south western corner of the Area 2 stilling pond, see Figure 5.4.1. The overflow structure consists of three 52-inch diameter steel circular weirs mounted on 48-inch diameter reinforced concrete riser pipes. The structures appeared to be in satisfactory conditions and there were no signs of a clogged outlet. Water could not be observed entering the structure; during the site visit flow was being pumped to the outlet. Area 1 and Area 2A each outfall into Area 2. Area 1 outfalls into Area 2 via a sluice ditch that extends along Area 1 and Area 2A, while Area 2A outfalls via open culvert pipes located through its south dike.

Figure 5.4.1: One of three primary overflow structures in the Area 2 stilling pond.

5.5.2 Outlet Conduit

The primary outlet conduits for all disposal areas consists of three 36-inch reinforced concrete pipes leading from the separate overflow structures located in the Area 2 stilling pond. Each concrete pipe outfalls through the west dike of Area 2 into the Clinch River. The final outlet of each pipe was not visible as each was completely submerged in the Clinch River, see Figure 5.5.2-1 and Figure 5.5.2-2. As previously mentioned, the outlet for Area 2A consists of two 24-inch HDPE pipes located near the south western corner. The location of the inlet of each conduit was unknown as each was completely submerged. However, each outfall was clearly identified and visible along the south dike downstream slope. Water exiting each conduit appeared to be flowing clear, see Figure 5.5.2-3.

Figure 5.5.2-1: Outlet conduit location along Clinch River, West. NPDES Permitted Outlet.

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Figure 5.5.2-2: Principal spillway outlet conduit in Area 2.

Figure 5.5.2-3: Outlet conduit for Area 2A.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation was provided to Dewberry regarding the local flood of record. USGS river gage (USGS 0353500) for Bull Run located about 12 miles upstream of the plant, shows the largest peak flows occurred during 1977 (see Exhibit 1). This peak flow is comparable to the Bull Run 1% annual chance (100-year) and 0.2% annual chance (500-year) discharges found in the Anderson County FIS Study (see Exhibit 2). Consequently, it can be concluded that the flood of record is comparable and within the range of the 100-yr and 500-yr flood elevation. The Anderson County FIRM's Map Number 47001C0245G (dated May 4, 2009) and Map Number 47001C0310F (dated January 17, 2007) show the plant facilities and the disposal areas to be adjacent to the limits of the 100-year flood boundary (see Exhibits 3 and 4).

6.1.2 Inflow Design Flood

The Solid Waste Operating Permit (see Appendix A, Doc 9)) requires the facility's stormwater runoff management system to collect and control peak flows from the 25-year, 24-hour storm and to divert through an emergency spillway the peak flow from a 100-year storm.

Stantec's *Hydrologic and Hydraulic Evaluation of the Ash Pond and Outlet Structures*, dated December 16, 2009, (Appendix A, Doc 4) provides a detailed analysis of the inflow design and overall capacity of the disposal facilities at Bull Run Fossil Plant. It was determined through this analysis that the impoundments at the facility have sufficient capacity to carry the 25-year and 100-year storm events while providing a freeboard of 3.1 ft and 2.9 ft, respectively. It was determined that no emergency spillway was needed to convey either design storm. It should be noted that Area 1, Area 2 and 2A are all hydraulically connected; therefore Stantec's analysis has been accepted to be applicable for all areas.

Additionally, the report includes computations that support the impoundments' compliance to the required 40.5 million gallons of free water volume under the NPDES Permit. As considered from the lowest weir elevation, the impoundment provides 94.2 million gallons of free water volume.

6.1.3 Spillway Rating

Data reviewed by Dewberry did not contain Spillway Rating information.

6.1.4 Downstream Flood Analysis

Data reviewed by Dewberry did not contain a downstream flood analysis. The dam breach analysis provided by TVA (see Appendix A, Doc 3) analyzed impacts along the dikes if a failure occurred along the dikes. Information regarding the impacts associated with a downstream flood event of either Clinch River or Bull Run Creek was not included in this analysis. However, additional information related to a downstream flood analysis can be found in the effective FEMA Firmettes found in Exhibits 3 and 4. Each exhibit shows the extent of flooding of both the Clinch River and Bull Run Creek does not impact/overtop the Bull Run Fossil Plant impoundment dikes. No additional information related to a downstream flood analysis is needed.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Supporting documentation reviewed by Dewberry is adequate.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

As previously mentioned, Stantec's *Hydrologic and Hydraulic Evaluation of the Ash Pond and Outlet Structures*, dated December 16, 2009, provides a detailed analysis of the inflow design and overall capacity of the disposal facilities at Bull Run Fossil Plant. The analysis shows that the impoundments at the facility are hydrologic/hydraulically safe, providing sufficient capacity to carry the 25-year and 100-year storm events while providing adequate freeboard. The analysis also shows the free water volume of the impoundments to be well within the permit-required limit.

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7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

Dewberry was provided Stantec's *Report of Geotechnical Exploration*, dated April 12, 2010, (Appendix A, Doc 5) and Stantec's *Results of Seismic Slope Stability Analysis* letter, dated September 29, 2011 (Appendix A, Doc 7). An update to these reports was provided by TVA in a calculation package *BRF-Gypsum Disposal Area 2A South Slope Buttressing and Armoring*, URS' *Seepage and Slope Stability Remediation*, dated July 20, 2011(Appendix A, Doc 13) and Stantec's *Results of Pseudostatic Slope Stability Analysis* letter, dated February 15, 2012 (Appendix A, Doc 6). These documents summarize the slope stability of the disposal facility's embankments. The stability analysis is based on subsurface data from geotechnical investigations completed by Stantec in August 2009. The slope stability of each embankment considered static and seismic conditions under steady-state seepage.

In the 2010 Stantec report, dike Factors of Safety were less than the minimum required value of 1.5. The report provided recommendations for remediation. TVA subsequently retained URS to prepare final design for the selected remediation of the dikes. The URS basis of design 2011 report showed that the remediation activities produced slope stability safety factors equal to or greater than 1.5. The URS stability calculations were performed at the same dike cross sections and used the same soil properties as the Stantec 2010 study.

7.1.2 Design Parameters and Dam Materials

Design parameters considered in the slope stability analyses are provided in the Stantec reports.

A total of 93 boring logs were completed in 2009 by Stantec (Appendix A, Doc 5). Embankment material was characterized for each area based on boring logs. Refer to Section 2.5.1 for a description of embankment material for Area 1, Area 2 and Area 2A.

7.1.3 Uplift and/or Phreatic Surface Assumptions

Along with the 2009 geotechnical investigation, 42 new piezometers were installed throughout the perimeter dikes for each area. Piezometers were used to determine phreatic surface elevations along the embankments, both at the crest and toe, for use in the slope stability analysis.

Groundwater observations were made on several occasions since the installation of the piezometers. Groundwater elevations were noted to generally increase in piezometers located in Area 2 and Area 2A, where impounded water levels affect the phreatic surface. A variation was noted in readings under different plant operations and sluice volumes variations.

7.1.4 Factors of Safety and Base Stresses

Nine critical sections were used in the slope stability analysis. Seepage conditions in Area 1, Area 2 and Area 2A were considered in determining phreatic water surfaces and hydraulic gradients along each section. Each section was analyzed considering steady state pore pressures using effective engineering parameters such as unit weight and shear strength properties of the subsurface materials. Only three of the nine sections were used for the seismic evaluation, one at each Area 1, Area 2 and Area 2A.

Different failure modes were considered for each section, under static loading using SLOPE/W 2007. The failure surfaces were generated using the Grid and Radius method or the Entry Exit method. Analysis of slope stability under seismic conditions considered undrained shear strength parameters for each section. A summary of the computed safety factors is included in Table 7.1.4.

Table 7.1.4 Summary of Computed Factors of Safety for Slope Stability

Disposal Area	Section	Calculated Static Loading Safety Factor	Required Safety Factor (US Army Corp of Engineers)	Calculated Seismic Loading Safety Factor per Undrained Shear Strength	Required Safety Factor (US Army Corp of Engineers)
Area 1	**D-D'**	2.1	1.5	1.1	>1.0
Area 1/ Area 2A	**F-F'**	1.54	1.5	-	>1.0
Area 2A	**I-I'**	1.56	1.5	1.0	>1.0
Area 2A	**K-K'**	1.56	1.5	-	>1.0
Area 2A	**L-L'**	2.2	1.5	-	>1.0
Area 2	**N-N'**	1.6	1.5	-	>1.0
Area 2	**O-O'**	1.58	1.5	-	>1.0
Area 2	**R-R'**	1.52	1.5	-	>1.0
Area 2	**S-S'**	1.52	1.5	1.4	>1.0

Safety factors for Area 2A were raised to the minimum by buttressing the toe area along the south dike with crushed stone and armoring the slope.

Lowering the normal pool elevations to an elevation of 801.0 feet was the most effective way to increase safety factors for Area 2 along the perimeter dike. Doing so reduces the phreatic levels within the diked embankments which improves safety factors. Construction of a buttress along the exterior slope of the perimeter dike increased safety factors for this area as well as for the west perimeter dike of Area 2A.

Surface runoff improvements along the exterior slope of Area 2 were also implemented to raise safety factors.

An additional stability analysis considering both current conditions and the future expansion of Area 2A was completed by URS in July 2011. (Appendix A, Document 10). Two French drains, upper and lower, were required for the west and north slope of the gypsum stack , one upper French drain was required for the east slope and small amounts of regrading along the west slope was required, all to provide a safety factor of at least 1.5, see Table 7.1.4.

Stantec's 2011 stability analysis (Appendix A, Doc 7) referenced seismic forces for the Bull Run Fossil Plant location that correspond to an approximate exceedance probability of 10-percent for 50 years. However, the updated 2012 stability analysis (Appendix A, Docs 6 and 11) references seismic forces that correspond to an approximate exceedance probability of 2-percent in 50 years, (see Exhibit 5). Factor of safety values shown in Table 7.1.4 reflect the updated stability analysis results for both static and seismic conditions.

7.1.5 Liquefaction Potential

No assessment of liquefaction potential was performed for the existing configurations Area 1, Area 2 and Area 2A. Stantec's *Report of Seismic Slope Stability Analysis* letter includes a White Paper – *Seismic Risk Assessment Closed CCP Storage Facilities* (Appendix A, Doc 7). This paper outlines the proposed engineering analyses to estimate seismic failure risks at wet storage facilities for CCP, after closure of various TVA fossil power plants. Within this analysis the potential for soil liquefaction will be evaluated at each closed facility.

A qualitative assessment by Dewberry of materials within and under the dikes for Ash Disposal Area 1 and 2A indicates there is a potential for liquefaction of CCR and soils under seismic conditions (Appendix B – Doc 17). We recommend that TVA proceed with conducting a quantitative liquefaction analysis of the impoundments to better determine the risks of a major release caused by a seismic event.

7.1.6 Critical Geological Conditions

Bedrock was encountered during drilling for the geotechnical investigation. Based on descriptions obtained from samples, the bedrock consists of interbedded layers of the Cambrian aged, Conassauga Group Limestone and the Rome shale formations. Limestone layers were categorized as gray to dark gray, moderately hard to hard, and thinly bedded with closely spaced fractures. Shale layers were categorized as very soft to moderately hard, reddish brown gray shale and thin to very thinly bedded and very fine grained. RQD values for the rock varied with depth.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

Slope stability documentation provided for disposal Area 1, Area 2 and Area 2A is adequate. Liquefaction documentation is inadequate.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

Overall, the structural stability of the Area 1, Area 2 and Area 2A dikes appears to be **Fair** based on the following observations:

- Implementation of recommendations made by Stantec to increase the global structural stability of perimeter and internal dikes for each area have been completed and dike stability meets minimum safety factors under static conditions for all three areas.

Liquefaction analyses of soils and materials within the Area 1 and Area 2A management units have not been performed. A qualitative analysis indicated that these units may be susceptible to liquefaction. The need for a liquefaction analysis of Area 2 is less critical.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

All bottom ash and some fly ash residuals generated at the Bull Run Plant are piped near the northeastern corner of Area 1; slurry pipes outfall directly into a sluice ditch, which flows along both Area 1 and Area 2A and into Area 2. All scrubber gypsum residuals are transported to Area 2A via wet sluicing.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

TVA has a Coal Combustion Products Management Program that specifies the operation, maintenance and inspection of all landfill operations, ash disposal ponds and treatment ponds. Under this surveillance program, there exist three separate levels of inspection for disposal facilities. First are informal inspections (daily, weekly and monthly) by qualified plant personnel to monitor visible changes and complete checklist type inspections. Second are intermediate inspections (quarterly and after significant storm events and earthquakes) also to be completed by qualified plant personnel. Third and last are formal inspections (not exceeding a five year interval) to be completed by a qualified engineer and under direct supervision of a licensed professional engineer according to the nature and type of dam. The Bull Run Fossil facility provided five year, annual, quarterly, monthly, weekly, daily and special event inspection reports for all ash disposal impoundments.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on the assessments of this report, documentation provided to Dewberry, discussions with the plant personnel and field observations, operating procedures appear to be adequate.

8.3.2 Adequacy of Maintenance

Based on visual observations, an overview of TVA's Coal Combustion Products Management Program, and a review of previously completed Bull Run Fossil Plant inspection forms, maintenance procedures are adequate for all ash disposal impoundments.

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

See Section 8.2 above.

9.2 INSTRUMENTATION MONITORING

Disposal impoundments at the Bull Run Fossil Plant are instrumented with piezometers, inclinometers, staff gauges and monitoring wells. The installed instrumentation serves slope stability analyses, monitoring ground water levels throughout the embankments and water surface levels.

A total of 51 active piezometers have been located throughout the Area 1 external west and south dike, the Area 2 perimeter dike and along all Area 2A dikes. Continuous monitoring and recording of piezometers are recorded on a monthly basis. Documentation provided to Dewberry included instrumentation reading summaries for piezometers.

A total of 5 slope inclinometers have been located along the south and east dike of Area 2A. Inclinometers were installed to monitor potential lateral movement within the subsurface in areas with a history of slope movement.

Area 2 has a staff gage present near the principal spillway in the stilling pond.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

Based on the data reviewed by Dewberry the inspection program at the Bull Run Fossil Plant appears to be adequate.

9.3.2 Adequacy of Instrumentation Monitoring Program

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

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Exhibit 1: USGS Peak Streamflow, USGS 03535000 Bull Run near Halls Crossroads, TN

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News updated July, 2011

Peak Streamflow for Tennessee

USGS 03535000 BULLRUN CREEK NEAR HALLS CROSSROADS, TN

Available data for this site: Surface-water: Peak streamflow | GO

Knox County, Tennessee
Hydrologic Unit Code 06010207
Latitude 36°06'51.60", Longitude 83°59'17.74" NAD27
Drainage area 68.5 square miles
Gage datum 854.91 feet above NGVD29

Output formats

- Table
- Graph
- Tab-separated file
- peakfq (watstore) format
- Reselect output format

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)	Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1958	Nov. 18, 1957	10.26	3,360	1977	Apr. 04, 1977	13.28	18,300
1959	Jan. 22, 1959	8.62	1,850	1978	Jun. 08, 1978	9.36	3,790
1960	Dec. 19, 1959	7.92	1,380	1979	Jul. 21, 1979	10.62	7,040
1961	Mar. 08, 1961	8.81	2,590	1980	Mar. 21, 1980	9.07	3,230
1962	Feb. 23, 1962	9.39	3,210	1981	Sep. 16, 1981	7.92	1,560
1963	Mar. 12, 1963	11.08	6,200	1982	Jan. 04, 1982	8.63	1,610
1964	Feb. 16, 1964	7.94	1,410	1983	May 21, 1983	9.29	2,400
1965	Mar. 26, 1965	9.68	4,400	1984	May 07, 1984	12.04	10,500
1966	Apr. 13, 1966	8.59	2,010	1985	Feb. 01, 1985	8.57	1,550
1967	Jul. 30, 1967	10.36	4,910	1986	Feb. 17, 1986	8.31	1,340
1968	Dec. 22, 1967	9.08	2,720	1987	Dec. 09, 1986	7.78	1,040
1969	Jun. 23, 1969	8.86	2,380	2002	Mar. 18, 2002	10.81	5,730
1970	Dec. 30, 1969	10.66	5,450	2003	Feb. 16, 2003	12.47	12,800
1971	Feb. 05, 1971	7.88	1,800	2004	Feb. 06, 2004	9.63	2,960
1972	Apr. 12, 1972	9.95	5,300	2005	Dec. 01, 2004	9.43	2,620
1973	Mar. 16, 1973	11.78	12,500	2006	Apr. 08, 2006	9.37	2,530
1974	Nov. 28, 1973	10.86	8,130	2007	Apr. 15, 2007	8.58	1,560
1975	Mar. 30, 1975	9.86	4,940	2008	Apr. 04, 2008	6.31	710
1976	Mar. 30, 1976	7.56	1,270	2009	Sep. 27, 2009	9.35	2,490
				2010	Dec. 09, 2009	10.43	4,620

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Exhibit 2: FEMA Anderson County FIS Study, Table 4-Summary of Discharges.

Table 4 – Summary of Discharges (continued)

		Peak Discharges (cubic feet per second)			
Flooding Source and Location	Drainage Area (square miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Brushy Fork Poplar Creek					
At mile 0.0	24.1	5,700	8,700	10,150	13,900
At mile 2.88	*	5040	7,710	9,000	12,330
At mile 3.9	19.5	4,900	7,500	8,750	12,000
At mile 4.0	16.6	4,350	6,700	7,800	10,700
At mile 6.1	14.9	4,000	6,200	7,250	9,950
At mile 7.1	10.2	3,050	4,750	5,550	7,650
Buffalo Creek					
At mile 0.0	1.2	1,690	2,310	2,580	3,230
At mile 0.7	1.9	1,650	2,260	2,530	3,170
At mile 0.9	9.3	1,360	1,860	2,080	2,610
At mile 8.7	10.47	650	890	990	1,250
Bullrun Creek					
At mile 5.2	93.3	9,100	13,8OO	16,300[1]	25,600[1]
At mile 7.3	88.0	8,900	13,900	16,500	25,900
Clinch River					
Just above Emory River	3,540	42,750	52,750	56,500	82,500
At mile 60.0	144.0[2]	30,300	41,000	45,600	52,300

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Exhibit 3: FEMA Anderson County FIRM, Map Number 47001C0245G

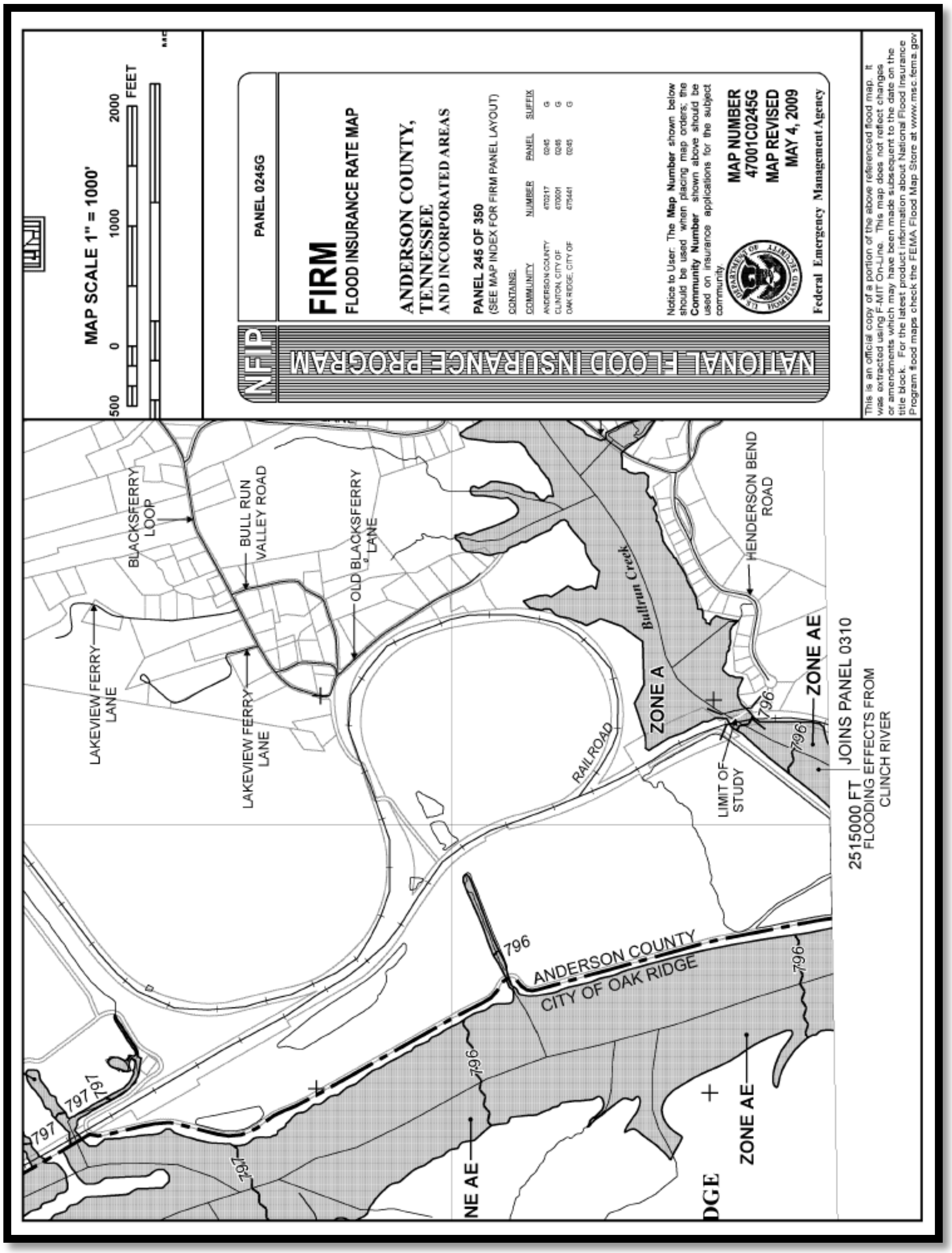

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Exhibit 4: FEMA Anderson County FIRM, Map Number 47001C0310F

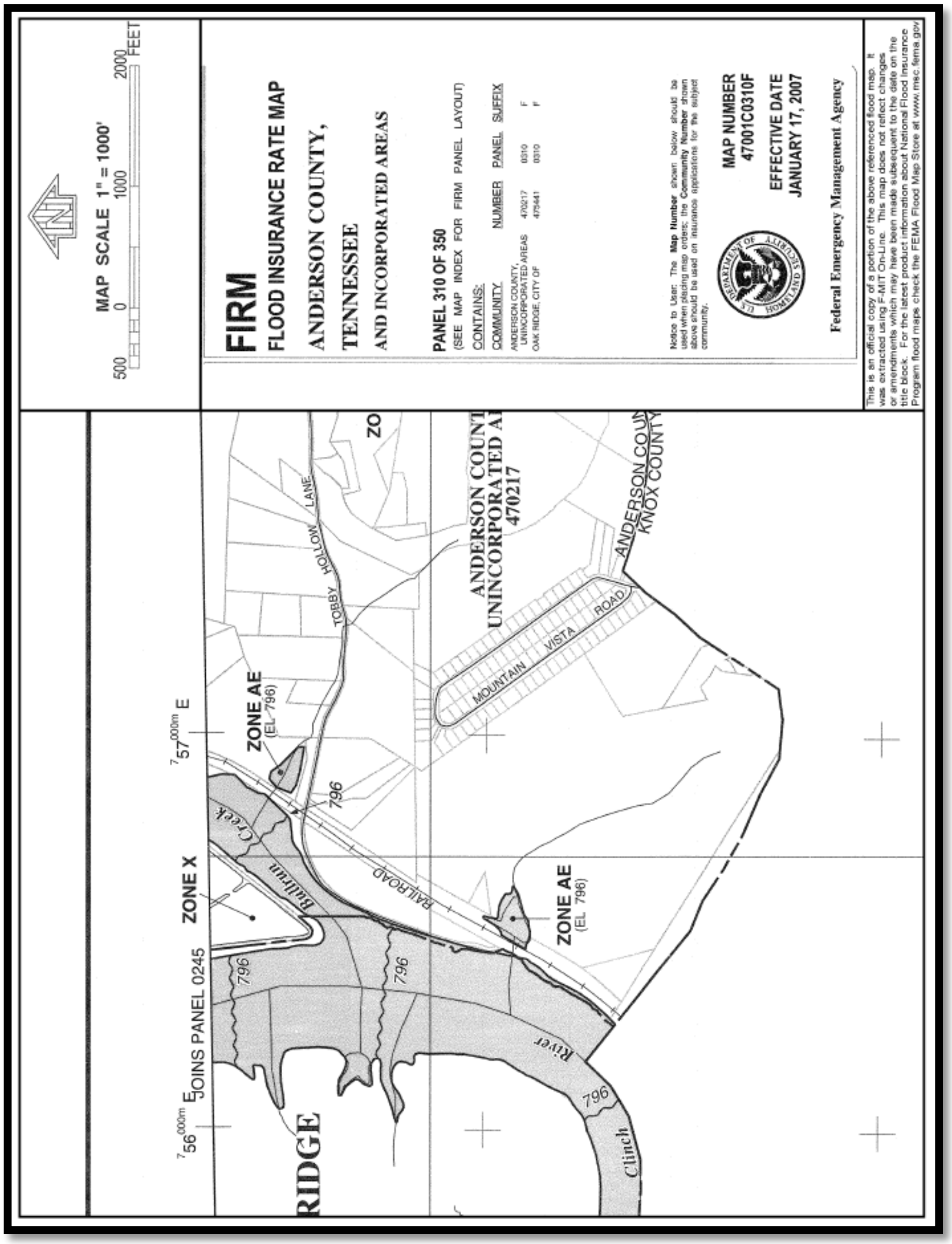

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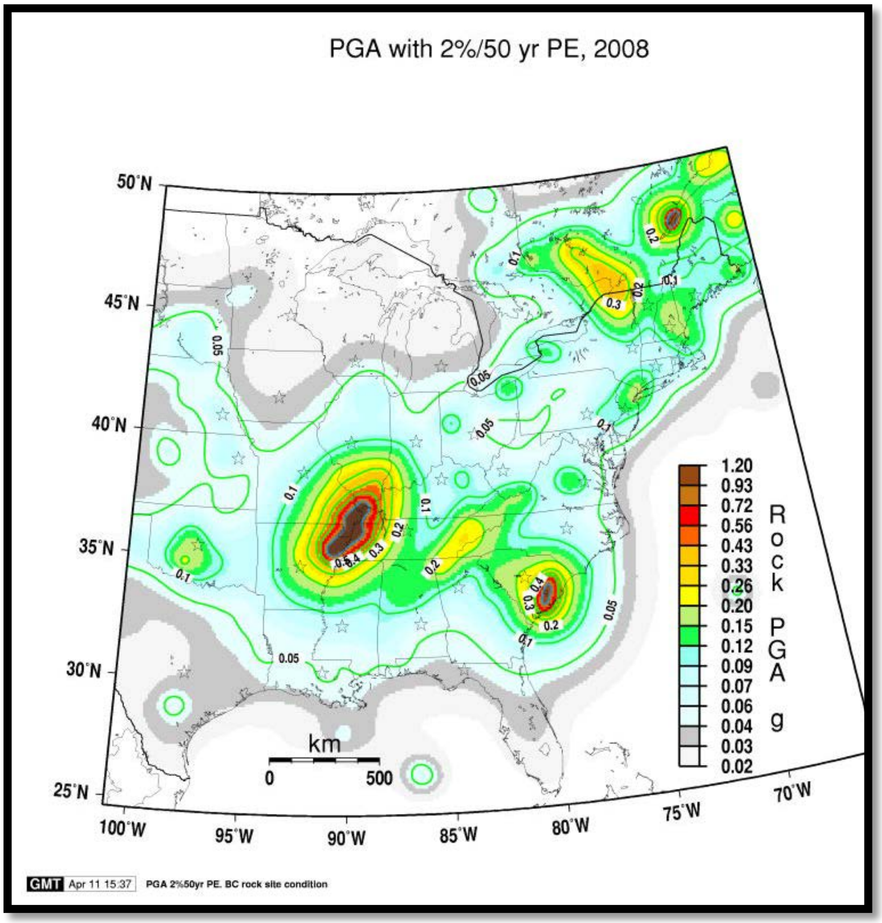
Exhibit 5: USGS Seismic-Hazard Map for Central/Eastern US, 2%/50 Years, 2008



APPENDIX A

Document 1

BRF_DikeCrest.scv. (n.d.)

100	595810.809	2543980.982	810.423	CHEM POND	9/14/2011
101	595785.829	2543973.531	810.333	CHEM POND	9/14/2011
102	595760.601	2543966.26	810.25	CHEM POND	9/14/2011
103	595736.105	2543959.646	810.181	CHEM POND	9/14/2011
104	595709.92	2543953.086	810.209	CHEM POND	9/14/2011
105	595685.383	2543947.131	810.205	CHEM POND	9/14/2011
106	595660.939	2543941.297	810.19	CHEM POND	9/14/2011
107	595634.681	2543935.002	810.286	CHEM POND	9/14/2011
108	595608.15	2543928.894	810.287	CHEM POND	9/14/2011
109	595582.093	2543923.299	810.301	CHEM POND	9/14/2011
110	595557.286	2543918.539	810.333	CHEM POND	9/14/2011
111	595532.53	2543914.697	810.352	CHEM POND	9/14/2011
112	595505.88	2543911.746	810.386	CHEM POND	9/14/2011
113	595479.744	2543910.048	810.458	CHEM POND	9/14/2011
114	595452.425	2543909.714	810.475	CHEM POND	9/14/2011
115	595426.333	2543911.002	810.441	CHEM POND	9/14/2011
116	595399.838	2543913.991	810.343	CHEM POND	9/14/2011
117	595374.188	2543918.518	810.235	CHEM POND	9/14/2011
118	595349.021	2543924.512	810.13	CHEM POND	9/14/2011
119	595323.967	2543932.156	810.09	CHEM POND	9/14/2011
120	595299.556	2543941.499	810.156	CHEM POND	9/14/2011
121	595276.365	2543952.276	810.175	CHEM POND	9/14/2011
122	595253.963	2543964.901	810.246	CHEM POND	9/14/2011
123	595232.551	2543978.828	810.256	CHEM POND	9/14/2011
124	595210.236	2543994.968	810.179	CHEM POND	9/14/2011
125	595189.317	2544010.01	810.068	CHEM POND	9/14/2011
126	595168.097	2544025.115	809.91	CHEM POND	9/14/2011
127	595147.776	2544040.804	809.601	CHEM POND	9/14/2011
128	595056.372	2544814.872	810.924	ASH POND	9/14/2011
129	595034.734	2544828.016	810.875	ASH POND	9/14/2011
130	595013.32	2544841.315	810.819	ASH POND	9/14/2011
131	594990.647	2544854.802	810.802	ASH POND	9/14/2011
132	594968.828	2544867.473	810.865	ASH POND	9/14/2011
133	594945.883	2544880.994	810.941	ASH POND	9/14/2011
134	594921.658	2544895.67	810.994	ASH POND	9/14/2011
135	594897.675	2544910.87	811.023	ASH POND	9/14/2011
136	594874.551	2544925.863	811.083	ASH POND	9/14/2011
137	594853.18	2544939.379	810.976	ASH POND	9/14/2011
138	594831.961	2544952.947	810.983	ASH POND	9/14/2011
139	594808.123	2544968.13	810.881	ASH POND	9/14/2011
140	594783.682	2544982.964	810.819	ASH POND	9/14/2011
141	594761.363	2544995.433	810.848	ASH POND	9/14/2011
142	594737.935	2545007.673	810.815	ASH POND	9/14/2011
143	594713.12	2545020.072	810.759	ASH POND	9/14/2011
144	594688.36	2545033.058	810.771	ASH POND	9/14/2011
145	594663.365	2545046.501	810.799	ASH POND	9/14/2011
146	594638.099	2545060.636	810.652	ASH POND	9/14/2011
147	594612.852	2545075.284	810.7	ASH POND	9/14/2011
148	594591.326	2545088.263	810.788	ASH POND	9/14/2011
149	594569.875	2545101.656	810.848	ASH POND	9/14/2011
150	594548.509	2545115.338	810.837	ASH POND	9/14/2011
151	594527.255	2545129.217	810.825	ASH POND	9/14/2011
152	594503.227	2545145.28	810.694	ASH POND	9/14/2011
153	594479.528	2545161.339	810.682	ASH POND	9/14/2011
154	594455.585	2545177.789	810.71	ASH POND	9/14/2011
155	594431.882	2545194.681	810.792	ASH POND	9/14/2011

156	594408.909	2545211.768	810.75	ASH POND	9/14/2011
157	594386.47	2545229.128	810.865	ASH POND	9/14/2011
158	594364.438	2545247.044	810.857	ASH POND	9/14/2011
159	594342.477	2545265.469	810.834	ASH POND	9/14/2011
160	594320.502	2545284.382	810.898	ASH POND	9/14/2011
161	594298.939	2545304.009	810.95	ASH POND	9/14/2011
162	594280.944	2545321.4	810.927	ASH POND	9/14/2011
163	594263.117	2545339.292	810.924	ASH POND	9/14/2011
164	594245.651	2545357.7	810.99	ASH POND	9/14/2011
165	594228.136	2545376.557	810.922	ASH POND	9/14/2011
166	594210.809	2545395.988	810.975	ASH POND	9/14/2011
167	594194.067	2545415.614	810.935	ASH POND	9/14/2011
168	594178.013	2545434.786	811.049	ASH POND	9/14/2011
169	594160.075	2545456.121	811.017	ASH POND	9/14/2011
170	594142.139	2545476.914	811.081	ASH POND	9/14/2011
171	594124.256	2545498.262	810.988	ASH POND	9/14/2011
172	594106.802	2545520.024	811.008	ASH POND	9/14/2011
173	594089.622	2545541.749	810.952	ASH POND	9/14/2011
174	594072.173	2545564.265	810.969	ASH POND	9/14/2011
175	594054.873	2545587.181	811.011	ASH POND	9/14/2011
176	594037.488	2545610.154	810.945	ASH POND	9/14/2011
177	594019.885	2545633.327	810.896	ASH POND	9/14/2011
178	594004.701	2545653.359	810.859	ASH POND	9/14/2011
179	593989.5	2545673.418	810.726	ASH POND	9/14/2011
180	593971.887	2545696.387	810.745	ASH POND	9/14/2011
181	593954.411	2545719.057	810.699	ASH POND	9/14/2011
182	593937.083	2545741.861	810.748	ASH POND	9/14/2011
183	593919.638	2545764.8	810.697	ASH POND	9/14/2011
184	593902.055	2545787.838	810.673	ASH POND	9/14/2011
185	593884.337	2545810.93	810.714	ASH POND	9/14/2011
186	593869.222	2545830.952	810.663	ASH POND	9/14/2011
187	593851.697	2545854.172	810.593	ASH POND	9/14/2011
188	593834.2	2545876.803	810.664	ASH POND	9/14/2011
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190	593799.386	2545921.278	810.752	ASH POND	9/14/2011
191	593781.815	2545943.313	810.73	ASH POND	9/14/2011
192	593763.984	2545965.425	810.757	ASH POND	9/14/2011
193	593746.575	2545987.322	810.922	ASH POND	9/14/2011
194	593730.056	2546008.527	811.084	ASH POND	9/14/2011
195	593713.749	2546029.51	811.082	ASH POND	9/14/2011
196	593697.397	2546050.527	811.166	ASH POND	9/14/2011
197	593680.981	2546071.509	811.224	ASH POND	9/14/2011
198	593665.076	2546092.694	811.188	ASH POND	9/14/2011
199	593649.408	2546113.418	811.116	ASH POND	9/14/2011
200	593632.714	2546133.678	810.869	ASH POND	9/14/2011
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203	593577.07	2546190.327	810.515	ASH POND	9/14/2011
204	593555.211	2546208.55	810.39	ASH POND	9/14/2011
205	593535.054	2546223.672	810.376	ASH POND	9/14/2011
206	593513.988	2546238.643	810.464	ASH POND	9/14/2011
207	593492.359	2546253.138	810.545	ASH POND	9/14/2011
208	593470.255	2546267.287	810.667	ASH POND	9/14/2011
209	593447.588	2546281.428	810.696	ASH POND	9/14/2011
210	593424.513	2546295.549	810.726	ASH POND	9/14/2011
211	593400.927	2546309.497	810.651	ASH POND	9/14/2011

212	593377.171	2546323.174	810.638	ASH POND	9/14/2011
213	593353.305	2546336.589	810.527	ASH POND	9/14/2011
214	593329.245	2546350.113	810.538	ASH POND	9/14/2011
215	593304.571	2546363.699	810.586	ASH POND	9/14/2011
216	593279.107	2546377.251	810.448	ASH POND	9/14/2011
217	593253.231	2546390.5	810.483	ASH POND	9/14/2011
218	593230.682	2546401.572	810.385	ASH POND	9/14/2011
219	593207.765	2546412.222	810.52	ASH POND	9/14/2011
220	593184.642	2546422.767	810.545	ASH POND	9/14/2011
221	593161.349	2546432.971	810.668	ASH POND	9/14/2011
222	593138.161	2546442.739	810.785	ASH POND	9/14/2011
223	593114.828	2546452.224	810.746	ASH POND	9/14/2011
224	593091.199	2546461.485	810.715	ASH POND	9/14/2011
225	593067.41	2546470.59	810.78	ASH POND	9/14/2011
226	593043.237	2546479.566	810.827	ASH POND	9/14/2011
227	593018.689	2546488.497	810.789	ASH POND	9/14/2011
228	592993.93	2546497.787	810.735	ASH POND	9/14/2011
229	592969.239	2546507.603	810.566	ASH POND	9/14/2011
230	592944.35	2546517.813	810.538	ASH POND	9/14/2011
231	592919.256	2546528.332	810.526	ASH POND	9/14/2011
232	592894.239	2546538.586	810.53	ASH POND	9/14/2011
233	592870.093	2546548.565	810.617	ASH POND	9/14/2011
234	592846.316	2546558.303	810.61	ASH POND	9/14/2011
235	592822.558	2546567.869	810.518	ASH POND	9/14/2011
236	592798.951	2546577.262	810.622	ASH POND	9/14/2011
237	592775.588	2546586.386	810.754	ASH POND	9/14/2011
238	592752.132	2546595.165	810.816	ASH POND	9/14/2011
239	592724.662	2546604.691	810.946	ASH POND	9/14/2011
240	592701.001	2546612.788	810.878	ASH POND	9/14/2011
241	592677.071	2546620.765	810.905	ASH POND	9/14/2011
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243	592628.783	2546636.096	811.058	ASH POND	9/14/2011
244	592604.508	2546643.492	811.234	ASH POND	9/14/2011
245	592579.929	2546650.699	811.346	ASH POND	9/14/2011
246	592555.094	2546658.007	811.48	ASH POND	9/14/2011
247	592530.273	2546665.434	811.559	ASH POND	9/14/2011
248	592505.348	2546672.973	811.63	ASH POND	9/14/2011
249	592480.479	2546680.87	811.737	ASH POND	9/14/2011
250	592455.71	2546689.004	811.809	ASH POND	9/14/2011
251	592431.125	2546697.506	811.862	ASH POND	9/14/2011
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253	592382.287	2546716.409	812.063	ASH POND	9/14/2011
254	592358.116	2546727.109	812.105	ASH POND	9/14/2011
255	592334.336	2546738.637	812.232	ASH POND	9/14/2011
256	592311.3	2546750.739	812.262	ASH POND	9/14/2011
257	592288.817	2546763.182	812.316	ASH POND	9/14/2011
258	592266.818	2546776.241	812.234	ASH POND	9/14/2011
259	592245.076	2546789.196	812.24	ASH POND	9/14/2011
260	592223.567	2546802.069	812.295	ASH POND	9/14/2011
261	592198.911	2546817.3	812.209	ASH POND	9/14/2011
262	592177.632	2546830.62	812.202	ASH POND	9/14/2011
263	592156.261	2546844.203	812.206	ASH POND	9/14/2011
264	592134.929	2546858.078	812.053	ASH POND	9/14/2011
265	592113.95	2546871.896	812.096	ASH POND	9/14/2011
266	592093.369	2546886.143	811.775	ASH POND	9/14/2011
267	592069.488	2546902.202	811.791	ASH POND	9/14/2011

268	592045.861	2546918.359	811.503	ASH POND	9/14/2011
269	592022.466	2546934.251	811.121	ASH POND	9/14/2011
270	591999.06	2546950.253	810.751	ASH POND	9/14/2011
271	591975.743	2546965.87	810.46	ASH POND	9/14/2011
272	591953.234	2546980.183	810.126	ASH POND	9/14/2011
273	591931.253	2546994.066	809.873	ASH POND	9/14/2011
274	591909.259	2547007.52	809.781	ASH POND	9/14/2011
275	591887.555	2547020.475	809.845	ASH POND	9/14/2011
276	591864.264	2547034.534	809.996	ASH POND	9/14/2011
277	591841.088	2547048.609	810.073	ASH POND	9/14/2011
278	591818.276	2547062.553	810.175	ASH POND	9/14/2011
279	591796.134	2547075.045	810.128	ASH POND	9/14/2011
280	591771.863	2547088.193	810.028	ASH POND	9/14/2011
281	591748.524	2547100.78	810.054	ASH POND	9/14/2011
282	591723.709	2547114.145	809.923	ASH POND	9/14/2011
283	591698.925	2547128.173	809.808	ASH POND	9/14/2011
284	591674.441	2547142.276	809.647	ASH POND	9/14/2011
285	591651.059	2547155.116	809.714	ASH POND	9/14/2011
286	591628.76	2547167.101	809.676	ASH POND	9/14/2011
287	591604.084	2547180.542	809.699	ASH POND	9/14/2011
288	591581.73	2547192.766	809.69	ASH POND	9/14/2011
289	591558.581	2547205.213	809.713	ASH POND	9/14/2011
290	591534.68	2547217.782	809.764	ASH POND	9/14/2011
291	591510.925	2547229.878	809.673	ASH POND	9/14/2011
292	591486.272	2547241.736	809.685	ASH POND	9/14/2011
293	591461.681	2547251.711	809.645	ASH POND	9/14/2011
294	591437.142	2547257.884	809.487	ASH POND	9/14/2011
295	591409.42	2547259.189	809.272	ASH POND	9/14/2011
296	591382.215	2547256.061	809.132	ASH POND	9/14/2011
297	591356.572	2547248.092	809.185	ASH POND	9/14/2011
298	591331.487	2547235.291	809.422	ASH POND	9/14/2011
299	591309.576	2547221.304	809.654	ASH POND	9/14/2011
300	591288.83	2547206.382	809.783	ASH POND	9/14/2011
301	591266.907	2547189.717	809.915	ASH POND	9/14/2011
302	591244.611	2547172.629	809.944	ASH POND	9/14/2011
303	591223.943	2547156.916	809.924	ASH POND	9/14/2011
304	591203.02	2547140.996	809.918	ASH POND	9/14/2011
305	591182.608	2547125.228	809.925	ASH POND	9/14/2011
306	591162.284	2547109.139	809.958	ASH POND	9/14/2011
307	591141.237	2547092.271	809.995	ASH POND	9/14/2011
308	591119.984	2547075.315	809.873	ASH POND	9/14/2011
309	591099.329	2547058.953	809.803	ASH POND	9/14/2011
310	591079.175	2547043.195	809.766	ASH POND	9/14/2011
311	591059.428	2547027.742	809.727	ASH POND	9/14/2011
312	591037.533	2547010.552	809.638	ASH POND	9/14/2011
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314	590995.533	2546976.693	809.696	ASH POND	9/14/2011
315	590975.367	2546959.913	809.695	ASH POND	9/14/2011
316	590955.194	2546943.157	809.675	ASH POND	9/14/2011
317	590935.004	2546927.23	809.713	ASH POND	9/14/2011
318	590914.988	2546912.147	809.731	ASH POND	9/14/2011
319	590894.034	2546896.616	809.727	ASH POND	9/14/2011
320	590874.096	2546881.328	809.652	ASH POND	9/14/2011
321	590854.494	2546865.355	809.557	ASH POND	9/14/2011
322	590833.606	2546847.727	809.523	ASH POND	9/14/2011
323	590813.316	2546831.425	809.525	ASH POND	9/14/2011

324	590793.533	2546816.084	809.612	ASH POND	9/14/2011
325	590771.922	2546799.503	809.687	ASH POND	9/14/2011
326	590752.077	2546784.289	809.791	ASH POND	9/14/2011
327	590731.713	2546768.608	809.789	ASH POND	9/14/2011
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330	590666.989	2546718.573	809.732	ASH POND	9/14/2011
331	590646.51	2546702.74	809.809	ASH POND	9/14/2011
332	590626.395	2546687.074	809.81	ASH POND	9/14/2011
333	590606.145	2546671.364	809.744	ASH POND	9/14/2011
334	590585.625	2546655.563	809.709	ASH POND	9/14/2011
335	590565.211	2546639.746	809.656	ASH POND	9/14/2011
336	590545.041	2546624.023	809.633	ASH POND	9/14/2011
337	590525.195	2546608.465	809.528	ASH POND	9/14/2011
338	590503.847	2546591.813	809.553	ASH POND	9/14/2011
339	590482.993	2546575.748	809.56	ASH POND	9/14/2011
340	590462.529	2546560.141	809.581	ASH POND	9/14/2011
341	590442.591	2546544.925	809.597	ASH POND	9/14/2011
342	590421.955	2546529.189	809.608	ASH POND	9/14/2011
343	590401.346	2546513.421	809.674	ASH POND	9/14/2011
344	590381.105	2546497.824	809.605	ASH POND	9/14/2011
345	590361.449	2546482.307	809.6	ASH POND	9/14/2011
346	590341.593	2546466.267	809.587	ASH POND	9/14/2011
347	590321.76	2546450.372	809.488	ASH POND	9/14/2011
348	590302.024	2546435.016	809.454	ASH POND	9/14/2011
349	590281.876	2546420.129	809.458	ASH POND	9/14/2011
350	590262.084	2546404.608	809.533	ASH POND	9/14/2011
351	590242.317	2546389.087	809.573	ASH POND	9/14/2011
352	590222.113	2546373.326	809.659	ASH POND	9/14/2011
353	590201.276	2546357.14	809.758	ASH POND	9/14/2011
354	590181.251	2546341.162	809.899	ASH POND	9/14/2011
355	590160.634	2546324.642	809.905	ASH POND	9/14/2011
356	590139.992	2546308.225	809.894	ASH POND	9/14/2011
357	590119.624	2546292.229	809.928	ASH POND	9/14/2011
358	590098.653	2546275.716	810.042	ASH POND	9/14/2011
359	590078.816	2546259.817	810.003	ASH POND	9/14/2011
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361	590037.552	2546226.954	809.976	ASH POND	9/14/2011
362	590017.927	2546211.092	809.881	ASH POND	9/14/2011
363	589997.8	2546195.112	809.845	ASH POND	9/14/2011
364	589977.836	2546179.461	809.944	ASH POND	9/14/2011
365	589956.916	2546163.014	810.041	ASH POND	9/14/2011
366	589935.872	2546146.376	810.079	ASH POND	9/14/2011
367	589915.105	2546129.929	810.138	ASH POND	9/14/2011
368	589894.076	2546113.257	810.217	ASH POND	9/14/2011
369	589873.662	2546097.243	810.25	ASH POND	9/14/2011
370	589852.872	2546080.996	810.257	ASH POND	9/14/2011
371	589831.602	2546064.346	810.246	ASH POND	9/14/2011
372	589810.382	2546047.809	810.239	ASH POND	9/14/2011
373	589790.533	2546032.04	810.232	ASH POND	9/14/2011
374	589769.744	2546015.369	810.255	ASH POND	9/14/2011
375	589748.829	2545998.456	810.331	ASH POND	9/14/2011
376	589729.039	2545982.406	810.377	ASH POND	9/14/2011
377	589709.517	2545966.643	810.386	ASH POND	9/14/2011
378	589689.109	2545950.024	810.486	ASH POND	9/14/2011
379	589669.335	2545933.951	810.533	ASH POND	9/14/2011

380	589648.906	2545916.609	810.531	ASH POND		9/14/2011	
381	589629.711	2545899.282	810.553	ASH POND		9/14/2011	
382	589615.764	2545877.659	810.33	ASH POND		9/14/2011	
383	589610.967	2545851.757	809.984	ASH POND		9/14/2011	
384	595255.927	2544431.522	820.201	BTM ASH STACK	UPPER RD		9/15/2016
385	595235.692	2544413.718	821.014	BTM ASH STACK	UPPER RD		9/15/2016
386	595217.791	2544394.523	821.922	BTM ASH STACK	UPPER RD		9/15/2016
387	595197.077	2544375.965	823.098	BTM ASH STACK	UPPER RD		9/15/2016
388	595174.987	2544361.803	823.992	BTM ASH STACK	UPPER RD		9/15/2016
389	595149.661	2544351.267	824.756	BTM ASH STACK	UPPER RD		9/15/2016
390	595125.094	2544345.474	825.689	BTM ASH STACK	UPPER RD		9/15/2016
391	595099.206	2544343.363	826.39	BTM ASH STACK	UPPER RD		9/15/2016
392	595072.027	2544344.27	827.034	BTM ASH STACK	UPPER RD		9/15/2016
393	595044.134	2544348.091	827.558	BTM ASH STACK	UPPER RD		9/15/2016
394	595016.139	2544353.253	828.359	BTM ASH STACK	UPPER RD		9/15/2016
395	594991.741	2544359.209	829.106	BTM ASH STACK	UPPER RD		9/15/2016
396	594967.618	2544366.184	829.985	BTM ASH STACK	UPPER RD		9/15/2016
397	594941.286	2544375.173	831.002	BTM ASH STACK	UPPER RD		9/15/2016
398	594915.996	2544385.175	831.987	BTM ASH STACK	UPPER RD		9/15/2016
399	594891.391	2544395.874	832.856	BTM ASH STACK	UPPER RD		9/15/2016
400	594866.994	2544407.691	833.37	BTM ASH STACK	UPPER RD		9/15/2016
401	594842.619	2544420.053	833.772	BTM ASH STACK	UPPER RD		9/15/2016
402	594819.1	2544432.176	834.187	BTM ASH STACK	UPPER RD		9/15/2016
403	594795.331	2544444.499	834.416	BTM ASH STACK	UPPER RD		9/15/2016
404	594770.952	2544457.413	834.716	BTM ASH STACK	UPPER RD		9/15/2016
405	594746.602	2544470.05	835.036	BTM ASH STACK	UPPER RD		9/15/2016
406	594722.549	2544482.417	835.427	BTM ASH STACK	UPPER RD		9/15/2016
407	594699.417	2544494.185	835.9	BTM ASH STACK	UPPER RD		9/15/2016
408	594674.614	2544507.363	836.437	BTM ASH STACK	UPPER RD		9/15/2016
409	594651.752	2544519.061	836.728	BTM ASH STACK	UPPER RD		9/15/2016
410	594628.11	2544530.973	836.983	BTM ASH STACK	UPPER RD		9/15/2016
411	594605.251	2544542.905	837.13	BTM ASH STACK	UPPER RD		9/15/2016
412	594580.67	2544555.984	837.436	BTM ASH STACK	UPPER RD		9/15/2016
413	594556.071	2544569.133	837.696	BTM ASH STACK	UPPER RD		9/15/2016
414	594531.622	2544582.143	838.023	BTM ASH STACK	UPPER RD		9/15/2016
415	594507.081	2544594.93	838.233	BTM ASH STACK	UPPER RD		9/15/2016
416	594484.138	2544606.837	838.321	BTM ASH STACK	UPPER RD		9/15/2016
417	594460.42	2544619.11	838.387	BTM ASH STACK	UPPER RD		9/15/2016
418	594436.023	2544631.917	838.56	BTM ASH STACK	UPPER RD		9/15/2016
419	594412.396	2544644.398	838.583	BTM ASH STACK	UPPER RD		9/15/2016
420	594389.914	2544656.387	838.631	BTM ASH STACK	UPPER RD		9/15/2016
421	594368.026	2544668.609	838.521	BTM ASH STACK	UPPER RD		9/15/2016
422	594343.437	2544682.116	838.764	BTM ASH STACK	UPPER RD		9/15/2016
423	594320.645	2544695.024	838.931	BTM ASH STACK	UPPER RD		9/15/2016
424	594296.803	2544709.292	838.801	BTM ASH STACK	UPPER RD		9/15/2016
425	594275.305	2544722.182	838.95	BTM ASH STACK	UPPER RD		9/15/2016
426	594253.893	2544735.554	839.07	BTM ASH STACK	UPPER RD		9/15/2016
427	594230.534	2544750.131	839.076	BTM ASH STACK	UPPER RD		9/15/2016
428	594208.695	2544763.55	839.226	BTM ASH STACK	UPPER RD		9/15/2016
429	594185.2	2544778.458	839.218	BTM ASH STACK	UPPER RD		9/15/2016
430	594164.046	2544791.914	839.242	BTM ASH STACK	UPPER RD		9/15/2016
431	594142.076	2544806.114	839.176	BTM ASH STACK	UPPER RD		9/15/2016
432	594120.466	2544820.259	839.198	BTM ASH STACK	UPPER RD		9/15/2016
433	594099.736	2544834.351	839.135	BTM ASH STACK	UPPER RD		9/15/2016
434	594078.348	2544848.819	839.209	BTM ASH STACK	UPPER RD		9/15/2016
435	594056.067	2544864.44	839.116	BTM ASH STACK	UPPER RD		9/15/2016

436	594033.284	2544880.603	839.016	BTM ASH STACK	UPPER RD	9/15/2016
437	594010.156	2544897.326	838.994	BTM ASH STACK	UPPER RD	9/15/2016
438	593989.682	2544912.606	838.852	BTM ASH STACK	UPPER RD	9/15/2016
439	593968.984	2544928.303	838.846	BTM ASH STACK	UPPER RD	9/15/2016
440	593948.659	2544943.335	838.895	BTM ASH STACK	UPPER RD	9/15/2016
441	593926.338	2544959.936	838.798	BTM ASH STACK	UPPER RD	9/15/2016
442	593904.308	2544976.369	838.632	BTM ASH STACK	UPPER RD	9/15/2016
443	593881.791	2544993.113	838.362	BTM ASH STACK	UPPER RD	9/15/2016
444	593858.823	2545009.651	838.206	BTM ASH STACK	UPPER RD	9/15/2016
445	593838.202	2545023.901	838.115	BTM ASH STACK	UPPER RD	9/15/2016
446	593817.322	2545037.724	837.869	BTM ASH STACK	UPPER RD	9/15/2016
447	593793.829	2545052.537	838.134	BTM ASH STACK	UPPER RD	9/15/2016
448	593770.16	2545066.863	838.156	BTM ASH STACK	UPPER RD	9/15/2016
449	593746.64	2545081.068	838.277	BTM ASH STACK	UPPER RD	9/15/2016
450	593724.167	2545094.461	838.14	BTM ASH STACK	UPPER RD	9/15/2016
451	593701.7	2545107.654	838.036	BTM ASH STACK	UPPER RD	9/15/2016
452	593678.734	2545120.675	837.831	BTM ASH STACK	UPPER RD	9/15/2016
453	593655.658	2545132.53	837.507	BTM ASH STACK	UPPER RD	9/15/2016
454	593631.974	2545143.107	837.056	BTM ASH STACK	UPPER RD	9/15/2016
455	593607.381	2545152.103	836.539	BTM ASH STACK	UPPER RD	9/15/2016
456	593581.755	2545159.236	835.992	BTM ASH STACK	UPPER RD	9/15/2016
457	593555.753	2545163.85	835.454	BTM ASH STACK	UPPER RD	9/15/2016
458	593529.049	2545166.901	834.518	BTM ASH STACK	UPPER RD	9/15/2016
459	593500.742	2545169.138	832.759	BTM ASH STACK	UPPER RD	9/15/2016
460	593474.886	2545170.51	831.154	BTM ASH STACK	UPPER RD	9/15/2016
461	593449.063	2545171.491	829.3	BTM ASH STACK	UPPER RD	9/15/2016
462	593422.833	2545172.97	827.333	BTM ASH STACK	UPPER RD	9/15/2016
463	593397.468	2545174.405	825.126	BTM ASH STACK	UPPER RD	9/15/2016
464	593369.897	2545177.142	822.406	BTM ASH STACK	UPPER RD	9/15/2016
465	593343.915	2545180.832	820.487	BTM ASH STACK	UPPER RD	9/15/2016
466	593317.346	2545185.85	819.441	BTM ASH STACK	UPPER RD	9/15/2016
467	592523.69	2545439.621	835.578	GYPSOM POND	UPPER RD	9/15/2016
468	592550.336	2545439.01	836.211	GYPSOM POND	UPPER RD	9/15/2016
469	592574.851	2545433.406	836.863	GYPSOM POND	UPPER RD	9/15/2016
470	592600.957	2545426.305	836.348	GYPSOM POND	UPPER RD	9/15/2016
471	592625.989	2545418.514	836.043	GYPSOM POND	UPPER RD	9/15/2016
472	592651.039	2545410.486	835.856	GYPSOM POND	UPPER RD	9/15/2016
473	592676.968	2545401.85	835.663	GYPSOM POND	UPPER RD	9/15/2016
474	592702.555	2545393.548	835.572	GYPSOM POND	UPPER RD	9/15/2016
475	592726.501	2545385.766	835.584	GYPSOM POND	UPPER RD	9/15/2016
476	592752.354	2545377.951	835.651	GYPSOM POND	UPPER RD	9/15/2016
477	592776.895	2545371.038	835.401	GYPSOM POND	UPPER RD	9/15/2016
478	592801.392	2545363.912	835.529	GYPSOM POND	UPPER RD	9/15/2016
479	592826.604	2545356.982	835.492	GYPSOM POND	UPPER RD	9/15/2016
480	592852.807	2545350.948	836.014	GYPSOM POND	UPPER RD	9/15/2016
481	592879.946	2545346.844	836.236	GYPSOM POND	UPPER RD	9/15/2016
482	592907.008	2545345.751	836.373	GYPSOM POND	UPPER RD	9/15/2016
483	592931.81	2545349.073	836.789	GYPSOM POND	UPPER RD	9/15/2016
484	592955.546	2545358.178	837.192	GYPSOM POND	UPPER RD	9/15/2016
485	592976.989	2545373.612	837.617	GYPSOM POND	UPPER RD	9/15/2016
486	592994.01	2545394.455	837.792	GYPSOM POND	UPPER RD	9/15/2016
487	593005.923	2545416.527	837.799	GYPSOM POND	UPPER RD	9/15/2016
488	593016.826	2545441.022	837.84	GYPSOM POND	UPPER RD	9/15/2016
489	593027.436	2545465.72	837.901	GYPSOM POND	UPPER RD	9/15/2016
490	593038.561	2545490.97	837.793	GYPSOM POND	UPPER RD	9/15/2016
491	593049.492	2545515.885	837.602	GYPSOM POND	UPPER RD	9/15/2016

492	593059.995	2545539.708	837.563	GYPSOM POND	UPPER RD	9/15/2016
493	593071.099	2545564.66	837.575	GYPSOM POND	UPPER RD	9/15/2016
494	593081.926	2545590.134	837.71	GYPSOM POND	UPPER RD	9/15/2016
495	593092.351	2545614.84	837.419	GYPSOM POND	UPPER RD	9/15/2016
496	593102.872	2545640.048	837.05	GYPSOM POND	UPPER RD	9/15/2016
497	593112.293	2545663.287	836.726	GYPSOM POND	UPPER RD	9/15/2016
498	593123.006	2545689.132	836.599	GYPSOM POND	UPPER RD	9/15/2016
499	593132.794	2545712.391	836.536	GYPSOM POND	UPPER RD	9/15/2016
500	593142.716	2545736.424	836.471	GYPSOM POND	UPPER RD	9/15/2016
501	593152.367	2545759.981	836.422	GYPSOM POND	UPPER RD	9/15/2016
502	593162.562	2545785.259	836.48	GYPSOM POND	UPPER RD	9/15/2016
503	593172.421	2545809.183	836.309	GYPSOM POND	UPPER RD	9/15/2016
504	593182.208	2545832.543	836.035	GYPSOM POND	UPPER RD	9/15/2016
505	593192.999	2545857.342	835.743	GYPSOM POND	UPPER RD	9/15/2016
506	593203.283	2545881.06	835.571	GYPSOM POND	UPPER RD	9/15/2016
507	593213.644	2545904.499	835.594	GYPSOM POND	UPPER RD	9/15/2016
508	593224.677	2545929.139	835.647	GYPSOM POND	UPPER RD	9/15/2016
509	593234.974	2545952.939	835.642	GYPSOM POND	UPPER RD	9/15/2016
510	593245.539	2545978.201	835.366	GYPSOM POND	UPPER RD	9/15/2016
511	593253.764	2546002.279	835.05	GYPSOM POND	UPPER RD	9/15/2016
512	593257.172	2546027.809	834.968	GYPSOM POND	UPPER RD	9/15/2016
513	593251.514	2546054.147	834.53	GYPSOM POND	UPPER RD	9/15/2016
514	593237.287	2546077.118	834.025	GYPSOM POND	UPPER RD	9/15/2016
515	593218.247	2546096.366	833.458	GYPSOM POND	UPPER RD	9/15/2016
516	593198.274	2546111.832	833.675	GYPSOM POND	UPPER RD	9/15/2016
517	593176.361	2546124.989	835.446	GYPSOM POND	UPPER RD	9/15/2016
518	593151.705	2546137.425	836.047	GYPSOM POND	UPPER RD	9/15/2016
519	593126.489	2546148.05	836.23	GYPSOM POND	UPPER RD	9/15/2016
520	593102.688	2546157.409	836.193	GYPSOM POND	UPPER RD	9/15/2016
521	593078.409	2546166.991	836.23	GYPSOM POND	UPPER RD	9/15/2016
522	593054.072	2546176.653	836.235	GYPSOM POND	UPPER RD	9/15/2016
523	593028.472	2546186.797	836.194	GYPSOM POND	UPPER RD	9/15/2016
524	593002.415	2546197.094	836.127	GYPSOM POND	UPPER RD	9/15/2016
525	592976.565	2546207.247	836.067	GYPSOM POND	UPPER RD	9/15/2016
526	592952.562	2546216.371	836.003	GYPSOM POND	UPPER RD	9/15/2016
527	592928.039	2546225.805	836.11	GYPSOM POND	UPPER RD	9/15/2016
528	592903.93	2546235.083	836.239	GYPSOM POND	UPPER RD	9/15/2016
529	592879.238	2546244.73	836.273	GYPSOM POND	UPPER RD	9/15/2016
530	592854.579	2546254.142	836.368	GYPSOM POND	UPPER RD	9/15/2016
531	592830.559	2546263.207	836.36	GYPSOM POND	UPPER RD	9/15/2016
532	592806.097	2546272.665	836.228	GYPSOM POND	UPPER RD	9/15/2016
533	592782.069	2546282.077	836.103	GYPSOM POND	UPPER RD	9/15/2016
534	592756.015	2546292.2	836.183	GYPSOM POND	UPPER RD	9/15/2016
535	592730.807	2546301.867	836.231	GYPSOM POND	UPPER RD	9/15/2016
536	592705.942	2546311.498	836.329	GYPSOM POND	UPPER RD	9/15/2016
537	592680.215	2546321.419	836.291	GYPSOM POND	UPPER RD	9/15/2016
538	592654.532	2546331.256	836.229	GYPSOM POND	UPPER RD	9/15/2016
539	592628.759	2546341.318	836.206	GYPSOM POND	UPPER RD	9/15/2016
540	592605.087	2546350.795	836.162	GYPSOM POND	UPPER RD	9/15/2016
541	592581.143	2546360.388	836.287	GYPSOM POND	UPPER RD	9/15/2016
542	592557.923	2546369.829	836.379	GYPSOM POND	UPPER RD	9/15/2016
543	592532.384	2546380.28	836.348	GYPSOM POND	UPPER RD	9/15/2016
544	592509.096	2546389.737	836.294	GYPSOM POND	UPPER RD	9/15/2016
545	592485.156	2546399.207	836.265	GYPSOM POND	UPPER RD	9/15/2016
546	592461.306	2546408.441	836.196	GYPSOM POND	UPPER RD	9/15/2016
547	592435.278	2546418.462	836.218	GYPSOM POND	UPPER RD	9/15/2016

548	592411.482	2546427.631	836.172	GYPSOM POND	UPPER RD	9/15/2016
549	592386.731	2546437.193	836.11	GYPSOM POND	UPPER RD	9/15/2016
550	592361.819	2546446.908	836.031	GYPSOM POND	UPPER RD	9/15/2016
551	592337.538	2546456.281	835.978	GYPSOM POND	UPPER RD	9/15/2016
552	592313.262	2546465.712	835.936	GYPSOM POND	UPPER RD	9/15/2016
553	592288.265	2546475.264	835.982	GYPSOM POND	UPPER RD	9/15/2016
554	592263.837	2546484.505	836.073	GYPSOM POND	UPPER RD	9/15/2016
555	592239.875	2546493.571	836.11	GYPSOM POND	UPPER RD	9/15/2016
556	592215.718	2546502.964	836.166	GYPSOM POND	UPPER RD	9/15/2016
557	592189.622	2546513.247	836.215	GYPSOM POND	UPPER RD	9/15/2016
558	592163.441	2546523.442	836.218	GYPSOM POND	UPPER RD	9/15/2016
559	592139.507	2546532.825	836.214	GYPSOM POND	UPPER RD	9/15/2016
560	592113.659	2546542.957	836.25	GYPSOM POND	UPPER RD	9/15/2016
561	592089.263	2546552.407	836.228	GYPSOM POND	UPPER RD	9/15/2016
562	592065.738	2546561.628	836.15	GYPSOM POND	UPPER RD	9/15/2016
563	592040.804	2546571.327	836.145	GYPSOM POND	UPPER RD	9/15/2016
564	592016.758	2546580.774	836.149	GYPSOM POND	UPPER RD	9/15/2016
565	591991.196	2546590.587	836.258	GYPSOM POND	UPPER RD	9/15/2016
566	591966.227	2546599.512	836.254	GYPSOM POND	UPPER RD	9/15/2016
567	591940.041	2546607.706	836.201	GYPSOM POND	UPPER RD	9/15/2016
568	591915.732	2546613.861	836.29	GYPSOM POND	UPPER RD	9/15/2016
569	591890.776	2546618.838	836.367	GYPSOM POND	UPPER RD	9/15/2016
570	591863.758	2546622.295	836.521	GYPSOM POND	UPPER RD	9/15/2016
571	591838.636	2546622.539	836.707	GYPSOM POND	UPPER RD	9/15/2016
572	591813.128	2546619.281	836.766	GYPSOM POND	UPPER RD	9/15/2016
573	591789.064	2546612.35	836.66	GYPSOM POND	UPPER RD	9/15/2016
574	591765.378	2546599.271	836.6	GYPSOM POND	UPPER RD	9/15/2016
575	591747.807	2546580.699	836.598	GYPSOM POND	UPPER RD	9/15/2016
576	591734.647	2546557.628	836.462	GYPSOM POND	UPPER RD	9/15/2016
577	591724.481	2546533.172	836.26	GYPSOM POND	UPPER RD	9/15/2016
578	591716.106	2546509.063	836.176	GYPSOM POND	UPPER RD	9/15/2016
579	591708.433	2546485.133	836.137	GYPSOM POND	UPPER RD	9/15/2016
580	591700.816	2546460.571	836.059	GYPSOM POND	UPPER RD	9/15/2016
581	591692.798	2546435.635	836.038	GYPSOM POND	UPPER RD	9/15/2016
582	591684.962	2546411.288	836.044	GYPSOM POND	UPPER RD	9/15/2016
583	591677.363	2546387.442	836.05	GYPSOM POND	UPPER RD	9/15/2016
584	591669.121	2546361.207	836.075	GYPSOM POND	UPPER RD	9/15/2016
585	591661.047	2546335.117	836.07	GYPSOM POND	UPPER RD	9/15/2016
586	591653.151	2546311.214	836.015	GYPSOM POND	UPPER RD	9/15/2016
587	591644.589	2546286.374	836.144	GYPSOM POND	UPPER RD	9/15/2016
588	591635.677	2546260.296	836.096	GYPSOM POND	UPPER RD	9/15/2016
589	591626.97	2546233.745	836.101	GYPSOM POND	UPPER RD	9/15/2016
590	591618.632	2546207.539	836.006	GYPSOM POND	UPPER RD	9/15/2016
591	591610.25	2546180.82	835.914	GYPSOM POND	UPPER RD	9/15/2016
592	591602.478	2546156.122	835.832	GYPSOM POND	UPPER RD	9/15/2016
593	591594.401	2546130.877	835.902	GYPSOM POND	UPPER RD	9/15/2016
594	591586.768	2546106.665	836.003	GYPSOM POND	UPPER RD	9/15/2016
595	591578.62	2546080.946	835.918	GYPSOM POND	UPPER RD	9/15/2016
596	591570.854	2546056.026	835.955	GYPSOM POND	UPPER RD	9/15/2016
597	591563.231	2546031.97	836.007	GYPSOM POND	UPPER RD	9/15/2016
598	591555.562	2546008.134	835.86	GYPSOM POND	UPPER RD	9/15/2016
599	591547.263	2545982.813	835.812	GYPSOM POND	UPPER RD	9/15/2016
600	591538.904	2545959.035	835.886	GYPSOM POND	UPPER RD	9/15/2016
601	591529.512	2545933.148	835.905	GYPSOM POND	UPPER RD	9/15/2016
602	591521.154	2545908.89	835.907	GYPSOM POND	UPPER RD	9/15/2016
603	591512.479	2545883.031	835.946	GYPSOM POND	UPPER RD	9/15/2016

604	591503.628	2545856.965	835.896	GYPSOM POND	UPPER RD	9/15/2016
605	591496.394	2545832.554	835.983	GYPSOM POND	UPPER RD	9/15/2016
606	591490.403	2545806.908	835.965	GYPSOM POND	UPPER RD	9/15/2016
607	591490.194	2545779.967	836.016	GYPSOM POND	UPPER RD	9/15/2016
608	591501.227	2545755.839	836.241	GYPSOM POND	UPPER RD	9/15/2016
609	591521.355	2545739.344	836.293	GYPSOM POND	UPPER RD	9/15/2016
610	591544.892	2545729.381	836.259	GYPSOM POND	UPPER RD	9/15/2016
611	591569.795	2545721.719	836.233	GYPSOM POND	UPPER RD	9/15/2016
612	591594.48	2545715.386	836.07	GYPSOM POND	UPPER RD	9/15/2016
613	591620.557	2545708.071	835.841	GYPSOM POND	UPPER RD	9/15/2016
614	591645.871	2545700.732	835.836	GYPSOM POND	UPPER RD	9/15/2016
615	591671.658	2545693.295	835.962	GYPSOM POND	UPPER RD	9/15/2016
616	591697.544	2545685.794	835.955	GYPSOM POND	UPPER RD	9/15/2016
617	591722.594	2545678.48	835.938	GYPSOM POND	UPPER RD	9/15/2016
618	591746.779	2545671.53	835.935	GYPSOM POND	UPPER RD	9/15/2016
619	591771.323	2545664.521	835.853	GYPSOM POND	UPPER RD	9/15/2016
620	591797.091	2545657.369	835.752	GYPSOM POND	UPPER RD	9/15/2016
621	591822.896	2545650.132	835.814	GYPSOM POND	UPPER RD	9/15/2016
622	591848.455	2545642.591	835.87	GYPSOM POND	UPPER RD	9/15/2016
623	591874.875	2545634.652	835.863	GYPSOM POND	UPPER RD	9/15/2016
624	591901.23	2545626.63	835.782	GYPSOM POND	UPPER RD	9/15/2016
625	591926.97	2545618.619	835.784	GYPSOM POND	UPPER RD	9/15/2016
626	591953.176	2545610.295	835.842	GYPSOM POND	UPPER RD	9/15/2016
627	591977.367	2545602.69	835.825	GYPSOM POND	UPPER RD	9/15/2016
628	592002.226	2545594.99	835.8	GYPSOM POND	UPPER RD	9/15/2016
629	592027.439	2545587.389	835.855	GYPSOM POND	UPPER RD	9/15/2016
630	592052.715	2545579.977	835.869	GYPSOM POND	UPPER RD	9/15/2016
631	592079.723	2545572.249	835.898	GYPSOM POND	UPPER RD	9/15/2016
632	592106.727	2545564.852	835.911	GYPSOM POND	UPPER RD	9/15/2016
633	592131.423	2545557.898	836.054	GYPSOM POND	UPPER RD	9/15/2016
634	592155.876	2545550.78	836.101	GYPSOM POND	UPPER RD	9/15/2016
635	592182.288	2545543.234	836.164	GYPSOM POND	UPPER RD	9/15/2016
636	592208.883	2545535.755	836.301	GYPSOM POND	UPPER RD	9/15/2016
637	592233.011	2545528.683	836.354	GYPSOM POND	UPPER RD	9/15/2016
638	592259.707	2545520.672	836.304	GYPSOM POND	UPPER RD	9/15/2016
639	592285.067	2545512.781	836.272	GYPSOM POND	UPPER RD	9/15/2016
640	592309.465	2545505.241	836.228	GYPSOM POND	UPPER RD	9/15/2016
641	592333.539	2545498.073	836.232	GYPSOM POND	UPPER RD	9/15/2016
642	592358.778	2545490.701	836.306	GYPSOM POND	UPPER RD	9/15/2016
643	592384.636	2545483.038	836.396	GYPSOM POND	UPPER RD	9/15/2016
644	592408.78	2545475.628	836.454	GYPSOM POND	UPPER RD	9/15/2016
645	592433.498	2545468.282	836.44	GYPSOM POND	UPPER RD	9/15/2016
646	592458.148	2545461.311	836.246	GYPSOM POND	UPPER RD	9/15/2016
647	592483.468	2545454.251	835.923	GYPSOM POND	UPPER RD	9/15/2016
648	594380.622	2545159.743	806.537	SLUICE CHANNEL	WATER ELEVATION	9/15/2016

APPENDIX A

Document 2

Stantec. (April 29, 2011). BRF Ash Pond Breach Analysis – TDEC Comment Response

Memo

Stantec

To:	Sam Hixson Tennessee Valley Authority	From:	John Menninger Stantec Consulting Services, Inc
File:	175669090	Date:	April 29, 2011

Reference: BRF Ash Pond Breach Analysis – TDEC Comment Response

1.0 Introduction

In 2010, Stantec Consulting Services, Inc. (Stantec) performed a breach analysis for postulated breach scenarios of the Bull Run Fossil Plant Ash Pond at the request of the Tennessee Valley Authority (TVA). The findings of this breach analysis are summarized in the report Stantec submitted to TVA entitled "Dam Breach Analysis and Inundation Mapping - Bull Run Fly Ash Pond" dated May 5, 2010.

In April, 2011, TVA requested that Stantec help address comments made by the Tennessee Emergency Management Agency (TEMA) on the Draft Emergency Response Plan for the Bull Run Fossil Plant. The Draft Emergency Response Plan was submitted by TVA to Tennessee Department of Environment and Conservation (TDEC) in accordance with an application for NPDES Permit TN0005410 for Bull Run Fossil Plant in February, 2011.

2.0 Potential Life Threatening Effects

According to TDEC, "any off-site multi-hazard emergency plan should address the requirements of TDEC NPDES Permit TN0005410 to address potential ash pond failure. A preparedness plan should be developed which considers a boundary for potentially affected topographic features based on mud flow and wave propagation to develop requirements for CCW storage that will minimize any life threatening effects due to failure."

2.1 DAM BREACH ANALYSIS

The previously completed breach analysis should satisfy the concerns outlined by TDEC with regards to the risks of potential life loss. The breach model developed by Stantec provides an estimation of the wave propagation associated with a potential dam breach of the Bull Run Ash Pond. The breach analysis incorporates the volume of both the impoundment water and sluiced fly ash in calculating the down gradient water surface impacts. Furthermore, these projected water surface elevations were mapped on topographic mapping along with area roadways and residences. The mapping demonstrates that no residences or roadways are within the estimated impact zone.

2.2 RISK REDUCTION STRATEGIES

In addition to the inundation mapping and emergency planning efforts, TVA has either completed or is in the process of completing a number of projects to reduce the risk and potential impacts of an ash pond breach at Bull Run. The list below outlines these risk reduction projects:

- Ash Pond dredging is currently underway to remove accumulated ash and maintain the freewater volume.
- The Ash Pond water surface elevation has been reduced from 806.5 feet to 799.5 feet while dredging; the pond will have a final maintained elevation of 801.0 feet. This will reduce the phreatic surface through the perimeter dikes, and increase freeboard.
- Riprap buttresses up to 4 feet thick are currently being placed along the outer slopes of the Ash Pond, Gypsum Stack and Bottom Ash Stack dikes along the Clinch River and Bullrun Creek to improve the computed factor of safety for stability.
- A riprap buttress was also constructed on the south side of the Gypsum Stack to improve the computed factor of safety for stability.
- French drains and slope re-grading were performed on the west and north sides of the Gypsum Stack to lower phreatic surface, improve drainage and increase the factor of safety for stability of the perimeter dikes and embankment.
- Re-grading was performed along the west and south slopes of the Bottom Ash Stack to reduce steep slopes and increase the factor of safety of embankments.
- Long term, TVA is planning the phased closure of all Coal Combustion Product (CCP) impoundment facilities at the Bull Run Fossil Plant.

3.0 Impacts to Downstream Water Intakes

According to TDEC, "the DRAFT Emergency Response Plan should address potential impacts or response requirements with notifications for critical infrastructure such as the immediate downstream drinking water intakes."

During a breach of the Ash Pond, there is potential for the transport of large quantities of fly ash into Bullrun Creek and the Clinch River. Stantec performed a simplified analysis to determine the potential impacts for the surrounding water intakes illustrated on the attached figure (1-mile and 5-mile radii from the ash pond are included for reference). Dam breach discharges and travel times were taken from the "Sunny Day" dam breach scenario for the May 2010 breach modeling. Stoke's law was used to predict settling velocities for fly ash particles.

Reference: BRF Ash Pond Breach Analysis – TDEC Comments

The results of the analysis indicate that the reviewed breach scenarios will not transport fly ash more than 500 feet upstream on either the Clinch River or Bullrun Creek and does not appear to pose a significant risk to the upstream water intakes.

For areas downstream of the facility, there is a potential for impacts to downstream water intakes due to finely-graded suspended ash particles and dissolved metals that would flow into the Clinch River during a breach of the Ash Pond dike. However, the results of the model indicate that it is unlikely that the intake for the West Knoxville Utility, located approximately 1000 feet downstream of the facility, will be blocked by mud-flow from a breach of the Ash Pond. The potential of intakes further downstream being blocked off by mud-flow is further reduced and is very unlikely.

Nevertheless, as a matter of prudence, Stantec recommends that TVA coordinate with the downstream water utilities to develop a plan for the monitoring and treatment of the potential water quality impacts associated with a potential breach of the Ash Pond.

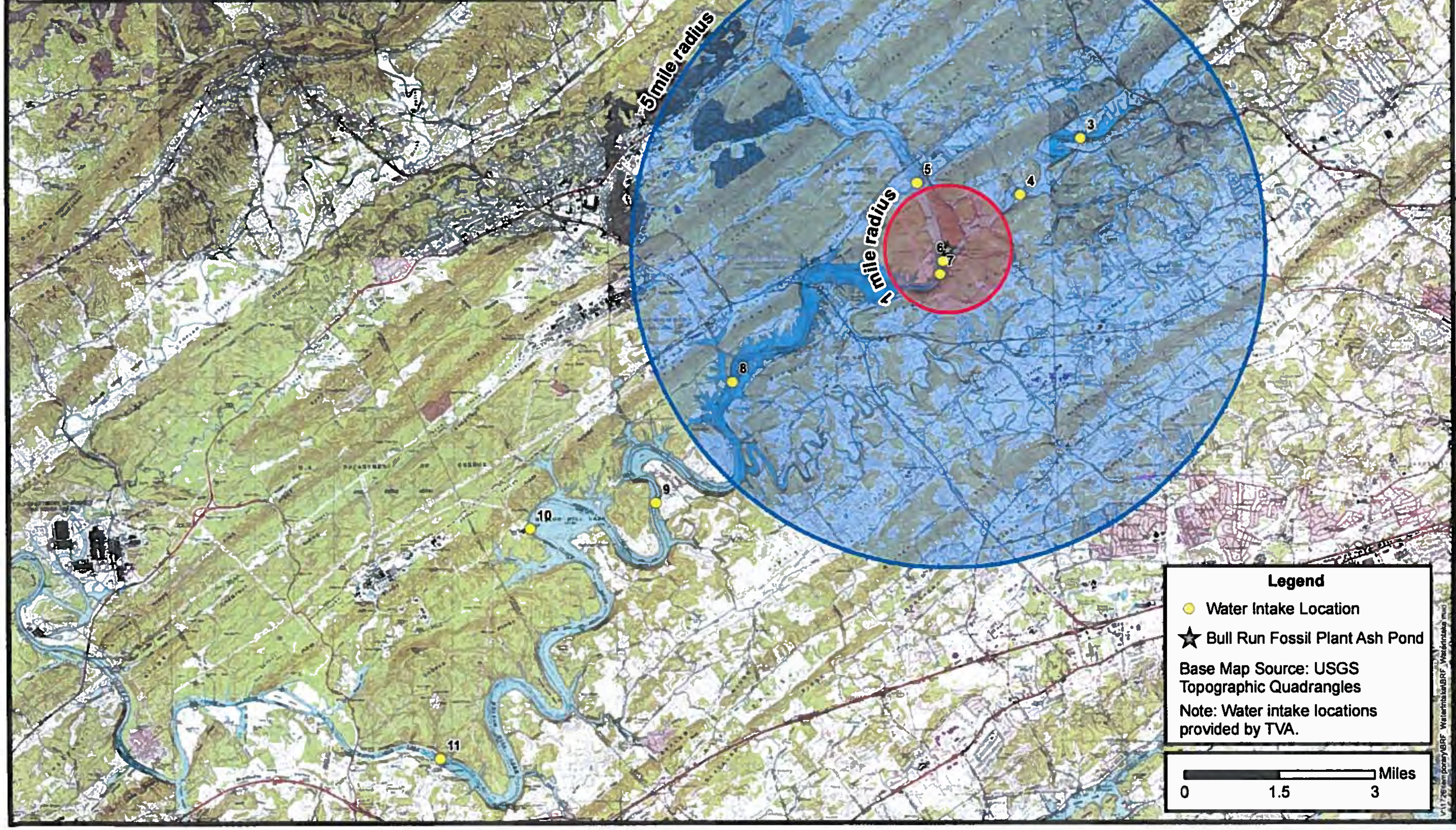
STANTEC CONSULTING SERVICES INC.

John Menninger, PE
Senior Project Engineer

Tiffany Coleman, PE
Senior Project Engineer

Attachment: Water Intake Locations Figure

ID	Name	River Mile	Miles from Ash Pond
1	Clinton Municipal Water Treatment Plant (WTP) Intake	Clinch River mile 56.9	10.6
2	Anderson County WTP (Oak Ridge WTP formerly Y-12 WTP)	Clinch River mile 52.6	6.3
3	Hallsdale Powell Utility Intake (backup Intake)	Bull Run Creek mile 3.9	3.9
4	Hallsdale Powell Utility Intake	Bull Run Creek mile 2.0	2
5	Bull Run Fossil Plant Intake	Clinch River mile 47.8	1.5
6	Bull Run Fossil Plant Discharge	Clinch River mile 46.3	0
7	West Knoxville Utility Intake	Clinch River mile 46.1	0.2
8	Oak Ridge National Laboratory WTP	Clinch River mile 41.2	5.1
9	West Knoxville Utility Intake	Clinch River mile 36.2	10.1
10	DOE Reactor	Clinch River mile 32.6	13.7
11	Melton Hill Dam	Clinch River mile 23.1	23.2



STANTEC CONSULTING SERVICES, INC.
1409 N. Forbes Road
Lexington, KY 40511
859-422-3000

Stantec

Water Intake Locations near Bull Run Fossil Plant

Tennessee Valley Authority
Bull Run Fossil Plant
Anderson County, Tennessee

PROJECT NO.	175669090
DATE	APRIL 2011
DRAWN BY	MEP
CHECKED BY	TGC
CHECKED BY	
SCALE	1 inch = 1.5 miles
REVISED	
1	
2	
3	
4	
SHEET	1 OF 1

APPENDIX A

Document 3

Stantec. (May 5, 2010). Dam Breach Analysis and Inundation Mapping

Dam Breach Analysis and Inundation Mapping

Bull Run Fly Ash Pond
Bull Run Fossil Plant
Anderson County, Tennessee

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1409 North Forbes Road
Lexington, KY 40511-2050
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www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

May 5, 2010

Stantec

Stantec Consulting Services Inc
1409 North Forbes Road
Lexington KY 40511-2050
Tel: (859) 422-3000
Fax: (859) 422-3100

May 5, 2010

rpt_001_175669090

Mr. Michael S. Turnbow
Tennessee Valley Authority
1101 Market Street, LP 5E-C
Chattanooga, Tennessee 37402

Re: Dam Breach Analysis and Inundation Mapping
Bull Run Fly Ash Pond
Bull Run Fossil Plant
Anderson County, Tennessee

Dear Mr. Turnbow:

Stantec performed updated breach analysis for postulated breach scenarios of the Bull Run Ash Pond at the request of the Tennessee Valley Authority (TVA) and produced dam breach inundation mapping for "Sunny Day" and PMP breach scenarios. No structures were identified within the impact zone for any breach scenario studied. The attached report details the breach scenarios, assumptions, methodologies and results.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Tiffany Coleman CW

Tiffany Coleman, PE
Water Resources Engineer

John S. Montgomery

John Montgomery, PE
Senior Principal

/rdr

Dam Breach Analysis and Inundation Mapping

Bull Run Fly Ash Pond
Bull Run Fossil Plant
Anderson County, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

May 5, 2010

Dam Breach Analysis and Inundation Mapping

Bull Run Fly Ash Pond
Bull Run Fossil Plant
Anderson County, Tennessee

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List of Appendixes

Dam Breach Analysis and Inundation Mapping

Bull Run Fly Ash Pond
Bull Run Fossil Plant
Anderson County, Tennessee

1. Introduction

The Bull Run Fossil Plant is located at the confluence of Bullrun Creek and the Clinch River in Anderson County, Tennessee. The fly ash pond has a footprint of approximately 50 acres with a dike crest elevation of approximately 810 feet.

Stantec had previously performed breach analyses of the fly ash pond at the Bull Run Fossil Plant using approximate methods. The results of this study were included in the summary titled, "Preliminary Dam Breach Approximate Limits of Impact – Methodology" and submitted to the TVA on July 24, 2009.

Stantec has been requested to perform a more detailed analysis using recently developed topographic data to determine the limit of impact caused by a breach of the ash pond dike. The following report summarizes the additional study of the breach impacts using HEC-HMS, a hydrologic routing software, and HEC-RAS, hydraulic modeling software capable of performing unsteady flow routing.

2. Breach Hydrograph Development

2.1. Failure Scenarios

Stantec performed breach analyses of the ash pond using the U.S. Army Corps of Engineers (USACE) HEC-HMS computer modeling software, Version 3.3. Breach analyses were performed for two basic types of failure scenarios: (1) A "Sunny Day" breach consists of a piping failure that is assumed to occur during normal operational inflows. The impoundment water surface elevation is normally assumed to be at the top of the lowest non-clogging spillway. (2) A "Probable Maximum Precipitation (PMP) Event" consists of an overtopping failure during a PMP event. Specific assumptions for the two types of scenarios are outlined below:

For a piping failure, HEC-HMS simulates a trapezoidal breach that begins at the bottom elevation of the breach and has a gradually increasing breach orifice height and width, until the dam crest is reached. Likewise, for a PMP failure, HEC-HMS simulates a trapezoid failure that begins at the top of the embankment and has gradually increasing breach width and decreasing weir elevation until the bottom elevation is reached.

2.1.1. "Sunny Day" Scenario (Scenario 1)

Since the Bull Run Ash Pond does not have an emergency spillway, the water surface elevation at the time of the breach was assumed to be equal to the perimeter dike crest elevation (810 feet). Inflow to the ash pond was neglected and the water surface elevation of Bullrun Creek and Clinch River was assumed to be 795 feet which is normal pool as identified on Clinch River Navigation Chart No. 111. A piping failure was assumed to occur near the location of the historical Bullrun Channel as shown in Figure A1 of Appendix A. The impounded water and fly ash within the pond was assumed to be lost down to elevation 795 feet since the surrounding water would act as tailwater and limit outflow. Conservatively, all ash above elevation 795 feet was assumed to mobilize and be lost through the breach. Additionally, the rapid drawdown of the fly ash pond was assumed to cause the failure of the adjacent gypsum stack. The gypsum material was assumed to be contained in the pond; however, water impounded in the gypsum pond was assumed lost in the breach. The gypsum pond was assumed to have a water surface elevation of 835 feet at the time of breach. The gypsum stack failure was postulated to occur after the water surface in the fly ash pond dropped five feet and was modeled as an inflow to the HEC-HMS "Sunny Day" model. Figure A2 in Appendix A is a schematic cross section through the ash pond and gypsum stack showing the "Sunny Day" failure configuration.

2.1.2. PMP Scenarios

The water surface in the ash pond at the beginning of the PMP event was assumed at normal pool elevation, 806.5 feet. The breach was assumed to occur near the location of the historical Bullrun Creek channel as shown in Figure A1 of Appendix A. The water surface elevation on Bullrun Creek and Clinch River was assumed at the level of the 100-year flood event, elevation 797 feet. This assumption is reasonable since some level of flooding of the surrounding waterways would be expected during a PMP storm of the ash pond and the water surface elevations of the surrounding waterways would be expected to be less than the PMP elevations since Bullrun Creek and Clinch River have much larger drainage areas and lag times. The overtopping failure was assumed to begin when the ash pond water surface reached the crest of the dike, elevation 810 feet.

The inflow consisted of the 6-hour PMP storm precipitation (35.3 inches based on Hydrometeorological Report No. 56[1] (HMR-56)). Three different hyetograph shapes were evaluated: (1) SCS 6-hour hyetograph, (2) "Early Peak" 6-hour hyetograph , and (3) "Late Peak" 6-hour hyetograph. The SCS 6-hour hydrograph is a standard hyetograph that is currently being used for spillway design at various TVA fossil plants (see Chow[2]). The "Early Peak" and "Late Peak" hydrograph were developed using a procedure outlined in HMR-56. The 1-, 2-, 3-, 4-, 5-, and 6-hr PMP depths were taken from Figure 16 in HMR-56 and arranged sequentially. Incremental depths were determined for each hour and then rearranged to develop the two hyetographs according to rules presented in HMR-56.

As in the "Sunny Day" Scenario, the rapid drawdown of the fly ash pond was assumed to cause the failure of the adjacent gypsum stack. The gypsum stack failure outflow was analyzed considering both "Existing" and "Future" conditions. For both conditions, the gypsum material was assumed to be contained in the pond; however, water impounded in the gypsum pond was assumed lost in the breach. Additionally, the gypsum stack failure for each condition was postulated to occur after the water surface in the ash pond dropped five feet and was modeled as inflow to the HEC-HMS "PMP" failure models.

For the "Existing" condition, the gypsum pond was assumed to have a water surface elevation of 828 feet (PMP depth added to normal pool elevation of 825 feet). Figure A3 in Appendix A is a schematic cross section through the ash pond and gypsum stack showing the "Existing Condition PMP" failure configuration.

For the "Future" condition, the gypsum pond dike crest was assumed to be raised 10-feet. However, the gypsum pond bottom was conservatively assumed unchanged at 824 feet. Additionally, the gypsum pond was assumed to have a water surface elevation of 843 feet

(PMP depth added to a normal pool elevation of 840 feet). Figure A4 in Appendix A is a schematic cross section through the ash pond and gypsum stack showing the "Future Condition PMP" failure configuration.

The PMP "Existing" and "Future" conditions were run for each of the 6-hour storm hyetographs resulting in the following PMP breach scenarios:

Scenario 2a – "Existing" conditions with SCS 6-hour Hyetograph;

Scenario 2b – "Existing" conditions with "Early Peak" Hyetograph;

Scenario 2c – "Existing" conditions with "Late Peak" Hyetograph;

Scenario 2d – "Future" conditions with SCS 6-hour Hyetograph;

Scenario 2e – "Future" conditions with "Early Peak" Hyetograph;

Scenario 2f – "Future" conditions with "Late Peak" Hyetograph;

2.2. Estimation of Dam Breach Parameters

Many empirical equations have been developed from case studies to predict average breach width and breach development time based on the height of the dam, depth of the water, volume impounded, and/or type of breach. Since there is great uncertainty in predicting dam breach parameters, Stantec used different empirical equations and based final breach parameters on the range of the estimates obtained and engineering judgment.

Estimates for breach development time and average breach parameters for the "Sunny Day" scenario are summarized in Table 1. The predicted average breach width (B_{av}) ranged from 45 feet to 61 feet and breach development time (t_f) ranged from 0.1 hours to 1.0 hours. These estimates are based on the assumed failure conditions, height of the breach (15 feet), and impoundment water volume in the ash pond (428 acre-ft). The impoundment volume of 428 acre-ft used in the breach equations is based on impounded water only and excludes ash assumed lost in the breach.

Table 1. Estimate of Dam Breach Parameters Based on "Sunny Day" Scenario

Equation Name	B_{av} (feet)	t_f (hours)
Froehlich (1987)[3]	61	0.9
Froehlich (1995)[4]	54	0.7
USBR (1988)[5]	45	0.2
Von Thun and Gillette (1990)[6]	57.5	0.1 – 1.0
Average	**54**	**0.5**

The selected parameters for the "Sunny Day" Scenario (Scenario 1) are summarized below:

(1) The average breach width is 55 feet, which is roughly the average of the predicted average breach widths from the equations referenced.

(2) The breach development time is 0.4 hours, which is slightly less than the average from the four equations referenced.

(3) The piping initiates at the Clinch River normal pool elevation of 795 feet, which is also the bottom elevation of the breach, and progresses linearly.

(4) The top of breach is the dike crest elevation of 810 feet.

(5) The piping coefficient is 0.8, which a common orifice coefficient value.

The empirical equations were also used to obtain estimates of dam breach parameters for the PMP Scenarios as shown in Table 2. The assumed overtopping failure conditions for this scenario include a breach height of 13 feet and impoundment volume in the fly ash pond of 396 acre-ft (this volume is based on water only and excludes ash assumed lost in the breach).

The average width for the PMP scenario was selected based on the Froehlich 1987[3] and Froehlich 1995[4] equations, which include a factor to account for failure mode since the average breach width tends to be higher for overtopping failures.

Table 2. Estimate of Dam Breach Parameters Based on PMP Scenario

Equation Name	B_{av} (feet)	t_f (hours)
Froehlich (1987)[3]	81	1.0
Froehlich (1995)[4]	71	0.8
USBR (1988)[5]	Not considered	0.1
Von Thun and Gillette (1990)[6]	Not considered	0.1 – 1.0

The selected parameters for the PMP Scenario are summarized below:

(1) The average breach width is 75 feet which is close to the average of the predicted average widths from the Froehlich 1987[3] and Froehlich 1995[4] equations.

(2) The breach development time is 0.4 hours.

(3) The bottom elevation of the breach is at the Clinch River 100-year flood elevation of 797 feet.

(4) The overtopping failure initiates at the dike crest elevation, 810 feet.

(5) Linear progression of the breach was assumed.

The empirical calculations that served as the basis for the dam breach parameters estimation are included in Figures A5 and A6 of Appendix A, for the "Sunny Day" and PMP Scenarios, respectively.

2.3. Development of Gypsum Pond Impoundment Failure Outflow Hydrographs

For the "Sunny Day", PMP "Existing" conditions, and PMP "Future" conditions scenarios, the rapid drawdown of the fly ash pond was assumed to cause the failure of the adjacent gypsum stack with the gypsum material assumed contained in the ash pond and water impounded in the gypsum pond lost in the breach. To be conservative, the gypsum pond was assumed full with a water surface elevation of 835 feet for the "Sunny Day" scenario. This elevation is based on survey data dated August, 2009. The gypsum pond water surface elevation for the PMP "Existing" condition scenarios were assumed to be 828 feet which is the PMP depth of 35.3 inches added to the normal pool elevation of 825 feet. Similarly, the gypsum pond water surface elevation for the PMP "Future" condition scenarios were assumed to be 843 feet which is the PMP depth of 35.3 inches added to an assumed future normal pool elevation of 840 feet. For all scenarios the gypsum stack failure was postulated to occur after the water surface in the ash pond dropped five feet and was modeled as an inflow to the ash pond.

Stantec used available data to develop a hydrologic model in HEC-HMS to estimate the outflow hydrograph for the gypsum pond failure. The failure was modeled as a dam breach with a breach width equal to the width of the stack. The breach development time was assumed at 0.1 hours to simulate a rapid failure. For the "Sunny Day" and "Existing" condition PMP scenarios, the breach bottom elevation was 824 feet and the breach top elevation was 835 feet. The stage-storage curve, provided as Figure A7 of Appendix A, was developed from hydrographic survey data dated August 2009 provided by TVA.

For the "Future" conditions PMP scenarios, the breach bottom elevation was 824 feet and the breach top elevation was 845 feet, based on a possible future configuration in which the dike crest would be raised 10 feet. The stage-storage curve, which is provided as Figure A8, is the same as Figure A7, except that it includes estimated future storage at elevation 845 feet.

The resulting outflow hydrographs are included as Figure A9, Figure A10 and Figure A11 of Appendix A for the "Sunny Day", "Existing condition" PMP scenarios, and "Future" condition PMP scenarios, respectively. The applicable hydrographs were applied as an inflow to the "Sunny Day" and PMP hydrologic modeling for the ash pond, and were lagged so that the first non-zero inflow occurred when the ash pond water surface elevation had dropped five feet.

2.4. "Sunny Day" Scenario Hydrologic Modeling (Ash Pond)

A dam breach outflow hydrograph for the "Sunny Day" scenario was estimated using the dam break capabilities of HEC-HMS version 3.3. The data required for the model included (1) an elevation-storage relationship for the ash pond impoundment, (2) starting water surface elevation, (3) dam breach parameters, and (4) an inflow hydrograph for the postulated failure of the adjacent gypsum stack.

These inputs are described as follows:

(1) The stage storage curve, shown in Figure A12 of Appendix A, was developed using aerial survey data dated May 2009 provided by TVA. The below water portion of the storage volume was estimated by assuming a 2H: 1V side slopes down to elevation 795 feet so that the fly ash and water would be included.

(2) The starting water surface was set to the dike crest elevation of 810 feet.

(3) The dam breach parameters described in Section 2.2 were applied to model.

(4) The model was first ran without applying the gypsum pond inflow hydrograph to determine the time required for the ash pond water surface to drop 5-feet. The gypsum pond hydrograph was then lagged 38 minutes to correspond to this drop.

The computed outflow hydrograph for the "Sunny Day" scenario had a peak outflow of 9,676 cfs which occurred 50 minutes after the start of the breach. The hydrograph is included as Figure A13 of Appendix A.

2.5. Pre-Failure Hydrologic Model Development for PMP Event (Ash Pond)

The purpose of the pre-failure hydrologic model was to establish the time during the PMP event that the ash pond water surface would reach the top of embankment elevation and overtopping would begin to occur. Stantec used available data to develop a hydrologic model of the ash pond in HEC-HMS version 3.3. Hydrologic information and outlet geometry information was taken from "Hydrologic and Hydraulic Evaluation of the Ash Pond and Outlet Structures: TVA Bull Run Fossil Plant" by Stantec dated December 2009. The data required for the model included (1) an elevation-storage relationship for the impoundment, (2) a starting water surface elevation, (3) an outflow rating curve, (4) watershed parameters, (5) and an inflow hydrograph. The hydrologic inputs are described as follows:

(1) The stage-storage curve, shown in Figure A14 of Appendix A, was developed for the PMP pre-failure modeling from a hydrographic survey provided by TVA and dated August 2009.

(2) The starting water surface was set to the normal pool elevation of 806.5 feet, since this is the water surface elevation in the ash pond under normal operating conditions. The dike crest elevation was not selected since it is unlikely that the water surface elevation would be at the dike crest at the beginning of inflow from the PMP storm event.

(3) The ash pond outlet consists of three riser structures. A rating curve for these structures was developed based on assumed tailwater of 797 feet for the PMP breach scenario and is included in Figure A15 of Appendix A.

(4) Watershed parameters input to the model included:

   a. Composite Curve Number = 87
   b. Lag time = 15.6 min
   c. Watershed area = 157 acres

(5) Inflow hydrographs were computed in HEC-HMS based on the watershed parameters and the three 6-hour PMP hyetographs (shown in Figure A16). An additional inflow of 53 cfs, which is the maximum expected plant flow to the pond, was also applied as a constant baseflow.

The model showed that overtopping would be expected to begin 2 hours and 38 minutes after the start of the SCS 6-hour PMP, 1 hour and 12 minutes after the start of the "Early Peak" 6-hour PMP, and 5 hours and 26 minutes after the start of the "Late Peak" 6-hour PMP. The computed PMP hydrographs are included in Figure A17 of Appendix A.

2.6. PMP Scenario Hydrologic Modeling (Ash Pond)

A dam breach outflow hydrograph for the PMP scenarios were calculated using the dam break capabilities of HEC-HMS version 3.3. The simulations were run from the time of overtopping, until 24-hours after the start of the PMP. The data required for the model included (1) an elevation-storage relationship for the ash pond impoundment, (2) starting water surface elevation, (3) dam breach parameters, (4), an inflow hydrograph for PMP event, and (5) an inflow hydrograph for the postulated failure of the adjacent gypsum pond. These inputs are described below:

(1) The stage storage curve, shown in Figure A12 of Appendix A, was developed using aerial survey data dated May 2009. The underwater portion of the storage volume was estimated by assuming a 2H: 1V side slope down to elevation 795 feet so that the fly ash and water would be included.

(2) The starting water surface was set to the top of embankment elevation of 810 feet.

(3) The dam breach parameters described in Section 2.2 were applied to the model.

(4) The models were first run without applying the gypsum pond inflow hydrograph to determine the time required for the ash pond water surface to drop 5-feet. The gypsum pond hydrograph inflow was lagged to correspond to this drop.

The peak outflow computed for the six PMP scenarios are summarized in Table 3. The hydrographs are included as Figure A18 and A19 of Appendix A for the "Existing" and "Future" condition PMP scenarios, respectively.

Table 3. Summary of Peak Outflow for PMP Breach Scenarios

Scenario	Description	Time of Peak (Hour:min after start of PMP Event)	Peak Outflow (cfs)
2a	"Existing" conditions with SCS 6-hour hyetograph	3:02	9,512
2b	"Existing" conditions with "Early Peak" hyetograph	1:36	8,912
2c	"Existing" conditions with "Late Peak" hyetograph	5:50	8,937
2d	"Future" conditions with SCS 6-hour hyetograph	3:32	45,168
2e	"Future" conditions with "Early Peak" hyetograph	2:05	44,974
2f	"Future" conditions with "Late Peak" hyetograph	6:14	43,511

3. Hydraulic Model Development

An unsteady flow hydraulic model was developed in USACE HEC-RAS version 4.0 software to calculate maximum water surface elevations for the postulated breach scenarios.

3.1. Model Geometry

The HEC-RAS model was developed using cross sections with an average spacing of less than 1000 feet for Bullrun Creek and Clinch River in the vicinity of the Bull Run Fossil Plant. Cross section overbank geometry was developed from 1-foot contour interval aerial mapping provided by TVA and dated December 2009 where available. Bullrun Creek channel geometry for the underwater portion of the cross sections was developed from a hydrographic survey of the Bullrun Creek Channel performed by TVA in December 2009.

In areas where aerial mapping along Clinch River was not available, cross section information was taken from a 2009 TVA calculation titled "SOCH Geometry Verification for Melton Hill Reservoir".

Four bridges were added to the hydraulic model based on field survey performed by TVA in December 2009 and/or information taken from Tennessee Department of Transportation (TDOT) drawings: (1) Bullrun Creek railroad bridge near the Bull Run Fossil Plant Facility, (2) New Henderson Road Bridge over Bullrun Creek, (3) State Route 170 (Edgemore Road) Bridge over Clinch River, and (4) State Route 62 (Oak Ridge Highway) Bridge over Clinch River.

3.2. HEC-RAS Unsteady Hydraulic Modeling

The "Sunny Day" breach (Scenario 1) was assumed to occur during a non-flood condition. Data for baseflow in Bullrun Creek and Clinch River were not available. Inflows were applied in the model such that the starting water surface was set to approximately 795 feet, which is the Clinch River normal pool. The "Sunny Day" breach hydrograph was applied as a lateral inflow to Bullrun Creek downstream of the railroad bridge at the location shown on Figure A1 of Appendix A. The simulation used an 8 hour duration time and a computation interval of 1-minute.

The PMP breach scenarios (Scenarios 2a – 2f) were assumed to occur during a 100-year flood of Bullrun Creek and Clinch River. The 100-year peak discharge for the Clinch River is approximately 50,000 cfs and the 100-year flood elevation is approximately 797 feet based on "Flood Insurance Study, Anderson County, Tennessee, and Incorporated Areas" published by FEMA on May 4, 2009. An inflow of 50,000 cfs was applied to the Clinch River so that the starting water surface was approximately 797 feet at the confluence with Bullrun Creek.

Discharge information from a HEC-2 model of Bullrun Creek developed in 1980 was not used since the discharge value is likely outdated due to changes in the watershed and advancement in hydrological methods since the time of the study. An approximate 100-year flow of 11,700 cfs was obtained from "Tennessee StreamStats" and applied as an inflow to Bullrun Creek in the HEC-RAS models. Stream Stats is a web based tool to obtain approximate peak flood flows using regression equations and based characteristics as described in "Tennessee StreamStats": A Web-Enabled Geographic Information System Application for Automating the Retrieval and Calculation of Streamflow Statistics published by USGS in 2007.

The PMP breach hydrographs were applied as a lateral inflow to Bullrun Creek downstream of the railroad bridge as shown in Figure A1 of Appendix A. The simulations also used an 8 hour duration and 1 minute computation time.

4. Results and Inundation Mapping

The inundation limits for the "Sunny Day" scenario and the worst case scenarios for the "Existing" conditions PMP and "Future" conditions PMP were mapped to determine which structures/roadways would be impacted. The primary areas of concern were structures on the east side of Bullrun Creek just upstream of the railroad bridge and a structure near New Henderson Road. Structure impact elevations were estimated using the lowest adjacent contour in the 1-foot contour interval topographic mapping. Bridge impact elevations, defined as the top of deck elevations, were determined based on field survey data. Peak water surface elevations at critical structures are summarized in Table 4. No structures or bridges were identified within the potential impact zone the "Sunny Day" or PMP Scenarios.

For each scenario, the breach was applied downstream of the railroad bridge. The railroad bridge restricts flows and acts to protect the area upstream from a downstream breach. Applying the breach upstream of the railroad bridge would result in a higher maximum water surface elevation. However, an upstream breach is unlikely since the area is historical high ground.

Inundation mapping was developed for each of the breach scenarios and is included as Appendix B1, B2, and B3 for the "Sunny Day", PMP "Existing" condition and PMP "Future" condition scenarios, respectively. The inundation limits were delineated using the hydraulic model outputs and the imagery and topographic data described in Section 3.2.

Table 4. Dam Breach Modeling Impact Summary

Facility	Impact Elevation (feet)	Max. Post-Breach WS (feet)		
		Sunny Day Breach	"Existing" Conditions PMP	"Future" Conditions PMP
Several Residences along Bullrun Creek Upstream of Railroad Bridge	803-804	795.2	798.3	799.5
Structure near New Henderson Road Bridge on Left Descending Overbank	802	795.2	798.5	799.7
Railroad Bridge	810	795.2	798.2	799.5
New Henderson Road Bridge	808	795.2	798.5	799.4

5. Hazard Classification

Because no structures were identified within the dam breach impact zone where maximum computed water surface elevations exceeded the defined impact elevation, it is recommended that the hazard classification be lowered from High Hazard to Significant Hazard. If the ash pond is modified (i.e. berm crest elevation raised) or development occurs within the impact zone, the hazard classification should be re-evaluated. Additionally, if the Railroad Bridge is removed or significantly modified, the hazard classification could be affected, since the maximum water surface elevations upstream of the bridge would be expected to increase.

6. References

(1) Zurndorter, E.A., et all. 1986. "Probable Maximum and TVA Precipitation Estimates with Areal Distribution for Tennessee River Drainages Less than 3,000 Mi^2 in Area. "Hydrometerological Report No. 56". U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and TVA. Silver Spring, MD, October 1986.

(2) Chow, Maidment, and Mays. 1988. Applied Hydrology. McGraw Hill, Singapore. P 461.

(3) Froehlich, David C. 1987. "Embankment Dam Breach Parameters" Hydraulic Engineering. Proceedings of the 1987 National Conference on Hydraulic Engineering. Williamsburg, Virginia. August 3-7, 1987. p. 570-575.

(4) Froehlich, David C. 1995. "Embankment Dam Breach Parameters Revisited". Water Resource Engineering, Proceedings of the 1995 ASCE Conference on Water Resources Engineering. San Antonio, Texas. August 14-18, 1995. p 887-891.

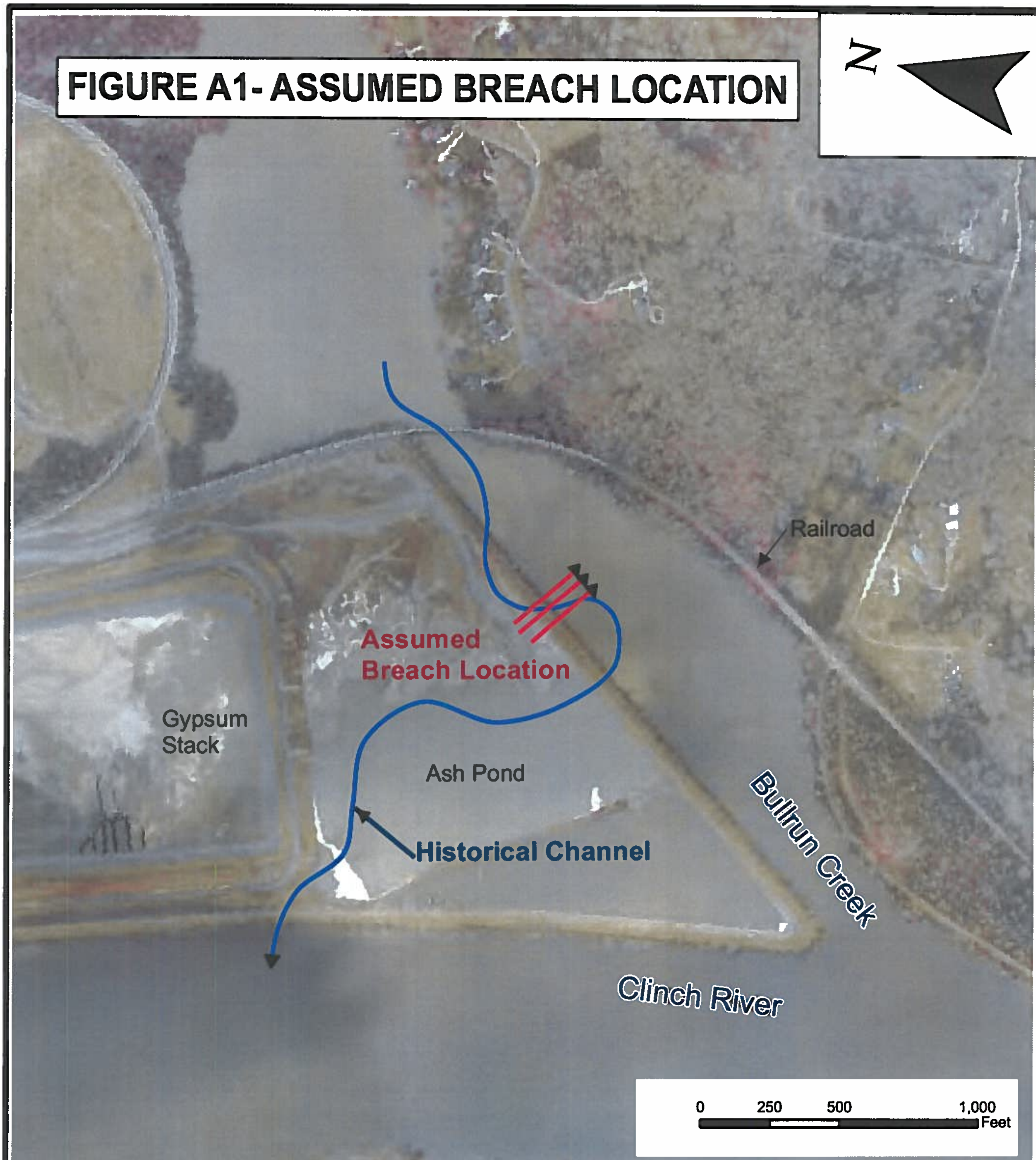
(5) U.S. Bureau of Reclamation (USBR). 1988. Downstream Hazard Classification Guidelines, ACER Technical Memorandum No. 11. Assistant Commissioner-Engineering and Research Denver, Colorado, December 1988, 57 p.

(6) Von Thun, J. Lawrence and David R. Gillette (1990). Guidance on Breach Parameters, unpublished internal document, USBR, Denver, Colorado, March 13, 1990, 17 p. (Referenced in Wahl, 1998).

Appendix A

Dam Breach Analysis Calculations

FIGURE A1- ASSUMED BREACH LOCATION



Bull Run Ash Pond Dam Breach Analysis
Anderson County, Tenessee

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STANTEC CONSULTING SERVICES INC.

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LEXINGTON, KENTUCKY
40511-2050
859-422-3000

DRAWN BY TGC	DATE 4/13/2010	REVISED		SHEET
CHECKED BY JSM	PROJ. NO. 175699090	1.	3.	
CHECKED BY --	SCALE 1"=500'	2.	4.	

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FIGURE A2- "SUNNY DAY" FAILURE CONFIGURATION SCHEMATIC

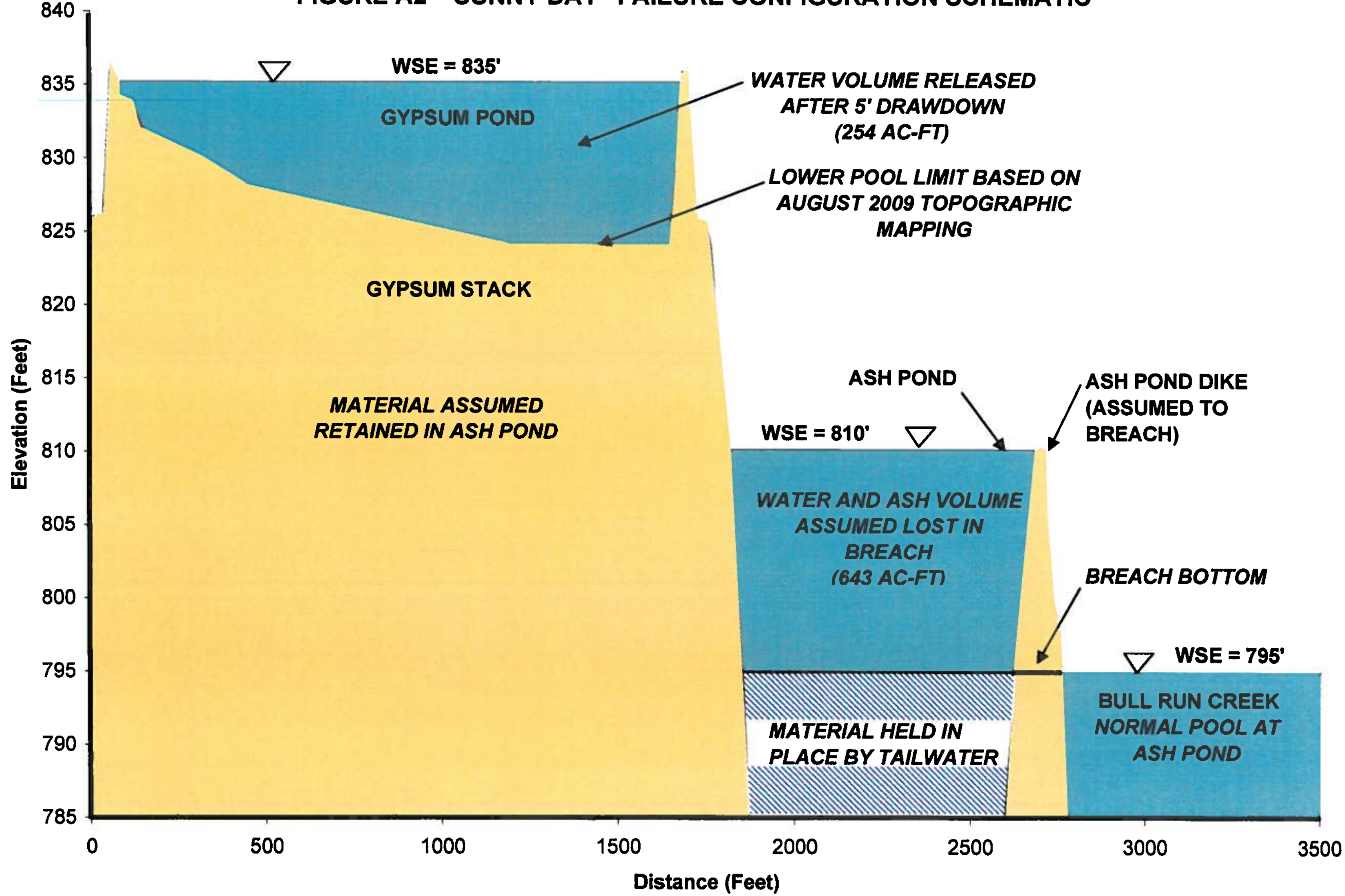

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FIGURE A3- EXISTING CONDITIONS PMP FAILURE CONFIGURATION

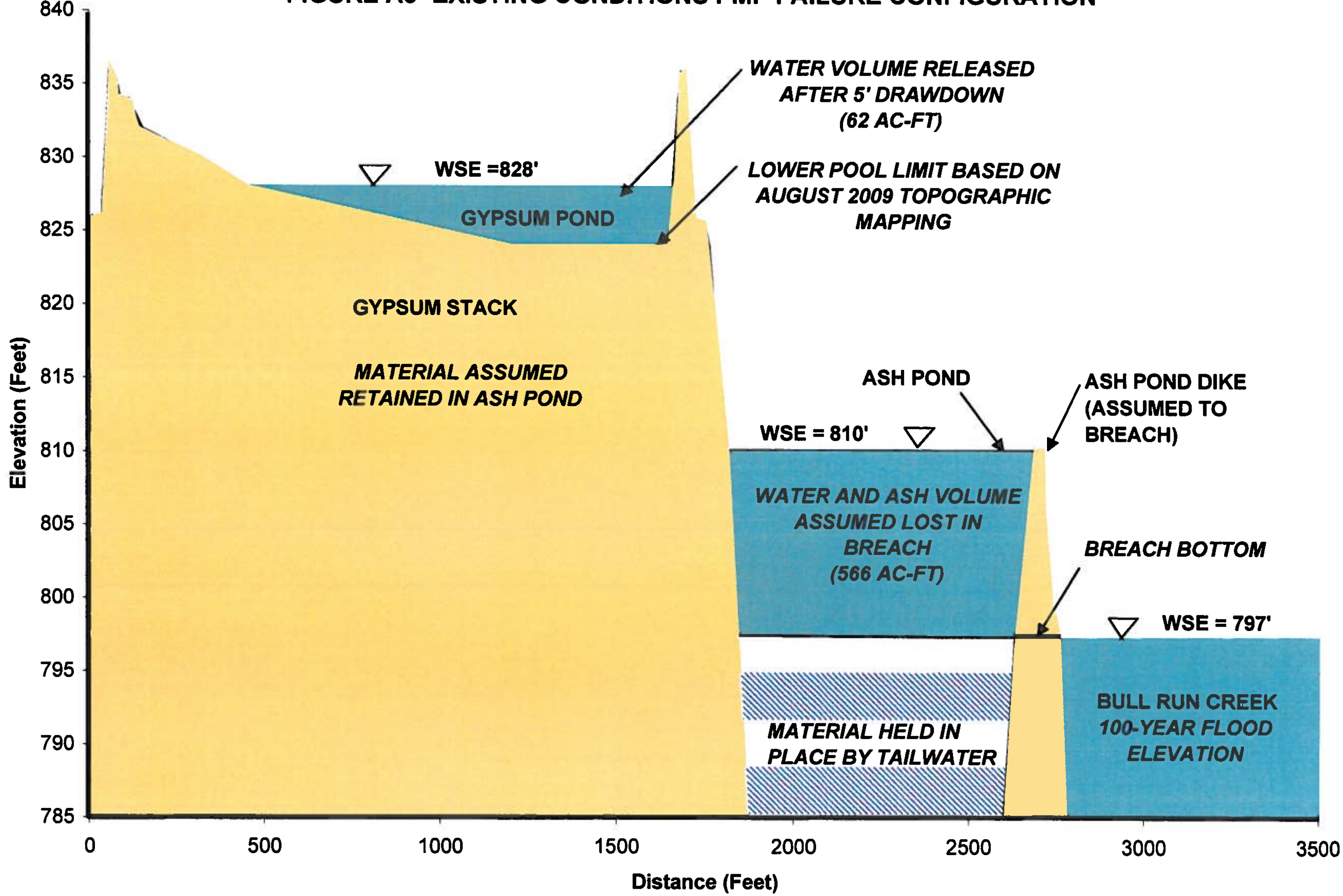

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FIGURE A4- FUTURE CONDITIONS PMP FAILURE CONFIGURATION

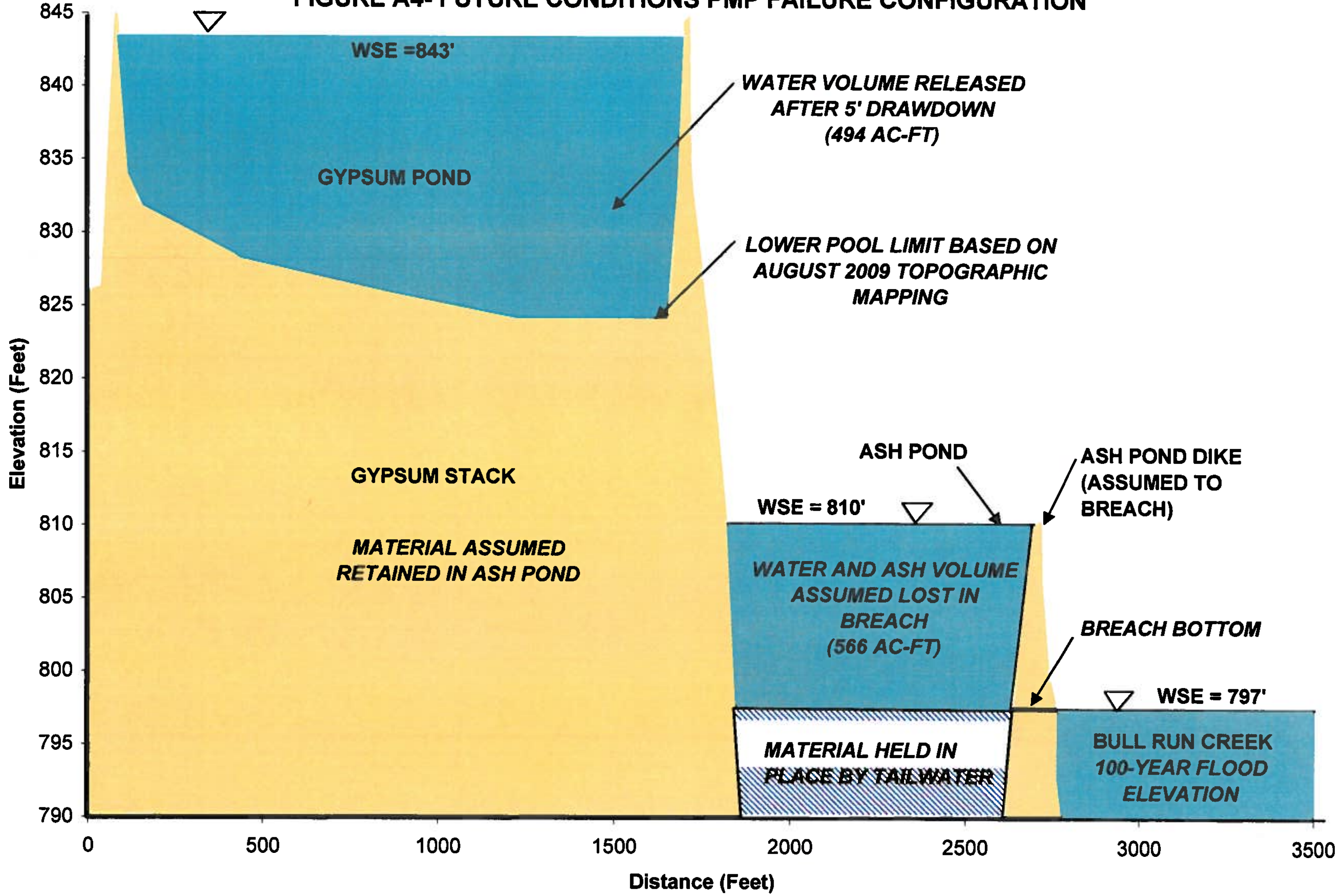

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FIGURE A5- "SUNNY DAY" SCENARIO DAM BREACH PARAMETERS

Dam Name: **Bull Run Fly Ash Pond**

HEC-HMS Dam Breach Geometry and Development Time	
Breach Geometry	
Elevation of water/Emergency Spillway Elevation (ft	810
Top Elevation (ft)	810
Breach Bottom Elevation (ft)	795.0
Left Slope (xH:1V)	1
Right Slope (xH:1V)	1
Average Predicted Average Bottom Width (ft)	39.2
Average Predicted Width (ft)	54.2
Average Predicted Development Time (HR)	0.5

Breach Width and Time to Failure Parameters				
Overtopping correction factor - 1.0 for piping failure	K_0		1	
height of dam (feet)	H_d		15.0	
hydraulic depth of water at dam failure, above breach bottom (feet)	H_w		15.0	
Constant in Von Thun and Gillette breach width relation	C_b		20	
*Volume of water above breach invert elevation at time of breach (acre-feet)**	V_w		428.2	
		Average Breach Width	Time to Failure	
Froehlich (1987)[1]		60.8	0.890	$B_{av}=0.47{*}K_0{*}(V_w H_w)^{0.25}$ $t_f=0.59{*}V_w^{0.47}/H_d^{0.9}$
Froehlich (1995)[2]		53.6	0.697	$B_{av}=15{*}K_0{*}({*}V_w)^{0.32}(H_w)^{0.19}$ $t_f=3.84{*}V_w^{0.53}/H_d^{0.9}$
USBR (1988)[3]		45.0	0.151	$B_{av}=3{*}H_w$ $t_f=B_{av}{*}0.011$
Von Thun and Gillette (1990)[4]		57.5		$B_{av}=2.5{*}H_w+C_b$
(based on t_f vs h_w)			0.069	*easily erodible;* $t_f=0.015{*}(H_w)$
(based on t_f vs h_w)			0.341	*erosion resistant;* $t_f=0.020{*}(H_d)+0.25$
(based on lateral erosion rates)			0.221	*easily erodible;* $t_f=B_{av}/\{4{*}(H_d/3.28)+61\}$
(based on lateral erosion rates)			0.958	*erosion resistant;* $t_f=B_{av}/\{4{*}(H_d/3.28)\}$

* Note that the impoundment volume used in the breach equations is based on impounded water only and excludes ash assumed to be lost in the postulated breach.

Chosen Values		
Bav=	55	feet
td=	0.4	hours
Bottom width=	40	feet
Width at WS=	70	feet
Width at Dam Top=	70	feet

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FIGURE A6- PMP SCENARIO DAM BREACH PARAMETERS

Dam Name: **Bull Run Fly Ash Pond**

HEC-HMS Dam Breach Geometry and Development Time	
Breach Geometry	
Elevation of water/Emergency Spillway Elevation (ft	810
Top Elevation (ft)	810
Breach Bottom Elevation (ft)	797.0
Left Slope (xH:1V)	1
Right Slope (xH:1V)	1
Average Predicted Average Bottom Width (ft)	47.8
Average Predicted Width (ft)	60.8
Average Predicted Development Time (HR)	0.5

Breach Width and Time to Failure Parameters		
Overtopping correction factor - 1.4 for overtopping failure	K_0	1.4
height of dam (feet)	H_d	13.0
hydraulic depth of water at dam failure, above breach bottom (feet)	H_w	13.0
Constant in Von Thun and Gillette breach width relation	C_b	20
Volune of water above breach invert elevation at time of breach (acre-feet) *	V_w	395.7

	Breach Width	Time to Failure	
Froehlich (1987)[1]	80.5	0.975	$B_{av}=0.47*K_0*(V_w H_w)^{0.25}$ $t_f=0.59*V_w^{0.47}/H_d^{0.9}$
Froehlich (1995)[2]	71.1	0.760	$B_{av}=15*K_0*(*V_w)^{0.32}(H_w)^{0.19}$ $t_f=3.84*V_w^{0.53}/H_d^{0.9}$
USBR (1988)[3]	39.0	0.131	$B_{av}=3*H_w$ $t_f=B_{av}*0.011$
Von Thun and Gillette (1990)[4]	52.5		$B_{av}=2.5*H_w+C_b$
(based on t_f vs h_w)		0.059	*easily erodible;* $t_f=0.015*(H_w)$
(based on t_f vs h_w)		0.329	*erosion resistant;* $t_f=0.020*(H_d)+0.25$
(based on lateral erosion rates)		0.208	*easily erodible;* $t_f=B_{av}/\{4*(H_d/3.28)+61\}$
(based on lateral erosion rates)		1.010	*erosion resistant;* $t_f=B_{av}/\{4*(H_d/3.28)\}$

* Note that the impoundment volume used in the breach equations is based on impounded water only and excludes ash assumed to be lost in the postulated breach.

Chosen Values		
Bav=	75	feet
td=	0.4	hours
Bottom width=	62	feet
Width at WS=	88	feet
Width at Dam Top=	88	feet

FIGURE A7- EXISTING CONDITIONS GYPSUM POND STAGE STORAGE CURVE

Facility Name: Bull Run Gypsum Pond

Elevation (ft)	Cumulative Volume (acre-ft)
824	0
826	27
828	64
830	109
832	164
834	223
835	254

NOTE: Volume includes water only and is based on hydrographic survey data provided by TVA dated August 2009.

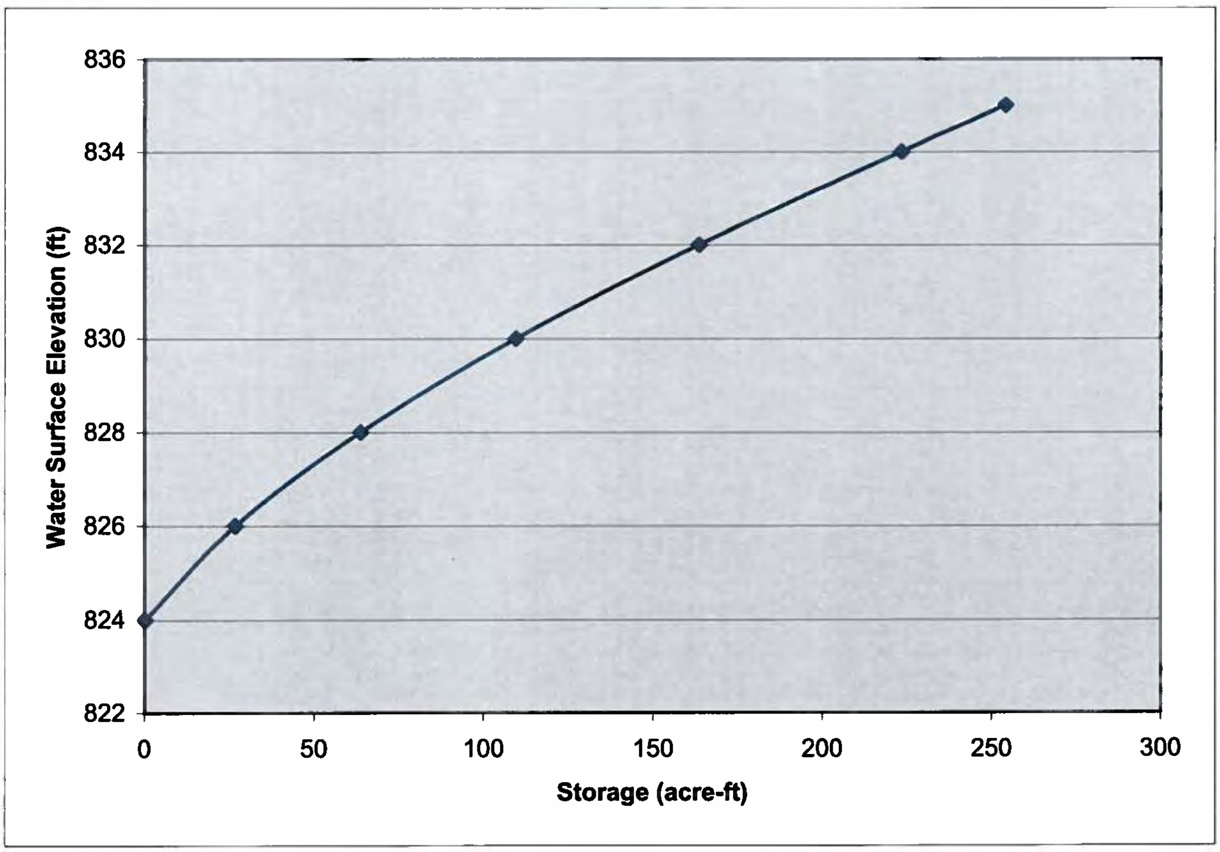

FIGURE A8- FUTURE CONDITIONS GYPSUM POND STAGE STORAGE CURVE

Facility Name: Bull Run Gypsum Pond

Elevation (ft)	Cumulative Volume (acre-ft)
824	0
826	27
828	64
830	109
832	164
834	223
835	254
845	554

NOTE: Volume includes water only. Storage below elevation 835 feet is based on hydrographic survey data provided by TVA dated August 2009. Storage at elevation 845 feet is based on a possible future gypsum stack configuration.

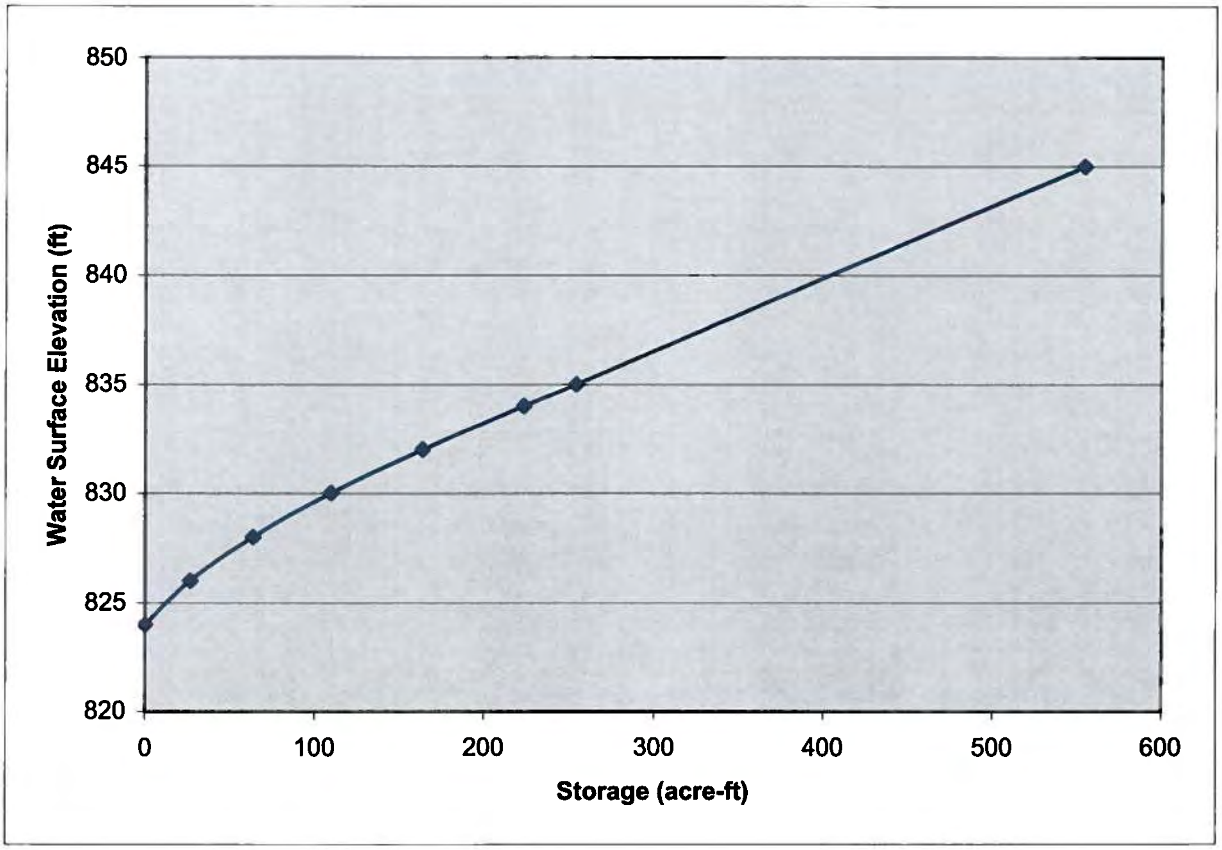

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FIGURE A9 -EXISTING CONDITION GYPSUM POND
OUTFLOW HYDROGRAPH FOR "SUNNY DAY" BREACH

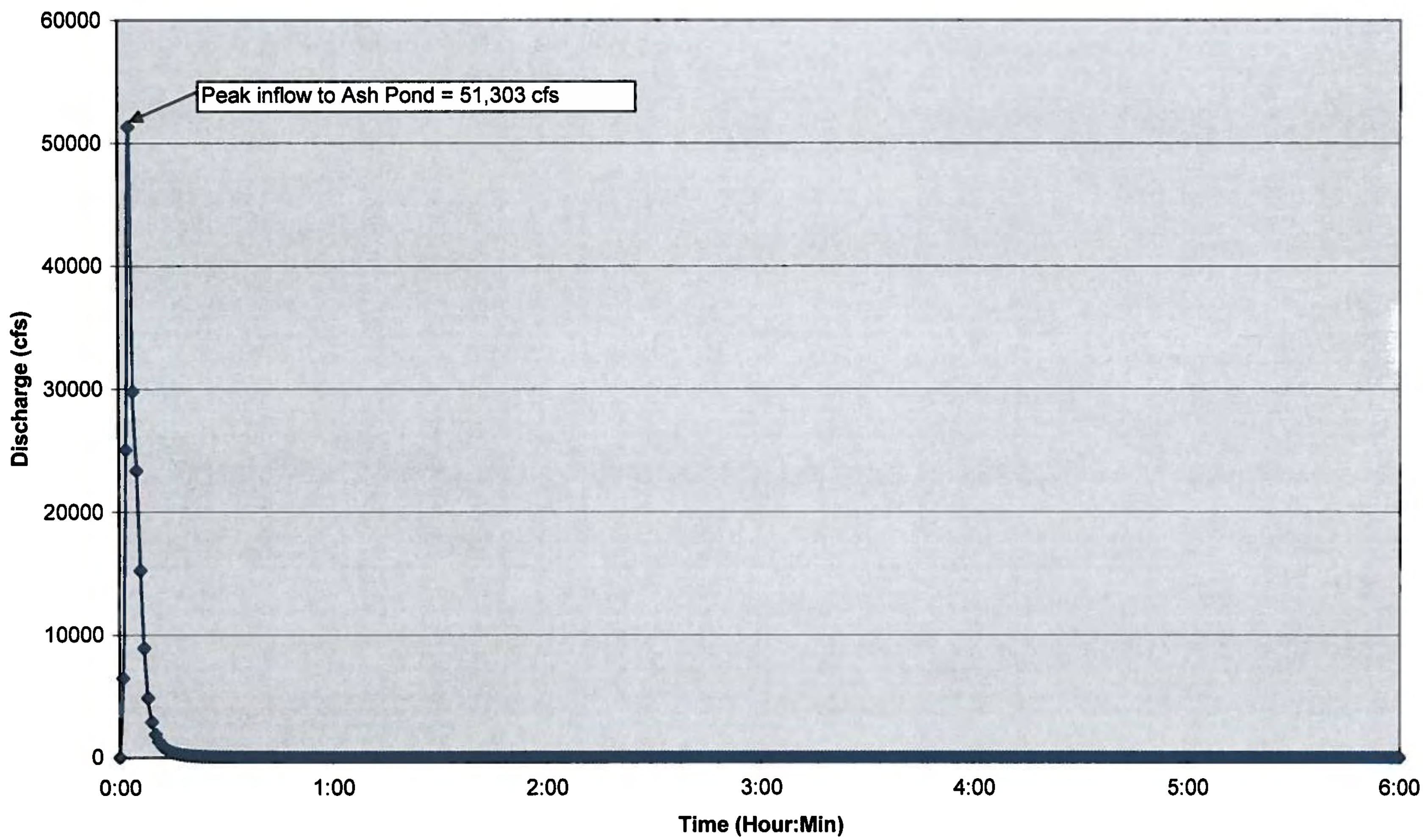

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FIGURE A10 -GYPSUM POND OUTFLOW HYDROGRAPH FOR EXISTING CONDITIONS PMP BREACH

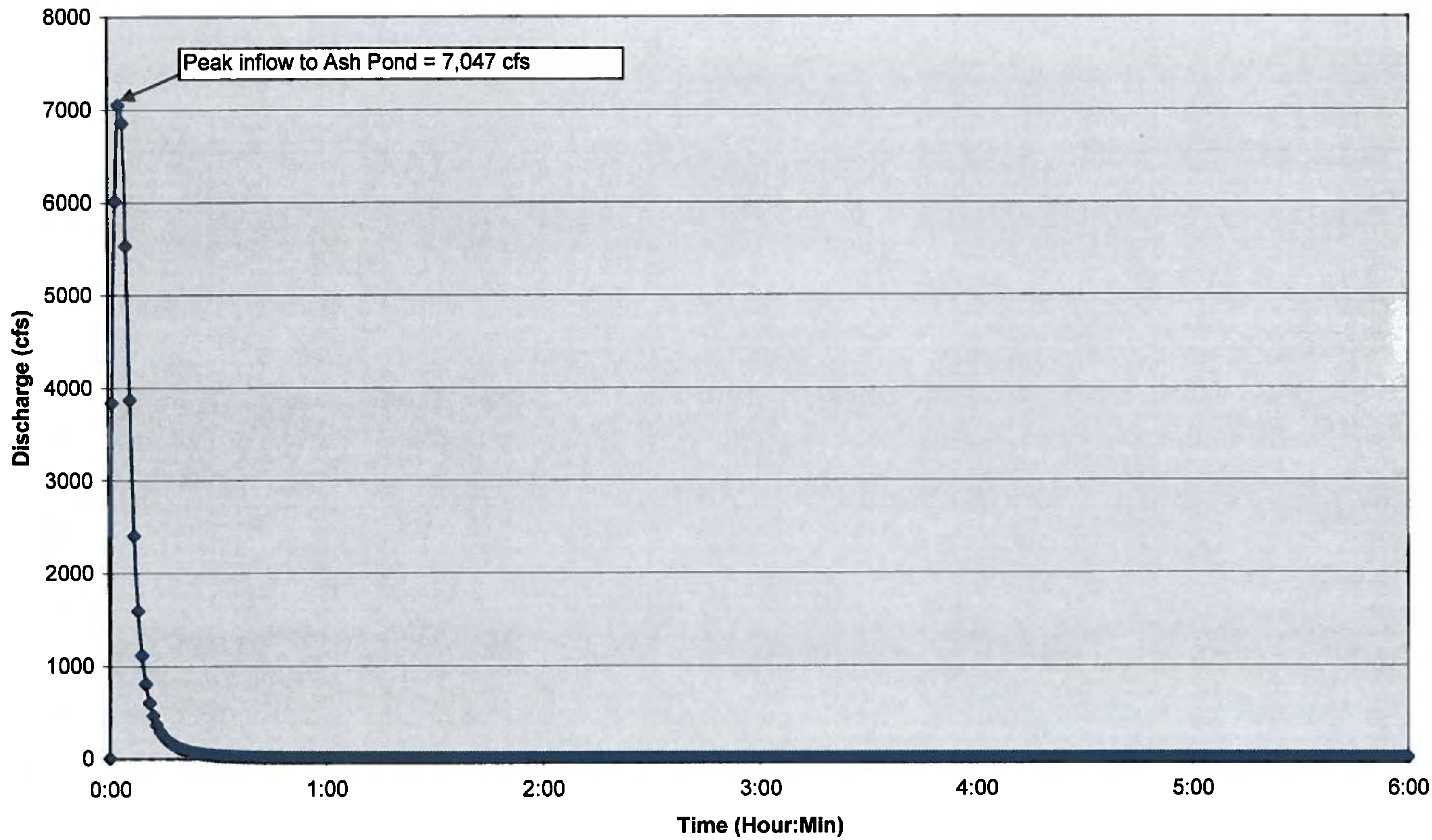

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FIGURE A11 -GYPSUM POND OUTFLOW HYDROGRAPH FOR FUTURE CONDITIONS PMP BREACH

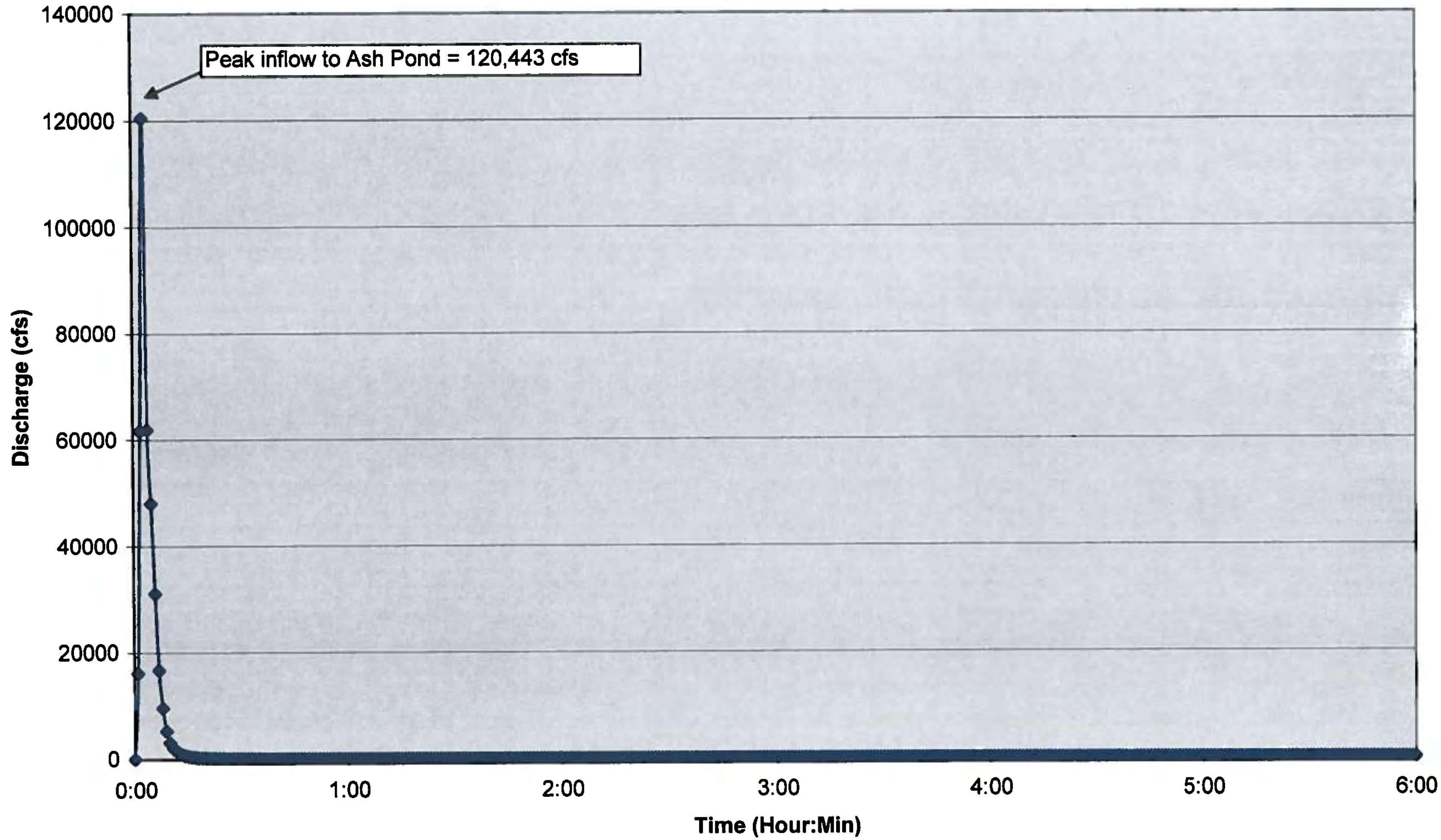

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FIGURE A12- ASH POND STAGE STORAGE CURVE

Facility Name: **Bull Run Fly Ash Pond**

Elevation (ft)	Cumulative Volume (acre-ft)
795	0
796	38
798	117
800	199
802	282
804	368
806	456
808	547
810	643

NOTE: Volume includes both ash material and water down to elevation 795 feet based on topographic mapping dated May 2009 provided by TVA. This stage-storage curve was used for the "Sunny Day" and PMP breach scenarios.

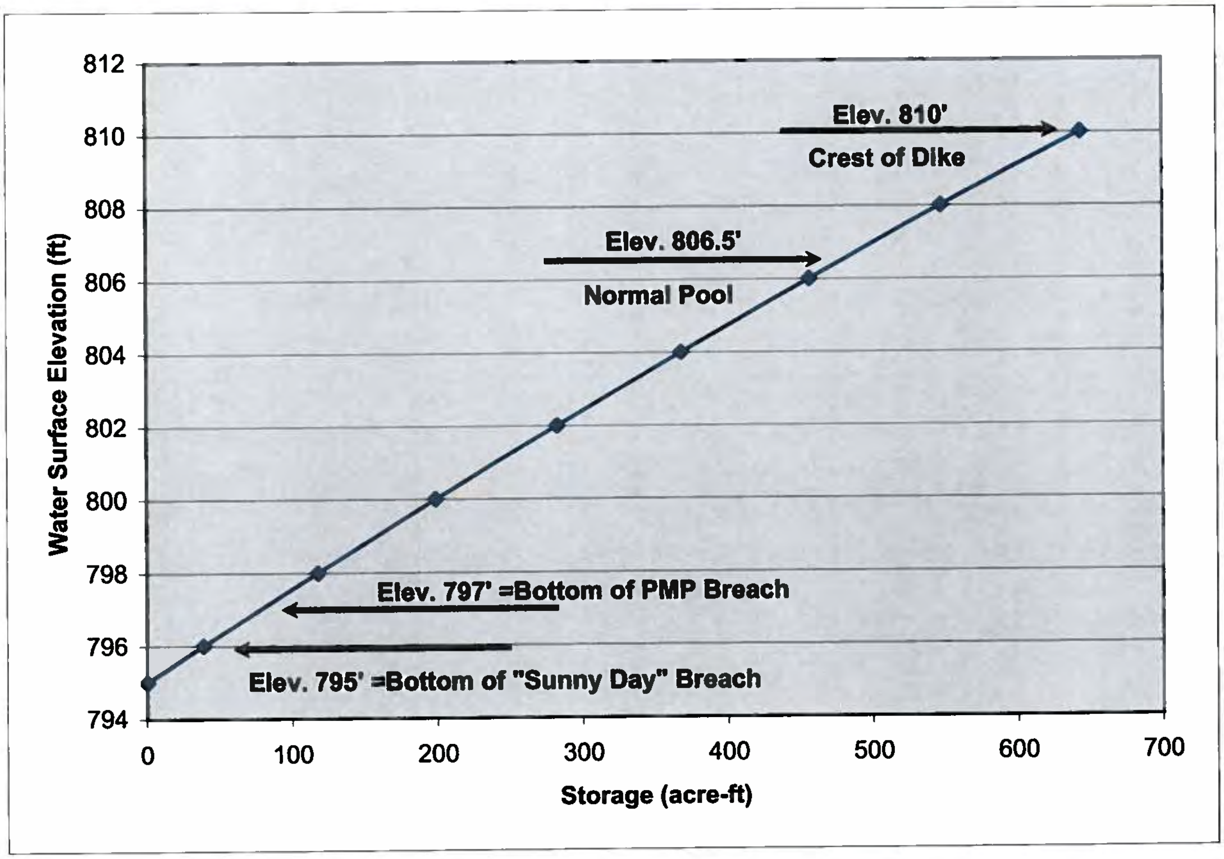

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FIGURE A13 -"SUNNY DAY" SCENARIO OUTFLOW HYDROGRAPH

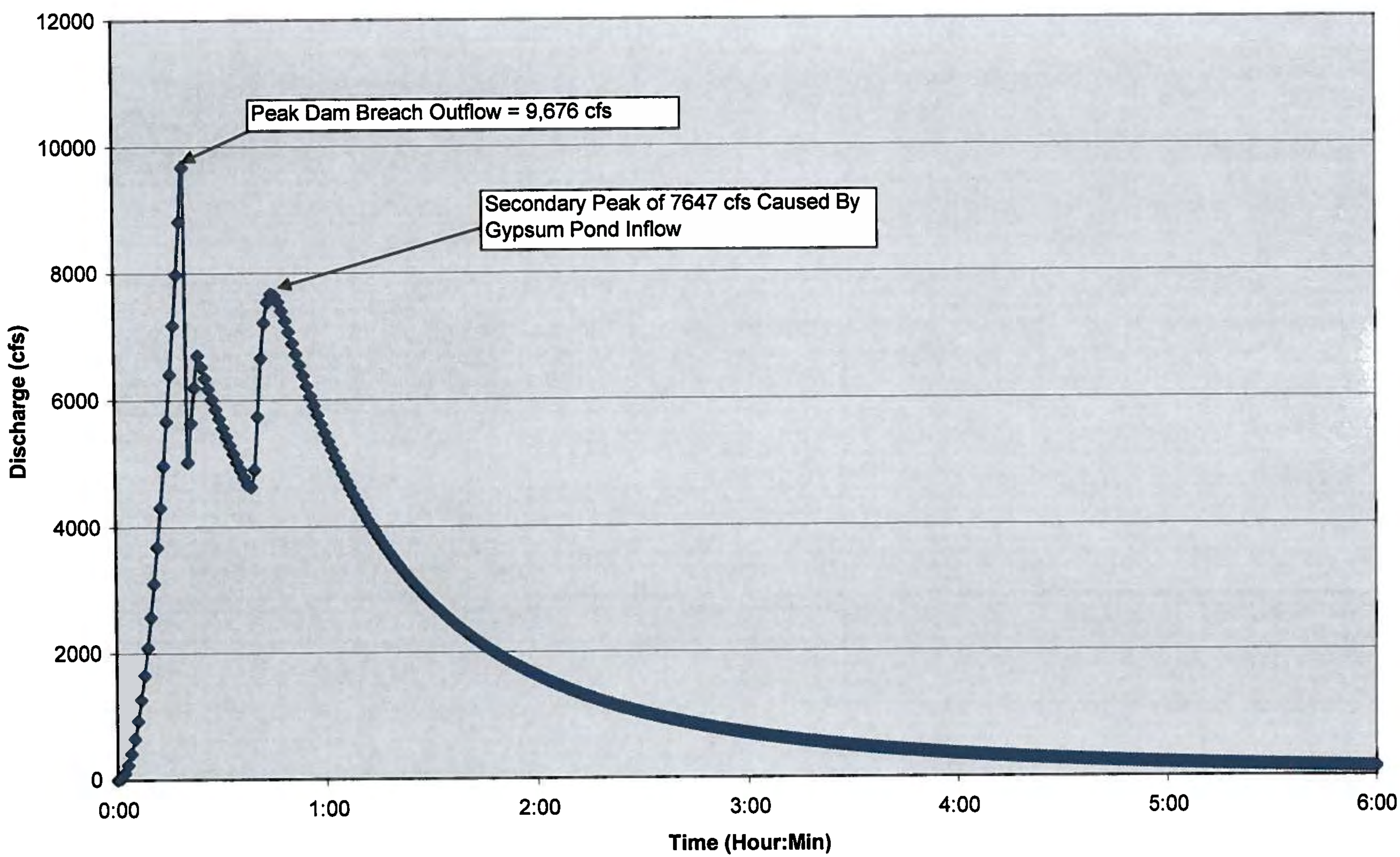

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FIGURE A14- ASH POND STAGE STORAGE CURVE WATER ONLY (FOR PMP STORM HYDROLGOIC ROUTING)

Facility Name: Bull Run Fly Ash Pond

Elevation (ft)	Cumulative Volume (acre-ft)
795	0
796	15
798	50
800	93
802	142
804	196
806	254
808	330
810	428

NOTE: Volume includes water only down to elevation 795 feet based on hydrographic survey dated August 2009 provided by TVA. This stage-storage curve was used for hydrologic routing of the PMP pre-failure inflows only and was not used in the modeling of the dam breach scenarios in HEC-HMS modeling.

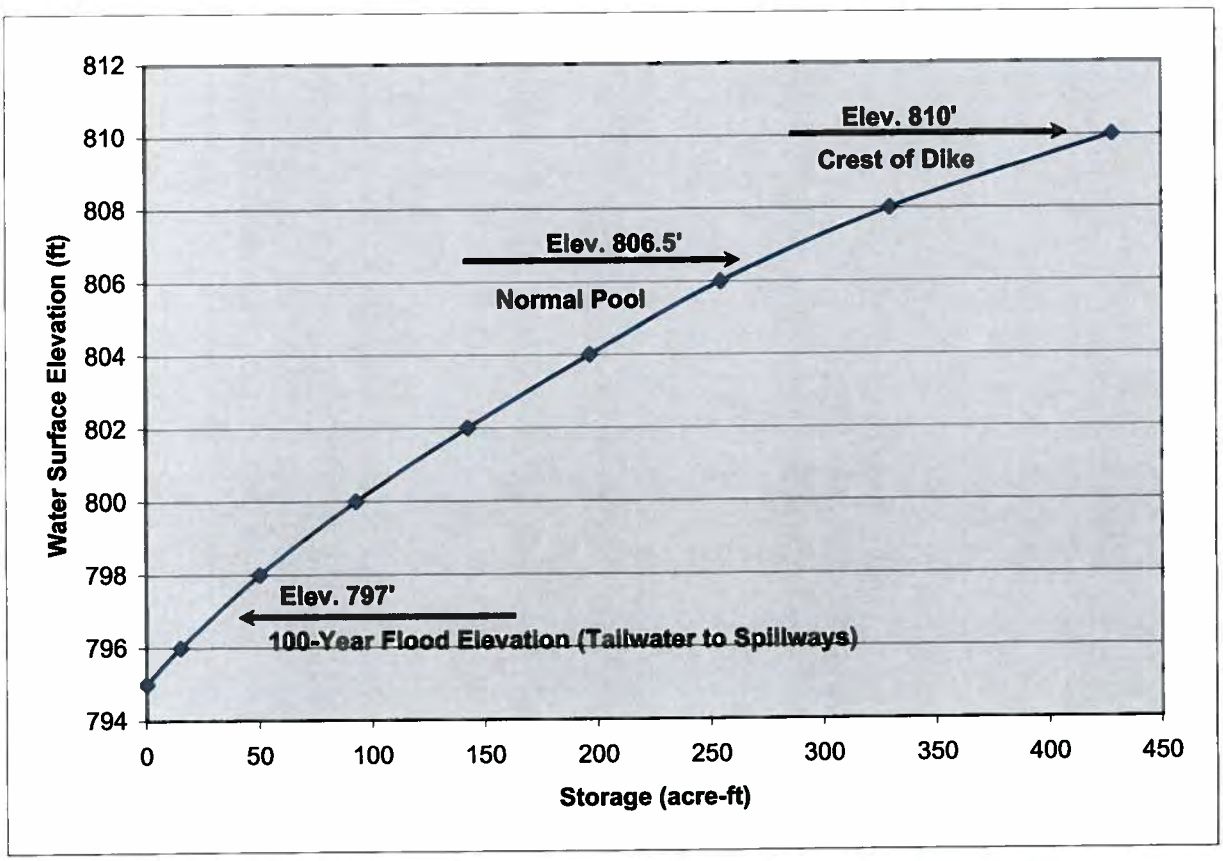

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FIGURE A15- FLY ASH POND SPILLWAY RATING CURVE FOR PMP CALCULATIONS

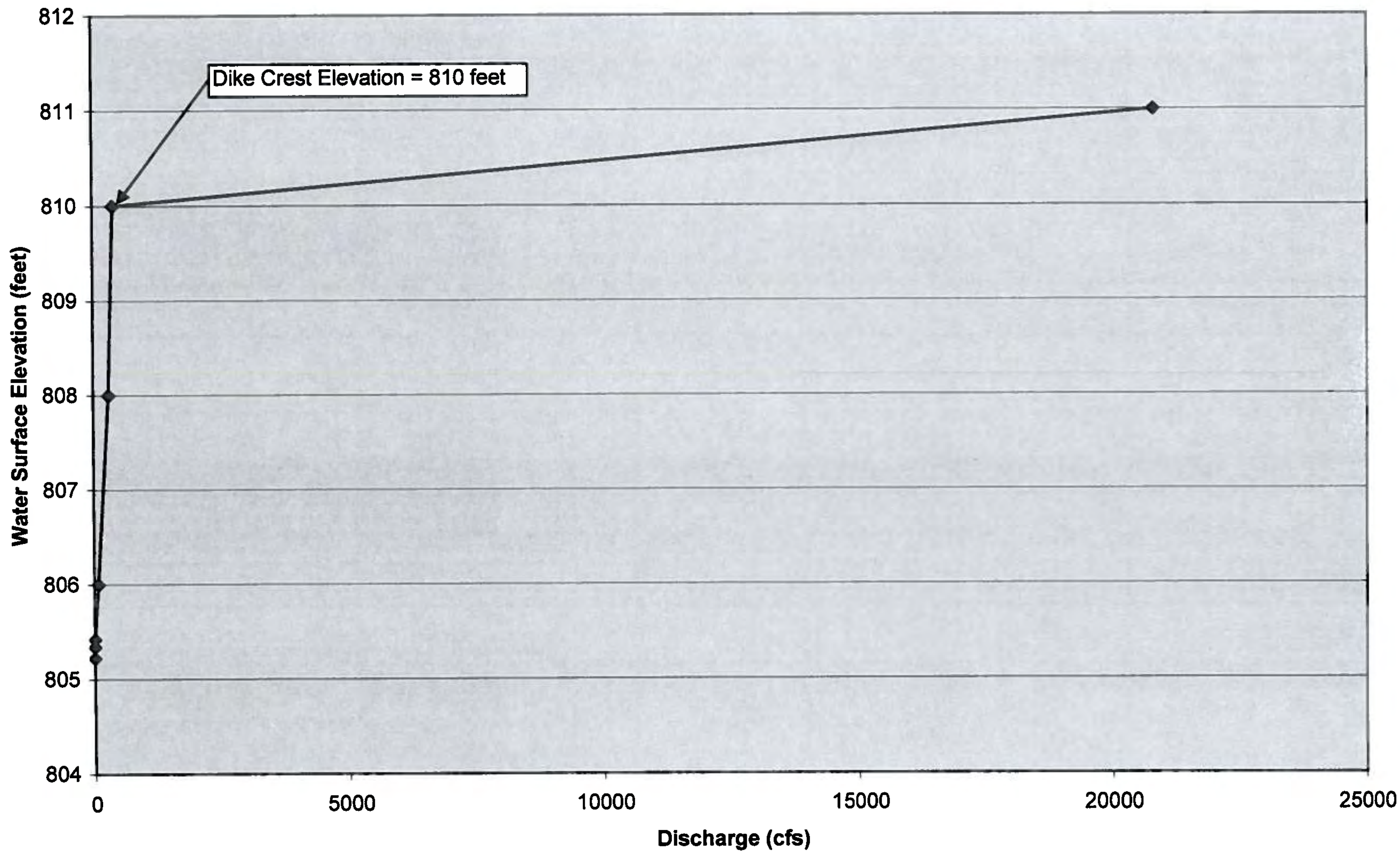

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FIGURE A16 -PMP HYETOGRAPHS

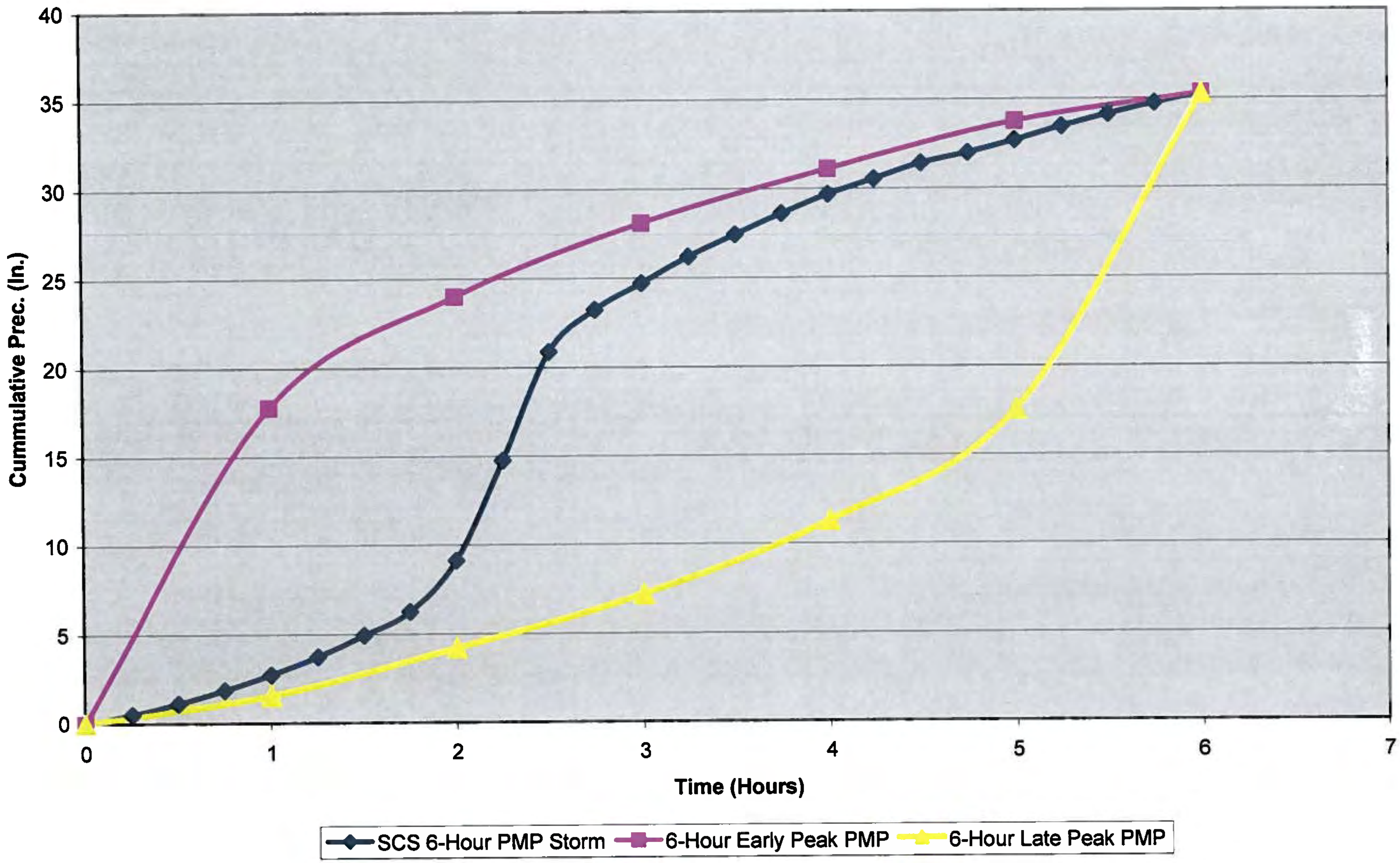

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FIGURE A17 -PMP INFLOW HYDROGRAPHS

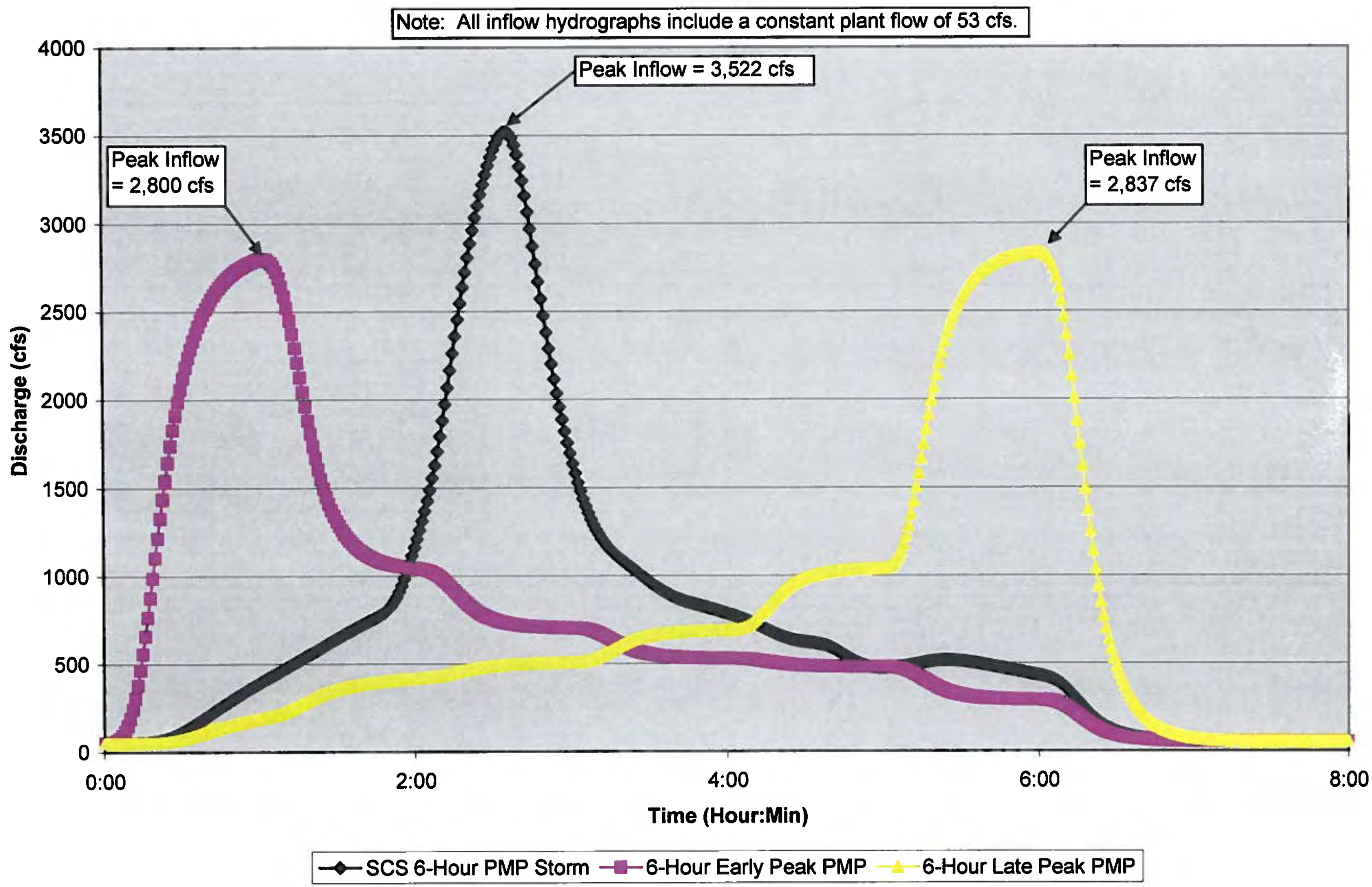

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FIGURE A18 - EXISTING CONDITIONS PMP SCENARIO DAM BREACH OUTFLOW HYDROGRAPHS

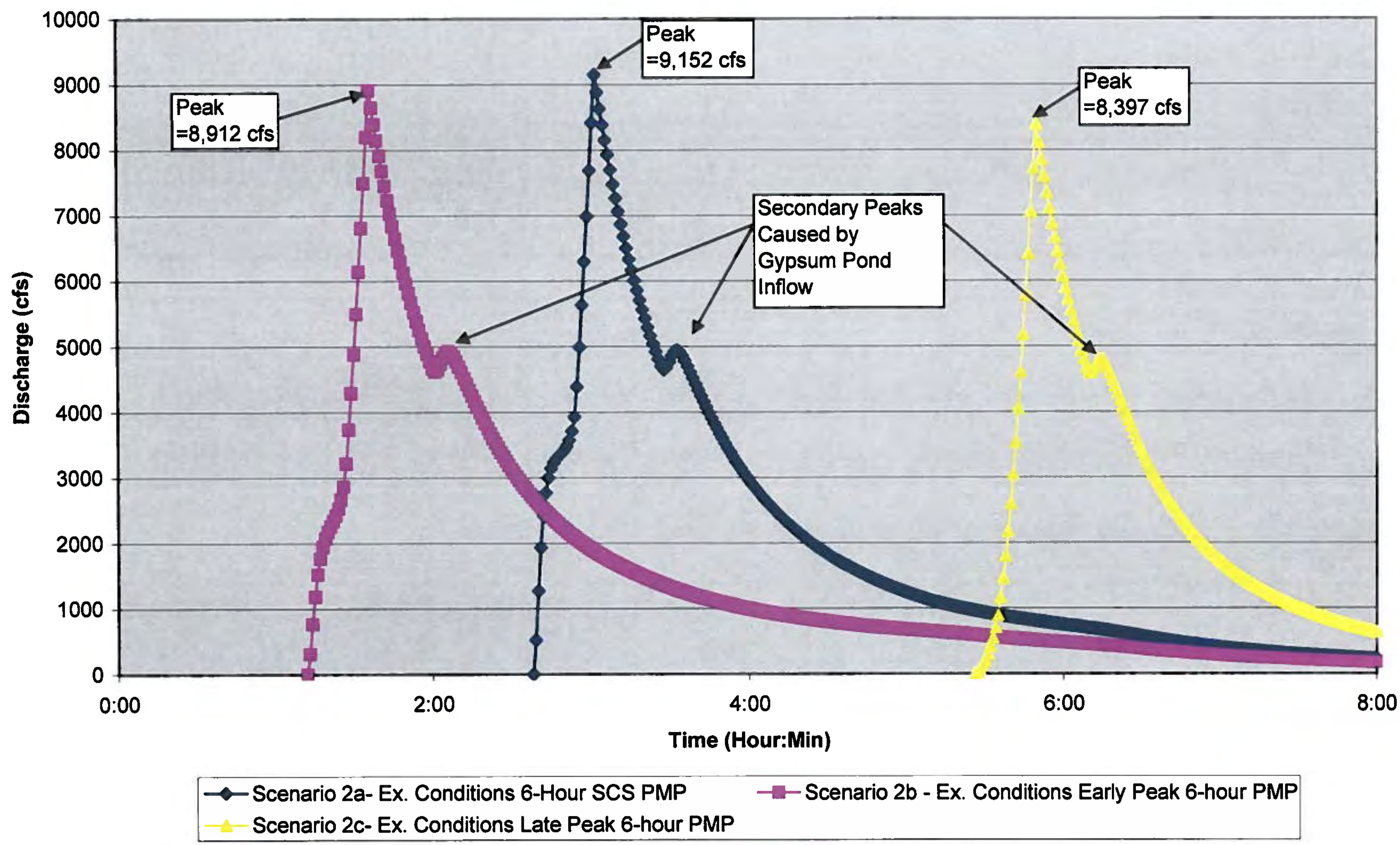

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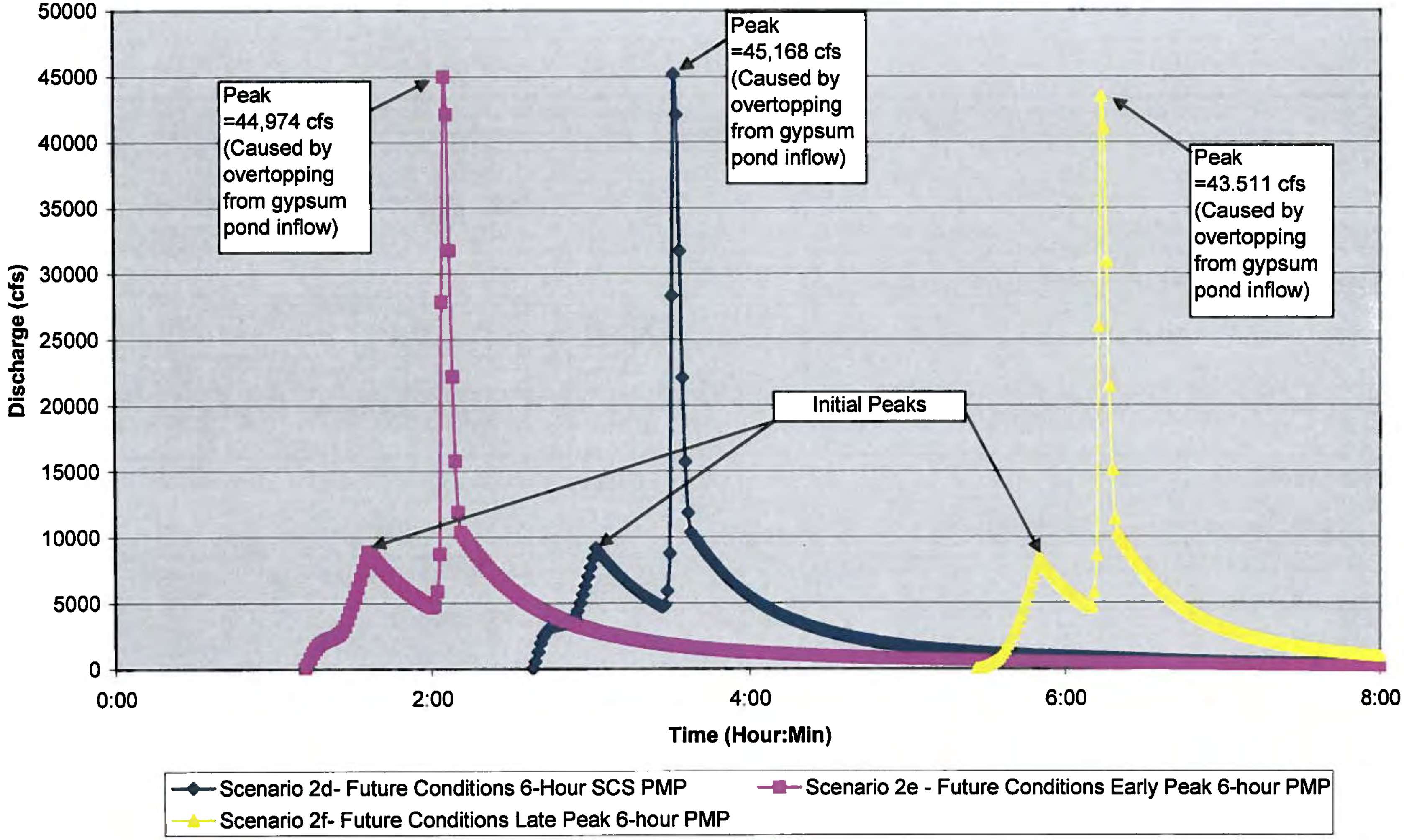
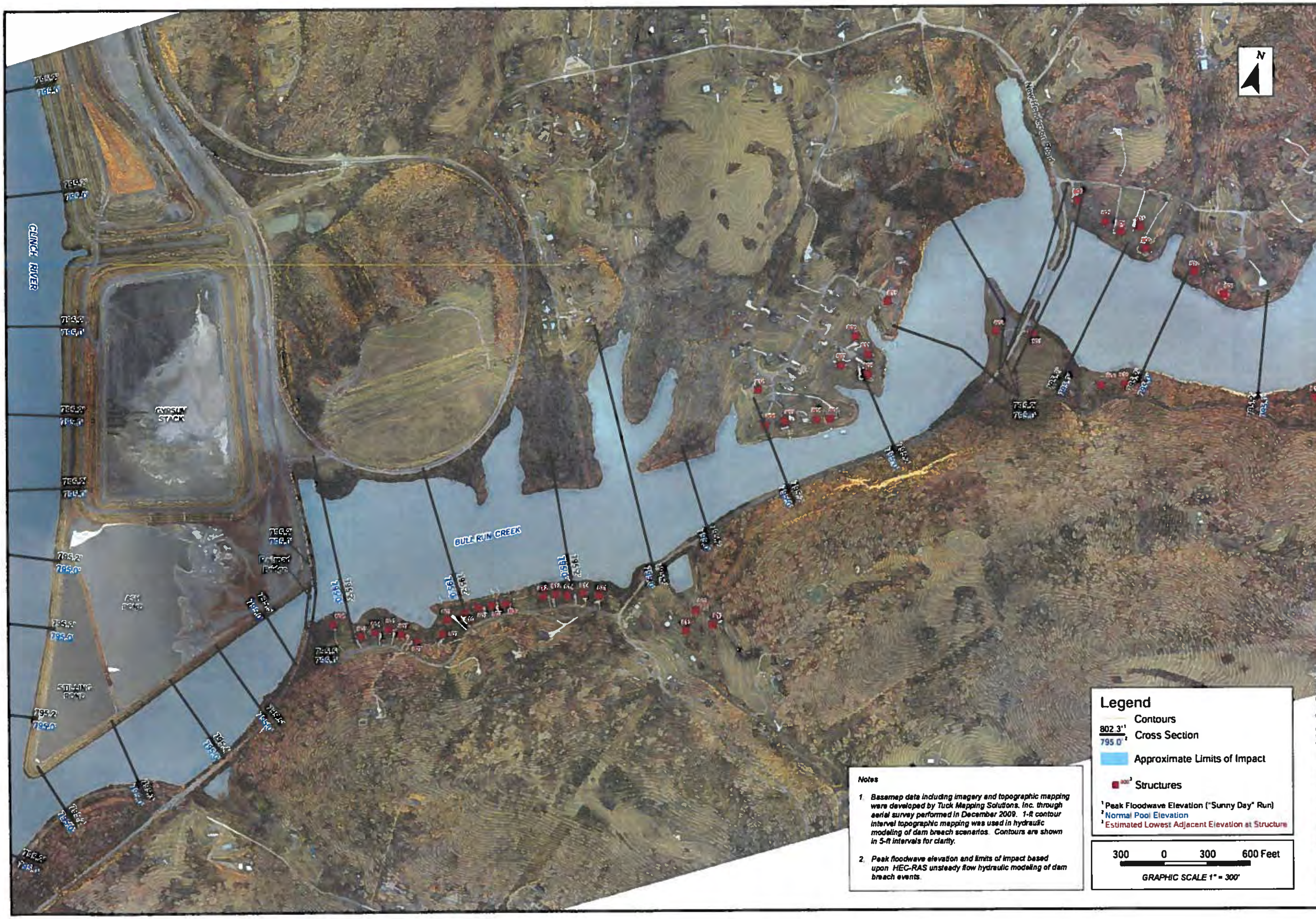
FIGURE A19 - FUTURE CONDITIONS PMP SCENARIO DAM BREACH OUTFLOW HYDROGRAPHS



Appendix B

Dam Breach Inundation Mapping



Legend

Contours
802.3'[1] / 795.0'[2] Cross Section
Approximate Limits of Impact
Structures[3]

[1] Peak Floodwave Elevation ("Sunny Day" Run)
[2] Normal Pool Elevation
[3] Estimated Lowest Adjacent Elevation at Structure

300 0 300 600 Feet
GRAPHIC SCALE 1" = 300'

Notes

1. Basemap data including imagery and topographic mapping were developed by Tuck Mapping Solutions, Inc. through aerial survey performed in December 2009. 1-ft contour interval topographic mapping was used in hydraulic modeling of dam breach scenarios. Contours are shown in 5-ft intervals for clarity.
2. Peak floodwave elevation and limits of impact based upon HEC-RAS unsteady flow hydraulic modeling of dam breach events.

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Lexington, Kentucky
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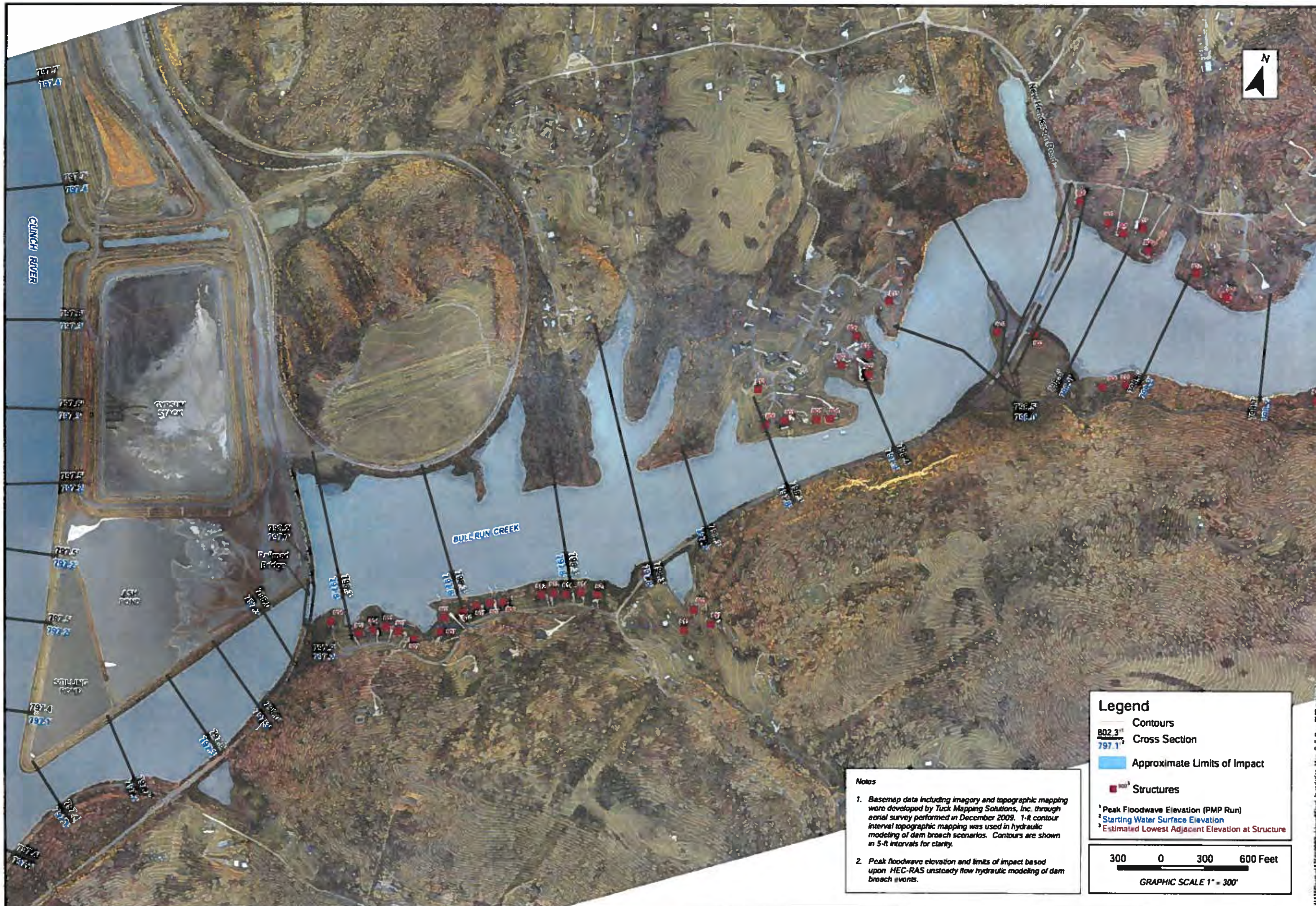
859-422-3000

"Sunny Day" Dam Breach Impact Zone
Fly Ash Pond Breach Analysis
Bull Run Fossil Plant
Tennessee Valley Authority
Clinton, Anderson County, Tennessee

PROJECT NO	175689000
DATE	May 2010
DRAWN BY	AMO
CHECKED BY	TGC
CHECKED BY	
SCALE	1" = 300'
REVISED	

SHEET

Figure B1



Notes

1. Basemap data including imagery and topographic mapping were developed by Tuck Mapping Solutions, Inc. through aerial survey performed in December 2009. 1-ft contour interval topographic mapping was used in hydraulic modeling of dam breach scenarios. Contours are shown in 5-ft intervals for clarity.

2. Peak floodwave elevation and limits of impact based upon HEC-RAS unsteady flow hydraulic modeling of dam breach events.

Existing PMP Scenario Dam Breach
Fly Ash Pond Breach Analysis
Bull Run Fossil Plant
Tennessee Valley Authority
Clinton, Anderson County, Tennessee

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1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

PROJECT NO	[illegible]
DATE	May 2010
DRAWN BY	AMG
CHECKED BY	TGC
CHECKED BY	
SCALE	1" = 300'
REVISED	
1	
2	
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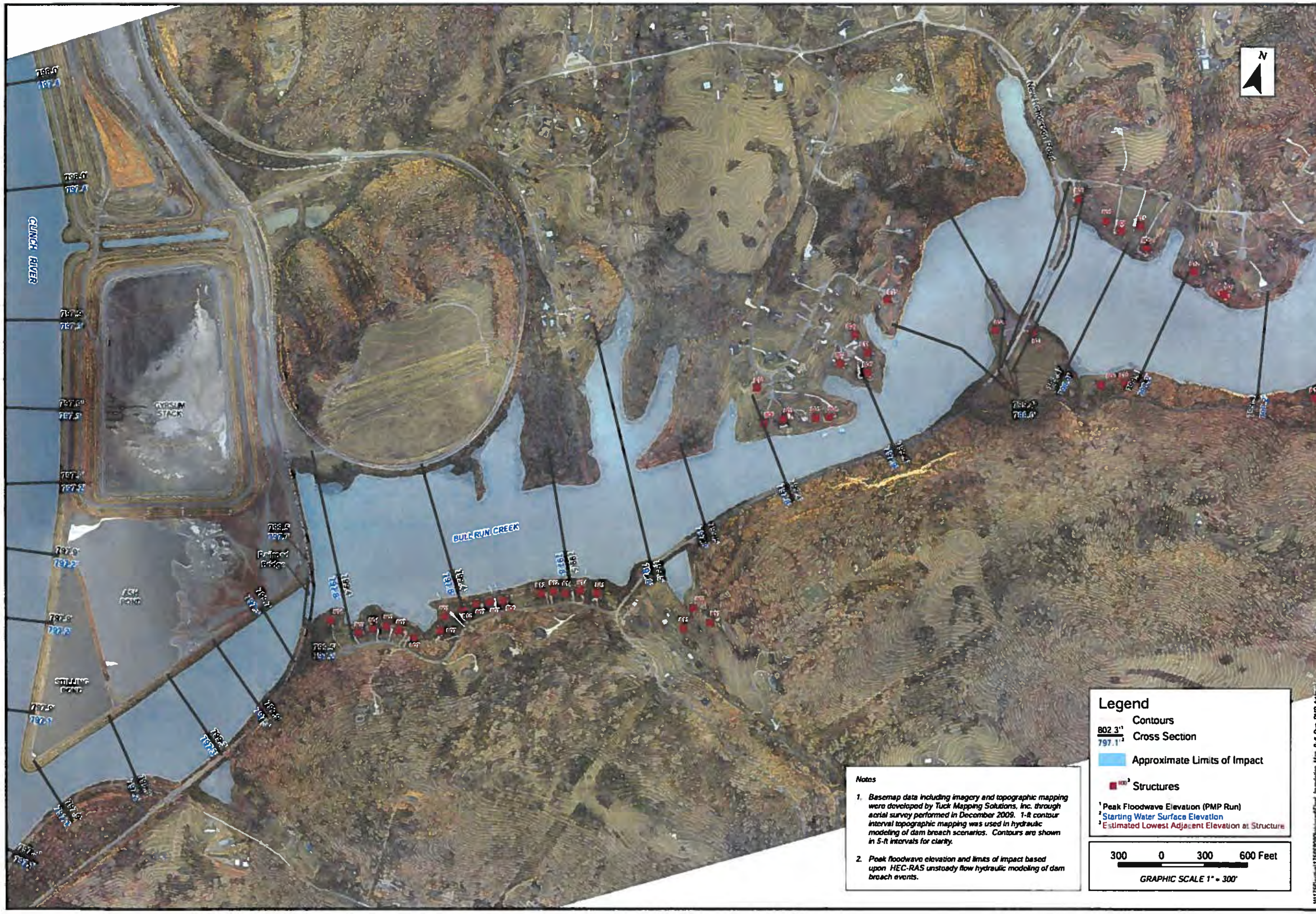
8	

SHEET

Figure B2



Legend

- Contours
- 802.3'[1] / 797.1'[2] Cross Section
- Approximate Limits of Impact
- Structures [3]

[1] Peak Floodwave Elevation (PMP Run)
[2] Starting Water Surface Elevation
[3] Estimated Lowest Adjacent Elevation at Structure

300 0 300 600 Feet

GRAPHIC SCALE 1" = 300'

Notes

1. *Basemap data including imagery and topographic mapping were developed by Tuck Mapping Solutions, Inc. through aerial survey performed in December 2009. 1-ft contour interval topographic mapping was used in hydraulic modeling of dam breach scenarios. Contours are shown in 5-ft intervals for clarity.*
2. *Peak floodwave elevation and limits of impact based upon HEC-RAS unsteady flow hydraulic modeling of dam breach events.*

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Lexington, Kentucky
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Future PMP Scenario Dam Breach
Fly Ash Pond Breach Analysis
Bull Run Fossil Plant
Tennessee Valley Authority
Clinton, Anderson County, Tennessee

PROJECT NO	[illegible]
DATE	May 2010
DRAWN BY	AMG
CHECKED BY	TGC
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SCALE	1" = 300'
REVISED	
1	
2	
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8	

SHEET

Figure B3

APPENDIX A

Document 4

Stantec. (December 16, 2009). Hydrologic and Hydraulic Evaluation of the Ash Pond and Outlet Structures

Stantec

Hydrologic and Hydraulic Evaluation of the Ash Pond and Outlet Structures

TVA Bull Run Fossil Plant

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STATE OF TENNESSEE

12-16-2009

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

December 16, 2009

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List of Appendices

Appendix

Executive Summary

The Ash Pond and its outlet structures at the Bull Run Fossil Plant were evaluated to determine their hydraulic adequacy compared to the standards of its NPDES Permit, Solid Waste Operating Permit and the Tennessee Safe Dams Act. This analysis confirms that the pond and its outlet structures are hydraulically adequate and provide sufficient freeboard to meet those requirements. The tall, unsupported outlet weir structure should be retrofitted or prioritized, inspected and replaced as necessary, with a more reliable structure for pool level regulation. Stantec did not evaluate the hydraulic capacities of the myriad pipes and ditches which convey stormwater and process water to the pond as a part of this analysis.

Hydrologic and Hydraulic Evaluation of the Ash Pond and Outlet Structures

TVA Bull Run Fossil Plant

1. Purpose of Study

The purpose of this study is to evaluate the adequacy of the size of the Ash Pond and its outlet structures to meet three sets of permits or regulations.

1. NPDES Permit # TN005410 requires that a minimum free water volume of 40.5 million gallons be maintained in the Ash Pond.

2. State Solid Waste Regulations and the facility's Solid Waste Operating Permit require that the stormwater runoff management system collect and control peak flows from the 25-year, 24-hour storm and divert through an emergency spillway the peak flow from a 100-year storm.

3. Although not legally applicable to this federally owned facility, the hydraulic capacity of the Ash Pond will be evaluated against the State of Tennessee's Safe Dams Act Rules (1200-5-7). If applicable, these Rules would require the Ash Pond spillway to be able to safely pass peak flows from the "Minimum Freeboard Design Storm".

2. Hydrologic Software Used

HydraFlow Hydrographs 2007 was used to model the flow of runoff into the pond for the desired storm durations and recurrence intervals. This program uses the NRCS HEC-22 method for generating runoff hydrographs and routing them through ponds and their outlet structures for design or evaluation of existing facilities.

3. Data Inputs

Design Storms:

The 25 and 100-yr return frequency events were modeled. The precipitation values for the 24-hr storm were obtained from NOAA Atlas 14 for the latitude and longitude of the site as provided on NOAA's Precipitation Frequency Data Server. An SCS Type II storm distribution is appropriate for the location of this site and was used in this analysis.

In addition, a value for the Probable Maximum Precipitation (PMP) for a 10 square mile drainage basin for the month of August (highest month) was obtained from NOAA Hydrometeorological Report #53.

Contributing Areas:

Stormwater runoff from the Bottom Ash and Gypsum Stacks contribute the majority of the runoff to the Ash Pond. This is the area north of Bull Run Creek and west of the railroad tracks. (See Drainage Map in Appendix B). There are approximately 157 acres which contribute runoff from this area. Rainfall directly entering the Chemical Pond is not included in this analysis since water would not likely be pumped from this pond during a peak storm event. The runoff hydrograph was calculated using a CN of 87 and a Tc of about 26 minutes. The calculations for these are documented within the HydraFlow output report.

The Ash Pond also receives runoff from other areas of the plant site including the Coal Yard Drainage Basin, the Unwatering Sump, the Ash Sluice Line Sump and the FGD Detention Basin. These areas contribute flow during rainfall events, but do so through pumping systems that discharge from their own sumps or ponds. Table 1 lists the number and capacity of these stormwater pumps. Two pumps typically serve each of these drainage areas. Although both pumps are not typically operated at the same time, for purposes of this analysis, we have assumed that they would be. There is a total of 26.3 cfs of pumping capacity which could be discharging to the Ash Pond during peak flow events.

There are also a number of other sources of process water which are or have in the past been discharged to the Ash Pond. Most significant are the sources that carry bottom ash, fly ash and gypsum. For purposes of this analysis, all possible sources were considered to be in operation during the peak storm events analyzed. The process water pumps and their capacities are listed in Table 1 in Appendix B. They represent an additional 26.7 cfs of potential flow to the Ash Pond during peak events. The stormwater and process water pumps together total 53 cfs of flow capacity. This flow is modeled as a hydrograph with a constant 53 cfs of runoff. This hydrograph is added to the storm hydrograph of the runoff from the 157-acre drainage area. This 53 cfs does not vary based on the storm return frequency, because it is limited by the pumping capacity.

Ash Pond:

The current volume of the ash pond was estimated based on hydrographic soundings of the pond bottom obtained by TVA in late 2008 and supplied to Stantec. The sounding depths and locations were used to create a terrain model of the pond bottom and contours were subsequently generated. The volume of the pond below the water surface was determined from within AutoCAD. The areas of the contours were also determined from within AutoCAD and entered as data into the HydraFlow model. A table listing these areas follows the HydraFlow report in Appendix C.

Information on the pond outlet structures was obtained from TVA record drawing 10N282 (1/15/79) and 10N283 (Appendix A). The outlets consist of three 52-inch diameter steel circular weirs mounted on 48" diameter reinforced concrete riser pipes. Each riser has a 36" RCP outlet pipe with an invert elevation of 793. These outlet pipes discharge through the pond dike to the Clinch River and an outlet invert elevation of 792. The overflow elevations of these weirs were surveyed by TVA in 2004 and were reported by TVA (Travis Markham) not to have been raised or lowered since that time. The three weirs have overflow elevations of 805.22, 805.34 and 805.42. The weir length is the circumference of the weir (14.14 feet). Since Hydraflow does not allow use of more than one riser, the structures were modeled as one riser with three 36 inch outlet pipes and two additional weirs acting as a multi-stage device. Since the flow over each weir is handled separately within the program and added together, this has the same effect as modeling the three risers separately. A tailwater elevation of 797 was also used for the outlet pipes, which is the Clinch River 100-yr flood elevation.

Initial Conditions:

The starting condition of the pond at the beginning of the modeled events is 805.20 (just below the overflow elevation of the riser). The true initial condition would be somewhat higher due to the 26.7 cfs of base process flow over the weir. HydraFlow will not allow an initial condition above the level of the lowest weir. Because of the lag in the arrival of the peak runoff, the level of the reservoir rises to its equilibrium level of about 805.9 before the arrival of the peak flow. Therefore the fact that the modeled starting condition is lower than the actual starting condition is of no consequence to these results.

4. Results

Pond Volume - Based on Stantec's calculations using both AutoCAD and HydraFlow, the Ash Pond (including the Stilling Pond) has a free water volume of 12,595,000 cubic feet (289 acre-ft) or 94,210,000 gallons. See Page 4 of the HydraFlow Report in Appendix C for a summary of pond data. The volume is interpolated at elevation 805.22 (lowest weir elevation) from the values at elevations 804 and 806. The free water volume is therefore well in excess of the required 40,500,000 gallons under the NPDES Permit.

Peak 25-yr and 100-yr storm events - The HydraFlow model results report is attached to this narrative. The peak 25-yr and 100-yr flows into the Ash Pond are estimated to be 612 and 796 cfs respectively. The peak outflow from the Ash Pond for these storms is about 186 and 240 cfs respectively. The water level is modeled to rise to elevations 806.53 and 806.75 in these cases.

The lowest spot elevation from the most recent topographic survey of the berm surrounding the Ash Pond is 809.7, resulting in an estimated freeboard of the pond at the modeled 25-yr and 100-yr storms of 3.1 and 2.9 feet respectively. Therefore, the pond and its primary outlet structures have sufficient capacity to carry the 25-yr and 100-yr storm events with sufficient freeboard remaining. No emergency spillway is necessary to convey these storm events.

Dam Safety Act PMP event – The Tennessee Dam Safety Act rules (Rule 1200-5-7) regulate "persons" who operate non-federal dams in the State of Tennessee. These regulations are not legally applicable to federal agencies and hence do not legally apply to the Bull Run Ash Pond. However, Stantec evaluated the hydraulic capacities of the Bull Run Ash Pond against the standards contained in those regulations. The regulations classify dams by size and by hazard potential. The pond would be categorized as a "small" dam in that it has between 30-999 acre-ft of storage (~290 acre-ft) and is between 20 and 49 feet high (~40'). TVA has classified this pond as Hazard Potential Category 1 which is a dam located:

> *"where failure would probably result in any of the following: loss of human life; excessive economic loss due to damage of downstream properties; excessive economic loss, public hazard, or public inconvenience due to loss of impoundment and/or damage to roads or any public or private utilities."*

These regulations require that the emergency spillway (or primary spillway) safely carry the flow from the "freeboard hydrograph". This is defined in the regulations for a small Category 1 dam to be the routed flow from ½ of the 6-hr PMP storm for a 10 square mile drainage area. Figure 21 from HMR#53 (included in Appendix D) gives the PMP as 29 inches for this location for July and August (highest months). The freeboard design storm would therefore be 14.5 inches. The hydrographs for this storm are included in Appendix D. The freeboard hydrograph peak inflow into the Ash Pond is estimated to be 1521 cfs. The peak outflow from the Ash Pond would be 334 cfs. The water level is modeled to rise to elevation 808.08' msl under this condition. This provides a freeboard of 1.62 feet. All flows under this condition are through the primary outlet structures. No emergency spillway is necessary to convey these storm events. The 14.5 inch rainfall depth of this storm is over two times the depth of rainfall for a 1,000-yr, 6-hr storm event (6.75 inches). Given the extreme unlikelihood of such an event, this amount of freeboard should be sufficient.

5. Spillway Design

Existing spillway: The base of the spillway riser is a 6x6x4 reinforced concrete box on an 18-inch thick footing slab. A 36-inch outlet pipe exits the side of this box and runs underneath the berm of the stilling pond to its point of discharge on the exterior face of the berm. Additional two-foot high, four-foot diameter reinforced concrete pipe sections are stacked onto one another until the desired overflow elevation is reached. In the case of the Bull Run Stilling Pond the riser is approximately 12 feet tall from its invert to its weir overflow elevation. The riser is topped by a 10-foot diameter corrugated metal skimmer which extends three feet above and two feet below the water level.

Design Criteria: Other than hydraulic capacity, there are no other specific spillway design criteria in the Tennessee Solid Waste Regulations.

Design Flow: Based on the Tennessee Dam Safety Act, the design flow for principal and emergency spillway for a small high-hazard potential structure is to be based on ½ of PMP. Spillways at the Ash Pond are capable of passing the design flow with sufficient freeboard as discussed above.

The structural design of the spillway structures is beyond the scope of this hydrologic and hydraulic analysis. However, Stantec recommends that this tall, unsupported weir structure be retrofitted or prioritized, inspected and replaced as necessary, with a more reliable structure for pool level regulation.

6. Conclusions

The spillway structures at the Ash Pond at Bull Run meet the applicable hydraulic capacity requirements of the Tennessee Solid Waste and Dam Safety Regulations.

The Ash Pond has sufficient freeboard under both operating and emergency conditions.

There is adequate pond volume to meet the requirements of the NPDES permit.

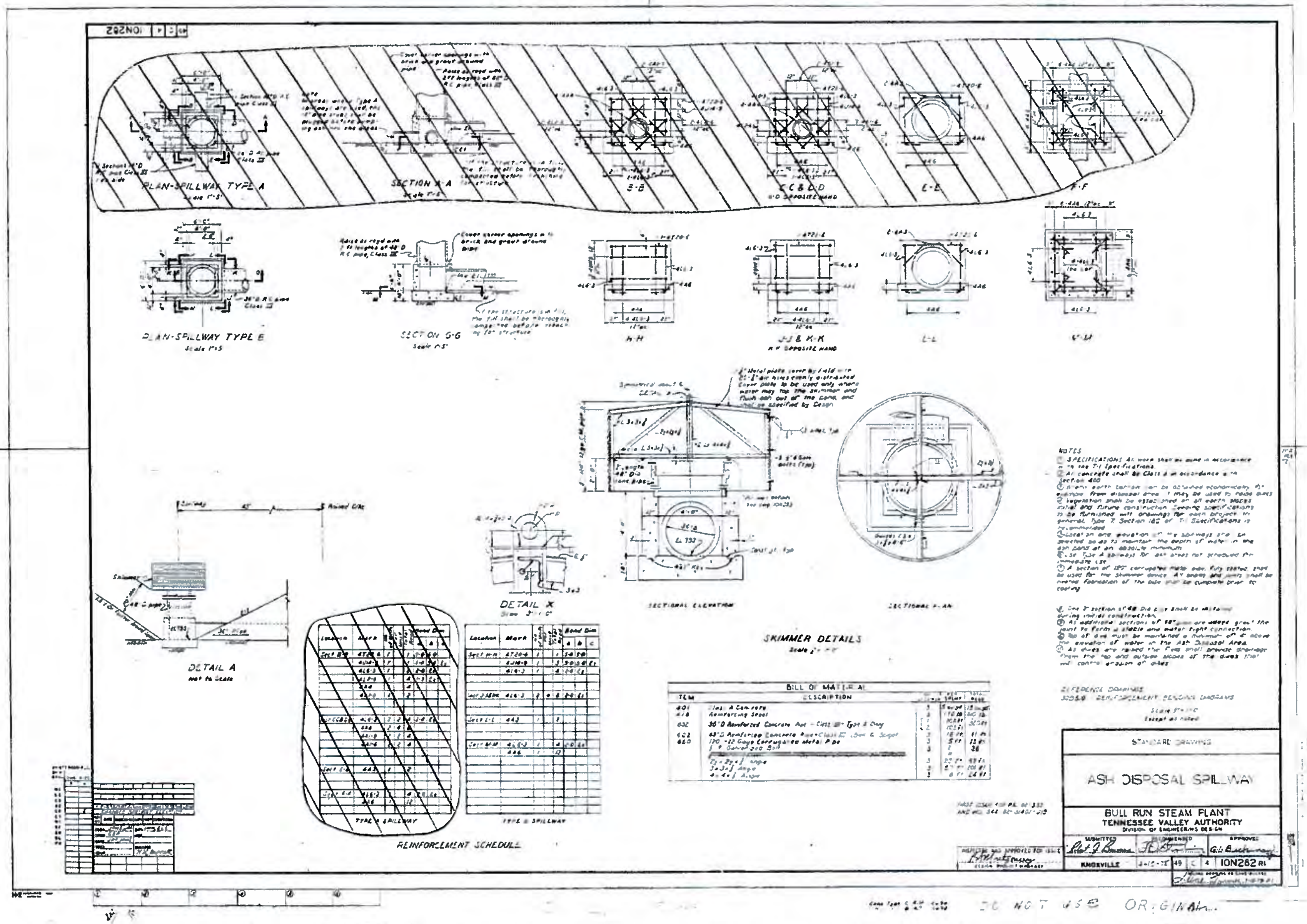
7. Recommendations

Hydraulic Capacity of the Fly Ash Pond: Stantec recommends that TVA continue to conduct maintenance dredging of the sluice channel and Fly Ash Pond to preserve their hydraulic capacity.

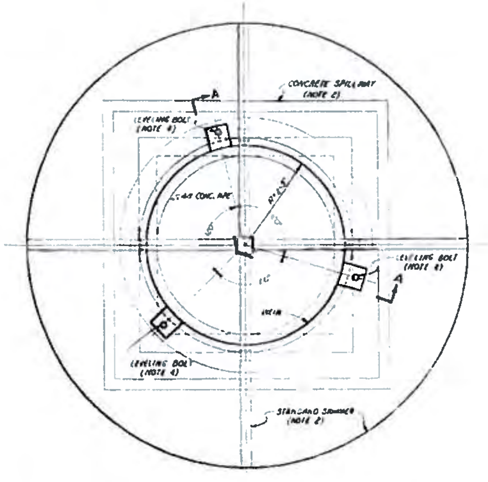
Spillway Design: Stantec recommends that this tall, unsupported weir structure be retrofitted or prioritized, inspected and replaced as necessary, with a more reliable structure for pool level regulation.

Appendix A

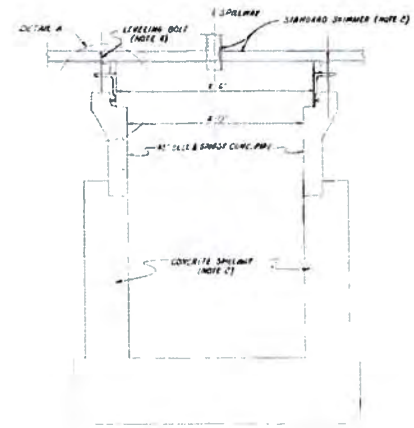
Pond Outlet Construction Drawings



1975-04_BRF-10N282-SHT -REV 1 STANDARD DRAWING ASH DISPOSAL SPILLWAY.cal (35% of Scale) Ash Pond - Area 2 4-7-2009 14-12-10 4/27/2009 09:57 AM

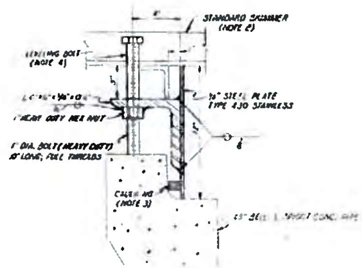


PLAN



SECTION A-A

HEAD H FEET	0.0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0	.04	.11	.21	.35	[illegible]	[illegible]	[illegible]	[illegible]	1.34
0.1	1.34	[illegible]	1.97	2.20	2.44	2.70	2.96	3.24	3.52	3.81
0.2	4.11	4.41	4.72	5.04	5.36	5.67	6.04	6.38	6.73	7.10
0.3	7.47	7.85	[illegible]	8.62	9.00	9.41	9.82	[illegible]	[illegible]	11.1
0.4	11.5	[illegible]	12.4	12.8	13.3	[illegible]	14.6	14.7	[illegible]	15.6
0.5	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	[illegible]
0.6	21.2	21.7	22.3	22.8	23.4	23.9	24.5	25.0	25.6	[illegible]
0.7	26.7	27.3	27.9	28.5	[illegible]	[illegible]	30.3	30.9	[illegible]	[illegible]
0.8	32.7	33.4	34.0	34.6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0.9	39.1	39.8	40.4	41.1	41.8	42.5	43.1	43.8	[illegible]	45.2
1.0	45.9									



DETAIL A
3 REQUIRED

NOTES
1. ALL CONNECTIONS TO BE WELDED.
2. FOR SKIMMER AND SPILLWAY DETAILS SEE STD. DWG. 10N282.
3. CAULKING SHALL EXTEND COMPLETELY AROUND THE WEIR AND FORM A WATER TIGHT SEAL.
4. WHEN THE WEIR IS INSTALLED THE TOP SHALL BE LEVELED WITH THE USE OF LEVELING BOLTS.

REFERENCE DRAWING: 10N282 ASH DISPOSAL SPILLWAY

SCALE: AS NOTED

BILL OF MATERIAL

ITEM	DESCRIPTION			
ANGLES	6"×6"×½"×1'-6"		3	
BOLTS	1"×10" HEAVY DUTY (FULL THREADS) W/NUT		3	
STEEL PLATE	3/8"×4' ∅, TYPE 430 STAINLESS		1	
CAULKING	BY FIELD			

STANDARD DRAWING

WEIR FOR ASH DISPOSAL SPILLWAY

BULL RUN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

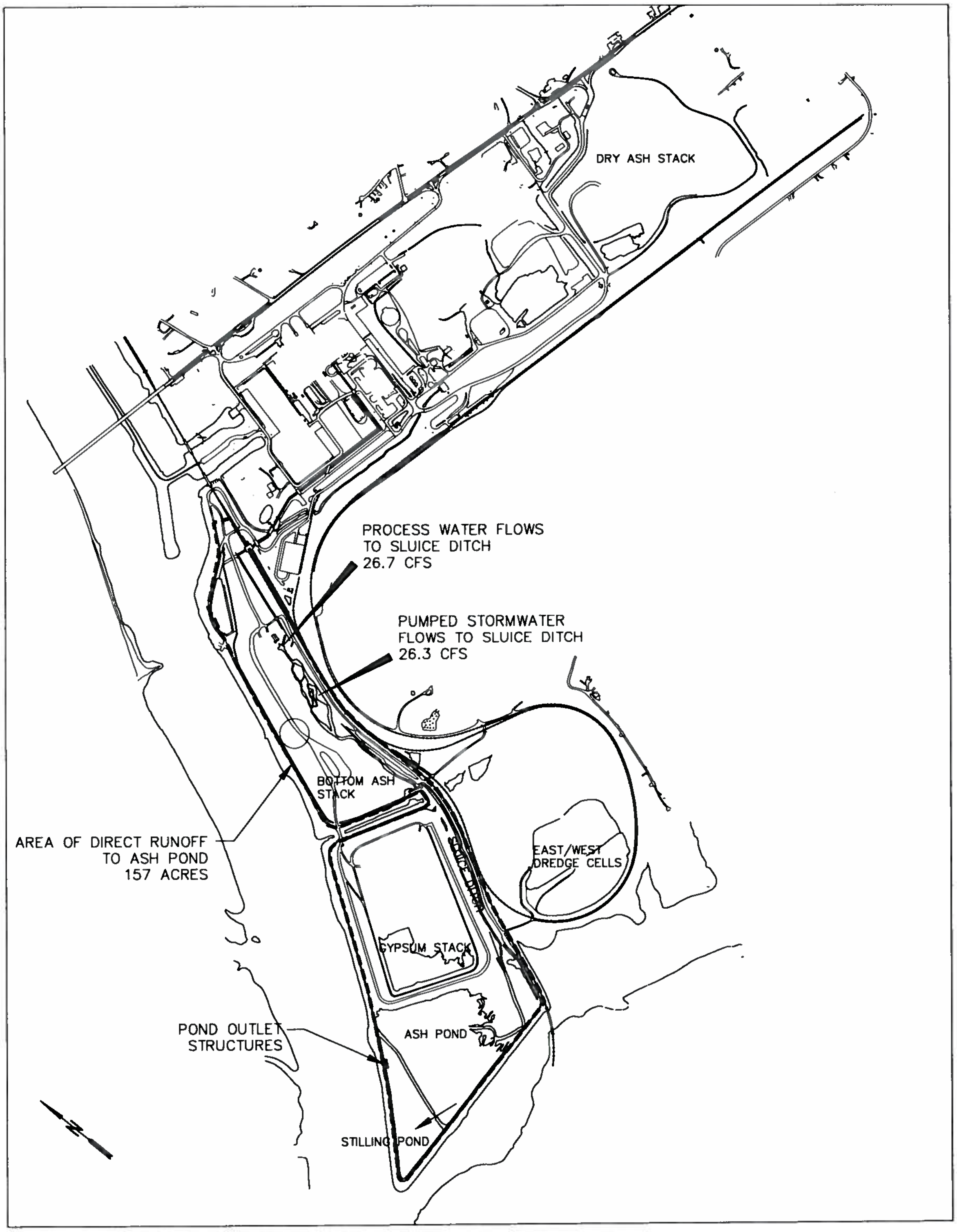
KNOXVILLE | 10N283 R0

ORIGINAL - DO NOT USE

1975-04_BRF-10N283-SHT -REV 0 STANDARD DRAWING WEIR FOR ASH DISPOSAL SPILLWAY.cal (37% of Scale), Ash Pond - Area 2, 4-7-2009 14-12-10, 4/27/2009 09 57 AM

Appendix B

Drainage Area Map
NPDES Flow Schematic
Table 1



DRAINAGE AREA MAP

0 1000 2000
SCALE FEET

SOURCE: Topographic Map - TVA

Tennessee Valley Authority Clinton, Tennessee	**Bull Run Fossil Plant** Stormwater Drainage To Ash Pond	Drawn By: RGS	Checked By: PK
		Project No. 172679015	
		Figure	

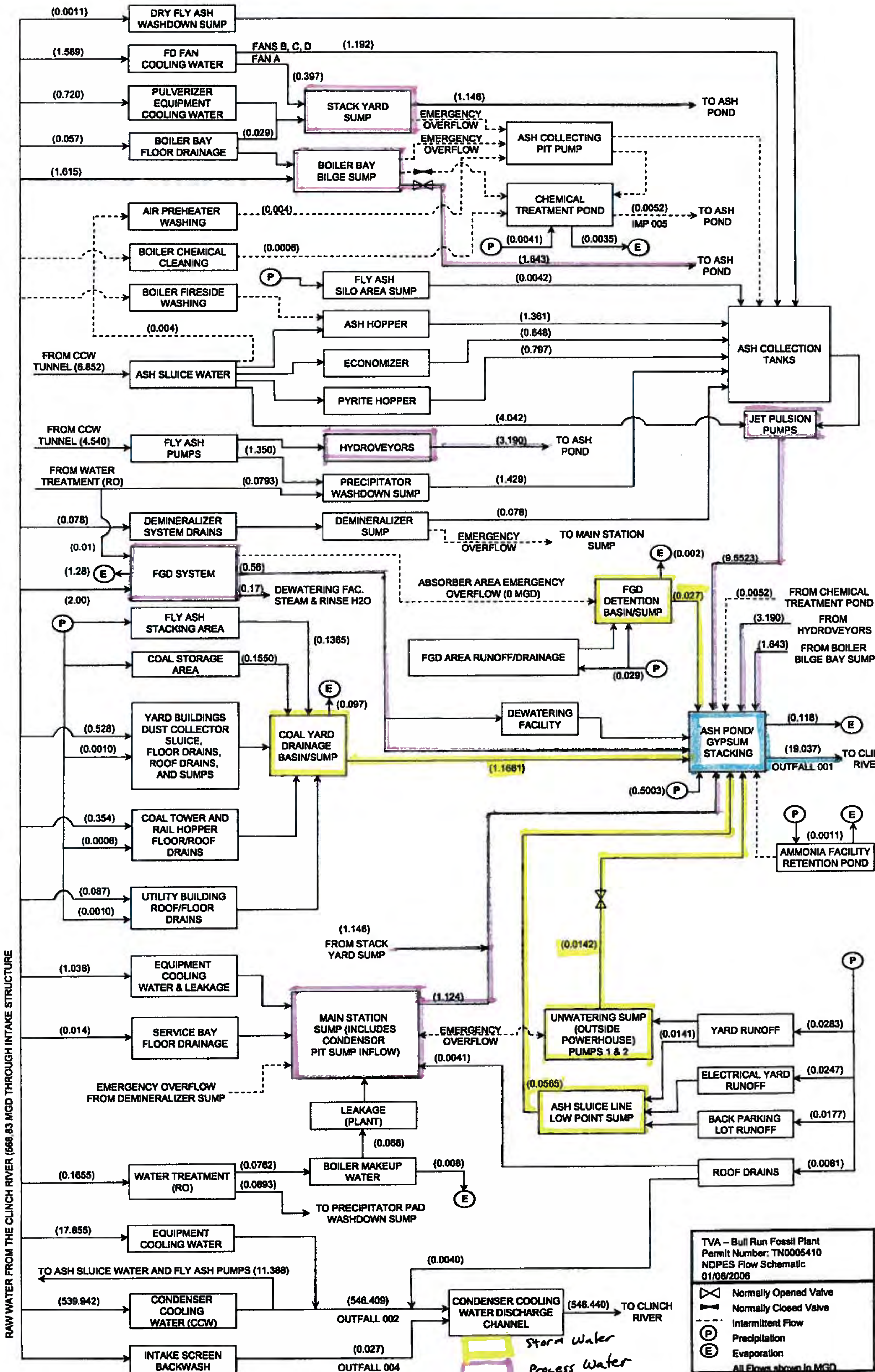

RAW WATER FROM THE CLINCH RIVER (568.83 MGD THROUGH INTAKE STRUCTURE
(0.0011)
DRY FLY ASH WASHDOWN SUMP
(1.589)
FD FAN COOLING WATER
FANS B, C, D
(1.192)
FAN A
(0.397)
(0.720)
PULVERIZER EQUIPMENT COOLING WATER
STACK YARD SUMP
(1.146)
TO ASH POND
EMERGENCY OVERFLOW
EMERGENCY OVERFLOW
ASH COLLECTING PIT PUMP
(0.029)
(0.057)
BOILER BAY FLOOR DRAINAGE
BOILER BAY BILGE SUMP
(1.615)
CHEMICAL TREATMENT POND
AIR PREHEATER WASHING
(0.004)
(0.0052)
IMP 005
TO ASH POND
(0.0041)
(0.0035)
BOILER CHEMICAL CLEANING
(0.0006)
(1.643)
TO ASH POND
FLY ASH SILO AREA SUMP
(0.0042)
BOILER FIRESIDE WASHING
ASH HOPPER
(1.361)
(0.004)
(0.648)
FROM CCW TUNNEL (6.852)
ECONOMIZER
(0.797)
ASH SLUICE WATER
ASH COLLECTION TANKS
PYRITE HOPPER
(4.042)
JET PULSION PUMPS
FROM CCW TUNNEL (4.540)
FLY ASH PUMPS
(1.350)
HYDROVEYORS
(3.190)
TO ASH POND
FROM WATER TREATMENT (RO)
(0.0793)
PRECIPITATOR WASHDOWN SUMP
(1.429)
(0.078)
DEMINERALIZER SYSTEM DRAINS
DEMINERALIZER SUMP
(0.078)
EMERGENCY OVERFLOW
TO MAIN STATION SUMP
(0.01)
(0.002)
(1.28)
FGD SYSTEM
(0.56)
(9.5523)
(0.17)
DEWATERING FAC. STEAM & RINSE H2O
ABSORBER AREA EMERGENCY OVERFLOW (0 MGD)
FGD DETENTION BASIN/SUMP
(0.027)
(0.0052)
FROM CHEMICAL TREATMENT POND
(2.00)
FLY ASH STACKING AREA
(3.190)
FROM HYDROVEYORS
(0.1385)
(1.643)
FROM BOILER BILGE BAY SUMP
COAL STORAGE AREA
(0.1550)
FGD AREA RUNOFF/DRAINAGE
(0.029)
(0.097)
DEWATERING FACILITY
(0.118)
(0.528)
YARD BUILDINGS DUST COLLECTOR SLUICE, FLOOR DRAINS, ROOF DRAINS, AND SUMPS
COAL YARD DRAINAGE BASIN/SUMP
ASH POND/ GYPSUM STACKING
(0.0010)
(19.037)
TO CLINC RIVER
(1.1681)
OUTFALL 001
(0.5003)
(0.354)
COAL TOWER AND RAIL HOPPER FLOOR/ROOF DRAINS
(0.0011)
(0.0006)
AMMONIA FACILITY RETENTION POND
(0.087)
UTILITY BUILDING ROOF/FLOOR DRAINS
(0.0010)
(1.146)
FROM STACK YARD SUMP
(0.0142)
(1.038)
EQUIPMENT COOLING WATER & LEAKAGE
(1.124)
MAIN STATION SUMP (INCLUDES CONDENSER PIT SUMP INFLOW)
UNWATERING SUMP (OUTSIDE POWERHOUSE) PUMPS 1 & 2
(0.014)
SERVICE BAY FLOOR DRAINAGE
EMERGENCY OVERFLOW
(0.0141)
YARD RUNOFF
(0.0283)
(0.0041)
EMERGENCY OVERFLOW FROM DEMINERALIZER SUMP
(0.0565)
ELECTRICAL YARD RUNOFF
(0.0247)
ASH SLUICE LINE LOW POINT SUMP
LEAKAGE (PLANT)
BACK PARKING LOT RUNOFF
(0.0177)
(0.068)
(0.1655)
WATER TREATMENT (RO)
(0.0762)
BOILER MAKEUP WATER
(0.008)
ROOF DRAINS
(0.0081)
(0.0893)
TO PRECIPITATOR PAD WASHDOWN SUMP
(17.855)
EQUIPMENT COOLING WATER
TVA – Bull Run Fossil Plant
Permit Number: TN0005410
NDPES Flow Schematic
01/06/2006
TO ASH SLUICE WATER AND FLY ASH PUMPS (11.388)
(0.0040)
(539.942)
CONDENSER COOLING WATER (CCW)
(546.409)
OUTFALL 002
CONDENSER COOLING WATER DISCHARGE CHANNEL
(546.440)
TO CLINCH RIVER
Normally Opened Valve
Normally Closed Valve
Intermittent Flow
Precipitation
Evaporation
INTAKE SCREEN BACKWASH
(0.027)
OUTFALL 004
Storm Water
Process Water
All Flows shown in MGD

Table 1

Bull Run Fossil Plant

			Flow		
Stormwater Pumps	Number of Pumps	Capacity Each (gpm)	Flow mgd (max)	Flow gpm (max)	Flow cfs (max)
Coal Pile Runoff	2	2,500		5,000	11.1
Pumphouse Unwatering Sump	2	2,500		5,000	11.1
Ash Sluice Trench Runoff	2	450		900	2.0
FGD Detention Basin	2	460		920	2.0
subtotal					26.3
Process Water Pumps					
Jet Pulsion Pumps			9.55	6,646	14.8
Hydroveyors			3.19	2,220	4.9
Boiler Bilge Bay			1.64	1,141	2.5
Stack Yard sump			1.146	798	1.8
FDG System			0.56	390	0.9
Main Station Sump			1.124	782	1.7
subtotal					26.7
Total					53.0

Appendix C

Stilling Pond Surface Water Elevation Plot – 100-Year Storm

HydraFlow Hydrograph Report – 25 and 100-Year Storms

NOAA Precipitation Frequency Data

Ash Pond Bottom Contour Areas

Hydrograph Report

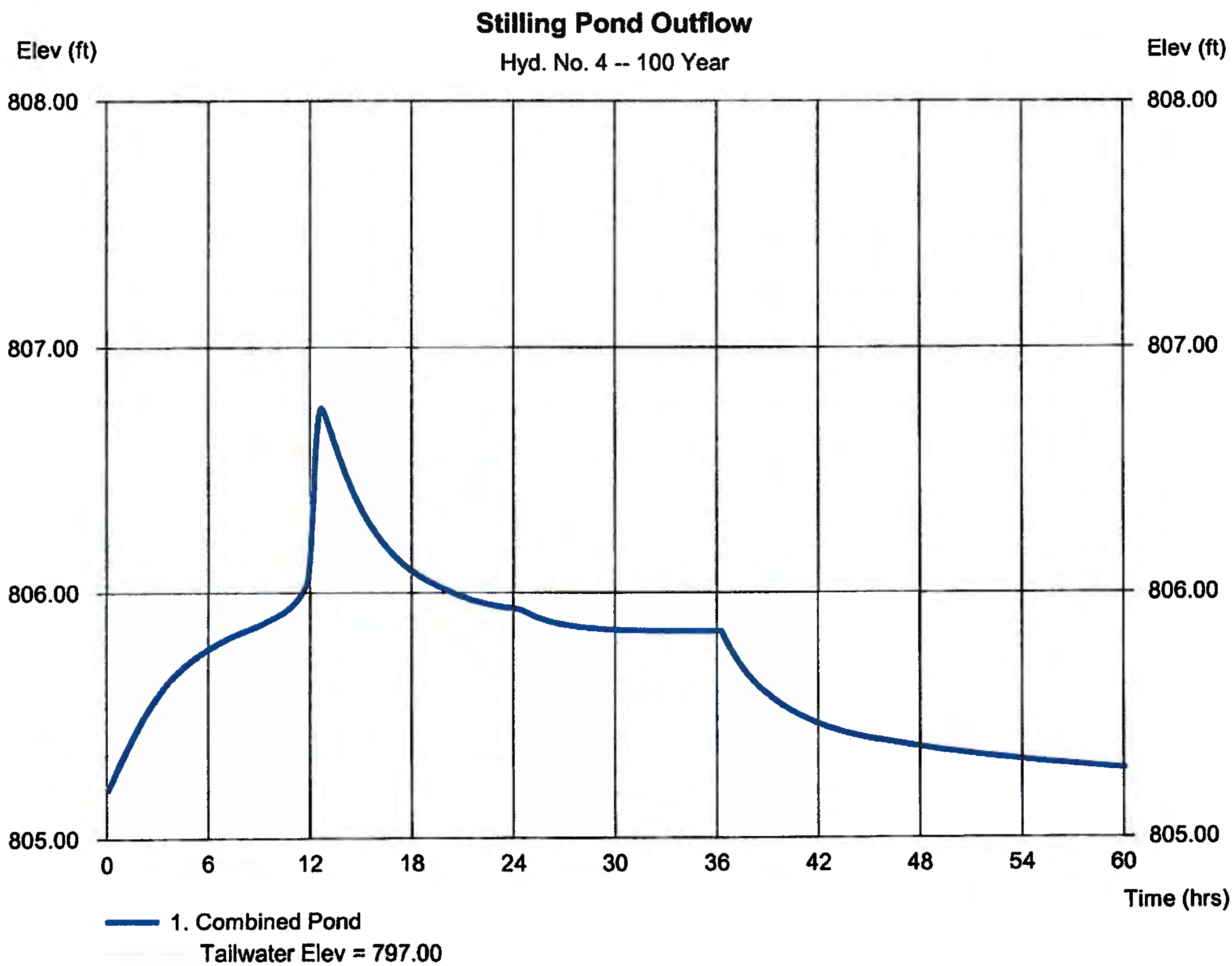
Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Dec 16, 2009

Hyd. No. 4

Stilling Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 239.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 3 min	Hyd. volume	= 9,942,447 cuft
Inflow hyd. No.	= 3 - Base plus Storm	Max. Elevation	= 806.75 ft
Reservoir name	= Combined Pond	Max. Storage	= 14,755,340 cuft

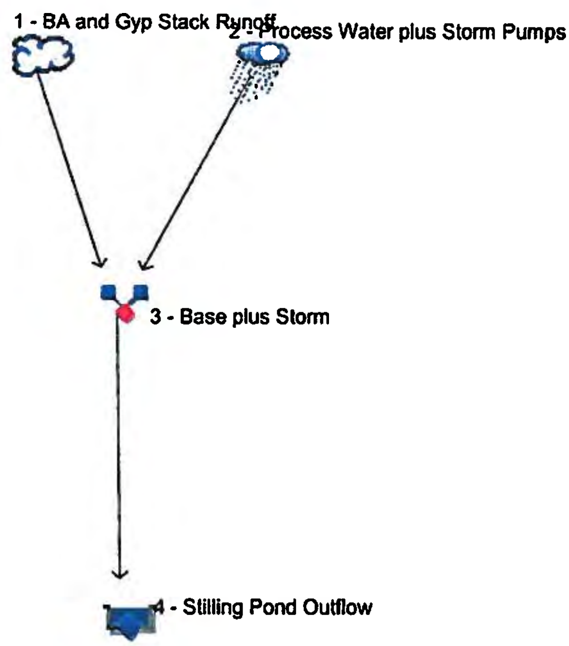
Storage Indication method used. Wet pond routing start elevation = 805.20 ft.



Hydraflow Table of Contents

Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Ash Pond12-07-09.gpw	Wednesday, Dec 16, 2009

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	558.82	3	729	2,264,765	----	------	------	BA and Gyp Stack Runoff
2	Manual	53.00	3	0	6,906,960	----	------	------	Process Water plus Storm Pumps
3	Combine	611.82	3	729	9,171,726	1, 2	------	------	Base plus Storm
4	Reservoir	186.43	3	759	9,161,569	3	806.53	14,407,840	Stilling Pond Outflow

Ash Pond12-07-09.gpw	Return Period: 25 Year	Wednesday, Dec 16, 2009

Hydrograph Report

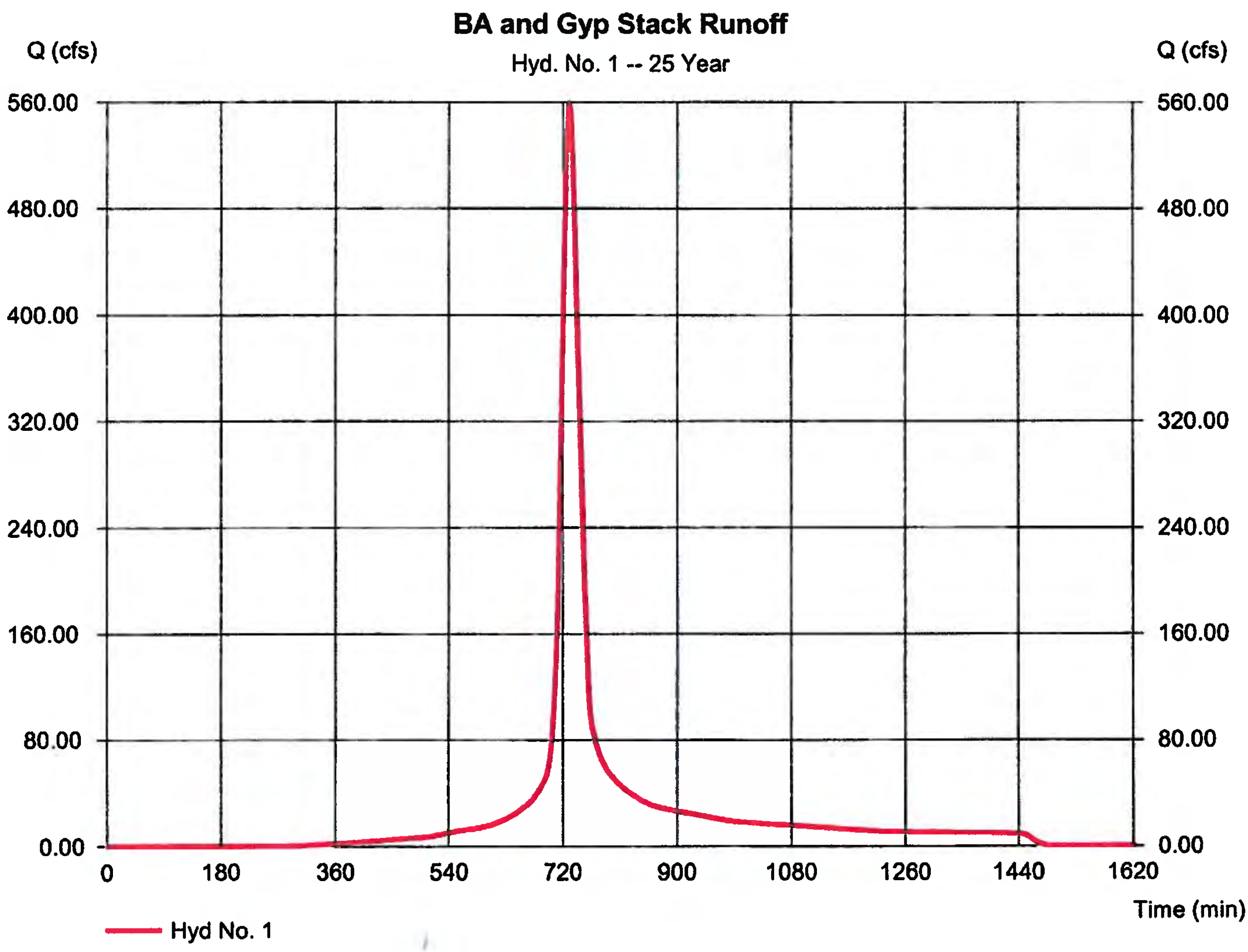
Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Dec 16, 2009

Hyd. No. 1

BA and Gyp Stack Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 558.82 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 3 min	Hyd. volume	= 2,264,765 cuft
Drainage area	= 157.000 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.80 min
Total precip.	= 5.43 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(40.000 x 100) + (87.000 x 87) + (30.000 x 71)] / 157.000



TR55 Tc Worksheet

Hyd. No. 1

BA and Gyp Stack Runoff

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.240		0.011		0.011		
Flow length (ft)	=	150.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.27		0.00		0.00		
Land slope (%)	=	20.00		0.00		0.00		
Travel Time (min)	**=**	**7.77**	**+**	**0.00**	**+**	**0.00**	**=**	**7.77**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	4.00		240.00		0.00		
Wetted perimeter (ft)	=	6.00		52.00		0.00		
Channel slope (%)	=	0.20		0.20		0.00		
Manning's n-value	=	0.020		0.020		0.015		
Velocity (ft/s)	=	2.54		9.28		0.00		
Flow length (ft)	=	2200.0		2000.0		0.0		
Travel Time (min)	**=**	**14.44**	**+**	**3.59**	**+**	**0.00**	**=**	**18.03**

Total Travel Time, Tc .... 25.80 min

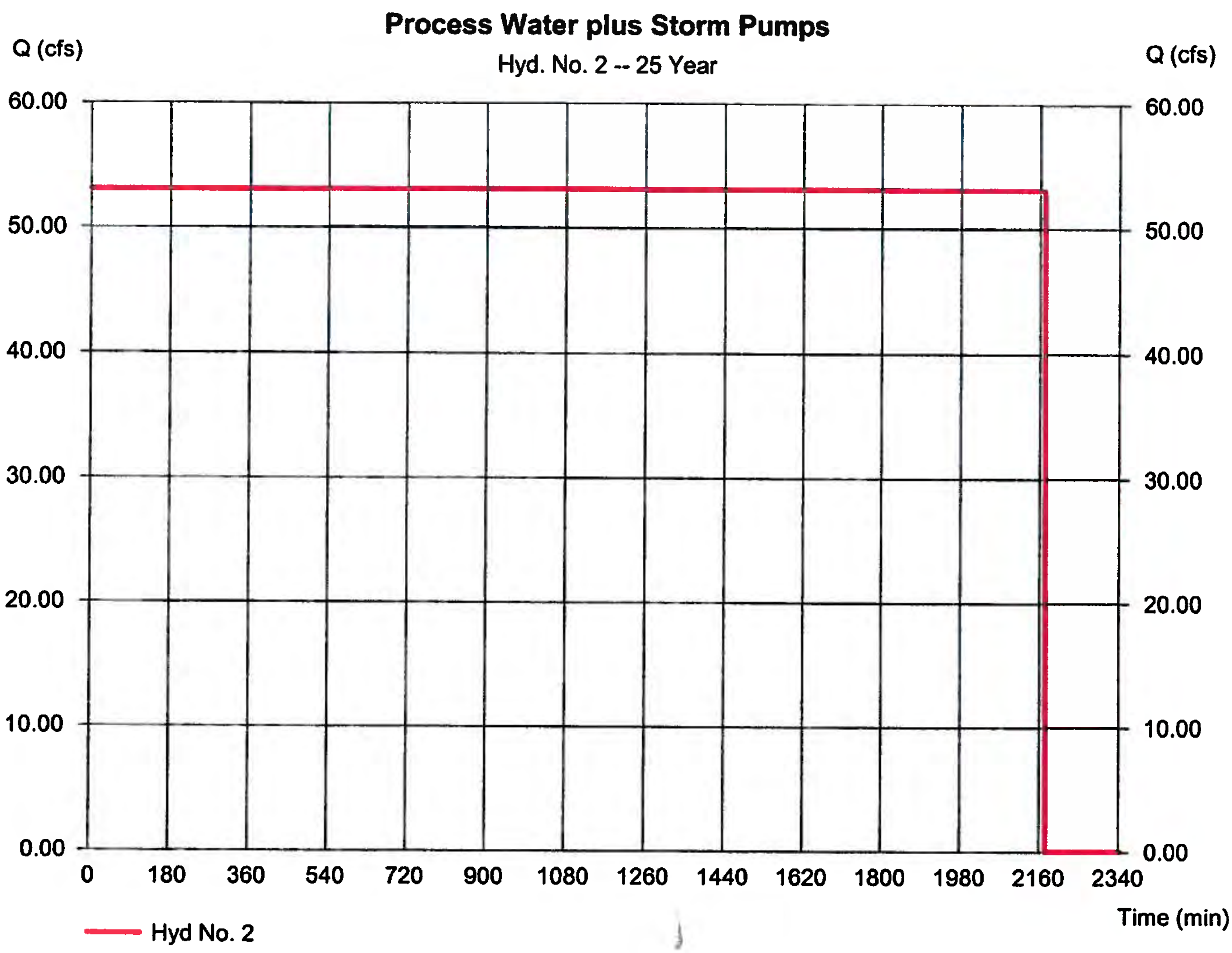
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Dec 16, 2009

Hyd. No. 2

Process Water plus Storm Pumps

Hydrograph type	= Manual	Peak discharge	= 53.00 cfs
Storm frequency	= 25 yrs	Time to peak	= 0 min
Time interval	= 3 min	Hyd. volume	= 6,906,960 cuft



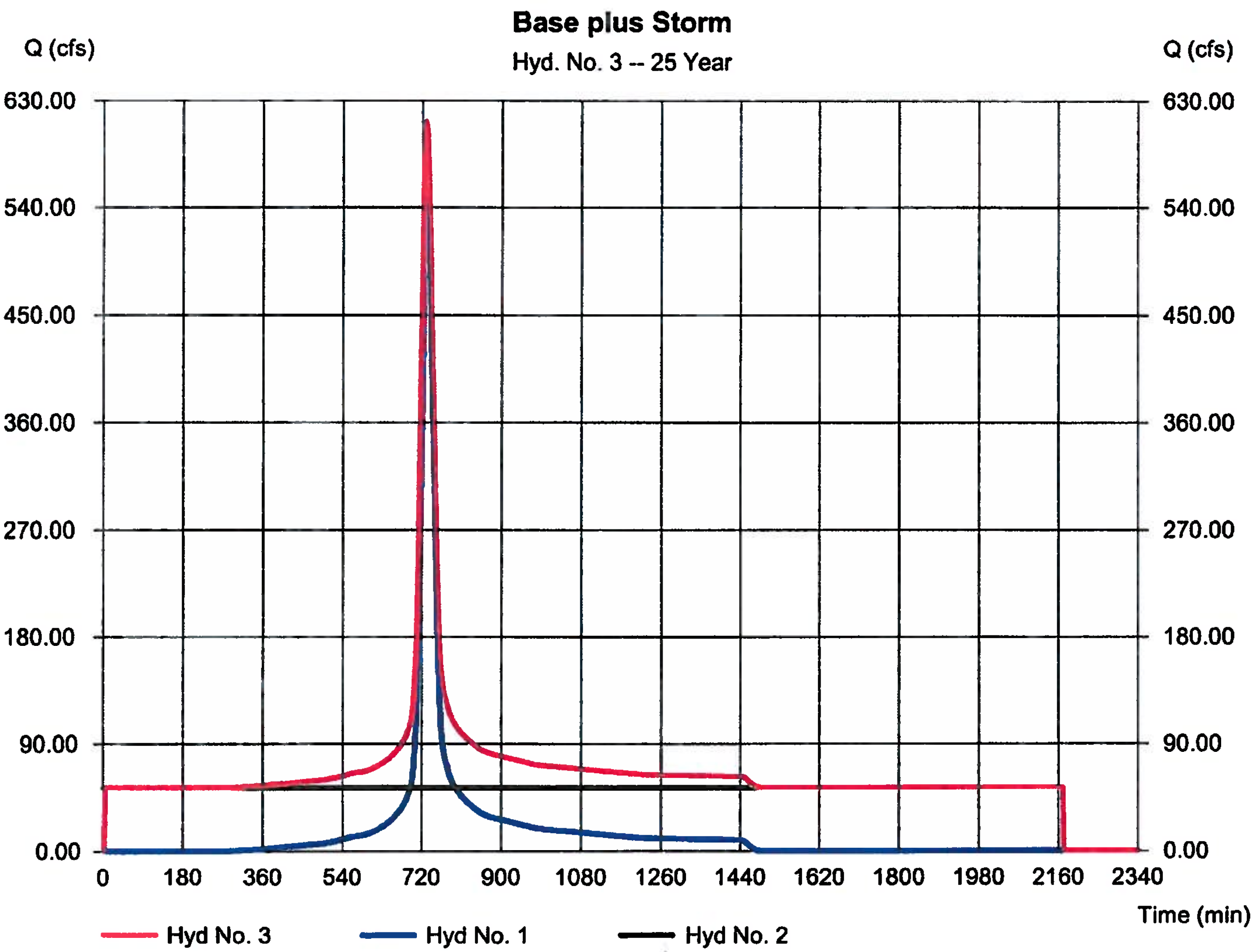
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Dec 16, 2009

Hyd. No. 3

Base plus Storm

Hydrograph type	= Combine	Peak discharge	= 611.82 cfs
Storm frequency	= 25 yrs	Time to peak	= 729 min
Time interval	= 3 min	Hyd. volume	= 9,171,726 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 157.000 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23

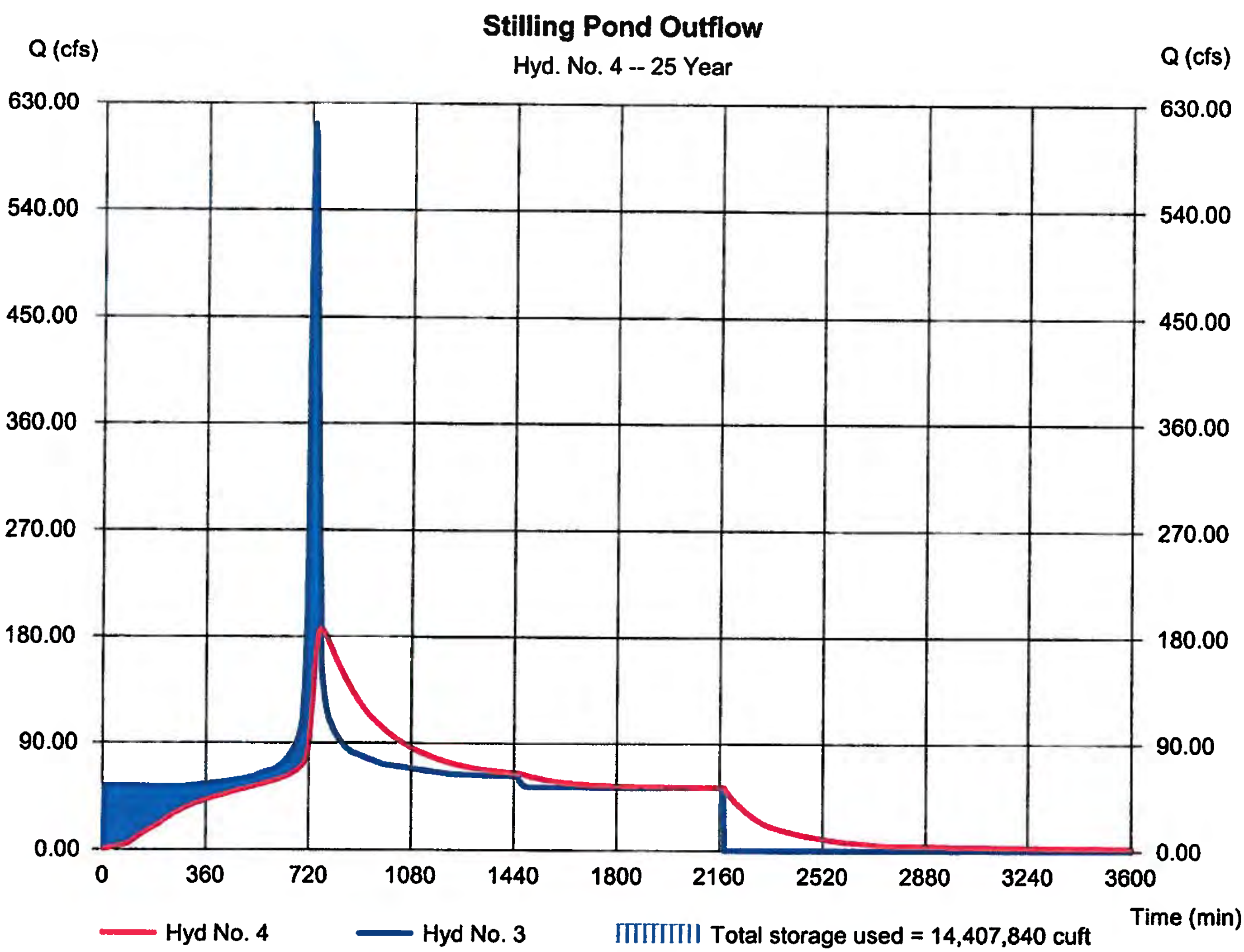
Wednesday, Dec 16, 2009

Hyd. No. 4

Stilling Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 186.43 cfs
Storm frequency	= 25 yrs	Time to peak	= 759 min
Time interval	= 3 min	Hyd. volume	= 9,161,569 cuft
Inflow hyd. No.	= 3 - Base plus Storm	Max. Elevation	= 806.53 ft
Reservoir name	= Combined Pond	Max. Storage	= 14,407,840 cuft

Storage Indication method used. Wet pond routing start elevation = 805.20 ft.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Dec 16, 2009

Pond No. 1 - Combined Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 784.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	784.00	3,000	0	0
2.00	786.00	9,000	11,463	11,463
4.00	788.00	158,500	136,832	148,295
6.00	790.00	210,700	367,927	516,222
8.00	792.00	355,700	560,053	1,076,275
10.00	794.00	551,800	900,263	1,976,538
12.00	796.00	682,000	1,231,380	3,207,918
14.00	798.00	849,700	1,528,478	4,736,396
16.00	800.00	1,023,700	1,870,514	6,606,910
18.00	802.00	1,102,500	2,125,500	8,732,410
20.00	804.00	1,222,880	2,324,110	11,056,520
22.00	806.00	1,300,100	2,522,330	13,578,850
24.00	808.00	1,866,350	3,149,120	16,727,970
26.00	810.00	2,000,000	3,865,200	20,593,170

Culvert / Orifice Structures

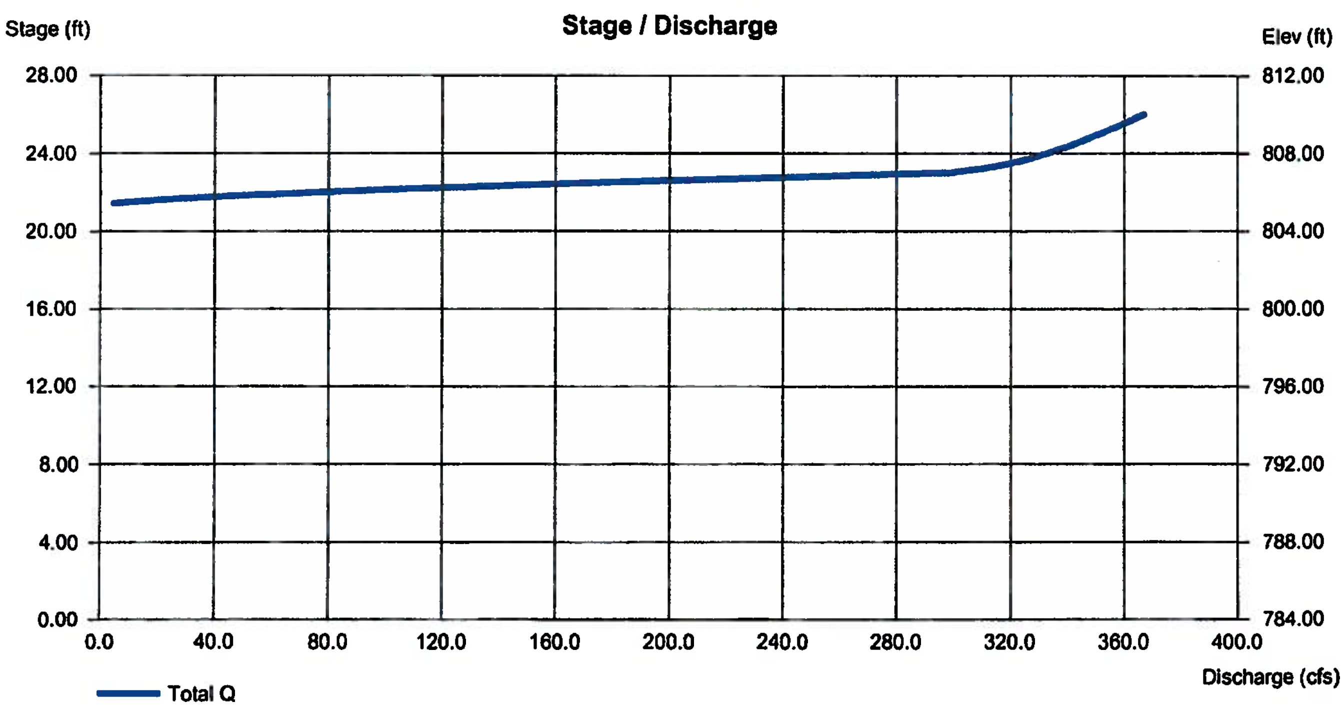
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	0.00	0.00	0.00
Span (in)	= 36.00	0.00	0.00	0.00
No. Barrels	= 3	0	0	0
Invert El. (ft)	= 793.00	0.00	0.00	0.00
Length (ft)	= 106.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.14	14.14	14.14	Inactive
Crest El. (ft)	= 805.42	805.34	805.22	807.00
Weir Coeff.	= 3.33	3.33	3.33	2.60
Weir Type	= Riser	Rect	Rect	Broad
Multi-Stage	= Yes	Yes	Yes	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 797.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	743.19	3	729	3,045,641	----	------	------	BA and Gyp Stack Runoff
2	Manual	53.00	3	0	6,906,960	----	------	------	Process Water plus Storm Pumps
3	Combine	796.19	3	729	9,952,598	1, 2	------	------	Base plus Storm
4	Reservoir	239.81	3	756	9,942,447	3	806.75	14,755,340	Stilling Pond Outflow

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23

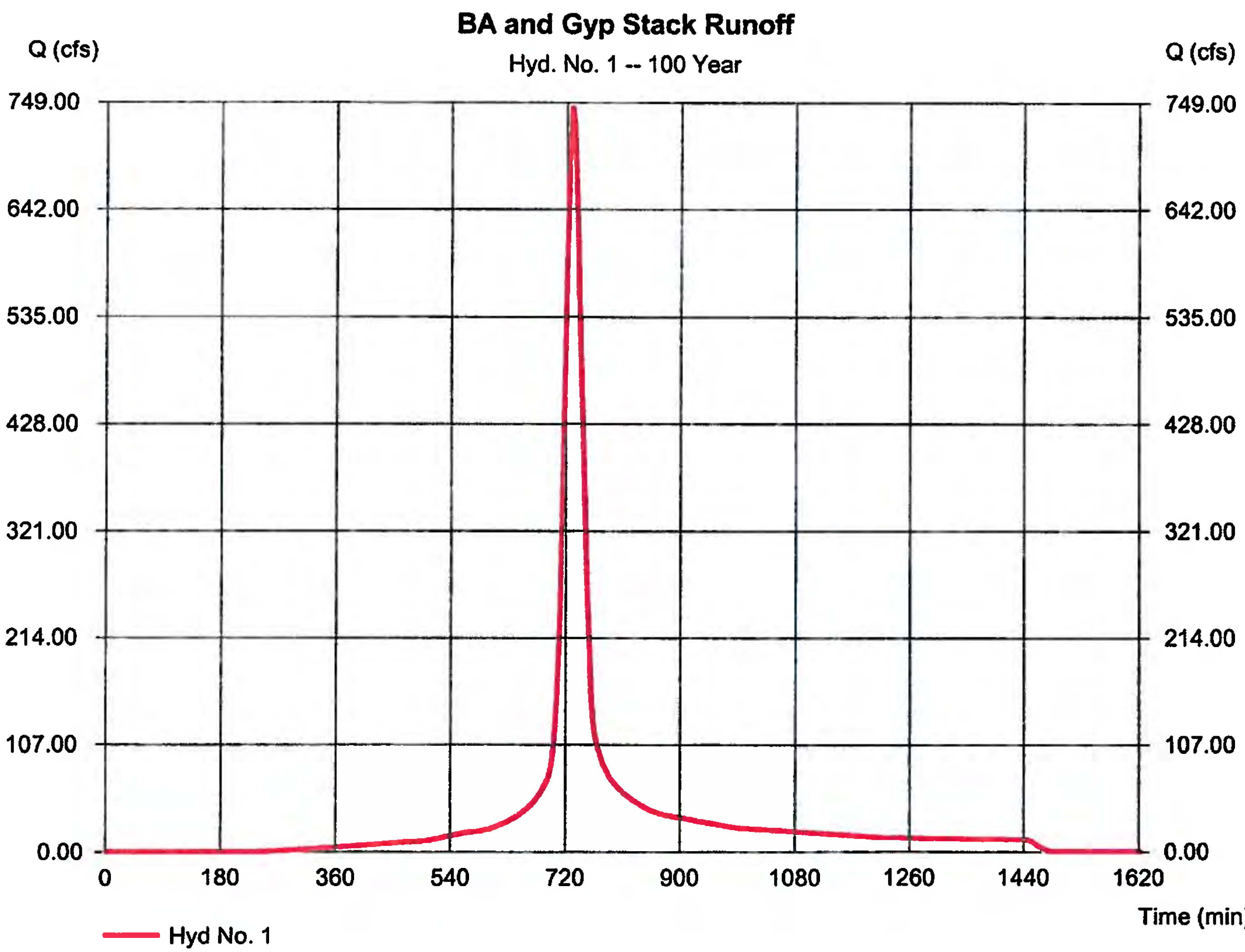
Wednesday, Dec 16, 2009

Hyd. No. 1

BA and Gyp Stack Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 743.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 729 min
Time interval	= 3 min	Hyd. volume	= 3,045,641 cuft
Drainage area	= 157.000 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.80 min
Total precip.	= 6.86 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

* Composite (Area/CN) = [(40.000 x 100) + (87.000 x 87) + (30.000 x 71)] / 157.000



Hydrograph Report

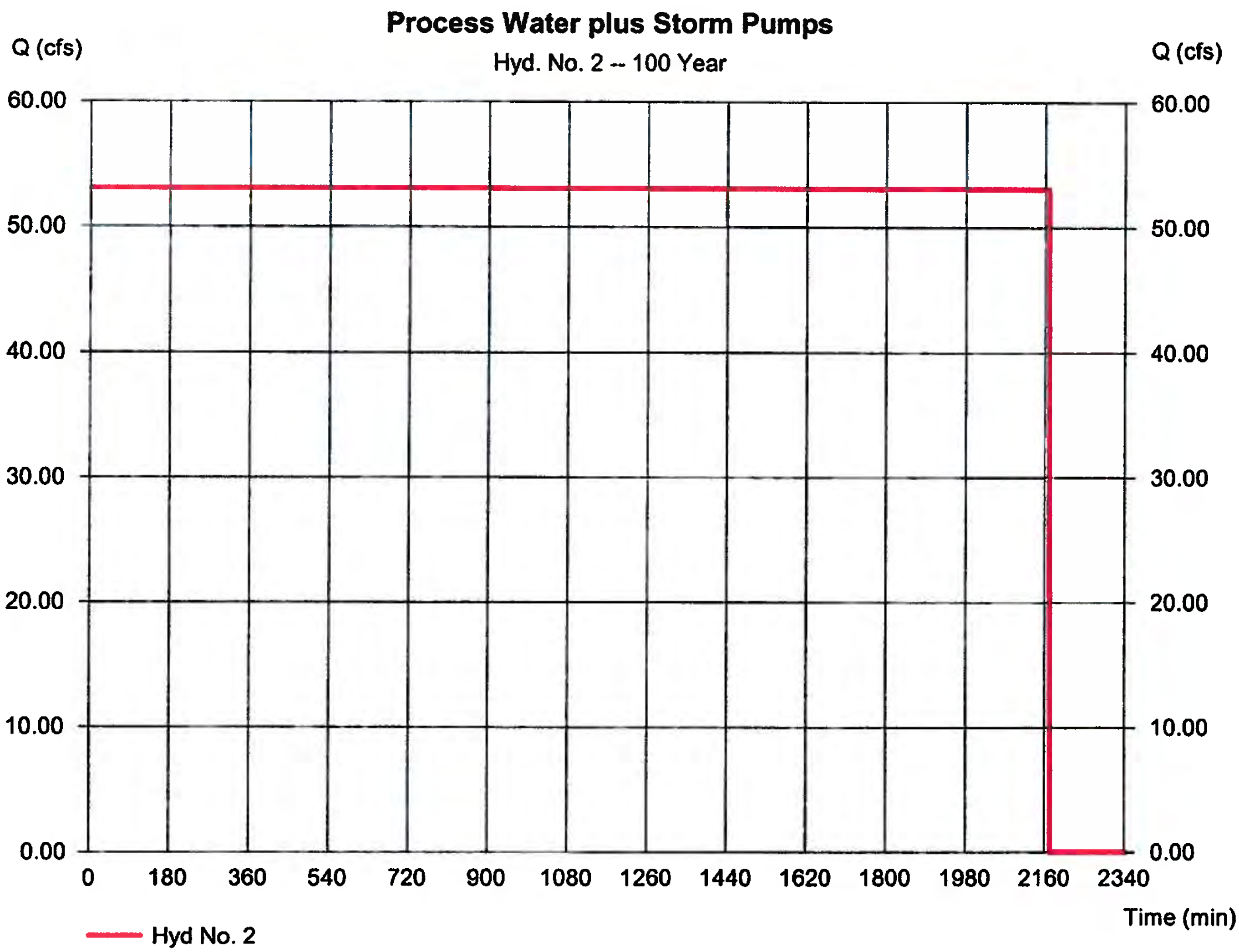
Hydraflow Hydrographs by Intelisolve v9.23

Wednesday, Dec 16, 2009

Hyd. No. 2

Process Water plus Storm Pumps

Hydrograph type	= Manual	Peak discharge	= 53.00 cfs
Storm frequency	= 100 yrs	Time to peak	= 0 min
Time interval	= 3 min	Hyd. volume	= 6,906,960 cuft



Hydrograph Report

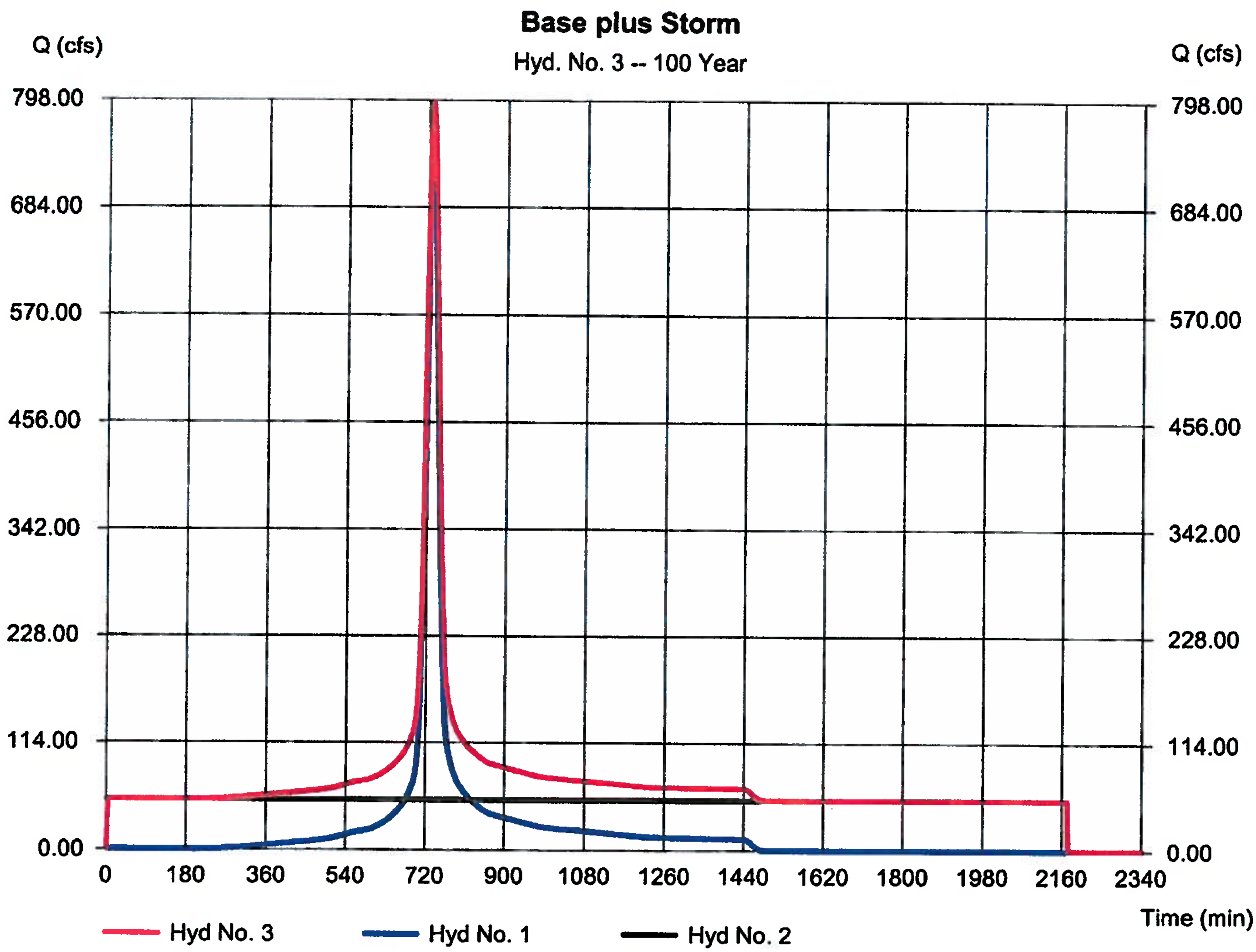
Hydraflow Hydrographs by Intelisolve v9.23

Wednesday, Dec 16, 2009

Hyd. No. 3

Base plus Storm

Hydrograph type	= Combine
Storm frequency	= 100 yrs
Time interval	= 3 min
Inflow hyds.	= 1, 2
Peak discharge	= 796.19 cfs
Time to peak	= 729 min
Hyd. volume	= 9,952,598 cuft
Contrib. drain. area	= 157.000 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23

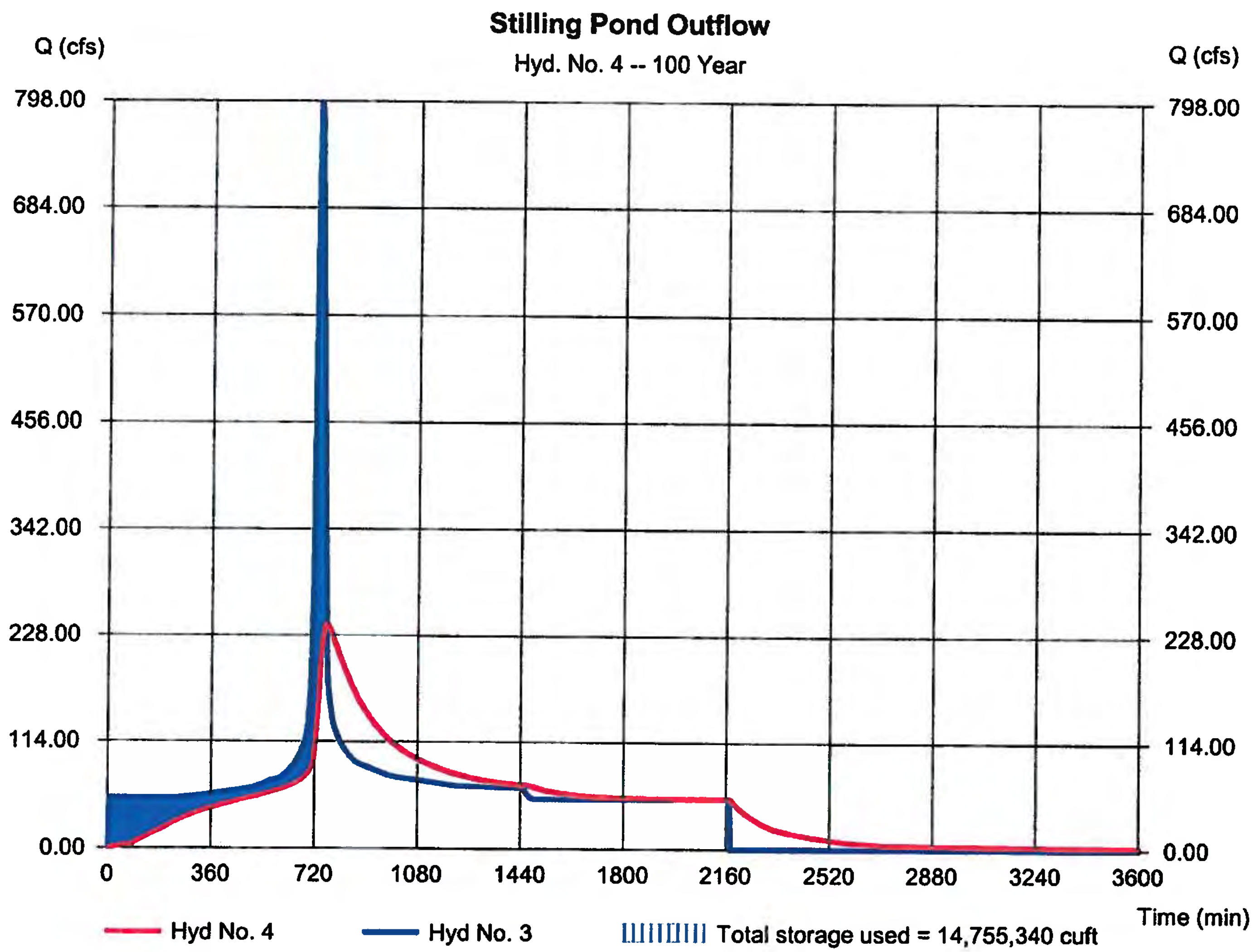
Wednesday, Dec 16, 2009

Hyd. No. 4

Stilling Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 239.81 cfs
Storm frequency	= 100 yrs	Time to peak	= 756 min
Time interval	= 3 min	Hyd. volume	= 9,942,447 cuft
Inflow hyd. No.	= 3 - Base plus Storm	Max. Elevation	= 806.75 ft
Reservoir name	= Combined Pond	Max. Storage	= 14,755,340 cuft

Storage Indication method used. Wet pond routing start elevation = 805.20 ft.



POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Bull Run Fossil

Tennessee 36.0045 N 84.1545 W 810 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 2, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2004
Extracted: Wed Jun 24 2009

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Docs

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day
1	0.33	0.53	0.66	0.91	1.13	1.33	1.44	1.79	2.24	2.74	3.34	3.83	4.68	5.36	7.47	9.21	11.58
2	0.39	0.62	0.79	1.08	1.36	1.59	1.73	2.13	2.66	3.27	3.99	4.57	5.58	6.37	8.83	10.82	13.54
5	0.46	0.74	0.93	1.33	1.70	1.98	2.13	2.60	3.23	4.00	4.88	5.55	6.72	7.61	10.31	12.40	15.36
10	0.52	0.84	1.06	1.53	2.00	2.33	2.50	3.02	3.73	4.59	5.60	6.32	7.61	8.57	11.41	13.56	16.68
25	0.61	0.97	1.23	1.82	2.42	2.83	3.01	3.61	4.42	5.43	6.61	7.37	8.78	9.86	12.79	14.99	18.30
50	0.68	1.08	1.36	2.06	2.78	3.25	3.46	4.11	5.00	6.13	7.42	8.20	9.70	10.87	13.81	16.02	19.47
100	0.75	1.19	1.50	2.30	3.17	3.71	3.93	4.65	5.60	6.86	8.29	9.04	10.61	11.88	14.78	16.98	20.53
200	0.82	1.30	1.65	2.56	3.59	4.21	4.44	5.22	6.25	7.63	9.19	9.91	11.53	12.89	15.71	17.87	21.51
500	0.93	1.46	1.84	2.93	4.20	4.94	5.19	6.05	7.14	8.73	10.46	11.10	12.76	14.24	16.87	18.94	22.68
1000	1.01	1.59	2.00	3.24	4.73	5.57	5.83	6.74	7.90	9.63	11.49	12.04	13.71	15.29	17.72	19.70	23.49

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

* Upper bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day
1	0.36	0.58	0.73	1.00	1.25	1.47	1.59	1.96	2.42	2.96	3.61	4.13	5.02	5.74	7.92	9.71	12.16
2	0.43	0.69	0.86	1.19	1.50	1.76	1.91	2.33	2.89	3.53	4.32	4.93	5.99	6.82	9.36	11.41	14.22
5	0.51	0.81	1.02	1.46	1.87	2.18	2.35	2.83	3.50	4.31	5.29	5.99	7.23	8.14	10.93	13.08	16.14
10	0.57	0.92	1.16	1.68	2.19	2.57	2.75	3.28	4.03	4.96	6.07	6.82	8.18	9.18	12.09	14.30	17.54
25	0.67	1.06	1.34	1.99	2.65	3.10	3.30	3.92	4.77	5.87	7.17	7.97	9.45	10.58	13.57	15.83	19.27
50	0.74	1.18	1.49	2.24	3.04	3.57	3.79	4.47	5.39	6.64	8.10	8.91	10.47	11.69	14.69	16.95	20.52
100	0.82	1.30	1.64	2.51	3.46	4.07	4.30	5.05	6.05	7.47	9.08	9.88	11.51	12.82	15.76	18.00	21.69
200	0.90	1.42	1.80	2.80	3.92	4.61	4.87	5.67	6.75	8.37	10.13	10.90	12.58	14.00	16.82	19.01	22.79
500	1.01	1.60	2.01	3.20	4.59	5.41	5.70	6.57	7.74	9.67	11.66	12.34	14.04	15.59	18.16	20.26	24.15
1000	1.11	1.75	2.19	3.55	5.18	6.11	6.42	7.36	8.58	10.77	12.94	13.50	15.20	16.84	19.16	21.17	25.10

* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

* Lower bound of the 90% confidence interval Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day

Bull Run Fossil-Contour Areas

	Contour Area (sf)		
	Ash Pond	Stilling Pond	Total
el.			
784		3,000	3,000
786		9,000	9,000
788		158,500	158,500
790	3,300	207,400	210,700
792	132,000	223,700	355,700
794	315,000	236,800	551,800
796	432,000	250,000	682,000
798	570,000	279,700	849,700
800	692,000	331,700	1,023,700
802	764,000	338,500	1,102,500
804	867,000	355,875	1,222,875
806	928,000	372,100	1,300,100
808	1,480,000	386,350	1,866,350

Contour Areas from 2008 soundings survey

Appendix D

Stilling Pond Inflow and Outflow Hydrographs – ½ PMP Storm

Stilling Pond Surface Water Elevation Plot – ½ PMP Storm

HydraFlow Hydrograph Reports – ½ PMP Storm

NOAA 6-HR PMP Storm Data – HMR #53

Hydrograph Report

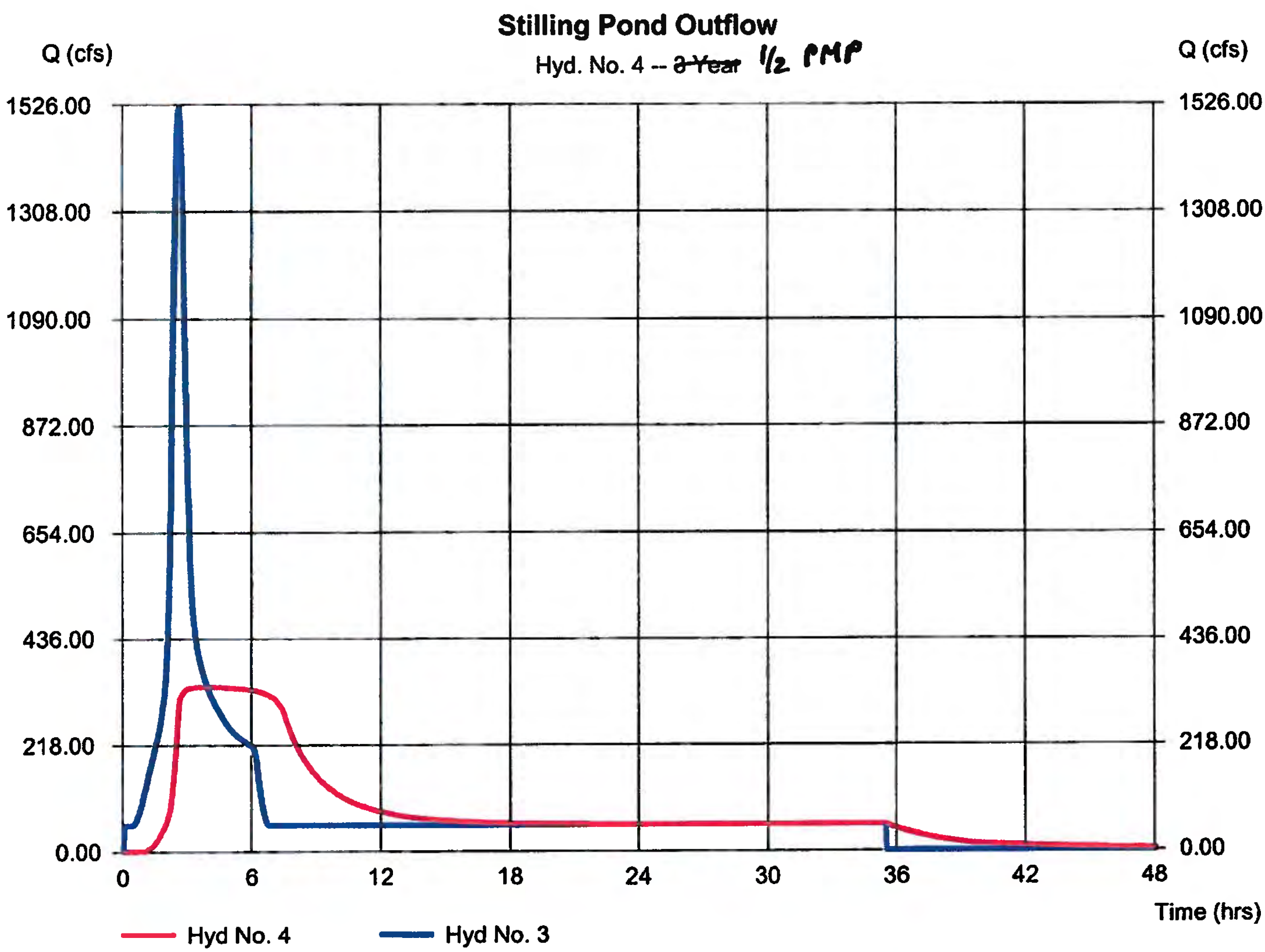
Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Dec 16, 2009

Hyd. No. 4

Stilling Pond Outflow

Hydrograph type	=	Reservoir	Peak discharge	=	336.15 cfs
Storm frequency	=	~~3 yrs~~ 1/2 PMP	Time to peak	=	234 min
Time interval	=	3 min	Hyd. volume	=	13,927,820 cuft
Inflow hyd. No.	=	3 - Base plus Storm	Max. Elevation	=	808.24 ft
Reservoir name	=	Combined Pond	Max. Storage	=	17,185,310 cuft

Storage Indication method used. Wet pond routing start elevation = 805.40 ft.



Hydrograph Report

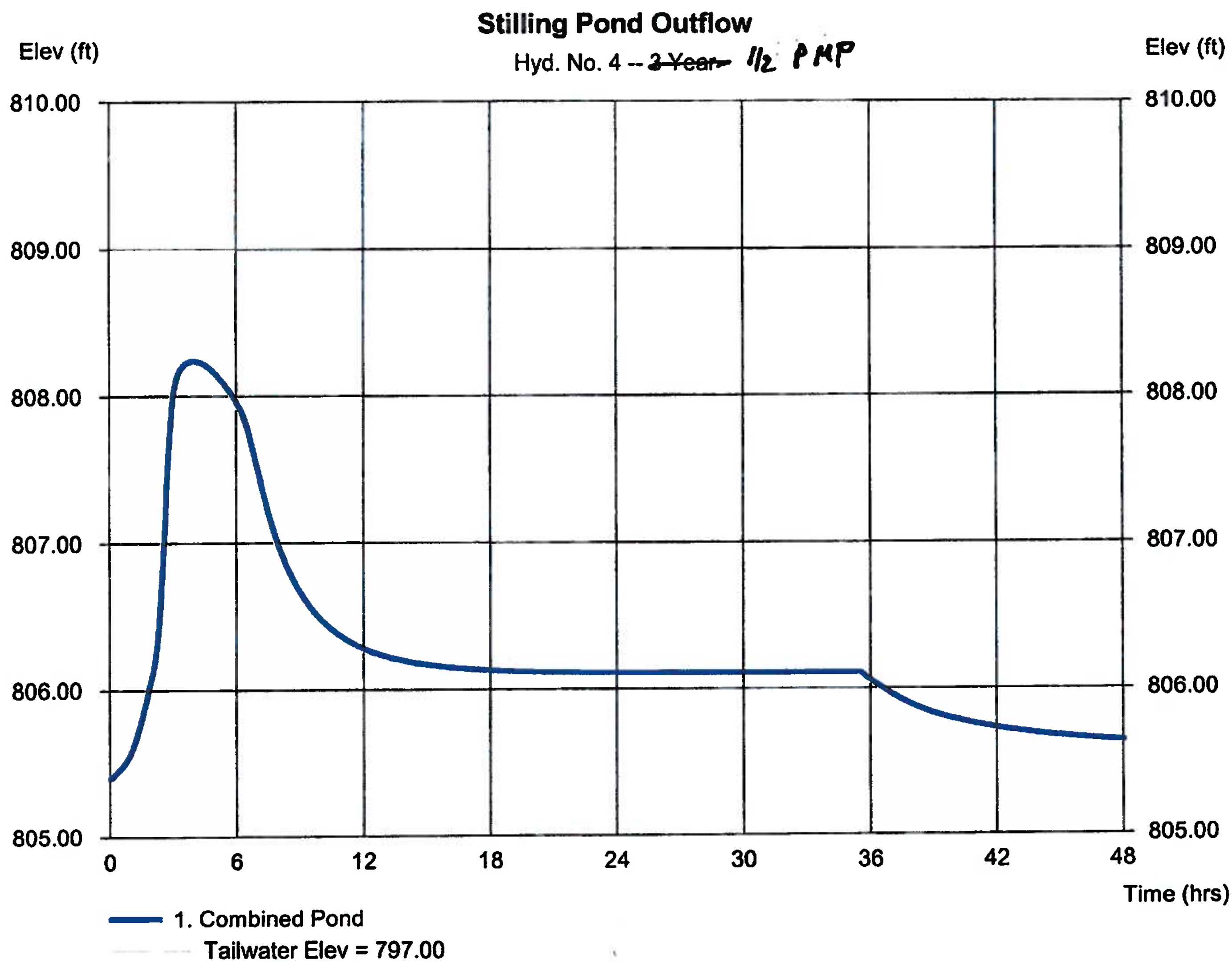
Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Dec 16, 2009

Hyd. No. 4

Stilling Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 336.15 cfs
Storm frequency	= ~~3 yrs~~ 1/2 PMP	Time to peak	= 234 min
Time interval	= 3 min	Hyd. volume	= 13,927,820 cuft
Inflow hyd. No.	= 3 - Base plus Storm	Max. Elevation	= 808.24 ft
Reservoir name	= Combined Pond	Max. Storage	= 17,185,310 cuft

Storage Indication method used. Wet pond routing start elevation = 805.40 ft.



Hydraflow Table of Contents

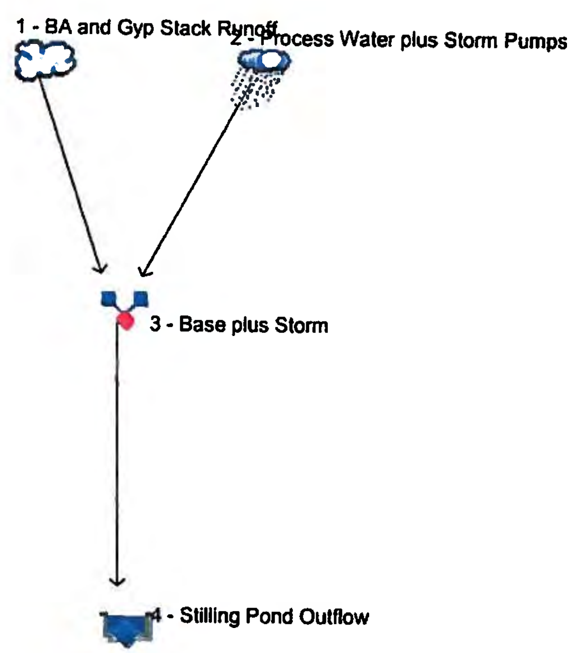
Ash Pond-half PMP storm rev 12-07-09.gpw

Hydraflow Hydrographs by Intelisolve v9.23

Wednesday, Dec 16, 2009

Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.23



Project: Ash Pond-half PMP storm rev 12-07-09.gpw	Wednesday, Dec 16, 2009

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.23

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	1468.20	3	156	7,322,860	----	------	------	BA and Gyp Stack Runoff
2	Manual	53.00	3	0	6,773,400	----	------	------	Process Water plus Storm Pumps
3	Combine	1521.20	3	156	14,096,260	1, 2	------	------	Base plus Storm
4	Reservoir	334.43	3	234	14,086,130	3	808.08	16,880,040	Stilling Pond Outflow

Ash Pond-half PMP storm rev 12-07-09.gpw	Return Period: ~~3 Year~~ 1/2 PMP	Wednesday, Dec 16, 2009

Hydrograph Report

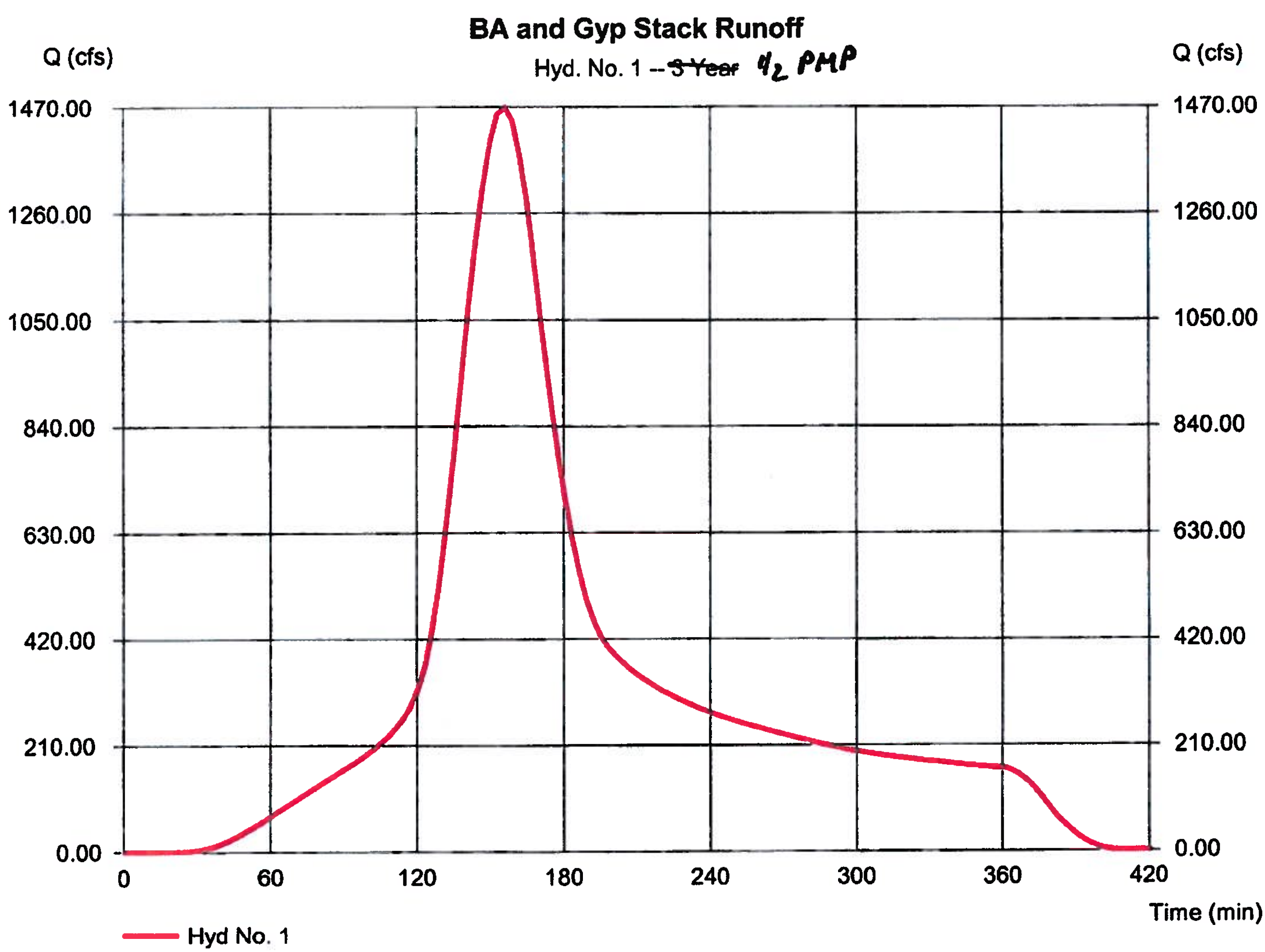
Hydraflow Hydrographs by Intelisolve v9.23 Wednesday, Dec 16, 2009

Hyd. No. 1

BA and Gyp Stack Runoff

Hydrograph type	= SCS Runoff	Peak discharge	= 1468.20 cfs
Storm frequency	= ~~3 yrs~~ 1/2 PMP	Time to peak	= 156 min
Time interval	= 3 min	Hyd. volume	= 7,322,860 cuft
Drainage area	= 157.000 ac	Curve number	= 87*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 25.80 min
Total precip.	= 14.50 in	Distribution	= SCS 6-Hr
Storm duration	= 6.00 hrs	Shape factor	= 484

* Composite (Area/CN) = [(40.000 x 100) + (87.000 x 87) + (30.000 x 71)] / 157.000



TR55 Tc Worksheet

Hyd. No. 1

BA and Gyp Stack Runoff

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.240		0.011		0.011		
Flow length (ft)	=	150.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.27		0.00		0.00		
Land slope (%)	=	20.00		0.00		0.00		
Travel Time (min)	**=**	**7.77**	**+**	**0.00**	**+**	**0.00**	**=**	**7.77**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=	0.00		0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	4.00		240.00		0.00		
Wetted perimeter (ft)	=	6.00		52.00		0.00		
Channel slope (%)	=	0.20		0.20		0.00		
Manning's n-value	=	0.020		0.020		0.015		
Velocity (ft/s)	=	2.54		9.28		0.00		
Flow length (ft)	=	2200.0		2000.0		0.0		
Travel Time (min)	**=**	**14.44**	**+**	**3.59**	**+**	**0.00**	**=**	**18.03**

Total Travel Time, Tc .... 25.80 min

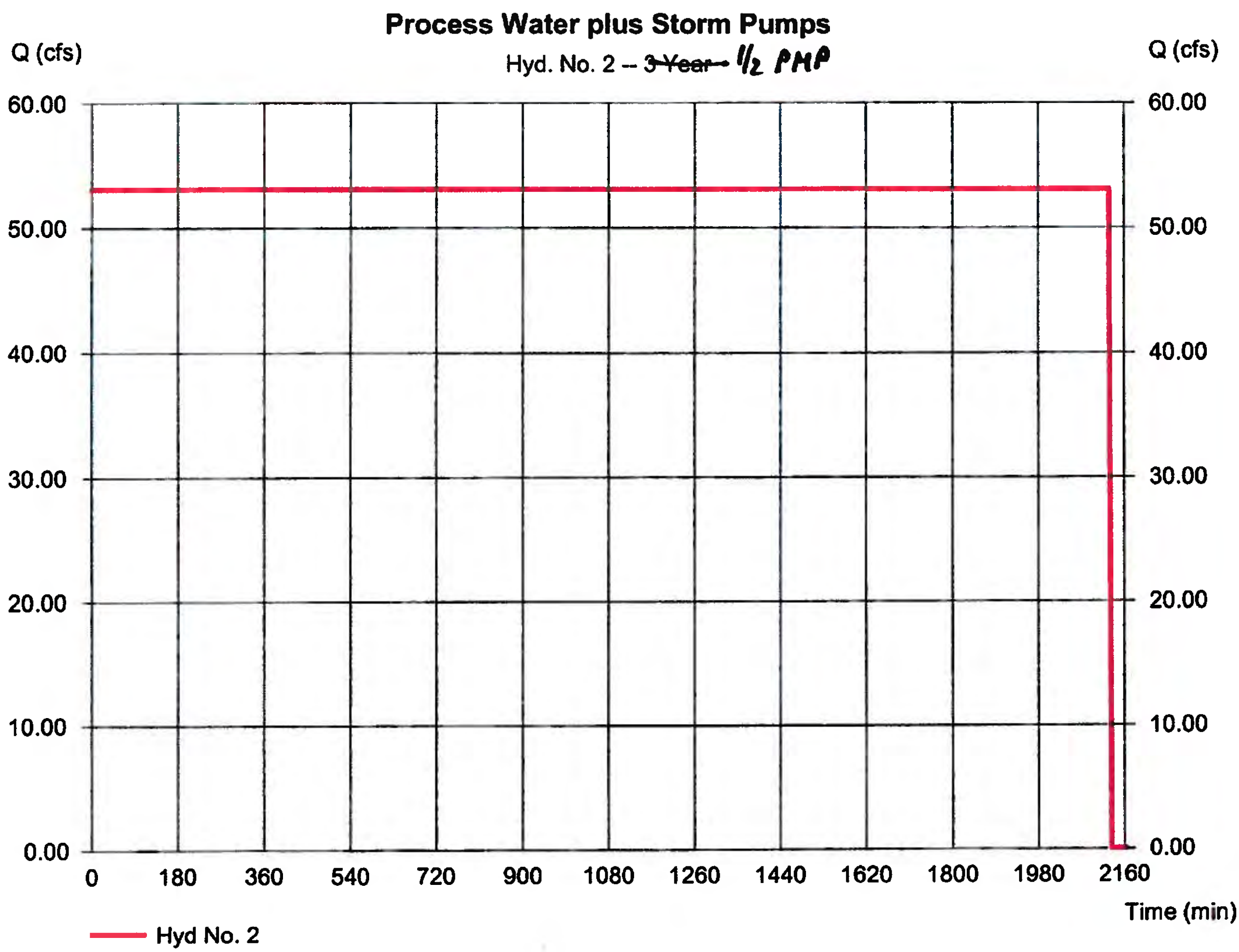
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Dec 16, 2009

Hyd. No. 2

Process Water plus Storm Pumps

Hydrograph type	= Manual	Peak discharge	= 53.00 cfs
Storm frequency	= ~~3 yrs~~ 1/2 PMP	Time to peak	= 0 min
Time interval	= 3 min	Hyd. volume	= 6,773,400 cuft



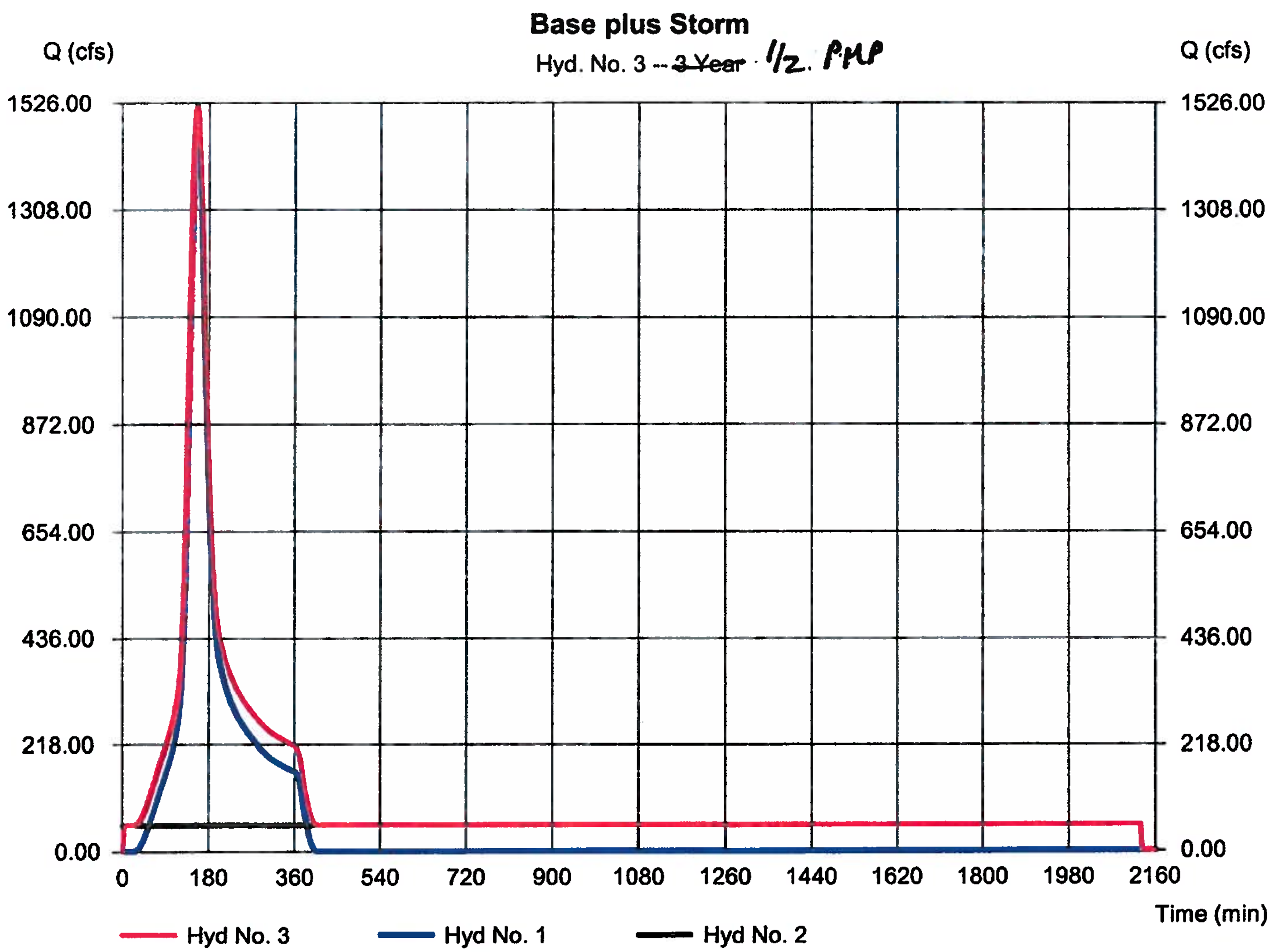
Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.23 | Wednesday, Dec 16, 2009

Hyd. No. 3

Base plus Storm

Hydrograph type	= Combine	Peak discharge	= 1521.20 cfs
Storm frequency	= ~~3 yrs~~ 1/2 PMP	Time to peak	= 156 min
Time interval	= 3 min	Hyd. volume	= 14,096,260 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 157.000 ac



Hydrograph Report

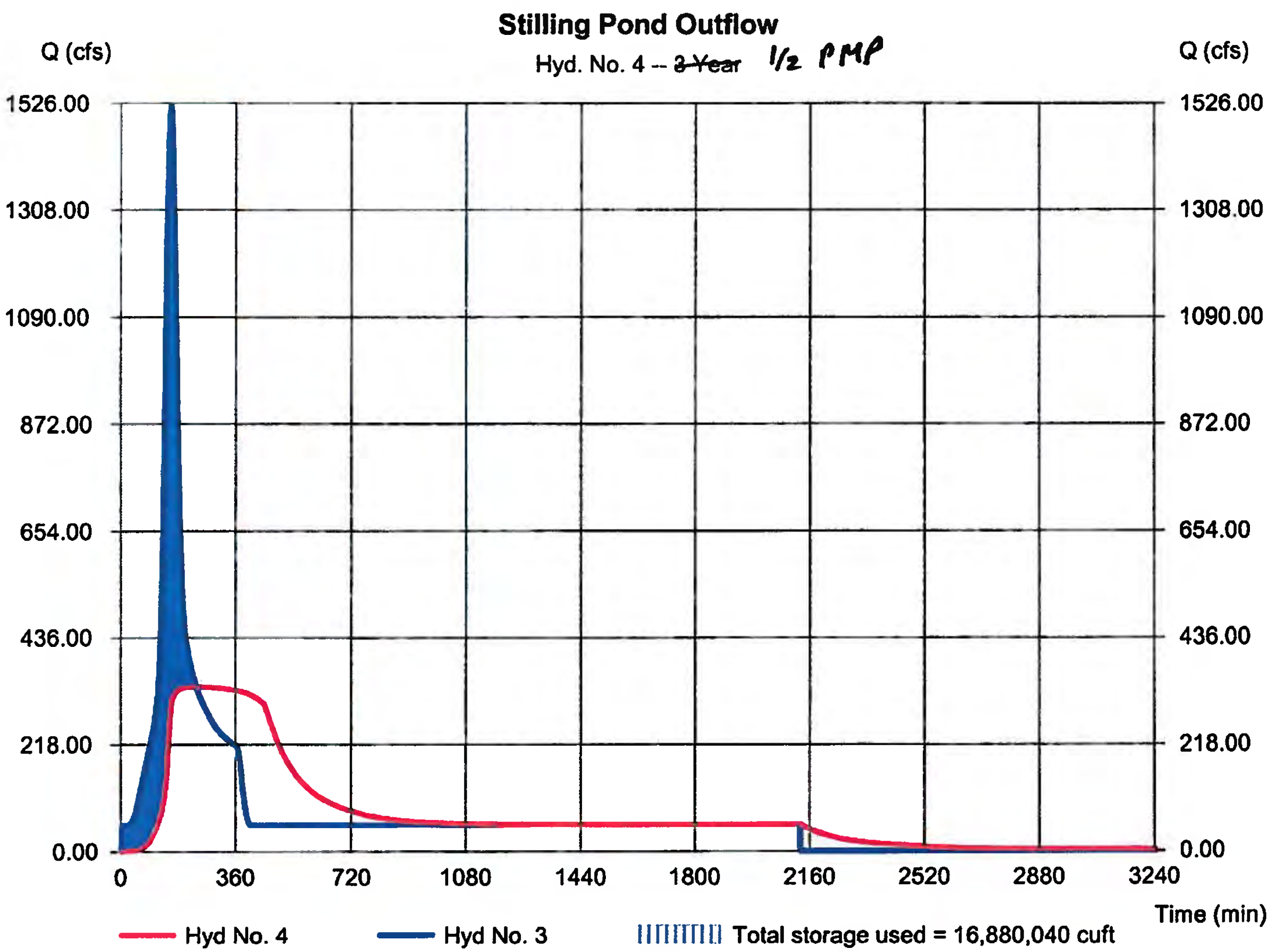
Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Dec 16, 2009

Hyd. No. 4

Stilling Pond Outflow

Hydrograph type	= Reservoir	Peak discharge	= 334.43 cfs
Storm frequency	= ~~3 yrs~~ 1/2 PMP	Time to peak	= 234 min
Time interval	= 3 min	Hyd. volume	= 14,086,130 cuft
Inflow hyd. No.	= 3 - Base plus Storm	Max. Elevation	= 808.08 ft
Reservoir name	= Combined Pond	Max. Storage	= 16,880,040 cuft

Storage Indication method used. Wet pond routing start elevation = 805.20 ft.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.23 — Wednesday, Dec 16, 2009

Pond No. 1 - Combined Pond

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 784.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	784.00	3,000	0	0
2.00	786.00	9,000	11,463	11,463
4.00	788.00	158,500	136,832	148,295
6.00	790.00	210,700	367,927	516,222
8.00	792.00	355,700	560,053	1,076,275
10.00	794.00	551,800	900,263	1,976,538
12.00	796.00	682,000	1,231,380	3,207,918
14.00	798.00	849,700	1,528,478	4,736,396
16.00	800.00	1,023,700	1,870,514	6,606,910
18.00	802.00	1,102,500	2,125,500	8,732,410
20.00	804.00	1,222,880	2,324,110	11,056,520
22.00	806.00	1,300,100	2,522,330	13,578,850
24.00	808.00	1,866,350	3,149,120	16,727,970
26.00	810.00	2,000,000	3,865,200	20,593,170

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 36.00	0.00	0.00	0.00
Span (in)	= 36.00	0.00	0.00	0.00
No. Barrels	= 3	0	0	0
Invert El. (ft)	= 793.00	0.00	0.00	0.00
Length (ft)	= 106.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

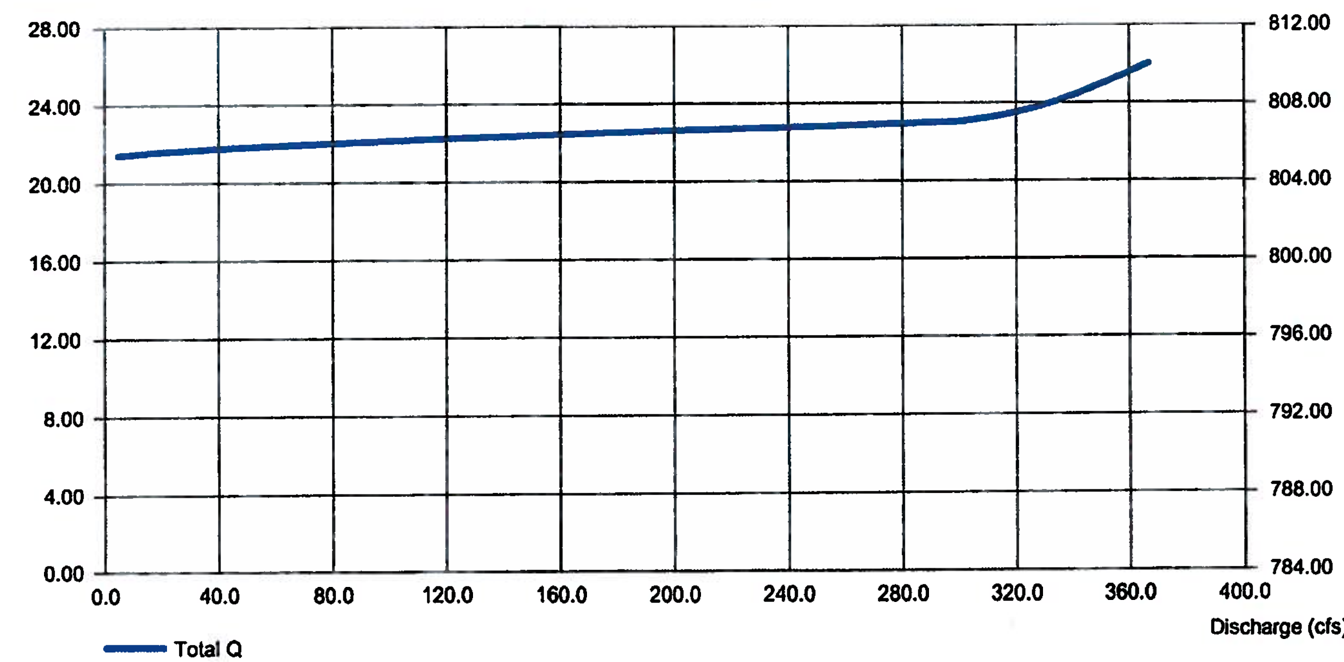
	[A]	[B]	[C]	[D]
Crest Len (ft)	= 14.14	14.14	14.14	Inactive
Crest El. (ft)	= 805.42	805.34	805.22	807.00
Weir Coeff.	= 3.33	3.33	3.33	2.60
Weir Type	= Riser	Rect	Rect	Broad
Multi-Stage	= Yes	Yes	Yes	No

Exfil.(in/hr) = 0.000 (by Contour)

TW Elev. (ft) = 797.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Discharge



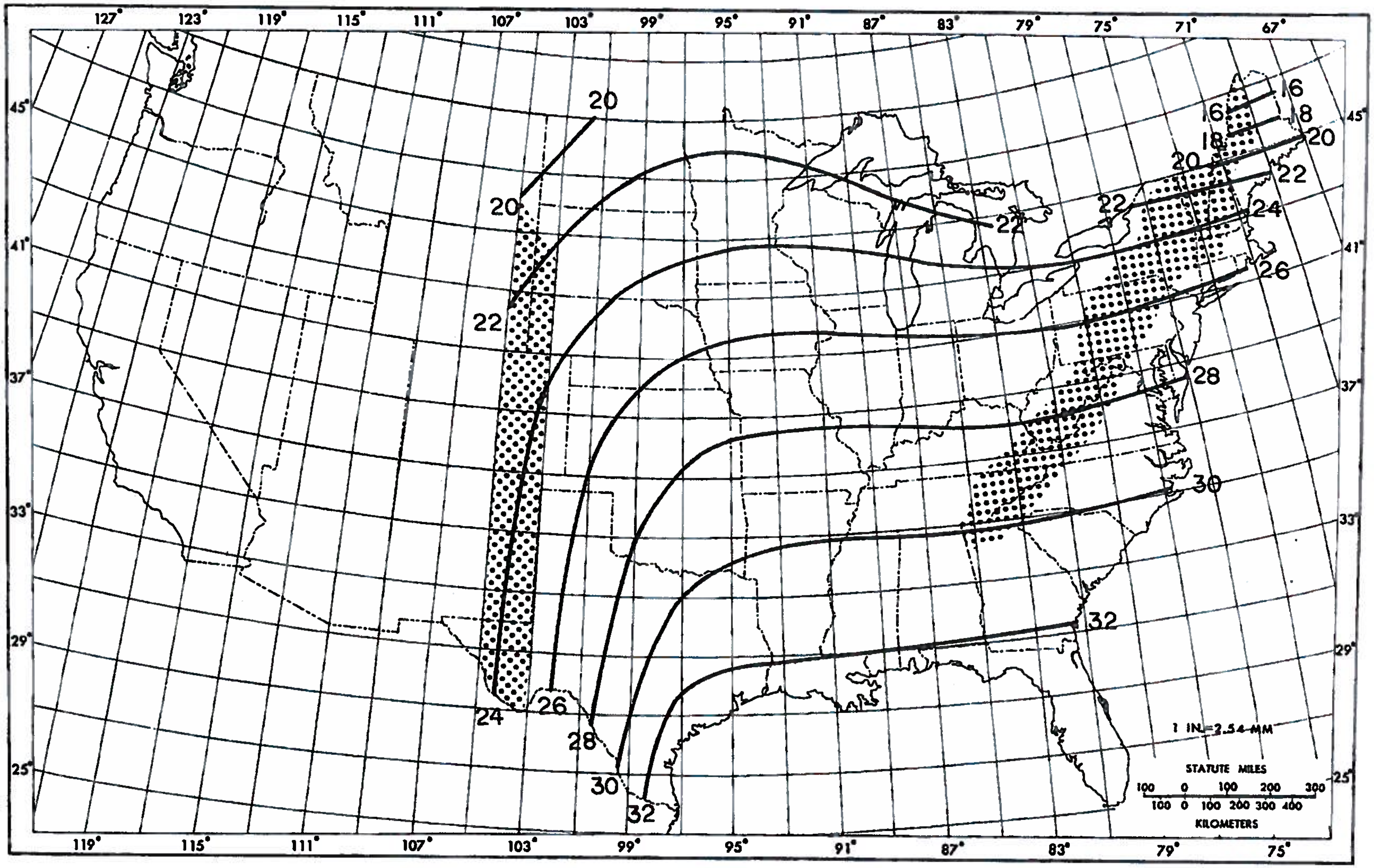


Figure 21.--6-hr 10-mi^2 PMP, July and August, (in.).

APPENDIX A

Document 5

Stantec. (April 12, 2010). Report of Geotechnical Exploration

Stantec

Report of Geotechnical Exploration

Bottom Ash Disposal Area 1
Gypsum Disposal Area 2A and
Fly Ash Pond Area 2
Bull Run Fossil Plant
Anderson County, 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

April 12, 2010

Stantec Consulting Services Inc.
1409 North Forbes Road
Lexington, KY 40511-2050
Tel: (859) 422-3000
Fax: (859) 422-3100

April 12, 2010 rpt_002_172679015

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

Re: Report of Geotechnical Exploration
Bottom Ash Disposal Area 1
Gypsum Disposal Area 2A and
Fly Ash Pond Area 2
Bull Run Fossil Plant
Anderson County, Tennessee

Dear Mr. Snider:

As requested, Stantec Consulting Services Inc. (Stantec) has completed the geotechnical exploration of the Bottom Ash Storage Area, Gypsum Storage Area and Main Ash Pond at the Bull Run Fossil Plant located in Clinton, Anderson County, Tennessee. The purpose of the exploration was to perform a general evaluation of the stability of the dikes that form the different structures. This report documents the subsurface conditions, results of laboratory testing, findings from historical document reviews, results of our seepage and slope stability analyses, and our conclusions and recommendations. These services were performed under Engineering Service Request ESR 909 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, feel free to contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Hugo R. Aparicio, PE
Principal

/rdr

Report of Geotechnical Exploration

Bottom Ash Disposal Area 1
Gypsum Disposal Area 2A and
Fly Ash Pond Area 2
Bull Run Fossil Plant
Anderson County, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

April 12, 2010

Report of Geotechnical Exploration

Bottom Ash Disposal Area 1
Gypsum Disposal Area 2A and
Fly Ash Pond Area 2
Bull Run Fossil Plant
Anderson County, Tennessee

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Executive Summary

Stantec has completed a geotechnical exploration of the Bottom Ash Disposal Area (Area 1), Gypsum Disposal Area (Area 2A) and Fly Ash Pond (Area 2) at the Bull Run 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 of the three Coal Combustion Byproduct (CCB) storage facilities.

The area occupied by the three facilities was initially developed in the 1960s by constructing dikes in the floodplain adjacent to Clinch River (Melton Hill Reservoir) and its tributary Bull Run Creek. The original facility was divided into two areas, Area 1 and Area 2, separated by a drainage channel. The tributary stream was relocated to increase the size of Area 2. At first both areas served as sluiced ash disposal facilities. The dike was initially built to a crest elevation of 800 feet, making it an approximately 15-foot high barrier. In the mid 1970s, the dikes were raised to their current elevation (810 feet) and a divider dike was added within Area 2 to create a stilling pond in the southwest corner. Starting in 1980, Area 1 was used for different dry and wet ash disposal activities, and since 2004 it has received all bottom ash not sold offsite. In 1981, an interior dike was constructed within Area 2 to form Area 2A. Area 2A received sluiced ash until about 1989; thereafter, it received dry bottom ash from Area 1 until 2004, when it became inactive.

The Gypsum Disposal Area was constructed within Area 2A starting in 2006. This facility went online in late 2008. The principal features constructed prior to going online were a dike to raise the west, south and east sides of Area 2A up to elevation 835'; grading the bottom so it would drain toward the south; and installing perimeter and finger under-drains to control seepage. According to design drawings, the dike was built of compacted bottom ash on top of different ash deposits, including sluiced and dredged fly ash. Additional measures were implemented to construct the south dike, as this area of the dike was underlain by sluiced ash deposits and located next to the fly ash pond (Area 2). Furthermore, according to design drawings and 2009 hydrographic survey information, the bottom of the pond is shallow and flat next to the east side of the south dike, but slopes downward toward the center of the ash pond next to the west side of the south dike.

In early 2007, seeps developed along the south slope of Area 2A causing sloughing near the toe of the slope. As a result, several changes were implemented to under-drain features installed initially to control seepage across the south dike. Although the sloughing was repaired by early 2008, it reappeared in October 2009. The changes reportedly consisted of installing an extensive bottom drainage system within the pool area. Water collected by this system is to be discharged into a header pipe installed near and parallel to the interior toe of the south dike. In turn, water collected by the header pipe is supposed to discharge into the existing spillway pipes of Area 2A.

Design and as-built drawings show the section of the initial dike that formed Areas 1 and 2 (up to elevation 800 feet) to be uniform. Conversely, the expansion of the dike to elevation 810 feet varied in cross section as well as foundation conditions according to location. The exterior slope of the initial dike remains under water below elevation 795 feet, the normal pool elevation of Melton Hill Reservoir.

The geotechnical exploration consisted of advancing 93 borings across the disposal areas. The subsurface investigation included Standard Penetration Testing (SPT) in most of the borings, and Cone Penetration Tests (CPT) and undisturbed soil sampling in selected borings. A total of 42 piezometers and 5 slope inclinometers were installed in some of the borings.

Seepage analyses were performed on selected Areas 2 and 2A dike cross-sections to estimate seepage gradients for the evaluation of piping potential and pore water pressures within the dike and foundation soils used in slope stability analyses. The analyses were performed for steady-state seepage through saturated and unsaturated soils. The applied boundary conditions represented the normal and observed maximum storage pool elevations in the Fly Ash Pond (806.5 feet) and Gypsum Disposal Area (825 feet), respectively. The lowest factors of safety against piping, computed for the surficial 3 to 5 feet of soil in these areas, ranged from 2.4 for one Area 2 dike section to 1.8 for a cross section of Area 2A. Based on USACE design criteria for dams (EM 110-2-1901), the target minimum factor of safety against piping is 3.0.

The stability of the dikes was evaluated using two-dimensional limit equilibrium methods of analysis, assuming static, long-term and fully drained conditions within the existing dikes and foundation soils. Stability analyses were performed for several existing cross sections using soil properties selected based on in-situ, as well as laboratory testing results, phreatic levels obtained from piezometer readings, and pore water pressures within the dike and foundation materials as estimated by the seepage analyses. Stability analyses of future expansions of the Gypsum Disposal Area were not performed as expansion plans for this area may vary depending on the final closure design.

The slope stability calculations produced factors of safety against sliding below 1.5 (which is the minimum acceptable value that current USACE criteria requires for long-term loading conditions on similar dikes) for the south dike of the Gypsum Disposal Area and the perimeter dikes constructed initially to form Area 2. The low factors of safety for the south slope of Area 2A are caused by the low shear strength of the foundation material (sluiced ash), relatively high phreatic levels near the dike toe, and the sloping ash pond pool bottom next to the west side of the slope. The low factors of safety for Area 2 perimeter dikes are a result of high phreatic levels caused by the ash pond pool level, lack of under-drain features to control seepage across the dike, exterior slope steepness of the dikes, and shear strength of the dike material.

The factor of safety against sliding for the south dike of Area 2A can be raised to the minimum acceptable value by buttressing the toe area using crushed stone and armoring the slope. The buttressing will require placing crushed stone on fly ash deposited on the bottom of the ash pond. In view of its soft and wet conditions, the surface of the fly ash needs to be stabilized prior to building the buttress. Applicable stabilization measures include placing a layer of geo-grid over the ash and then placing thin layers of sand or fine crushed stone at a prescribed rate of construction. Sand is required in areas where the factor of safety against piping needs to be improved. A work plan to construct this buttress is being prepared parallel with this report.

The factor of safety against sliding and piping for the perimeter dike of Areas 2 and 2A can be raised to acceptable levels by different methods or a combination thereof. One measure that can be implemented immediately is to lower the normal pool elevation of the ash pond permanently. Lowering this normal pool elevation approximately 6 feet would reduce the seepage across the perimeter dike along the south and west sides of the ash pond/stilling basin, which in turn would raise the factor of safety against deep seated slope failure to above 1.5, the minimum acceptable value. Constructing a buttress along the exterior slope of the lower perimeter dike would also raise the factors of safety above minimum acceptable levels, including those of the perimeter dike system along the west side of the gypsum disposal area.

TVA can also consider constructing a slurry wall within the upper dike to lower the phreatic surface across the perimeter dikes (from the southeast corner of the ash pond to the northwest corner of the gypsum stack) and obtain higher factors of safety. However, unless the pool level is also lowered near elevation 795 feet, this measure alone would not raise the factors of safety of the ash pond dikes to adequate levels. In the case of the perimeter dike system west of the gypsum disposal area, flattening the slope of the upper perimeter dike would need to be implemented in addition to the slurry wall in order to raise the factor of safety to 1.5.

This report presents the results of stability analyses performed along five cross sections of the perimeter dike after the different methods discussed above, by themselves or combined, are included in the analyses. Lowering the normal pool elevation of the fly ash pond permanently to reduce seepage across the dike appears to be the most effective method to raise the factors of safety of the fly ash pond/stilling basin dike system. Buttressing of the exterior lower perimeter dike slope or combining the use of a slurry wall with flattening of the upper perimeter dike slope appear to be the most practical measures to raise the factor of safety of the perimeter dike system located west of the gypsum stack. A work plan to attain acceptable factors of safety against sliding and piping for the perimeter dike of Areas 2 and 2A should be prepared based on more detailed analyses and additional geotechnical information.

Existing ditches controlling exterior surface drainage of Areas 1, 2 and 2A lack adequate positive grading. Likewise, there are slopes along the north side of Area 2A and west side of Area 1, above elevation 810 feet, which are steeper than 2:1 and pose a concern in terms of maintenance activities. Work plans have already been prepared to grade back these steep slope areas and address deficient surface runoff conditions along the west and south sides of Area 1 and all sides of Area 2A. Implementation of these work plans is scheduled to start April 2010. Surface runoff improvements along the exterior slope of Area 2 should be included as part of a work plan to raise the factors of safety against sliding and piping.

Report of Geotechnical Exploration

Bottom Ash Disposal Area 1
Gypsum Disposal Area 2A and
Fly Ash Pond Area 2
Bull Run Fossil Plant
Anderson County, Tennessee

1. Introduction

1.1. General

Subsequent to the failure of the dredge cell at the Kingston Fossil Plant in December of 2008, the Tennessee Valley Authority (TVA) contracted with Stantec Consulting Services Inc. (Stantec) to perform stability evaluations for the coal combustion byproduct (CCB) storage facilities at each of its coal fired power plants. These facilities consist of ash ponds, scrubber sludge (gypsum) ponds, wet ash dredge cells, dry ash stacks, and gypsum stacks. A number of the facilities have completed their design life and are abandoned; however, a majority of the facilities are currently receiving by-products.

Initial efforts consisted of site visits with TVA personnel and review of historical documents to provide recommendations for immediate risk reduction measures and to identify sites/facilities that require further evaluation. The final reports for these efforts, labeled as Phase I of the stability evaluations, were submitted in June of 2009. In general, these reports recommend conducting geotechnical explorations for CCB disposal facilities and performing engineering analyses of existing configurations for comparison against current dam safety criteria.

1.2. Plant Location and Layout of CCB Disposal Facilities

The Bull Run Fossil Plant (BRF) is located in Anderson County and is situated along the banks of Clinch River (Melton Hill Reservoir) and Bull Run Creek in Clinton, Tennessee. Nearby cities include Oak Ridge, which is located approximately six miles to the west, and Knoxville, which is located approximately 12 miles to the southeast. Figure 1 provides an approximate location of the plant and its vicinity.

The construction of the Bull Run Fossil Plant began in 1962 and was completed in 1966. Initial development of the CCB disposal areas covered in this report was part of the original plant construction. The plant has one coal-fired generating unit, consumes approximately 7,300 tons of coal per day, and generates about six billion kilowatt-hours of electricity each year.

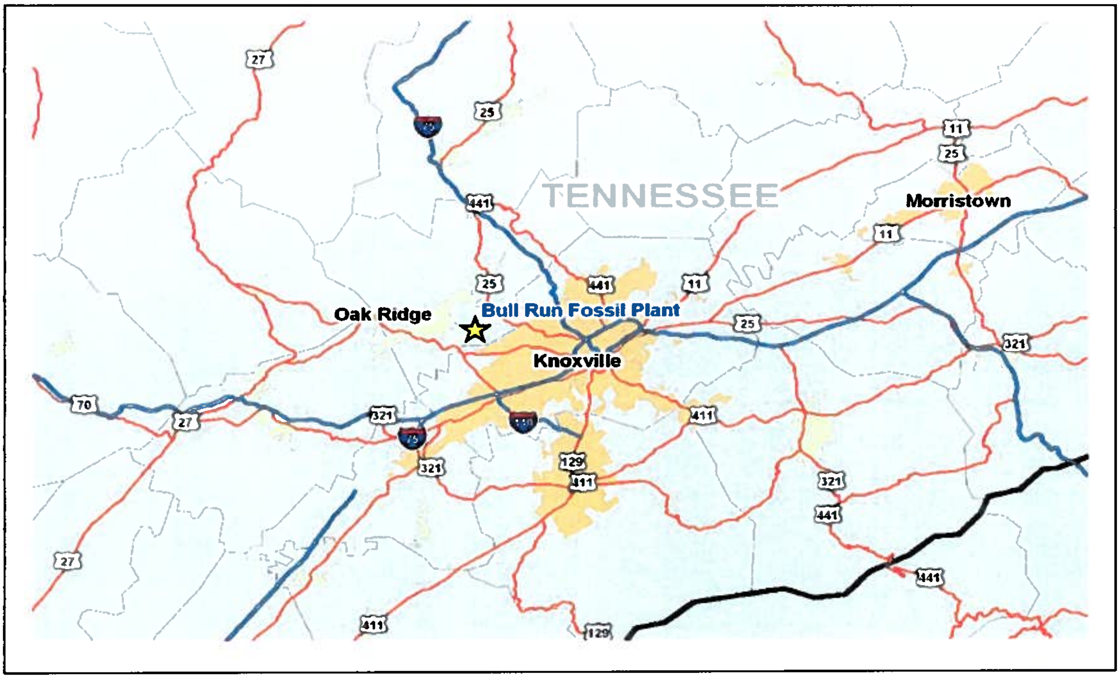
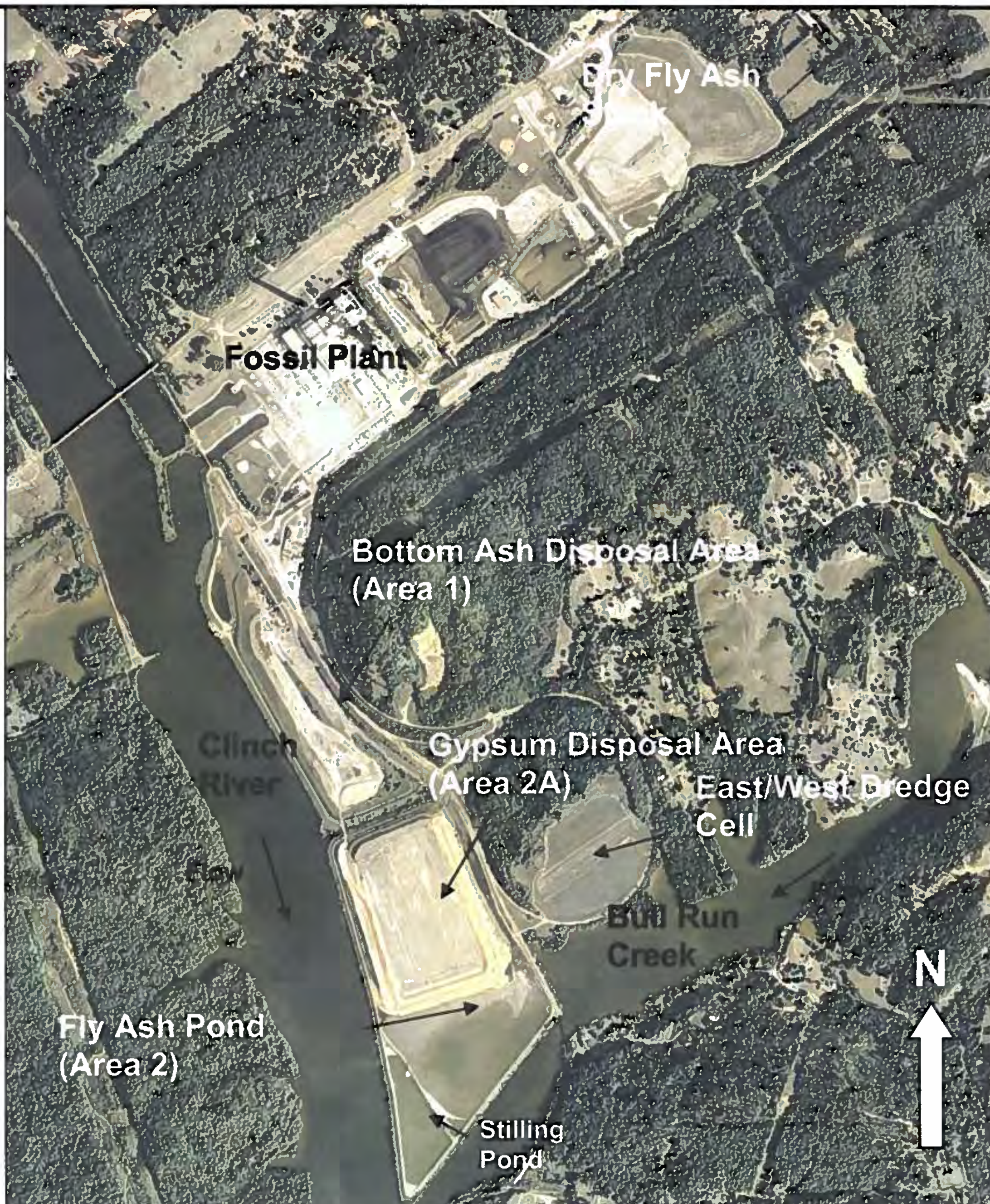


Figure 1. Site Vicinity Map

The Bull Run Fossil Plant currently utilizes four CCB storage facilities. The location of these facilities, along with other pertinent features, is provided in Figure 2. This report focuses on three of the CCB facilities; the Bottom Ash Disposal Area (also known as Area 1), Gypsum Disposal Area (also known as Area 2A) and the Fly Ash Pond (also known as Area 2). The Fly Ash Pond includes a Stilling Pond. The fourth CCB storage facility is a Dry Ash Disposal Area located on the northeast side of the plant. This fourth area is not part of this exploration. At one time the CCB disposal facilities also included an area known as the East/West Dredge Cell located east of Area 2. This dredge cell was closed and has remained inactive since 1995.



Bull Run Fossil Plant
Bottom Ash Disposal Area 1
Gypsum Disposal Area 2A and
Fly Ash Pond Area 2
Anderson County, Tennessee

Stantec

Figure 2. Aerial View of Coal Combustion By-Product Storage Facilities at BRF

1.3. Scope of Work

This report addresses the geotechnical exploration performed to support Stantec's engineering evaluation of three of the CCB disposal facilities at the Bull Run Fossil Plant. The scope of work performed included the following tasks:

- Review of available documentation to support the development of a work plan for the geotechnical exploration and engineering evaluations.
- Survey services to develop dike cross-sections – performed by TVA surveyors.
- Development and planning of the geotechnical exploration.
- Execution of a drilling program to develop the subsurface lithology and provide samples for subsequent laboratory testing.
- Installation of piezometers for monitoring water levels in the dikes and foundation soils, and slope inclinometers for monitoring subsurface movement along the south slope of the Gypsum Disposal Area.
- Execution of a laboratory testing program to develop strength and permeability data to support engineering analyses.
- Instrumentation monitoring program to observe the fluctuations of water levels in the installed piezometers and movements in the slope inclinometers over a period of six months.
- Perform seepage and stability analyses on the existing dike geometry. As previously discussed, the initial development of the CCB disposal areas covered in this report occurred in the late 1960's and these areas have been in use since that time. As such, the slope stability and seepage analyses model static, long-term, steady-state seepage conditions. Seismic stability evaluations were beyond the scope of work for this effort.
- Prepare a geotechnical report documenting the scope of work, outlining the results of the exploration, discussing the engineering analyses, and providing applicable recommendations relative to the existing slope conditions observed at the site.

Parallel with the preparation of this report, Stantec has also developed a workplan to address the stability of the south slope of the Gypsum Storage Area (Area 2A). The workplan includes measures that once implemented, will result in an acceptable factor of safety against sliding. The engineering analyses associated with this workplan are discussed in this report.

2. General Site Description and Geologic Setting

2.1. Site Location and Description

The Bull Run Fossil Plant is located in the eastern half of Tennessee just northwest of the city of Knoxville. The plant is situated next to the east bank of Clinch River, with the three CCB disposal areas located mostly on the floodplain of the river and its tributary, Bull Run Creek. The local topography is relatively level, with the constructed dikes originally rising about 0 to 40 feet above the surrounding terrain. Based on available drawings dating to the time of the construction of the CCB disposal areas (see Reference No. 1 in Table 1), the natural ground elevation within the CCB disposal areas varied from approximately 770 to 820 feet above Mean Sea Level (MSL) prior to excavating native (borrow) materials for construction of the dikes.

The original construction of the perimeter dikes included the relocation of Bull Run Creek, which meandered across Areas 2 and 2A, and constructing a channel that separated these areas from Area 1. Bull Run Creek was relocated by constructing a straight channel traversing parallel to the south dike of Area 2. The channel separating Area 1 from Areas 2 and 2A was apparently constructed to convey surface drainage from the areas east of the storage facilities to Clinch River.

2.2. Geologic Setting

The Bull Run Fossil Plant is located within the Valley and Ridge Province of the Appalachian Highlands. The three CCB disposal facilities lie within a peninsula bordered by the Clinch River to the west and Bull Run Creek to the south. Accordingly, the majority of the site is underlain by alluvial deposits consisting of silts and clays with varying amounts of sand. The remaining portion of the plant is underlain by residual soils resulting from in-place weathering of the parent Ordovician and Cambrian aged limestone and calcareous shale bedrock formations.

The topography and geology within the vicinity of the plant are typical of the Valley and Ridge Physiographic Province, characterized by parallel ridges trending northeast to southwest and underlain by more erosion resistant siltstones, sandstones, and dolomites, and valleys underlain by the less erosion resistant shales and limestones. The area has been subjected to several tectonic events that have caused folding, fracturing and faulting of the bedrock throughout the region. A succession of thrust faults within the area has resulted in several bedrock units being present beneath the plant footprint.

The plant straddles Bull Run Ridge, which is underlain by the Rome Formation consisting of arenaceous shale and sandstone beds. The valley to the south of Bull Run Ridge is underlain by interbedded argillaceous shales and siltstones of the Conassauga Group, while the valley to the north of the ridge is underlain by several sub-units of the Chickamauga Formation consisting of limestone, shaley limestone, calcareous shale, and calcareous siltstones. The Chickamauga formation dips about 40° to the southeast, is moderately to highly jointed and faulted, and is moderately solutioned along the joints and bedding planes. These solution features produce near vertical “slots” filled with soft clay which can extend to significant depths.

While geologic information for the CCB disposal area sites is only available in typically broad descriptions, a foundation investigation (see Reference 4 in Table 1) performed within the Bull Run plant area as part of the original project provides a more in depth description of the geology and its potential impacts on the construction of the different plant unit foundations. These potential impacts, such as exposure of clay-filled cavities or open cavities, were related to relatively deep bedrock excavation required to construct the plant building foundations. Since similar excavation into the bedrock was not required for the construction of the CCB disposal areas, similar impact of the geology would not necessarily apply to the performance of the CCB structures. Furthermore, available historical project information does not mention the presence of karst activity within the CCB disposal areas.

3. Review of Available Information

3.1. General

As part of the Phase 1 site assessments, Stantec engineers and geologists reviewed documents provided by TVA with the objective of developing an understanding of the development and history of the plant and CCB storage facilities. The documents reviewed include design drawings, design and construction memoranda, aerial photographs, survey/topographical data, and annual inspection 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 subject CCB storage facilities. A copy of the documents listed in Table 1 is presented in Appendix A.

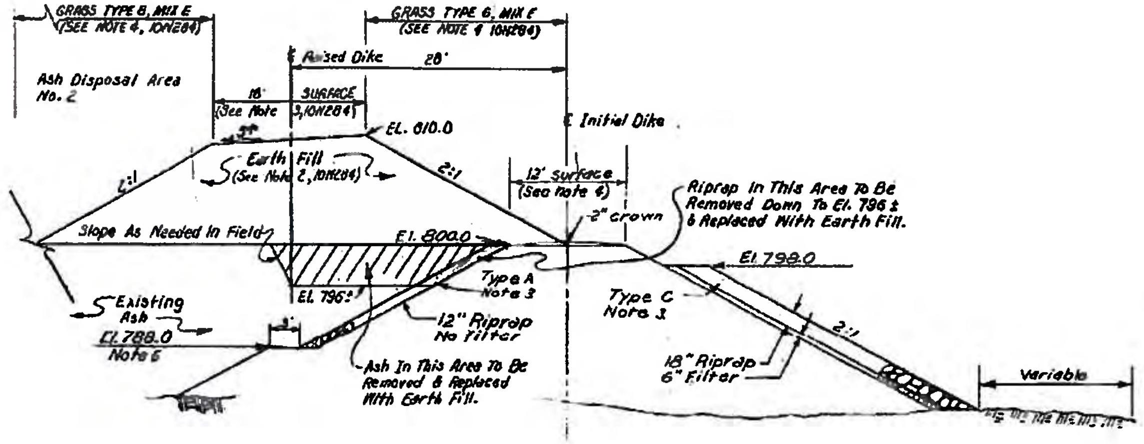
3.2. Development of CCB Disposal Areas

Reference 1 is a design drawing titled "*Ash Disposal Areas and Dikes*", originally dated April 1962 and revised for the fourteenth time in February, 1977. This drawing was prepared by TVA and identifies several historic changes to the original layout of the ash storage facilities, including addition of rip-rap protection in 1966, raising the dike in 1975, constructing a divider dike in 1975, and relocating the dike in 1977. The drawing is believed to have been used mainly for constructing the starter dike for Areas 1 and 2. A summary of the quantities for construction of the initial dike are included on this drawing along with notes indicating that the initial dike for Areas 1 and 2 was constructed up to an elevation of 800 feet. This drawing also appears to illustrate the original ground contours prior to any development of the ash disposal facility.

Reference 2 is a drawing titled "*Ash Disposal Areas Supplemental Details Sheet 3*," originally dated April, 1962 and last revised in May, 1975. This design drawing includes typical cross sections of the dike impoundments for Areas 1 and 2 associated with Drawing 10N213 (Reference 1). This drawing was revised in 1975 to include raising the dike and limits of ash removal. The section shown below in Figure 3 illustrates the south dike of Area 2 having a crest elevation of 800 feet and external slopes at 2H:1V (Horizontal:Vertical). The raised dike is also show on this section with a maximum crest elevation of 810 feet and sloped embankments at 2H:1V.

Table 1. List of Documents Reviewed for Geotechnical Exploration

Reference No.	Document Name	Type of Document	Dated	Agency	TVA Reference No.
1	Ash Disposal Areas and Dikes	Design/As-Built Drawing	April 1962 (Revised 1977)	TVA	10N213
2	Ash Disposal Areas Supplemental Details Sheet 3	Design/As-Built Drawing	April 1962 (Revised 1975)	TVA	10N214
3	Ash Disposal Areas Supplemental Details Sheet 4	Design/As-Built Drawing	April 1975 (Revised 1975)	TVA	10N284
4	Foundation Investigation for the Bull Run Steam Plant	Report	January 1962	TVA	NA
5	Gypsum & Ash Disposal	Design Drawings	June 2008	TVA	10W297 1 through 40
6	Gypsum & Ash Disposal	Design Drawings	December 2008	TVA	10W298 1 through 42
7	FPG- Design Change Notice	Notes and Design Drawings	February 2008	TVA	BRF-08-1052-001 and Drawings. 10W297-5A, 10W297-27A and 10W297-32A
8	Report of Geotechnical Exploration	Report	July 2004	MACTEC	NA
9	BRF Plant FGD Disposal Area Dike Seepage and Stability	MS Power Point Slides	April 2007	Geosyntec	NA
10	BRF Plant Gypsum Stack and Ash Disposal Dike Field Observations and Recommended Actions	Letter	February 2009	Stantec	NA
11	Ash Ponds 1 & 2A Soil Investigation	Report	March 1985	TVA	NA
12	Report of a Geotechnical Exploration	Report	March 1989	Tri-State Testing & Drilling	NA



DIKE SECTION C-C

Figure 3. Ash Disposal Area 2 – Dike Construction (Drawing 10N213)

Reference 3 is a drawing titled "Ash Disposal Areas Supplemental Details Sheet 4," originally dated April, 1975 and last revised in July, 1975. This design drawing includes typical cross sections of the dike impoundments for Area 2 also associated with Drawing 10N213 (Reference 1). This drawing was revised in 1975 to include an added divider dike and the addition of a stilling pool in the southwestern corner of Area 2. A typical section of the divider dike is shown to have a crest elevation of 810 feet and 2H:1V external slopes down to elevation 798 feet and 6H:1V slopes thereafter. The drawing notes that the divider dike was to be constructed of compacted bottom ash. According to available design or as-built information, no under-drain features were installed to control seepage across the dikes generated by the ash/stilling pond.

3.2.1. Area 1 - Bottom Ash Disposal Area

Area 1 was initially utilized to store hydraulically placed (wet sluiced) fly ash when the plant went online in 1966. This area originally had a spillway in the southwest corner which discharged into the Clinch River. Starting in 1980, a major portion of Area 1 was diked to receive dredged material from Area 2 (fly ash). When the East/West Dredge Cell went online in 1981, Area 1 was used as a fly ash settlement pond and discharged into an ash channel. The northeast corner of Area 1 received sluiced bottom ash and a channel traversing along its east side conveyed the bottom ash to Area 2 (current operations). In 1985, the settlement pond in Area 1 ceased receiving sluiced ash and was filled with bottom ash. Bottom ash was stacked according to a 1986 stacking plan until 1988. From 1988 to 2004, bottom ash was temporarily stacked in this area prior to going to Area 2A for disposal. From 2004 to present, all bottom ash not sold is stacked in Area 1.

Historical information reviewed as part of the Phase 1 assessment Stantec performed in 2009 indicates that slippage and settlement was observed along the south dike of Area 1 in 1981. Also, several slides were noted on the upper dike in 1998, but the records do not indicate where in Area 1 this occurred or the extent of the slides.

The lower and upper dikes that form Area 2 also extend along the west and south sides of Area 1. The west dikes along Area 1 have flatter slopes and, in fact, the top of the lower dike in the north portion of Area 1 slopes down toward the river instead of forming a flat intermediate bench. The ash stacked on top of the sluiced ash rises above the upper dike up to near elevation 850 feet. There are areas along the west and east sides of the raised stack where the slope of the bottom ash deposits approach 1.5H:1V.

3.2.2. Area 2 - Fly Ash Pond

The Fly Ash Pond Area 2 was one of the original facilities constructed when the plant went online in 1966-1967. No ash was sluiced to the pond until 1971, when the sluice channel was constructed that linked Area 1 to the current Fly Ash Pond Area 2. The original spillway was located in the south end of the pond and discharged into Bull Run Creek. In 1976, an internal dike was constructed to form the stilling pond in the west portion of Area 2. Since then, water enters the stilling pond through a rock weir near the south end of the internal dike and effluent from the stilling pond discharges into the Clinch River through three concrete riser spillway structures. The spillway in the south portion of the pond was abandoned.

In 1981, a portion of Area 2 was diked off to form Area 2A, the eventual location of the Gypsum Disposal Area. In 1981, Area 2A was used as a secondary fly ash settlement pond. Currently, Area 2 receives sluiced fly ash (and some bottom ash) from the ash channel which originates on the east side of Area 1. The pond also receives discharges from the Gypsum Disposal Area 2A, Coal Yard Runoff Pond and Chemical Treatment Pond.

According to historical records, seepage was observed along the west dike from 1976 to 1979. Also, a wet and soft area was noted on the toe of the south dike in 1995. This area was probably located along the top of the lower dike, which is also the toe of the upper dike, since the toe of the lower dike is submerged under waters of Bull Run Creek. Wet areas were also observed during the Phase 1 field reconnaissance, as described in Reference 10, along the top of the lower dike. A slump of the Bull Run Creek bank, or exterior south slope of the lower dike, was also observed during the Phase 1 assessment. This slumped area was repaired in the spring of 2009 using crushed stone rip rap.

3.2.3. Area 2A- Gypsum Disposal Area

In 1981, a divider dike was constructed within Area 2 to form Area 2A. Fly ash was sluiced into Area 2A until 1989, after which, bottom ash from Area 1 was dry stacked there until 2004. Construction began in 2006 to create the Gypsum Disposal Area which went online in late 2008. Approximately 240,000 dry tons of scrubber gypsum are supposed to be produced each year and transported to Area 2A through wet sluicing. Approximately 50,000 tons of byproduct are supposed to be sold to off-site sources.

The lower and upper dikes that form Area 2 also extend along the west and north sides of Area 2A. In general, the south and east sides of Area 2A above elevation 810 feet were constructed using uniform 3:1 slopes up to elevation 835 feet, with a 20-foot wide intermediate bench at elevation 825 feet. The east slope toes out along the sluice ditch channel that extends from the northeast corner of Area 1 to the northeast corner of Area 2. The south slope of Area 2A toes out into the Fly Ash Pond. The west and north side slopes above elevation 810 feet are not uniform, varying in steepness from 1.5V:1H to 3H:1V, but include an intermediate bench that varies in width near elevation 825 feet and elevation 818 feet (north slope only).

3.2.4. As-Built Drawings

The title blocks for References 1, 2, and 3 drawings contain the description "Record Drawings as Constructed." The date of signing for all three referenced drawings is January, 1979. All documented revisions have prior dates.

3.2.5. Geotechnical Studies

The historical documentation provided by TVA for review does not include geotechnical exploration information that would have preceded the initial development of the CCB disposal areas. As mentioned before, Reference 4 documents a foundation investigation performed only at the site of the plant building structures. References 11 (1985) and 12 (1989) are reports of limited subsurface explorations of Areas 1 and 2A. The 1985 exploration included borings drilled along the west and south sides of Area 2A and the west side of Area 1. According to Reference 11, the raised portion of the perimeter dike was constructed either on top of bottom ash deposits or on top of fly ash deposits. Also, based on the reference, it was not uncommon to stack ash inside the pool of Area 2A up to elevation 825 feet.

3.3. Design, Construction and Sloughing of Area 2A South Slope

The south dike of the gypsum disposal area was constructed over sluiced ash deposits that extend into the Fly Ash Pond (Area 2) well beyond the toe of the dike. In view of the foundations conditions, the design of the south dike included certain features to reduce the potential for settlement or failure due to pore pressure buildup within the soft sluice ash foundation deposits, and to control seepage across the dike. A review of available information relative to the design, construction modifications and performance of the south embankment is presented in the following paragraphs.

3.3.1. Design of South Dike Toe Area

The design of this area called for bottom ash columns to be constructed within the sluiced ash deposits underneath most of the south dike, as shown in Drawing 10W298-40 (included in Reference 6) which shows the column layout, details and grid pattern. According to TVA, the columns were actually constructed with manufactured sand instead of bottom ash. The columns were to extend from elevation 810 feet down to native soil (approximate elevation 784 feet). The purpose for the columns was to reduce pore pressure buildup within the sluiced ash deposits during construction of south dike. In addition, a 5-foot thick blanket of bottom ash was constructed between elevations 810 feet and 805 feet, around the columns, to further promote pore pressure dissipation near the top of the columns (see Drawing 10W297-27 in Reference 5). The top of the 5-foot thick blanket of bottom ash was to be lined with geotextile fabric, which was to extend from the bottom (interior) of the disposal area toward the south toe of the exterior slope, and end about 5 feet from the face of the slope.

In addition, the toe area design included a perimeter under-drain (6 inch perforated pipe wrapped in crushed stone and filter fabric traversing parallel to the slope contours) at elevation 810 feet. The perimeter under-drain was to include lateral outlet pipes (6 inch non-perforated pipe) at 100 feet intervals, as indicated on Detail D27 of Drawing 10W297-27 reproduced below.

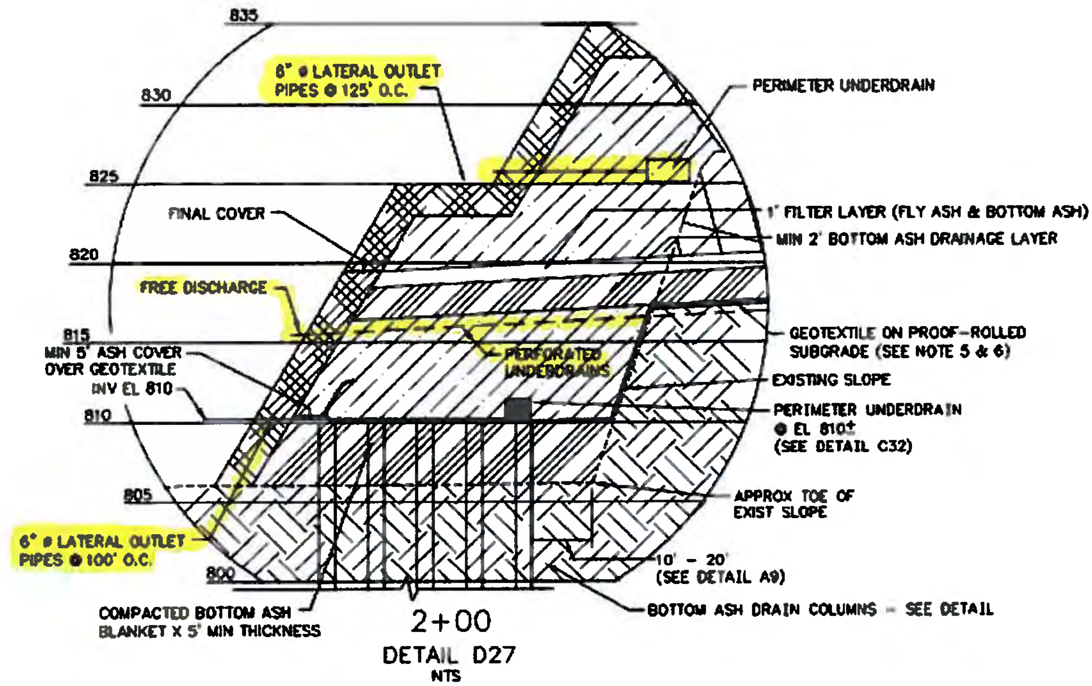


Figure 4. Detail D27 South Slope Toe Area Design (Drawing 10W297-27)

Detail D27 and Section B27 of Drawing 10W297-27 also show a series of 4 inch perforated under-drain pipes traversing across the entire bottom of the disposal area in a north-south direction, with the pipes installed at 50-foot intervals and discharging near elevation 815 feet. The design also called for another perimeter under-drain at elevation 825 feet with 6-inch lateral outlet pipes installed at 125-foot intervals. Drawing 10W297-26 also shows perimeter drains at elevation 815 feet running parallel to the east and west sides of Area 2A, with lateral outlet pipes installed at 250 feet spacing intervals.

Stantec's October 2009 reconnaissance of the exterior dike slopes revealed the presence of two sets of lateral pipes exiting the south slope and one set exiting each the west and east slopes of the dike. On the south dike, one set consists of six 6-inch diameter lateral pipes daylighting slightly below elevation 825 feet at approximately 125-foot intervals. The second set daylights near the toe of the slope, slightly above or below the normal ash pond pool elevation. A total of ten 4-inch diameter or 6-inch diameter lateral pipes were found day lighting near elevation 806 feet at 50-foot to 100-foot intervals.

3.3.2. Sloughing along Toe Area and 2007 Repair Measures

As the construction of the initial gypsum disposal area dike was being completed in 2007, seepage through the lower portion of the dike caused sloughs along the exterior toe of the south dike. In addition, erosion around the 30 inch CMP outlet of the spillway pipes was observed, presumably caused by leakage through openings encountered in pipe joints.

The 2007 sloughing was repaired along with some modifications to the seepage control features as discussed in the next paragraphs. However, new sloughing developed along the toe of the south embankment on October 6, 2009. Information from slope inclinometers installed as part of this exploration show the bottom of the sloughing to be near elevation 803 feet.

According to a TVA Design Change Notice dated February 22, 2008 (Reference 7), the seepage problems were corrected by implementing several corrective measures along the toe of both the exterior and interior south dike slopes and the south side of the gypsum stack bottom. The 30 inch CMP spillway pipes were reportedly slip-lined using a 24 inch HDPE (butt-fusion weld), which included grouting the annular space between the two pipes. The erosion (voids) observed around the outlet of the spillway pipes was to be filled by the grouting.

According to notes dated February 15 and 27, March 15, and April 4, 2007 in Reference 7, under-drainage through the 4-inch perforated HDPE pipe system (Section B27 of Drawing 10W297-27) was cutoff. These under-drain pipes were connected to a 12-inch header pipe installed north (upstream) of the interior toe of the embankment slope. This header pipe included a penetration into each of the 24-inch spillway pipes, such that the water collected by the header pipe would drain into the spillway pipes (Page 2A of Reference 7). The header pipe also included two 12-inch HDPE stand pipes immediately south of each stop log structure (weir). The stand pipes can be seen today protruding out of the pool, near the weir structures.

The under-drain perforated pipes (finger drains) through the dike were to be plugged, retaining the outer 20 feet (+/-) as a toe drain but blocking drainage from within the embankment. Detail D27 on Drawing 10W298-27 calls for field plugging these under-drain pipes using bentonite pellets.

Notes on Sheet 4 of 6 contained within Reference 7 calls for a clay plug/shoulder to be constructed along the interior toe of the embankment, immediately south of the 12-inch header pipe. The dimensions of this plug were presumably modified as per recommendations from Geosyntec and are presented on the last page of Reference 7. Reference 7 also includes two drawings (10W298-5A and 10W298-27A) prepared by Geosyntec with recommendations to change the bottom drainage system by installing drainage collection pipes wrapped in gravel and geotextile filter fabric. Figure 5 presents photos of the modified bottom drainage system. These photos were obtained from TVA's FY2009 Annual Report of Waste Disposal Areas at the Bull Run Fossil Plant.

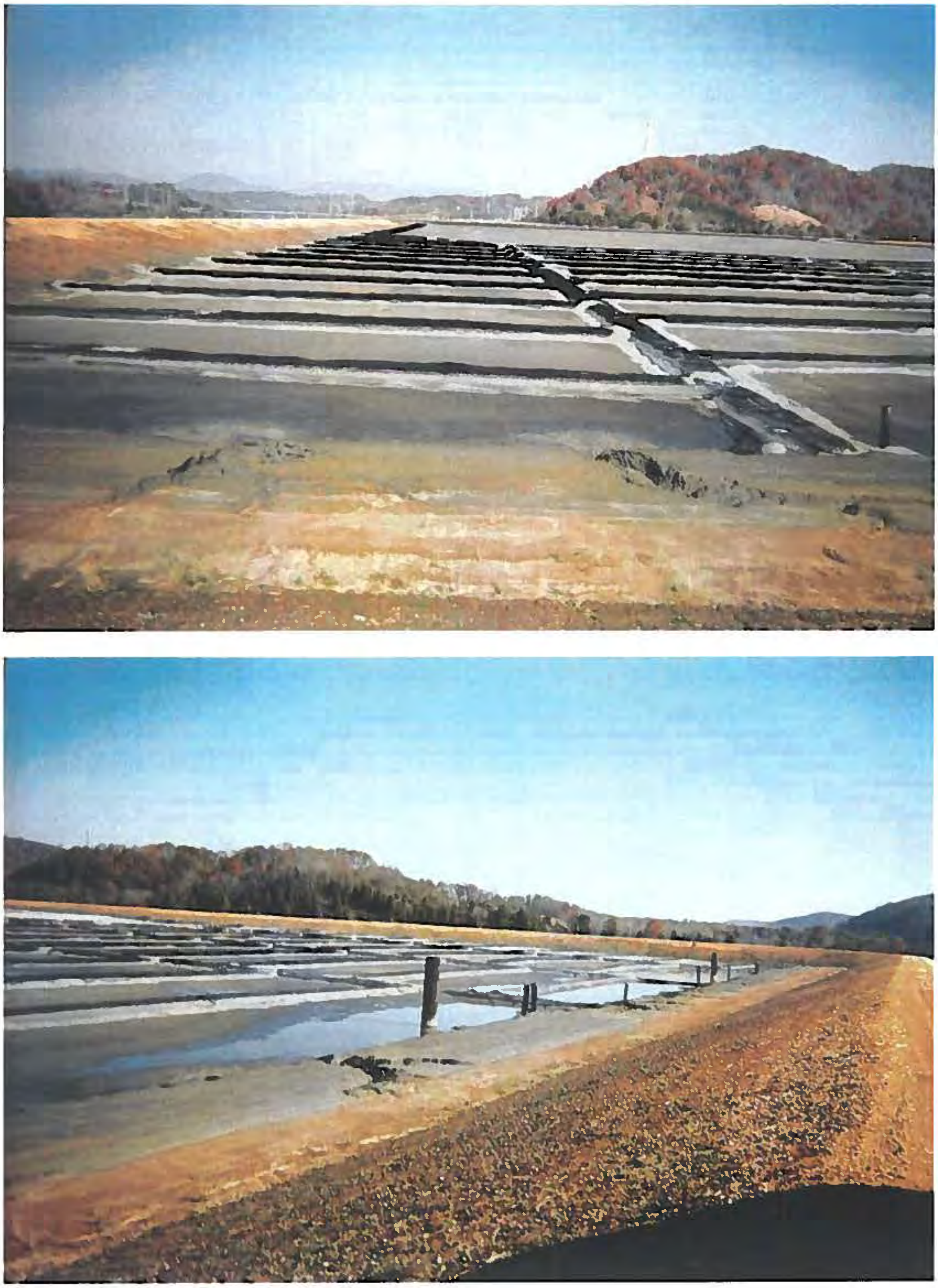


Figure 5. Area 2A – Gypsum Disposal Area – Bottom Drainage Systems

Sheet 4 of 6 of Reference 7 and Drawing 10W298-27 (dated February 1, 2008) also show the proposed construction of crushed stone pocket drains on 50-foot centers along the exterior toe of the embankment. These pockets were to be constructed by excavating approximately 14 feet into the slope at elevation 805 feet, with the top of the excavation located near elevation 812 feet. The pockets were to be lined with non-woven filter fabric and formed using #7 crushed stone.

Thirteen pocket drains installed at 50-foot centers were found near the toe of the south slope during the October 2009 observations. Each pocket is 2 to 3 feet wide and appears to have been constructed using #7 or finer crushed stone. It is assumed that the toe areas between pocket drains were repaired using ash and clay.

TVA provided two sets of documents that describe Geosyntec's review and assessment of the sloughing conditions. One set of documents consists of a Power Point presentation dated April 4, 2007 (Reference 9). The second document consists of three drawings (10W297-32A, 10W297-5A and 10W297-27A) that are also part of Reference 7.

3.4. 2009 Field Observations and Repair Work

Observations made during Phase 1 of the disposal facility assessment identified several areas or features of concern along both the exterior and interior slopes of the dikes. These observations are described in the Phase 1 report submitted to TVA in June 2009. Some of the most relevant concerns were discussed in a Stantec letter dated February 25, 2009 (Reference 10) to TVA.

Outstanding concerns, aside from global stability of some of the dike slopes, are poor surface drainage conditions along exterior intermediate benches of Area 2A above elevation 810 feet, and the exterior bench of the perimeter dike (top of lower dike) along the south and west sides of Area 2 and west side of Area 2A. The source of wet conditions on top of the lower dike along the south and west sides of Area 2 is likely due to seepage of impounded water through the dike. Other concerns consist of steep slopes (1.5:1) above elevation 810 feet in Areas 1 and 2A which require periodic maintenance, especially after significant precipitation events. In 2009, sloughing and erosion were observed along the intermediate bench at elevation 818 feet, on the north slope of Area 2A. These disturbed areas were repaired temporarily, waiting for permanent measures to be implemented based on the results of the geotechnical exploration reported herein. More recently, in 2010, tension cracks have developed next to the crest of the same bench (elevation 818 feet).

Several of the concerns identified during the Phase 1 assessment have been corrected and Stantec has prepared and issued work plans to address drainage and grading for Areas 1 and 2A. This report provides recommendations for further work to provide adequate factors of safety for slope stability as part of the final closure of Areas 2 and 2A.

4. Subsurface Exploration

4.1. General

Fieldwork for the geotechnical exploration was performed by Stantec personnel from June 3 through August 14, 2009. The subsurface exploration consisted of advancing a total of 93 borings (including offset borings from original sample borings) at select locations across the project site. Boring locations were chosen by Stantec and were staked and surveyed by TVA. The subsurface exploration included performing 2,374 standard penetration (SP) tests in selected borings; the installation of 42 piezometers advanced using 3¼ inch (ID) hollow stem augers; the installation of 5 slope inclinometers advanced using 4¼ inch (ID) hollow stem augers, and 8 cone penetration test (CPT) borings. The locations of the borings and their corresponding elevations are shown on the boring layout drawing provided in Appendix B. The locations of the installed slope monitoring instruments (piezometers and slope inclinometers) and their corresponding elevations are shown on the instrumentation layout drawing provided in Appendix B.

An automatic hammer was utilized to perform SP 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. In accordance with ASTM D1586, this method was used to obtain soil samples, estimate the consistency or relative density of subsurface materials and estimate the vertical limits of the subsurface soil horizons. In addition, undisturbed samples (Shelby Tubes) were also obtained from selected depth intervals within clay fill, sluiced ash and fine grained alluvial materials. Upon completion of the drilling and sampling procedures, the boreholes were either backfilled with bentonite-grout, 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 exploration in order to supervise drilling operations and to visually classify and collect the subsurface samples. Particular attention was given to the subsurface material's color, texture, moisture content and consistency or relative density. Following the field exploration, the recovered samples were transported to laboratory facilities for testing.

4.2. 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 and instrumentation layouts are presented in Appendix B. A summary of the boring information is presented in Table 2, where all measurements are expressed in feet.

Table 2. Summary of Borings

Boring No.	Surface Elevation (ft)	Northing (ft)	Easting (ft)	Depth to Bottom of Hole (ft)	Elevation of Bottom of Hole (ft)
STN-1	832.4	595,024.10	2,544,375.85	82.0	750.4
STN-2	819.4	595,022.62	2,544,232.15	55.5	763.9
STN-3	810.2	595,020.59	2,544,104.02	40.8	769.4
STN-5	841.0	594,652.96	2,544,484.24	75.0	766.0
STN-6	818.2	594,610.05	2,544,394.75	50.8	767.4
STN-7	809.5	594,577.54	2,544,332.94	54.3	755.2
STN-8	821.0	594,312.72	2,544,896.21	52.0	769.0
STN-9	837.5	594,232.56	2,544,740.10	73.5	764.0
STN-10	817.9	594,173.80	2,544,636.59	50.5	767.4
STN-11	808.6	594,140.80	2,544,576.48	40.3	768.3
STN-13	831.3	593,923.78	2,545,228.66	69.0	762.3
STN-14	848.7	593,802.44	2,545,004.48	85.5	763.2
STN-15	818.1	593,734.18	2,544,875.42	51.3	766.8
STN-16	808.0	593,705.67	2,544,823.03	42.7	765.3
STN-18	821.7	593,524.13	2,545,835.46	52.5	769.2
STN-19	810.2	593,480.64	2,545,884.32	45.0	765.2
STN-20	819.6	593,389.26	2,545,507.73	53.0	766.6
STN-21	808.0	593,286.66	2,545,087.68	44.8	763.2
STN-22	799.0	593,138.35	2,545,015.84	34.5	764.5
STN-23	835.0	593,275.52	2,546,061.35	82.0	753.0
STN-24	809.9	593,211.79	2,545,589.93	45.0	764.9
STN-25	826.2	593,158.33	2,545,607.45	60.0	766.2
STN-26	817.3	592,971.96	2,546,347.19	54.0	763.3
STN-27	831.3	592,960.52	2,546,295.43	66.0	765.3
STN-28	816.8	592,587.48	2,546,501.20	52.5	764.3
STN-29	816.8	592,243.83	2,546,673.33	39.5	777.3
STN-30	826.2	592,227.12	2,546,605.60	60.2	766.0
STN-31	823.8	592,969.83	2,545,291.84	60.0	763.8
STN-32	808.2	593,010.17	2,545,153.51	45.5	762.7
STN-33	836.1	592,559.31	2,545,426.43	70.4	765.7
STN-34	825.6	592,527.95	2,545,300.77	65.0	760.6
STN-35	808.9	592,523.92	2,545,221.40	44.7	764.2
STN-36	800.5	592,517.47	2,545,204.09	36.0	764.5
STN-38	808.6	592,160.74	2,545,322.53	44.3	764.3
STN-39	835.7	591,840.77	2,545,638.39	73.2	762.5
STN-40	825.8	591,821.33	2,545,513.41	62.7	763.1
STN-41	809.7	591,800.67	2,545,427.16	44.9	764.8
STN-43	825.0	591,427.25	2,545,657.42	61.4	763.6
STN-44	835.7	591,537.09	2,545,975.54	66.1	769.6
STN-45	824.8	591,478.25	2,545,990.45	58.2	766.6
STN-46	808.2	591,420.20	2,546,001.83	42.0	766.2
STN-47	835.7	591,691.40	2,546,454.06	69.9	765.8
STN-48	825.8	591,636.19	2,546,471.30	60.4	765.4
STN-49	808.5	591,576.97	2,546,494.42	49.5	759.0

Table 2. Summary of Borings

Boring No.	Surface Elevation (ft)	Northing (ft)	Easting (ft)	Depth to Bottom of Hole (ft)	Elevation of Bottom of Hole (ft)
STN-50	825.1	591,841.40	2,546,757.19	60.2	764.9
STN-51	809.8	591,336.60	2,545,543.56	50.0	759.8
STN-52	809.8	591,060.68	2,545,599.52	45.0	764.8
STN-53	801.3	591,057.48	2,545,580.54	39.0	762.3
STN-54	810.1	590,638.72	2,545,959.39	44.5	765.6
STN-55	810.1	590,589.87	2,545,693.73	46.4	763.7
STN-56	800.2	590,580.44	2,545,673.06	37.5	762.7
STN-58	810.3	590,091.97	2,545,756.90	47.3	763.0
STN-59	800.0	590,089.21	2,545,731.11	38.0	762.0
STN-60	810.2	589,601.84	2,545,827.99	48.0	762.2
STN-61	799.9	589,536.98	2,545,830.43	53.2	746.7
STN-62	809.4	590,000.07	2,546,208.94	46.7	762.7
STN-63	801.2	589,989.70	2,546,223.76	41.5	759.7
STN-65	809.1	590,472.00	2,546,579.19	42.9	766.2
STN-66	799.8	590,462.23	2,546,593.73	35.0	764.8
STN-67	809.5	590,946.92	2,546,949.33	30.5	779.0
STN-68	800.8	590,938.03	2,546,963.83	36.5	764.3
STN-70	809.4	591,380.61	2,547,267.77	49.0	760.4
STN-71	809.1	591,954.22	2,546,956.25	54.5	754.6
STN-87	825.3	591,549.15	2,546,217.62	63.7	761.6
STN-88	808.6	591,493.79	2,546,234.83	49.3	759.3
STN-89	836.1	593,192.06	2,545,830.78	40.0	796.1
STN-90	838.4	593,043.65	2,545,471.40	37.0	801.4
STN-10A	817.9	594173.802	2544636.594	35.0	782.9
STN-25P	826.1	593154.555	2545599.904	54.0	772.1
STN-29P	816.8	592243.83	2546673.332	44.0	772.8
STN-34A	825.5	592522.402	2545302.171	28.0	797.5
STN-34P	825.9	592529.459	2545337.087	58.0	767.9
STN-35A	809.1	592527.793	2545220.582	18.0	791.1
STN-41A	809.6	591803.053	2545424.87	18.0	791.6
STN-46P	808.4	591422.849	2546003.927	43.0	765.4
STN-48P	826.1	591636.189	2546471.303	45.0	781.1
STN-49A	808.5	591577.765	2546496.61	12.0	796.5
STN-49P	808.5	591577.472	2546496.416	28.0	780.5
STN-51A	809.8	591329.16	2545545.058	17.0	792.8
STN-51P	809.8	591336.601	2545543.557	38.0	771.8
STN-55A	810.3	590581.123	2545694.583	18.0	792.3
STN-56P	799.3	590578.052	2545666.216	30.0	769.3
STN-62A	809.6	590004.498	2546211.203	22.0	787.6
STN-65A	809.1	590474.376	2546581.373	19.0	790.1
STN-88A	808.5	591494.074	2546236.742	12.0	796.5

4.3. Undisturbed Sampling

A total of one-hundred sixteen (116) undisturbed Shelby tube samples were obtained containing the fill (clayey soil to construct the dikes), ash and alluvial soils from select borings advanced across the project site. The undisturbed samples were retrieved using 2 7/8-inch inside diameter, 30-inch long thin walled tubes and a piston sampler. The undisturbed soil sampling was 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 unit weight, unconsolidated-undrained triaxial tests, consolidated-undrained triaxial tests, unconfined compression tests, direct simple shear tests, index testing, and falling head permeability tests. Laboratory results are presented in Appendix F.

4.4. Cone Penetration Testing

Eight (8) CPT borings were advanced at locations situated adjacent to previously drilled sample borings STN-10, 25, 34, 46, 48, 49, 59 and 88 within the perimeter and ash dikes of Areas 1, 2, and 2A (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 to 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 un-drained shear strength. CPT test results were used to compare to laboratory shear strength test results and field sampling results. The results of the CPT testing can be found in Appendix H.

5. Field Instrumentation and Monitoring

5.1. General

As part of the geotechnical exploration, Stantec devised and implemented a slope monitoring program. The program started by installing instrumentation in select boreholes drilled for the geotechnical exploration. After taking initial or baseline instrumentation measurements, the monitoring of the dike slope conditions continued by obtaining periodic readings. The monitoring will continue until actions are implemented to provide adequate, long term stability of the structures, and beyond that time at TVA's discretion. Much of the information obtained from the instrumentation readings was used in the engineering analysis presented in this report. The following paragraphs provide additional details regarding the instrumentation and monitoring program.

5.2. Instrumentation

A total of forty-two (42) borings were instrumented with 5 foot long, slotted screen piezometers (PZ) to monitor pore pressures at the specific depths and locations shown on the piezometer installation details presented in Appendix D and on the instrumentation layout in Appendix B. In general, each piezometer screen was surrounded by a sand filter pack of varying thickness, followed by the application of a minimum two-foot thick bentonite seal, and then the annulus outside the riser pipe 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 3 summarizes the piezometers installed at the Bull Run Fossil Plant disposal areas during Stantec's exploration.

Table 3. Piezometer Data

Location	PZ No.	Surface Elevation (ft MSL)	PZ Tip Elevation (ft MSL)	Range of Water Elevations (7/24/09 to 4/2/10) (ft MSL)	
				Min.	Max.
STN-3	PZ-3	810.2	770.1	799.1	804.3
STN-5	PZ-5	841.0	806.7	807.7	810.7
STN-6	PZ-6	818.2	768.2	795.8	797.1
STN-10A	PZ-10A	817.9	785.7	806.5	807.6
STN-14	PZ-14	848.7	800.7	807.4	809.0
STN-15	PZ-15	818.1	768.1	771.8	798.9
STN-18	PZ-18	821.7	796.8	806.2	807.4
STN-19	PZ-19	810.2	791.2	805.1	806.1
STN-27	PZ-27	831.3	803.1	808.5	809.6
STN-30	PZ-30	826.2	801.1	807.9	811.1
STN-33	PZ-33	836.1	814.5	814.9	815.4
STN-34	PZ-34	825.6	764.2	795.5	796.7
STN-34A	PZ-34A	825.5	801.1	808.1	809.1
STN-35	PZ-35	808.9	771.7	792.0	796.0
STN-35A	PZ-35A	809.1	794.0	804.8	806.3
STN-36	PZ-36	800.5	766.5	794.2	795.3
STN-39	PZ-39	835.7	815.6	816.2	818.0
STN-40	PZ-40	825.8	795.2	808.7	810.3
STN-41	PZ-41	809.7	767.6	794.0	796.0
STN-41A	PZ-41A	809.6	791.5	808.0	809.5
STN-44	PZ-44	835.7	805.2	810.1	815.8
STN-45	PZ-45	824.8	793.7	807.7	811.4
STN-46	PZ-46	808.2	799.0	805.4	810.8
STN-47	PZ-47	835.7	808.6	807.9	813.4
STN-48	PZ-48	826.1	801.6	808.4	811.6
STN-49A	PZ-49A	808.5	799.7	808.1	810.1
STN-51	PZ-51	809.8	761.7	794.3	805.5
STN-51A	PZ-51A	809.8	792.7	793.9	806.0
STN-55	PZ-55	810.1	768.9	795.8	796.6
STN-55A	PZ-55A	810.3	792.3	805.2	805.7
STN-56	PZ-56	800.2	764.2	795.7	796.7
STN-62	PZ-62	809.4	768.4	799.7	800.3

Table 3. Piezometer Data

Location	PZ No.	Surface Elevation (ft MSL)	PZ Tip Elevation (ft MSL)	Range of Water Elevations (7/24/09 to 4/2/10) (ft MSL)	
				Min.	Max.
STN-62A	PZ-62A	809.6	787.5	804.8	805.8
STN-63	PZ-63	801.2	762.4	798.1	799.0
STN-65	PZ-65	809.1	771.5	803.6	804.6
STN-65A	PZ-65A	809.1	789.6	805.1	806.3
STN-66	PZ-66	799.8	767.3	793.4	794.6
STN-67	PZ-67	809.5	798.5	803.8	804.7
STN-68	PZ-68	800.8	765.7	793.6	794.9
STN-88	PZ-88	808.5	797.9	806.6	808.6
STN-89	PZ-89	836.1	798.0	809.5	810.5
STN-90	PZ-90	838.4	804.3	810.5	811.6

A total of five (5) borings (STN-29P, STN-46P, STN-49, STN-87 and STN-88) were instrumented with 2.75 inch OD slope inclinometer (SI) casing to monitor potential lateral movement within the subsurface. These instruments were located in areas having a prior history of slope movement, or within areas believed to have a potential for slope movement. Slope inclinometer readings were obtained a minimum of one week after their installation to establish a baseline reading. Depending on their location and evidence of slope movement, subsequent readings were conducted on a weekly to monthly basis since their installation. Specifically, movement was detected near the ground surface at the location of slope inclinometer SI-49. This report includes the results as of the last recorded slope inclinometer reading on April 4, 2010. Future readings will be conducted and the results will be issued under separate cover. A summary table of installed slope inclinometers is provided in Table 4 below. Details of the slope inclinometer installation are presented in Appendix D and the latest slope inclinometer readings presented as displacement curves are shown in Appendix E.

Table 4. Summary of Slope Inclinometers Installed

Boring No.	Instrument ID	Top of Concrete Pad Elevation (ft)	Top of Casing Elevation (ft)	Bottom of Casing Depth (ft)	Bottom of Casing Elevation (ft)
STN-29P	SI-29	817.1	819.9	47.1	772.8
STN-46P	SI-46	808.4	811.2	46.0	765.2
STN-49	SI-49	808.5	811.3	52.6	758.7
STN-87	SI-87	825.3	828.0	66.4	761.6
STN-88	SI-88	808.6	811.0	51.7	759.3

5.3. 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.

Stantec's schedule for monitoring readings taken to date is presented in Table 5. Results of the monitoring program are presented in Appendix E in the following order:

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

Table 5. Monitoring Program Schedule

Reading Number	Date of PZ Reading	Date of SI Reading
1	July 24, 2009	August 18, 2009
2	July 31, 2009	September 10, 2009
3	August 7, 2009	October 6, 2009
4	August 14, 2009	October 14, 2009
5	September 10, 2009	October 19, 2009
6	October 6, 2009	October 28, 2009
7	October 14, 2009	November 3, 2009
8	October 19, 2009	November 13, 2009
9	October 28, 2009	November 20, 2009
10	November 3, 2009	November 24, 2009
11	November 13, 2009	December 3, 2009
12	November 20, 2009	December 18, 2009
13	November 24, 2009	December 22, 2009
14	December 3, 2009	December 28, 2009
15	December 10, 2009	January 8, 2010
16	December 18, 2009	January 14, 2010
17	December 22, 2009	January 22, 2010
18	December 28, 2009	January 27, 2010
19	January 8, 2010	February 19, 2010
20	January 14, 2010	March 11, 2010
21	January 22, 2010	March 30, 2010
22	January 27, 2010	April 2, 2010
23	February 19, 2010	
24	March 30, 2010	
25	April 2, 2010	

5.4. Slug Testing

In addition to obtaining water level readings at frequent intervals, Stantec also performed slug testing at all piezometer locations. 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 the static water level followed by the insertion of the pressure transducer 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 the 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 material surrounding the piezometer tip. The hydraulic conductivity was estimated for the soil strata that the piezometer screen is set in. Results from the slug testing data are presented in Appendix E.

6. Surveying

6.1. General

Topographic mapping of the Bull Run Fossil Plant (developed from aerial photographs), contour mapping of the Clinch River adjacent to the south and western perimeter of the disposal areas (developed from a hydrographic survey) and field topographic data from selected locations were provided by TVA upon Stantec's request. A summary of survey data obtained is presented in the following paragraphs.

6.2. Aerial Survey

TVA provided topographic mapping of the overall Bull Run Fossil Plant based on aerial photography performed in April, 2009. The limits of the topographic mapping as well as control points referenced to the plant coordinate system were established by TVA with input from Stantec. The results of aerial survey can be seen on the basemap presented in the boring layout drawing in Appendix B.

6.3. Topographic Survey

Stantec requested a field topographic survey be performed by TVA in September, 2009 of specific cross-sections and slopes across the disposal areas. 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 TVA's topographic survey were applied to the cross section profiles used for stability analysis. Selected cross sections are presented in Appendix B.

6.4. Hydrographic Survey

At the request of Stantec, TVA also performed a hydrographic survey of the Clinch River adjacent to the south and west sides of Areas 1, 2, and 2A in September 2009 to supplement land and aerial survey data. A hydrographic survey completed in February, 2006 of Disposal Area 2 and the Stilling Pond was also provided as supplemental data. The combined survey information was used to aid in cross-section geometry development for engineering analysis.

7. Laboratory Testing

7.1. 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.

In general, the laboratory analyses consisted of natural moisture content determinations, sieve and hydrometer analyses, Atterberg Limits; specific gravity determinations, consolidated-undrained triaxial compression, direct simple shear, and permeability testing. The results of the strength, permeability, and index testing were used to assist in estimating appropriate soil parameters for the engineering analyses. The results of the index testing were also used to help classify and define the different soil horizons encountered at the Disposal Areas and develop geometric cross-sections used in the engineering analysis. Detailed results of the laboratory testing are presented in Appendix F.

7.2. Laboratory Tests Performed

Stantec performed laboratory testing on the materials encountered during the drilling program to assist in estimating appropriate soil parameters used in the engineering analysis. Geotesting Express Inc. was subcontracted by Stantec to assist in performing laboratory testing on specific undisturbed soil samples. A summary of laboratory tests performed is presented in Table 6.

Table 6. Laboratory Tests Performed

Group*	Test	Standard
1	Natural Moisture Content	ASTM D 2216
2	Classification	ASTM D 2487
	Particle Size Analysis	ASTM D 422
	Atterberg Limits	ASTM D 4318
	Specific Gravity	ASTM D 854
3	Density	ASTM D 2937
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
8	Direct Simple Shear (DSS)	ASTM D 6528

*Results Presented in this order in Appendix F.

7.3. Natural Moisture Content

Natural moisture content tests were performed on all split-spoon samples, and undisturbed Shelby tube samples. For 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 the moisture content determinations are presented in Attachment 1 of Appendix F and are summarized in Table 7 below.

7.4. Classification Testing

Soil classification testing consisting of Atterberg Limits, and particle-size analyses were performed on select undisturbed Shelby tube samples and composite SPT samples. These tests were used specifically for classifying the different soil strata. The results can be found in Attachment 2 of Appendix F. A summary of the natural moisture content and classification testing is presented in Table 7 below.

Table 7. Summary of Natural Moisture Content and Classification Testing

Horizon	Predominant USCS Classification	Moisture Content Range	Liquid Limit	Plasticity Index	% Passing #200 Sieve
Lower Dike	CL (CH)	15% to 28%	37 to 51	15 to 28	84 to 98
Upper Dike	CL (SC, ML)	19% to 42%	32 to 46	11 to 19	36 to 73
Sluiced Ash	ML	20% to 95%	NP	NP	86 to 97
Alluvium	CL, CH	24% to 56%	26 to 47	8 to 27	56 to 99
	ML, SC, SM	25% to 41%	NP to 41	NP to 15	26 to 83

7.4.1. Specific Gravity

Specific gravity tests at 20 degrees Celsius were performed in accordance with ASTM 854A on select undisturbed Shelby tube samples of clay and ash materials. The results of these tests were used during falling head permeability and consolidated-undrained triaxial tests.

7.4.2. Particle Size Analysis

Particle size distribution tests were performed on select undisturbed and SPT composite samples from representative soils encountered at the project site. 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.

7.5. 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. The respective dry density for each sample was then calculated from the total density, the moisture content measurement, and sample dimensions.

7.6. Shear Strength

Stantec performed consolidated-undrained (CU) triaxial tests with pore pressure measurements (ASTM D 4767) on selected six-inch clay and ash specimens extruded from the Shelby tubes to establish effective-stress shear-strength parameters. Nine (9) CU test sets were performed on clay samples and four sets were performed on sluiced ash samples. The results of the CU testing were considered in selecting effective stress shear-strength parameters for the slope stability analyses. Failures stresses expressed in terms of p'-q values were plotted for each material. A summary of the CU triaxial testing data is provided in Table 8 below. The individual consolidated-undrained testing results are presented as Attachment 5 in Appendix F. The individual p'-q plots are presented in Appendix G.

Table 8. Summary of Consolidated – Undrained Triaxial Testing

Location	Boring No.	Sample Interval (feet)	USCS Textural Classification	CU Triaxial Strength	
				c' (psf)	ϕ' (degrees)
Area 1	STN-10	30.5-31.0	CL	440	32.0
		33.8-34.3			
		37.1-37.6			
	STN-11	20.6-21.1		80	33.5
		25.5-26.0			
		33.6-34.1			
Area 2A	STN-34P	50.0-50.5		540	27.5
		52.6-53.1			
		54.0-54.5			
	STN-88	24.6-25.1		500	26.4

Table 8. Summary of Consolidated – Undrained Triaxial Testing

Location	Boring No.	Sample Interval (feet)	USCS Textural Classification	CU Triaxial Strength	
				c' (psf)	ϕ' (degrees)
Area 1	STN-10	26.5-27.0	ML (Sluiced Fly Ash)	100	36.0
	STN-20	24.0-24.5			
		29.0-29.5			
Area 2A	STN-34P	30.2-30.8		323	35.3
		31.4-32.0			
		40.8-41.4			
		36.2-36.8		478	31.7
		37.4-38.0			
		39.4-40.0			
	STN-46P	11.5-12.0		120	35.2
	STN-88	13.4-14.0			
Area 2A	STN-49P	24.2-24.8	ML (Sluiced Fly Ash)	120	35.2
Area 2	STN-62	4.5-5.0	FILL: CL	800	25.6
	STN-62	9.5-10.0			
	STN-68	9.0-9.5			
	STN-51	4.5-5.0		620	28.6
	STN-51	5.1-5.6			
	STN-51	9.5-10			
	STN-51	20.0-20.5		300	31.8
	STN-68	24.7-25.2			
	STN-67	4.5-5.0		400	31.0
	STN-67	5.1-5.6			
	STN-67	9.5-10.0			
	STN-59	12.6-13.1		300	29.0
	STN-59	19.1-19.6	CH	300	29.0
	STN-59	19.7-20.2			
	STN-62	39.6-40.1	CL	300	31.8

Unconsolidated undrained triaxial tests were performed on undisturbed soil specimens, in accordance with ASTM D 2850. The individual unconsolidated-undrained testing results are presented as Attachment 6 in Appendix F and summarized in Table 9 below.

Table 9. Summary of Unconsolidated–Undrained Triaxial Testing

Location	Boring No.	Sample Interval (feet)	USCS Textural Classification	Max Shear Stress/ Cohesion (psf)	Corrected Deviater Stress (psf)	Axial Strain (%)
Area 2	STN-56P	20.6-21.1	CL	561	1,126	14.6
		22.6-23.1		734	1,463	11.7
		28.6-29.1		288	567	14.2

Seven (7) unconfined compression tests were performed on undisturbed clay samples obtained from Areas 2 and 2A borings, in accordance with ASTM D2166. The individual unconfined compression testing results are presented as Attachment 7 in Appendix F and summarized in Table 10 below.

Table 10. Summary of Unconfined Compression Strength Testing

Location	Boring No.	Sample Interval (feet)	USCS Textural Classification	Unconfined Compressive Strength (psf)	Maximum Shear Strength/ Cohesion (psf)
Area 2A	STN-34P	50.0-52.0	CL	5,160	2,580
		56.0-58.0		800	400
	STN-88	26.0-28.0		480	240
Area 2	STN-51P	32.0-34.0		1,680	840
		36.0-38.0		920	460
	STN-67	19.0-21.0		4840	2420
		24.0-26.0		5280	2640

Direct Simple Shear (DSS) tests were performed in accordance with ASTM D 6528 on undisturbed six-inch sluiced ash specimens obtained from borings located on the south side of Area 2A. The results of the DSS tests were plotted in terms of p-q values and used to aid in selection of effective-stress shear strength parameters. Results from the tests are presented as Attachment 8 in Appendix F and summarized in Table 11 below. The p-q plots are presented in Appendix G.

Table 11. Summary of Direct Simple Shear Testing

Location	Boring No.	Sample Interval (ft)	USCS Textural Classification	Max. Shear Strength (psf)	Eff. Internal Friction Angle (degrees)
Area 2A	STN-46	8.1-8.9	ML (Sluiced Fly Ash)	531.4	25.0
		11.0-11.5		288	33.7
	STN-48P	27.0-27.8		786.2	21.6
		34.3-35.0		986.4	27.8
		40.4-41.0		711.4	26.3
	STN-49P	4.3-5.0		228.9	39.9
		25.4-26.0		861.1	35.8

7.7. Permeability

Falling head permeability tests were performed on select undisturbed clay and ash samples from each disposal area. The tests were performed in triaxial cells in general accordance with ASTM D 5084, "Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials using Flexible Wall Permeameter. The summary of the permeability tests conducted is presented below in Table 12 and complete test results are provided in Attachment 4 of Appendix F.

Table 12. Permeability Test Results

Location	Boring No.	Sample Interval (ft)	USCS Textural Class.	In-Situ Moisture Content (%)	Initial Dry unit Weight, (pcf)	Specific Gravity	Average Hydraulic Conductivity k (cm/s)
Area 1	STN-10	26.5-28.5	ML (Fly Ash)	23.6	102.8	2.63	3.27E-07
Area 1	STN-10	32.5-34.5	CL (Alluv.)	21.5	106.1	2.71	8.66E-08
Area 1	STN-10	45.2-45.7	SM (Alluv.)	20.7	106.6	2.68	7.46E-06
Area 2A	STN-34P	40.2-40.6	ML (Fly Ash)	42.8	72.6	Est.	1.4E-07
Area 2A	STN-46P	7.0-7.3	ML (Fly Ash)	57.9	63.9	Est.	2.2 E-07
Area 2A	STN-48P	28.0-28.3	CH (Alluv.)	38.5	77.3	Est.	5.6E-08
Area 2	STN-51	10.1-10.6	CL (Alluv.)	20.0	104.1	2.71	2.63E-06
Area 2	STN-59	4.5-6.5	CL (Fill)	24.5	98.1	2.69	2.38E-08
Area 2	STN-62	39.0-41.0	CL (Alluv.)	26.0	98.4	2.71	1.49E-07
Area 2	STN-68	25.0-27.0	CL (Alluv.)	25.1	98.9	2.68	8.81E-08

8. Results of Field Exploration & Laboratory Testing

8.1. General

Based on the results of the drilling, laboratory testing, historical documentation, and drawings, the on-site materials were divided into soil layers used during development of cross-section geometry for engineering analysis. Please refer to the geologic sections in Appendix B and boring logs in Appendix C which depict the approximate soil breaks/horizons and soil descriptions for each section. The soil layers identified on the cross sections are described per disposal area in the paragraphs below.

8.2. Area 1 – Bottom Ash Disposal Area

Borings STN-1 through STN-21 were advanced within Area 1 along the upper dike bordering the western and southern perimeters of the facility, and within the limits of the coal ash impoundment area. Borings were not advanced within the lower dike along the western portion of Area 1, however, based on boring logs in Reference 11 of Table 1, it is believed that its subsurface composition is relatively consistent with the subsurface conditions found during our exploration of this dike at similar elevations along the western perimeter of Areas 2 and 2A.

The upper dike is generally comprised of a surficial layer consisting of six inches of topsoil along the outer embankments and six to eight inches of gravel across the roadway situated atop of the dike. Beneath the surficial layer is earth fill material consisting of light brown to red-brown, clayey sand (SC) and clayey gravel (GW) with a relative density ranging from very loose to medium dense. Other soils encountered within the Upper Dike consist of light brown, medium stiff to stiff, variably sandy, lean clay (CL). The fill material extends to elevations ranging from 797 to 800 feet MSL, or 7.5 to 11.5 feet below the top of the existing grade elevation. Beneath the upper dike are variably thick intervals of moist to saturated, sluiced ash materials (bottom and fly ash) with loose to medium relative densities underlain by alluvial materials. The ash intervals extend to elevations of 792.6 feet MSL in boring STN-11 to 787.0 feet MSL in boring STN-16.

A placed bottom ash/fly ash mixture occupies most of the interior portions and upper dike embankments above elevation 810 feet MSL of Area 1. However, the subsurface profile occasionally consists of a six inch thick topsoil layer or a two to three feet thick capping layer of tan to light brown, lean clay (CL) followed by a light to dark gray, bottom/fly ash mixture ranging in thickness from 10 feet to 23 feet. The consistency of the ash mixture is generally medium to very dense in relative density and damp to moist in natural moisture content. Underlying the placed ash material are alternating intervals of sluiced fly ash and sluiced bottom ash with varying thicknesses ranging from four feet in boring STN-1 to 36 feet in boring STN-13. According to N-values obtained from SP testing, the sluiced materials have a very loose to loose relative density and were generally observed to be saturated.

Native soils consisting of alluvial clays overlying alluvial sands make up the foundation materials within Area 1. The clay soils consist of light brown to red-brown, often sandy, lean clays (CL) and clayey silts (ML) with consistencies ranging from very soft to very stiff. Generally, the clay soils are underlain by light brown to brown, sometimes clayey, medium to coarse grained sands with relative densities ranging from very loose to dense.

8.3. Area 2- Fly Ash Pond

Borings STN-51 through STN-71 were advanced within the lower and upper perimeter dikes along the south and western side of the Fly Ash Pond - Area 2. The lower dike was the initial structure constructed of earth fill material for purposes of enclosing the coal ash impoundment areas and extends from the southeastern corner of the Fly Ash Pond to the northwest corner of the Bottom Ash Disposal Area 1. The crest of the lower dike sets at about elevation 800 feet (MSL) and its depth throughout the perimeter varies according to the pre-construction elevation of the ground surface upon which it was constructed. Generally, thicker intervals of earth fill exist within the southern portions of the Area 2 facility correlating well with historical topographic maps showing the original ground surface generally sloping downward to the south across the facility. Portions of the lower dike were constructed over the original channel of Bull Run Creek. According to historical documents, the channel was redirected and filled in prior to the dike construction resulting in thicker horizons of fill material in locations where the creek had originally coursed.

Along the outer embankment of the lower dike are roughly six inches of topsoil for vegetative cover. Underlying this surficial layer is earth fill consisting of light brown to dark brown, sometimes sandy, lean clay (CL) extending to elevations ranging from 792 feet MSL in boring STN-53, to 771 feet MSL in boring STN-68. According to N-values from SP testing, soil consistencies range from stiff to very stiff and indicate a history of some form of compaction during the placement of the earth fill material.

The upper dike's surficial layer consists of six inches of topsoil along its outer embankments and six to eight inches of gravel across a roadway situated atop of the dike. Beneath the surficial layers are earth fill materials consisting of light brown to red-brown, variably sandy, lean clay (CL) with medium to very stiff consistencies. The depths of the fill material range from approximately 10 feet in boring STN-65 to about 28 feet in boring STN-60. As mentioned, larger quantities of fill material were placed in low lying areas to match a consistent elevation across the dike structures. Underlying the earth fill is two to three feet of clayey gravel or compacted bottom ash. This interval is believed to have been placed at the time of construction in order to provide a stable platform (subgrade) for the overlying upper dike. Alluvial clays overlying alluvial sands with characteristics very similar to those described for Area 1 underlie the upper dike subgrade. Sluiced ash was not encountered in any of the borings advanced at Area 2 during our exploration due to the location of the borings along the middle to outside edge of the upper dike crest, and no borings were advanced in the Ash Pond limits. However, it is believed that sluiced ash is impounded by the perimeter dikes of Area 2 at varying depths and extending from the bottom of the ash pond to the alluvial materials.

8.4. Area 2A- Gypsum Disposal Area

Borings STN-23 through STN-50 and borings STN-87 through STN-90 were advanced within Area 2A. The lower and upper dikes described earlier constitute the lower perimeter of this facility on the western and northern sides and the subsurface conditions observed are consistent with those found at Areas 1 and 2.

Ash dikes composed of primarily compacted bottom ash material, with co-mingled fly ash, were constructed in two tiers up to elevations 825 feet and 835 feet, respectively, and form the perimeter of Area 2A. The lower tier ash dike structure was constructed partially on top of the upper dike along the western and northern sides of Area 2A above elevation 810 feet and over sluiced ash material along the south and eastern sides of the facility.

A one to one and a half foot thick capping layer consisting of red-brown, lean and fat clay (CL and CH) make up the surficial layer of the ash dike subsurface profile. Compacted bottom ash with lesser quantities of fly ash underlie the capping layer and extend to approximate elevations ranging from 800 feet to 808 feet (MSL). In general, this material is gray to dark gray and dense to very dense with occasional pockets of loose relative densities. As mentioned, the ash dike system overlies sluiced ash materials. According to N-values derived from SP testing, the sluiced ash materials exhibit a very loose to loose relative density. The thickness of the sluiced ash deposits range from 14 feet to 26 feet and overlie the previously described alluvial clays and sands. Some alluvial silts were also noted in several borings at the interface between the sluiced ash and alluvial clays, and had soft to medium stiff consistencies according to the SPT blow counts.

8.5. Bedrock Conditions

Elevations to the top of bedrock were estimated from attaining 'N'-values of 50+ from standard penetration tests and confirmed by further auguring until refusal was met. In most cases, refusal was achieved on a layer of weathered, shale bedrock. Upon reaching auger refusal, rock coring was performed within borings STN-1, STN-7, STN-23, STN-61 and STN-71 for visual examinations of the bedrock composition.

The underlying bedrock consists of interbedded layers of the Cambrian aged, Conassauga Group limestone and Rome shale formations. The bedrock samples obtained indicate that the underlying shale is gray to reddish-brown, soft to moderately hard, thin to very thinly bedded and very fine grained. Limestone samples are gray to dark gray, moderately hard to hard and thinly bedded with closely spaced fractures. Weathered zones exist within the upper one to ten feet of bedrock at each of the cored locations. Overall, within the upper ten feet of the bedrock unit, rock recovery ranged from 49% in boring STN-23 to 87% in boring STN-7. The percent RQD is the sum of rock core lengths of four inches or greater from a particular run. With the exception of boring STN-1, most of the samples obtained have a RQD of 0% to 22%, which indicates a very poor rock quality. Generally, the bedrock becomes slightly more competent at depths below five feet. The measured recovery and calculated RQD data for each cored location is shown on the appended logs and is summarized in Table 13 below.

Table 13. Rock Core Summary

Boring No.	Approximate Coring Elevations (ft MSL)	Run (ft)	Recovery (ft)	RQD (%)
STN-1	760.0-755.0	5.0	3.5	32
	755.0-750.4	5.0	5.0	64
STN-7	765.2-762.5	2.7	2.7	0
	762.5-757.5	5.0	5.0	22
	757.5-755.2	2.3	1.0	0
STN-23	765.8-763.0	2.8	0.5	0
	763.0-759.0	4.0	2.0	0
	759.0-758.0	1.0	0.6	0
	758.0-753.0	5.0	3.2	0
STN-61	759.5-756.7	2.8	0.5	0
	756.7-751.6	5.1	2.5	8
	751.6-746.7	4.9	4.8	20
STN-71	764.8-762.1	2.7	2.3	19
	762.1-754.6	7.5	5.0	0

8.6. Subsurface Water

Forty two (42) borings advanced at the subject CCB storage facilities 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 SP samples obtained during drilling. 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 3. The subsurface water conditions were generally higher in piezometers located at the Gypsum Disposal Area and Fly Ash Pond, where the pool level of the ponds influence the phreatic surface. The piezometer readings also varied over time due to the variable nature of the sluice volume and plant operations.

9. Engineering Analyses

9.1. General

Geotechnical engineering analyses included evaluations of strength and permeability parameters, seepage analyses, and slope stability analyses. Prior to performing the analyses, Stantec developed the dike geometry at each of the twenty (20) cross-sections at the Bottom Ash Disposal Area (Area 1), Gypsum Disposal Area (Area 2A) and Fly Ash Pond (Area 2) using survey data provided by TVA, design drawings, site observations, and the results of the drilling and lab testing programs discussed herein. Once the geometries of the sections were determined, each section was reviewed and evaluated for potential slope failure and several cross-sections were deemed critical and in need of further analysis. The criteria for selecting the critical sections were based on the steepness of slopes, the geometry of the sections, the piezometric surface, and the subsurface conditions. Based on Stantec's evaluations, eight (8) critical cross sections (Sections F, I, K, L, N, O, R, and S) were selected for seepage and slope stability analyses and one cross-section (Section D) was selected for slope stability analysis only (due to no active pool present at the structure to conduct seepage analysis). Permeability and strength parameters were derived based on the results of the drilling and lab testing programs, supplemental in-situ testing, historical information from past explorations, and Stantec's past experience with similar soils and CCB materials. The selection process for material properties modeled in the analyses is discussed in detail in Sections 9.2.2 and 9.3.2 of this report. The cross-sections provided in Appendix B depict the dike geometry, subsurface horizons, and material parameters modeled in the engineering analyses. Results of the analyses and evaluations are summarized in the following paragraphs. The results of the seepage and slope stability analyses are included in Appendix I and the plan locations of each cross section are identified on the geotechnical drawings included in Appendix B.

It should be noted that construction records indicating the methods used to construct the dikes, as-built dike configurations, etc. were not available for review. As a result, generalizations in soil parameters and dike geometry were needed to construct the seepage and stability models.

9.2. Seepage Analysis

9.2.1. SEEP/W Model

An analysis of steady state seepage through the dike was needed to estimate the magnitude of seepage gradients (for the evaluation of potential piping) and pore water pressures within the soils (for the evaluation of slope stability). The numerical seepage model for Bull Run Fossil Plant CCB Disposal Areas was developed using SEEP/W 2007 (Version 7.14), a finite element code tailored for modeling groundwater seepage problems in soil and rock. SEEP/W is distributed by GEO-SLOPE International, Ltd, of Calgary, Alberta, Canada.

SEEP/W uses soil properties, geometry, and boundary conditions provided by the user to compute the total hydraulic head at nodal points within the modeled cross section. Among other features, SEEP/W includes a graphical user interface, semi-automated mesh generation routines, iterative algorithms for solving unconfined flow problems, specialized boundary conditions (seepage faces, etc.), capabilities for steady-state or transient analyses, and features for visualizing model predictions. The program also includes material models that allow tracking both saturated and unsaturated flow, including the transition in seepage characteristics for soils that become saturated or unsaturated during the model simulation.

Eight cross sections through the Gypsum Disposal Area and Fly Ash Pond were modeled using SEEP/W, then subsequently evaluated for slope stability (Section 9.3). For the numerical analysis, each cross section was subdivided into a mesh of elements, consisting of first-order quadrilateral and triangular finite elements. For seepage problems, where the primary unknown (hydraulic head) is a scalar quantity, first-order elements provide for efficient, effective modeling. Given appropriate hydraulic conductivity properties and applied boundary conditions, the finite element method (as implemented in the SEEP/W program) was then used to simulate steady seepage across the mesh. The total hydraulic head was computed at each nodal location, from which pore water pressures and seepage gradients were determined.

9.2.2. Seepage Properties

For each cross section analyzed, a representative subsurface profile was configured based on boring logs, available record drawings, and the known project history. Stantec derived material properties for the seepage analyses based on available laboratory test data, field slug test data, and published reference sources. If no data was available, the material properties were estimated based on typical values for similar soils. For the ash materials encountered at the disposal areas, Stantec assumed one set of values for all sluiced ash (hydraulically placed fly and bottom ash) and ash dikes (compacted bottom and fly ash) due to the co-mingled composition and varying percentages of ash found in each boring. The material properties modeled in the seepage analyses are summarized in Table 14.

Table 14. Material Properties for SEEP/W Analysis

Soil Horizon	Saturated Hydraulic Conductivity k_v (cm/s)	Anisotropy Ratio k_h / k_v	Specific Gravity G_s	Void Ratio e	Volumetric Water Content	
					Saturated (%)	Residual (%)
Sluiced Fly Ash	5.1E-4	50	2.31	0.85	46	4
Ash Dike	2.0E-6	25	2.31	0.85	46	4
Lean Clay Dike (Fill)	7.0E-6	10	2.70	0.70	41	2
Sandy Lean Clay Dike (Fill)	8.5E-6	10	2.70	0.625	38	2
Lean Clay Alluvium	1.4E-5	20	2.70	0.70	41	2
Sandy Lean Clay Alluvium	8.5E-6	20	2.70	0.625	38	2
Fat Clay Alluvium	1.1E-6	20	2.73	0.70	41	2

Table 14. **Material Properties for SEEP/W Analysis**

Soil Horizon	Saturated Hydraulic Conductivity k_v (cm/s)	Anisotropy Ratio k_h / k_v	Specific Gravity G_s	Void Ratio e	Volumetric Water Content	
					Saturated (%)	Residual (%)
Silt	2.1E-3	20	2.68	0.65	39	2
Silty Sand to Sandy Silt	6.9E-2	20	2.68	0.65	39	2
Clayey Sand	5.0E-5	50	2.68	0.65	39	2
Gravelly Sand to Sand	1.6E-4	50	2.68	0.65	39	1

Note: SEEP/W requires input parameters k_h and ratio of k_v/k_h

Engineering judgment is very important in selecting appropriate hydraulic properties for earth materials. Unlike other soil properties, hydraulic conductivity can vary over several orders of magnitude for various soil horizons, often with substantial anisotropy (seepage in horizontal versus vertical directions). Laboratory test samples often do not represent important variations within a large soil deposit. For the BRF analysis, an iterative process of parametric calibration was used to arrive at final estimates of the seepage properties. Results from trial simulations were compared to field data (measured piezometric levels and the depth of groundwater in the borings). The material properties shown in Table 14 represent a solution matrix that closely matches the field data on all cross-sections. The results of the seepage analysis are discussed in Section 9.2.4.

Saturated vertical hydraulic conductivity values (k_v) were selected using available field data and laboratory test data, TVA memoranda, and published data. Typical values were selected for materials where laboratory test data was not available.

The ratio of horizontal hydraulic conductivity (k_h) to vertical hydraulic conductivity (k_v) was estimated based on Stantec's understanding of the placement or deposition of the material. An isotropic material would have k_h/k_v = 1, while deposits of horizontally layered soils, such as alluvial deposits, might have values as high as k_h/k_v = 100. Relatively high ratios were assumed for the sluiced fly ash (k_h/k_v = 50) and gravelly sands (k_h/k_v = 50), reflective of periodic deposition of materials with different gradations. Such deposits typically exhibit much greater permeability in the horizontal direction than in the vertical direction. More modest values (k_h/k_v = 10) were assumed for the dike fill materials, which were reportedly compacted in horizontal lifts.

The SEEP/W finite element program is structured to consider seepage through both saturated and unsaturated soils. To represent the change in hydraulic conductivity due to de-saturation of each soil, SEEP/W implements a model based on two functions – a hydraulic conductivity function and a volumetric water content function. Three parameters are needed to define this behavior: the saturated hydraulic conductivity, saturated water content, and residual water content (water content of air dried soil). Of these three parameters, only the residual water contents were estimated for each soil. The estimated residual water content values in Table 14 are based on Rawls et al. (1982) and Stantec's experience with similar materials at other TVA sites.

9.2.3. Boundary Conditions

The seepage analyses were performed assuming steady-state seepage with static water levels upstream and downstream of the dike. The upstream boundary condition values used in these analyses were based on the normal storage pool elevations for the Gypsum Disposal Area and Fly Ash Pond, where applicable by cross-section. The normal pool elevations were obtained from TVA Bull Run Fossil Plant personnel and historical information.

On the downstream side, the normal water elevation for sections K and L was assumed to be the normal storage pool elevation for the Fly Ash Pond. For sections F, I, N, O, R and S, the normal pool elevation for the Clinch River was assumed to be 795 feet MSL based on historical drawings and pool elevation data for 2009 provided by TVA personnel.

Cross-sections K and L, located on the south side of the Gypsum Disposal Area were modeled with a total head node to simulate the underdrain and header pipe system installed during the construction of the Area 2A dike. The node was placed at the horizontal coordinate of the header pipe taken from design drawings and survey information and was assumed to be at elevation 817 feet MSL, which corresponds to the bottom of the header pipe elevation as shown on the design drawings in Reference 7 of Table 1.

The Potential Seepage Face boundary condition applied on the downstream slope and toe assumes no seepage (flux = 0) through these areas of the dike. At the end of the first iteration, SEEP/W checked the nodes along the Potential Seepage Face for positive pressure, which is indicative of water ponding which is not possible along the slope face. Physically, it means water wants to leave through these nodes but the boundary condition prohibits the model from doing so. In subsequent iterations, SEEP/W assigned total head pressure at these nodes equal to the elevation head pressure. The boundary conditions modeled for steady-state seepage analysis are summarized in Table 15.

Table 15. Boundary Conditions

Stability Section	Upper Boundary Condition	Upper Boundary Condition Elevation (feet)	Lower Boundary Condition	Lower Boundary Condition Elevation (feet)
Section I	Gypsum Disposal Area	825.0	Clinch River	795.0
Section K	Gypsum Disposal Area	825.0	Fly Ash Pond	806.5
Section L	Gypsum Disposal Area	825.0	Fly Ash Pond	806.5
Section N	Fly Ash Stilling Pond	806.5	Clinch River	795.0
Section O	Fly Ash Stilling Pond	806.5	Clinch River	795.0
Section R	Fly Ash Pond	806.5	Clinch River	795.0
Section S	Fly Ash Pond	806.5	Clinch River	795.0
Section F	Gypsum Disposal Area/Piezometer Readings	811.0	Clinch River Channel	795.0

The boundary conditions used in the SEEP/W analysis for the ponds described above were modeled as total head equal to the given pool elevation. For sections where the pool limits were just beyond the cross section or the groundline was above recorded pond elevation, a total head vertical boundary line equal to the pond elevation was input into the model. For this scenario, the hydraulic head at each node was constant with depth and equal to the pool elevation on that side of the embankment. At other locations along the ground surface where potential seepage might occur, a total flux condition was modeled and potential seepage reviewed. The horizontal boundary at the base of the model (located within the bedrock) was modeled as a seepage barrier, with no vertical flow across the boundary nodes.

9.2.4. Seepage Analysis Results

Steady-state seepage analyses were conducted on four cross-sections through the Gypsum Disposal Area dikes and four sections through the Fly Ash Pond perimeter dikes. The material properties and boundary conditions were varied in our analysis until a reasonable match was obtained between the model results and field data. After several iterations, the final soil parameters were within expected ranges, based on soil type and laboratory data, and calibrated to give model predictions consistent with field measurements.

Plots from the SEEP/W analyses of the seven cross-sections are presented in Appendix I. These plots show the finite element mesh, material horizons, and boundary conditions used in each analysis. The results are shown in contour plots of total head, pore water pressure, and seepage gradients. For the slope stability analyses (Section 9.3), the pore water pressures along the considered slip surfaces were determined by interpolation between the nodal pore pressures predicted with the SEEP/W model. The seepage gradients were assessed for maximum exit gradients and the potential for soil piping (Section 9.2.4.3).

The phreatic surface (groundwater table or line of zero pore water pressure) is shown on the plots in Appendix I. In SEEP/W analysis, the location of the phreatic surface is found by interpolation between positive pore water pressures in the upper areas of saturated soil and negative pore pressures or suction in the unsaturated soil zone above. In the SEEP/W formulation, seepage flows are tracked in both the saturated and unsaturated zones. Hence, the top flow line in the SEEP/W results will be above the phreatic line. In more traditional seepage analyses, where unsaturated flows are ignored, the top flow line and the phreatic surface coincide. Hence, while the more complete unsaturated flow formulation in SEEP/W gives a reasonable prediction about the location and shape of the phreatic surface, the results are often different than would be obtained with a solution that considers only saturated flow. Furthermore, the pore water pressures in the stability analysis are determined from the full finite element solution, and not just from the depth below the phreatic surface.

9.2.4.1. Comparison with Field Data

After the initial seepage parameters were estimated, results from the SEEP/W model were compared to the readings in piezometers installed in the sections analyzed. Data from eighteen piezometers at six modeled cross-sections (all critical sections with installed piezometers) were used in this evaluation (three cross-sections at the Gypsum Disposal Area dikes and three on the Fly Ash Pond dikes). Nodes were depicted in our seepage models that corresponded to the elevations of the piezometer tips installed in the field. The total head predicted at the node was compared to the corresponding piezometer reading.

As previously discussed, piezometer data has been collected for the past seven months. Figure 6 shows a comparison between the maximum and minimum piezometer readings over the past seven months and the SEEP/W predicted total head at these piezometer locations.

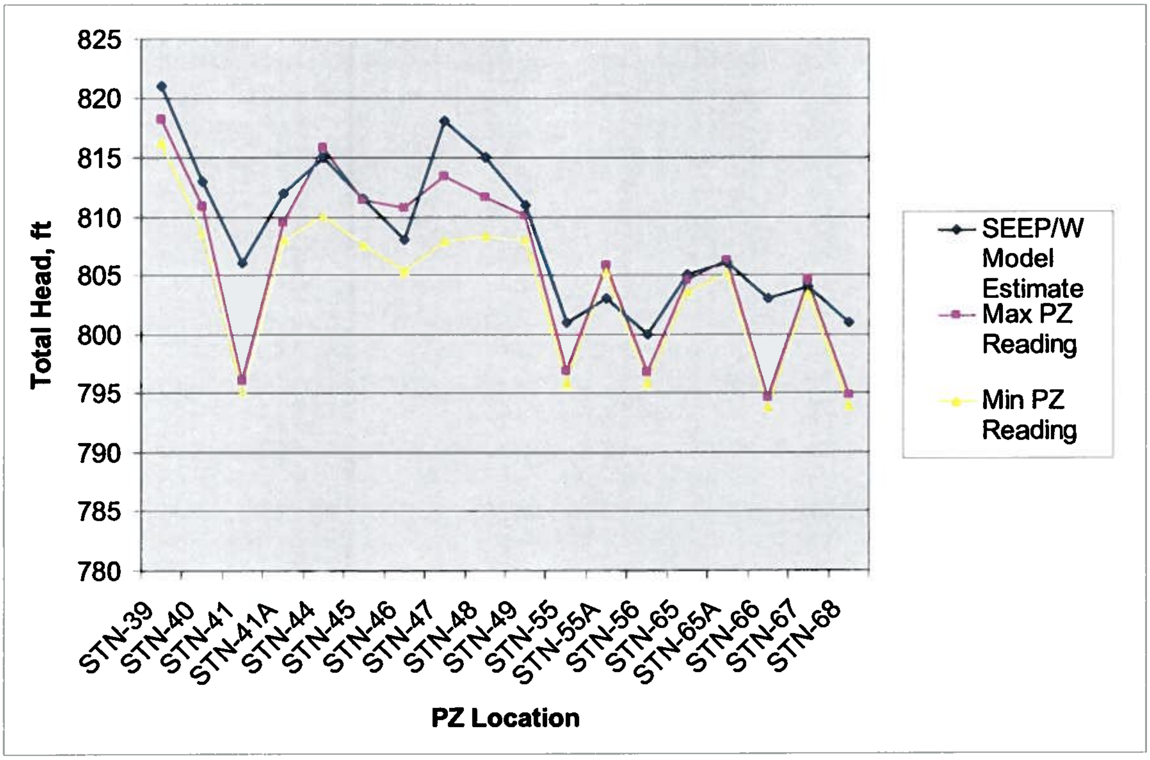


Figure 6. Comparison between the field piezometer readings and total head predicted by the SEEP/W model

The difference between highest field measurements of total head and the model predictions varies from -2.8 feet at STN-46 and STN-55A to 10.0 feet at STN-41. The degree of deviation between the model prediction and the actual piezometer reading is likely due to seasonal fluctuations of the groundwater table and river levels, precipitation, material properties, sluice discharge volume, and accuracy of the field data. As previously mentioned, our model assumed a steady-state condition upstream and downstream using the previously discussed boundary conditions and material properties.

9.2.4.2. Critical Exit Gradients

Seepage forces, resulting from hydrodynamic drag on the soil particles, can destabilize earth structures. Excessive hydraulic gradients near the ground surface can lead to the initiation of soil erosion and piping, which has caused numerous dam failures in the past. Hydraulic gradients, computed at points where seepage exits onto the ground surface, can be evaluated to understand the potential severity of this problem. The factor of safety with respect to soil piping (FS_{piping}) is defined as:

$$FS_{piping} = \frac{i_{crit}}{i}$$ **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:

$$i_{crit} = \frac{\gamma_{sub}}{\gamma_w} = \frac{G_s - 1}{1 + e}$$ **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 Equation 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 $i=i_{crit}$.

9.2.4.3. Seepage Gradients

Contour plots of the hydraulic gradients computed from the SEEP/W solutions are shown for each modeled cross-section in Appendix I. Large gradients and significant seepage can be seen at various locations within the cross-sections, but the concern is for areas where these gradients can initiate erosion or piping of material. In general, areas of potential concern are where water seeps laterally out onto a sloping ground surface, or where vertical, upward seepage occurs at the ground surface. Away from the ground surface, the potential movement of material due to seepage forces is arrested by the adjacent soil. Hence, the evaluation of seepage gradients within the dike is focused on areas near the ground surface on the downstream side of the dike.

In order to locate areas of maximum seepage pressure, contour plots of vertical gradient (i) were generated using a SEEP/W utility function. When turned on, this function can plot contours of maximum vertical gradient within a cross-section. Areas with higher vertical gradient will be shown in gradually darker colors (green to red) in SEEP/W generated models. Results of these models with vertical gradients are attached in Appendix I. All the cross-sections exhibited maximum vertical gradients at the downstream toe of the dike or within alluvial material below the phreatic surface of the downstream pool. Within a region of maximum vertical gradient, the node with the highest vertical gradient, (usually a surface node at the toe of the slope), was determined using another SEEP/W utility function. The critical gradient (i_{crit}) at that particular node was determined from the material properties using

Equation 2. The factor of safety against piping is then calculated using Equation 1. The factors of safety against piping were computed based on the exit gradients from the SEEP/W Model and critical gradients determined from the soil properties, which are summarized below in Table 16.

Table 16. Summary of Computed Exit Gradients and Factors of Safety against Piping

Cross-Section	Vertical Gradient (i) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}	Pool Elevation
I-I'	0.556	Downstream Slope Toe	Lean Clay Fill	1.000	1.8	Normal Pool
K-K'	0.379	Downstream Slope Toe	Sluiced Ash	0.708	1.9	Normal Pool
L-L'	0.277	Downstream Slope Toe	Sluiced Ash	0.708	2.6	Normal Pool
N-N'	0.226	Downstream Slope Toe	Sandy Lean Clay Fill	1.046	4.6	Normal Pool
O-O'	0.219	Downstream Slope Toe	Fat Clay Alluvium	1.018	4.7	Normal Pool
R-R'	0.312	Downstream Slope Toe	Lean Clay Fill	1.000	3.2	Normal Pool
S-S'	0.424	Downstream Slope Toe	Lean Clay Fill	1.000	2.4	Normal Pool

The United States Army Corps of Engineers (USACE) design criteria in EM 1110-2-1901 indicates factors of safety against piping should be at least 3.0. As per our understanding, TVA guidelines match this criterion. The lowest computed factor of safety was found at cross-section I-I' on the downstream slope toe of the dike. However, cross-sections I-I', K-K', L-L' and S-S' show factors of safety below 3.0, hence, they do not meet the design criteria for piping.

9.3. Slope Stability Analyses

The stability of the Bottom Ash Disposal Area (Area 1), Gypsum Disposal Area (Area 2A) and Fly Ash Pond (Area 2) dikes were evaluated using limit equilibrium methods as implemented in the SLOPE/W module. With SLOPE/W, the distribution of pore water pressures within the earth mass can be mapped directly from a SEEP/W solution. In this study, steady-state pore pressures were obtained from the SEEP/W model described in Section 5.2. For Section D-D' in the Bottom Ash Disposal Area, the phreatic surface was estimated from maximum piezometer readings obtained in the field during the previous seven months. Engineering parameters, including unit weight and shear strength properties of the subsurface materials modeled in the stability analyses are discussed in Section 9.2 of this report.

9.3.1. Limit Equilibrium Methods in SLOPE/W

Limit equilibrium methods for evaluating slope stability consider the static equilibrium of a soil mass above a potential failure surface. 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.

Spencer's solution procedure (1967), which satisfies both moment and force equilibrium for each slice, was used in this study. Spencer's procedure computes FS_{slope} for an assumed failure surface; a search must be made to find the critical slip surface corresponding to the lowest FS_{slope}. Both circular and noncircular potential failure surfaces can be evaluated. The optimization scheme available within SLOPE/W was used to consider noncircular, curved slip surfaces. The results of the slope stability analyses discussed in Section 9.3.3 and depicted on the slope with plots in Appendix I represent factors of safety computed from the optimized, circular slip surface routine.

9.3.2. Strength Parameter Selection

The perimeter lower dikes along the south and west sides of the Bull Run disposal areas were constructed in the mid-1960's and the upper dikes were constructed in the mid-1970's and have exhibited their current cross-sectional geometry (slopes and crest elevation) for approximately 30 years. The ash perimeter dike above elevation 810 feet impounding the Gypsum Disposal Area was constructed in 2006 and has maintained its current cross-sectional geometry for about 3 years. 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, our analyses focused 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 soil can be determined from effective stress strength parameters using the following equations:

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

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

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

The soil parameters used for the clay dikes, ash dikes, sluiced ash and alluvial materials were derived using both current and historical laboratory test data (consolidated-undrained triaxial tests, direct simple shear tests, standard penetration testing data, and classification testing data) and Stantec's experience with these materials in similar applications.

Uncemented or Granular Soil

Uncemented soils exhibit no strength at $\sigma'=0$, 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 our exploration that were unable to be sampled using undisturbed methods. This prevented conducting triaxial testing to derive shear strength parameters. Compacted bottom ash/fly ash mixture soil horizons were the predominant horizons encountered in the dike above elevation 810' at the Gypsum Disposal Area and Bottom Ash Disposal Area, while sand, silt, silty sand, clayey sand and gravel horizons were encountered at varying thicknesses within the foundation alluvium across the entire project site. 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 densities, and effective friction angles Φ'. However, as discussed in Section 6.1 of this report, the SP 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 SP 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:

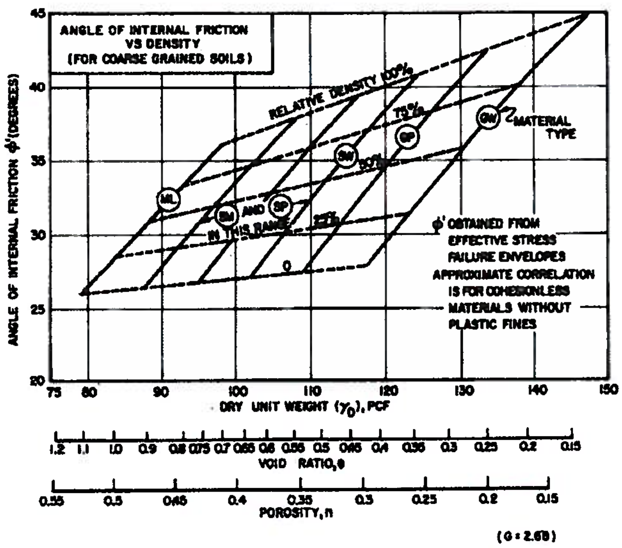
$$(N')_{60} = C_N N_{60} \qquad \textbf{Eqn. 8}$$

Where:

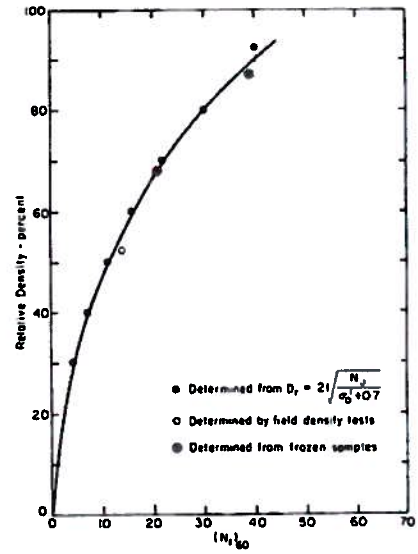
C_N = correction factor for overburden stress
$(N')_{60}$ = standardized N-value

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 blowcounts 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 7 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 7 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 7. 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 each soil horizon was estimated based upon blow counts (N-values) from all cross-sections and using the 2/3rd rule. The rule implies that approximately two-thirds of the data points fall above and one-third fall below the chosen parameter.

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.

An effective friction angle for the lean clay dike (fill), sandy lean clay dike (fill), lean clay alluvium, sandy lean clay alluvium and fat clay alluvium horizons were selected based on (1) results of nine consolidated-undrained triaxial (CU) tests, (2) results of the SP testing 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 8 (from Duncan and Wright, 2005). The unit weight for the clay soil horizons were selected based on density testing of undisturbed 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 8. Typical Values of Peak Friction Angle Φ') for Normally Consolidated Clays

Sluiced Fly Ash

Stantec performed four consolidated undrained triaxial tests and seven (7) direct simple shear tests on undisturbed samples of sluiced fly ash with co-mingled sluiced bottom ash. For the purposed of the stability analysis, the sluiced ash (fly and bottom ash) were modeled as one layer with a single set of shear strength parameters. To select the representative strengths for sluiced ash, 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. Separate plots were created using the data generated from the consolidated undrained triaxial tests and the direct simple shear tests. The selected strength parameters represent a failure envelope where about 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 Kingston 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 Kingston 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 25 degrees was selected for the sluiced ash encountered at the Bull Run disposal facilities based on the DSS plot and comparison with Kingston Fossil Plant data. The saturated and moist unit weights selected for sluiced ash are 105 and 100 pounds per cubic foot, respectively.

The soil parameters for the clay, ash and granular horizons modeled in the slope stability analyses are summarized in Table 17 and shown on the stability analysis results in Appendix I.

Table 17. Selected Strength parameters for Stability Analysis

Soil Horizon	Saturated Unit Weight (pcf)	Effective Stress Strength Parameters	
		C' (psf)	φ' (degrees)
Lean Clay Dike (Fill)	126	0	33
Sandy Clay Dike (Fill)	126	0	33
Sluiced Fly Ash	105	0	25
Compacted Ash Dike	105	0	33
Lean Clay Alluvium	123	0	31
Sandy Lean Clay Alluvium	127	0	33
Fat Clay Alluvium	121	0	30
Clayey Sand Alluvium	112	0	33
Silt Alluvium	109	0	28
Sandy Silt to Silty Sand Alluvium	107	0	29
Sand Alluvium	120	0	33
Gravel Alluvium	135	0	40

9.3.3. Slope Stability Results

Using the strength parameters listed in Table 17, in conjunction with the results of the seepage analyses, the existing dike slopes were analyzed at the nine referenced cross-sections of the disposal areas. The slope stability analyses were performed using SLOPE/W 2007 to evaluate the downstream faces of the dike as applicable. The failure surfaces were generated using the "Grid and Radius" method where a wide variation of trial slip surfaces were generated with a defined grid of possible circle centers and a defined range of radii or "Entry and Exit" method where failure circles were analyzed by defining ranges for potential failure circle entry and exit points and a defined range of radii.

Where the surface slope is composed of cohesionless (c' = 0) materials, an infinite slope failure (shallow sliding parallel to the surface) will be critical. While solutions were obtained for this case for two sections, as reported below, there is less concern for this potential failure mechanism. Suction pressures in unsaturated surface soils will often create enough apparent cohesion to prevent this type of failure. If shallow sliding does occur, the resulting deformations are unlikely to threaten the integrity of the dike and can be repaired. To force the search routine to evaluate deeper failure mechanisms, the surfaces were generated using the "Grid and Radius" method where a wide variation of trail slip surfaces were generated with a defined grid of possible circle centers and a defined range of radii.

The slope/w plots in Appendix I depict the modeled shear-strength parameters, predicted failure surfaces, and associated factors of safety. The results of the analyses are included in Appendix I and summarized in Table 18 below.

Table 18. Summary of Computed Factors of Safety for Slope Stability

Cross-Section	Exterior Slope Global Failure	Exterior Slope Non-Global Failure	Pool Elevation
D – D'	2.1	1.4	Normal Pool
F – F'	N/A	1.4	Normal Pool
I – I'	1.2	1.0 (dike) 1.1 (embankment)	Normal Pool
K – K'	1.2	N/A	Normal Pool
L – L'	1.1	N/A	Normal Pool
N – N'	1.4	1.1	Normal Pool
O – O'	1.4	1.1	Normal Pool
R – R'	1.3	1.0	Normal Pool
S – S'	1.2	1.1	Normal Pool

The term global failure used in the table above refers to deep seated movements that would threaten partial or total loss of the Area 2 or 2A pool. The slip plane in this case was assumed to be as close as 15 to 20 feet from the ground surface and result in a breach of the dike system by causing most of the upper dike and the entire lower dike to fail.

The term non-global failure refers to relatively shallow slides that, while not detrimental to the overall stability of the dike, could progress into failures that could threaten the pool if not repaired. The deepest segment of this slip surface is as close as 10 feet below the ground surface and this slip plane would correspond to the failure of either the upper or lower dike exterior slopes, or both, but not the entire dike system. It is assumed maintenance or repair actions can be implemented before this failure results in a breach of the dike system.

The Tennessee Department of Environment and Conservation (TDEC) "Rules and Regulations Applied to the Safe Dams Act of 1973" provides guidance and standards with regards to existing dams. The standards do not specifically address target factors of safety for slope stability, but instead merely indicate that the dam shall be "stable". Based on discussions with TVA and to be in accordance with current prevailing practices, a minimum factor of safety of 1.5 was established for long term conditions using the guidelines presented in USACE Manual EM 1110-2-1902 "Slope Stability".

The results of our stability analyses show that the CCB storage facility slopes do not meet the established criteria for a long term factor of safety of 1.5 for a deep seated failure at cross-sections I-I', K-K', L-L', N-N', O-O', R-R' and S-S'. The lowest factors of safety were calculated at the downstream side of the perimeter clay lower dike surrounding the south and west sides of Disposal Areas 2 and 2A and along the ash dike on the south side of Area 2A. It should also be noted that the slope at several of these locations does not meet the established factor of safety standard against piping as discussed in the Section 9.2.4.3. Remedial measures will be required to improve the factors of safety for both piping and stability.

9.4. Results of Engineering Analysis after Conceptual Repairs

Where the analyses of existing conditions did not result in acceptable factors of safety for piping and/or stability, the cross-sections were further analyzed assuming certain corrective measures would be implemented. In the case of the perimeter clay dikes on the south and west side of Areas 2 and 2A (cross-sections I-I', N-N', O-O', R-R' and S-S'), the proposed corrective measures analyzed included lowering the pool in the Fly Ash Pond to elevation 801.5 feet (a decrease of approximately 5 feet), and to elevation 795 feet (a decrease of approximately 11.5 feet), or the construction of a crushed stone (rip-rap) buttress along the downstream slope extending into the Clinch River. Additionally, cross-sections I-I' and S-S' were analyzed with a proposed 30' deep slurry wall installed at the crest of the upper perimeter dike, and also the combination of the proposed slurry wall in addition to lowering the pool in the Fly Ash Pond to elevation 801.5' (section S-S' only).

The proposed corrective measures selected for the south dike of the Gypsum Disposal Area are consistent with the workplan that Stantec has prepared to address this slope. The corrective measures include the construction of a crushed stone (rip-rap) buttress at the toe of the slope in combination with armoring of the slope above the buttress and constructing a reverse filter to address low factor of safety against piping on the toe of the slope. This proposed repair condition was analyzed with the current pool elevation in the Gypsum Disposal Area of 825 feet MSL.

Several corrective measures were considered to attempt improving the stability of the perimeter dike system along the west side of the Gypsum Disposal Area. Lowering the Gypsum Disposal Area pool elevation to lower the phreatic surface across the perimeter dikes is not considered a viable option since at this time the plan is for the plant to continue sluicing gypsum into the stack for the next 3 to 5 years and the bottom of the stack (gypsum surface) is already near elevation 825 feet. If TVA elects to construct cells within the existing pool area and these cells are properly lined to isolate the sluicing operation and possibly reduce seepage across the dikes, then this option can be reconsidered.

Another corrective measure considered was the construction of a sub-drain along the exterior toe of the Gypsum Area west embankment. However, this is not a practical option due to the following factors: (1) The phreatic surface elevation between the upper Gypsum Area embankment (818 feet) and the upper perimeter dike (809 feet) has only a slight gradient; (2) the phreatic surface along the toe of the west embankment is at or above the existing ground surface (808 feet); (3) the existing ground surface along the toe of the gypsum stack west embankment is practically flat (elevation 808 feet); and (4) as per permit, the toe drain would have to drain into the Fly Ash Pond, where the normal pool elevation is 806.5 feet. Based on the length and flat ground surface along the toe of the west embankment of Area 2A, the construction of a toe drain with adequate gradient would not be practical or effective in lowering the phreatic surface across the perimeter dike system.

To simulate future operations for the next 3 to 5 years at Area 2A, stability analysis was run on the proposed corrective measures described above for cross-section I-I', L-L' and K-K' assuming the pool is raised to elevation 830'. In regards to section I-I', both the proposed measures of constructing a rip-rap buttress on the exterior slope of the lower dike or constructing a 30-foot deep slurry wall along the centerline of the upper perimeter dike yield factors of safety against sliding of 1.4 for global failures. In order to achieve a factor of safety of 1.5 against global failure, a combination of corrective measures had to be modeled. Using the assumed corrective measures of constructing a 30-foot slurry wall described above and regrading the exterior slope of the upper perimeter dike to a 3H:1V slope, which involves shifting the perimeter access road approximately 9 feet, a factor of safety of 1.6 is achieved against global failure. For the south side of the Gypsum Disposal Area, the work plan Stantec has prepared for construction of a rock buttress meets the minimum factor or safety against sliding of 1.5 for both sections with the Area 2A pool raised to elevation 830'.

Cross-section F-F' on the north slope of the Gypsum Disposal Area and section D-D' on the west slope of the Bottom Ash Disposal Area exhibited deficient factors of safety against maintenance type slope failures. These two cross-sections were analyzed assuming regrading of the deficient steep slopes until a passing factor of safety was achieved. Cross-section I-I' also exhibited a deficient factor of safety against a non-global failure on the ash embankment portion of the slope above elevation 810 feet. Proposed remedial efforst analyzed to achieve a passing factor of safety included a 3H:1V configuration utilizing clay fill and a reverse filter to control seepage. Stantec is currently preparing a work plan to flatten these slopes as part of the construction contract to improve drainage around the perimeter of the subject CCB storage facilities.

Seepage and slope stability analysis of the different proposed conditions for the sections mentioned above were analyzed using the same parameters and search methods discussed in previous sections of this report. Further discussion relative to implementation of corrective measures is presented in Section 10.4 'Slope Stability Improvement Measures'. The results of the additional seepage and stability analyses are included in Appendix I and summarized in Tables 19-26 below.

Table 19. Summary of Computed Exit Gradients and Factors of Safety against Piping with Fly Ash Disposal Area Pool Lowered to Elevation 801.5'

Cross-Section	Vertical Gradient (i_v) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}	Pool Elevation
N-N'	0.137	Downstream Slope Toe	Sandy Lean Clay Fill	1.046	7.6	Lowered Pool
O-O'	0.123	Downstream Slope Toe	Fat Clay Alluvium	1.018	8.3	Lowered Pool
R-R'	0.189	Downstream Slope Toe	Lean Clay Fill	1.0	5.3	Lowered Pool
S-S'	0.253	Downstream Slope Toe	Lean Clay Fill	1.0	4.0	Lowered Pool

Table 20. Summary of Computed Exit Gradients and Factors of Safety against Piping with Proposed Buttress Constructed on Downstream Slope

Cross-Section	Vertical Gradient (i_v) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}	Pool Elevation
I-I'	0.172	Downstream Slope Toe	Lean Clay Fill	1.0	5.8	Normal Pool
N-N'	0.206	Downstream Slope Toe	Sandy Lean Clay Fill	1.046	5.1	Normal Pool
O-O'	0.219	Downstream Slope Toe	Fat Clay Alluvium	1.018	4.7	Normal Pool
R-R'	0.056	Downstream Slope Toe	Lean Clay Fill	1.0	17.9	Normal Pool
S-S'	0.082	Downstream Slope Toe	Lean Clay Alluvium	1.0	12.2	Normal Pool

Table 21. Summary of Computed Exit Gradients and Factors of Safety against Piping with Proposed Slurry Wall and Combination of Remedial Measures

Cross-Section	Vertical Gradient (i_v) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}	Pool Elevation
S-S' (Slurry Wall)	0.214	Downstream Slope Toe	Lean Clay Alluvium	1.0	4.7	Normal Pool
S-S' (Slurry Wall and Lowered Pool)	0.120	Downstream Slope Toe	Lean Clay Alluvium	1.0	8.3	Lowered Pool
I-I' (Slurry Wall)	0.377	Downstream Slope Toe	Lean Clay Fill	1.0	2.7	Normal Pool
I-I' (Slurry Wall, 3H:1V Dike Re-grade, Raised Pool)	0.373	Downstream Slope Toe	Lean Clay Fill	1.0	2.7	Raised Pool

Table 22. Summary of Computed Global Factors of Safety for Slope Stability Assuming Proposed Repairs

Cross-Section	Ash Pond Pool Lowered to 801.5'	Crushed Stone Buttress	30' Deep Slurry Wall	30' Deep Slurry Wall, 3H:1V Dike Regrade, Raised Pool to 830'	30' Deep Slurry Wall and Pool Lowered to 801.5'
I – I'	N/A	1.5	1.5	1.6	N/A
N – N'	1.6	1.7	N/A	N/A	N/A
O – O'	1.6	1.8	N/A	N/A	N/A
R – R'	1.5	1.7	N/A	N/A	N/A
S – S'	1.4	1.7	1.4	N/A	1.5

Table 23. Summary of Computed Exit Gradients and Factors of Safety against Piping with Proposed Buttress Constructed on South Side of Gypsum Stack

Cross-Section	Vertical Gradient (i_v) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}	Pool Elevation
K-K'	0.518	Downstream Slope Toe	Ash Dike	0.708	1.4*	Normal Pool
L-L'	0.040	Downstream Slope Toe	Sluiced Ash	0.708	17.7	Normal Pool

* The work plan prepared by Stantec for the buttress and armoring of the south slope of the Gypsum Disposal Area includes a reverse filter in the area of low factor of safety against piping to control seepage. This filter cannot be modeled in SeepW to raise the Factor of Safety against piping, but construction of the filter will raise the F.S. for piping above the minimum target of 3.0.

Table 24. Summary of Computed Exit Gradients and Factors of Safety against Piping with Proposed Buttress Constructed on South Side of Gypsum Stack and Gypsum Disposal Area Pool Raised to Elevation 830'

Cross-Section	Vertical Gradient (i_v) at Critical Exit Point	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}	Pool Elevation
K-K'	0.719	Downstream Slope Toe	Ash Dike	0.708	1.0*	Raised Pool
L-L'	0.050	Downstream Slope Toe	Sluiced Ash	0.708	14.2	Raised Pool

* The work plan prepared by Stantec for the buttress and armoring of the south slope of the Gypsum Disposal Area includes a reverse filter in the area of low factor of safety against piping to control seepage. This filter cannot be modeled in SeepW to raise the Factor of Safety against piping, but construction of the filter will raise the F.S. for piping above the minimum target of 3.0.

Table 25. Summary of Computed Global Factors of Safety for Slope Stability with Proposed Buttress Constructed on South Side of Gypsum Stack

Cross-Section	Gypsum Disposal Area Pool 825'	Gypsum Disposal Area Pool 830'
K – K'	1.7	1.5
L – L'	2.3	2.2

Table 26. Summary of Computed Maintenance Factors of Safety for Slope Stability with Proposed Slopes Reconfiguration

Cross-Section	Slopes Regrade to 2.5:1	Slopes Regrade to 3:1
D – D'	1.9	N/A
F – F'	N/A	2.3
I – I'	N/A	1.6 (Fill)

Table 27. Summary of Computed Global Factors of Safety for Slope Stability for Varying Ash Pond Pool Levels

Cross-Section	Ash Pond Pool at Elev. 806.5'	Ash Pond Pool Lowered to Elev. 801.5'	Ash Pond Pool Lowered to Elev. 795'
N – N'	1.4	1.6	1.9
O – O'	1.4	1.6	1.9
R – R'	1.3	1.5	1.8
S – S'	1.2	1.4	1.7

10. Conclusions and Recommendations

10.1. Area 1 – Bottom Ash Disposal Area

10.1.1. Historical Information

Area 1 was initially utilized to store sluiced fly ash when the BRF plant went online in 1966. In 1980, Area 1 was modified to receive dredged material from Area 2 (fly ash), and in 1981 it was used as a fly ash settlement pond which discharged into an ash channel. The northeast corner of Area 1 received sluiced bottom ash and a channel traversing along its east side conveyed the bottom ash to Area 2 (current operations). In 1985, the settlement pond in Area 1 ceased receiving sluiced ash and was filled with bottom ash. From 1988 to 2004, bottom ash was temporarily stacked in this area prior to going to Area 2A for disposal. From 2004 to present all bottom ash not sold is stacked in Area 1.

According to historical information, slippage and settlement was observed along the south dike in 1981. Also, several slides were noted on the upper dike in 1998, although the records do not indicate on which side of Area 1 this occurred.

10.1.2. Subsurface Conditions and Stability Analyses

The lower and upper dikes extend along the west side of Area 1 are similar to the Area 2 and 2A perimeter dikes. However, the Area 1 dikes have flatter slopes and, in fact, the top of the lower dike in the north portion of Area 1 slopes down toward the river instead of forming a flat intermediate bench as is the case in Areas 2 and 2A. The subsurface conditions within the dikes and foundation deposits next to Area 1 are similar to those encountered in Area 2 dikes. The dikes were constructed using clayey soil and the foundation conditions are as discussed previously in Section 8.2.

The subsurface conditions within the original pool area consist of cyclic sequences of bottom ash, fly ash and bottom ash mixed with fly ash layers, underlain by alluvial clays and sands. Depending on boring location, the presumed top of sluiced ash originally deposited in this area was found at elevations ranging approximately from 788 feet in Boring STN-15 to 810 feet in Borings STN-9 and STN-14.

The stability of the perimeter dikes built along the Clinch River bank was evaluated using two-dimensional limit equilibrium methods of analysis, assuming static, long-term and fully drained conditions within the existing dikes and foundation soils. The slope stability calculations for existing conditions along Section D-D' of the perimeter dike produced a factor of safety of 2.1 against sliding, which is above the minimum acceptable value.

Above elevation 810 feet, the lower portion of the west slope of Area 1 has a 1.5H:1V slope up to elevation 818 feet. Although the factor of safety for global stability above elevation 810 feet is above 1.5, the factor of safety for a shallow (or local) failure is 1.4 due to the steep slope. This factor of safety for shallow failure should also apply to other sites within Area 1 where bottom ash stacks have similar steep slopes.

10.2. Area 2 - Fly Ash Pond

10.2.1. Historical Information

The Fly Ash Pond was originally developed as wet ash disposal area located on the floodplain of the Clinch River along with Area 1. The principal initial feature of the disposal area was a 15-foot (±) high earthen dike constructed along the east flank of Clinch River and what is now the north flank of Bull Run Creek. The top of dike elevation was 800 feet and the interior and exterior dike slopes were 2H:1V. The dike was later expanded vertically toward the pool to a maximum crest elevation of 810 feet also using 2H:1V slopes. Available design or as-built information shows that no under-drain features were installed to control seepage across the dikes. At the present, the normal pool elevation of the pond is 806.5 feet.

According to historical information, the upper dike was constructed partially on top of the lower dike and partially on bottom, fly ash or earthen fill material placed after undercutting ash deposits. Also, it was not uncommon to stack ash inside the pool up to elevation 825 feet. Seepage or wet and soft areas have been observed on the west and south dikes at various times from 1976 to 2009. A slump of the Bull Run Creek bank, or exterior slope of the lower south dike, was also observed near the southeast corner of the pond during the Phase 1 assessment.

10.2.2. Subsurface Conditions and Slope Stability Analyses

Boring and survey information obtained during this exploration generally confirms the information provided by the historic documents relative to the materials used to construct the dikes and geometry of the dikes. The dikes were constructed with clayey soil and using 2H:1V slopes. The lower dike was constructed mostly on top of alluvial clay deposits underlain by alluvial sands and gravel. The foundation deposits directly under the upper dike vary in terms of material types and consistency. These deposits consist of clayey soil (top of lower dike), bottom ash, fly ash, or a combination thereof. The lateral extent of the different foundation conditions is unknown. The consistency of the clayey dike material and foundation deposits varies from soft to very stiff. The ash deposits and alluvial sand range from very loose to very dense in terms of relative density.

Data obtained from instrumentation installed within the dikes and foundation deposits show high phreatic levels. These conditions are a result of the high Fly Ash Pond normal pool elevation (806.5 feet) with respect to the top of the upper dike (810 feet) and the lack of seepage control measures (under-drain features) within the dikes. It is also possible the uncontrolled seepage across the upper dike is the source of wet conditions observed along the top (elevation 800 feet) of the lower dike.

The stability of the dikes was evaluated using two-dimensional limit equilibrium methods of analysis, assuming static, long-term and fully drained conditions within the existing dikes and foundation materials. The slope stability calculations for existing conditions along four typical cross sections of the dikes produced factors of safety against sliding ranging from about 1.2 to 1.4, which are below the minimum acceptable value that current USACE criteria requires for long-term loading conditions. The low factors of safety for the perimeter dikes are a result of high phreatic levels described in the previous paragraph, lack of under-drain features to control seepage across the dike, steepness of exterior slopes, and shear strength of the dike material.

10.2.3. Seepage Analyses

Seepage analyses were performed on selected cross sections of Area 2 to estimate seepage gradients for the evaluation of piping potential, and pore water pressures within dike and foundation soils used in slope stability analyses. The analyses were performed for steady-state seepage through saturated and unsaturated soils. The lowest factors of safety against piping, computed for the surficial 3 to 5 feet of soil in these areas, ranged from 2.4 to 4.7. According to USACE design criteria for dams (EM 110-2-1901), the target minimum factor of safety against piping is 3.0.

10.3. Area 2A - Gypsum Disposal Area

10.3.1. Historical Information

Area 2A was created in 1981 after a divider dike was constructed to divide Area 2. Prior to its creation and until 1989, Area 2A received mostly sluiced ash. Bottom ash from Area 1 was dry stacked in Area 2A from 1989 until 2004. Construction of the Gypsum Disposal

Area began in 2006 and the facility went online in late 2008. The more recent Area 2A dikes were constructed mostly over sluiced ash deposits, although certain areas of these deposits appear to have filled over with dry ash before the dikes were constructed.

The south dike of the gypsum disposal area was constructed over sluiced ash deposits that extend into the Fly Ash Pond (Area 2) well beyond the toe of the dike. The design of the Gypsum Disposal Area included the construction of sand columns within the sluiced ash foundation deposits to reduce the potential for slope instability of the south dike during construction due to excessive pore pressure buildup. The design also specified the construction of under-drain features to control seepage across the dike. The seepage control measures consisted of perimeter drains discharging into finger drains which in turn discharged seepage water along the exterior slope of the east, west and south dikes.

As construction was being completed in 2007, seepage through the lower portion of the south dike caused sloughs along the exterior toe. As a result, some of the seepage control features were modified, new features were added and the sloughing was repaired. However, new sloughing developed along practically the same areas of the south dike on October 6, 2009.

Observations made during 2009 identified several areas or features of concern along both the exterior and interior slopes of the dikes. Some of the concerns identified in 2009 have been already corrected, or work plans have already been issued to correct them. Other concerns are subject of this exploration. Outstanding concerns aside from global stability of some of the dike slopes are poor surface drainage conditions on the exterior intermediate benches of the Gypsum Disposal Area and the top of the lower dike along the west side of Area 2A.

10.3.2. Subsurface Conditions and Stability Analyses

The dikes of the Gypsum Disposal Area were constructed using bottom ash mixed with fly ash over sluiced ash deposits. The sluiced ash deposits are underlain by alluvial clays, silts and sands. The dike material appears to be well compacted based on SPT information obtained in several borings. Conversely, N-values obtained from standard penetration tests performed within the sluiced ash range from 0 to 5 blow per foot, indicating a very loose to loose relative density. The consistency of the alluvial deposits is generally very soft to medium stiff.

The subsurface conditions of the dikes located along the west side of the Gypsum Disposal Area are similar to those encountered under the dikes that form the west and south sides of Area 2. These conditions are described in Section 8.4 of this report.

The slope stability calculations produced factors of safety against sliding below 1.5 -- the minimum acceptable value that current USACE criteria requires for long-term loading conditions -- for the south dike of the Gypsum Disposal Area and the perimeter dikes (top elevation 810 feet) constructed along the Clinch River bank and the drainage channel that separates Area 1 and 2A. The low factors of safety for the south slope of Area 2A are caused by the low shear strength of the foundation material (sluiced ash), relatively high phreatic levels near the dike toe and sloping ash pond bottom next to the west side of the south slope. The low factor of safety calculated for the perimeter dikes of Area 2A is a result of steep slope conditions and high phreatic levels due to lack of seepage control measures within the dikes.

Above elevation 810 feet, the lower portion of the north and west slope of Area 2A has a 1.5H:1V slope up to elevation 818 feet. Although the factor of safety for global stability above elevation 810 feet is above 1.5, the factor of safety for a shallow (or local) failure is 1.4 for the north side and 1.1 for the west side. Obviously, if the dike below elevation 810 feet fails, the slope above 810 feet may also fail.

10.3.3. Seepage Analyses

Seepage analyses were performed on two south dike cross sections of Area 2A to estimate seepage gradients for the evaluation of piping potential, and pore water pressures within dike and foundation soils used in slope stability analyses. The analyses were performed for steady-state seepage through saturated and unsaturated soils. The factors of safety against piping computed for the surficial 3 to 5 feet of soil near the toe of the south dike were 2.6 for Section L-L' and 1.9 for Section K-K', which are lower than the target minimum factor of safety against piping of 3.0.

A similar analyses was performed for Section I-I' of the perimeter dike located next to Clinch River. The factor of safety against piping computed for the surficial 3 to 5 feet of soil near the toe of the lower dike was 1.8 for Section I-I'.

10.4. Slope Stability Improvement Measures

10.4.1. Area 2 – Fly Ash Pond

After reviewing different corrective measures, Stantec considered one corrective action and two construction measures that could improve the stability of the Area 2 dikes. The factors of safety against sliding were then calculated for the typical dike cross sections after the corrective measures are applied independently.

If the normal pool elevation of the Fly Ash Pond is permanently lowered five feet (to 801.5 feet), as a corrective action to lower the phreatic level across the dikes, the improved calculated factors of safety range from 1.4 to 1.6. Also, lowering the normal pool elevation by five feet would result in an acceptable factor of safety against piping. Based on information provided by TVA, the required free water volume of the ash pond is maintained provided the pool is not lowered below 801 feet. Therefore, since ash would continue to be sluiced into the pond, lowering the pool permanently will probably require dredging ash out of the pond in the near future. In addition, the pool would need to be lowered at a prescribed rate to prevent rapid drawdown failures of the dike interior slopes and the south dike of the Gypsum Disposal Area.

Constructing a rock buttress on the exterior slope of the lower dike would raise the factors of safety against sliding above 1.5. A buttress crest elevation of 800 feet and a slope ranging from 3H:1V to 4H:1V extending approximately 90 to 110 feet into the Clinch River and Bull Run Creek as measured from the outside crest of the lower dike would be required. If at the same time a reverse filter is placed near the exterior toe of the lower dike, the recommended minimum factor of safety against piping would also de attained. Most of the buttress would be constructed within US waters, which would require submitting and attaining an encroachment permit from federal and state regulatory agencies.

Another construction measure TVA may consider would be to construct a cement-bentonite slurry or cutoff wall through the crest of the upper dike. The purpose of the slurry wall would be to control seepage across the two dikes by constructing a two-foot (±) thick barrier that extends approximately 30 feet into the ground. Constructing a slurry wall would initially lengthen the path of the pool water seeping across the dikes and lower the phreatic surface outside the upper dike to approximate elevation 798 feet, or about 3 feet above the normal pool elevation of Melton Hill Reservoir. The engineering analysis of the case analyzed at cross-section S-S' shows that the resultant factor of safety against sliding would increase to 1.4, however, if the slurry wall was constructed in conjunction with permanently lowering the Ash Pond pool to elevation 801.5 feet, then the resultant factor of safety against sliding would increase to 1.5, the minimum target factor of safety. The factor of safety against piping would also be raised to 4.7 and 8.3, respectively, for the two conditions described above. The cost of a slurry wall is dependent on the depth, length, and width of wall, site geological and hydrological characteristics, available workroom, selected backfill material and other ancillary costs such as site restoration and disposal. The typical cost of a cement-bentonite slurry wall ranges from $3.00 to $6.00 per square foot. Economies of scale should apply in this case.

10.4.2. Area 2A – Gypsum Disposal Area

At TVA's request, Stantec has prepared a work plan to improve the stability of the south dike of the Gypsum Disposal Area. The work plan consists of constructing a rock buttress in the fly ash pond next to the toe of the south dike and armoring the south slope from elevation 808 feet up to 825 feet.

The preparatory work to construct the buttress includes removing the sloughed material (vegetative and clay cover). The combination of the constructed buttress and a reverse filter constructed immediately below the toe of the dike and the slope armoring will attain an acceptable factor of safety against piping of the ash material. The work plan also calls for placing a geogrid layer over the sluiced ash surface below the reverse filter to reduce buttress rock fragment penetration into the wet ash.

According to engineering analyses, after constructing the buttress and reverse filter as shown on the work plan, the factor of safety against sliding for long term loading conditions would rise to 1.7 in Section K-K' and to 2.3 in Section L-L', assuming the pool elevation within the Gypsum Disposal Area is at elevation 825 feet. The resulting factor of safety against piping would be above 17 for Section L-L', and below 3.0 for Section K-K' before the graded filter is installed to control piping. If the pool is raised to elevation 830 feet, the calculated factor of safety against sliding is 1.5 in Section K-K' and 2.2 in Section L-L', and the factor of safety against piping would be above 14 for Section L-L', and below 3.0 for Section K-K' before the graded filter is installed to control piping. As mentioned above, the work plan prepared by Stantec for the buttress and armoring of the south slope of the Gypsum Disposal Area includes a reverse filter in the area of low factor of safety against piping to control seepage. This filter cannot be modeled in SeepW due to its thickness and program limitations, but construction of the filter will raise the F.S. for piping above the minimum target of 3.0.

The purpose of the armoring is to prevent sloughing of the south slope due to uncontrolled seepage emerging from the south dike. The armoring will consist of removing the clay cover and undercutting the underlying ash approximately two feet and backfilling the excavation with reverse filter materials and crushed stone.

High phreatic levels were also observed in areas of the dike that extend north of the Fly Ash Pond, along the west side of Area 2A. The exterior slope of the lower dike in this area is also 2H:1V. Therefore, the construction measures described above for the perimeter dikes of Area 2 would need to be extended to near the northwest corner of Area 2A.

It is recommended that the north dike be graded back above elevation 810 feet using 3H:1V slopes and an intermediate bench near elevation 825 feet. The resultant factor of safety against shallow failure for the graded slope is 2.3. The intermediate bench should be graded such that surface runoff is directed toward the east. These measures would eliminate sloughing and erosion problems experienced in this area during 2009. It is also recommended that the west embankment above elevation 810 feet be graded to 3H:1V slope using clay fill and a reverse filter. The resultant factor of safety against non-global failure for the final grade after fill is 1.6. This repair work is to be added to a current work plan scheduled to be implemented in the spring of 2010.

10.4.3. Area 1 – Bottom Ash Disposal Area

Those areas within this CCB disposal facility where existing slopes are 2H:1V or steeper should be graded back to flatter slopes to improve the factor of safety against shallow or local failure; provide safer conditions for maintenance operations and prevent sloughing and surface erosion. Flattening of the steep slopes observed along the west side of Area 1, above elevation 810 feet will be added to a current work plan scheduled to be implemented in the spring of 2010.

10.5. Long Term Stability of Perimeter Dike Slopes and South Dike Area 2A

As discussed earlier, the calculated factors of safety against sliding and piping for portions of the perimeter dikes are below the recommended minimum values. The less than acceptable factors of safety appear to be a result of a combination of the following factors: (1) high phreatic levels, (2) lack of under-drain features to control seepage across the dike, (3) exterior dike slope steepness and (4) shear strength of the dike material. Based on the cross-sections selected for stability analysis, the low factors of safety apply to dike areas extending from the southeast corner of Area 2 to the northeast corner of Area 2A. It appears that low phreatic conditions and flatter exterior dike slopes existing along the west side of Area 1 result in factors of safety at or above recommended minimum values.

This report discusses briefly certain options TVA may consider to improve the stability of perimeter dike areas not meeting the recommended criteria for maintaining long term stability against slope failure and soil piping. In order to determine more specifically the dike areas exhibiting less than acceptable factors of safety and to select corrective measures, it is anticipated that additional geotechnical exploration and engineering analyses may need to be performed. Most of the additional work will probably consist of installing additional piezometers to better define the lateral extent of the high phreatic conditions. The additional borings may also provide further information relative to the subsurface conditions directly below the upper perimeter dike.

The stability and seepage analyses of the Gypsum Stack Disposal Area south dike were performed based on our understanding of historical information describing the seepage control measures (under-drain system) installed within the pool and the assumption that the under-drain system is and will be functional during the service life of the facility. It is critically important that all instrumentation be read periodically and pool elevations recorded at the same time. A geotechnical engineer should review this information and perform additional engineering analyses of the different dikes as necessary.

11. Closure

The root cause analysis of the December 22, 2008 dredge cell pond failure at TVA's Kingston Fossil Plant identified four main destabilizing factors contributing to the breach of the containment dike and subsequent failure. Stantec's scope of work included a review of the historic documentation, results of the drilling and laboratory testing program, and current dike configurations with respect to these contributing factors to asses the potential for these conditions to exist at the BRF CCB disposal facilities. The review focuses on the conditions encountered within Areas 1, 2 and 2A.

- Weak Silt/Ash Foundation – It is our understanding the BRF plant has historically discharged ash into Areas 1, 2 and 2A via discharge points in the northeast corner of each area. Consequently, there is the potential that weak silt/ash deposits may have formed under the different areas. Sluiced ash over soft weak alluvial material was noted in some of the borings; however, the SPT samples did not encounter a transition zone between the two materials that would be considered as a particularly adverse condition. The sluiced ash deposits are a factor contributing to the lower factors of safety against sliding calculated from the stability analysis of the Gypsum Disposal Area south dike. However, the contact between the sluiced ash and the weak alluvial materials is too deep (too far below the bottom of the dikes) to be considered as a likely contributing factor, unless the height of the Area 2A dike is increased significantly.

- Hydraulically Placed, Loose, Wet Ash – Hydraulically placed, wet ash was encountered below the upper perimeter dike of Areas 1, 2 and 2A and under the Gypsum Disposal Area dikes. Its presence is a contributing factor affecting the stability of the Gypsum Disposal Area south dike but not so for the perimeter dikes. This report includes recommendations that will result in obtaining acceptable factor of safety against sliding for the south dike.

- Increased Loads Due to Embankment/Fill Height – This factor is not applicable for the BRF CCB disposal facilities unless TVA decides to raise the height of the Gypsum Disposal Area dikes.

- Embankment Geometry Setback – This factor is applicable because there is a setback between the perimeter dike of the Fly Ash Pond and the south dike of Area 2A. The potential impact of this factor on the stability of the Area 2A south dike is being addressed by a work plan being prepared concurrently with this report. When implemented, the work plan will result in acceptable factors of safety against sliding and piping provided the Area 2A dikes are not raised.

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.

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. The stability of the facilities during a potential earthquake was not analyzed. 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).

12. References

The following is a list of documents referenced in this report and/or used to evaluate the stability of the structures at Bull Run 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).

Rawls, W. J., Brakensiek, D. L., and Saxton, K. E., Estimation of Soil Water Properties, Transactions of the American Society of Agricultural Engineers, Vol. 25, No. 5, pp. 1316 – 1320 & 1328, 1982.

Liao, S.C. and Whitman, R.V. Overburden Correction Factors for SPT in Sand, JGED, ASCE, Vol. 112, No. 3, pp. 373-377, 1985 as referenced in Seed and Harder, "SPT Based Analysis of Cyclic Pore Pressure Generation and Undrained Residual Strength", Volume 2 Memorial Symposium Proceedings, pp. 361-362, May 1990.

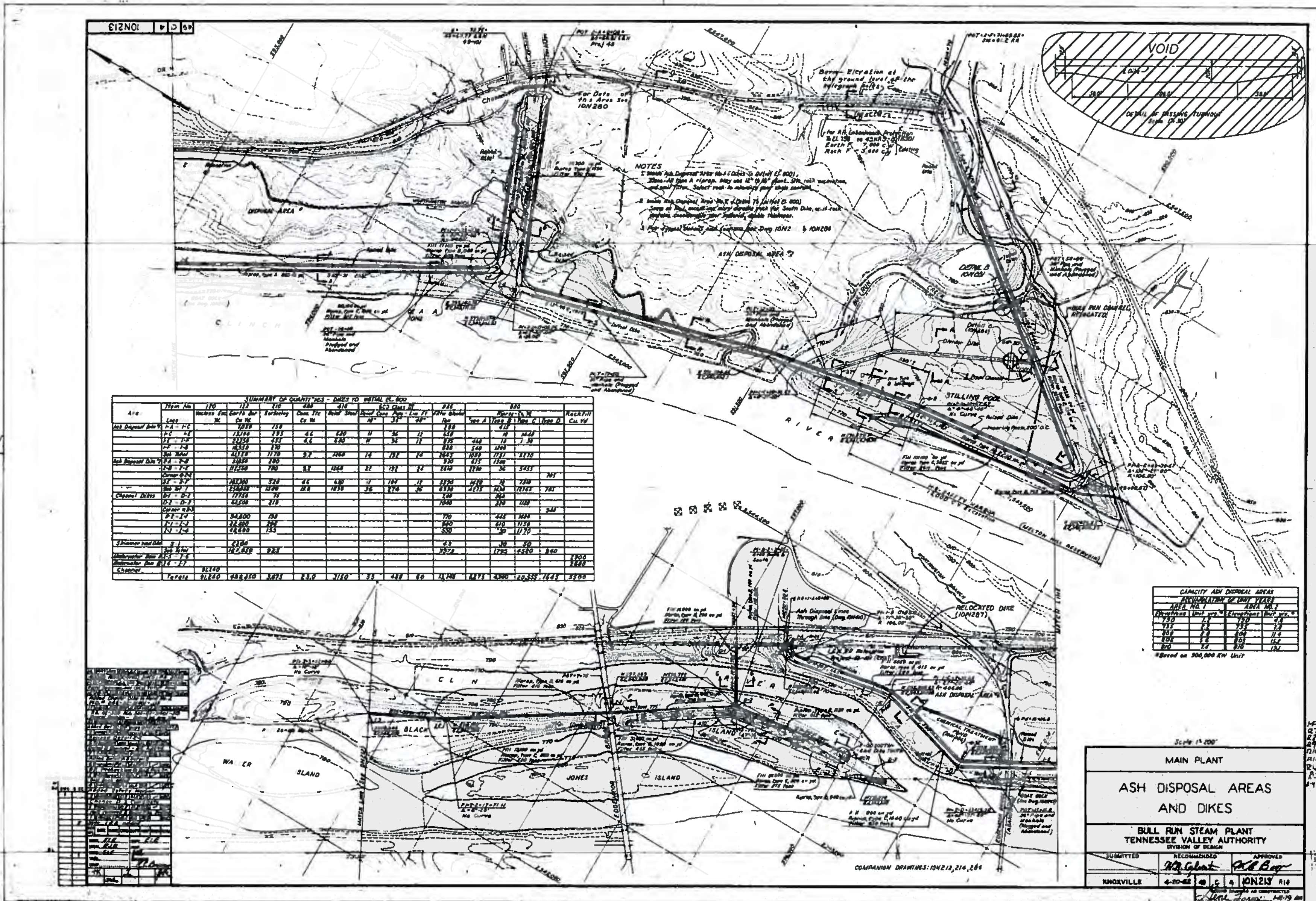
Root Cause Analysis of TVA Kingston Dredge Cell Pond Failure from December 22, 2008, AECOM, June 12, 2009.

Appendix A

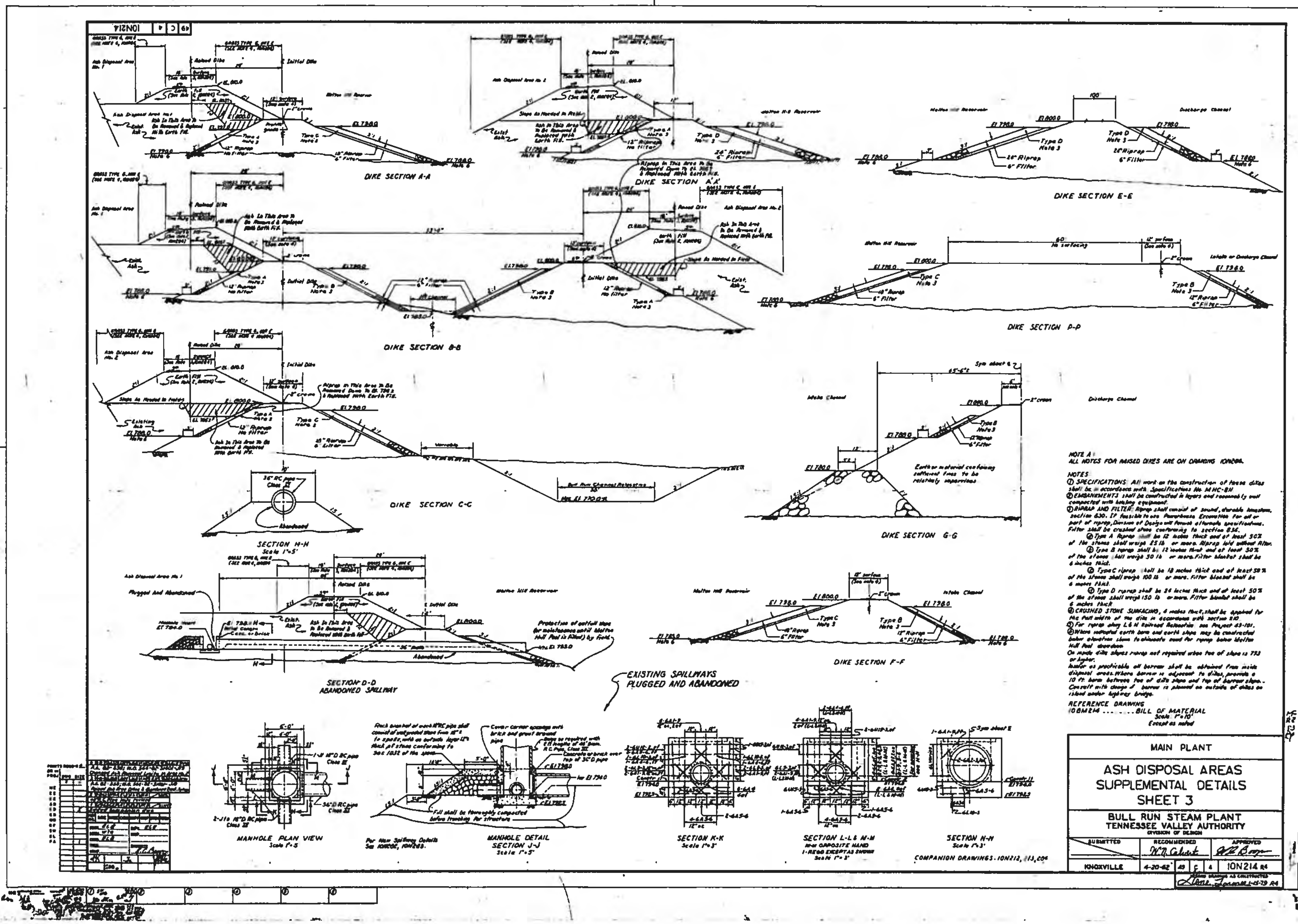
Historical Documents

- Reference No. 1
- Reference No. 2
- Reference No. 3
- Reference No. 4
- Reference No. 5
- Reference No. 6
- Reference No. 7
- Reference No. 8
- Reference No. 9
- Reference No. 10
- Reference No. 11
- Reference No. 12

Reference No. 1


VOID
DETAIL OF PASSING TURNOUT
NOTES
ASH DISPOSAL AREA
STILLING POOL
RIVER
CLINCH
RELOCATED DIKE (10N287)
ASH DISPOSAL AREA
CHEMICAL TREATMENT PONDS
BLACK
ISLAND
JONES
WALKER
ISLAND
SUMMARY OF QUANTITIES - DIKES TO INITIAL EL. 800
CAPACITY ASH DISPOSAL AREAS
AREA NO. 1
AREA NO. 2
Based on 900,000 KW Unit
COMPANION DRAWINGS: 10N212, 214, 284
Scale 1" = 200'
MAIN PLANT
ASH DISPOSAL AREAS
AND DIKES
BULL RUN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF DESIGN
SUBMITTED
RECOMMENDED
APPROVED
KNOXVILLE
4-20-62
10N213
10N213

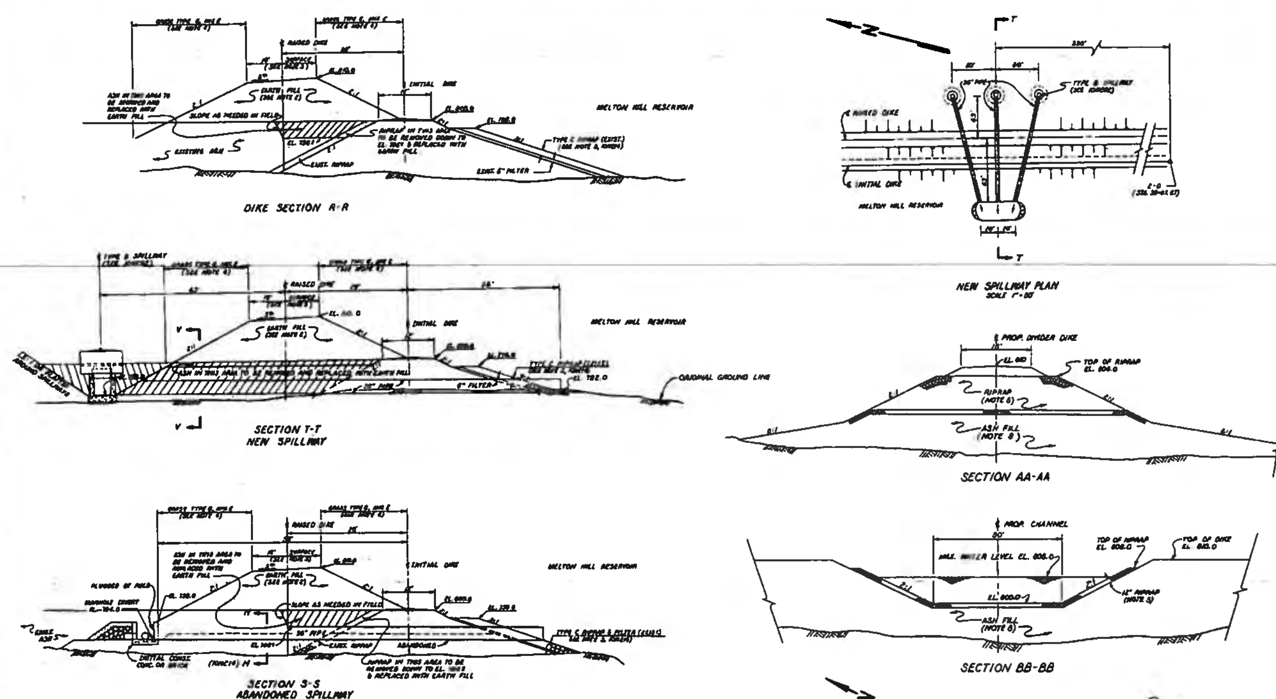
Reference No. 2

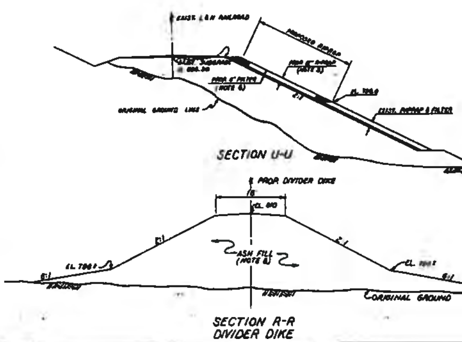


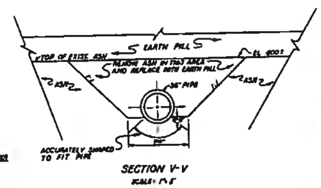
BRF-10N214-SHT -REV 4 MAIN PLANT ASH DISPOSAL AREAS SUPPLEMENTAL DETAILS SHEET 3 (36% of Scale); BRF - Ash Pond 2; Projects; 2/9/2009 11:52 AM

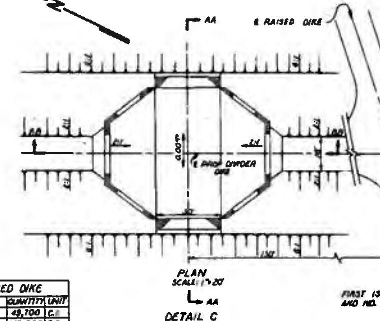
Reference No. 3

10N284 C 49









SUMMARY OF QUANTITIES - RAISED DIKE			
ITEM	DESCRIPTION	QUANTITY	UNIT
	REMOVAL OF ASH & RIPRAP	49,700	C.Y.
125	EARTH BORROW	143,900	C.Y.
210	SURFACING (4" CRUSHED STONE)	4,730	TONS
830	RIPRAP	2,140	C.Y.
836	FILTER	1,690	TONS
180 & 182	SEEDING	69,200	S.Y.
	ASH FILL (FOR DIVIDER DIKE)	30,000	C.Y.

NOTES:

1. SOILS INVESTIGATIONS BY THE TVA MATERIALS LABORATORY ARE REPORTED IN THE MEMORANDUM, GENE FARMER TO ROY H. DUNHAM, DATED DEC. 12, 1974.
2. EARTH FILL FOR RAISED DIKES SHALL BE PLACED IN ACCORDANCE WITH ALL APPLICABLE SECTIONS OF GENERAL CONSTRUCTION SPECIFICATION G-9 FOR ROLLED EARTH FILL FOR DAMS AND POWER PLANTS. EARTH FILL SHALL BE OBTAINED FROM DESIGNATED BORROW AREAS. THE EARTH FILL MOISTURE CONTENT SHALL NOT EXCEED 3% ABOVE OPTIMUM MOISTURE CONTENT AND SHALL BE PLACED AND COMPACTED TO BE AT LEAST 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY THE TVA MATERIALS LABORATORY. AT LEAST ONE MOISTURE-DENSITY ASSURANCE TEST SHALL BE MADE ON EACH 5000 CU. YD. OF FILL PLACED.
3. SURFACING FOR RAISED DIKES SHALL BE 4 INCHES OF CRUSHED STONE, PER SECTION 210, FOR FULL WIDTH OF DIKE.
4. ALL NEW AND DISTURBED DIKE SLOPES SHALL BE SEEDED WITH TYPE 6, MIXTURE E. BORROW AREA SHALL BE SEEDED WITH TYPE 6, MIXTURE A. ALL GRASSED AREAS TO BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 180 & 182 RESPECTIVELY.
5. RIPRAP ALONG THE L & N RAILROAD AND CHANNEL THROUGH DIVIDER DIKE SHALL BE 12 INCHES THICK, WITH A MINIMUM OF 50%, BY WEIGHT, CONSISTING OF STONES AT LEAST 50 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 830.
6. FILTER BLANKET, 6 INCHES THICK, SHALL CONFORM TO SECTION 836.
7. IN THE EVENT CONSIDERABLE WATER IS ENCOUNTERED IN THE EXCAVATION OF ASH IN DISPOSAL AREA NO. 2, IT IS REQUESTED THAT DED BE CONTACTED BEFORE EARTH FILL IS PLACED.
8. THE DIVIDER DIKE SHALL BE CONSTRUCTED OF COMPACTED BOTTOM ASH. PLACEMENT OF THE UNDERWATER ASH FILL SHALL BE BY END DUMPING ALONG THE LENGTH OF THE DIKE. THE TOP SURFACE OF THE UNDERWATER DIKE JUST ABOVE THE WATER SHALL BE THOROUGHLY COMPACTED AND SCARIFIED BEFORE PLACING THE OVERLAYING ASH FILL. BOTTOM ASH FOR THAT PORTION OF THE DIVIDER DIKE ABOVE WATER SHALL BE PLACED IN NOT MORE THAN 9-INCH LAYERS, AND WELL COMPACTED WITH RUBBER TIRED HAULING EQUIPMENT.

FIRST ISSUE FOR EA. 82-339 AND MO. 544-82-31401-J13

COMPANION DRAWINGS, 10N213, 10N214

SCALE 1"=10' EXCEPT AS NOTED

2 ADDED DIVIDER DIKE IN POND NO. 2, AND NOTE 8. REVISED NOTE 3 & SECTION T-T. MO. 544-82-31401-J13

1 CHANGED ASH REMOVAL LIMITS IN AREA No. 2, ADDED NOTE 7. EA. 82-339 MO. 544-82-31401-J13

MAIN PLANT

ASH DISPOSAL AREAS
SUPPLEMENTAL DETAILS
SHEET 4

BULL RUN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED RECOMMENDED APPROVED

KNOXVILLE 4-10-75 49 C 10N284 R2

1975-04_BRF-10N284-SHT -REV 2 MAIN PLANT ASH DISPOSAL AREAS SUPPLEMENTAL DETAILS SHEET 4 (36% of Scale); Bull Run; Bull Run; 1/5/2010 01:48 PM

Reference No. 4

FOUNDATION INVESTIGATIONS FOR

THE BULL RUN STEAM PLANT

J. M. Kellberg

SUMMARY

Preliminary geologic investigations at the Bull Run Steam Plant site were carried on from February through September 1961. During this period 153 core drill holes and 104 auger holes were drilled in the site area. Analysis of the results of the drilling along with other concurrent geologic studies indicates that the condition of the siltstones, shaly limestones, and pure limestones of the Chickamauga formation underlying the site area pose certain problems that will affect both the design of the plant and construction procedures.

The rock strata trend northeast, parallel with Raccoon Valley, and dip at an average inclination of 30° to the southeast--plant south. Secondary faulting and shearing associated with the presence of a major thrust fault along the northwest flank of Bull Run Ridge some 2000 feet southeast of the plant not only have complicated the geologic structure in the plant area, but, in breaking and shattering the limestones, have provided access for circulating groundwater with the consequent development of numerous cavities. The majority of these cavities are clay-filled, but open cavities up to 10.6 feet were encountered. Differences of as much as 70 feet in the elevation of the top of rock and of over 120 feet in the elevation of the bottom serious weathering were recorded in exploratory holes. In some instances holes within 10 feet of rock outcrops were drilled as deep as 30 feet before encountering rock.

The irregular configuration of the bedrock surface will make preliminary grading more expensive than normal. The extensive use of pans will be limited and most of the excavation will have to be done by using trucks and shovels. The numerous cavities which, in many cases, extend well below the desired foundation grade will require specialized design and construction procedures for adequate treatment. The brittle nature of the limestone underlying the Unit 1 area will accentuate overbreakage on blasting unless care is taken. The dip of the rock strata toward the excavation in cuts along or parallel to the north wall will make it difficult to maintain a stable rock face in these areas. The presence of open cavities in the foundation area raises the possibility that water may enter deep excavations from Melton Hill Lake during construction and also impose uplift under the major structures after completion.

INTRODUCTION

The Bull Run Steam Plant site is located in Anderson County, Tennessee, on the left bank of the Clinch River at mile 48.0. The main plant will be located 2000 feet back from the river channel on the shore of Melton Hill Lake. It is approximately 5-1/2 airline miles east of Oak Ridge, Tennessee, and 13 airline miles west of Knoxville, Tennessee.

Prior to the selection of the Bull Run site by the Division of Design, three other sites in the general area had been explored. The Edgemoor site (Clinch River mile 47.0) and the Kirkstall site (Clinch River mile 50.5) were explored during the fall and winter of 1958-59.[1] The Medford site (Clinch River mile 73.0) was explored in the spring of 1960.[2] From February 1961 through September 1961, 153 core drill holes totaling 11,131.6 linear feet, and 104 auger holes totaling 1119.2 linear feet were drilled at the Bull Run site. Through September 1961 all holes were drilled on an extension of the drilling grid laid out for the Edgemoor site, one mile downstream. This grid consisted of lettered ranges trending N 26° 12' W, roughly parallel to the Clinch River, and numbered sections at right angles to the ranges. (Exhibit 1.)

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1. "Preliminary Geologic Investigations - Knoxville Area Steam Plant - Edgemoor and Kirkstall Sites," John M. Kellberg, March 1959.
2. "Preliminary Foundation Investigations for the Medford Steam Plant," John M. Kellberg and Hunter C. Harrell, January 1961.

GENERAL GEOLOGY

Physiography

The Bull Run site is located in the Valley and Ridge province of the Appalachian Highlands. This province extends from New York to Alabama and varies in width from 20 to 75 miles. It is bounded on the east by the steep slopes of the Blue Ridge front and on the west by the abrupt escarpment of the Cumberland Plateau.

Physiographically, this subregion is characterized by long, narrow ridges and somewhat broader intervening valleys with a northeast-southwest trend. The ridges are roughly parallel with fairly level tops. They are held up by the resistant sandstones and less soluble limestones and dolomites, while the valleys have been excavated in the easily weathered shales and the more soluble limestones.

In the vicinity of the Bull Run site the Clinch River flows in a channel 300-400 feet wide about 25 feet below the level of the top of the flood plain deposits on either bank. The river channel is around elevation 775, while the top of the flood plain deposits lies between elevations 795 and 800. Drilling shows that the top of bedrock under the flood plain is at about the same elevation as in the present river channel, indicating that the Clinch River has migrated back and forth across a valley approximately 2000 feet wide during its present cycle of erosion.

The site proper occupies Raccoon Valley, a northeastward trending valley, eroded in predominantly shaly limestones, with a gently rolling terrain varying in elevation from 800 to 860. To the northwest this valley is flanked by Chestnut Ridge with elevations along the crest of over 1200 and to the southeast it is flanked by Bull Run Ridge with crest elevations of over 1100. The floor of Raccoon Valley is generally some 300 to 400 feet below the tops of the flanking ridges.

Regional Geology

The Appalachian Valley is a region of highly deformed but unmetamorphosed sedimentary rocks of Paleozoic age. Limestones, dolomites, and calcareous shales predominate, but argillaceous shales, siltstones, and some sandstones are present. These rocks range in age from early Cambrian to Pennsylvanian, but the Cambrian and Ordovician rocks are the most abundant.

The various formations crop out in relatively narrow, linear belts of northeast-southwest trend, each formation being repeated several times at the surface from the southeast to the northwest across the valley. This outcrop pattern is the result of folding and faulting of the originally nearly horizontal strata, followed by truncation of the resulting structures by erosion. Apparently the rocks were folded and faulted by forces acting from the southeast. Individual folds were compressed tightly, overturned to the northwest, and finally broken by thrust faults along the axial planes of the folds. The structure of the valley, therefore, is characterized by a series of overlapping linear fault blocks which dip to the southeast.

DETAILED GEOLOGY

Stratigraphy

Various lithologies of the Chickamauga formation of Ordovician age make up the bedrock at the site. Overlying bedrock are thicknesses of residual and alluvial material varying from nothing to over 40 feet and averaging 12.5 feet. A brief description of the unconsolidated deposits and of the various members of the Chickamauga formation follows.

Overburden--The unconsolidated materials overlying bedrock can be divided into two categories: (1) alluvial clays, silts, sands, and gravels, deposited by the Clinch River and its tributaries, and (2) residual clay and weathered rock, derived from the decomposition of the Chickamauga limestone. Alluvial materials blanket the main flood plain of the Clinch River west of the L&N Railroad and extend northeastward up the small tributary valleys to approximately elevation 800. The remainder of the area is covered by residual deposits. The majority of the alluvial material is composed of yellow silty, sandy clay containing lenses of gravel scattered throughout. The amount of sand and gravel increases with depth, especially west of the L&N Railroad, until there is usually a blanket of sand and gravel immediately overlying bedrock. Occasionally lenses of dark blue, organic clay are encountered, marking old slough fillings on an earlier flood plain.

Over the majority of the area the overburden consists of yellow, residual clay derived from the weathering of the underlying limestone. Pinnacles and detached boulders of partially weathered limestone are common throughout the overburden. In the northern portion of the site, where the underlying bedrock is maroon to gray calcareous siltstone, the overburden is red to tan silty clay which grades downward through weathered siltstone into sound, unweathered siltstone.

Chickamauga Formation--All of the bedrock which will be involved in any of the construction activities at the site belongs to the Chickamauga formation of Middle Ordovician age. The Chickamauga formation is a heterogenous assemblage of limestones, shaly limestones, calcareous shales, and calcareous siltstones. The stratigraphic thickness of this formation in the Bull Run area is around 1800 feet; however, this does not represent the total thickness inasmuch as the formation is truncated at the top by a major thrust fault. Inasmuch as the dip of the rocks averages 30° to the southeast, erosion has exposed the older beds at the surface in the northwest portion of the site, while successively younger and higher beds are exposed at the surface to the southeast. Many attempts have been made to subdivide this mass of rock into smaller, subordinate formations with the unfortunate result that over 250 different formational names have been proposed. For purposes of clarity and convenience in this report the Chickamauga is broken down into four recognizable subdivisions called Units A, B, C, and D. A brief description of each of these units follows.

Unit A

The lowest unit of the Chickamauga formation is a series of interbedded ash-gray and maroon, fissile, calcareous siltstones some 250 feet thick which contain at least one prominent zone of siliceous limestone 30 feet thick approximately 65 feet below the top and numerous small limestone lenses and nodules scattered throughout. In contrast to the other units the siltstones break down fairly rapidly upon weathering or exposure. Drill cores after being exposed for a few weeks disintegrate into thin chips or irregular fragments and finally after several months exposure much of the material has disintegrated into mud. Unit A makes up the bedrock surface under the northwestern (plant north) portion of the site. The base lies near the crest of the hill northwest of the state highway, while the trace of the top of the unit angles across the construction area from Station 25 + 25 on Range S to Station 28 + 00 on Range AA + 50 (exhibit 1).

Unit B

Overlying Unit A are 180 feet of limestone of varying textures and lithologies, but this group of strata is sufficiently distinct from the underlying siltstones of Unit A and overlying argillaceous limestones of Unit C to be easily recognizable either in cores or on outcrop. The following tabulation describes the individual members of this unit from top to bottom:

Thickness	Description
23'	Medium gray, medium crystalline limestone with shaly partings.
10'	Light gray, coarse crystalline limestone.
25'	Medium gray, medium crystalline limestone with shaly partings.
10'	Light gray, coarse crystalline limestone.
11'	Medium gray, medium crystalline limestone with shaly partings.
15'	Dark gray, nodular, argillaceous limestone.
8'	Medium gray, medium crystalline limestone with shaly partings.
3'	Light gray, coarse crystalline limestone.
10'	Medium gray, medium crystalline limestone with shaly partings.
50'	Dark gray, nodular, argillaceous limestone.
10'	Medium gray, medium crystalline limestone with shaly partings.
5'	Dark gray, nodular, argillaceous limestone.

The Unit 1 powerhouse will be founded on these rocks. Inasmuch as Unit B contains a greater amount of purer limestone as compared with overlying and underlying units, there has been more solution with the resultant development of cavities. Most of these are clay-filled, although quite a few open cavities were encountered in exploratory drilling.

Unit C

Overlying the relatively pure limestones of Unit B is 250 feet of dark gray, nodular, banded, argillaceous limestone designated as Unit C. Because of their relatively high argillaceous, or clay, content these strata do not weather as rapidly as do the purer limestones of Unit B, with the result that the surface of the area underlain by Unit C is characterized by numerous rock outcrops. The outcrops normally occur as low ridges of limestone trending northeast-southwest, separated from overlying and underlying ridges to the southeast and northwest by intervening pockets of clay residuum containing numerous partially weathered limestone fragments. This unit will be encountered only along the south side of the Unit 1 powerhouse excavation, but will underlie all of Unit 2.

Unit D

Immediately above Unit C is 20 feet of calcareous, fossiliferous shale marking the base of Unit D. The total thickness of this unit exposed in the Bull Run area is approximately 1100 feet, but this is, in all probability, not the total thickness inasmuch as the top of the formation is truncated by a major thrust fault near the crest of Bull Run Ridge. With the exception of the basal shale member, this unit is composed of alternating sequences of gray, green, pink, and red impure, silty limestones that at times contain shale bands up to one foot in thickness. In general these strata underlie the site area southeast (plant south) of the old county road and extend up the northwest flank of Bull Run Ridge to within 100 feet of the crest. Future units 3 and 4 will be founded on these rocks, as will the coal handling facilities along the flank of Bull Run Ridge. Relatively few holes were drilled in this unit during the preliminary site investigations and it may well be that this unit can be further subdivided when more details about it are known.

Structure

Three major features of geologic structure have a direct bearing on the foundation conditions that will be encountered at the site. These are (1) the attitude of the bedding, (2) faults and shears, and (3) joints. Each of these will be discussed briefly.

Attitude of the Bedding--Strike measurements made on over 100 rock outcrops in the plant area gave an average reading of N 55° E, which is consistent with the trend of the crests of Flint Ridge to the northwest and Bull Run Ridge to the southeast; however, individual measurements varied from N 35° E to N 70° E. The average dip of the strata determined both from outcrops and cores is 30° to the southeast, although dips as low as 10° and as high as 90° were noted in cores. The major variations in the alignment of the strike and the degree of dip occur in the vicinity of faults and shears where minor folding and brecciation associated with these displacements are the cause of the abnormal readings. The strata trend nearly parallel to the Unit 1 (E-W) base line and dip toward plant south, which means that excavation for the north wall of the powerhouse will be a dip slope and may require either pinning of rock strata adjacent to a vertical cut or cuts being laid back to the dip of the rock. Vertical cuts should be able to be maintained on the other three sides of the excavation (S, W, E) without undue difficulty.

Faults and Shears--Cores from practically every hole drilled at the site showed some evidence of shearing or faulting. In many instances the movements could be classified as minor shears wherein the displacement was practically negligible and represented minor adjustments along bedding planes during folding and larger scale faulting. In other instances correlation of cores between adjacent holes indicated displacement of as much as 65 to 70 feet. The faulting in the plant area is directly related to the presence of a major thrust fault, the Copper Creek fault, which crops out along the northwest flank of Bull Run Ridge some 2000 feet southeast of the plant site. The Copper Creek fault can be traced for some 400 miles from northwest Georgia to Central Virginia and along it in the Bull Run area the Lower Cambrian Rome formation has been thrust northwestward an undetermined distance over the Chickamauga formation. The Chickamauga formation, being composed primarily of relatively incompetent shaly limestones, has been complexly sliced and sheared. This deformation is most intense nearest the fault and becomes progressively less to the northwest, however the plant is not sufficiently far away to be free from the effects of the secondary shearing and faulting that accompanied the movement along the major fault. From striations observed in the drill cores it appears that much of the fault movement was somewhat rotational in nature with the major component in a westerly to southwesterly direction instead of to the northwest, as would normally be expected. Exposure of the bedrock during excavation will undoubtedly show more faults and shears than are indicated on the geologic sections (exhibits 2, 3, 4, 5, 6). In most instances the dip of the faults is steeper than the dip of the bedding--up to 70°--but many are comformable with the bedding, dipping about 30° to the southeast. All of these faults are ancient structures and further movement along them is highly improbable. The major difficulty that they will cause is in the fact that in breaking and shattering the limestone they have provided access for circulating ground water with the consequent development of cavities.

Joints--All of the rocks at the site are cut by numerous joints which to a large degree will control the breakage of the rock during blasting. Inasmuch as solution has progressed along many of these steeply dipping joints, it is not possible to determine their trend from surface exposures for they are masked by residuum, but from indications afforded by the drill cores it appears that there are three sets. The most prominent set strikes approximately N 55° E parallel to the bedding and dips steeply, 70° to 90° to the northwest. The other two sets strike approximately north and west and are nearly vertical.

Foundation Conditions

The preliminary exploratory drilling has shown that foundation conditions change rapidly throughout the site area. This is a result of the combination of two factors: (1) the original physical and chemical character of the various rock types, and (2) the structural deformation the rock has been subjected to in the geologic past. Numerous solution cavities have developed in the purer limestone zones along bedding, fault, and joint planes while the less competent siltstones have been crumpled and contorted by folding and faulting. An indication of the irregularity of the conditions is shown by the maximum and minimum elevations of the top of rock and the bottom of serious weathering. The maximum elevation of top of rock encountered in any of the drill holes was 844.7 in hole DD - (-28 + 00), while the minimum was 774.1 in hole S - (-24 + 00). The highest elevation for the bottom of serious weathering was 837.9 in hole DD - (-28 + 00) and the lowest was 716.5 in hole V + 50 - (-25 + 00)--a variation of over 120 feet. The following paragraphs summarize briefly the general foundation conditions to be expected in the powerhouse, stack, service bay, intake and discharge areas, but development of specific details will have to await the completion of the more intensive drilling program currently underway.

Powerhouse--With the new design of this plant there will be two general base slab elevations--elevation 770 under the turbine area (the western portion of the powerhouse) and elevation 808 under the boiler area (the eastern portion of the powerhouse). The turbine area is roughly delineated by exploratory holes on the Y, Y + 50, Z, and Z + 50 ranges between stations -27 + 00 and -24 + 00. The boiler area is roughly delineated by the AA, AA + 50, and BB ranges between stations -27 + 00 and -24 + 00 (exhibit 1). Analysis of the 27 holes in the turbine area indicates an average elevation for top of rock as 807, while the average elevation of the bottom of serious weathering is 787--some 20 feet lower. However, in specific instances, the elevation of the top of rock is as low as 791.4 and the bottom of serious weathering as low as 764.4. In the boiler area the analysis of 19 holes shows the average elevation of the top of rock to be 817 and the average elevation of the bottom of serious weathering to be 798--again roughly 20 feet lower. The minimum elevations of top of rock and bottom of serious weathering are 800.0 and 768.9 respectively. The zones of deepest weathering occur in the purer limestone zones near the top of Unit B, where cavities have developed along near-vertical joints and moderately dipping faults and bedding planes. Most of these cavities are clay-filled; however, open cavities or caves, up to 9.1 feet in hole Z - (-24 + 50), have been encountered. Apparently the most seriously weathered zone lies between ranges Z and AA + 50 and between stations 24 + 00 and 25 + 00.

Stack--Only one hole, DD - (-26 + 00), was drilled in the stack area during the initial exploratory program. This hole indicated sound rock at elevation 802, however, considering the height of the proposed stack, it would be advisable to drill additional holes in this area before a final foundation grade is set.

Service Bay and Office Wing--These structures lying to the north of the main powerhouse will be founded primarily on the siltstones and interbedded limestones of Unit A. This area lies between Ranges Y and DD and Stations -27 + 50 and -28 + 00. The 14 holes drilled within these limits indicated an average elevation of top of rock of 814 and an average elevation of the bottom of serious weathering of 793. Though the siltstones are less competent than the overlying limestones of Unit B, they should be adequate to support the relatively light loading of the service bay and office wing of the plant. In contrast to the limestones, there is no sharp demarcation between residuum and siltstone. The siltstone breaks down gradually on weathering into red to tan silty clay in which the original bedding structures of the siltstone may still be seen, while in the areas underlain by limestone the rock is either relatively unweathered or else entirely replaced by residual clay. The few cavities that were encountered in this unit were found where small limestone lenses in the siltstone had been dissolved.

Intake and Discharge Areas--Initial drilling for a proposed intake tunnel was carried out along section -25 + 50 between Ranges S and Y. These 13 holes indicated that the average elevation of the top of rock was 800 and the average elevation of the bottom of serious weathering was 773. This information indicated that tunneling at the desired grade would not be feasible, so it was decided to use cut and cover for the intake conduit. The generally poor condition of bedrock in this area is attributable to the presence of fault with approximately 65-foot displacement, which thrusts the lower part of Unit B over the siliceous limestone member of Unit A. The fracturing and contortion associated with this faulting provided numerous paths of access for circulating ground water with the resultant development of numerous cavities. At the site for the intake structure 11 holes indicated an average elevation for the top of rock of 782 and for the bottom of serious weathering of 762. Holes drilled for the discharge structure and discharge tunnels indicated sound rock well above the desired grade for the discharge structure, but a zone of deep weathering along the proposed tunnel alignment. As shown on exhibit 5, a section of the initial tunnel alignment some 175 feet long between holes W + 30 - (-23 + 00) and X + 50 - (-23 + 00) is seriously weathered to or below elevation 750. On the basis of this information it was decided to raise the discharge and make it a cut and cover conduit rather than a tunnel. However, the intake system for Units 2, 3, and 4 will have to be tunnels that will pass under the Unit 1 discharge conduit. These may, depending on their alignment, encounter the above mentioned zone of deep weathering.

Construction Problems

Various construction problems directly attributable to the character and condition of the overburden and rock at the Bull Run site are foreseen. The following paragraphs summarize the major problems.

General Excavation--The irregular configuration of the bedrock surface and the presence of numerous detached, partially weathered limestone boulders in the residual overburden will tend to make general excavation costs higher than normal. Over most of the area it will not be possible to use pans effectively to remove the overburden. There are numerous rock ledges that crop out at the surface and these ledges are separated by troughs filled with residual clay as much as 30 feet in depth. Much of the excavation probably will have to be done by shovels and trucks, with some blasting to break up large boulders and bedrock ledges so that they may be handled efficiently. This condition will obtain not only in the powerhouse area but in the coal storage and handling areas as well.

Foundation Excavation--Once excavation has reached essentially solid bedrock there will still be some problems. Many of the filled and open cavities extend below desired foundation grade and special treatment will be required to assure an adequate foundation for the heavy structures. It is currently proposed to solve this problem by the use of large-diameter holes drilled well into sound rock at required column and footing locations. These holes will be filled with steel and concrete to form, in effect, cast-in-place piles. Secondly, some of the limestone beds that will be encountered in the foundation excavation, especially those of Unit B, are relatively brittle and when blasted tend to shatter to a greater extent than is normally experienced. It is recommended that the "pre-split" method of blasting be used to minimize this tendency as much as possible. Thirdly, as the north (plant) wall of the powerhouse and service bay is nearly parallel to the strike of the rock and the dip is toward the excavation, it will be difficult to obtain a stable vertical rock face along this side of the excavation. As the bedding planes, which dip approximately 30° toward the cut, are undercut by excavation, the rock will tend to slough off along them, resulting in excessive overbreak. This problem will be especially bothersome in any deep cuts along the north wall of the service bay, for in this area the bedrock is the relatively weak and fissile siltstone. Evidence of what well may occur is visible in cuts along the north side of the nearby state highway.

Blasting--Inasmuch as the plant site lies in a valley between two relatively high ridges, it is probable that residents on the ridge to the north will claim damages due to blast shock. Air waves from large blasts probably will be reflected from Bull Run Ridge to the south and increase the apparent effect to residents living on and just behind Flint Ridge to the north. It is recommended that the first few large blasts be monitored with a seismograph so that accurate data will be available to refute any potential blast damage claims.

Ground Water--The presence of both filled and open cavities in the plant area at elevations well below the proposed pool level of Melton Hill Reservoir--795--indicates the possibility that when the lake is impounded and the water table elevation is thereby raised, water may enter deep excavations from the reservoir. While this is not considered too great a probability, it is a distinct possibility. The following tabulation lists the known open cavities in the construction area:

Hole	Elevation From	Elevation To	Size
W + 30 - (-23 + 00)	757.5	746.9	10.6'
X - (-24 + 00)	763.6	757.3	6.3'
Z - (-24 + 50)	773.5	764.4	9.1'
Z + 50 - (-25 + 00)	777.8	777.1	0.7'
AA - (-24 + 50)	808.9	807.8	1.1'
AA + 50 - (-24 + 50)	773.0	768.9	4.1'
BB - (-25 + 00)	793.5	791.0	2.5'

Other than the inconvenience that this potential flooding might cause during the construction period, there remains the question of uplift and possible flooding of basement areas below pool level after construction is completed. Provisions should be made to make all contraction joints in the base slab waterproof.

Construction Materials

No specific investigations were made to determine a source of suitable aggregate for the project. There is, however, one operating quarry on the west side of Clinch River in Union Valley operated by Rogers Brothers that could supply suitable aggregate. This quarry is approximately 4 miles by road from the plant. Lambert Brothers has purchased a quarry site along Bull Run Creek which is approximately 2 miles by road from the plant. The Lambert site is in the same rock--Maynardville limestone--as the Rogers quarry and also could furnish suitable aggregate.

If there are not too many limestone boulders in the residual overburden from the plant site, the residual clay probably would be suitable for fill; however, this problem is one that will have to be resolved by the Materials Testing Section of the Construction Plant Branch.

EXHIBITS

MACTEC

July 13, 2004

Mr. Ron Purkey
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, TN 37402

Subject: **Report of Geotechnical Exploration**
Ash Disposal Area
TVA Bull Run Fossil Plant
Clinton, Tennessee
MACTEC Project 3043041022/01

Dear Mr. Purkey:

We at MACTEC Engineering and Consulting, Inc., (MACTEC) are pleased to submit this Report of Geotechnical Exploration for your project. Our services, as authorized through TAO No. MAC-0696-00054, were provided in general accordance with our proposal number Prop04Knox/162 dated May 3, 2004.

This report reviews the information provided to us, discusses the site and subsurface conditions, and presents our results of field and laboratory testing of the materials at the existing Ash Disposal Area. The Appendices contain a brief description of the Field Exploratory Procedures, a Key Sheet and Test Boring Records, Cone Penetrometer Test Results, the Laboratory Test Procedures, and the Laboratory Test Results.

We anticipate further dialog and interaction with your team and will be happy to provide additional information or interpretation of the data and recommendations presented herein which may be necessary.

We will be pleased to discuss our results with you and would welcome the opportunity to provide the engineering services needed to successfully complete your project.

Sincerely,
MACTEC ENGINEERING AND CONSULTING, INC.

C. Todd Justice, E.I.T
Project Professional

Hussein A. Benkhayal
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REPORT OF GEOTECHNICAL EXPLORATION

ASH DISPOSAL AREA
BULL RUN FOSSIL PLANT
CLINTON, TENNESSEE

Prepared For:

TENNESSEE VALLEY AUTHORITY

Chattanooga, Tennessee

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.

Knoxville, Tennessee

MACTEC Project 3043041022/01

July 13, 2004

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EXECUTIVE SUMMARY

MACTEC was selected by the Tennessee Valley Authority (TVA) to perform a geotechnical exploration for the existing Ash Disposal Area at the Bull Run Fossil Plant near Clinton, Tennessee. The objectives of our exploration were to determine the subsurface conditions at the site, to obtain data to evaluate the strength and hydraulic conductivity characteristics of the ash materials and alluvial soils, and also to evaluate the consolidation characteristics of the alluvial soils.

The exploration consisted of drilling a total of thirteen geotechnical test borings, installing one piezometer, and performing 13 Cone Penetrometer Test (CPT) probes at 11 selected locations. The major findings and recommendations of our geotechnical exploration are as follows:

- The test borings typically encountered ash and intervals of fill soils overlying alluvial and residual soils. The ash was typically comprised of silt and sand sized particles with lesser percentages of clay and gravel sized particles. The consistency and relative density of the ash varied from very soft to firm and very loose to dense. The fill soils were typically comprised of silty clay with shale fragments, and silty sand. The fill soils are judged to generally be of stiff consistency and loose relative density. The underlying alluvial soils were typically comprised of clays, silts, and sands with varying percentages of gravel. The alluvial soils are judged to have very soft to very stiff consistencies and very loose to very dense relative densities. The residual materials consisted of shale and silty clay with varying percentages of limestone fragments. The consistency of the residuum varied from very soft to very hard.

- Ground-water was measured in the test borings at the time of drilling. Table 2 summarizes the recorded ground-water data. A piezometer identified as B-2P was installed near boring location B-2 (see Figure 2: Boring Location Plan). A 24-hour water level reading was recorded at location B-2P. Long-term ground-water levels can be obtained at this location.

- Cone Penetrometer Test soundings were performed at locations near the geotechnical test borings and at other selected locations. The test locations are shown on Figure 2: Boring Location Plan. A discussion of the test results is found in Section 7.0. The CPT results are found in Appendix C.

This summary is only an overview and should not be used as a separate document or in place of reading the entire report, including the appendices.

1.0 INTRODUCTION

This report presents the findings of our subsurface exploration and field and laboratory testing recently performed for the existing Ash Disposal Area at TVA's Bull Run Fossil Plant. Our services were authorized by Mr. Ron Purkey of TVA.

2.0 OBJECTIVES OF EXPLORATION

The objectives of our exploration were to characterize the subsurface conditions at the Ash Disposal Area, and to obtain data to aid in the evaluation of the strength and hydraulic conductivity characteristics of the ash materials and alluvial soils and to evaluate the consolidation characteristics of the alluvial soils. An assessment of site environmental conditions, or an assessment for the presence or absence of pollutants in the soil, bedrock, surface water, or ground water of the site was beyond the proposed objectives of our exploration.

3.0 SCOPE OF EXPLORATION

The scope of our exploration was based on our proposal number Prop04Knox/162 dated May 03, 2004, and the geotechnical scope of work outlined in the project's scope of work prepared by TVA and Parsons E & C. It included the following:

3.1 DRILLING AND SAMPLING

The subsurface exploration for this project consisted of drilling and sampling nine geotechnical borings (designated B-1 through B-3, and B-5 through B-10), four offset geotechnical borings (designated B-1A, B-3A, B-8A, and B-10A), and drilling and installing one piezometer, (designated B-2P). The boring locations are shown on Figure 2: Boring Location Plan. TVA and Parsons E & C located the borings in the field, and determined the coordinates and ground surface elevations at the geotechnical boring locations relative to mean sea level (msl) using surveying techniques.

The borings were drilled with an all-terrain vehicle (ATV) mounted Central Mine Equipment (CME) Model 55 drill rig in general accordance with the procedures described in Appendix A. Standard Penetration Tests (SPTs) were performed in the geotechnical borings using a CME automatic hammer. The SPTs were performed using standard 2.00-inch OD split spoons with

1.38-inch ID barrels (i.e., no room for liners in the barrels). SPTs were performed at 3-foot intervals.

Three-inch-diameter relatively undisturbed (Shelby tube) samples were obtained from representative cohesive soils in the geotechnical borings. The Shelby tubes were pushed into the bottoms of the boreholes at the desired sampling depth. The samples were then sealed with wax and capped at both ends to minimize changes in the structure and moisture content of the samples.

A 3.5-inch OD, 3-inch ID split spoon with liner was used to sample the ash at varying depths. The spoon was pushed into the bottoms of the boreholes at the desired sampling depths. The ash samples, enclosed in the liners, were then sealed with wax at both ends and capped to minimize changes in the structure and moisture content of the samples.

3.2 MEASUREMENT OF GROUND-WATER LEVELS

Ground-water levels in the geotechnical borings were generally measured and recorded when first encountered (at the time of drilling). Twenty-four-hour ground-water readings were not recorded in the geotechnical borings due to the introduction of water into the boreholes during drilling, and the necessity of grouting the borings immediately after termination of the borings. The recorded ground-water levels are discussed in Section 9.0 and are summarized in Table 2.

3.3 PLUGGING AND ABANDONMENT OF BOREHOLES

Upon completion of drilling and sampling, the geotechnical boreholes were plugged with a Type I Portland cement-bentonite grout mixture using a tremie pipe method. The borings were backfilled in general accordance with the requirements specified by TVA. During plugging and abandonment precautions were taken to stabilize against cave-ins prior to and during plugging procedures, however, it was observed that at a few of the boring locations portions of the ash profiles collapsed (caved-in) within the borings due to the behavior of the saturated ash. However, it is noted that the alluvial and residual soil profiles encountered underlying the intervals of ash were successfully grouted.

3.4 CONE PENETROMETER TESTING (CPT)

Thirteen CPT soundings were performed to supplement the data obtained from the geotechnical borings. The CPT locations are shown on Figure 2: Boring Location Plan. Eleven soundings were performed near geotechnical test boring locations while two were performed at other selected locations in ash disposal area. The CPT results are found in Appendix C. A discussion of the test results is found in Section 7.0.

CPT soundings were performed using an electric penetrometer with pore pressure measurements. The cone penetrometer equipment was mounted on a track vehicle. Continuous data was recorded with a computerized data acquisition system. Pore pressure measurements were performed to evaluate the rate of pore pressure dissipation within the ash and underlying soils.

3.5 LABORATORY TESTING

This section outlines the geotechnical laboratory testing program. The discussion and summary of the results of the laboratory testing program are found in Section 8.0. The laboratory testing procedures and laboratory test results are included in Appendix D.

- 42 Natural Moisture Content Tests
- 5 Unit Weight with Moisture Content Tests
- 4 Specific Gravity Tests
- 8 Atterberg Limits Tests
- 17 Particle Size Distribution Tests
- 4 Consolidated Undrained Triaxial Compression (CU) Tests
- 4 Falling Head Permeability Tests
- 1 Consolidation Test

4.0 PROJECT INFORMATION AND SITE CONDITIONS

Project information was provided to us by TVA and Parsons E & C in the form of a Subsurface Exploration document and a boring location plan. The existing Ash Disposal Area is bordered by the Clinch River to the west and Bull Run Creek to the south and is located just south of the Bull Run Fossil Plant. The ground surface elevation varies by as much as about 30 feet in the areas of our exploration program. The locations of our exploration included areas 2A and 1 of the disposal facility.

5.0 AREA AND SITE GEOLOGY

The Bull Run Fossil Plant is located in the Appalachian Valley and Ridge Physiographic Province. This province extends as a continuous belt from Central Alabama, through Georgia and Tennessee, northward into Pennsylvania. The formations that underlie this province consist primarily of limestone, dolostone, shale, and sandstone, which have been folded and faulted in the geologic past. These formations range in age from Cambrian to Pennsylvanian and have been subject to at least one extensive period of erosion since their structural deformation. The erosion has produced a series of subparallel, alternating ridges and valleys. The valleys are formed over more soluble bedrock (limestone and interbedded limestone and shale), whereas bedrock more resistant to solution weathering forms ridges (sandstone, shale, and cherty dolostone).

The site and vicinity are blanketed with alluvial (water-transported) soils that have been deposited over time by the nearby Clinch River. The alluvial soils typically consist of heterogeneous mixtures of clay, silt, sand and gravel. The alluvial soils typically grade coarser with depth and may contain rock fragments ranging up to cobble and boulder size. The published geologic map of this area shows that this site is underlain by bedrock of the Chickamauga Group. The bedrock underlying the site can be generally characterized as fine to medium grained limestone with interbedded shale.

6.0 SUBSURFACE CONDITIONS

Subsurface conditions encountered in our borings are described in the following paragraphs. The approximate boring locations are shown on Figure 2: Boring Location Plan. Subsurface conditions encountered at the boring locations are shown on the Boring Records. The Boring Records represent our interpretation of the subsurface conditions based on the field boring logs and visual examination of the field samples by one of our geotechnical engineers. The lines designating the interfaces between various strata on the Boring Records represent the approximate interface locations. Boring depths and types are summarized in Table 1. Descriptions of the materials encountered in the borings are given below:

- Ash – Ash was encountered at each boring location. The ash typically consisted of fine and coarse sized particles as described on the boring logs. Standard Penetration Test (SPT) N-values in the ash ranged from 0 (woh / "weight of hammer") to 48 blows per foot (bpf).

- Fill Soils – Fill was encountered in borings B-2 and B-9. Fill soils are soils that have been transported to their present location by man. These soils typically consisted of silty clay and silty sand with varying percentages of shale fragments. N-values in the fill soils ranged from 10 to 15 blows per foot (bpf).

- Alluvium – Alluvial soils were encountered below the ash in borings B-1 through B-3, and borings B-5 through B-10. Alluvial soils are soils that have been transported to their present location by running water. These soils consisted of clays, silts, and sands with varying percentages of gravel and roots. The N-values in the alluvial soils ranged from 0 (woh / "weight of hammer") to over 50 bpf. The depth to alluvium varied from about 22.0 ft at boring B-9 to about 62.4 ft at boring B-1. Based on the results of the laboratory testing, the alluvial soils were classified as CL and ML in accordance with the USCS.

- Residuum - The residuum was encountered below the alluvial soils and extended to auger refusal or to auger termination depth in borings B-1, B-2, B-5, B-6, B-8, and B-9. Residual soils (residuum) are soils that have developed from the in-place weathering of the underlying parent bedrock. The residuum typically consisted of shale and silty clay with varying percentages of limestone fragments. The N-values in the residuum ranged from 0 to over 50 bpf. The depth to residuum varied from about 44.1 ft at borings B-8 and B-9, to about 68.5 ft at boring B-1.

7.0 CONE PENETROMETER TEST RESULTS

The subsurface profiles developed by the CPT soundings were consistent with those obtained from the geotechnical borings. Typically, the CPT soundings indicated that the tip resistance decreased from the coarser, cohesionless ash into the finer ash. Several pore pressure dissipation tests were performed at the CPT locations which give further indications of material types. Refer to Appendix C for details of the CPT results.

8.0 LABORATORY TESTING AND DISCUSSION OF LAB RESULTS

This section describes the geotechnical laboratory testing program performed for this project. The laboratory testing procedures and laboratory test results are included in Appendix D. The following paragraphs provide a short discussion of the laboratory testing conducted and summarize the results.

8.1 ASH SAMPLES

8.1.1 Index Properties, Specific Gravity, and Unit Weight

Moisture contents of the tested ash ranged from 7.9 (B-2) to 83.8 (B-2) percent. Table 3 summarizes the results of the natural moisture content testing.

The grain size testing confirmed the variability of the grain size distributions of the sampled ash materials. Percent fines (percent silt and clay-size particles) varied from 6.3 to 89.7 percent.

Specific gravities for the ash samples tested varied from 2.20 to 2.26. Moist unit weights in the ash material ranged from 76.9 to 108.7 pounds per cubic foot (pcf), and averaged 94.8 pcf. Dry unit weights in the ash material varied from 60.2 to 85.6 pcf and averaged 71.2 pcf.

8.1.2 Strength

Shear strength testing on ash material included consolidated-undrained triaxial compression with pore pressure measurements (CU w/PP). Tests were performed on relatively undisturbed ash specimens. The strength parameters from the triaxial shear strength testing are summarized in Table 4. The test results are discussed below.

As shown in Table 4, CU w/PP parameters consisted of total stress cohesion intercepts of 1.15 and 2.96 ksf and total stress friction angles of 32.1 and 36.0 degrees. Effective stress cohesion intercepts varied from 0 to 0.89 ksf, and effective stress friction angles varied from 33.2 to 40.7 degrees. The high total stress cohesion values may be indicative of chemical bonding within the ash.

8.1.3 Hydraulic Conductivity

Hydraulic conductivity tests were performed on relatively undisturbed specimens of ash material. The results of the hydraulic conductivity tests are presented in Table 5. Values of hydraulic conductivity for the three specimens were 1.53×10^{-5} cm/sec, 3.24×10^{-5} cm/sec, and 1.29×10^{-3} cm/sec.

8.2 SOIL SAMPLES

8.2.1 Index Properties, Specific Gravity, and Unit Weight

Moisture contents of the tested alluvial soils ranged from 18.8 (B-2) to 23.9 (B-10) percent. Liquid limits of the tested alluvial soils varied from 25 to 44, while the plastic limits varied from 14 to 23. Plasticity indices (PIs) varied from 11 to 21. One sample of the tested alluvial soils was non-viscous and non-plastic. The tested soils, having plasticity indices of less than 30, are considered to have a relatively low potential for volume change with changes in moisture content. The alluvial soils classified as CL and ML in accordance with the Unified Soil Classification System. Table 3 summarizes the results of the natural moisture content and Atterberg limits testing.

The grain size testing confirmed the variability of the grain size distributions of the sampled alluvial soils. Percent fines (percent silt and clay-size particles) varied from 52.0 to 88.6 percent. Specific gravities of the tested alluvial soil samples varied from 2.62 to 2.70. Moist unit weights in the alluvial soils ranged from 125.9 to 129.7 pounds per cubic foot (pcf), and averaged 128.2 pcf. Dry unit weights in the alluvial soils varied from 101.6 to 109.2 pcf and averaged 106.0 pcf.

8.2.2 Strength

Shear strength testing on the alluvial soils included consolidated-undrained triaxial compression with pore pressure measurements (CU w/PP). Tests were performed on relatively undisturbed specimens. The strength parameters from the triaxial shear strength testing are summarized in Table 4. The test results are discussed below.

As shown in Table 4, CU w/PP parameters consisted of a total stress cohesion intercept of 0.25 ksf and a total stress friction angle of 17.1 degrees. The effective stress cohesion intercept was 0.18 ksf, and the effective stress friction angle was 28.8 degrees.

8.2.3 Hydraulic Conductivity

A hydraulic conductivity test was performed on a relatively undisturbed specimen of alluvial soil. The results of the hydraulic conductivity tests are presented in Table 5. The value of the hydraulic conductivity for the alluvial soil specimen was 5.18×10^{-8} cm/sec.

8.2.4 Compressibility

One-dimensional consolidation testing was performed on an undisturbed specimen of alluvial soil. Compression properties of the soil subjected to one-dimensional consolidation testing are summarized in Table 6. The laboratory consolidation data is presented in Appendix D. The preconsolidation pressure listed in Table 6 was estimated graphically by hand using the Casagrande Method and checked by the Log-Log Method.

The coefficients of consolidation were computed for each load increment by the consolidation test software. The compression index for the "laboratory" void ratio versus log pressure curve also was computed by the consolidation test software. The "field" compression index was estimated graphically using the Schmertmann Method.

9.0 GROUND-WATER CONDITIONS

Ground-water level measurements made in the borings during drilling are summarized in Table 2. Ground water was observed in all of the geotechnical borings. Depths below the ground surface to ground-water levels at the time of drilling varied from about 6.0 to 28.5 feet. The ground-water elevations at the time of drilling varied from about 795.4 to 810.0 feet msl.

To provide long-term ground-water data for the site vicinity near boring B-2 a piezometer was installed and identified as B-2P. A twenty-four-hour ground-water measurement was taken at this location after the installation of the piezometer. The initial measurement indicated a depth below the ground surface to the ground-water level of 10.9 ft. This corresponds to a ground-water elevation of 808.2 feet msl.

10.0 BASIS OF RESULTS

The results of our geotechnical exploration provided herein are based on the encountered subsurface conditions, and on the field and laboratory testing performed with respect to the specific project site and locations discussed in this report. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions between test borings will differ from those at specific test boring locations, and that conditions may not be as anticipated. In addition, the interpretation and analysis of the results of a geotechnical exploration are critical related to proposed design criteria. Therefore, we recommend that experienced geotechnical engineers review any proposed site specific design plans that incorporate the results of our geotechnical exploration. We recommend that TVA retain MACTEC to provide this service, based upon our familiarity with the subsurface conditions, field and laboratory testing results, and our geotechnical experience.

Our exploration services include storing the collected samples and making them available for inspection for a period of 30 days. The samples are then discarded unless you request otherwise.

TVA Bull Run Fossil Plant

FGD Disposal Area

Dike Seepage and Stability

April 4 2007

TVA

Geosyntec consultants

Situation Analysis

- Dikes have been recently constructed to form a gypsum disposal area as part of the BRF FGD Project
- Seepage and stability issues have been identified in the lower portions of the new dikes
- Geosyntec performed a site visit on March 28 2007 to review current situation and review TVA's proposed solutions

TVA

Geosyntec consultants

Situation Analysis

- Good quality dike construction
- Sloughing of lower portion (5-10 ft) of slope
- Area appears to be wet/saturated to a relatively consistent height

TVA

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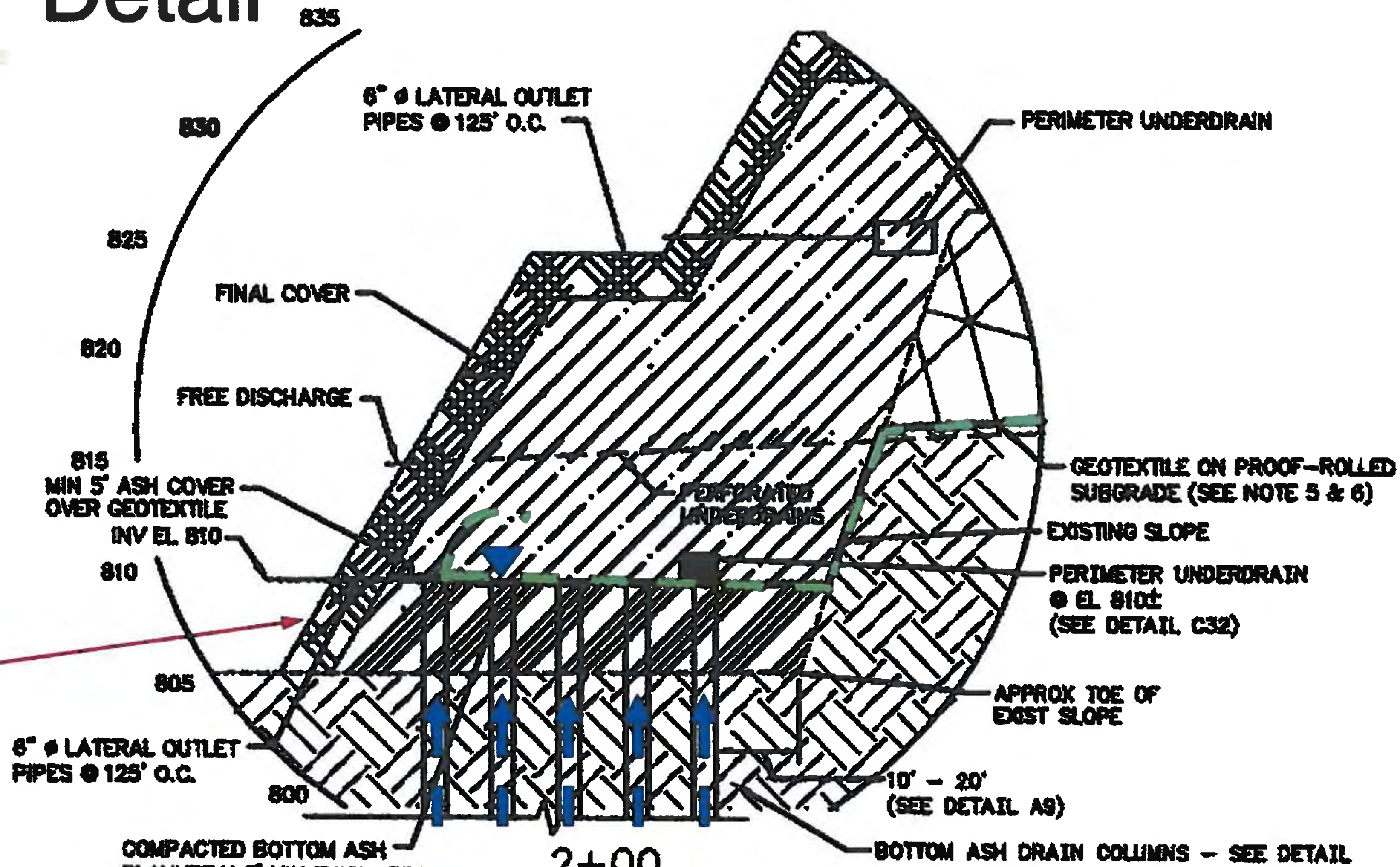
Detail



DETAIL D27
NTS

TVA

Geosyntec consultants

Toe Instability - Likely Cause

- Column drains were installed to improve dike foundation (accelerate consolidation through relief of excess pore pressure)
- First underdrain is located at EL 810 (i.e., 5 ft above the top of the column drains
- If drains are functional, consolidation water will saturate the bottom ash layer and tend to "blow out" the interim clay layer
- While water pressure is not sufficient to "lift" the clay layer, it has become saturated and tended to slough off the slope face

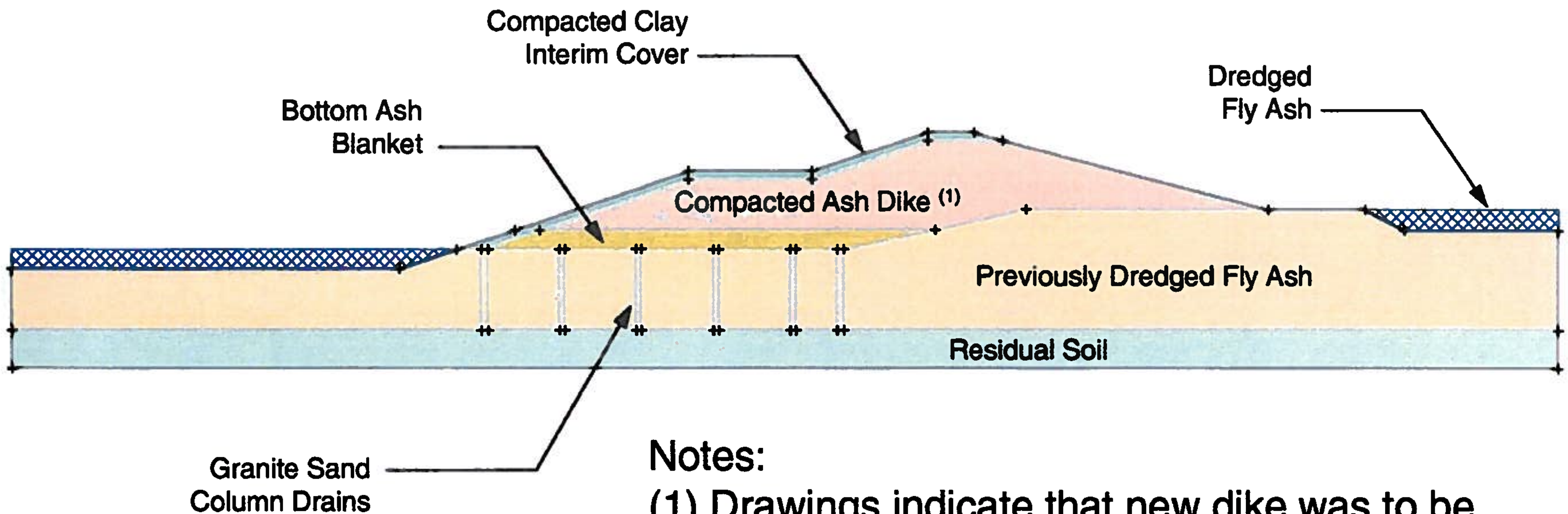
Situation Analysis – Other Issues

Item	Proposed Fix
Apparent failure of CMP drainage pipes	▪ Slip-line with HDPE and grout annulus ▪ Suggest camera survey of "pig" with a short length of pipe in advance ▪ Avoid excessive grout pressures
Disposal area bottom ash/fly ash underdrains extend into dikes using perforated pipes resulting in potential source of water to saturate dikes during operation	▪ Grout inboard length (~20 ft) of pipe to cut off future water path ▪ Construct interceptor/header to convey under-drainage through dike to existing outfalls ▪ Utilize perforated length with thin the dike for future drainage

TVA

Geosyntec consultants

Analysis Section



Notes:

(1) Drawings indicate that new dike was to be constructed "bottom ash", but permeability is more like bottom/fly ash blend (1.29 x 10-3 cm/sec)

TVA

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Material Parameters

Material #	Material	Horizontal hydraulic conductivity (K_h)		K_h/K_v
		cm/sec	ft/sec	
1	Dredged Fly Ash	1.29E-03	4.23E-05	2
2	Bottom Ash	1.80E-02	5.90E-04	2
3	Compacted Fly Ash Dike	1.29E-03	4.23E-05	2
4	Final Clay Cover	1.00E-05	3.28E-07	1
5	Residual	5.18E-08	1.70E-09	1
6	Granite Sand Column	1.00E-01	3.28E-03	1
7	Rip Rap	1.00E+02	3.28E+00	1

Seepage Analysis

- Existing Conditions (2 cases)
  - Excess head due to consolidation water, no toe drain
  - Excess head due to consolidation water, rip-rap toe drain
- Future Conditions (3 cases)

  Note: Consolidation complete, therefore no excess head
  - Underdrains blocked, no toe drain
  - Underdrains functioning, no toe drain
  - Underdrains functioning, rip-rap toe drain

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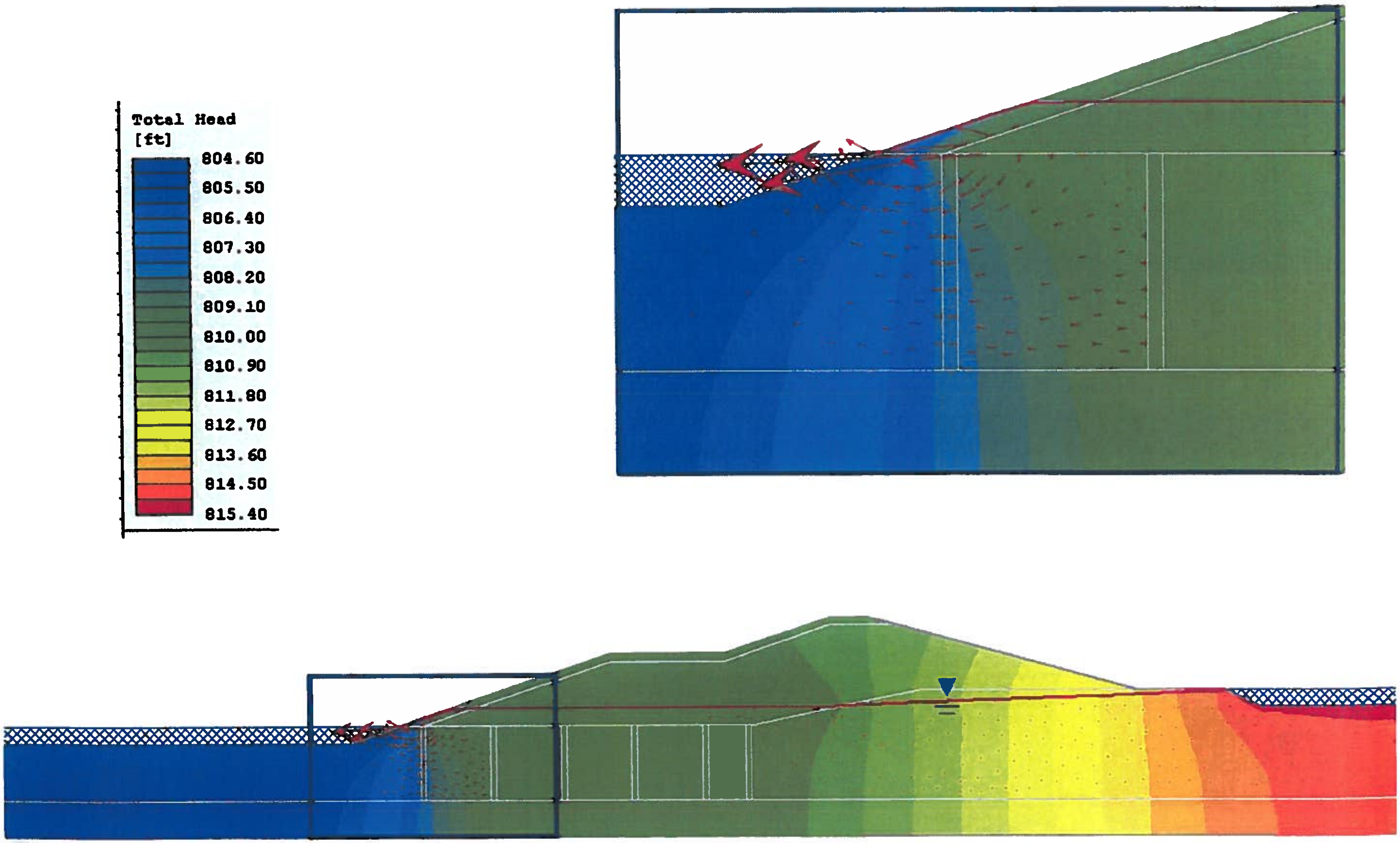
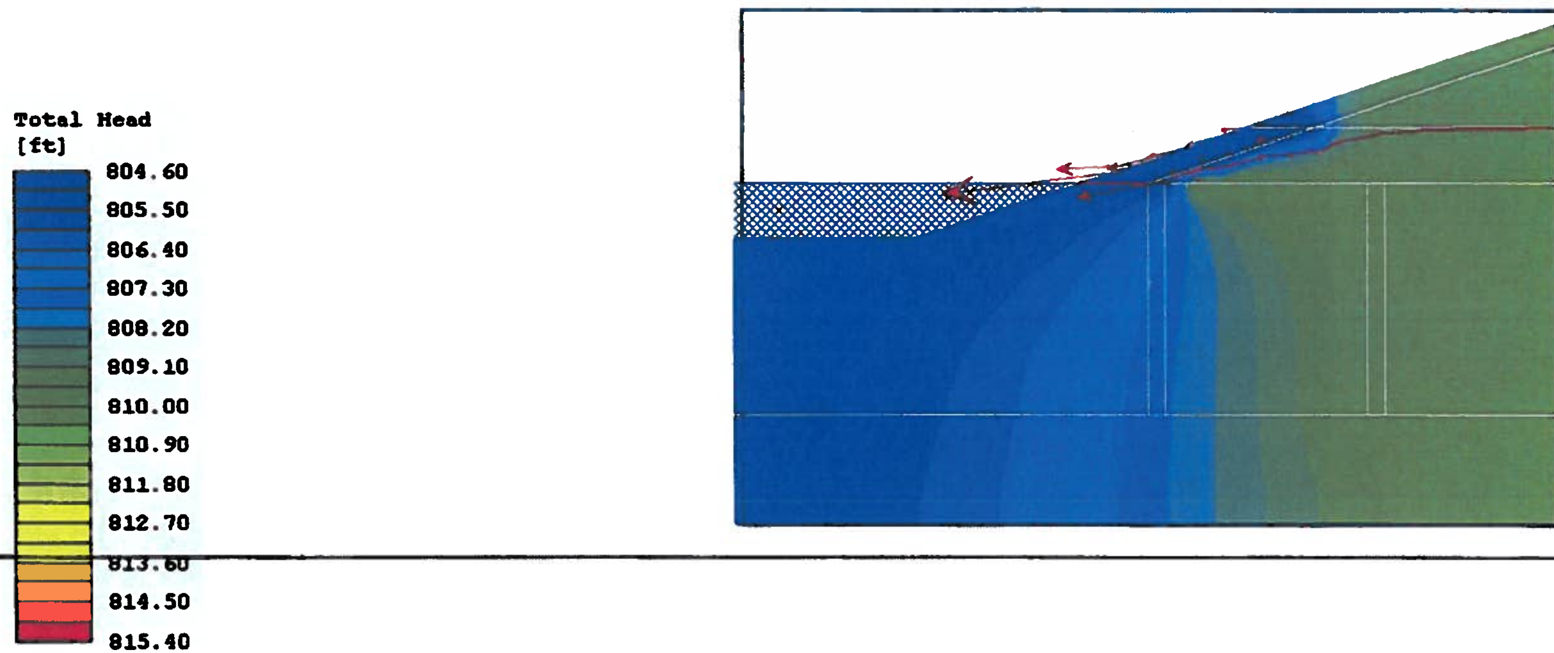
Existing Condition: Excess head due to consolidation water, no toe drain



Existing Condition: Excess head due to consolidation water, rip-rap toe drain



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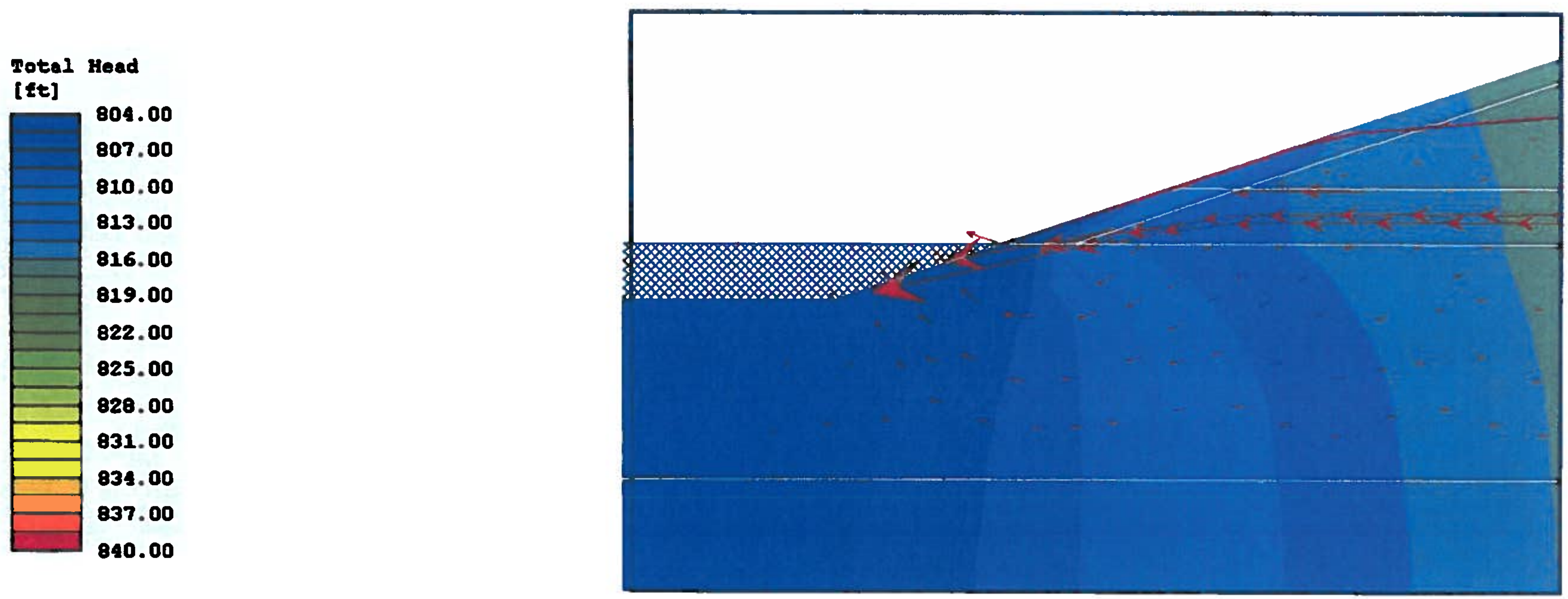
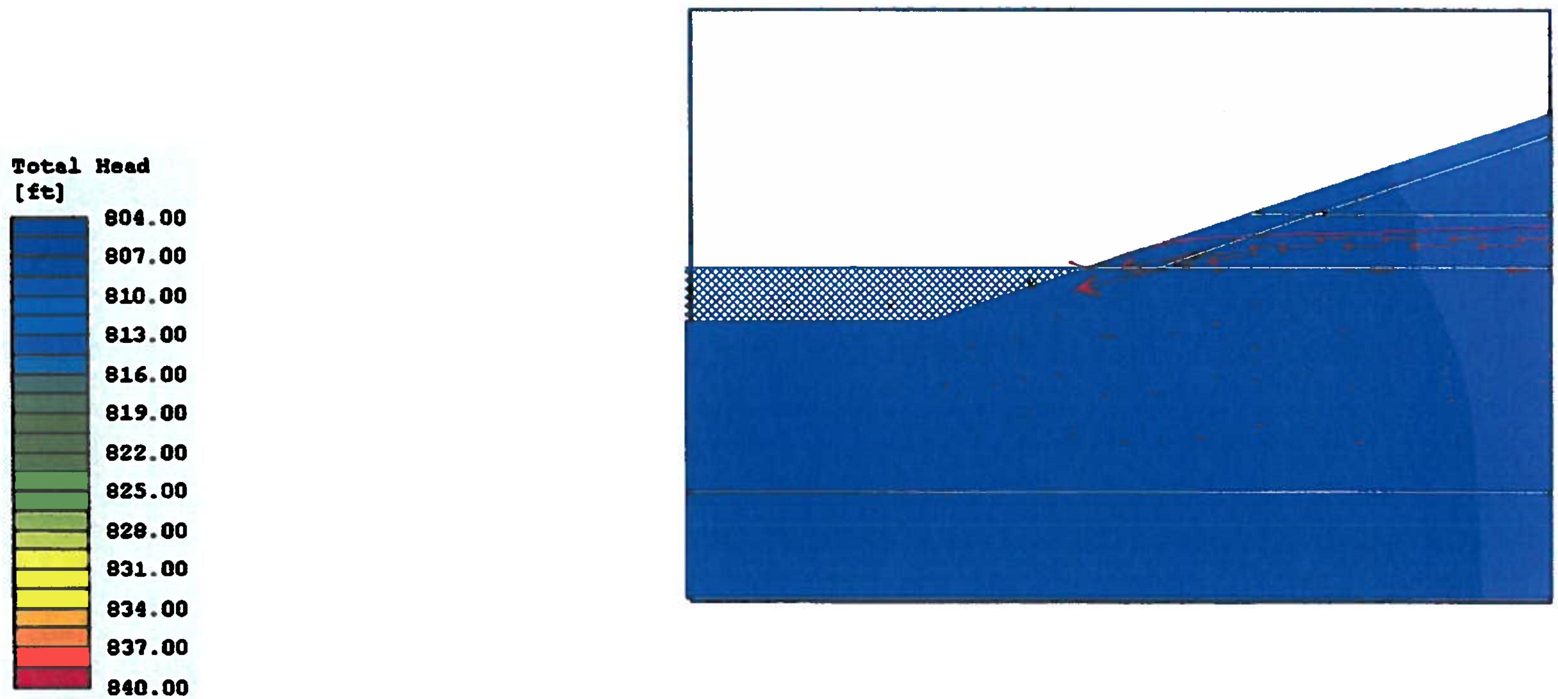
Future Condition: Underdrains blocked, no toe drain



TVA

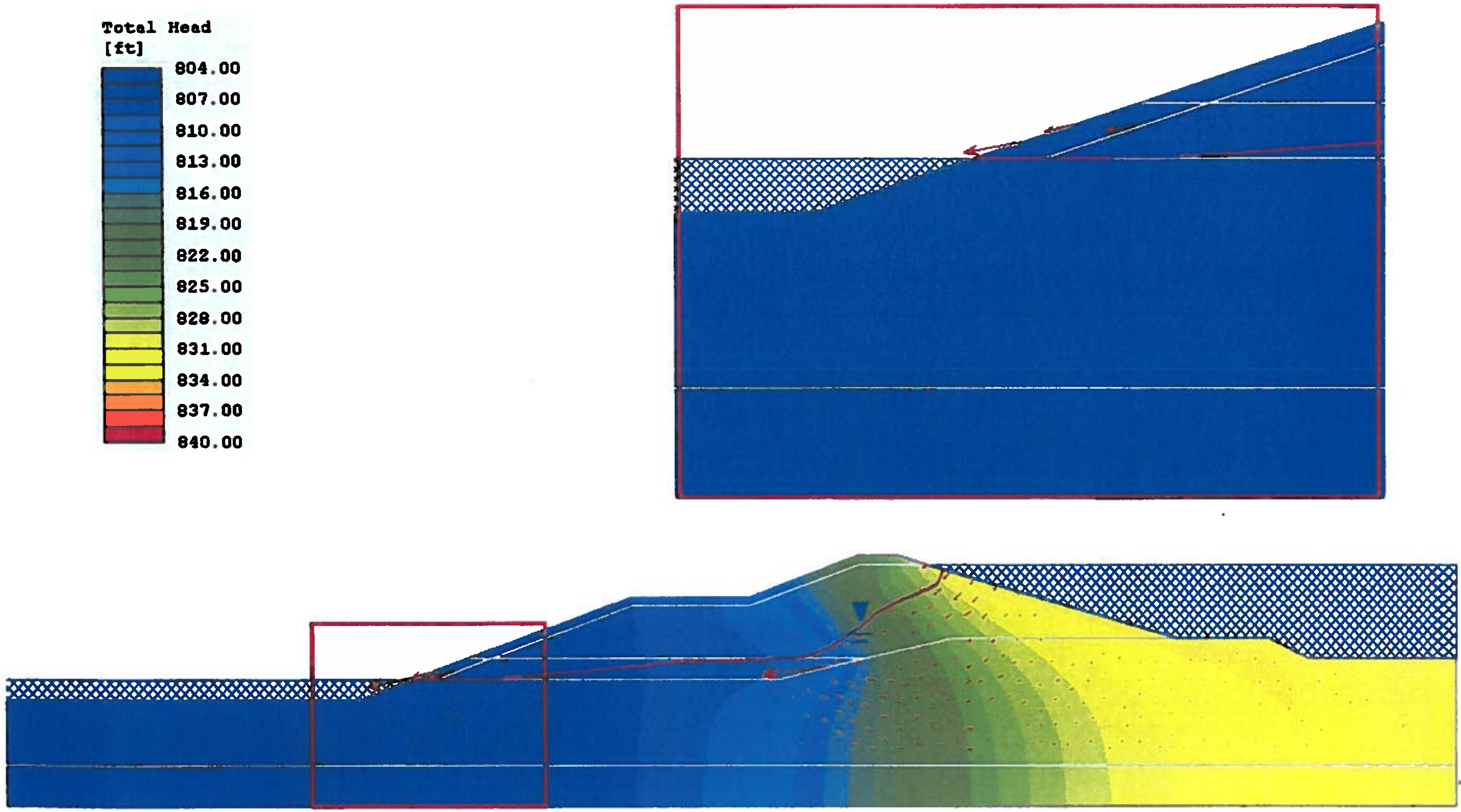
Geosyntec consultants

Future Condition: Underdrains functioning, no toe drain



Geosyntec consultants

Future Condition: Underdrains functioning, rip-rap toe drain



Sensitivity Analysis

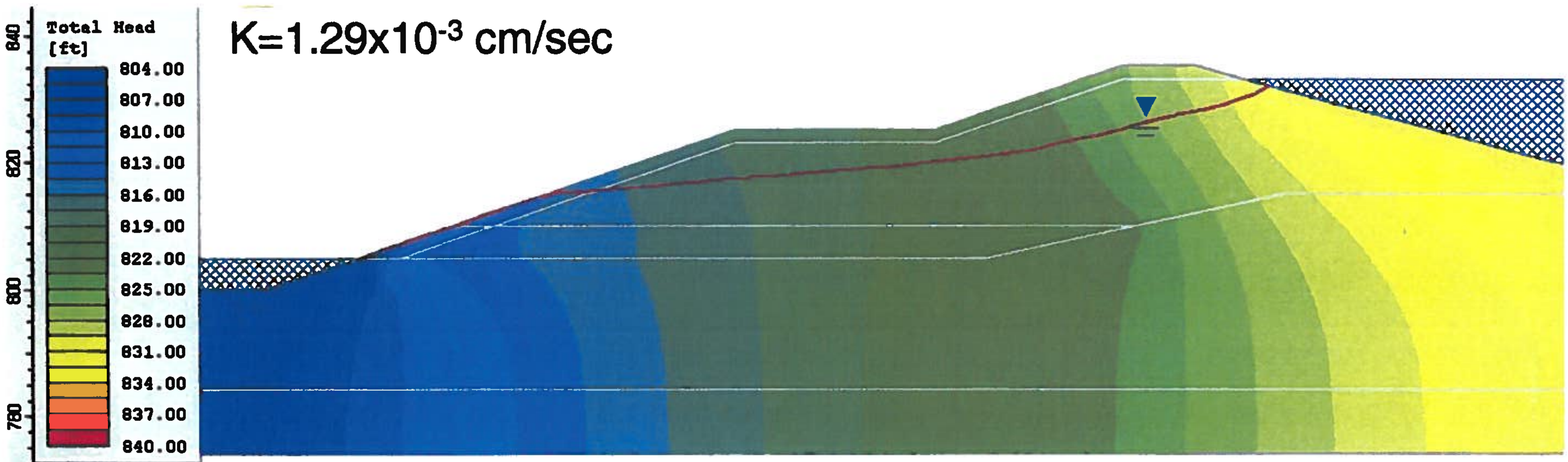
Assess sensitivity to two key parameters:

- Permeability of dike material
  - Use $K=1.29 \times 10^{-3}$ cm/sec
  - Use $K=4 \times 10^{-5}$ cm/sec
- Functionality of drains
  - Vary functionality by limiting the flux out of the model at the drain location (this is analogous to a drain blocking over time)
  - Flux (drainage) varied from Q=0 gpm to Q=20 gpm per drain (assuming a 200 ft lateral spacing)

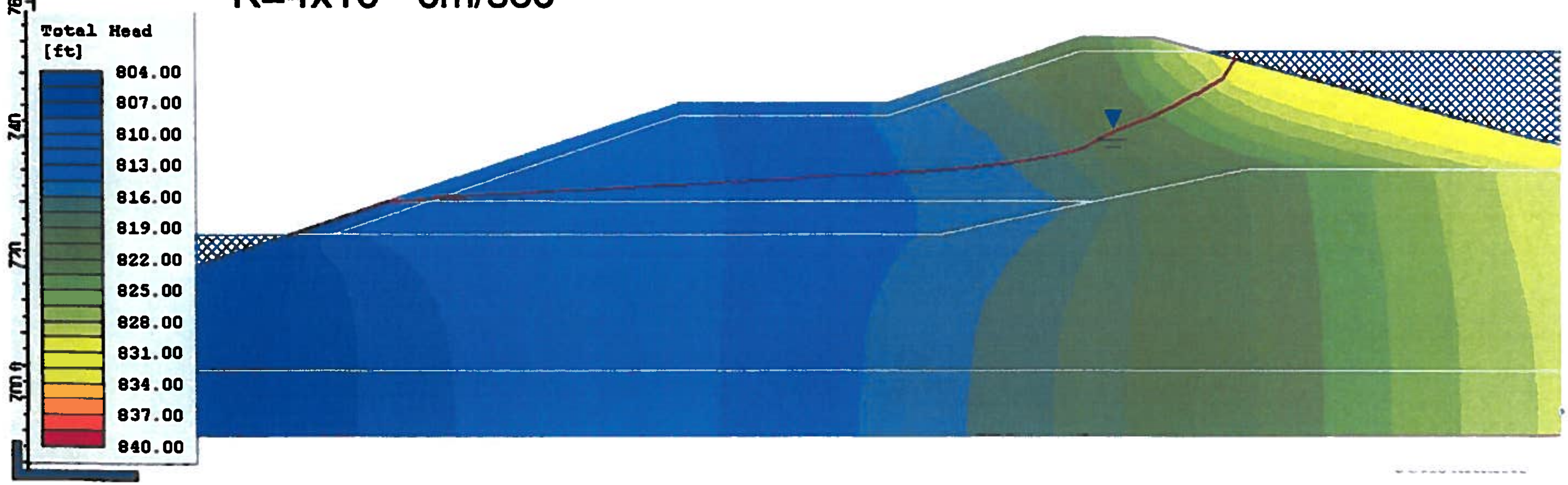
Sensitivity to Permeability

Future Condition: No toe drain, underdrains blocked

K=1.29x10^{-3} cm/sec

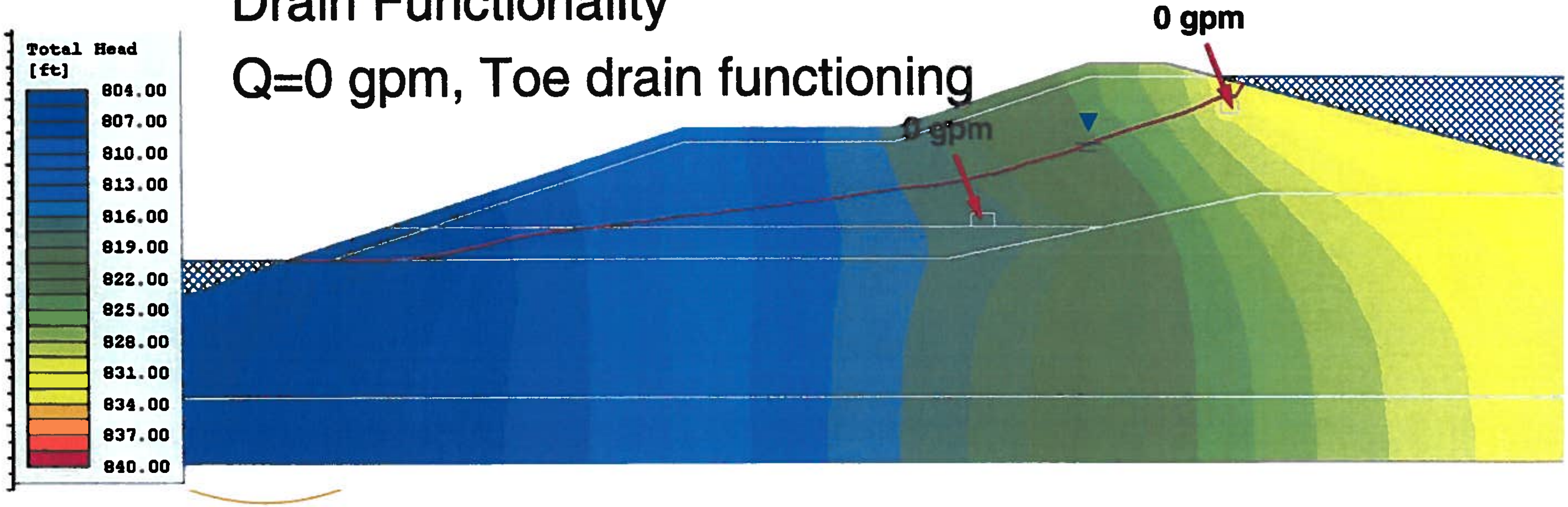


K=4x10^{-5} cm/sec

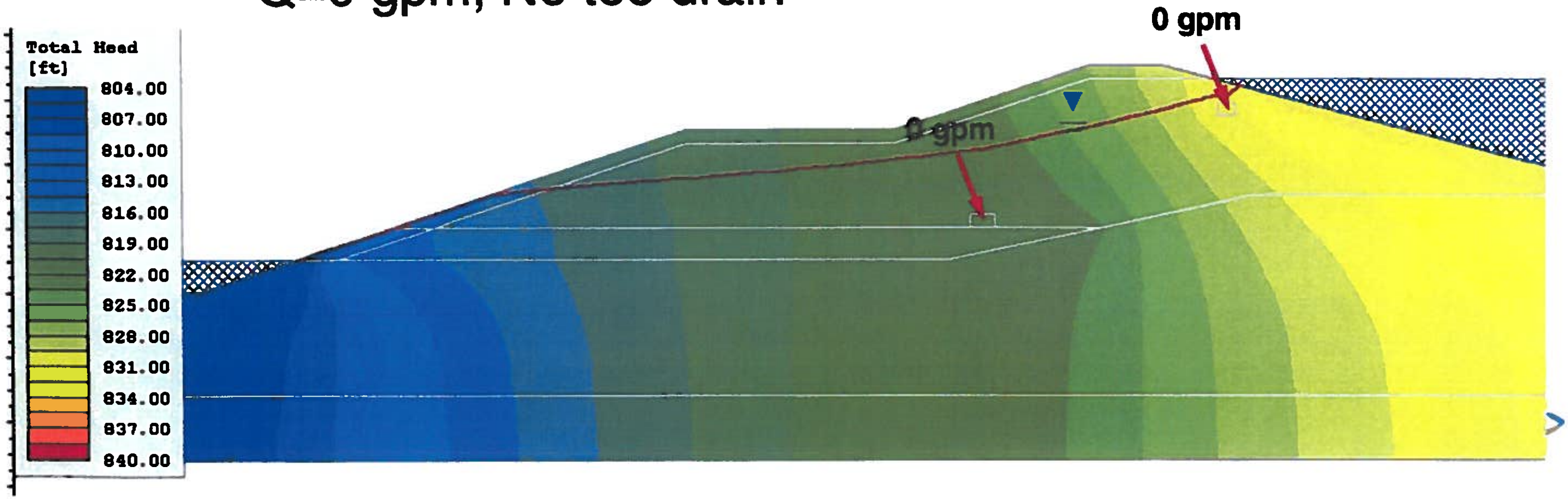


Drain Functionality

Q=0 gpm, Toe drain functioning

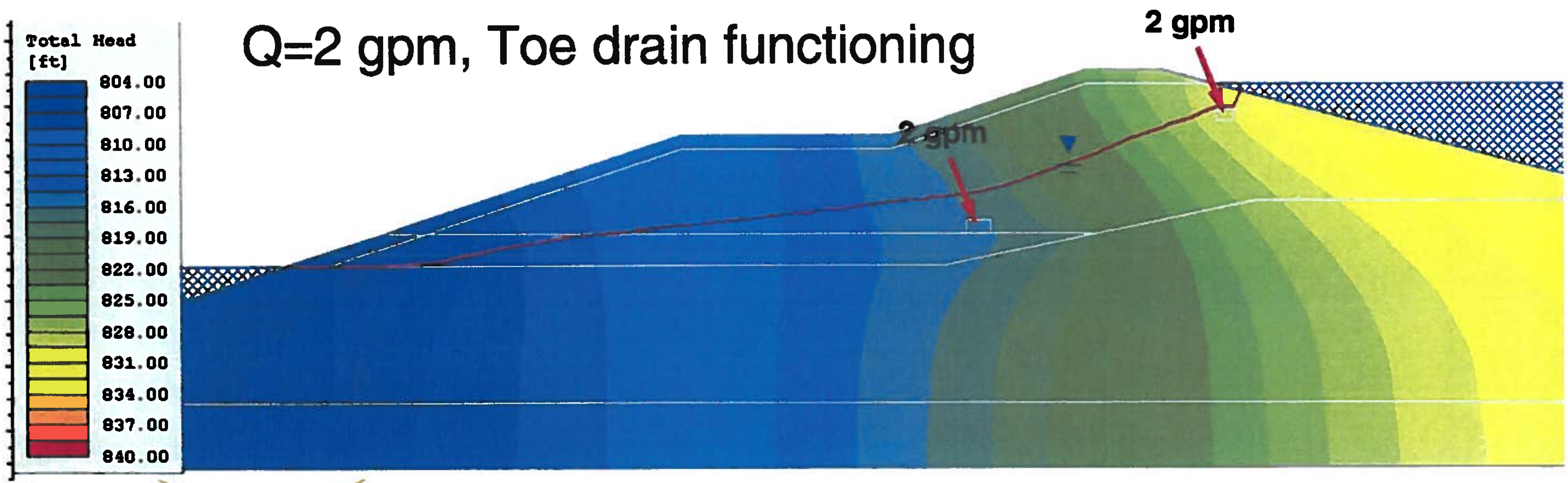


Q=0 gpm, No toe drain

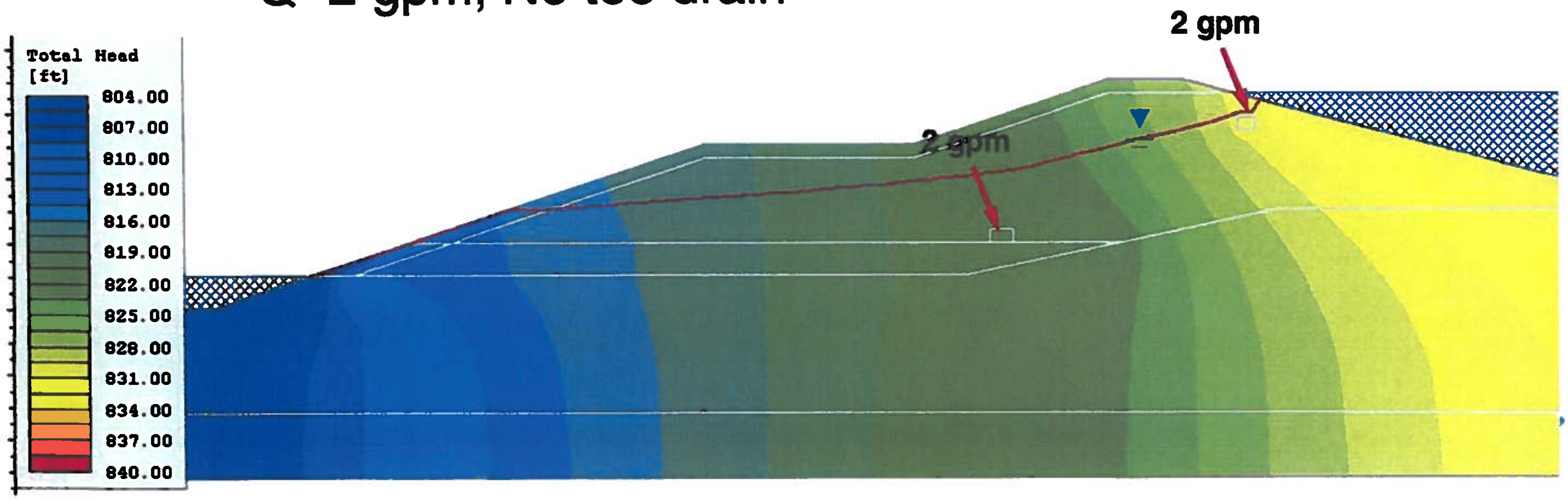


Drain Functionality

Q=2 gpm, Toe drain functioning

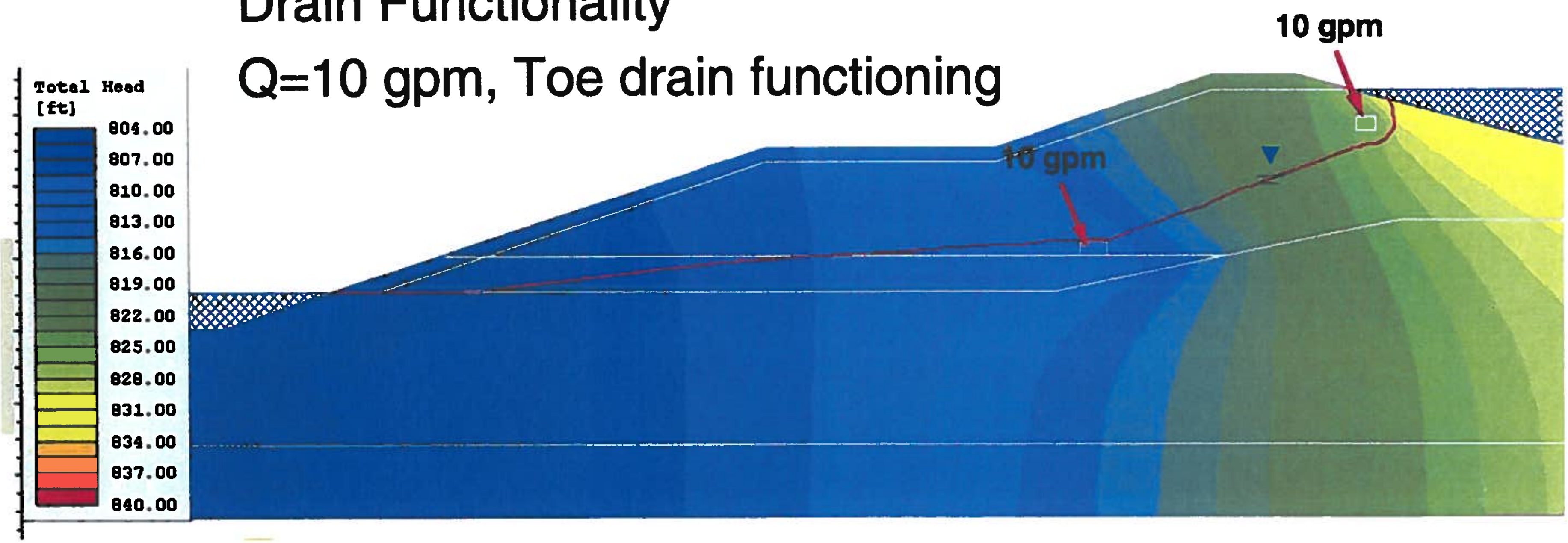


Q=2 gpm, No toe drain

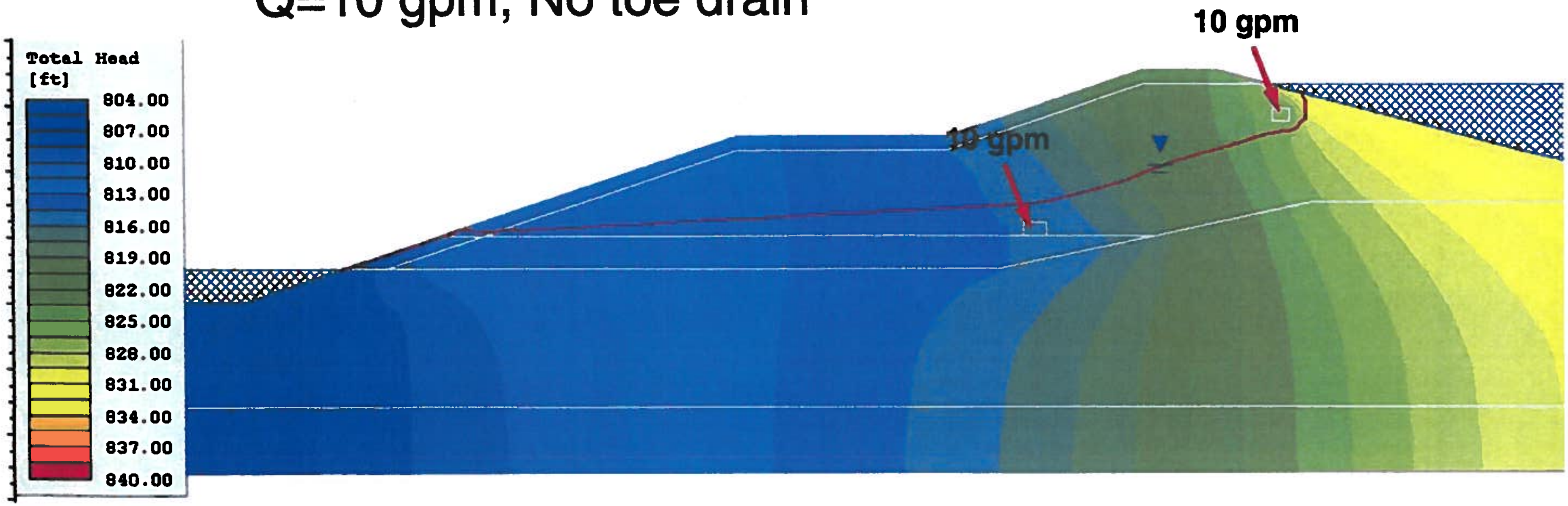


Drain Functionality

Q=10 gpm, Toe drain functioning

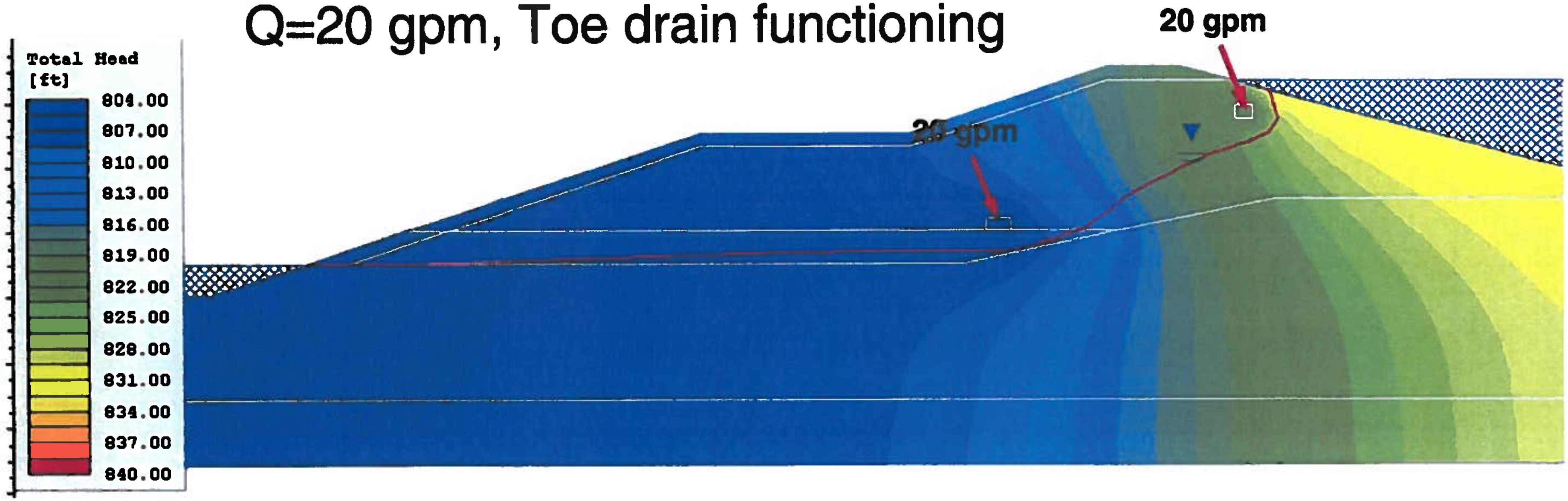


Q=10 gpm, No toe drain

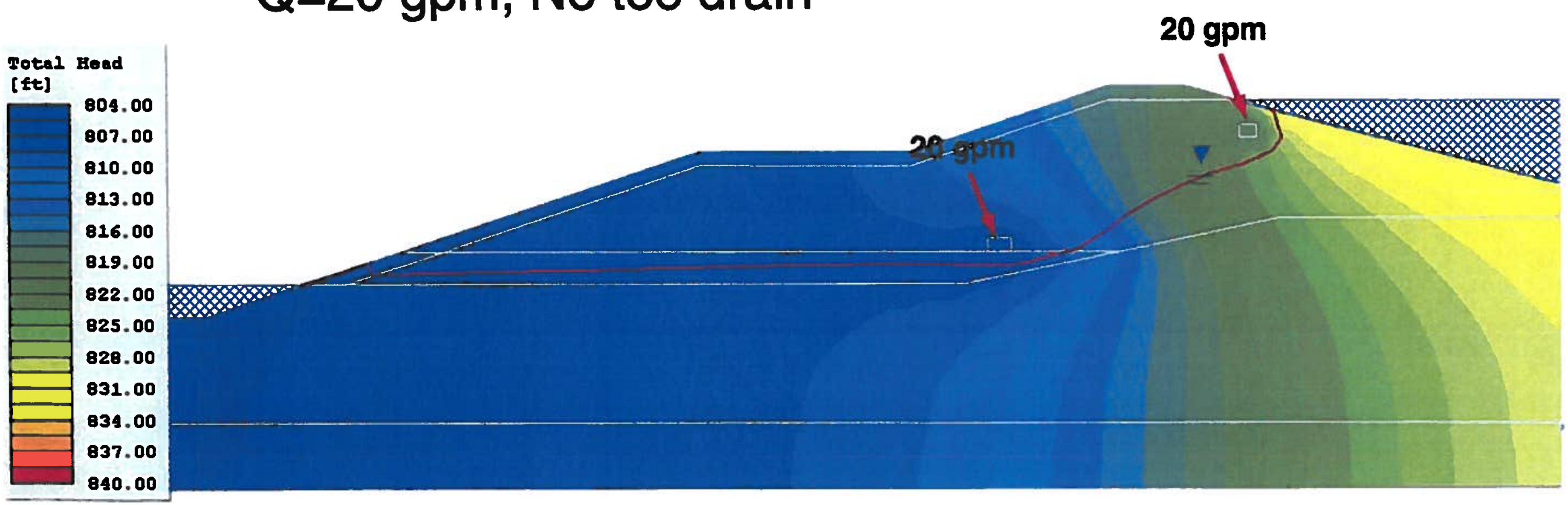


Drain functionality

Q=20 gpm, Toe drain functioning



Q=20 gpm, No toe drain



Conclusions

- Short-term seepage and stability issues should be addressed by installing pocket drains as recommended by TVA
- Seepage and stability are highly dependant on functionality of internal drainage
- Sensitivity to permeability of dike material has the most impact if drains are not functioning
- TVA's Proposed fix for CMP outfalls and bottom ash/fly ash underdrains is appropriate

Geosyntec consultants

Recommendations

Other Go-forward Recommendations

- Assess stability and seepage under full build-out conditions
- Review need for any additional drainage measures while the opportunity exists

Reference No. 10

Stantec Consulting Services Inc.
1409 North Forbes Road
Lexington KY 40511-2050
Tel: (859) 422-3000
Fax: (859) 422-3100

Stantec

February 25, 2009

let_001_brf_171468118

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

Re: Bull Run Fossil Plant
Gypsum Stack and Ash Disposal Dike
February 12, 2009 Field Observation and Recommended Actions

Dear Mr. Casaday:

Stantec engineers Roger Denick and Hugo Aparicio visited the referenced site February 12, 2009 and met briefly with Travis Markum and John Settles of TVA prior to reviewing surface conditions along different slopes of the Gypsum Stack and Ash Disposal dikes. The primary purpose of the visit was to review exterior slopes of the Ash Pond and adjacent stilling basin. In addition, the slopes of the Gypsum stack and the south slope of the Bottom Ash Storage area were reviewed. A description of our observations, conclusions and recommendations is presented in the next paragraphs.

- A walk along the downhill side of the dike that separates the stilling basin and ash pond from Clinch River and Bull Run Creek revealed relatively steep but well vegetated slope conditions. We closely reviewed areas located toward the north corner of the stilling basin where plant personnel had noticed wet conditions. Similar wet conditions were also observed in three other areas of the dike. In each case the wet conditions were located on a narrow bench next to the toe of the dike, not on the slope of the dike. The narrow bench appears to be used mostly as access for mowing equipment (see Photo 1).

  Although the source of water creating wet conditions in some of these areas may be pool water from the ash pond or stilling basin, no water flow or ground erosion was observed in any of the wet areas. It is recommended that plant personnel continue observing these areas periodically until a formal monitoring program is prepared and implemented. Wet areas where mowing equipment has difficulty crossing should be stabilized by placing No. 57 or No. 2 stone as necessary. The purpose of placing the stone is to prevent the equipment from creating deep ruts next to the toe of the dike.

Photo 1 Ash Pond Dike Slope

- During a prior visit to the site Stantec personnel had observed slumping/erosion along a Bull Run river bank area located toward the southeast corner of the ash pond, immediately below the narrow bench described above. TVA has since proceeded to stabilize this area by placing riprap on the river bank.

  The river (Clinch River and Bull Run) bank areas below the ash pond and stilling basin should be monitored periodically and stabilization measures implemented as necessary. Once current topographic mapping is obtained during Phase 2 of the facility assessment, Stantec will prepare a formal monitoring program which will include installing piezometers near some of the locations exhibiting wet conditions.

- There are at least four locations along the south exterior slope of the gypsum stack where relatively small, round or elongated depressions have formed (see Photo 2). In each case these depressions are occurring where the ground surface has been recently lined with erosion control blanket. The largest depression is located directly above one of the decant pipes; it is possible piping of the subsoil (gypsum and/or clay) into coarse material typically placed as bedding or trench backfill of buried pipes may have caused the ground to subside. It is not obvious what caused other smaller depressions to form. In addition, the toe of the slope appears to be wet and soft.

  The subsurface conditions of these depressed areas should be explored using a backhoe or excavator and treated accordingly based on the results of the exploration. The exploratory and treatment work should be performed under the monitoring of a geotechnical engineer, who should formulate the treatment measures to be used based on his observations. Depending on the subsurface material encountered, the treatment may require the use of geotextile fabric, fine (1" maximum dimension) and medium (2") coarse stone, clayey soil, topsoil and erosion control blanket. Proper equipment to compact the fill material will be required in addition to the backhoe and excavator. This work can be implemented as soon as TVA's resources are available, preferably within the next two to three weeks.

Photo 2 Depression along south slope of Gypsum Stack

It is possible the design of the structure allows for controlled seepage to occur along the toe of the slope. A more detailed review of design documents during Phase 2 of the facility assessment may determine if additional measures are necessary to correct these conditions. In the mean time, the wet conditions observed along the toe of the slope should be monitored periodically.

- The east side of the gypsum stack exterior slope toes out along the bank of an ash sluice ditch traversing from north to south. The ditch bank height is less than 10 feet but relatively steep or practically vertical in some intervals. The existing grading of several ditch intervals does not appear to allow positive drainage as indicated by standing or pooled water observed in several areas along the ditch (see Photo 3). It is possible current ditch bank conditions have not changed significantly in recent years but have occasionally become more unstable due to uncontrolled flow or standing water along the ash sluice ditch. One bank area exhibiting slumping and erosion has been stabilized using riprap since the initial visit to the site by Stantec personnel in early January.

  The dike slope is 3:1 or flatter and includes an intermediate bench. Therefore, the unstable ash ditch bank areas will probably not cause a sudden failure of the gypsum stack dike unless slumping and erosion of the bank is left uncontrolled. The bank slope should be stabilized by either (1) grading it back and lining it with a clay cover and erosion control blanket, or (2) by lining it with a layer of filter blanket and riprap as recently performed. Once current topographic mapping of the site is provided by TVA and current ash sluice ditch/ash pond operations are reviewed, Stantec will prepare a work plan to establish long term stability as well as positive drainage conditions.

Photo 3 Ash sluice ditch eroded bank along toe of gypsum stack east slope

- Certain interior slopes of the gypsum stack have been severely eroded or rutted by surface runoff (see Photo 4) . This is occurring because gypsum erodes readily when exposed to rainfall runoff for an extended period of time. In this case, the pool elevation is several feet below the top of the dike, which leaves the gypsum on the interior slopes exposed and subject to erosion.

Photo 4 Interior slope of gypsum stack eroded by surface runoff

Interior slope areas of the gypsum stack showing severe rutting should be re-graded periodically to prevent ruts from creating slumps or slope failures.

- Standing water was observed in surface ditches traversing (1) the toe of the Bottom Ash Storage Area - Pond 1 (see Photo 5) and Gypsum Stack west slopes; and (2) the roadside ditch of the access road traversing along the south side of Pond 1.

  These ditch areas need to be re-graded to provide positive drainage (eliminate standing water) to allow proper inspection of the slopes. At this time it is not known if the source of the standing water is rainfall runoff, seepage through the dike slopes, or both. Stantec will obtain current topographic information during the next phase of the facility assessments and prepare re-grade plans to provide positive drainage along these ditch areas. A monitoring program will be prepared and implemented after these ditch areas are repaired to allow proper assessment of the dike surface conditions.

Photo 5 Standing water in ditch traversing along west slope of Bottom Ash Storage Area – Pond 1

- Red water seeps were observed surfacing along the toe of the south slope of Pond 1, near the southeast corner of the pond (see Photo 6). In this area, the slope between the access road and the bottom ditch (separating Pond 1 from the gypsum stack) has apparently failed in the past as indicated by the slumped configuration of the slope. The bottom ditch, which separates Pond 1 and the Gypsum Stack, detains water for undetermined reasons.

  The purpose of detaining water along the bottom ditch described above should be reviewed. If practical, this water detention should be eliminated. Once the detained water is drained, the slumped slope area and red water seeps can be evaluated to determine what corrective actions may be appropriate. Since this appears to be a localized failure, the corrective measures may consist of placing fill material along the toe of the slope to provide additional support. Further movement of the slumped area may require more substantial corrective measures.

Photo 6 Red water seeps surfacing along toe of failed bank below south side of Bottom Ash Storage Area – Pond 1

If you have any questions or require additional information, please contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Hugo R. Aparicio, PE
Principal

/rdr

Reference No. 11

BULL RUN STEAM PLANT

ASH PONDS 1 AND 2A

SOIL INVESTIGATION

OE SOILS SCHEDULE 81.4

TVA 64 (OS-9-65)

UNITED STATES GOVERNMENT

B46 '85 0326 001

Memorandum

TENNESSEE VALLEY AUTHORITY

TO : R. O. Barnett, Chief Civil Engineer, W9D224 C-K

FROM : John A. Raulston, Chief Nuclear Engineer, W10C126 C-K

DATE : MAR 26 1985

SUBJECT: BULL RUN STEAM PLANT - ASH PONDS 1 AND 2A - SOIL INVESTIGATION - OE SOILS SCHEDULE 81.4

The soils investigation requested in a memorandum from R. E. Harris to J. Floyd Best, dated November 30, 1984, has been completed. Its purpose was to provide data for (1) a stability analysis of the existing dikes and (2) an analysis of any remedial treatments that may be necessary to improve the dikes' stability. The field exploration was completed intermittently from December 3 through December 31, 1984, and January 11 through January 16, 1985. During the intervening period the higher priority railroad loop exploration was completed. A total of 896 lin ft was drilled and sampled at 32 locations. Borings were advanced by a CME model 55 drill equipped with 3-3/8-in. and 6-in. id hollow stem augers and AW drill rod. Dry drill procedures were used and methods conformed to ASTM D 1586, D 1587, D 2488, and D 2573.

Certain boring locations were changed from where indicated in the memorandum. These changes were either initiated by or made in coordination with the Geotechnical Group after initial sampling, primarily to better define conditions in the earlier underlying dikes. Figures 1 and 2 are schematics of the actual relative positions of the completed borings. They also show the location of V-8, where vane shear tests were conducted, and piezometer locations. Boring locations are in the plan and table 1. Surface profiles have been previously submitted for ranges 1, 2, 3, 4, and 5. General cross sections showing the surface and subsurface profiles are included for ranges 1, 2, and 4. The on-shore profiles were done by CSB (Gary Neibert, extension 8658, Knoxville) and the subaqueous profiles were done by Maps Data (Kary Kaley, extension 5437, Chattanooga).

All borings were backfilled and tamped immediately after the job's completion. However, settlement was reported and certain locations had to have additional backfill several weeks later.

Site Conditions

Both ponds 1 and 2A are contained by a series of stair-stepped dikes built at progressively higher levels as the ponds are approached. These are designated for purposes of discussion as: A, the lower, outermost and oldest dike; B, the intermediate dike; and C, the highest, innermost and youngest dike. (See figure 1.)

In general the dikes' profiles are as follows:

Dike A is composed of compacted saprolitic fill or earthfill resting directly on the in-place alluvial soils. Dike B is typically compacted saprolitic fill of variable thickness resting on either equipment-placed bottom ash or hydraulically placed fly ash. Usually the outer margins of this dike abut the inner slope of dike A. Dike C is composed of equipment-placed bottom ash fill resting on hydraulically placed fly ash. Except on the cross dike segment, separating ponds 2 and 2A, it abuts against the inner slope of dike B. The foundations of both dikes B and C are alluvial soils.

Dike A Fill

Dike A level fill soils were penetrated in borings SS-2P and SS-5P at pond 1 and at pond 2A in boring SS-9C. The pond 1 fill was saprolitic and classified as silty clayey sand, SM-SC. Here it was about 10 ft thick and of medium to stiff consistencies. In boring SS-9C at pond 2A the fill soils of dike A were encountered between depths of 15 to 18 ft. They were silty clays, CL, of medium consistency.

Dike B Fill

At pond 1, borings SS-1, SS-3, SS-4, SS-6, and SS-14 penetrated dike B level fill. Typically, compacted saprolitic fill soils were present from the surface to depths of 8 to 12 ft. They classified as clayey sands or silty clayey sands, SC, SM-SC, with very soft to very stiff consistencies, the weaker soils occurring normally near the bottom of the fill. Underlying the saprolitic fill, bottom ash fill was present at depths between 8 and 17 ft. These soils classify as silty sands, SM, and based on N values have relative densities ranging from very loose to medium. The looser soils were concentrated near the interface of the overlying saprolitic fill. At boring SS-6 on the inner margin of the dike, bottom ash fill was present from the surface and loose ash occurred immediately above the foundation alluvium.

At pond 2A the dike B level was penetrated by boring SS-9A on the inner margin and borings SS-9B and SS-9C on the outer margin. Saprolitic fill soils extended from the surface to a depth of 13 to 15 ft. These soils classified as sandy silt, ML, or silty sand, SM. They had loose to medium relative densities based on SPT results. Underlying the saprolitic fill silty sand, SM, bottom ash extends up to a depth of 21 ft. It has a loose to medium relative density. Borings SS-9B and SS-9C on the outer margin of this dike level penetrate a riprap layer at a depth of about 15 ft facing and above dike A fill.

Dike C Fill

Borings SS-7 through SS-13 penetrated dike C level fill at pond 2A. Typically, equipment-placed bottom ash classifying as silty sand, SM, extends to a depth of 15 to 26 ft. The upper 12 ft had high medium to dense relative densities and the lower portion very loose to loose relative densities. This bottom ash fill was underlain by hydraulically placed fly ash typically classifying as sandy silt, ML, and showing very loose to loose relative densities.

Stacked Fly Ash

Two locations in pond 1, US-2ST and US-5ST, were sampled to obtain undisturbed samples of the equipment-stacked fly ash.

Foundation Soils

Where penetrated at both pond areas, the alluvial foundation soils exhibit a generally consistent profile. The upper portions immediately under the fill materials were typically silty clays, CL, grading downward into sandy silts, ML; silty sands, SM; or poorly graded sands, SP. N values showed a wide range. Cohesive soils had consistencies ranging from soft to very stiff and sandy soils were normally weak with relative densities ranging from very loose to loose.

Bedrock

Refusal on bedrock, where encountered, varied from elevation 763.6 to elevation 789.0 giving a total known top of rock relief of 25.4 ft.

Water Levels

Along that portion of the pond 1 dikes facing Melton Hill Lake, water levels in the open borings on the dike B level ranged from elevation 804 to elevation 807 and averaged about 806. At SS-4, water adjusted at only 0.3 ft beneath the surface. In contrast, the piezometric water levels established at SS-2P, 2P, SS-5P, and 5P were between elevations 794 and 797. This suggests the general GWL is reflected in the piezometers and the higher levels seen in the open borings are fed either through the fly ash or directly from the water-filled ditch between dikes B and C. (The perforated sections of the 2-in. PVC pipes were in the lower 5 ft of the borings centered approximately at elevation 768.)

On the dike B level of pond 2A at SS-9A, water level in the open boring was at elevation 807.4 or 1.5 ft below the surface. This was the approximate level of water in the ditch between dike B and dike C levels. At pond 2A on the dike C level, all borings showed water levels near elevation 810, some 15 ft below the surface.

Vane Shear Testing

Due to the difficulty of taking undisturbed samples on the hydraulically placed fly ash underlying the bottom ash fill on dike C level at pond 2A, vane shear tests were conducted 5 ft from boring SS-8. Testing was in sandy silts, ML, with N values of 0 to 1 between depths of 20 to 27 ft. Testing, which essentially followed ASTM D 2573, was with a 2.5-in. diameter, tampered vane taken through and below the 3-3/8-in. id hollow stem auger. Measurements were made with a calibrated torque wrench rotated at approximately 0.1 degrees per second. Results are tabulated in table 2.

Laboratory Testing

Laboratory testing of split-spoon samples included tests for Atterberg limits (ASTM D 4318), specific gravity (ASTM D 854), and grain-size anlysis (ASTM D 422). These index tests were also performed on all undisturbed samples, in addition to tests for moisture content (ASTM D 2216) and dry density (SLP-1 and SLP-2, SM-106). Selected undisturbed samples were also tested for shear strength under triaxial R test and direct shear S test conditions. Triaxial R tests were conducted on samples at natural moisture content and saturated samples. Test results are summarized in the attached table 3.

Dikes A, B, and C, as previously described, consist of materials of variable origin, methods of placement, and age of placement. Saprolitic compacted fill, encountered in dikes A and B, can be defined by test results from US-2SS, US-4, US-4A, and US-9A. The natural moistures range from 18.5 to 30.8 percent with dry densities from 88.9 to 109.5 pcf. The fill is composed of silty clayey sands, SM-SC; silty sands, SM; and sandy silts, ML. Friction angles from natural moisture R tests range from 22.3 to 26.5 degrees with 0.28 to 0.81 tsf cohesion. Saturated R-test apparent friction angles vary from 10.4 to 19.9 degrees with 0.25 to 1.20 tsf cohesion. Corresponding S-test values range from 21.9 to 42.4 degrees and 0.06 to 0.74 tsf cohesion.

Compacted earthfill encountered at SS-9C was penetrated at US-9B (sample 1). Because its density was relatively high, no shear strength testing was requested.

Equipment-placed bottom ash, silty sand, SM, was encountered at US-6, US-4A, US-9B, and US-11 and sampled at US-11, where natural moistures range from 19.7 to 24.9 percent with dry densities from 58.3 to 59.3 pcf. Friction angles from natural R, saturated R, and direct shear S tests are 33.7, 21.3, and 35.0 degrees, respectively, with corresponding cohesions of 0.64, 1.02, and 0.28 tsf.

Equipment-stacked fly ash was encountered at US-2ST, US-2AST, and US-5ST. It is classified as sandy silt, ML, or silty clay or sand, CL or SM. Natural moistures average 25.3 percent, ranging from 16.8 to 31.7 percent. Dry densities range from 60.8 to 96.1 pcf. A natural moisture R test resulted in a friction angle of 31.0 degrees with 0.11 tsf cohesion, while saturated R-test apparent values are 15.0 degrees and 0.31 tsf. Direct shear test values are 37.8 degrees, 0.00 tsf cohesion.

Alluvial foundation soils, sampled at US-6, US-2B, US-4A, and US-9B, classify as silty clays, CL, or silty sands, SM. Natural moistures range from 17.8 to 30.6 degrees, with dry densities from 86.9 to 106.2 pcf. Only saturated R tests were conducted on these foundation soils. Resulting apparent friction angles average 17.1 degrees, ranging from 14.3 to 18.6 degrees, and cohesions vary from 0.12 to 1.34 tsf.

BULL RUN STEAM PLANT - ASH PONDS 1 AND 2A - SOIL INVESTIGATION - OE SOILS SCHEDULE 81.4

Summary

The stepped sequence of dikes containing the present ponds are composed of compacted saprolitic fill or earthfill, equipment-placed bottom ash, and hydraulically placed fly ash. The alluvial foundation soils consist of clays overlying and grading downward into sands.

Field and laboratory testing indicate variable conditions. However, general relative weaknesses are seen in the hydraulically placed fly ash and in the lower portion of the alluvial foundation soils. Elsewhere low strengths are common on both sides of the interfaces of the differing fill material types.

High water levels in the open borings on the intermediate dikes (B level) indicate water is migrating either from the adjacent drainage ditches into the saprolitic fill or is rising from the underlying ash under positive head.

Original ... ed By
John ... Cox

John A. Raulston

HPM:BCJ
Attachments
cc (Attachments):
W. H. Childres, SME-K
O. P. Thornton, W3A2 C-K
RIMS, SL26 C-K

Principally prepared by H. P. Matthews, extension 2771.

A35078.2

INFORMAL MEMORANDUM

J. Floyd Best, SME-K

R. E. Harris, 338 SPT-K

NOV 3 0 1984

BULL RUN STEAM PLANT - ASH PONDS 1 AND 2A - SOIL INVESTIGATION - OE SOILS SCHEDULE NO. 81.4

We request that you arrange for a soils investigation at the Bull Run Steam Plant for Ash Ponds 1 and 2A. The investigation's results will be used to provide data for (1) a stability analysis of the existing conditions of the ash pond dikes, and (2) analysis of any remedial treatments that may be necessary to improve the stability of the ash pond dikes. This investigation will include field and laboratory testing of the soil material in the existing dikes and of the ash in the pond.

Field Investigation

The field investigation will consist of borings for standard penetration tests (SPT) (ASTM D 1586), borings for undisturbed sampling, possible test pits in the ash pond, and piezometers for monitoring the groundwater. Figure 1 shows the proposed locations of the borings, test pits, and piezometers. The borings may be shifted slightly to avoid obstructions (coordinate the boring locations with site personnel to avoid obstructions), but final locations are to be included in the final report. Borings along the perimeter dike road for Ash Pond 1 should be located on the pond side of the road. The ash pond dike for Pond 2A is an interior pond to Ash Pond 2, and the borings should be located on approximately the centerline of the dike. The one boring in the dike for Ash Pond 2 (shown on cross-section line 4) should be located on the pond side of the road.

Each boring for SPT sampling is to be extended to a minimum of 5 feet below the dike/foundation interface, except for those borings shown on figure 1 to extend to the top of rock or 25 feet below the dike/foundation interface. SPTs are to be made at a minimum of 5-feet-on-center intervals or at each material change if layers are less than 5-feet thick. Jar samples of each SPT sample are to be taken. The SPT borings for Ash Pond 1 should be done before the SPT borings for Ash Pond 2A.

A copy of the field drilling logs for the borings should be submitted to Ray Threlkeld, 163 LB-K, as soon, after completion of the borings for each pond, as possible to allow for prompt review and determination in coordination with SME of the soils that need to have undisturbed samples taken. Undisturbed sampling should be done in borings located 5 feet from the borings for SPTs.

The ash that has been dry-stacked above the level of the perimeter dike of Ash Pond 1 needs to be sampled. The capacity of the ash to adequately support a drilling rig is uncertain. Undisturbed samples are to be obtained by taking block samples at a depth of 5 feet, or if access with a drill rig is possible, by taking shelby tube samples at depths of 5 and 10 feet. Sample locations are shown on figure 1.

Seepage from Ash Pond 1 can be visually seen to extend to near the midpoint of the road on top of the dike for Ash Pond 1. Two piezometers need to be installed at the locations shown on figure 1. One piezometer may be installed in the boring for SPT sampling, and the second piezometer should be located on the riverside slope of the dike 10 to 15 feet off the road. The piezometers should be installed as early possible in the investigation.

Groundwater readings should be taken daily from each piezometer during the investigation. In addition, the 1-hour and 24-hour groundwater levels should be determined after completion of field drilling.

Each boring/test pit is to be backfilled with tamped earth (or ash for those borings in the ash pond) upon completion.

Due to the wide spacing of the borings, additional borings to define the extent of soft or weak areas may be identified during the course of the investigation. The need for additional borings will be coordinated with SME, FEP, and CEB.

Laboratory Testing

The laboratory testing shall consist of determining the moisture content of each SPT sample and classification of a representative sample of each layer identified for the site. The representative sample should be an actual sample and not a mixture of several samples representing a layer. Also, a sample should not be selected to represent two layers in the same boring.

Testing of undisturbed samples will be dependent on the existing and future loading conditions for each ash pond. Testing will include determination of moisture, density, and classification of each sample. The attached Table 1 shows the laboratory tests to be carried out on each undisturbed sample.

NOV 3 0 1984

BULL RUN STEAM PLANT - ASH PONDS 1 AND 2A - SOIL INVESTIGATION - OE SOILS SCHEDULE NO. 81.4

Report

The report should contain the final locations of each boring, graphic logs, generalized soil profile, and summary tables on each SPT and undisturbed boring and sample testing.

Work on this investigation should be charged to Account No. 544-68-31207.XXX. Per agreement, this work is authorized in the amount of $44,500. Per discussions with you, the completion date for this investigation will be dependent on the amount of undisturbed sampling and testing and the number of extra borings for SPTs that are required to define weak or soft areas, but based on the scope of your estimate for this work, the final report should be completed by March 1, 1984.

Other Items

You are responsible for arranging for a survey to locate the borings, surveying to provide five cross-sections of the dikes being investigated, and for obtaining site clearances to do this work. The locations of the cross-sections are shown on figure 1. The three cross-sections shown to extend into the reservoir are to be extended approximately 150 feet from the shoreline into the reservoir. The cost of the surveying is included in the estimate prepared for this work.

R. E. Harris

R. E. Harris

HRT:BSH
Attachments
cc: O. P. Thornton, 102 SPT-K (Attachments)

OPT:REH:BSH
cc: F. Van Meter, 500 SPT-K (3) (Attachments)--Please coordinate any required support with SME.

Principally Prepared By: H. R. Threlkeld, Extension 4774

HRT
COT
JMO

Table 1

Laboratory Test	Ash Pond 1 Soil	Ash Pond 1 Ash	Ash Pond 2A Soil	Ash Pond 2A Ash
Moisture	X	X	X	X
Density	X	X	X	X
Classification[1]	X		X	
Sieve Analysis		X		X
R Test				
@ Natural Moisture	X		X	
@ 100% Saturation[2]	X	X	X	X
S Test				
@ Natural Moisture	X		X	

1. Includes Atterberg Limits tests and sieve analysis.

2. Monitor pore water pressure.

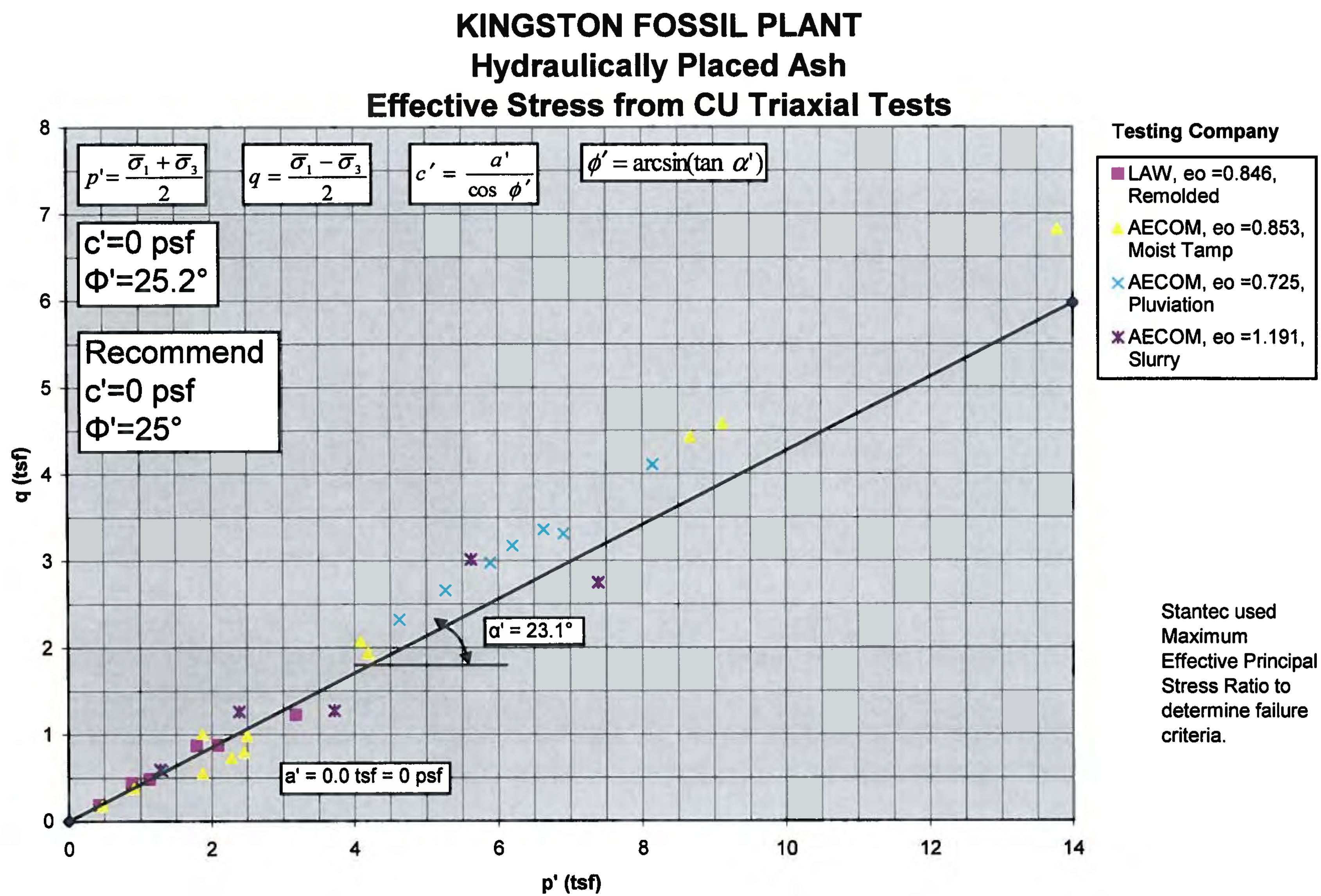
Appendix G

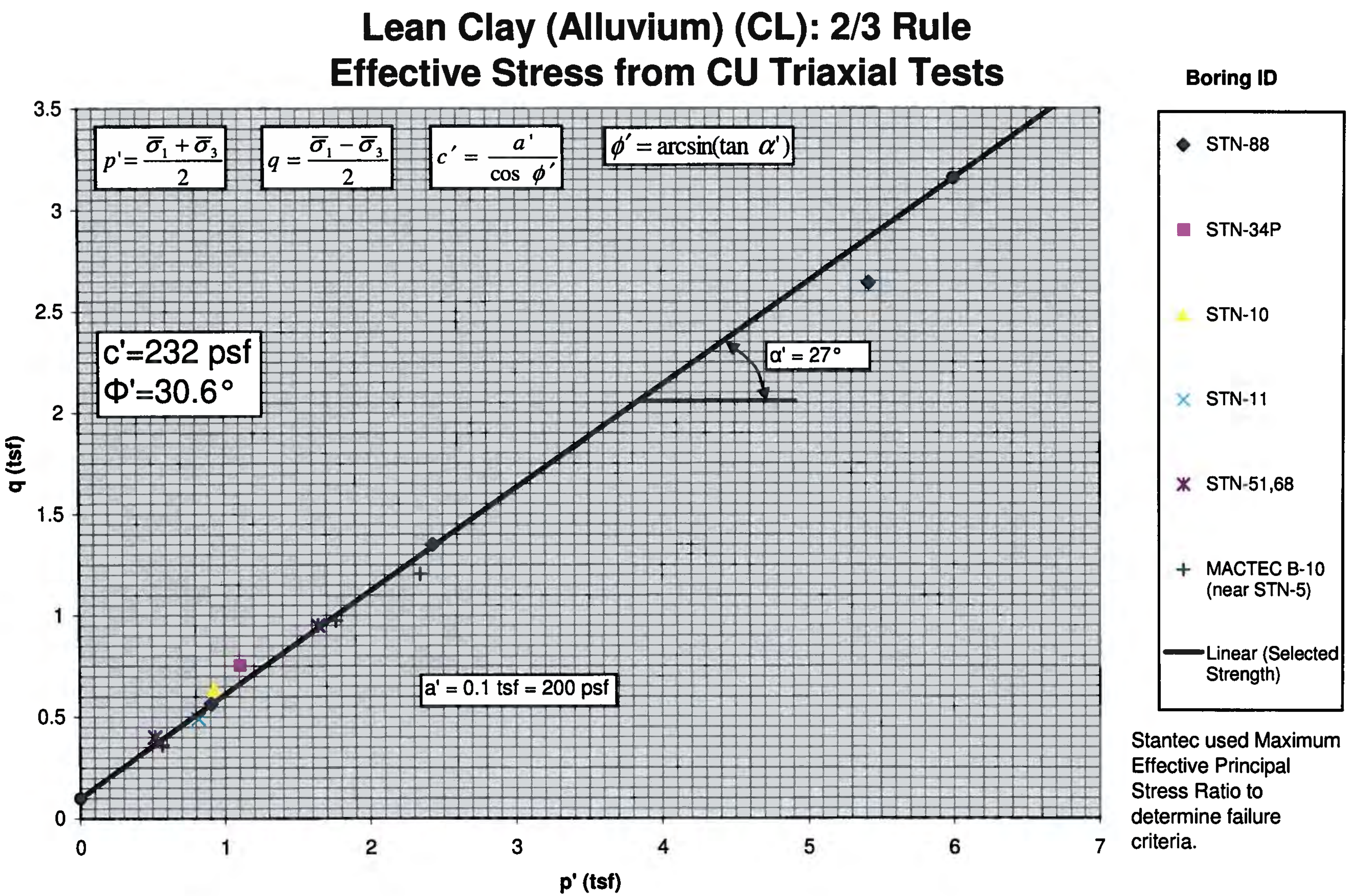
SPT Correlation Tables and Mohr Plots

- Attachment 1 – Effective Stress (Mohr) P-Q Plots
- Attachment 2 – SPT Correlation Tables

Attachment 1

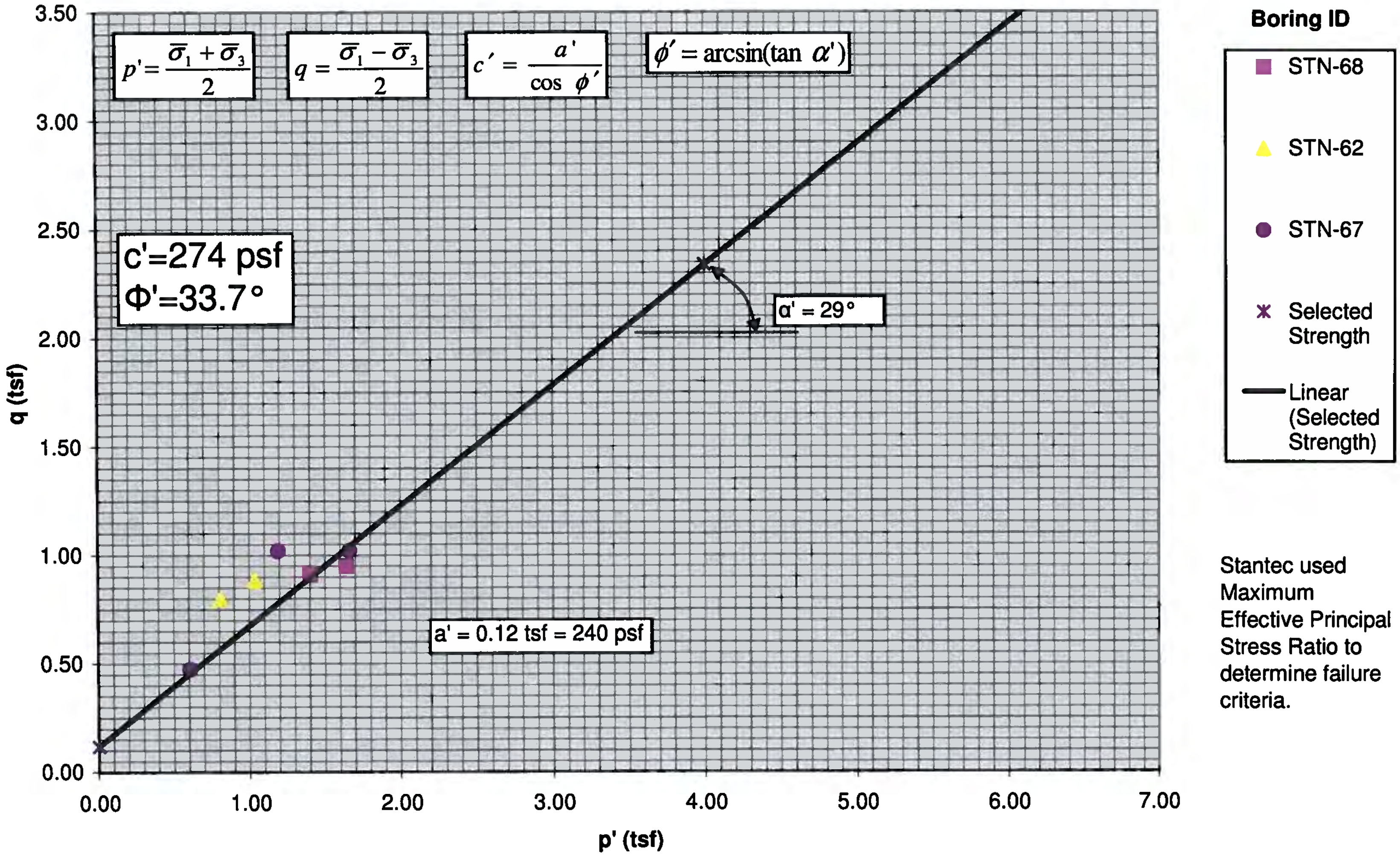
Effective Stress (Mohr)
P-Q Plots


KINGSTON FOSSIL PLANT
Hydraulically Placed Ash
Effective Stress from CU Triaxial Tests
$p' = \frac{\overline{\sigma}_1 + \overline{\sigma}_3}{2}$
$q = \frac{\overline{\sigma}_1 - \overline{\sigma}_3}{2}$
$c' = \frac{a'}{\cos \phi'}$
$\phi' = \arcsin(\tan \alpha')$
c'=0 psf
Φ'=25.2°
Recommend
c'=0 psf
Φ'=25°
α' = 23.1°
a' = 0.0 tsf = 0 psf
q (tsf)
p' (tsf)
Testing Company
LAW, eo =0.846, Remolded
AECOM, eo =0.853, Moist Tamp
AECOM, eo =0.725, Pluviation
AECOM, eo =1.191, Slurry
Stantec used Maximum Effective Principal Stress Ratio to determine failure criteria.



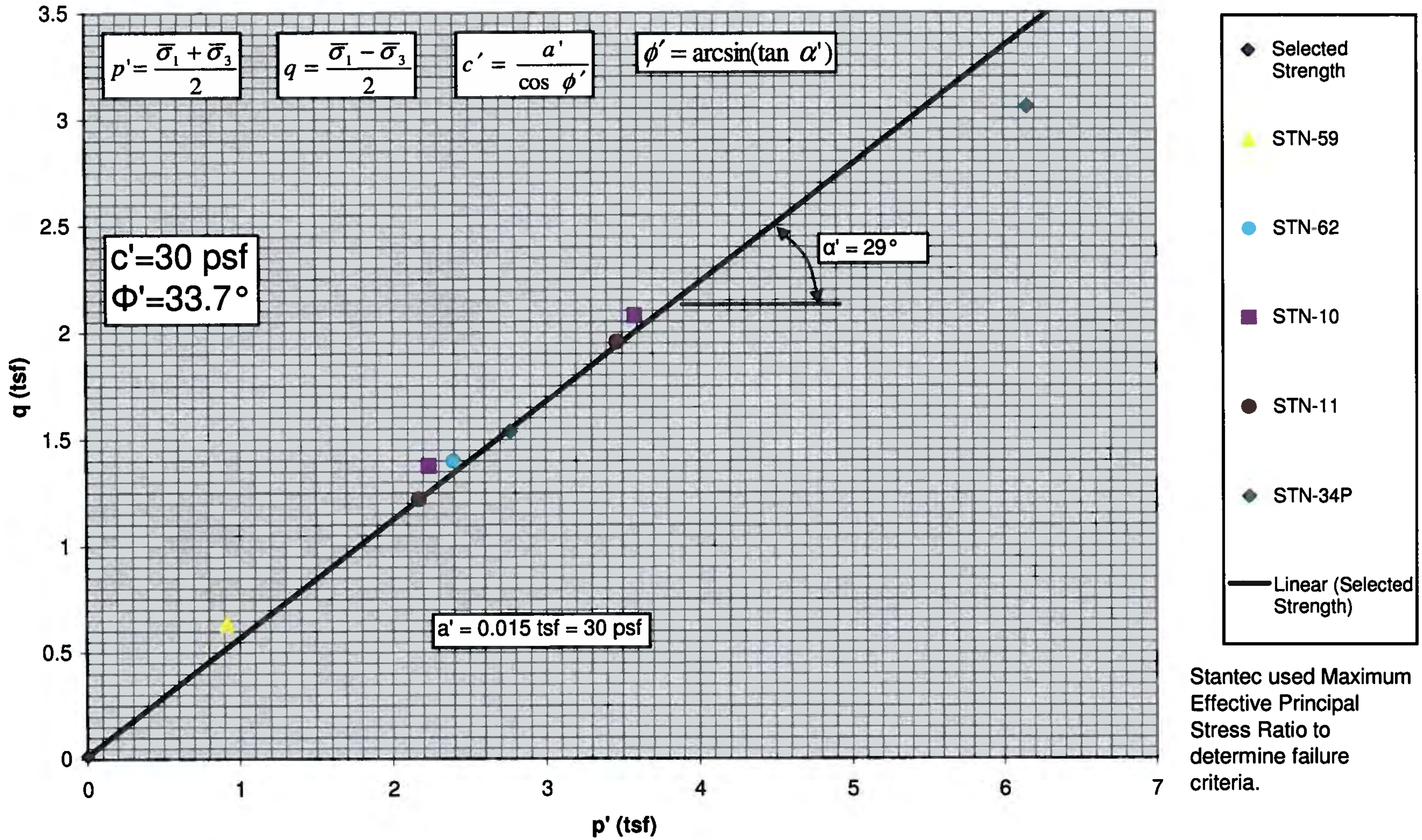
Stantec used Maximum Effective Principal Stress Ratio to determine failure criteria.

Lean Clay (Fill) (CL): 2/3 Rule
Effective Stress from CU Triaxial Tests



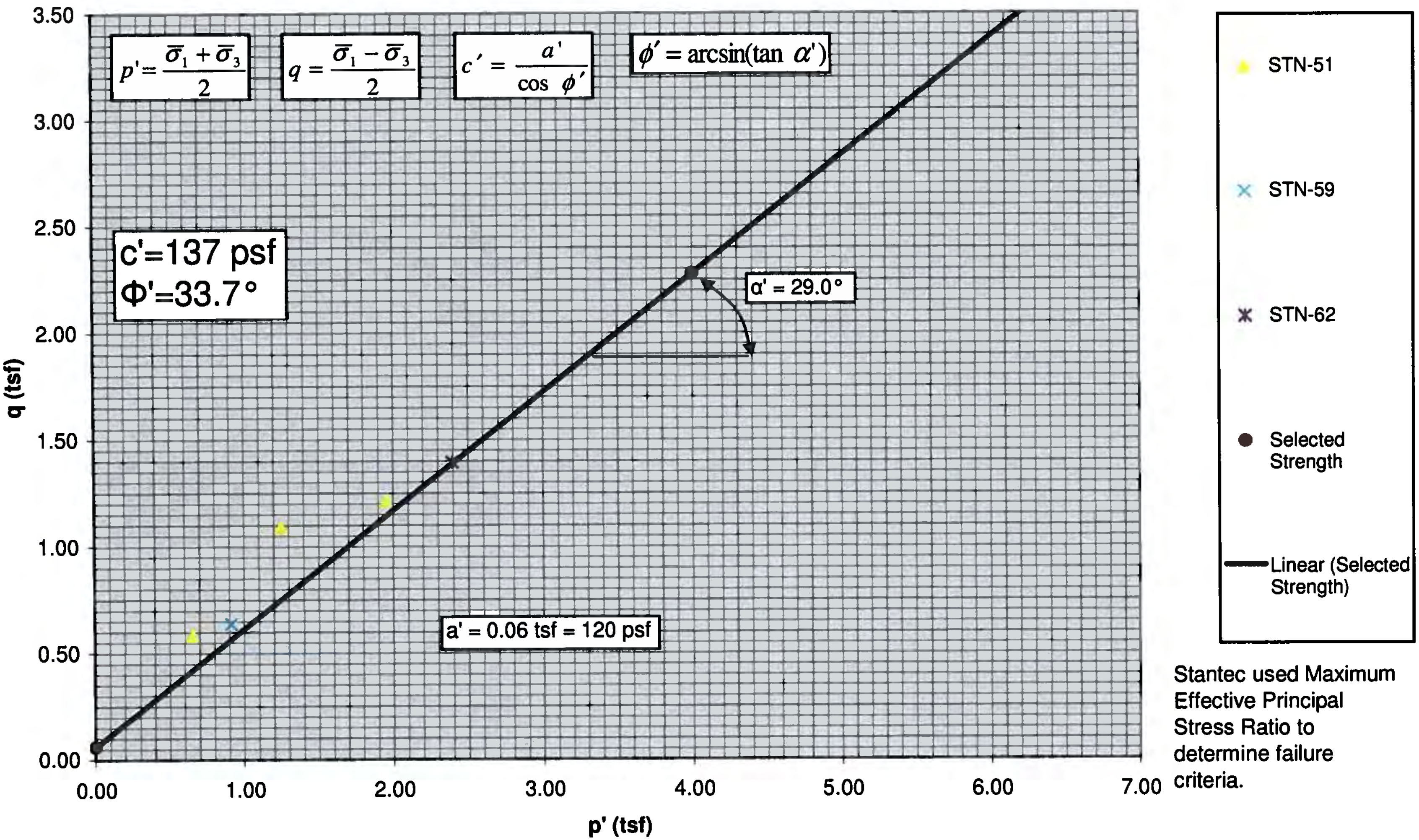
Stantec used Maximum Effective Principal Stress Ratio to determine failure criteria.

Sandy Lean Clay (Alluvium): 2/3 Rule
Effective Stress from CU Triaxial Tests



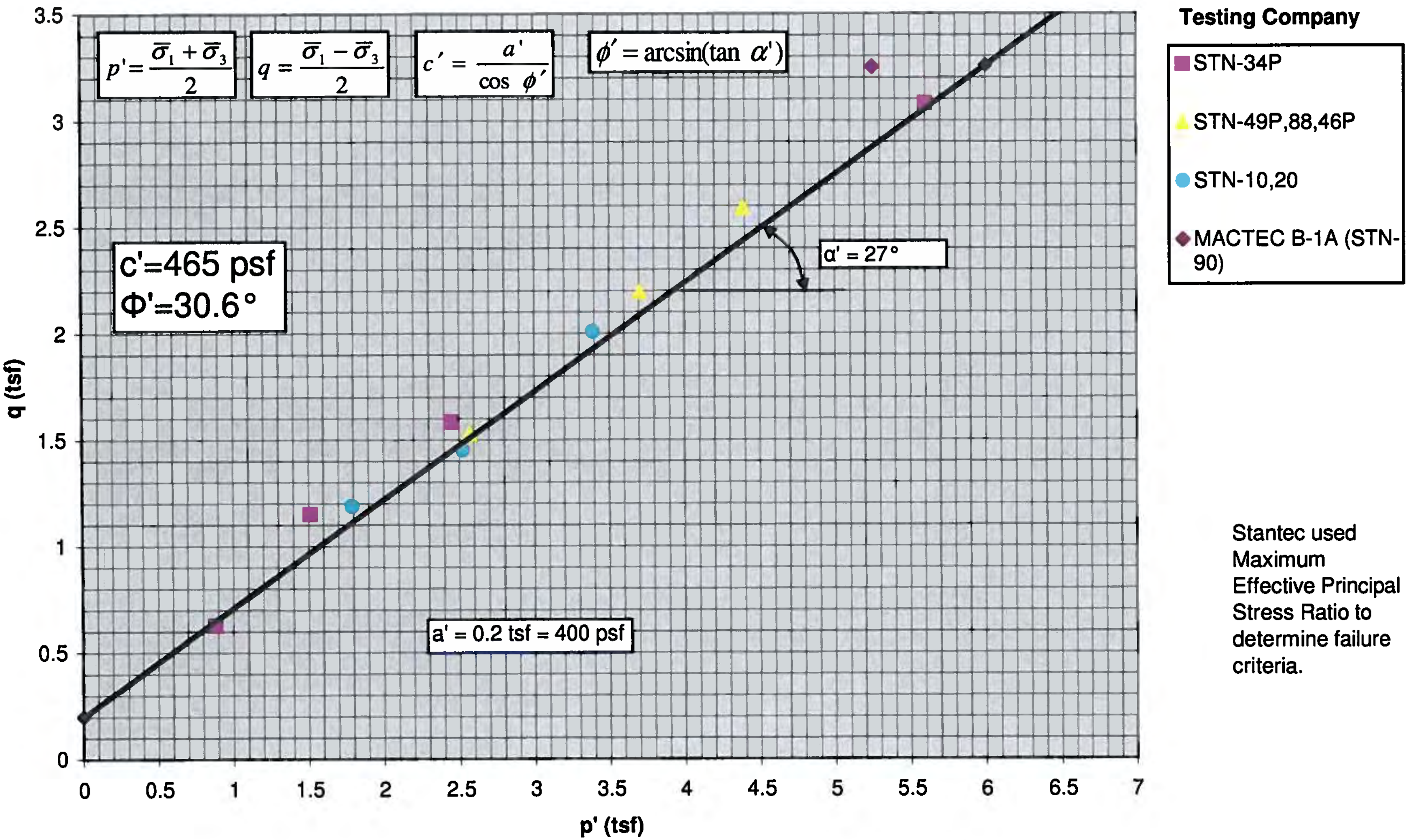
Stantec used Maximum Effective Principal Stress Ratio to determine failure criteria.

Sandy Lean Clay (Fill) (CL): 2/3 Rule Effective Stress from CU Triaxial Tests



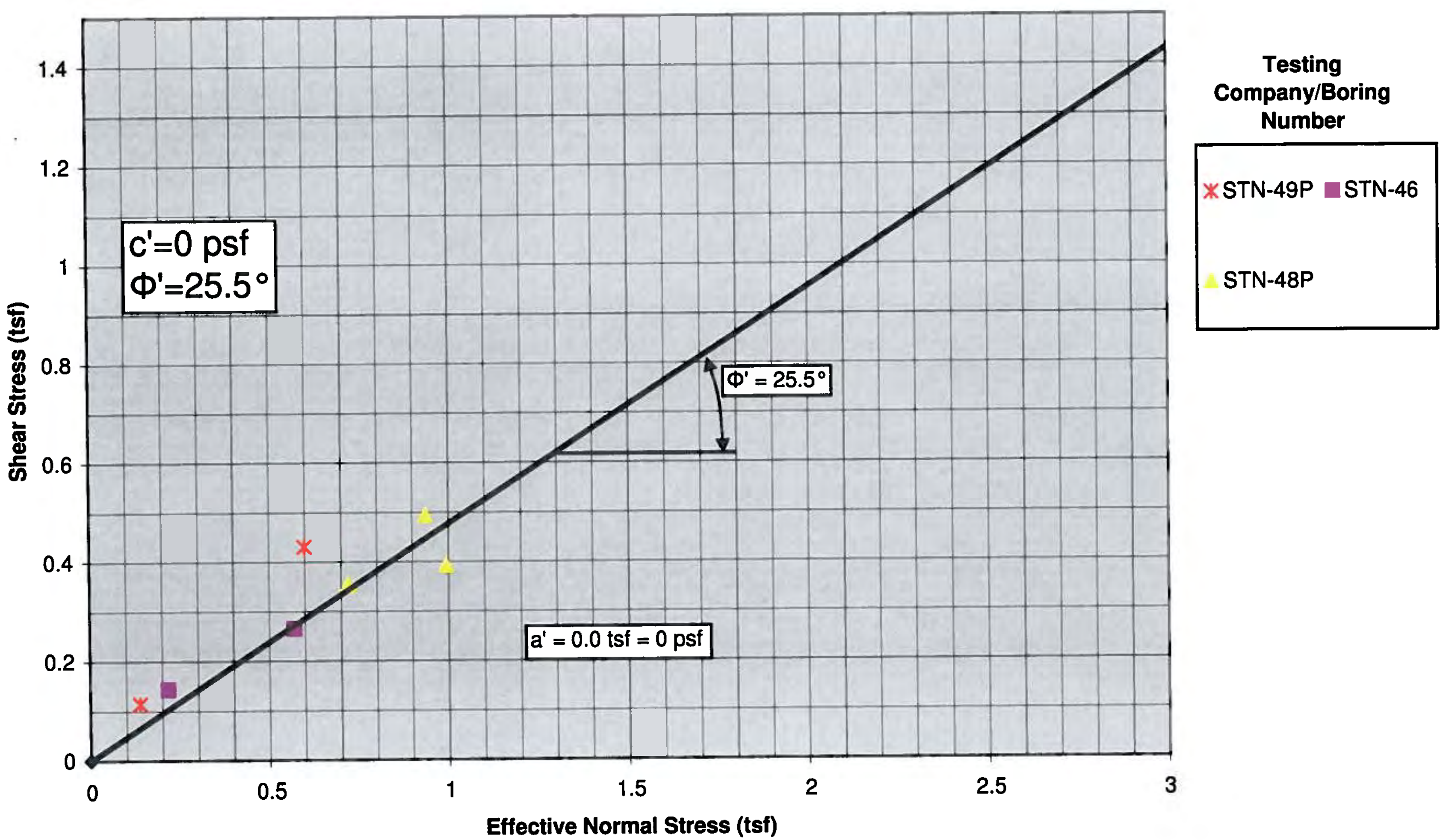
Stantec used Maximum Effective Principal Stress Ratio to determine failure criteria.

Sluiced Fly Ash: 2/3 Rule
Effective Stress from CU Triaxial Tests



Stantec used Maximum Effective Principal Stress Ratio to determine failure criteria.

Sluiced Fly Ash: 2/3 Rule
Effective Stress from Direct Simple Shear Tests



Appendix I

Engineering Analysis Results

Slope Stability

Cross-Section D-D'
Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

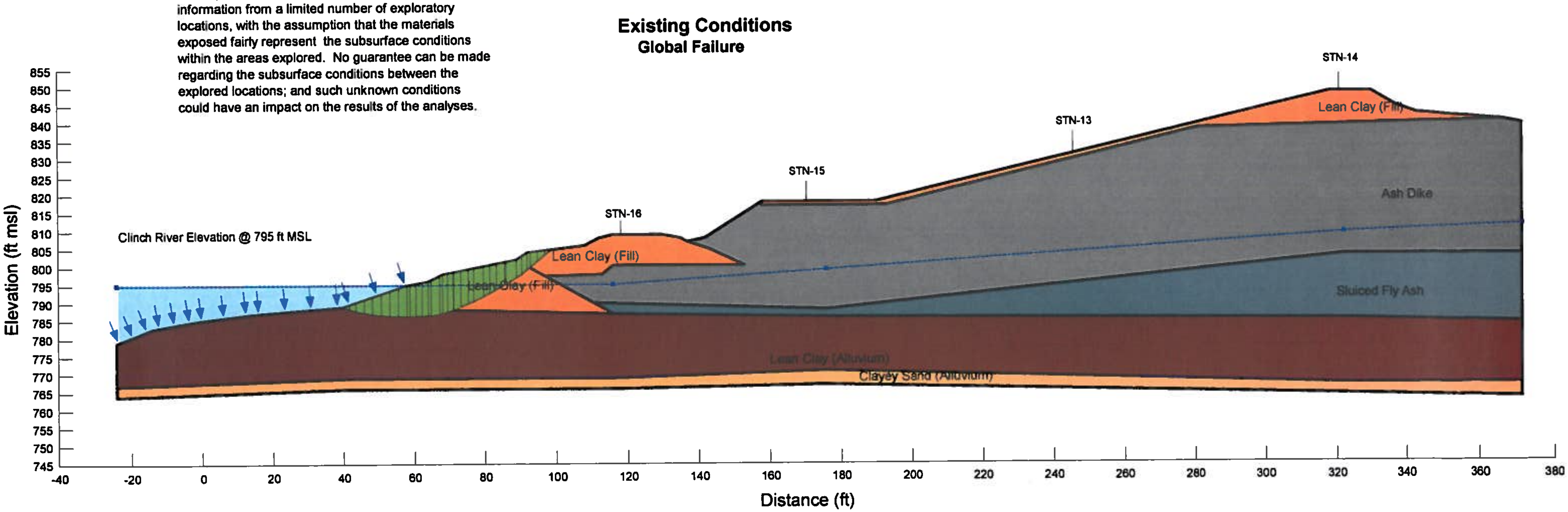
February 2010
Method: Modified Spencer
File Name: Section D-D' existing conditions (Perimeter Dike Failure).gsz

Factor of Safety: 2.1
Center: (59.188, 839.874) ft
Radius: 29.08809 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Ash Dike	100	105	0	33
Sluiced Ash	100	105	0	25
Lean Clay (Alluvium)	123	123	0	31
Clayey Sand (Alluvium)	112	112	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions
Global Failure



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect D-D'\Section D-D' existing conditions (Perimeter Dike Failure).gsz

Slope Stability

Cross-Section D-D'
Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Section D-D' existing conditions.gsz

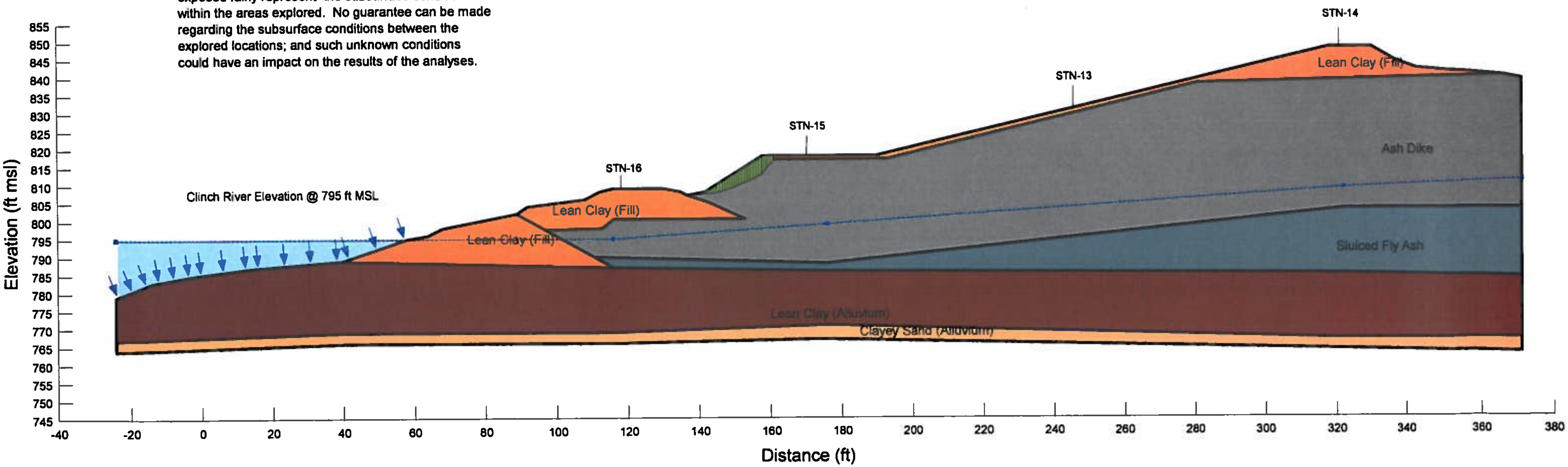
Factor of Safety: 1.4
Center: (134.162, 858.475) ft
Radius: 13.78136 ft
Minimum Slip Surface Depth: 5 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	126	125	0	33
Ash Dike	100	105	0	33
Sluiced Ash	100	105	0	25
Lean Clay (Alluvium)	123	123	0	31
Clayey Sand (Alluvium)	112	112	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Non-Global Failure



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Slope Stability

Cross-Section D-D'
Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

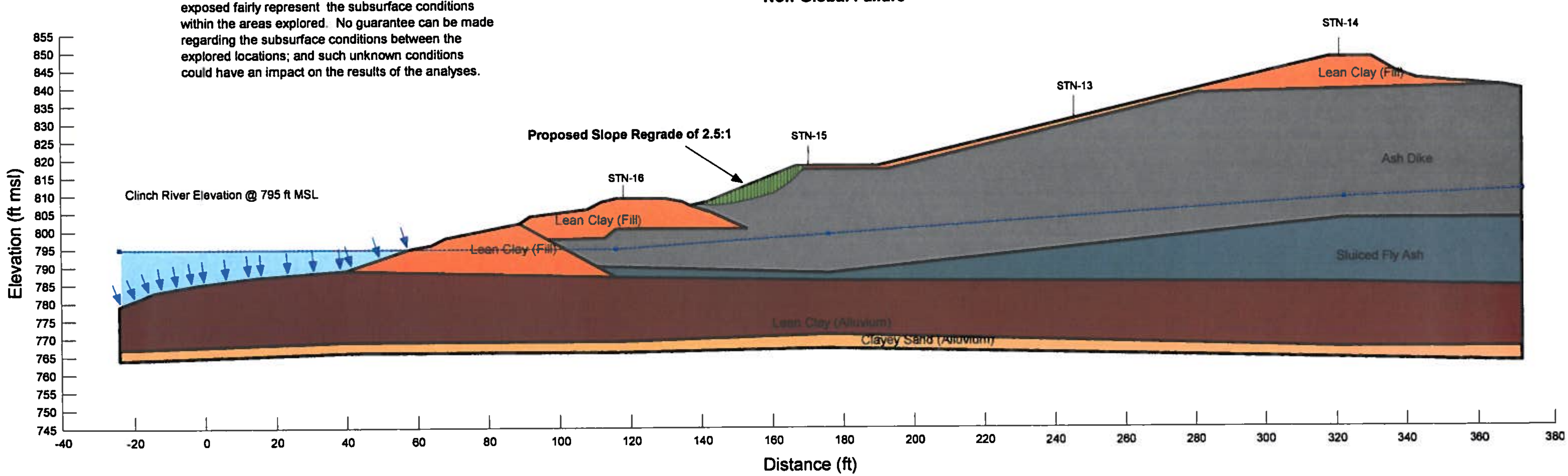
February 2010
Method: Modified Spencer
File Name: Section D-D' with slope regrade to 2.5H to1V.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.9
Center: (151.748, 836.074) ft
Radius: 16.26878 ft
Minimum Slip Surface Depth: 5 ft

Material Types	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Ash Dike	100	105	0	33
Sluiced Ash	100	105	0	25
Lean Clay (Alluvium)	123	123	0	31
Clayey Sand (Alluvium)	112	112	0	33

Proposed Slope Regrade to 2.5H:1V
Non-Global Failure



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SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

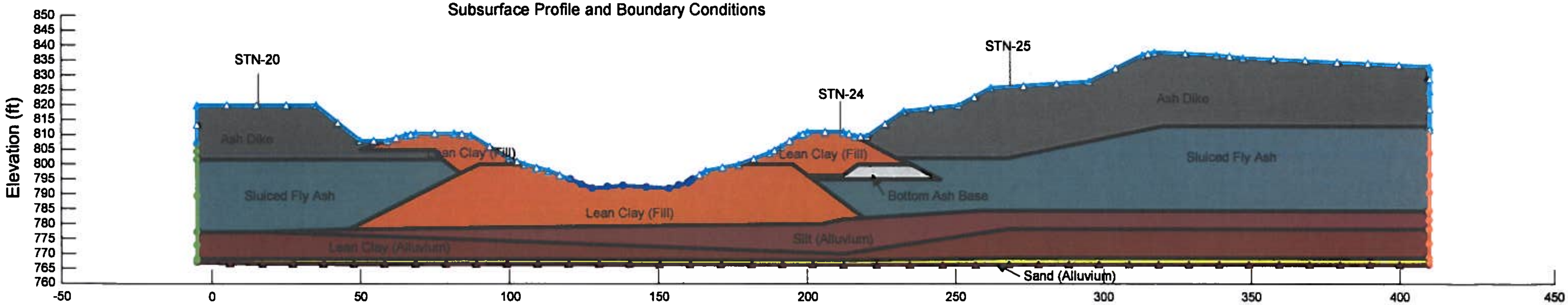
February 2010
Method: Steady-State Seepage
File Name: Section F-F' existing conditions.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

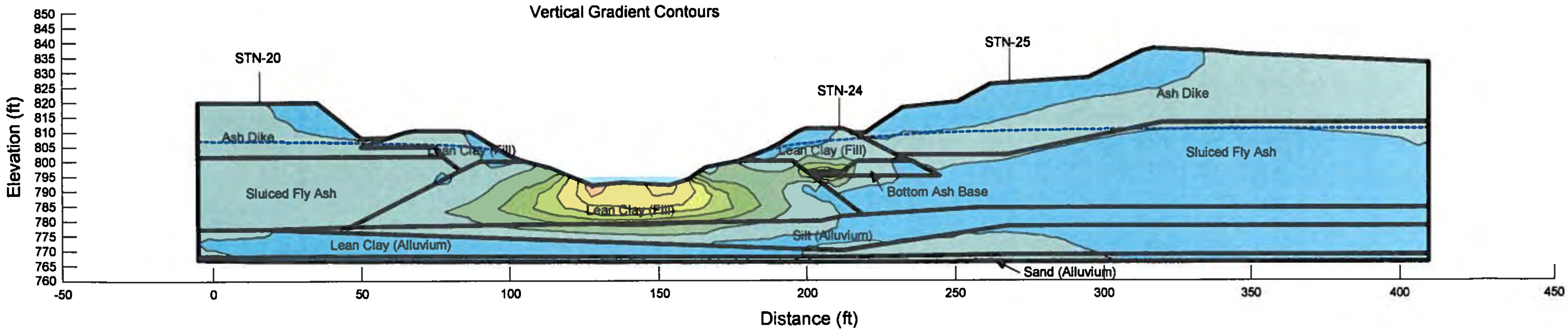
February 2010
Method: Steady-State Seepage
File Name: Section F-F' existing conditions.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

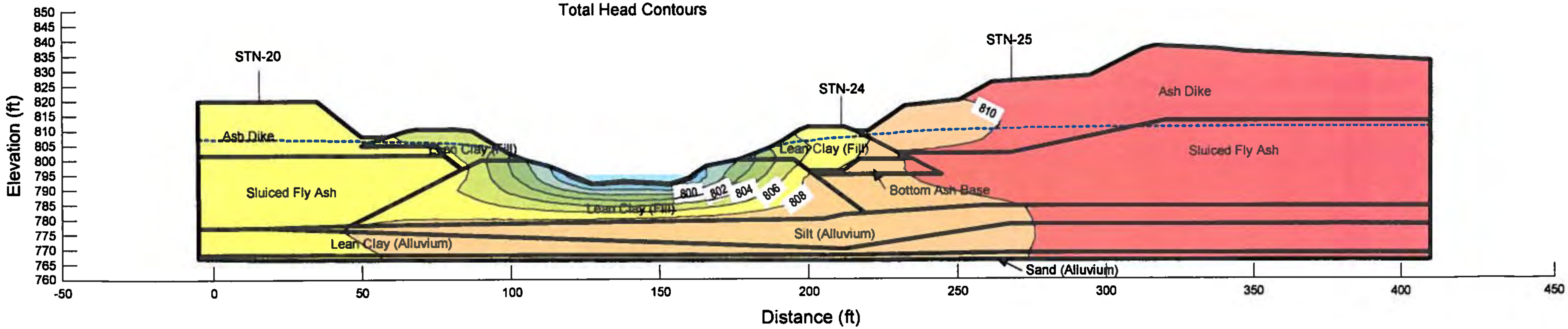
February 2010
Method: Steady-State Seepage
File Name: Section F-F' existing conditions.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Total Head Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\DRAFT Report\Engineering Analysis\Sect F-F'\Slope\Section F-F' existing conditions.gsz

SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

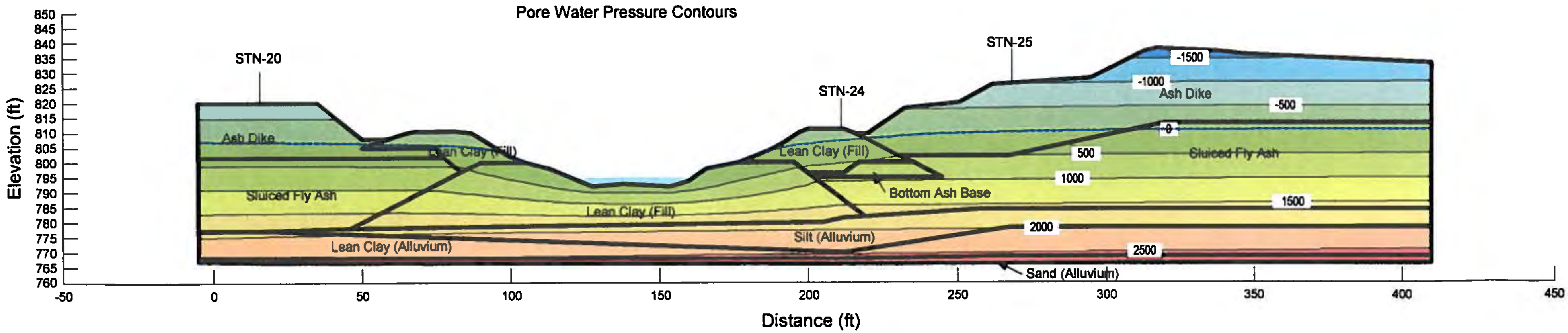
February 2010
Method: Steady-State Seepage
File Name: Section F-F' existing conditions.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Pore Water Pressure Contours



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Slope Stability

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

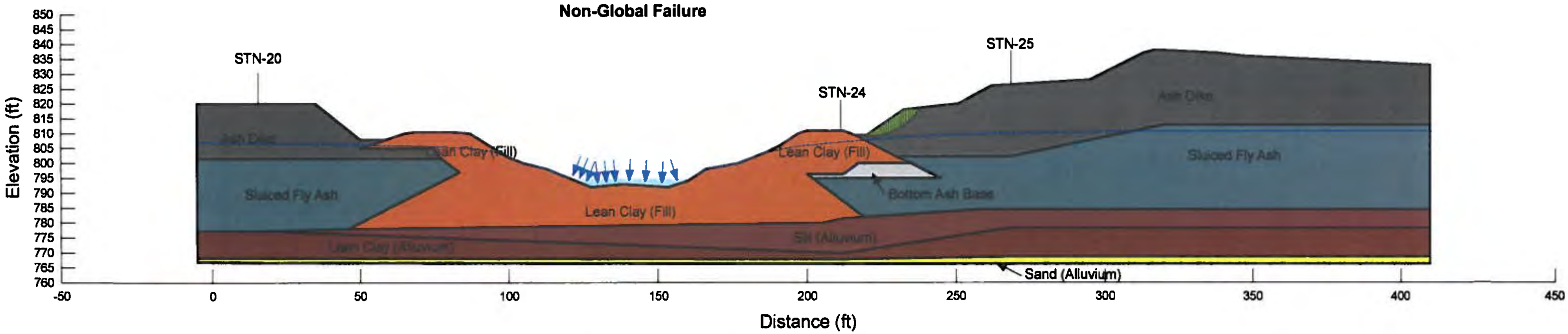
February 2010
Method: Modified Spencer
File Name: Section F-F' existing conditions.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.4
Center: (220.598, 829.443) ft
Radius: 20.38 ft
Minimum Slip Surface Depth: 5 ft

Material Type	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Bottom Ash Base	100	105	0	33
Silt (Alluvium)	108	109	0	28
Lean Clay (Alluvium)	123	123	0	31
Sand (Alluvium)	120	120	0	33

Existing Conditions
Non-Global Failure



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SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

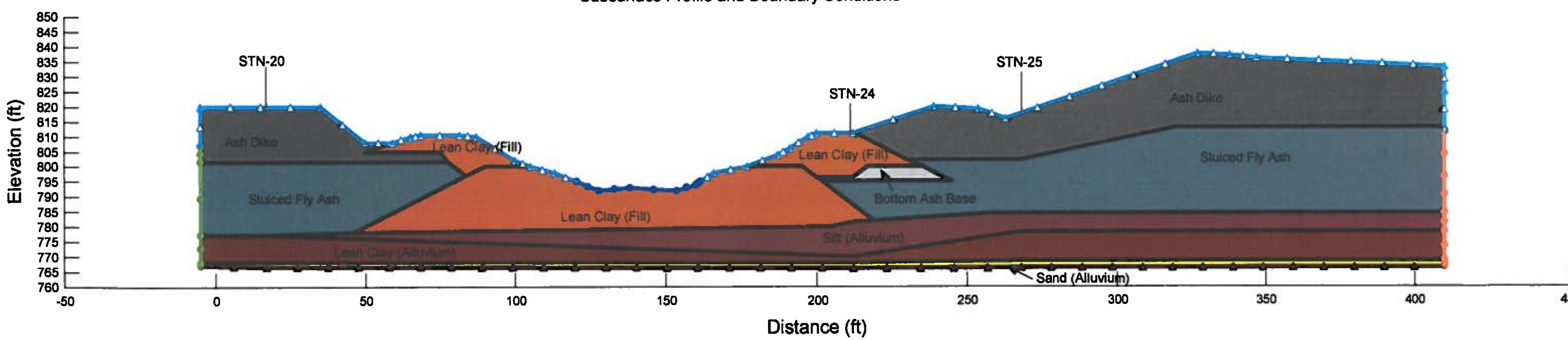
February 2010
Method: Steady-State Seepage
File Name: Section F-F' Laid Back.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Ash Dikes Slopes Laid Back to 3:1 Above Elevation 810'

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

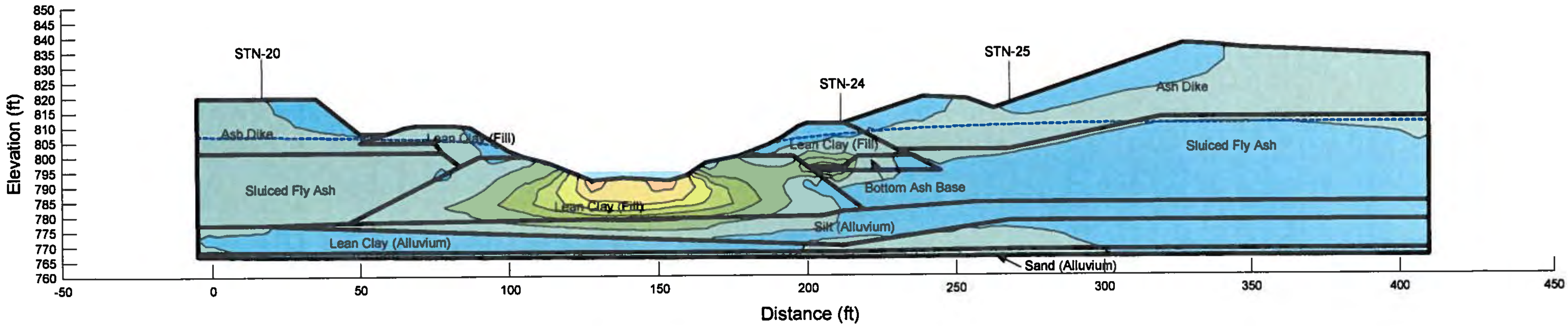
February 2010
Method: Steady-State Seepage
File Name: Section F-F' Laid Back.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Ash Dikes Slopes Laid Back to 3:1 Above Elevation 810'

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

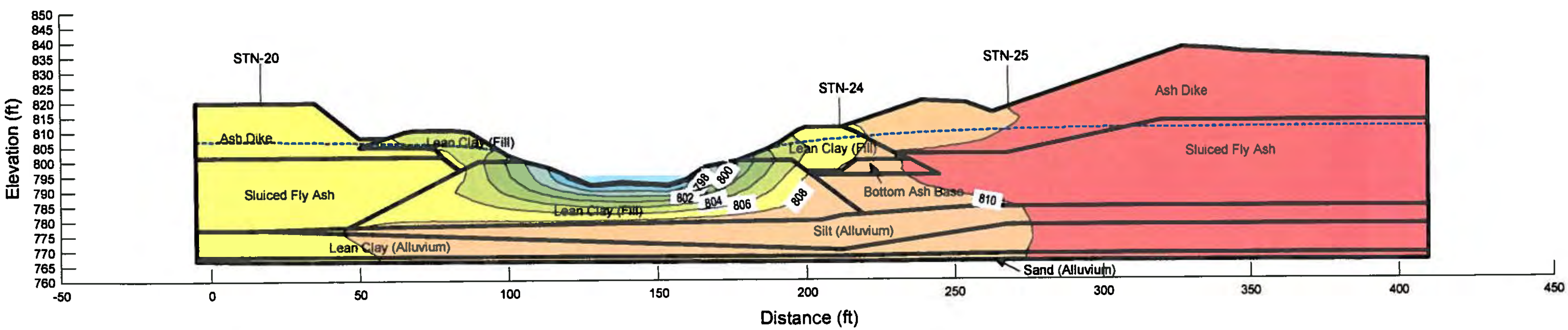
February 2010
Method: Steady-State Seepage
File Name: Section F-F' Laid Back.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Ash Dikes Slopes Laid Back to 3:1 Above Elevation 810'

Total Head Contours



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SEEP/W Analysis

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

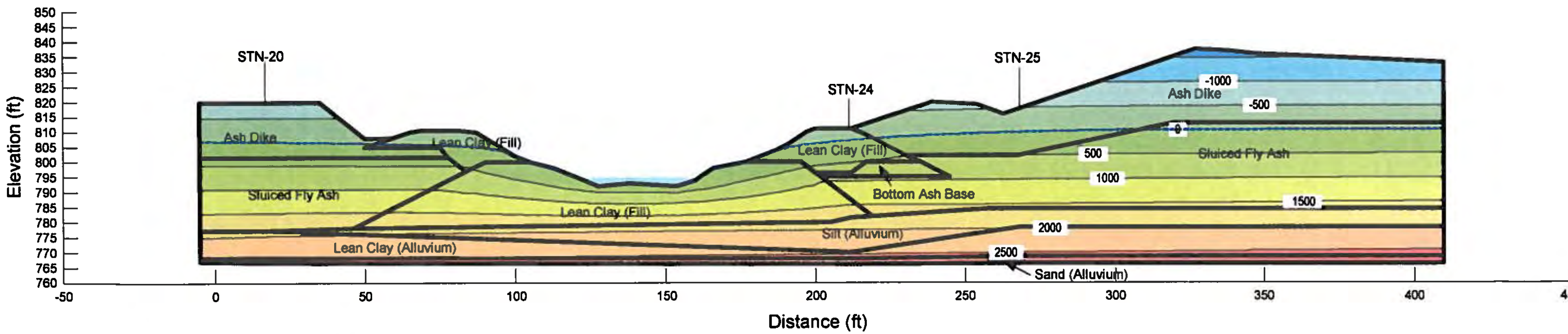
February 2010
Method: Steady-State Seepage
File Name: Section F-F' Laid Back.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Silt (Alluvium)	6.95e-005	0.05	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.35e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Ash Dikes Slopes Laid Back to 3:1 Above Elevation 810'

Pore Water Pressure Contours



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Slope Stability

Cross-Section F-F'
Gypsum Disposal Area 2A / Bottom Ash Disposal Area 1

Bull Run Fossil Plant
Tennessee Valley Authority

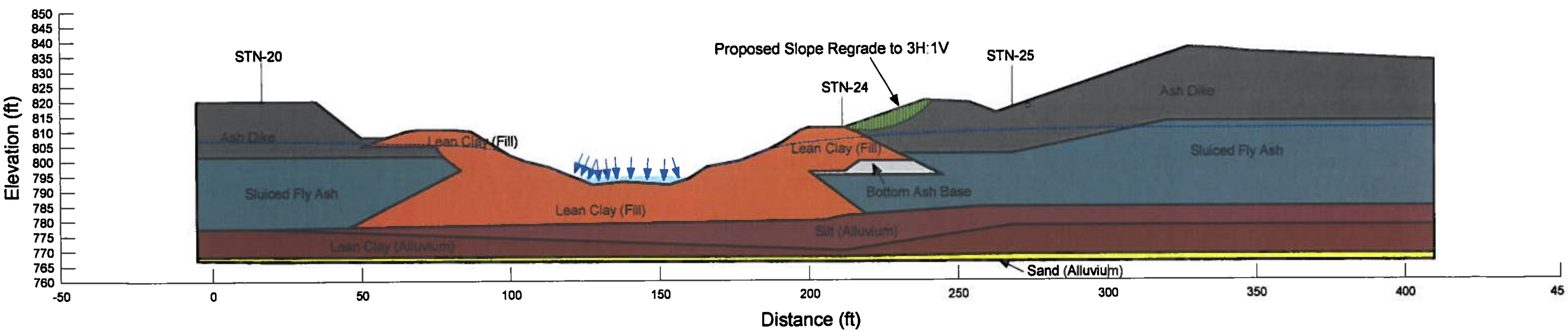
February 2010
Method: Modified Spencer
File Name: Section F-F' Slope Regrade.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 2.3
Center: (219.075, 840.702) ft
Radius: 30.828 ft
Minimum Slip Surface Depth: 5 ft

Material Type	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Bottom Ash Base	100	105	0	33
Silt (Alluvium)	108	109	0	28
Lean Clay (Alluvium)	123	123	0	31
Sand (Alluvium)	120	120	0	33

Proposed Ash Dikes Slopes Laid Back to 3H:1V Above Elevation 810'
Non-Global Failure



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' existing conditions (global).gsz

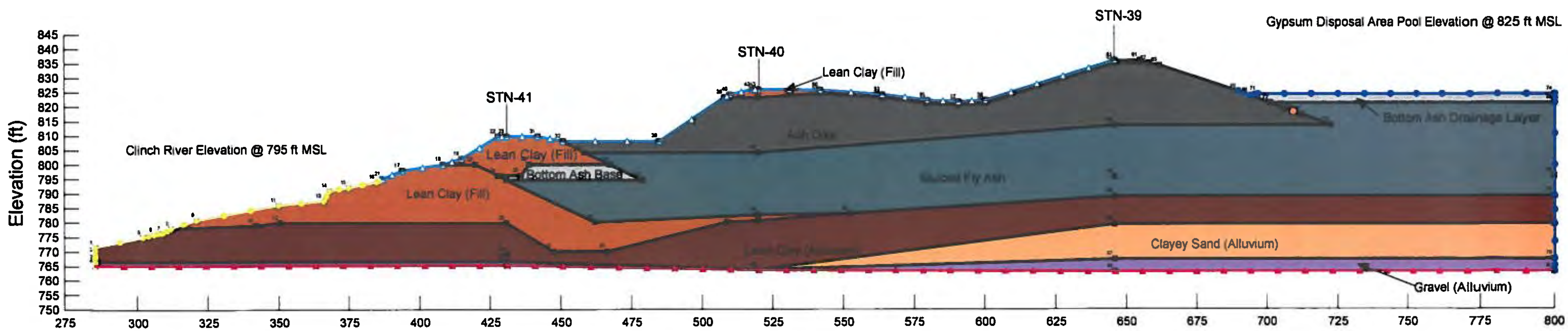
Piping Potential
Maximum Exit Gradient occurs at (385,794)
Total Head = 795 ft
At (385.90,789.93)
Total Head = 797.77 ft
dH = 2.77 ft   dl = 5.07 ft
i = 0.546 i(criticial) = 1.0
FSpiping = 1.8

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' existing conditions (global).gsz

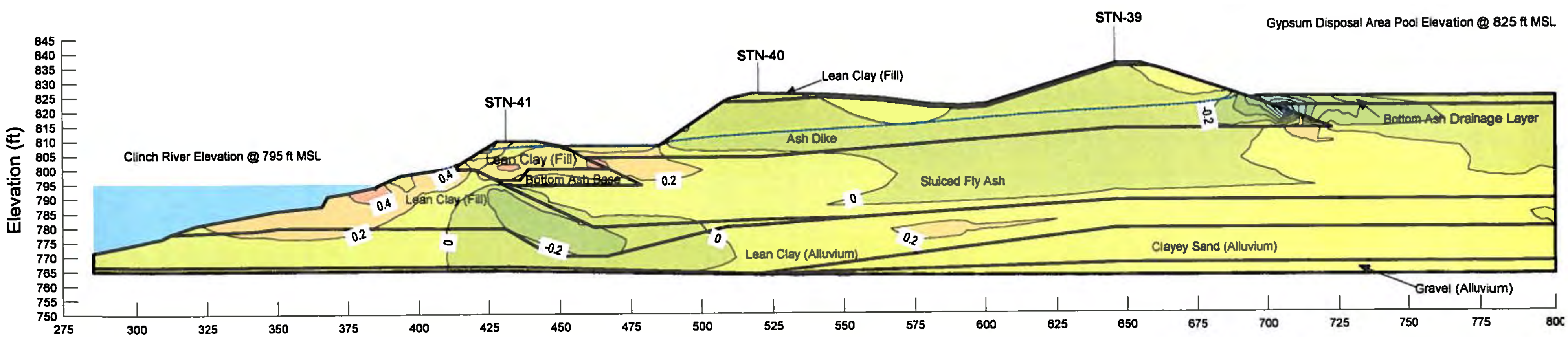
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (385,794)
Total Head = 795 ft
At (385.90,789.93)
Total Head = 797.77 ft
dH = 2.77 ft   dl = 5.07 ft
i = 0.546 i(criticial) = 1.0
FSpiping = 1.8

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Existing Conditions

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' existing conditions (global).gsz

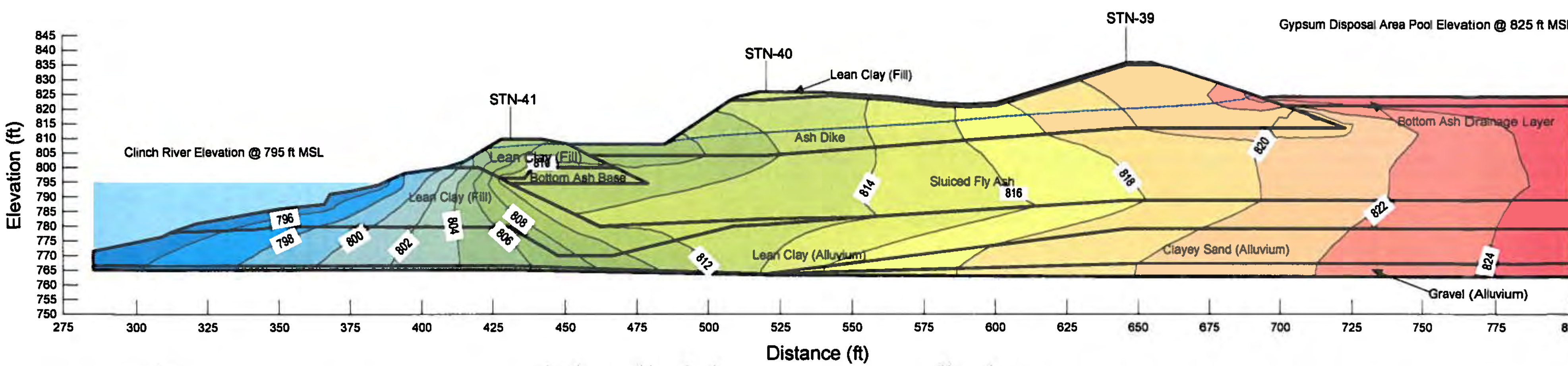
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (385,794)
Total Head = 795 ft
At (385.90,789.93)
Total Head = 797.77 ft
dH = 2.77 ft dl = 5.07 ft
i = 0.546 i(criticial) = 1.0
FSpiping = 1.8

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Existing Conditions

Total Head Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' existing conditions (global).gsz

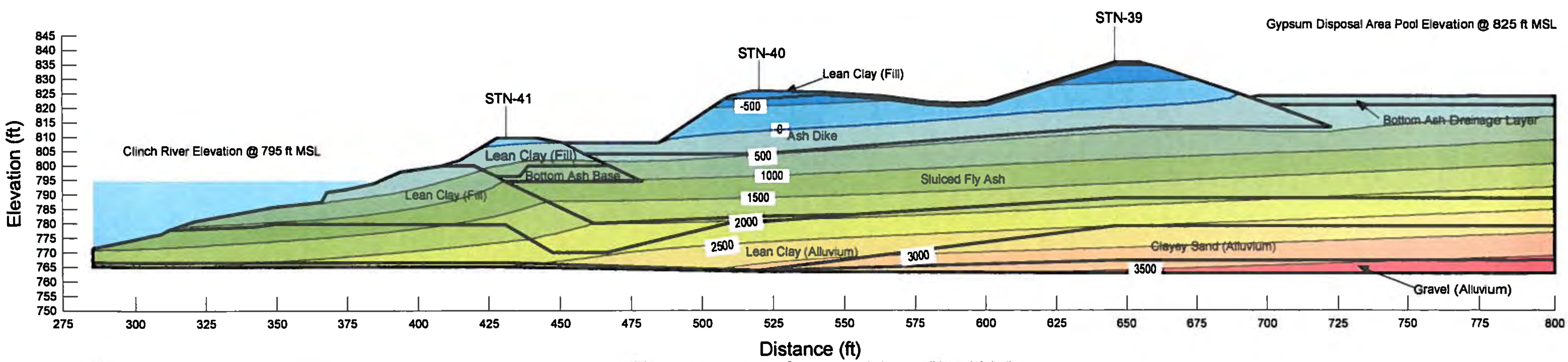
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (385,794)
Total Head = 795 ft
At (385.90,789.93)
Total Head = 797.77 ft
dH = 2.77 ft   dl = 5.07 ft
i = 0.546 i(criticial) = 1.0
FSpiping = 1.8

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Existing Conditions

Pore Water Pressure Contours



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Slope Stability dMin=20

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

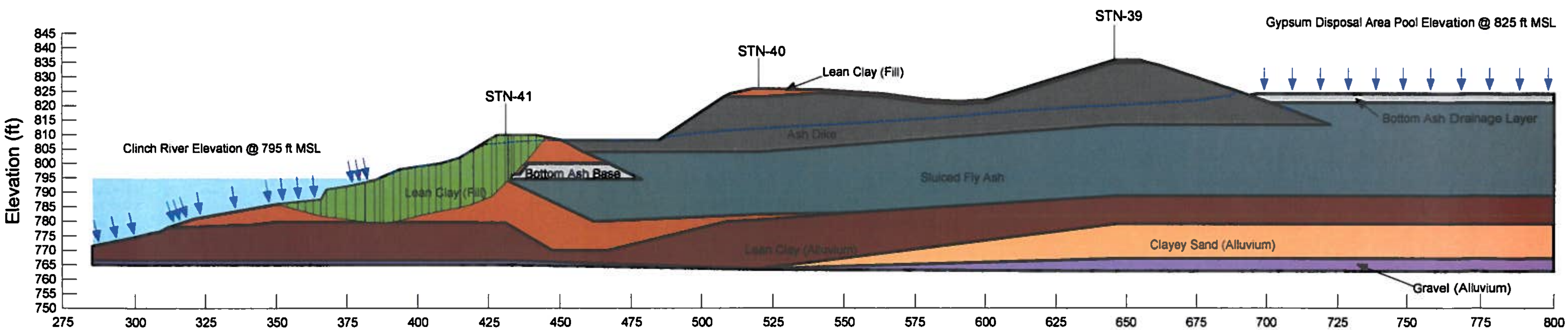
February 2010
Method: Modified Spencer
File Name: Section I-I' existing conditions (global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.2
Center: (390.5, 849.25) ft
Radius: 45.95482 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Gravel (Alluvium)	135	135	0	40
Clayey Sand (Alluvium)	112	112	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Ash Dike	100	105	0	33

Existing Conditions
Global Failure



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Slope Stability

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

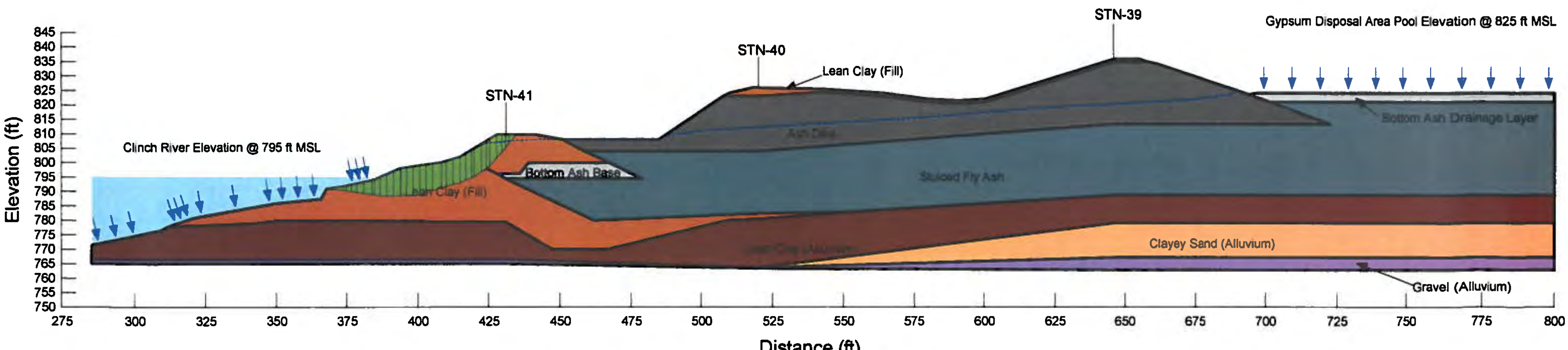
February 2010
Method: Modified Spencer
File Name: Section I-I' existing conditions (global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.0
Center: (390.5, 844.25) ft
Radius: 33.17688 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Gravel (Alluvium)	135	135	0	40
Clayey Sand (Alluvium)	112	112	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Ash Dike	100	105	0	33

Existing Conditions
Non-Global Failure (Perimeter Dike)



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Slope Stability (Ash Failure)

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

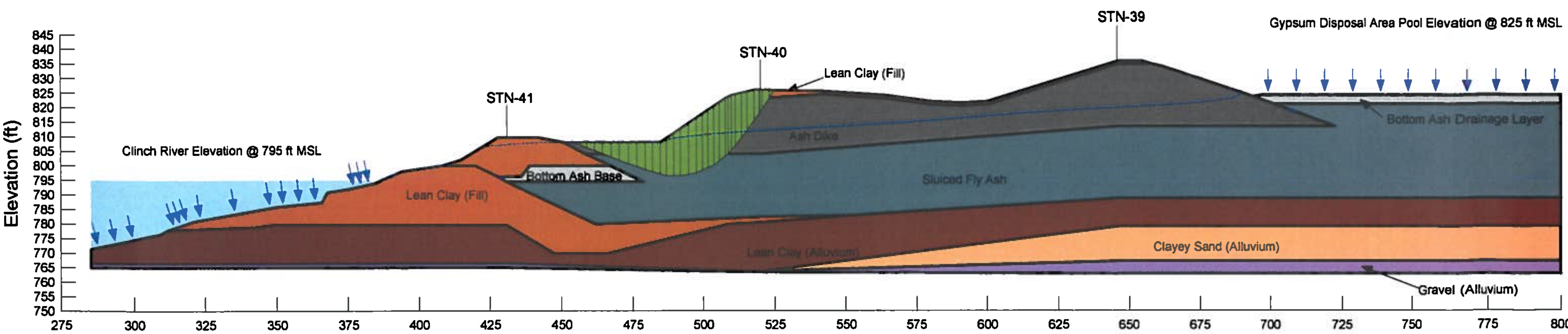
February 2010
Method: Modified Spencer
File Name: Section I-I' existing conditions (global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.1
Center: (488.286, 838.489) ft
Radius: 37.40835 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Gravel (Alluvium)	135	135	0	40
Clayey Sand (Alluvium)	112	112	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Ash Dike	100	105	0	33

Existing Conditions
Non-Global Failure (Ash Embankment)



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' buttress.gsz

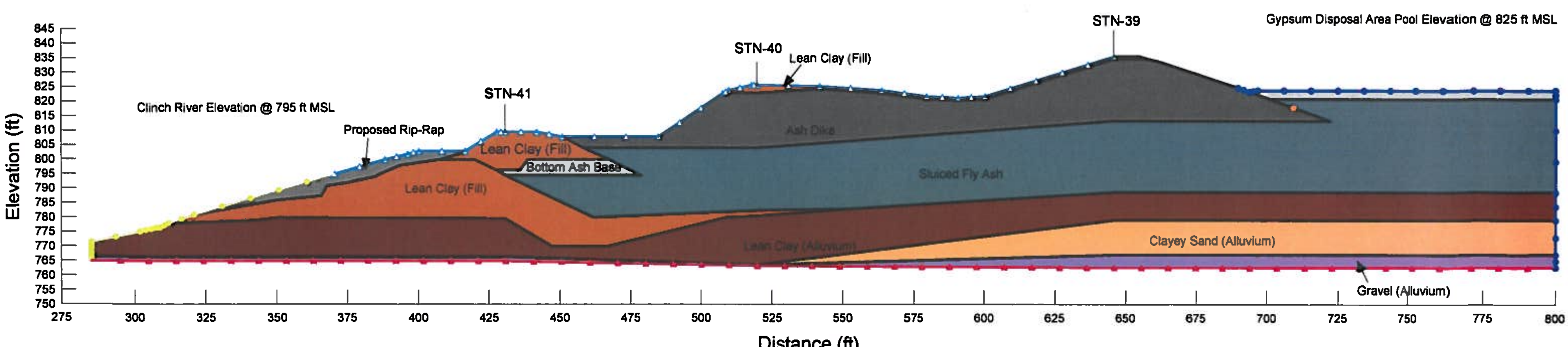
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (316.5,779.5)
Total Head = 795 ft
At (317.14,773.22)
Total Head = 796.05 ft
dH = 1.05 ft dl = 6.28 ft
i = 0.167 i(criticial) = 1.0
FSpiping = 6.0

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Lean Clay (Fill)	2.297e-007	0.1	0.41
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Lean Clay (Alluvium)	4.59e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' buttress.gsz

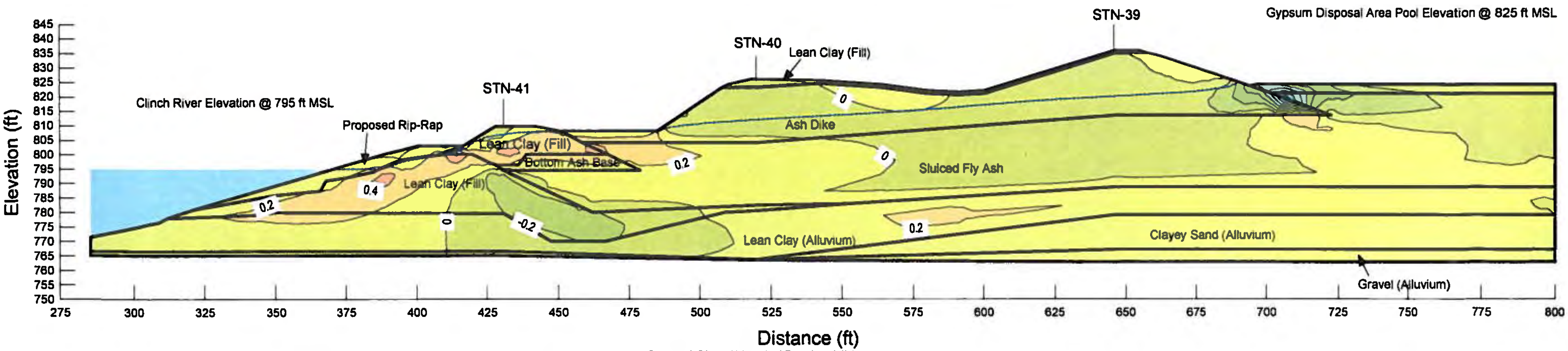
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (316.5,779.5)
Total Head = 795 ft
At (317.14,773.22)
Total Head = 796.05 ft
dH = 1.05 ft dl = 6.28 ft
i = 0.167 i(criticial) = 1.0
FSpiping = 6.0

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Lean Clay (Fill)	2.297e-007	0.1	0.41
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Lean Clay (Alluvium)	4.59e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' buttress.gsz

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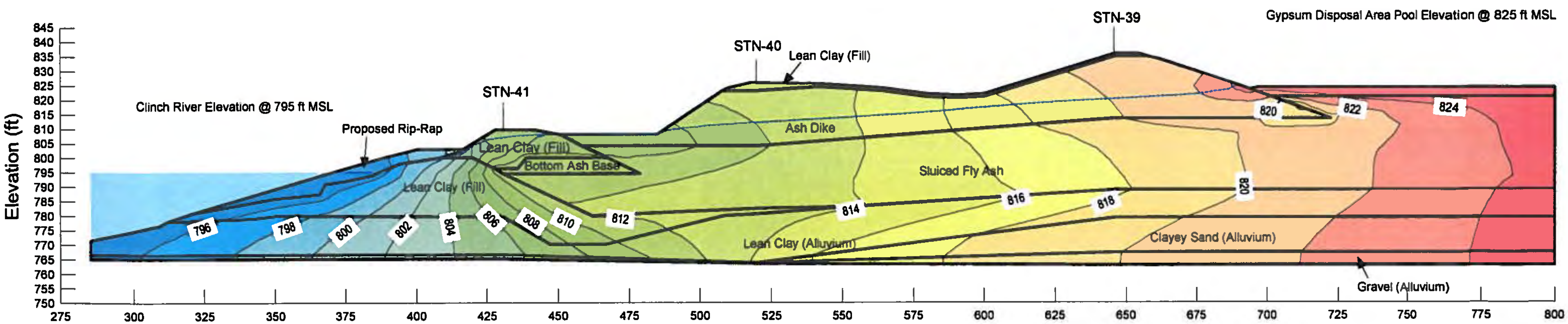
Ash Dike	6.5e-005	0.1	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Total Head Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' buttress.gsz

Note:
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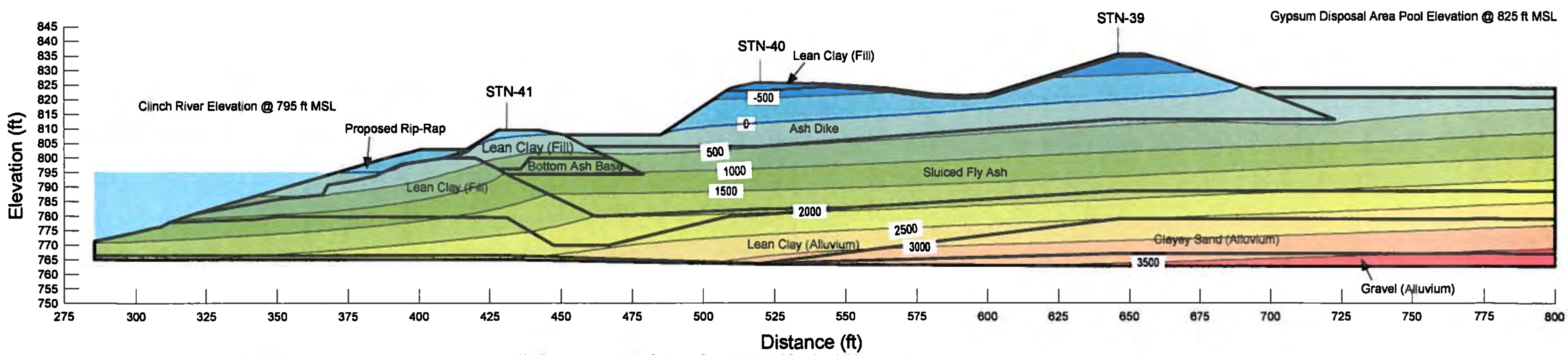
Ash Dike	6.5e-005	0.1	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Pore Water Pressure Contours



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Slope Stability dMin=15

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Section I-I' buttress.gsz

Note:
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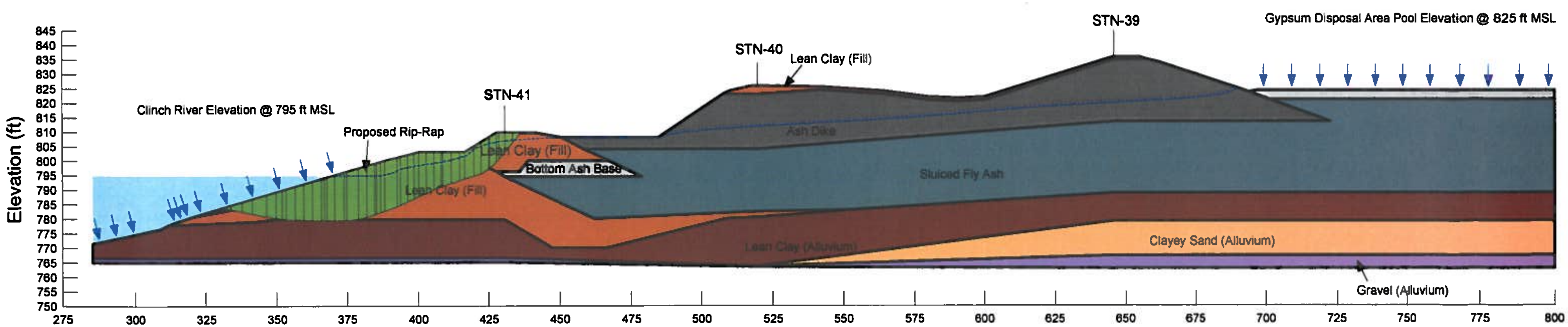
Factor of Safety: 1.5
Center: (372.5, 853.75) ft
Radius: 50.08418 ft
Minimum Slip Surface Depth: 15 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Gravel (Alluvium)	135	135	0	40
Clayey Sand (Alluvium)	112	112	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Ash Dike	100	105	0	33
Rip Rap	115	115	0	40

Proposed Rip-Rap Buttress
Global Failure



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Embankment Regrade.gsz

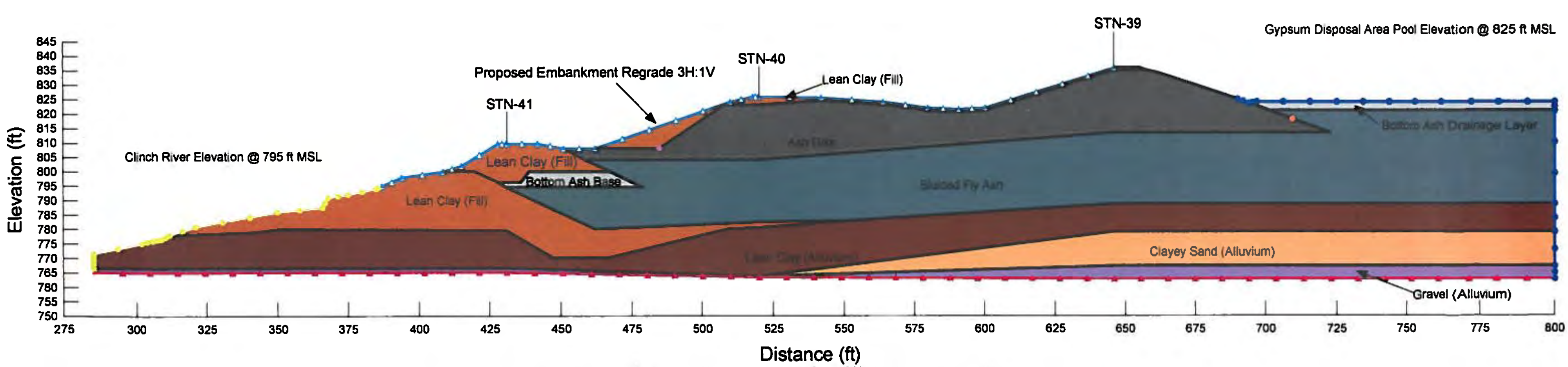
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (385,794)
Total Head = 795 ft
At (385.90,789.93)
Total Head = 797.77 ft
dH = 2.77 ft dl = 5.07 ft
i = 0.546 i(criticial) = 1.0
FSpiping = 1.8

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed Embankment Regrade 3H:1V

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Embankment Regrade.gsz

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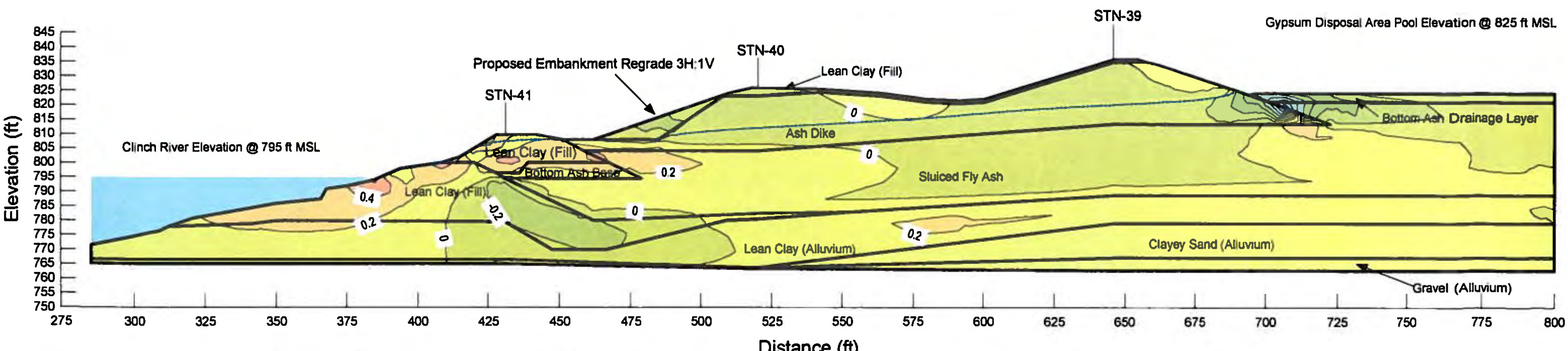
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed Embankment Regrade 3H:1V

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Embankment Regrade.gsz

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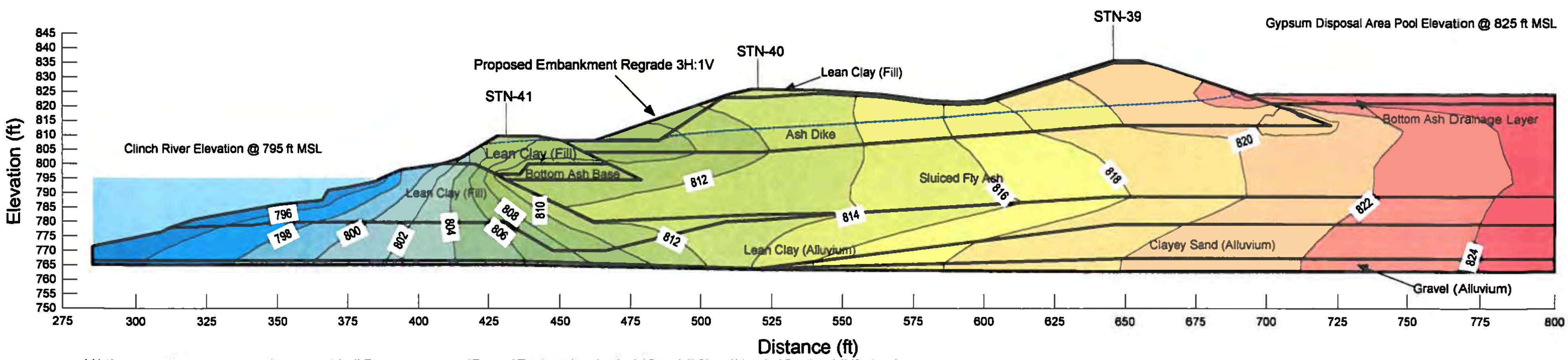
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed Embankment Regrade 3H:1V

Total Head Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Embankment Regrade.gsz

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Gravel (Alluvium)	5.3e-006	0.02	0.39
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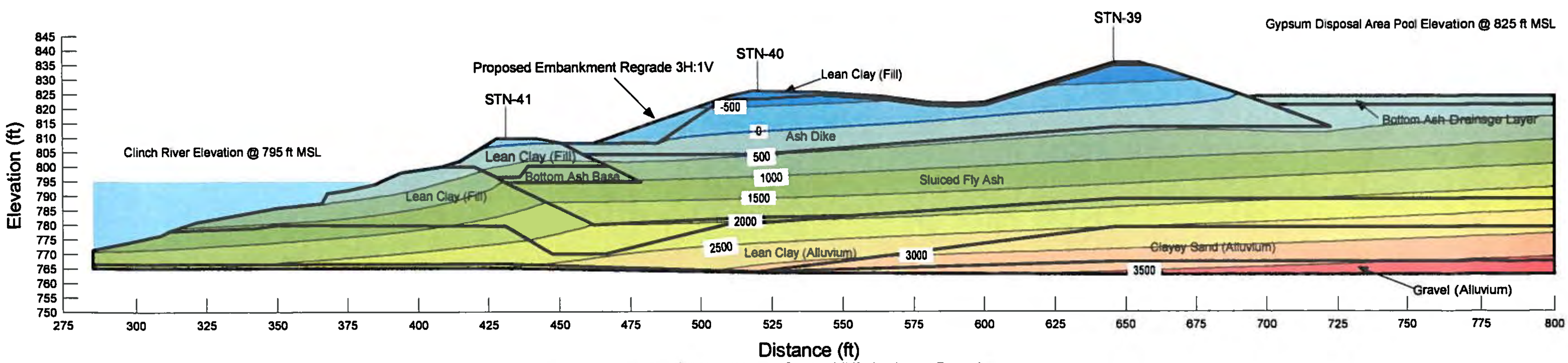
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed Embankment Regrade 3H:1V

Pore Water Pressure Contours



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Slope Stability (Ash Failure)

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Section I-I' Embankment Regrade.gsz

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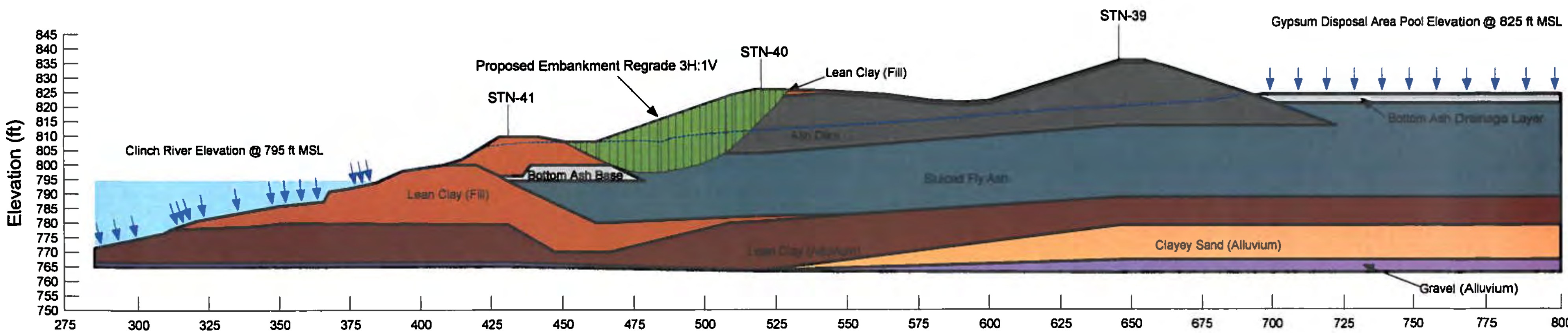
Factor of Safety: 1.6
Center: (482.296, 855.842) ft
Radius: 39.01048 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Gravel (Alluvium)	135	135	0	40
Clayey Sand (Alluvium)	112	112	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Ash Dike	100	105	0	33

Proposed Embankment Regrade 3H:1V
Non-Global Failure



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' 30' Deep Slurry Wall.gsz

Note:
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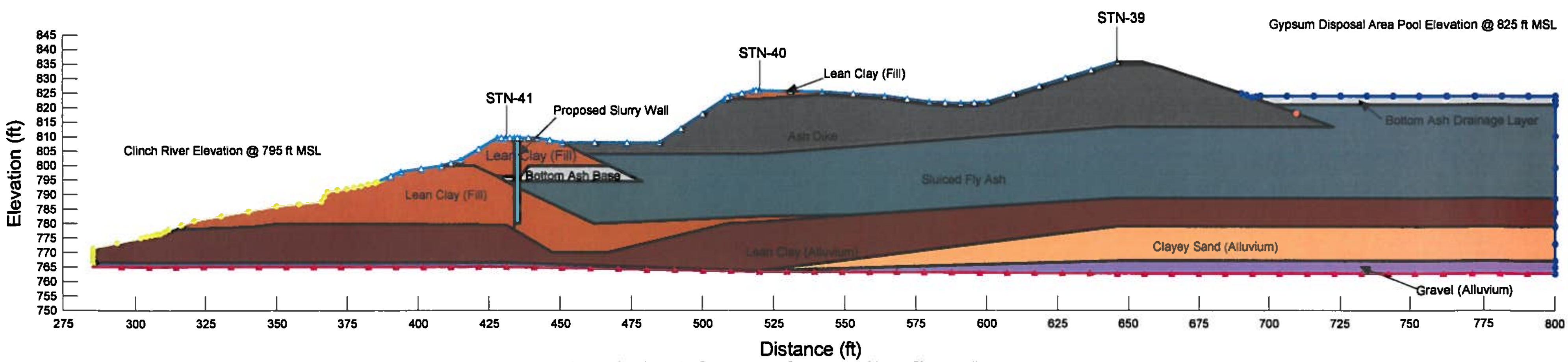
Piping Potential
Maximum Exit Gradient occurs at (385,794)
Total Head = 795 ft
At (385.90,789.93)
Total Head = 796.91 ft
dH = 1.91 ft dl = 5.07 ft
i = 0.377 i(critical) = 1.0
FSpiping = 2.7

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed 30 Ft Deep Slurry Wall to Elevation 780'

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' 30' Deep Slurry Wall.gsz

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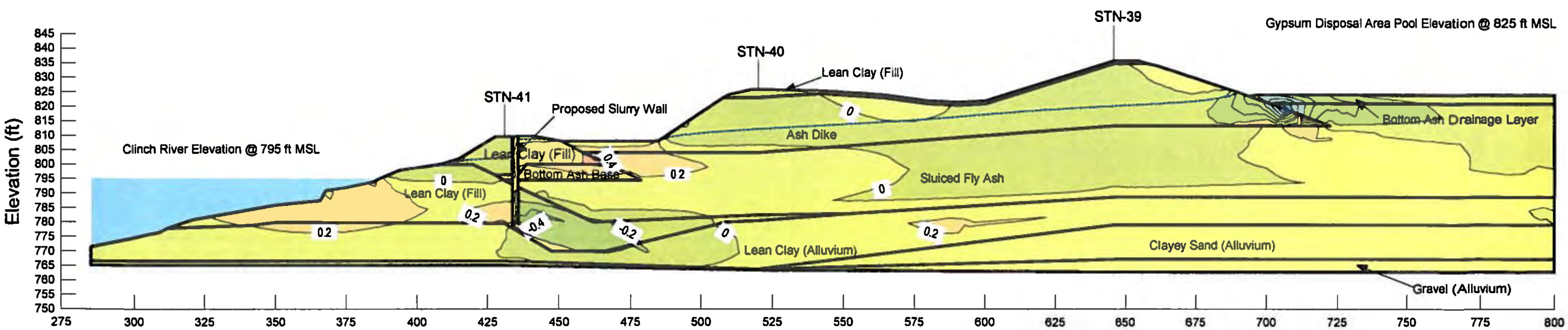
Proposed 30 Ft Deep Slurry Wall to Elevation 780'

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' 30' Deep Slurry Wall.gsz

Piping Potential
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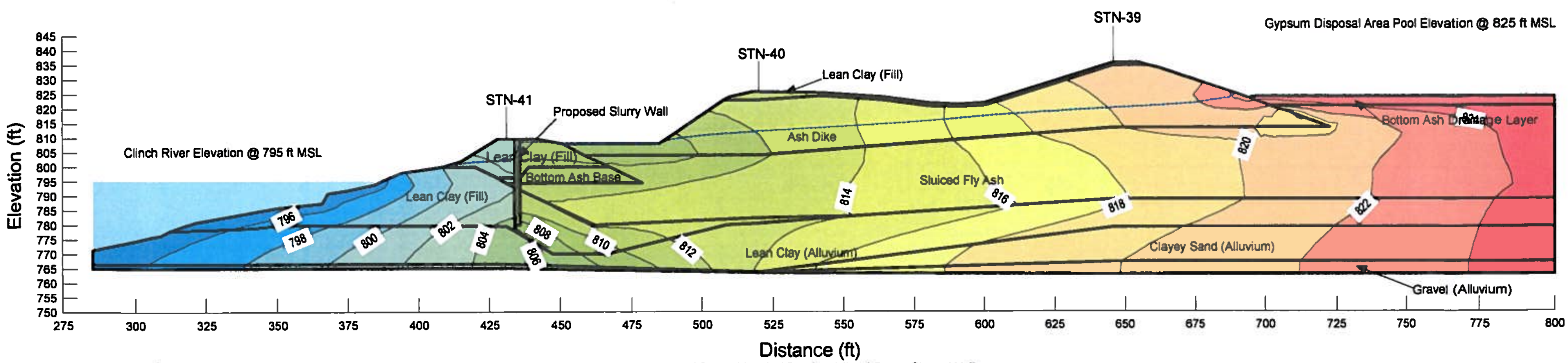
Proposed 30 Ft Deep Slurry Wall to Elevation 780'

Total Head Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' 30' Deep Slurry Wall.gsz

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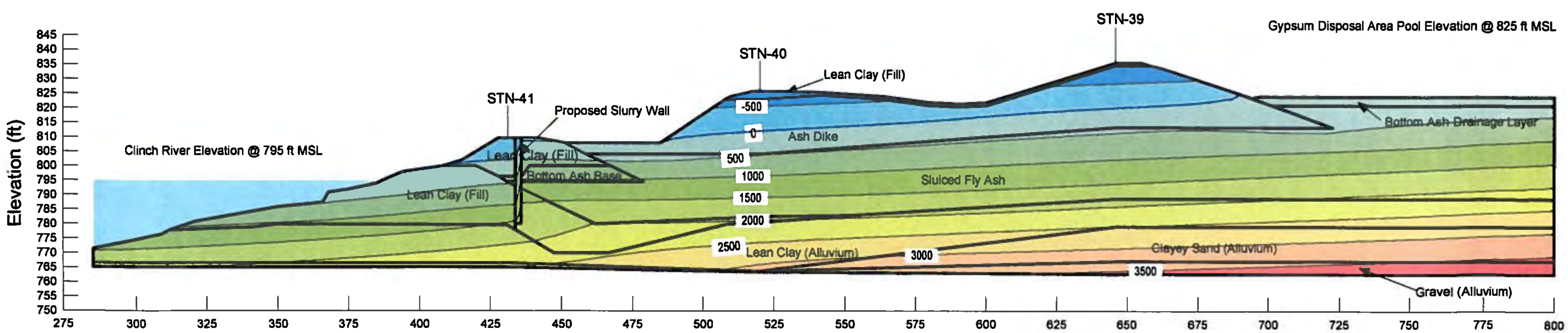
Proposed 30 Ft Deep Slurry Wall to Elevation 780'

Pore Water Pressure Contours



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Slope Stability dMin=20

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Section I-I' 30' Deep Slurry Wall.gsz

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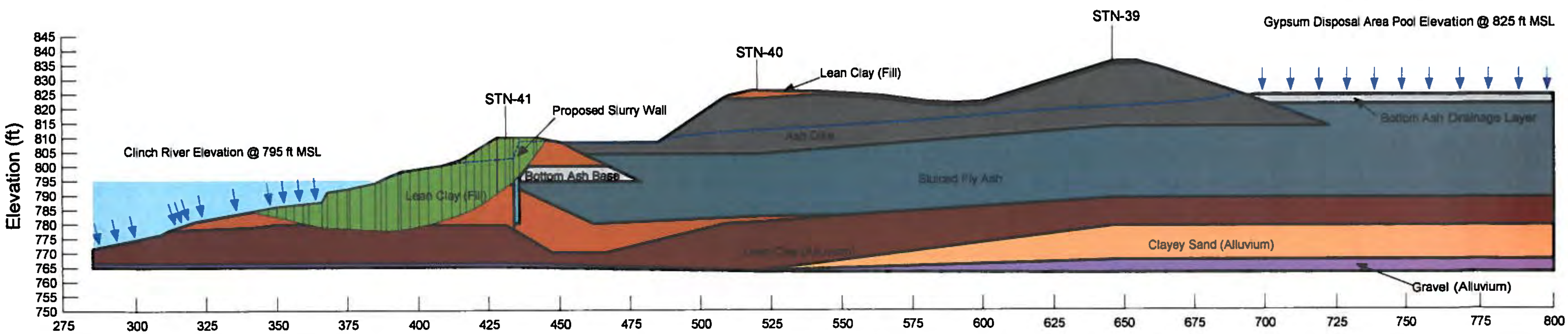
Factor of Safety: 1.5
Center: (381.5, 855.25) ft
Radius: 50.52097 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Gravel (Alluvium)	135	135	0	40
Clayey Sand (Alluvium)	112	112	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Ash Dike	100	105	0	33

Proposed 30 Ft Deep Slurry Wall to Elevation 780'

Global Failure



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect I-I'\Slope\Header\Section I-I' 30' Deep Slurry Wall.gsz

SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

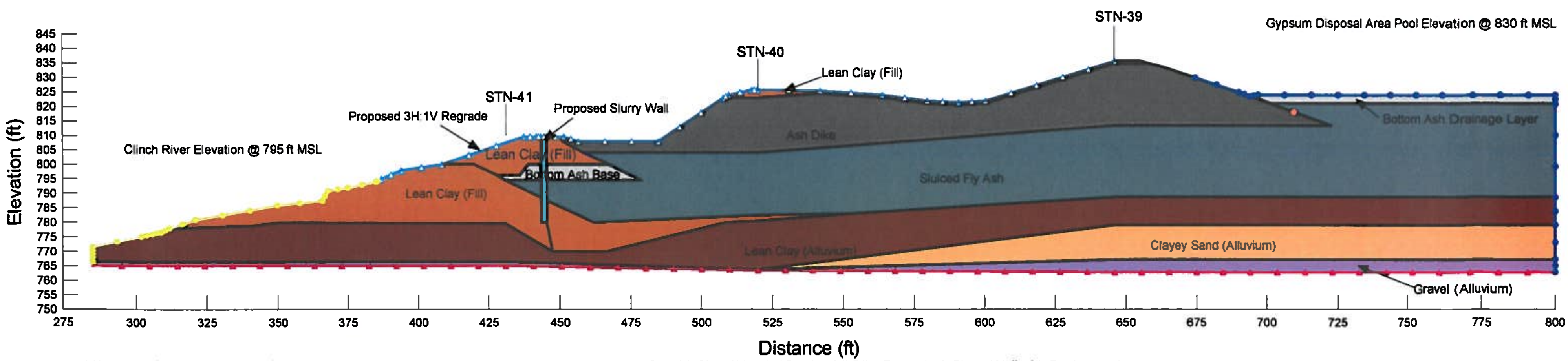
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (385,794)
Total Head = 795 ft
At (385.90,789.93)
Total Head = 796.89 ft
dH = 1.89 ft dl = 5.07 ft
i = 0.373 i(criticial) = 1.0
FSpiping = 2.7

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed 3H:1V Upper Dike Regrade and 30' Slurry Wall with Pool at Elevation 830'

Subsurface Profile and Boundary Conditions



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect I-I'\Slope\Header\Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

Piping Potential
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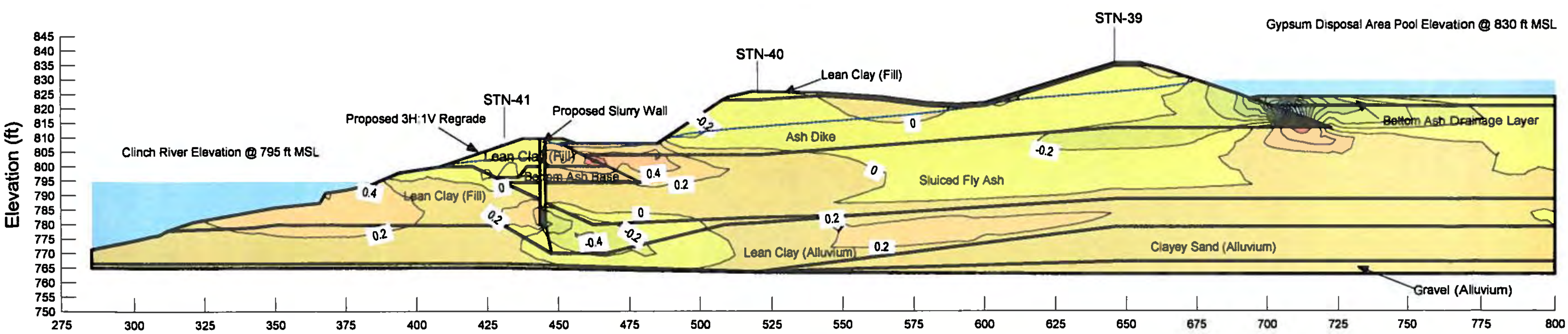
FSpiping = 2.7

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed 3H:1V Upper Dike Regrade and 30' Slurry Wall with Pool at Elevation 830'

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

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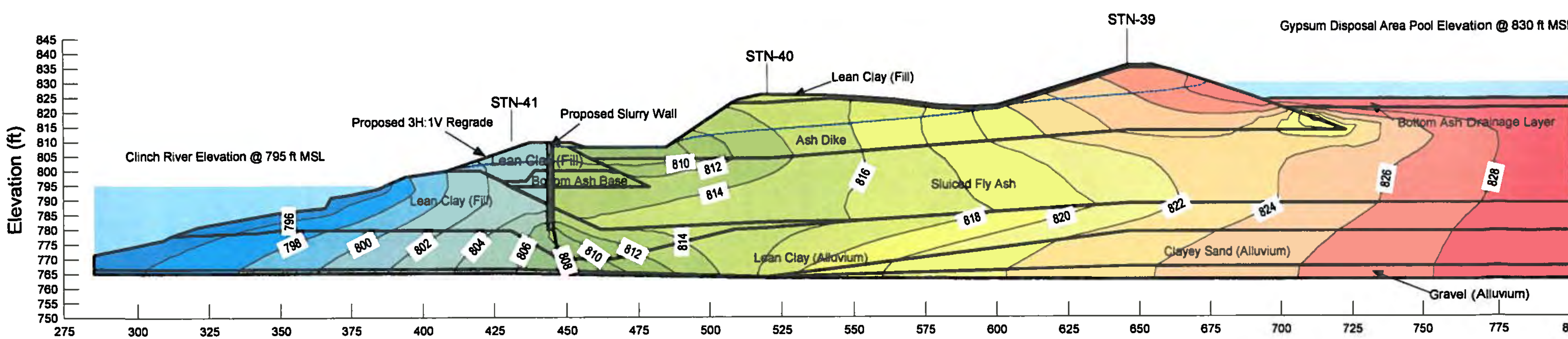
Total Head = 796.89 ft
dH = 1.89 ft dl = 5.07 ft
i = 0.373 i(criticial) = 1.0
FSpiping = 2.7

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed 3H:1V Upper Dike Regrade and 30' Slurry Wall with Pool at Elevation 830'

Total Head Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect I-I'\Slope\Header\Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

SEEP/W Analysis

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

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At (385.90,789.93)
Total Head = 796.89 ft
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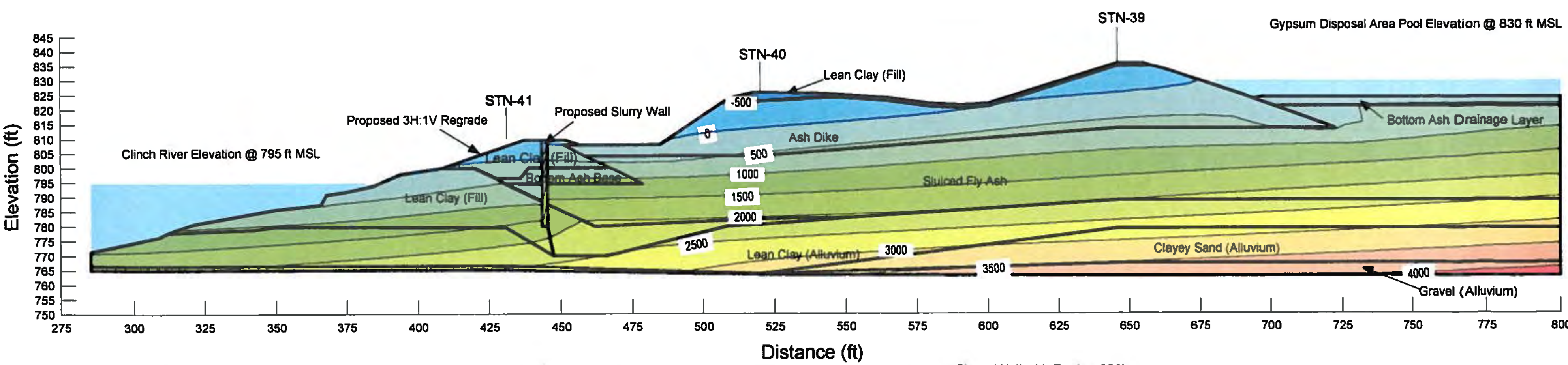
i = 0.373 i(criticial) = 1.0
FSpiping = 2.7

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Gravel (Alluvium)	5.3e-006	0.02	0.39
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Bottom Ash Base	6.5e-005	0.04	0.46
Ash Dike	6.5e-005	0.1	0.46

Proposed 3H:1V Upper Dike Regrade and 30' Slurry Wall with Pool at Elevation 830'

Pore Water Pressure Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect I-I'\Slope\Header\Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

Slope Stability dMin=20

Cross-Section I-I'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

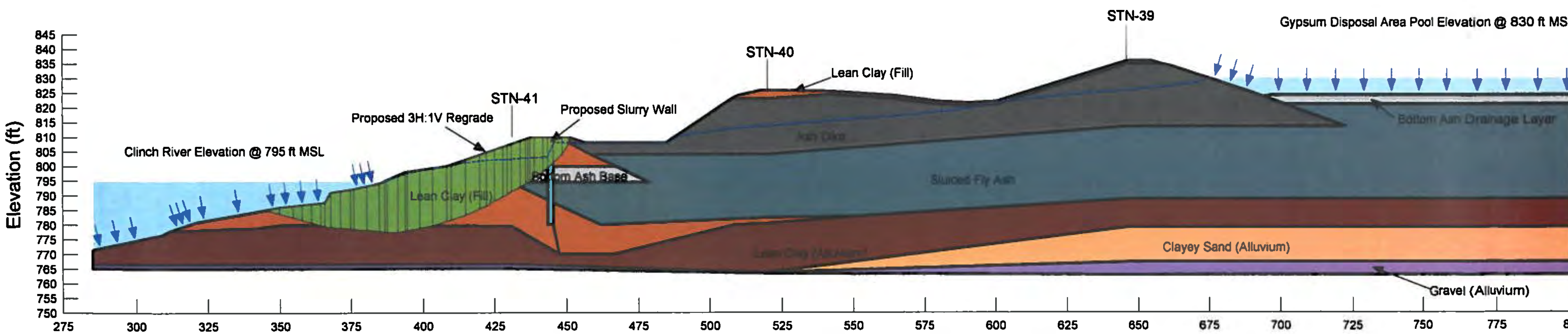
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.6
Center: (386, 856) ft
Radius: 51.28833 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Gravel (Alluvium)	135	135	0	40
Clayey Sand (Alluvium)	112	112	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Ash Dike	100	105	0	33

Proposed 3H:1V Upper Dike Regrade and 30' Slurry Wall with Pool at Elevation 830'

Global Failure



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect I-I'\Slope\Header\Section I-I' Dike Regrade & Slurry Wall with Pool at 830'.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

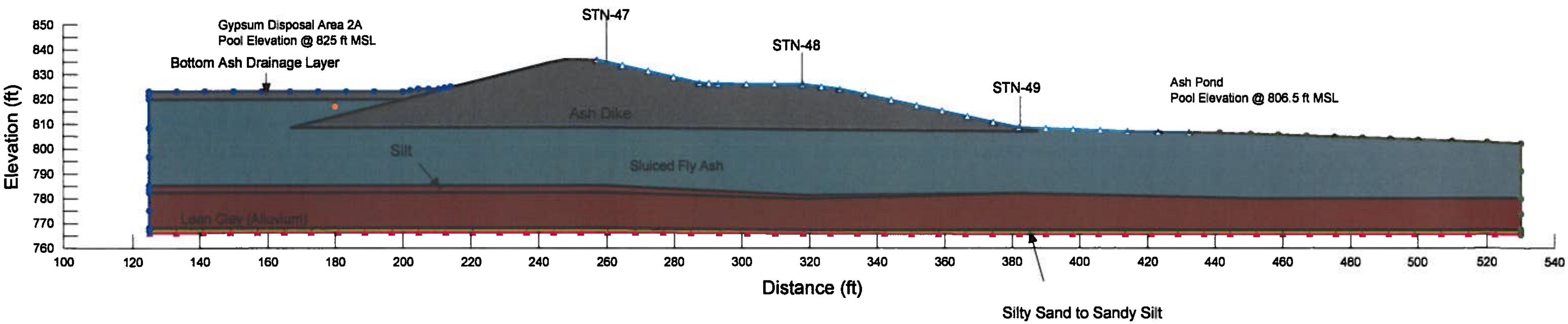
February 2010
Method: Steady-State Seepage
File Name: 1A.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (387.33,808.25)
Total Head = 808.25 ft
At (387.41,802.10)
Total Head = 810.58 ft
dH = 2.25 ft dl = 6.15 ft
i = 0.379 i(criticial) = 0.708
FSpiping = 1.9

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.39
Lean Clay (Alluvium)	4.59e-007	0.05	0.41
Silt (Alluvium)	6.95e-005	0.05	0.39
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Condition
Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1A.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (387.33,808.25)
Total Head = 808.25 ft
At (387.41,802.10)
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dH = 2.25 ft   dl = 6.15 ft
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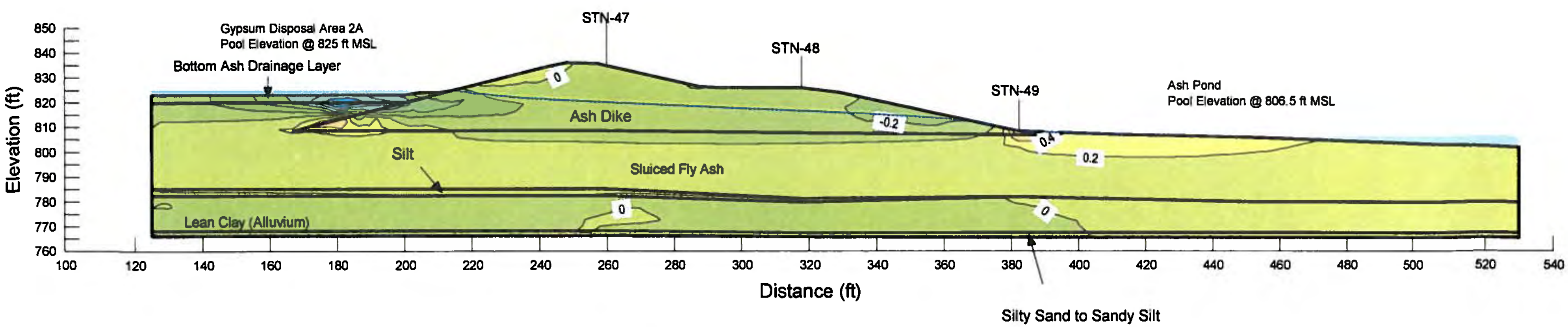
Lean Clay (Alluvium)	4.59e-007	0.05	0.41
Silt (Alluvium)	6.95e-005	0.05	0.39
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Condition
Vertical Gradient Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1A.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1A.gsz
(See workplan for file name convention)

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Total Head = 808.25 ft
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Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.39
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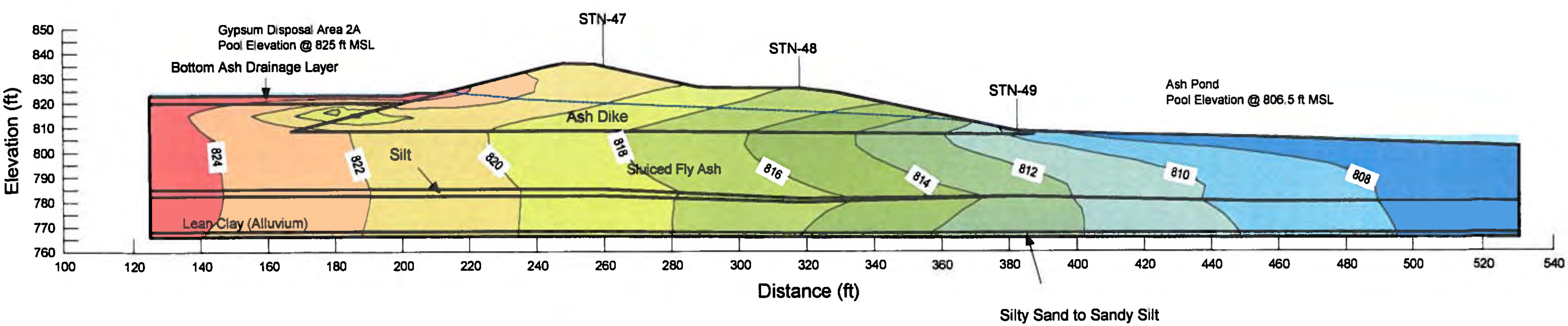
Silt (Alluvium)	6.95e-005	0.05	0.39
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Condition
Total Head Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1A.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1A.gsz
(See workplan for file name convention)

Piping Potential
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At (387.41,802.10)
Total Head = 810.58 ft
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Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.39
Lean Clay (Alluvium)	4.59e-007	0.05	0.41
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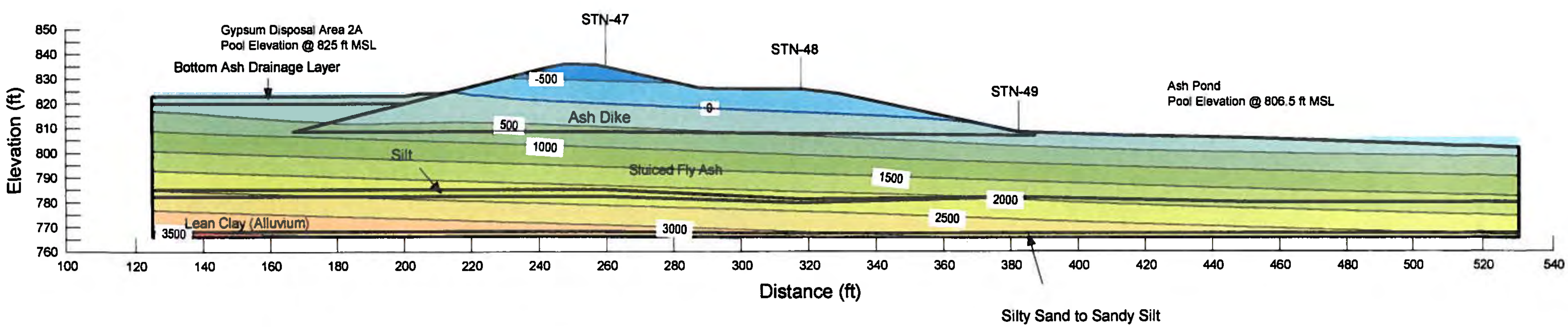
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Condition
Pore Water Pressure Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1A.gsz

Slope Stability

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

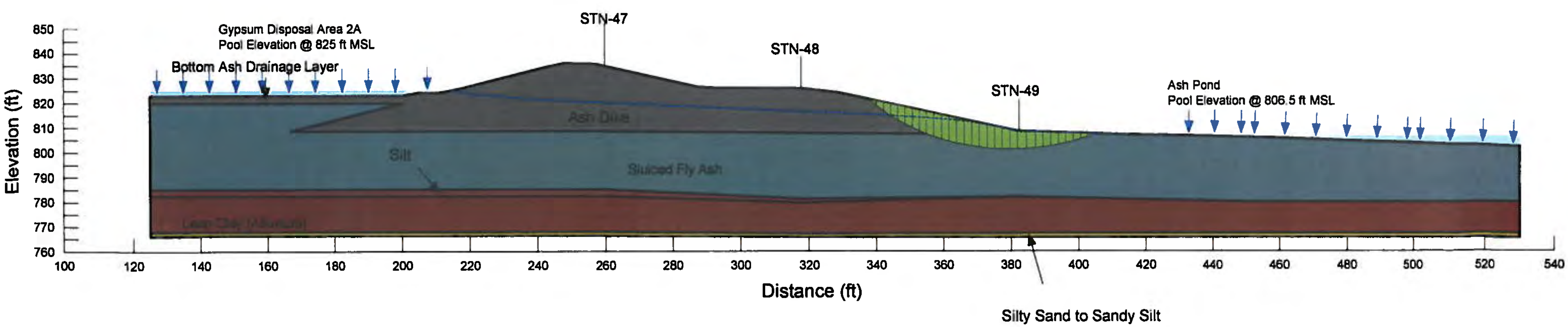
Factor of Safety: 1.2
Center: (380, 855) ft
Radius: 53.802 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: 1A.gsz
(See workplan for file name convention)

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Silty Sand to Sandy Silt (Alluvium)	106	107	0	29
Lean Clay (Alluvium)	123	123	0	31
Silt (Alluvium)	108	109	0	28
Sluiced Fly Ash	100	105	0	25

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Condition



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SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

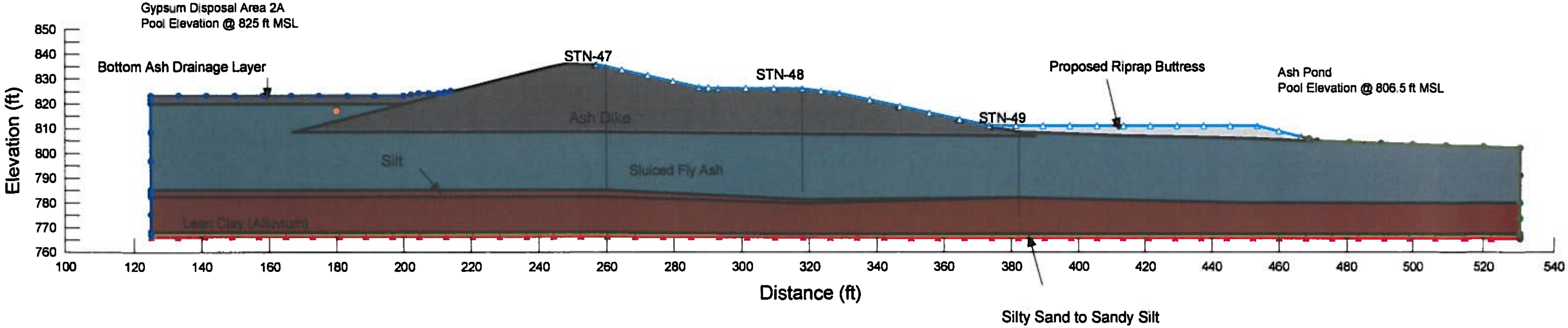
February 2010
Method: Steady-State Seepage
File Name: 1B.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
Total Head = 808.91 ft
At (372.15,807.12)
Total Head = 810.92 ft
dH = 2.01 ft dl = 3.88 ft
i = 0.518 i(criticial) = 0.708
FSpiping = 1.37

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.36
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.21
Lean Clay (Alluvium)	4.59e-007	0.05	0.26
Silt (Alluvium)	6.95e-005	0.05	0.21
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811'
Pore Water Pressure Contours



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SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1B.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
Total Head = 808.91 ft
At (372.15,807.12)
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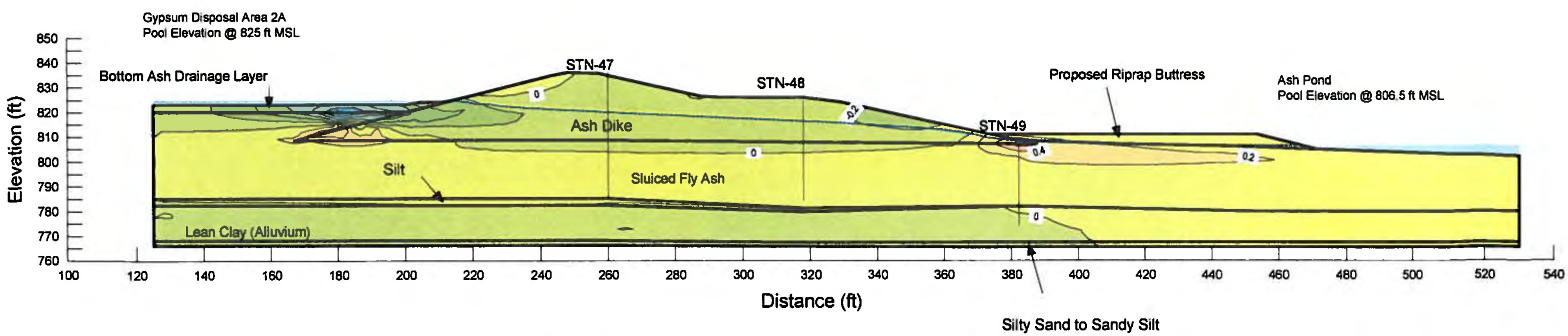
Proposed Buttress to Elev. 811'
Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1B.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
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At (372.15,807.12)
Total Head = 810.92 ft
dH = 2.01 ft dl = 3.88 ft
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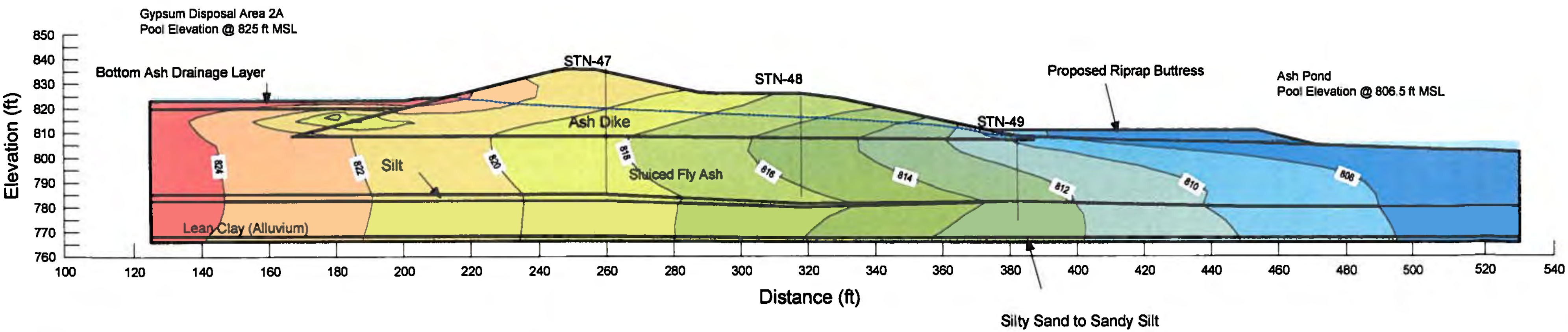
FSpiping = 1.37

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.36
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.21
Lean Clay (Alluvium)	4.59e-007	0.05	0.26
Silt (Alluvium)	6.95e-005	0.05	0.21
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811'
Total Head Contours



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SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1B.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
Total Head = 808.91 ft
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Ash Dike	6.5e-008	0.04	0.36
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.21
Lean Clay (Alluvium)	4.59e-007	0.05	0.26
Silt (Alluvium)	6.95e-005	0.05	0.21
Sluiced Fly Ash	1.6076e-005	0.02	0.46

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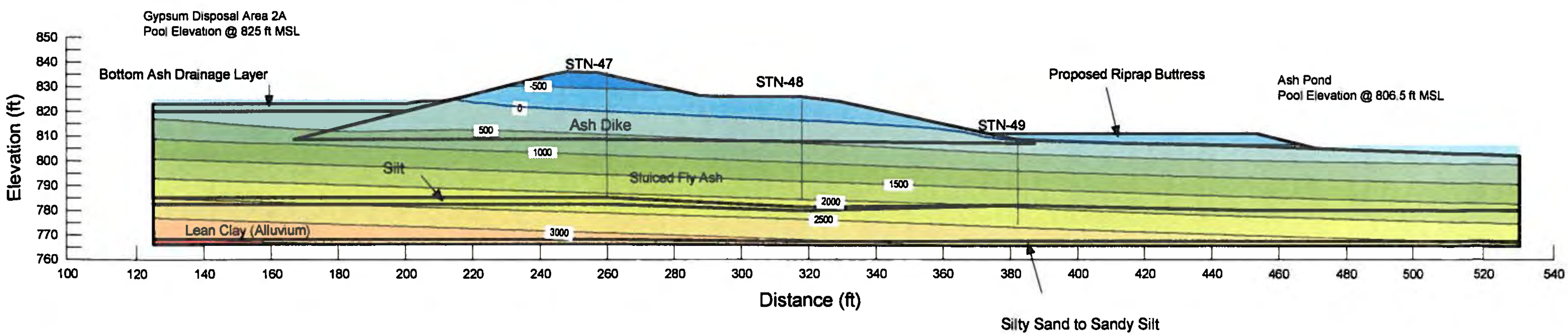
Proposed Buttress to Elev. 811'
Pore Water Pressure Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1B.gsz

Slope Stability

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

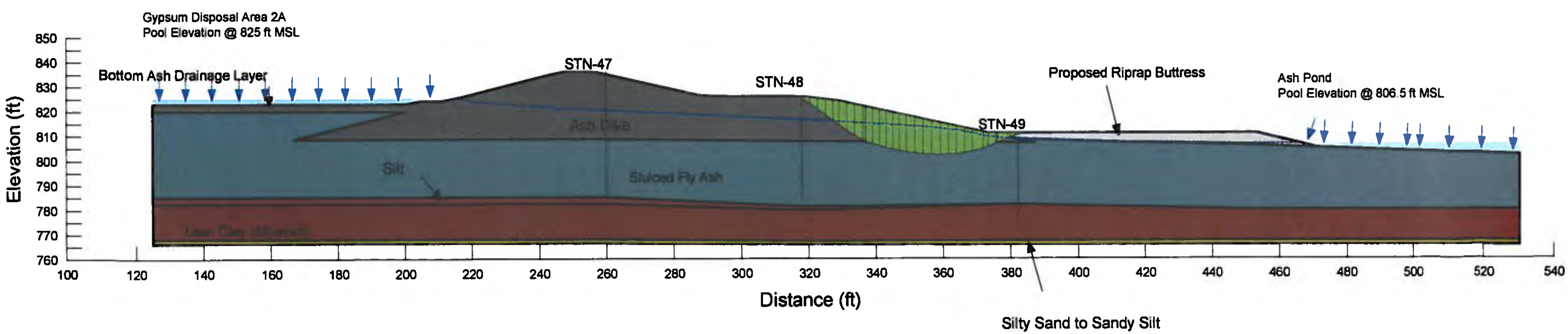
Factor of Safety: 1.7
Center: (357.5, 850) ft
Radius: 32.66393 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: 1B.gsz
(See workplan for file name convention)

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Silty Sand to Sandy Silt (Alluvium)	106	107	0	29
Lean Clay (Alluvium)	123	123	0	31
Silt (Alluvium)	108	109	0	28
Sluiced Fly Ash	100	105	0	25

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811'



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1B.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1C.gsz
(See workplan for file name convention)

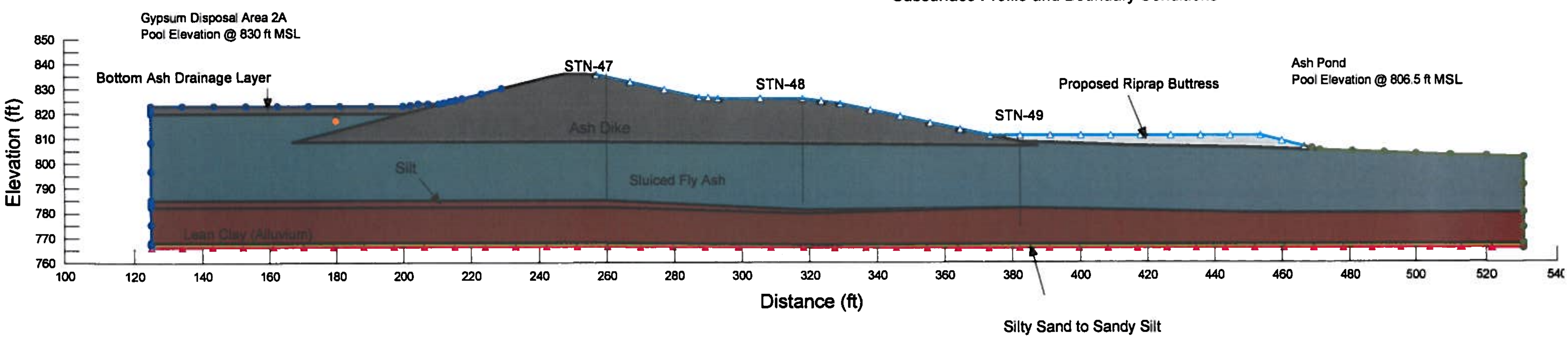
Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
Total Head = 809.11 ft
At (372.15,807.12)
Total Head = 811.9 ft
dH = 2.79 ft   dl = 3.88 ft
i = 0.719   i(criticial) = 0.708
FSpiping = 0.98

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.36
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.21
Lean Clay (Alluvium)	4.59e-007	0.05	0.26
Silt (Alluvium)	6.95e-005	0.05	0.21
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811' (Gypsum Area Pool Elev. 830')

Subsurface Profile and Boundary Conditions



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1C.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1C.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
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Total Head = 811.9 ft
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Sluiced Fly Ash	1.6076e-005	0.02	0.46

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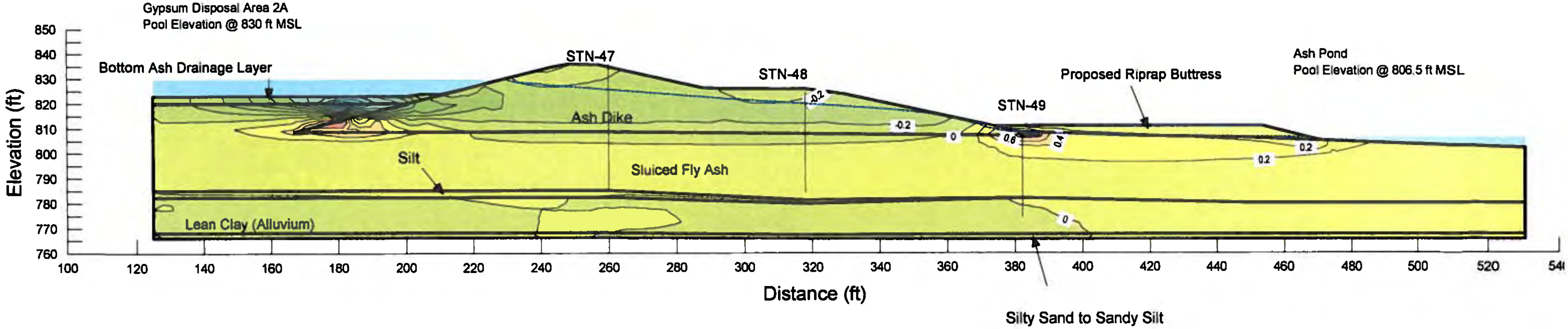
Proposed Buttress to Elev. 811' (Gypsum Area Pool Elev. 830')

Vertical Gradient Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1C.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1C.gsz
(See workplan for file name convention)

Piping Potential
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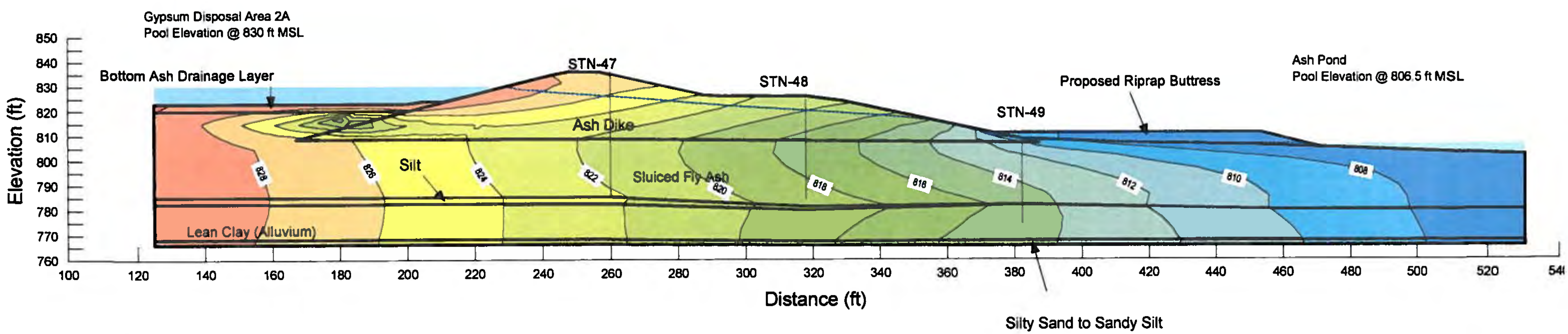
Proposed Buttress to Elev. 811' (Gypsum Area Pool Elev. 830')

Total Head Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1C.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 1C.gsz
(See workplan for file name convention)

Piping Potential
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Total Head = 809.11 ft
At (372.15,807.12)
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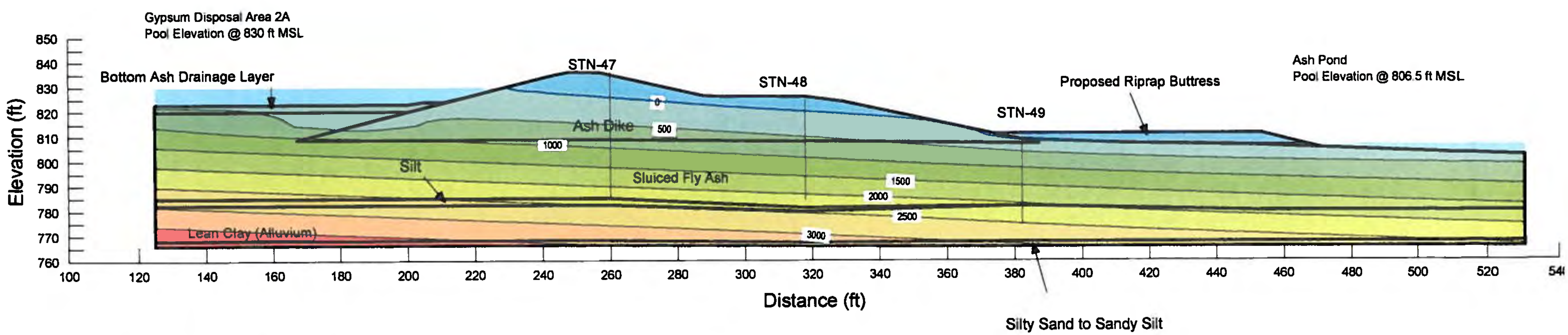
Proposed Buttress to Elev. 811' (Gypsum Area Pool Elev. 830')

Pore Water Pressure Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1C.gsz

Slope Stability

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

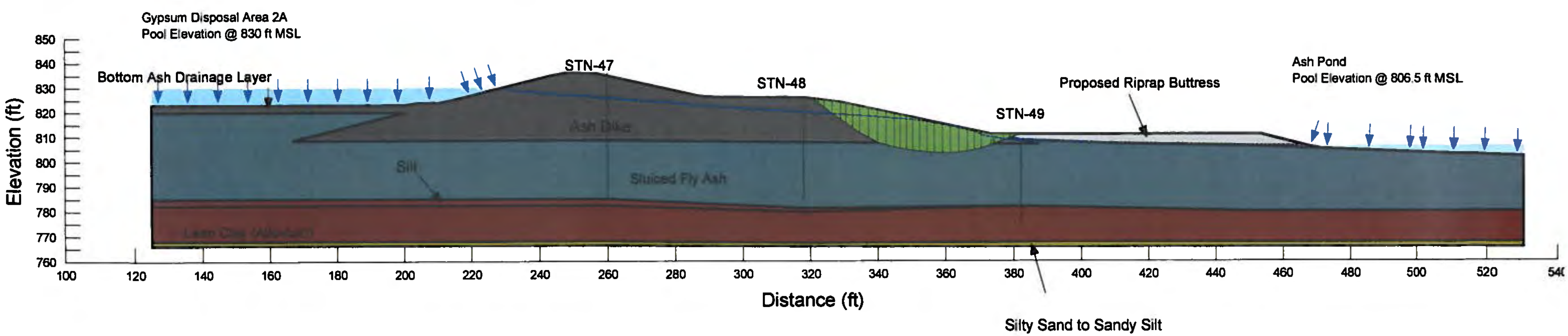
Factor of Safety: 1.5
Center: (357.5, 850) ft
Radius: 30.56362 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: 1C.gsz
(See workplan for file name convention)

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Silty Sand to Sandy Silt (Alluvium)	106	107	0	29
Lean Clay (Alluvium)	123	123	0	31
Silt (Alluvium)	108	109	0	28
Sluiced Fly Ash	100	105	0	25

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811' (Gypsum Area Pool Elev. 830')



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect K-K'\Slope\1C.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2A.gsz
(See Workplan for file name convention)

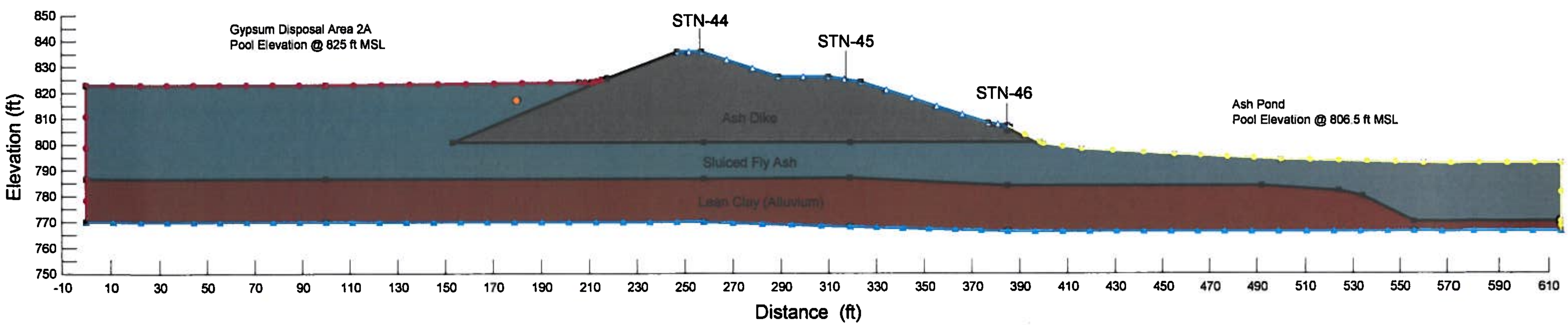
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (400,800)
Total Head = 806.50 ft
At (399.44,796.39)
Total Head = 807.50 ft
dH = 1.0 ft   dl = 3.61 ft
i = 0.277   i(criticial) = 0.708
FSpiping = 2.6

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46

Existing Condition

Subsurface Profile and Boundary Conditions



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2A.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2A.gsz
(See Workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

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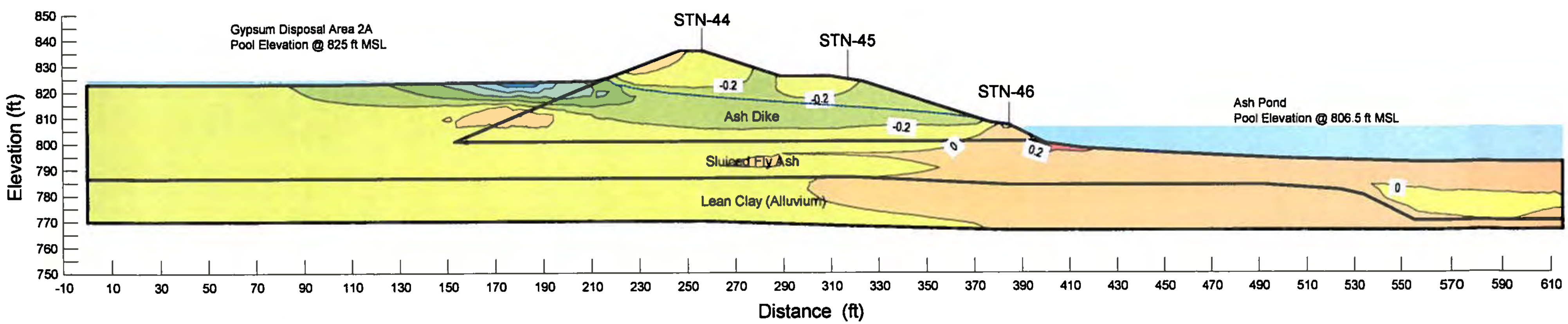
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46

Existing Condition

Vertical Gradient Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2A.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2A.gsz
(See Workplan for file name convention)

Note:
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Total Head = 807.50 ft
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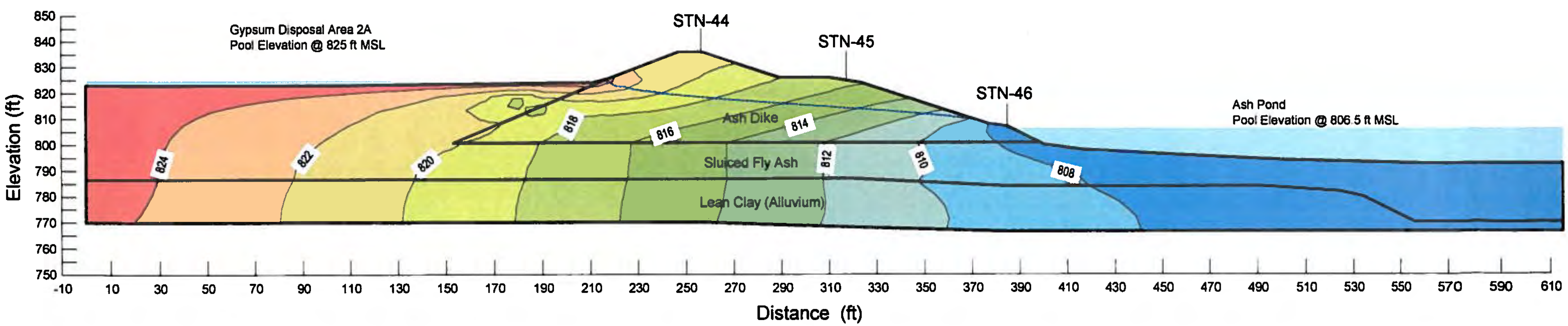
FSpiping = 2.6

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46

Existing Condition

Total Head Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2A.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2A.gsz
(See Workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

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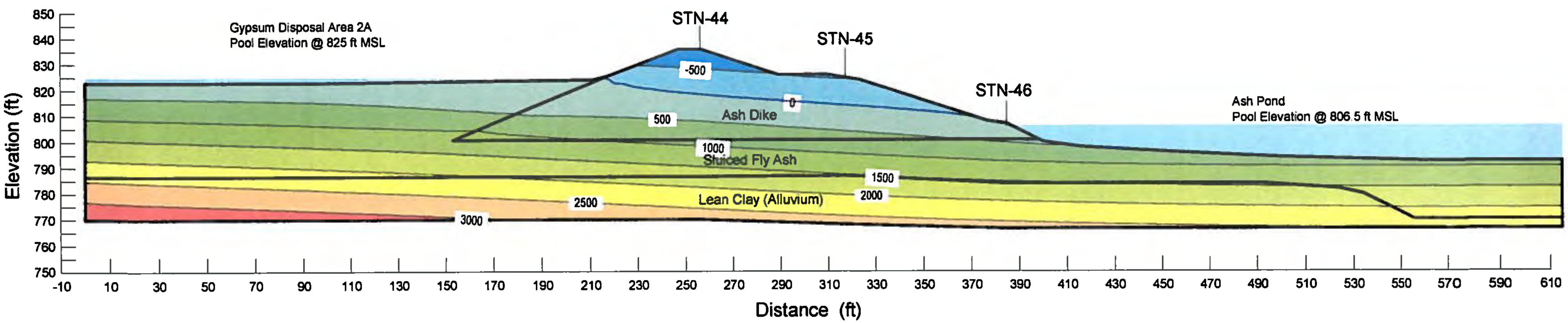
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46

Existing Condition

Pore Water Pressure Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2A.gsz

Slope Stability

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

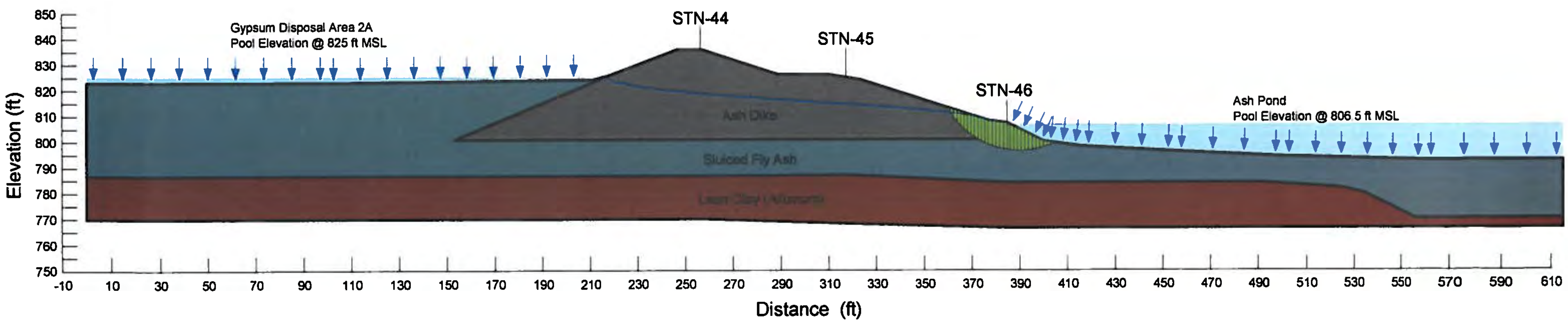
February 2010
Method: Modified Spencer
File Name: 2A.gsz
(See workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.1
Center: (390, 832.2) ft
Radius: 35.877 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Alluvium)	123	123	0	31
Sluiced Fly Ash	100	105	0	25
Ash Dike	100	105	0	33

Existing Condition



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2A.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2B.gsz
(See workplan for file name convention)

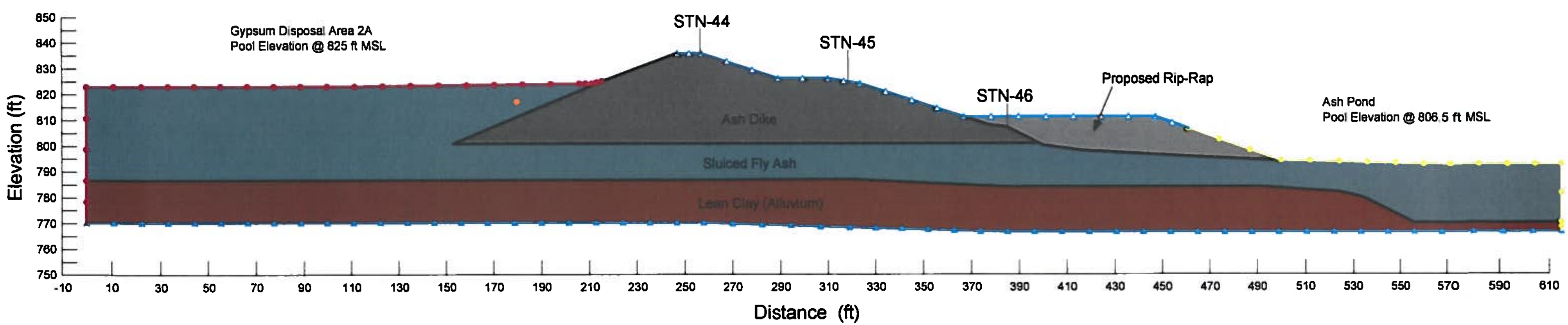
Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Piping Potential
Maximum Exit Gradient occurs at (505,793.88
Total Head = 806.50 ft
At (504.07,788.16)
Total Head = 806.73 ft
dH = 0.23 ft   dl = 5.72 ft
i = 0.04   i(criticial) = 0.708
FSpiping = 17.7

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811'

Subsurface Profile and Boundary Conditions



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2B.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2B.gsz
(See workplan for file name convention)

Material Type	Ksat	Kratio	Wsat
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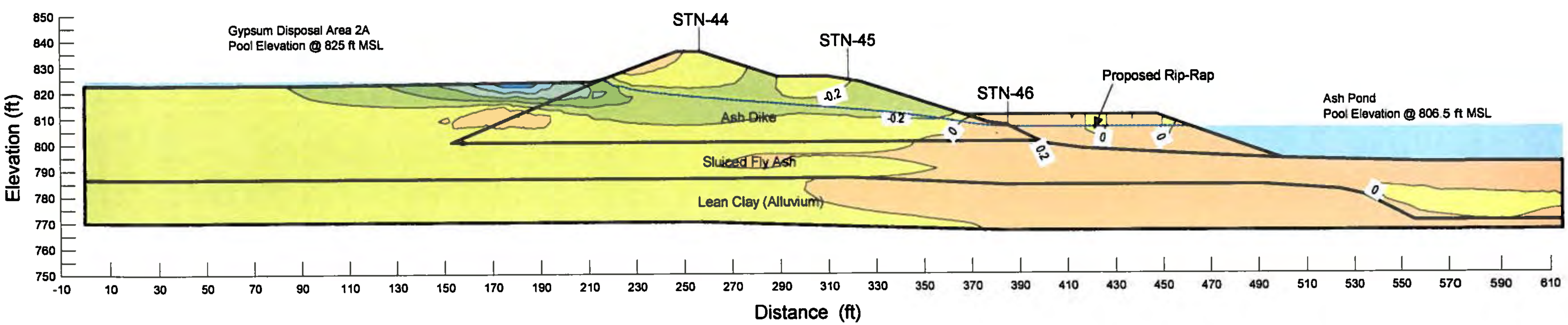
Proposed Buttress to Elev. 811'

Vertical Gradient Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2B.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2B.gsz
(See workplan for file name convention)

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
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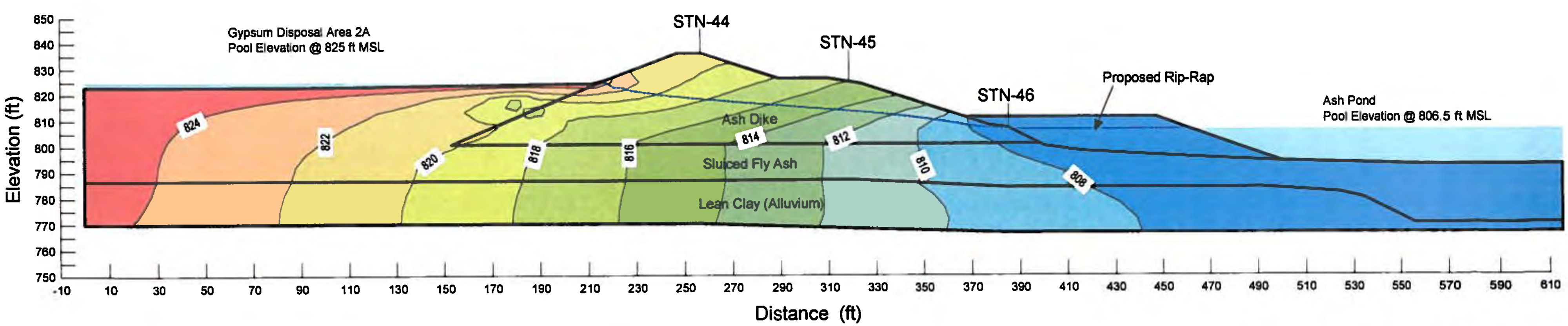
Proposed Buttress to Elev. 811'

Total Head Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2B.gsz

SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2B.gsz
(See workplan for file name convention)

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
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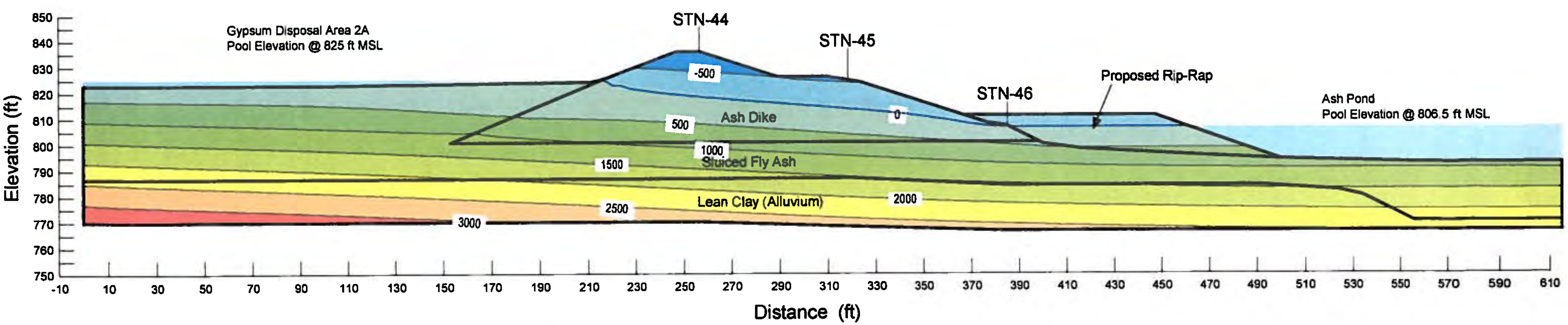
Proposed Buttress to Elev. 811'

Pore Water Pressure Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect L-L'\Slope\2B.gsz

Slope Stability (Slope Failure)

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

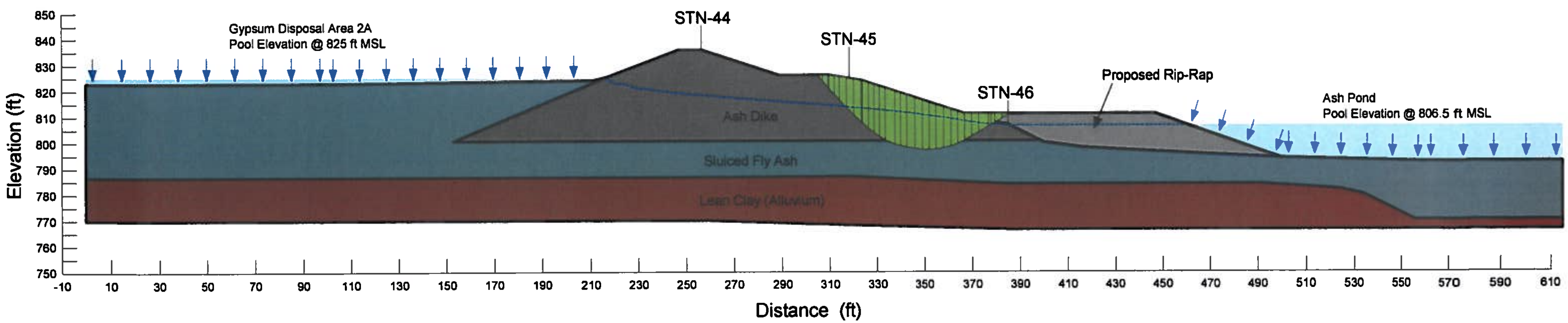
February 2010
Method: Modified Spencer
File Name: 2B.gsz
(See workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 2.3
Center: (350.966, 843.553) ft
Radius: 39.00674 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Alluvium)	123	123	0	31
Sluiced Fly Ash	100	105	0	25
Ash Dike	100	105	0	33
Rip Rap	115	115	0	40

Proposed Buttress to Elev. 811'



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SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2C.gsz
(See workplan for file name convention)

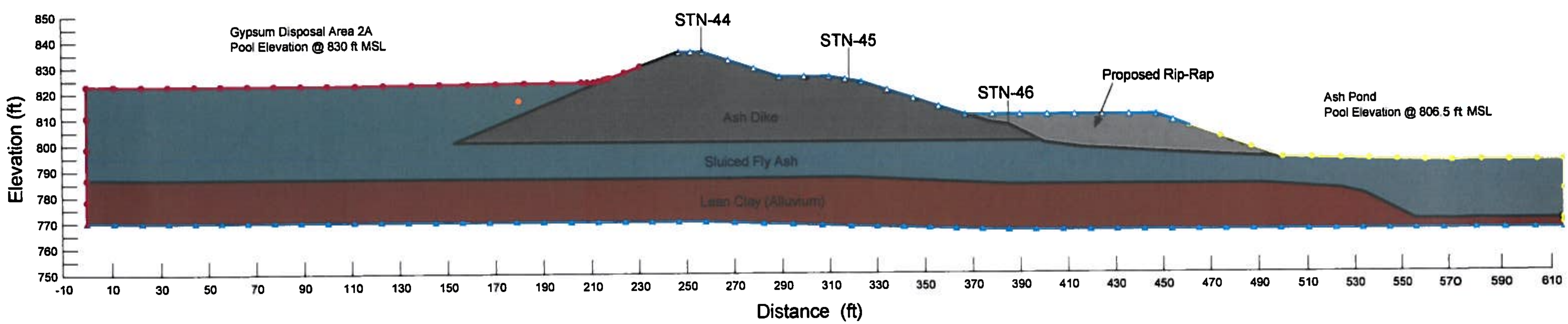
Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Piping Potential
Maximum Exit Gradient occurs at (505,793.88)
Total Head = 806.50 ft
At (504.07,788.16)
Total Head = 806.79 ft
dH = 0.29 ft dl = 5.72 ft
i = 0.05 i(critical) = 0.708
FSpiping = 14.2

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811', Gypsum Pool Area Elev. 830'

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2C.gsz
(See workplan for file name convention)

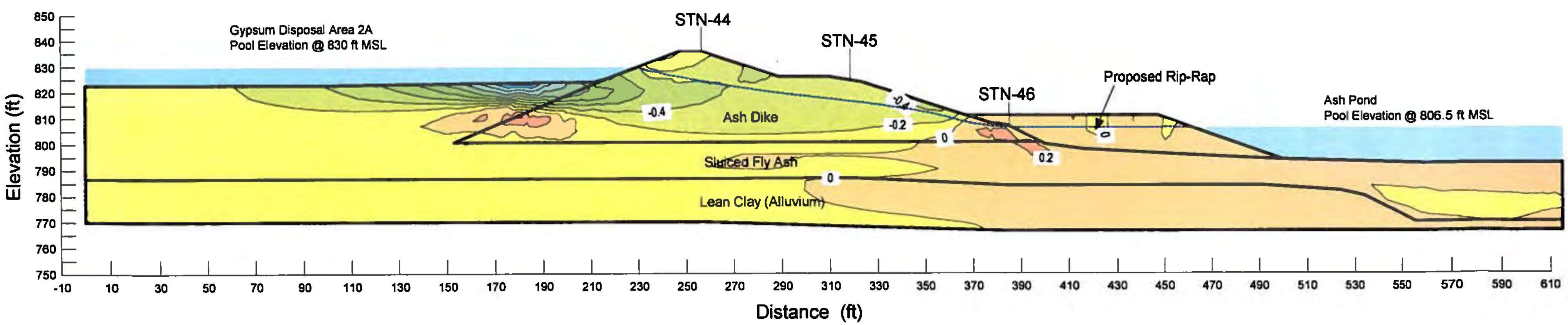
Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Piping Potential
Maximum Exit Gradient occurs at (505,793.88)
Total Head = 806.50 ft
At (504.07,788.16)
Total Head = 806.79 ft
dH = 0.29 ft dl = 5.72 ft
i = 0.05 i(criticial) = 0.708
FSpiping = 14.2

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811', Gypsum Pool Area Elev. 830'

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2C.gsz
(See workplan for file name convention)

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46
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Total Head = 806.79 ft
dH = 0.29 ft dl = 5.72 ft
i = 0.05 i(criticial) = 0.708
FSpiping = 14.2

Note:
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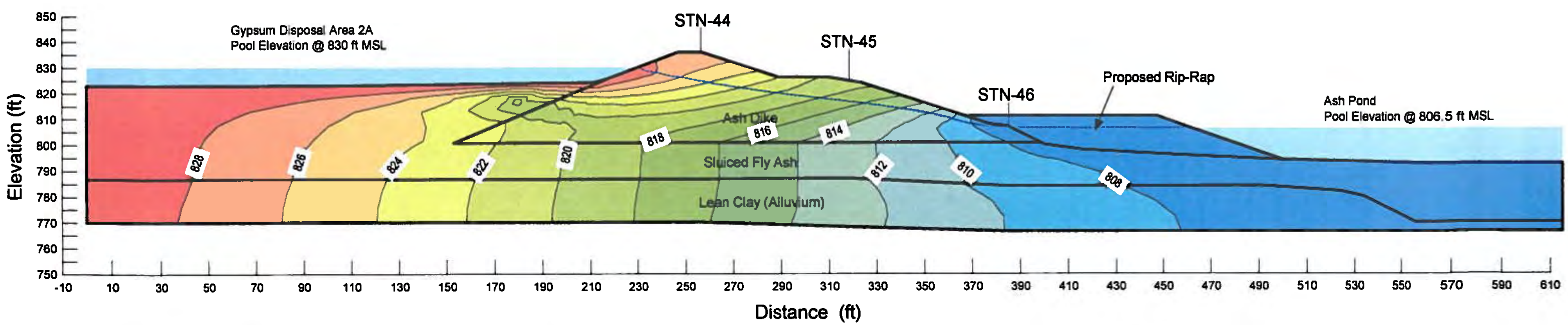
Proposed Buttress to Elev. 811', Gypsum Pool Area Elev. 830'

Total Head Contours



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SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: 2C.gsz
(See workplan for file name convention)

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46
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i = 0.05   i(criticial) = 0.708
FSpiping = 14.2

Note:
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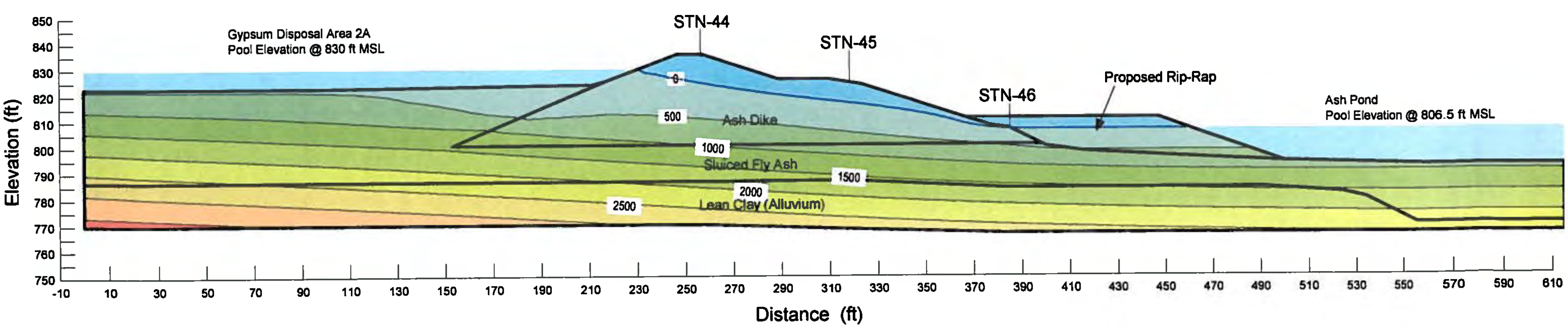
Proposed Buttress to Elev. 811', Gypsum Pool Area Elev. 830'

Pore Water Pressure Contours



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Slope Stability (Slope Failure)

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

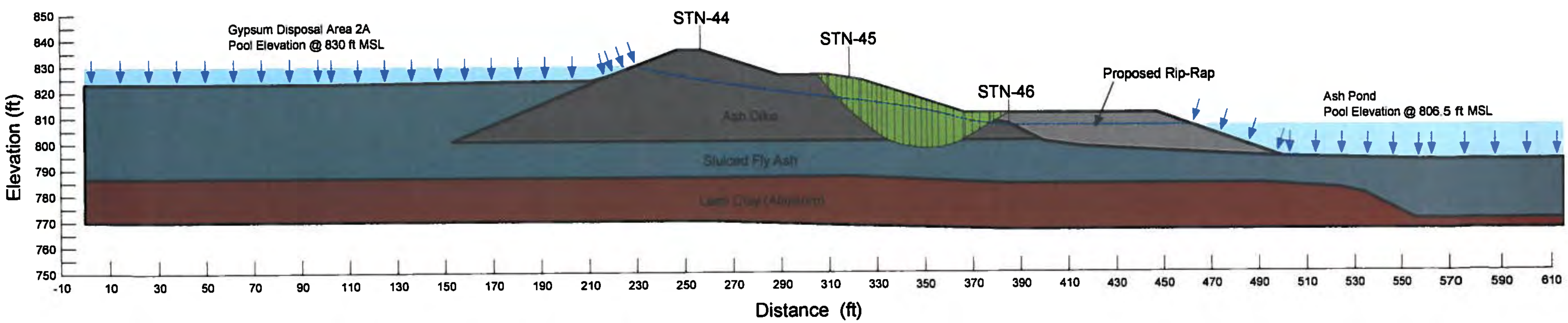
February 2010
Method: Modified Spencer
File Name: 2C.gsz
(See workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 2.2
Center: (350.966, 843.553) ft
Radius: 38.62748 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Alluvium)	123	123	0	31
Sluiced Fly Ash	100	105	0	25
Ash Dike	100	105	0	33
Rip Rap	115	115	0	40

Proposed Buttress to Elev. 811', Gypsum Pool Area Elev. 830'



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' existing conditions (Global).gsz

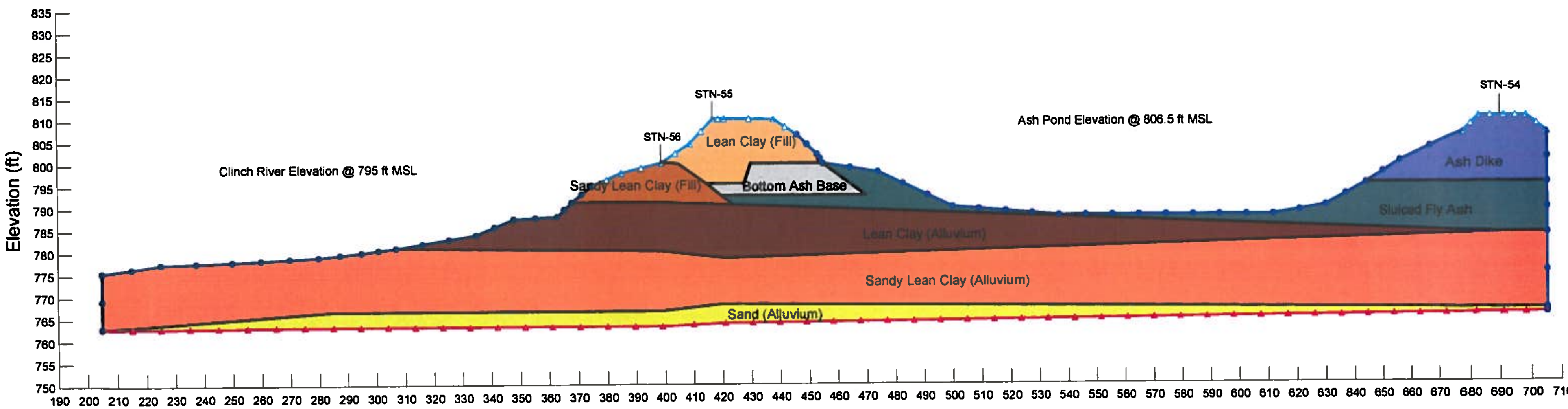
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (375,795)
Total Head = 795 ft
At (373.17,791.2)
Total Head = 795.86 ft
dH = 0.86 ft dl = 3.8 ft
i = 0.226 i(criticial) = 1.046
FSpiping = 4.6

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' existing conditions (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

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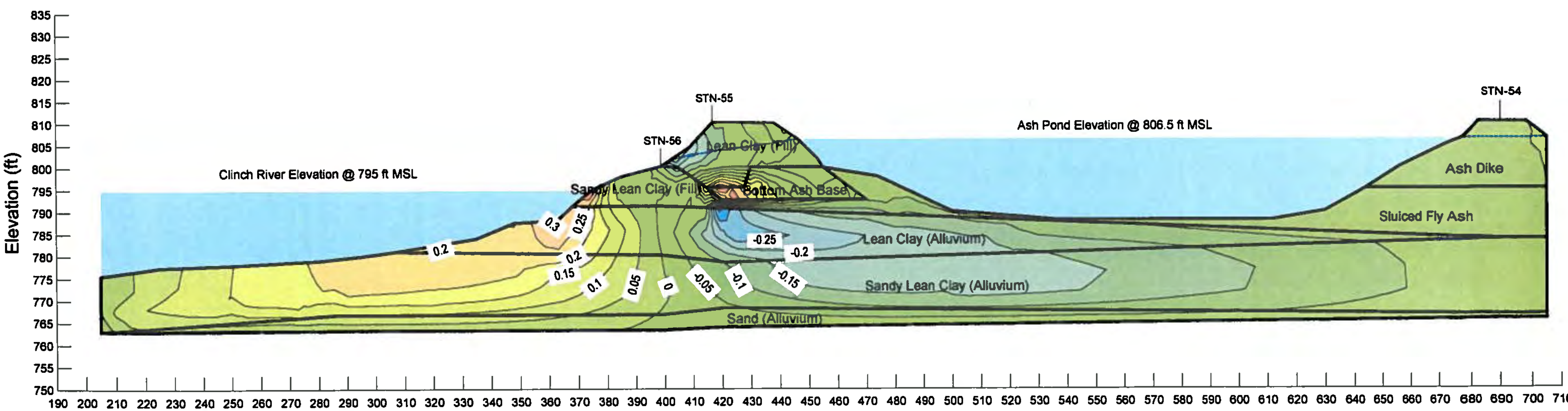
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' existing conditions (Global).gsz

Note:
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At (373.17,791.2)
Total Head = 795.86 ft
dH = 0.86 ft dl = 3.8 ft
i = 0.226 i(criticial) = 1.046
FSpiping = 4.6

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
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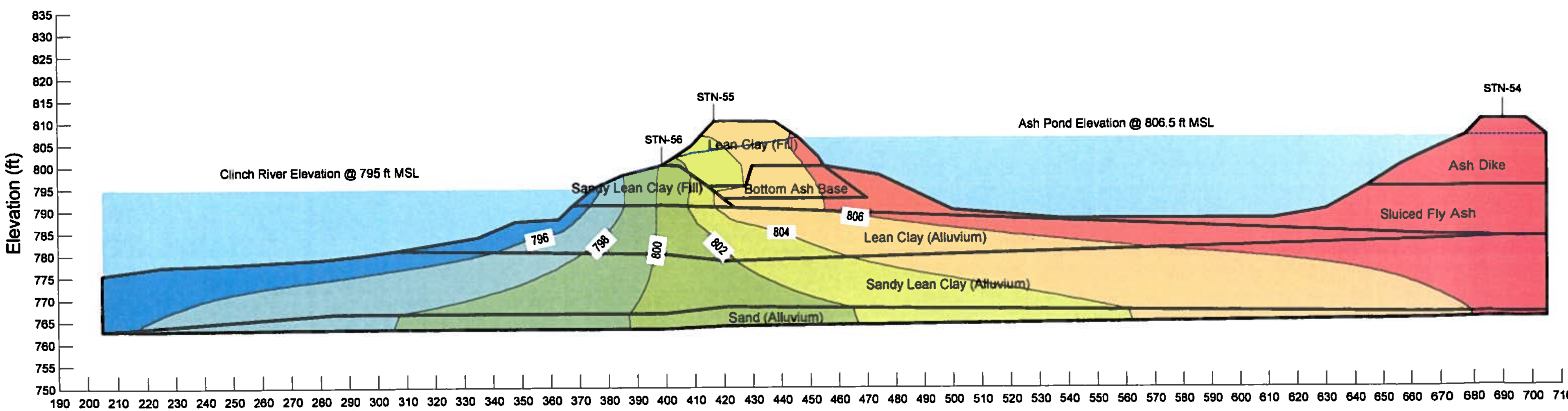
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Total Head Contours



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' existing conditions (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

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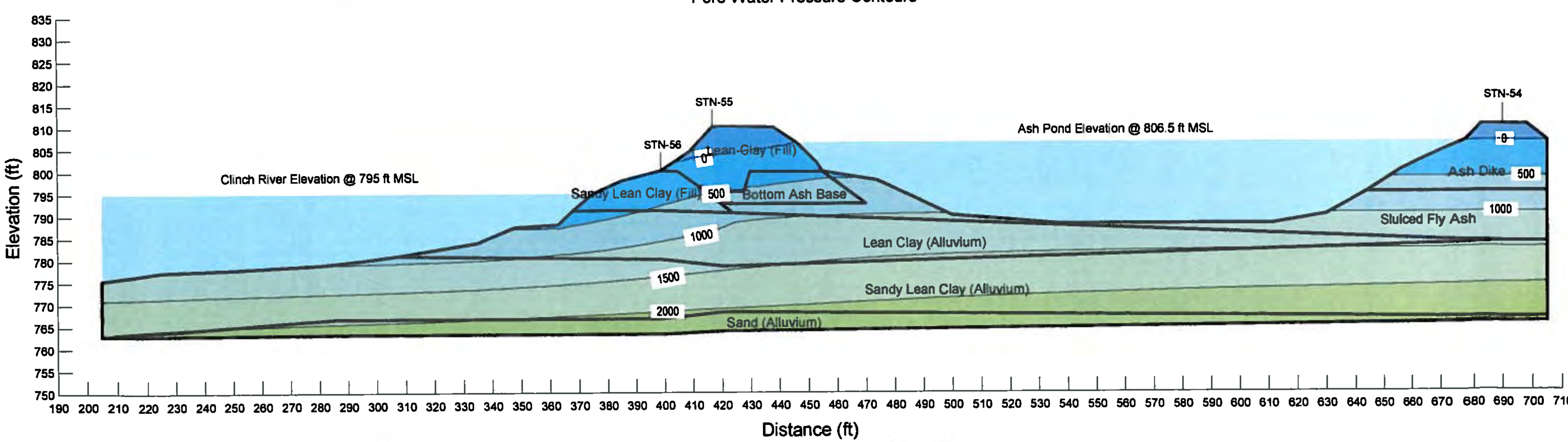
At (373.17,791.2)
Total Head = 795.86 ft
dH = 0.86 ft dl = 3.8 ft
i = 0.226 i(criticial) = 1.046
FSpiping = 4.6

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Pore Water Pressure Contours



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Slope Stability dMin=20

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

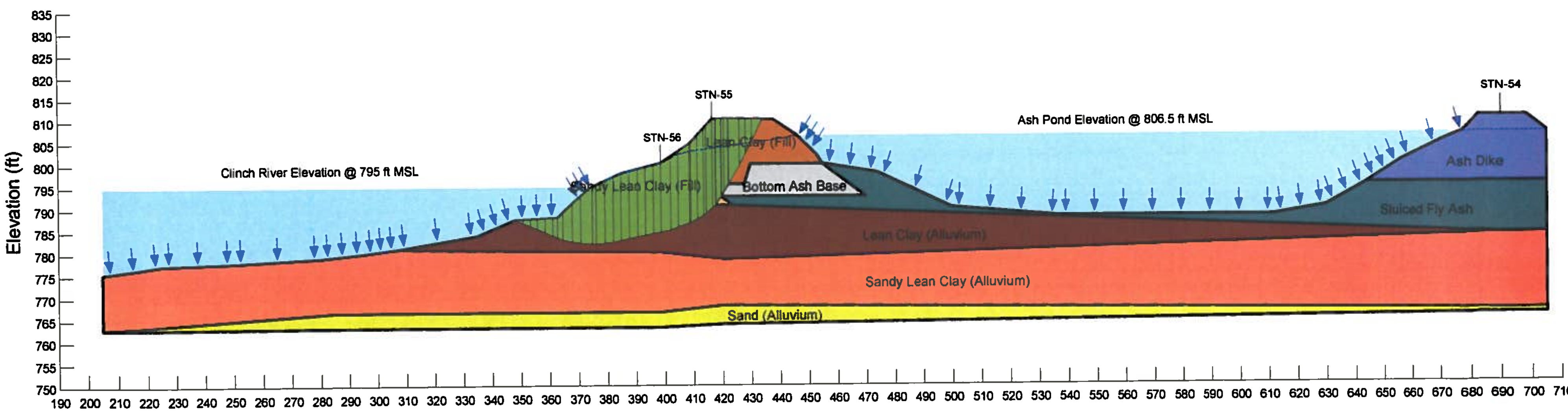
February 2010
Method: Modified Spencer
File Name: Slope W Section N-N' existing conditions (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.4
Center: (381.645, 858.5) ft
Radius: 43.19965 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	25
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Fill)	125	126	0	33
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Sand (Alluvium)	120	120	0	33
Sandy Lean Clay (Alluvium)	126	127	0	33
Bottom Ash Base	100	105	0	33

Existing Conditions
Global Failure



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Slope Stability dMin=10

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

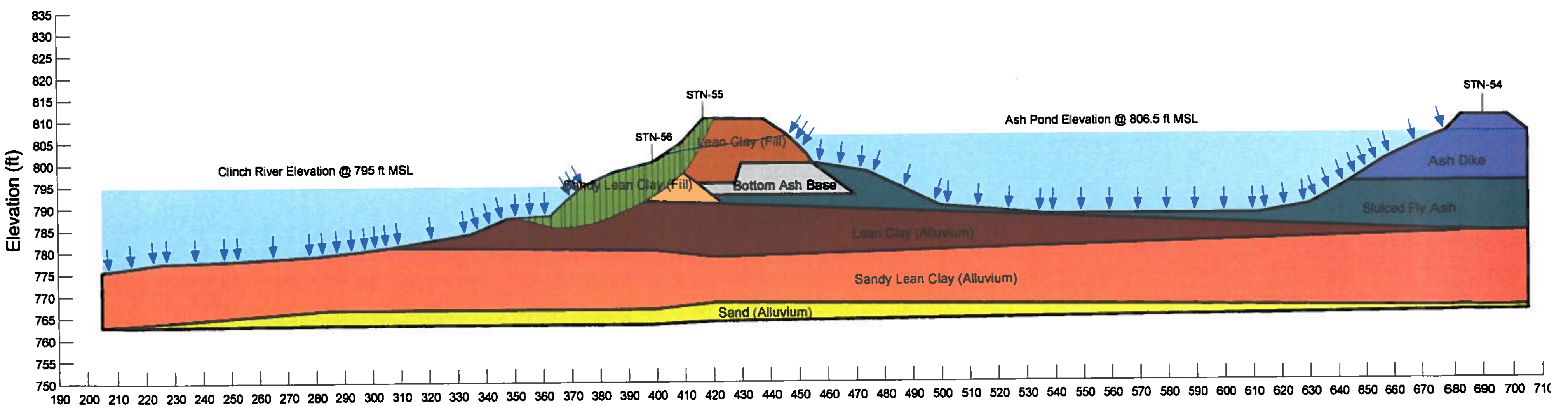
February 2010
Method: Modified Spencer
File Name: Slope W Section N-N' existing conditions (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.1
Center: (373.645, 842) ft
Radius: 36.5009 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	25
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Fill)	125	126	0	33
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Sand (Alluvium)	120	120	0	33
Sandy Lean Clay (Alluvium)	126	127	0	33
Bottom Ash Base	100	105	0	33

Existing Conditions
Non-Global Failure



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' buttress.gsz

Note:
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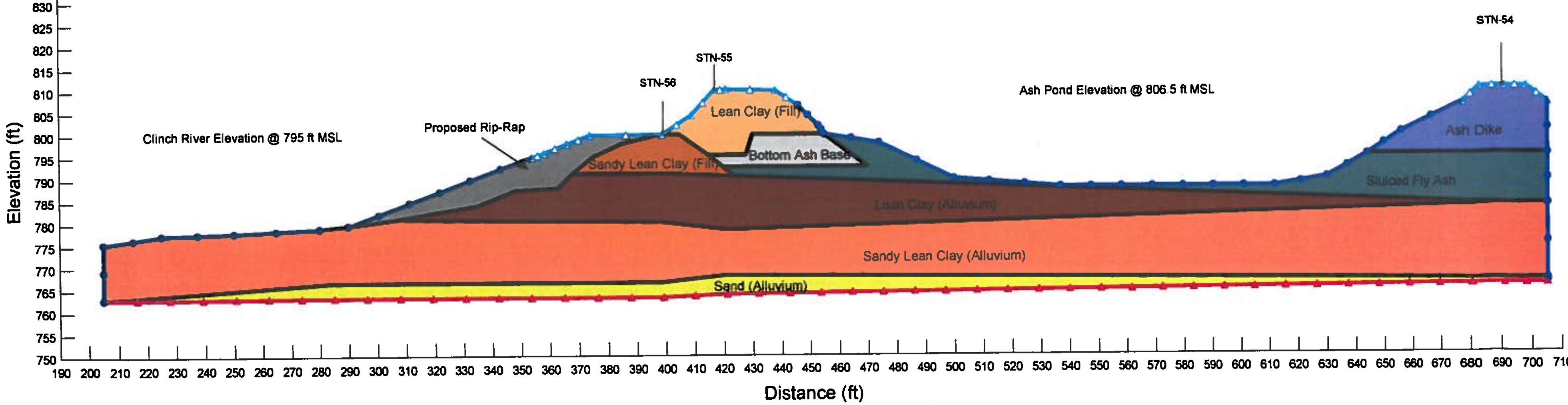
Piping Potential
Maximum Exit Gradient occurs at (280,779)
Total Head = 795 ft
At (278.94,772.05)
Total Head = 796.43 ft
dH = 1.43 ft dl = 6.95 ft
i = 0.206 i(criticial) = 1.046
FSpiping = 5.08

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.496e-008	0.04	0.46
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Lean Clay (Fill)	2.297e-007	0.1	0.41
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sand (Alluvium)	5.3477e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' buttress.gsz

Note:
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Piping Potential
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Total Head = 795 ft
At (278.94,772.05)
Total Head = 796.43 ft
dH = 1.43 ft dl = 6.95 ft
i = 0.206 i(criticial) = 1.046
FSpiping = 5.08

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Sluiced Fly Ash	1.6076e-005	0.02	0.46
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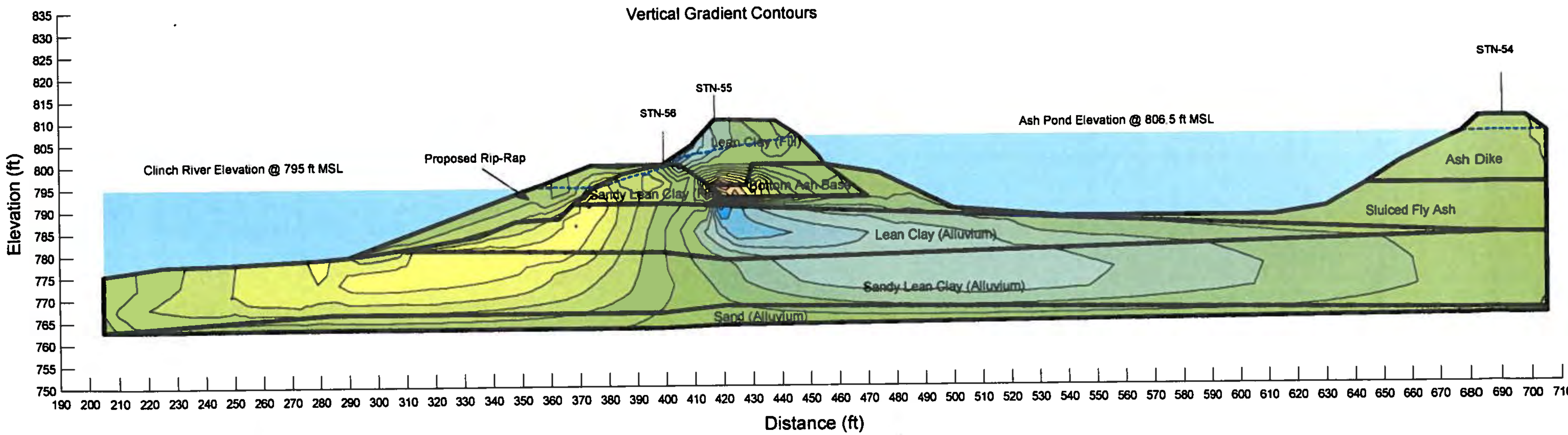
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' buttress.gsz

Note:
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Piping Potential
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At (278.94,772.05)
Total Head = 796.43 ft
dH = 1.43 ft dl = 6.95 ft
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Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
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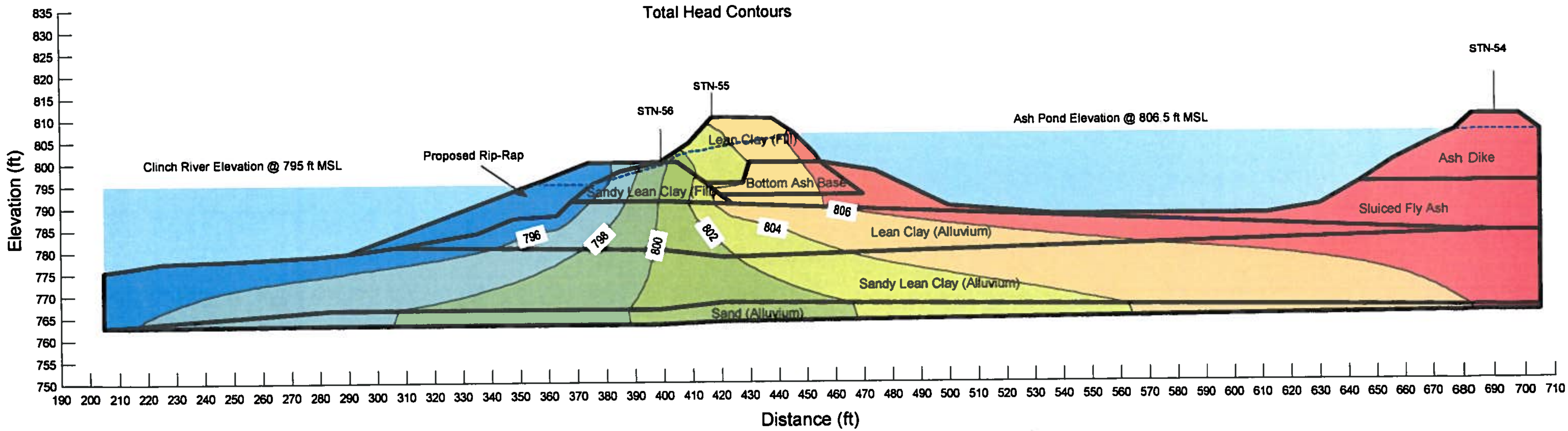
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Lean Clay (Fill)	2.297e-007	0.1	0.41
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sand (Alluvium)	5.3477e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Total Head Contours



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' buttress.gsz

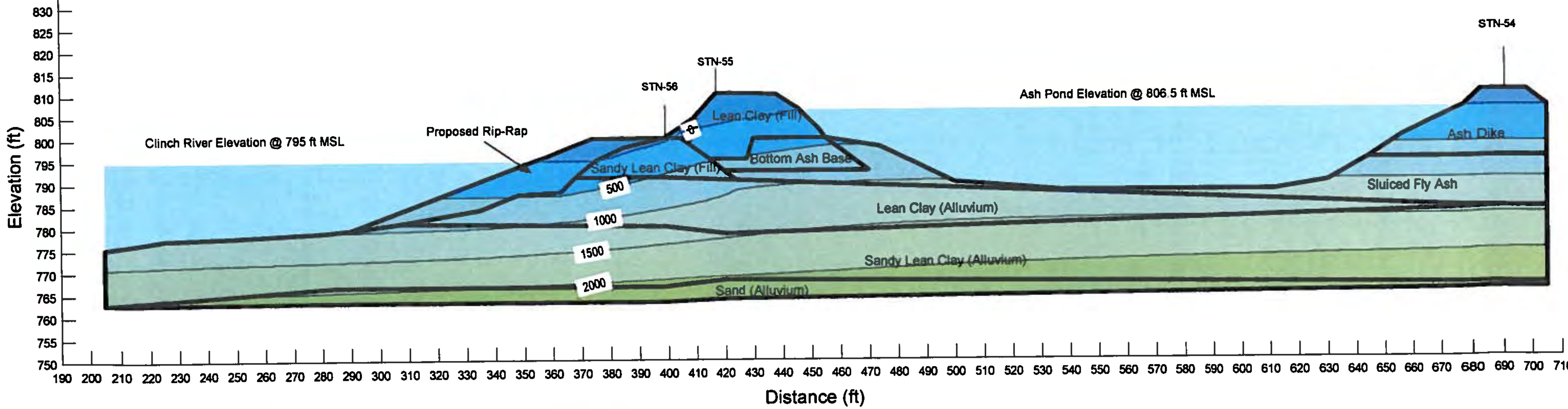
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (280,779)
Total Head = 795 ft
At (278.94,772.05)
Total Head = 796.43 ft
dH = 1.43 ft dl = 6.95 ft
i = 0.206 i(criticial) = 1.046
FSpiping = 5.08

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.496e-008	0.04	0.46
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Lean Clay (Fill)	2.297e-007	0.1	0.41
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sand (Alluvium)	5.3477e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Pore Water Pressure Contours



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Slope Stability

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

January 2010
Method: Modified Spencer
File Name: Slope W Section N-N' buttress.gsz

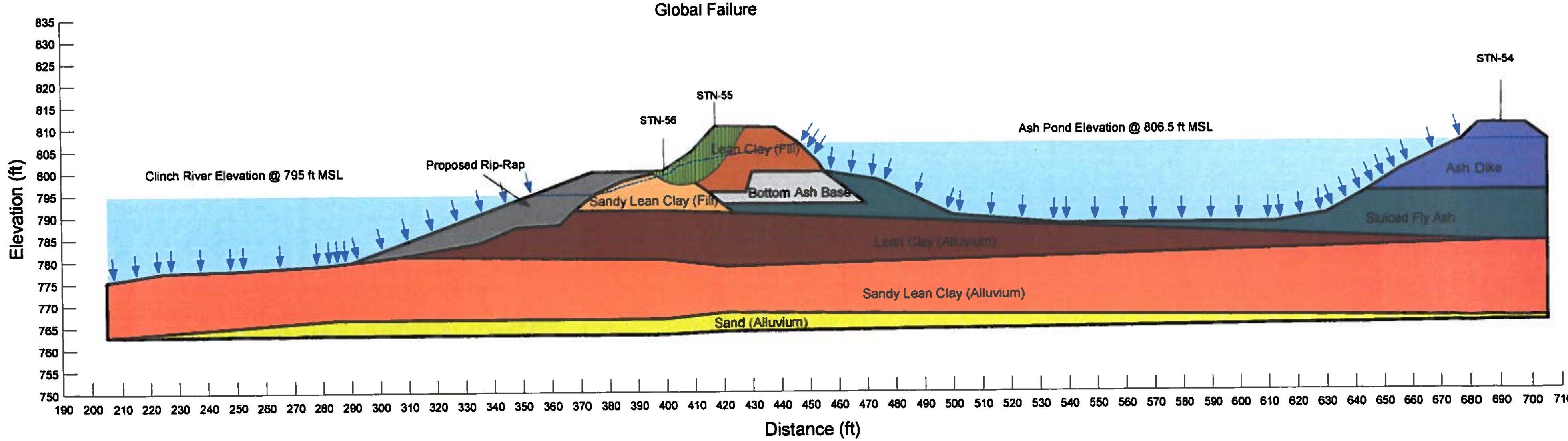
Factor of Safety: 1.7
Center: (405, 831) ft
Radius: 17.91326 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	25
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Fill)	125	126	0	33
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Sand (Alluvium)	120	120	0	33
Sandy Lean Clay (Alluvium)	126	127	0	33
Bottom Ash Base	100	105	0	33
Rip Rap	115	115	0	40

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Rip-Rap Buttress

Global Failure



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

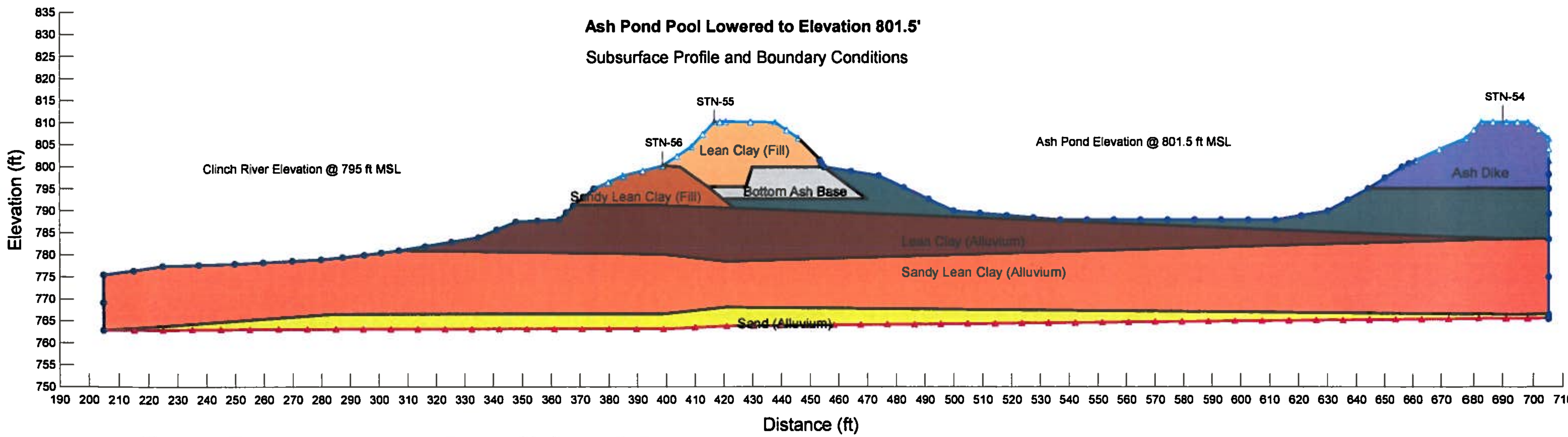
Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' Ash Pond Pool 801.5' (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (375,795)
Total Head = 795 ft
At (373.17,791.2)
Total Head = 795.52 ft
dH = 0.52 ft   dl = 3.8 ft
i = 0.137 i(criticial) = 1.046
FSpiping = 7.6

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

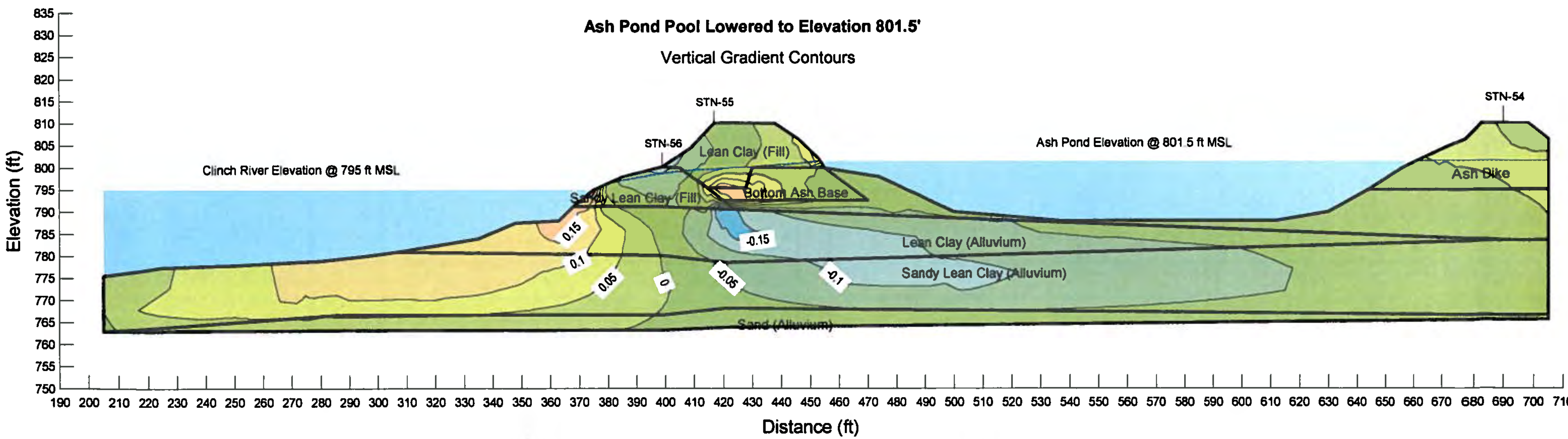
Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' Ash Pond Pool 801.5' (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (375,795)
Total Head = 795 ft
At (373.17,791.2)
Total Head = 795.52 ft
dH = 0.52 ft   dl = 3.8 ft
i = 0.137 i(criticial) = 1.046
FSpiping = 7.6

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' Ash Pond Pool 801.5' (Global).gsz

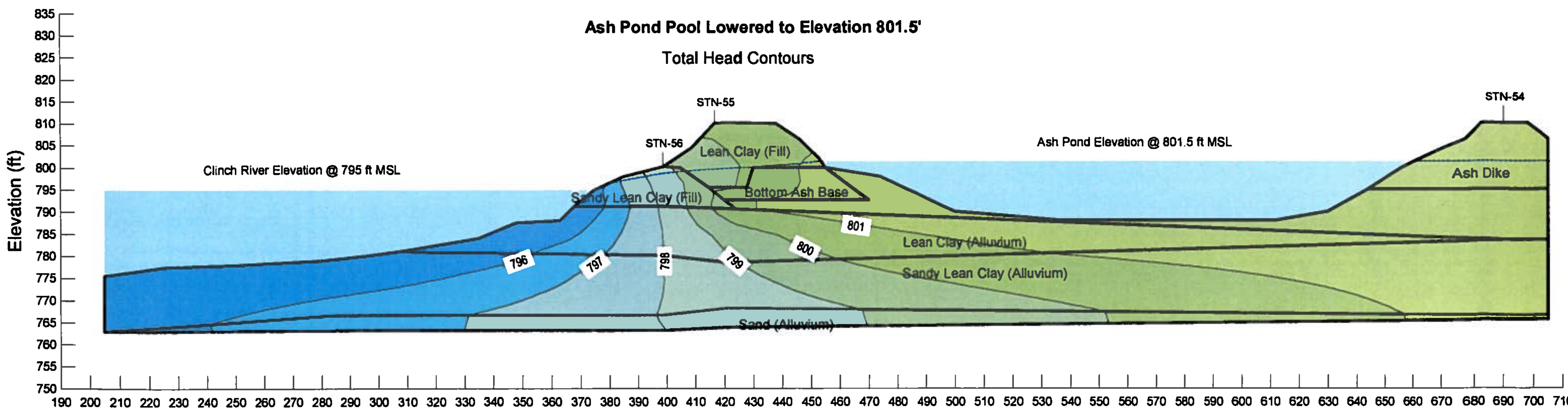
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (375,795)
Total Head = 795 ft
At (373.17,791.2)
Total Head = 795.52 ft
dH = 0.52 ft dl = 3.8 ft
i = 0.137 i(criticial) = 1.046
FSpiping = 7.6

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46

Ash Pond Pool Lowered to Elevation 801.5'

Total Head Contours



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SEEP/W Analysis

Cross-Section N-N'
Fly Ash Disposal Area 2

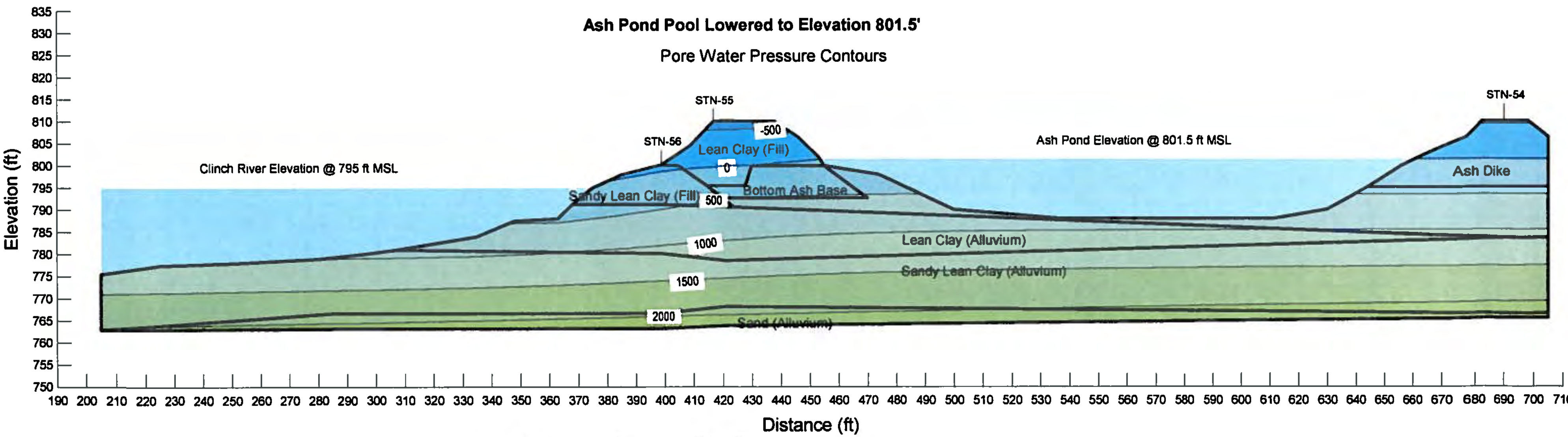
Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section N-N' Ash Pond Pool 801.5' (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (375,795)
Total Head = 795 ft
At (373.17,791.2)
Total Head = 795.52 ft
dH = 0.52 ft dl = 3.8 ft
i = 0.137 i(criticial) = 1.046
FSpiping = 7.6

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Sand (Alluvium)	5.3e-006	0.02	0.39
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Bottom Ash Base	6.5e-008	0.04	0.46



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Slope Stability dMin=20

Cross-Section N-N'
Fly Ash Disposal Area 2

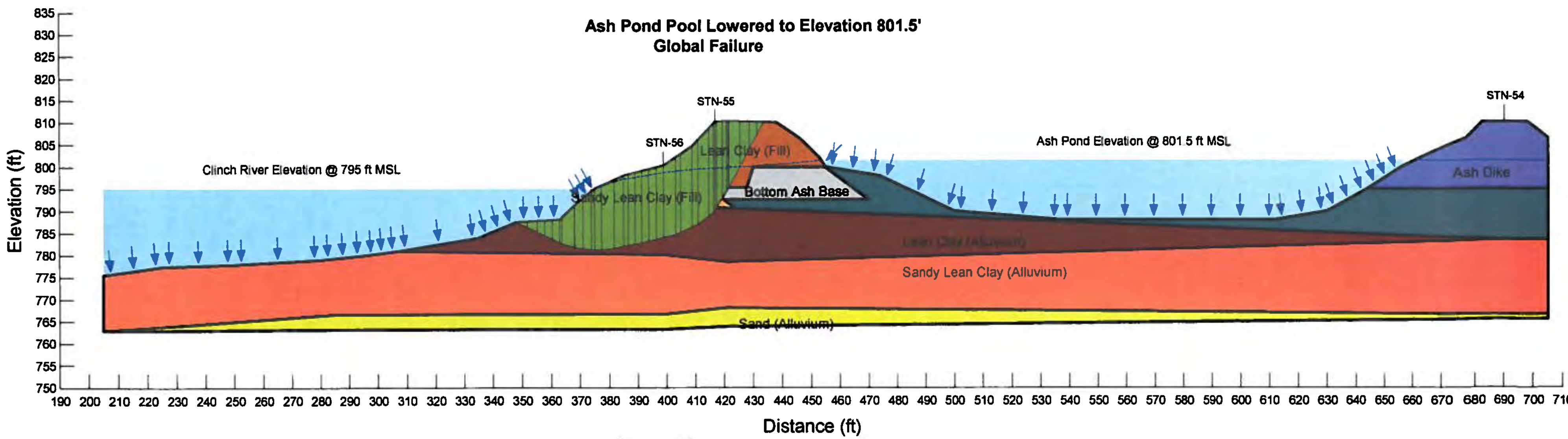
Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Slope W Section N-N' Ash Pond Pool 801.5' (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.6
Center: (381, 853) ft
Radius: 42.83189 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	25
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Fill)	125	126	0	33
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Sand (Alluvium)	120	120	0	33
Sandy Lean Clay (Alluvium)	126	127	0	33
Bottom Ash Base	100	105	0	33



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

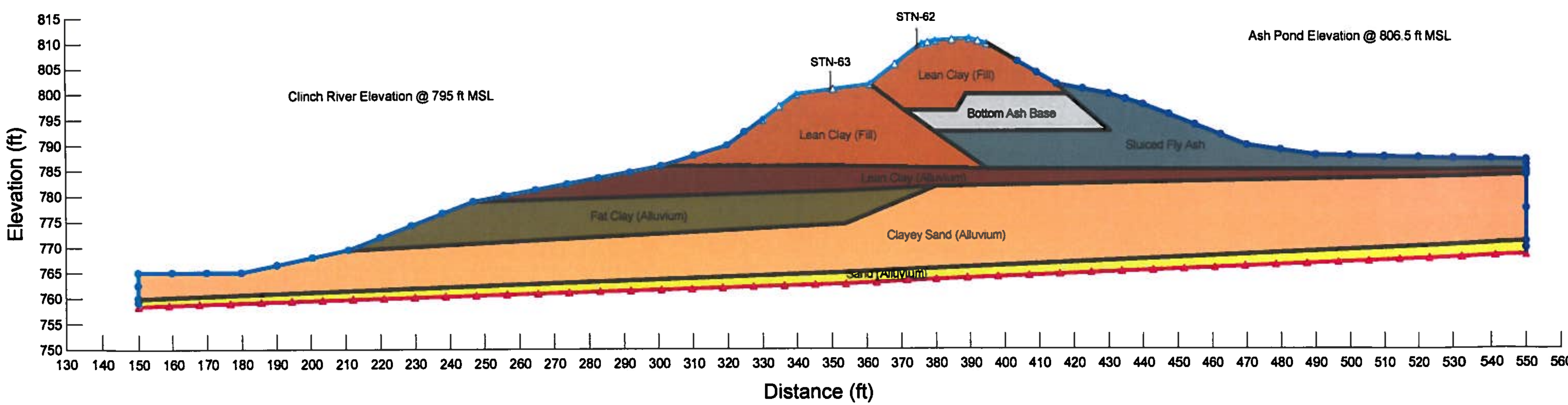
February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' existing conditions.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft dl = 3.24 ft
i = 0.219 i(criticial) = 1.018
FSpiping = 4.65

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.345e-006	0.02	0.39

Existing Conditions
Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' existing conditions.gsz

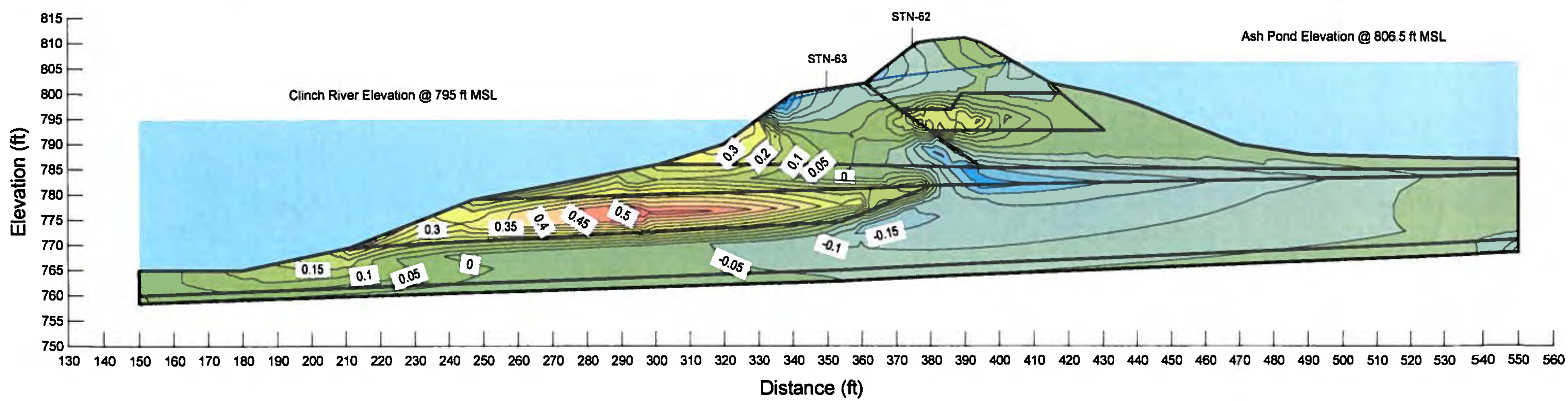
Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft   dl = 3.24 ft
i = 0.219   i(criticial) = 1.018
FSpiping = 4.7

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Fat Clay (Alluvium)	3.7e-008	0.05	0.41
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.3e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

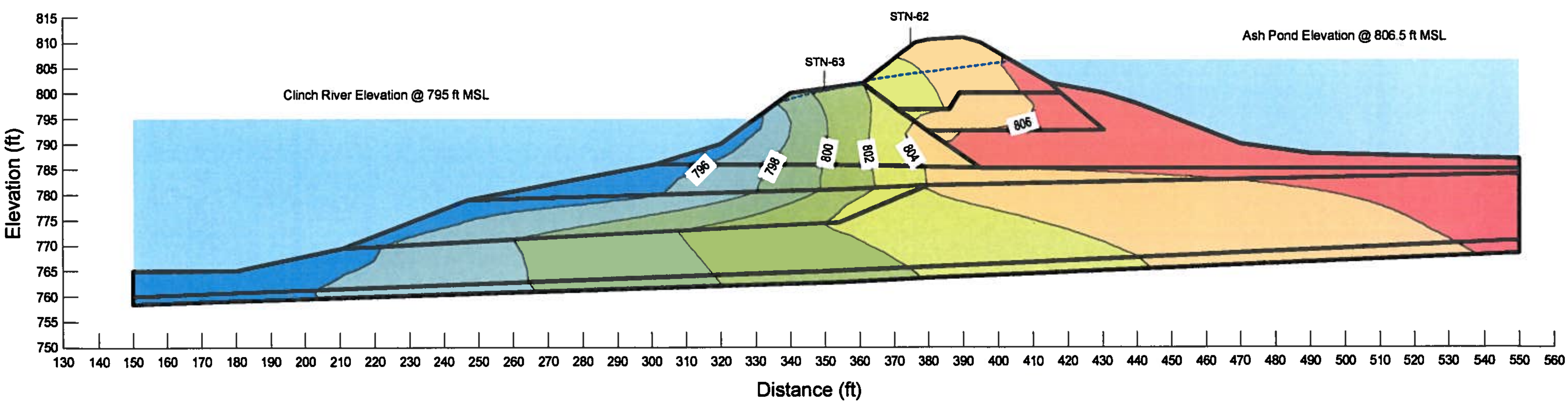
February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' existing conditions.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft   dl = 3.24 ft
i = 0.219   i(criticial) = 1.018
FSpiping = 4.65

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.345e-006	0.02	0.39

Existing Conditions
Total Head Contours



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

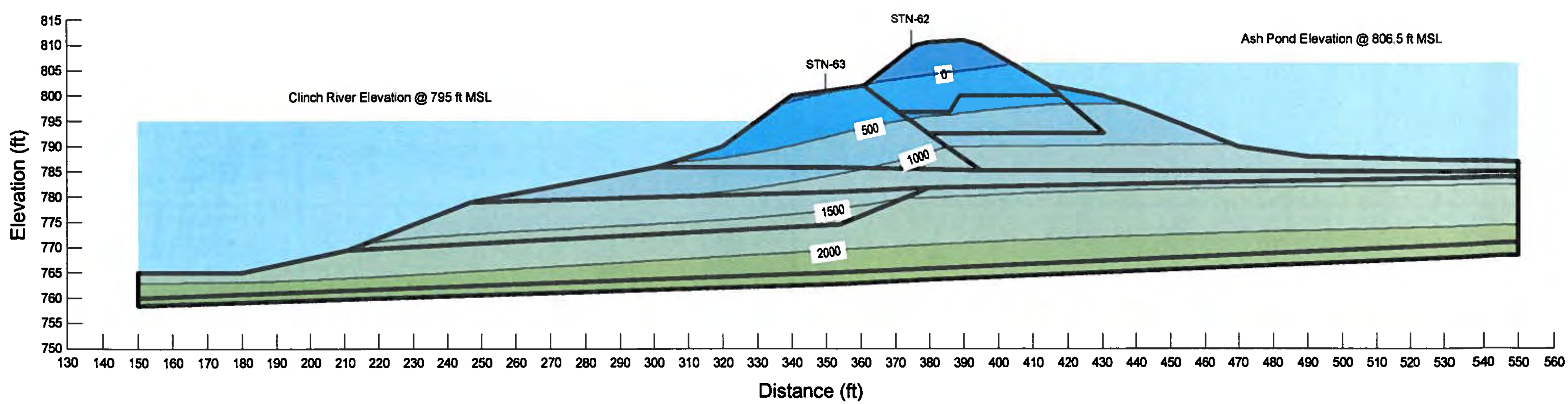
February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' existing conditions.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft   dl = 3.24 ft
i = 0.219   i(criticial) = 1.018
FSpiping = 4.65

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.345e-006	0.02	0.39

Existing Conditions
Pore Water Pressure Contours



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Slope Stability (Entry-Exit)

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

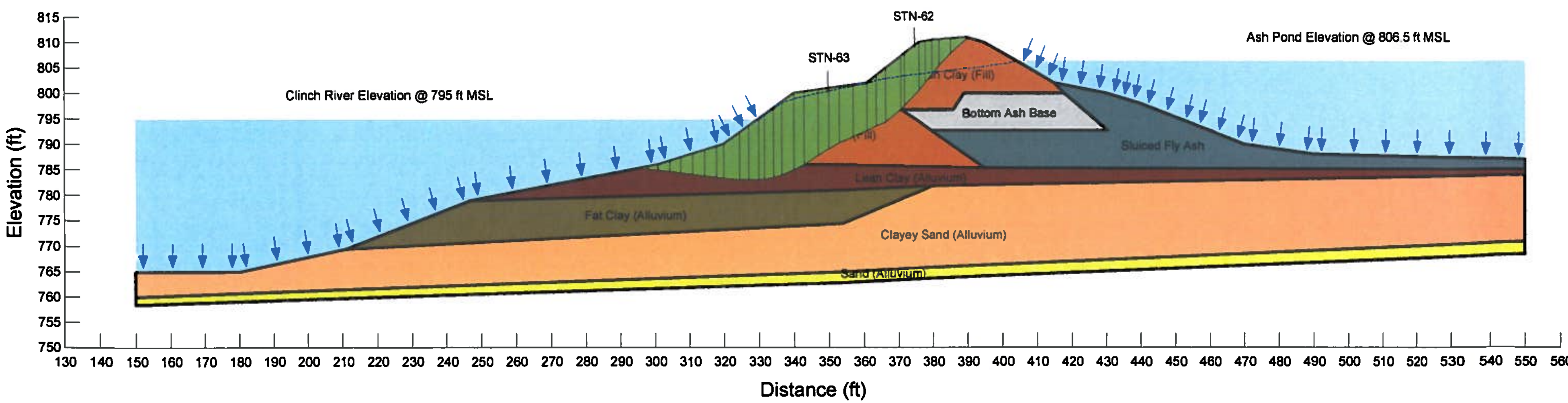
February 2010
Method: Modified Spencer
File Name: Slope W Section O-O' existing conditions (Global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.4
Center: (321.002, 882.058) ft
Radius: 46.03329 ft
Minimum Slip Surface Depth: 15 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Lean Clay (Alluvium)	123	123	0	31
Fat Clay (Alluvium)	117	121	0	30
Clayey Sand (Alluvium)	112	112	0	33
Bottom Ash Base	100	105	0	33
Sand (Alluvium)	120	120	0	33

Existing Conditions
Global Failure



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Slope Stability

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

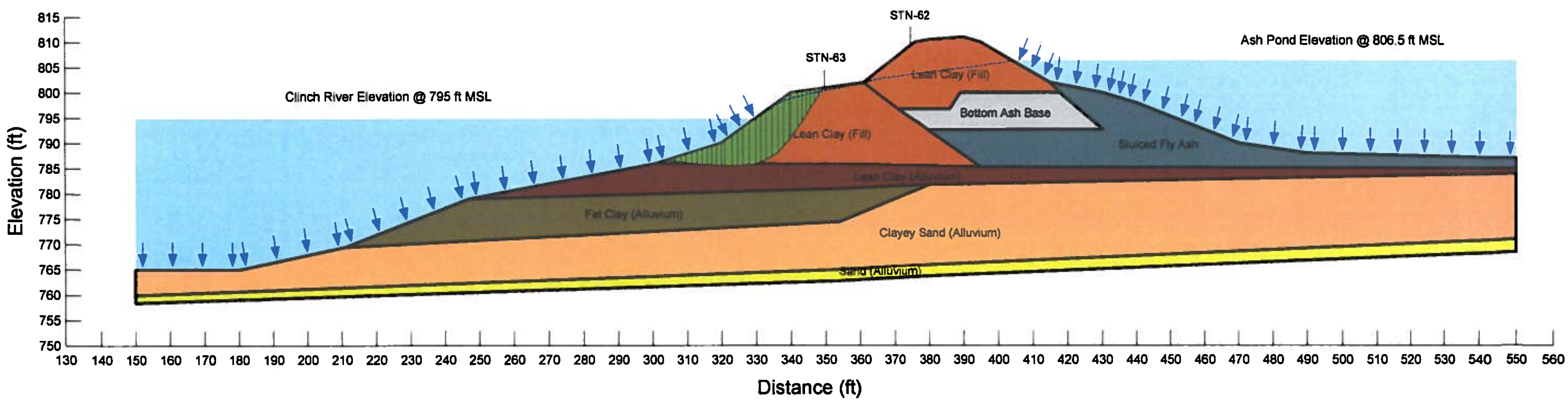
Factor of Safety: 1.1
Center: (321.667, 823.667) ft
Radius: 23.87803 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: Slope W Section O-O' existing conditions.gsz

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Lean Clay (Alluvium)	123	123	0	31
Fat Clay (Alluvium)	117	121	0	30
Clayey Sand (Alluvium)	112	112	0	33
Bottom Ash Base	100	105	0	33
Sand (Alluvium)	120	120	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions
Non-Global Failure



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

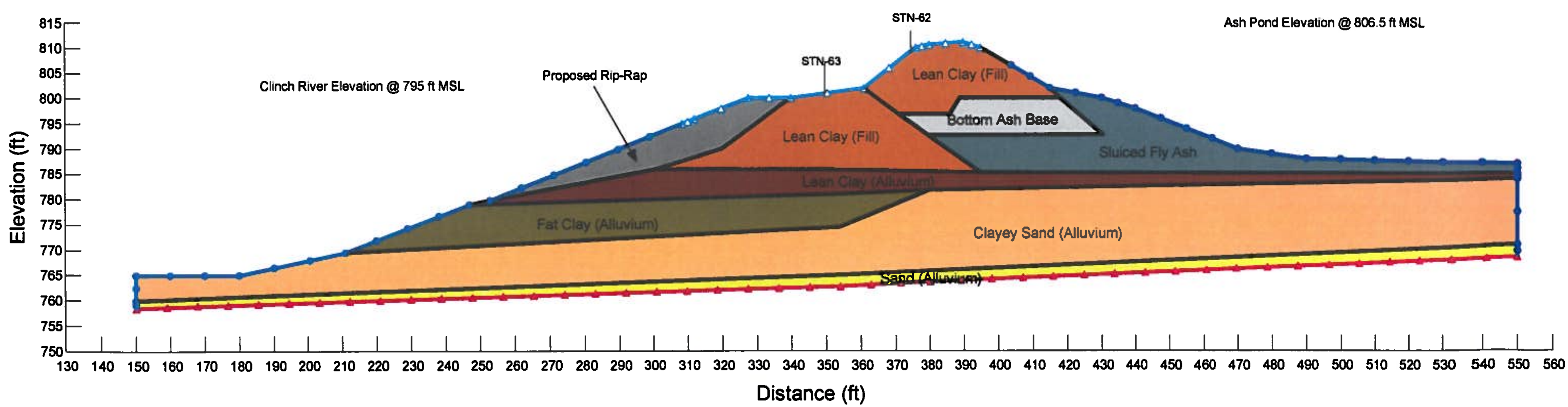
February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' buttress.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft   dl = 3.24 ft
i = 0.219 i(criticial) = 1.018
FSpiping = 4.65

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.35e-006	0.02	0.39
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress
Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' buttress.gsz

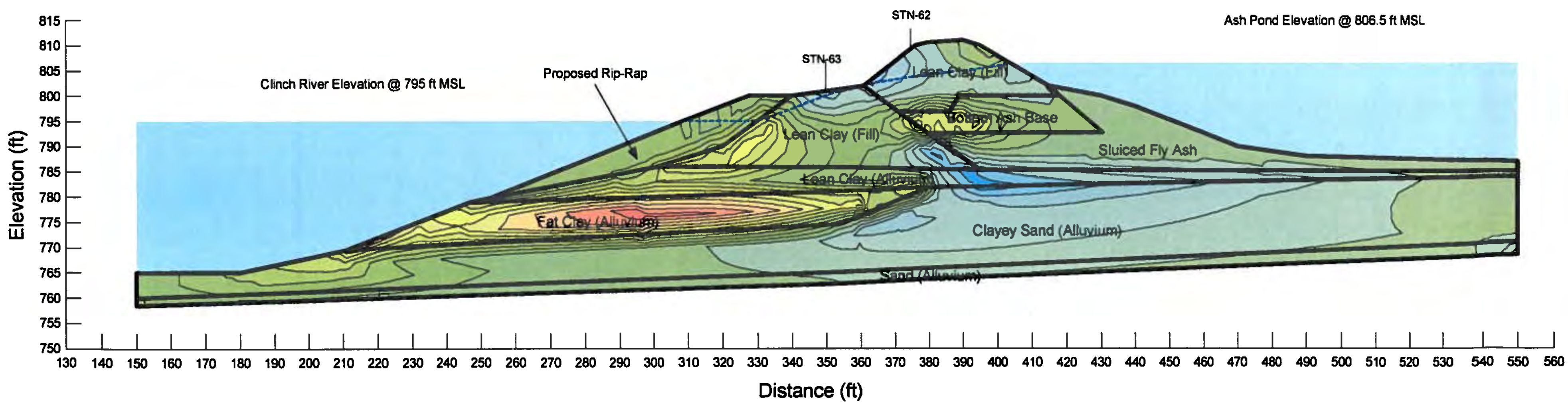
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft   dl = 3.24 ft
i = 0.219 i(criticial) = 1.018
FSpiping = 4.65

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.35e-006	0.02	0.39
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' buttress.gsz

Note:
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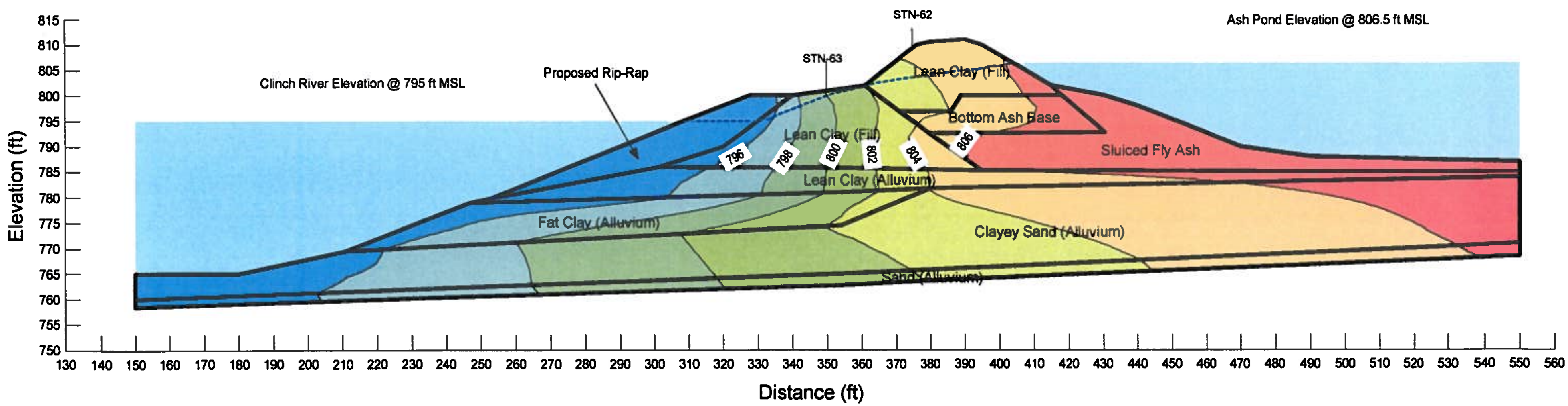
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft dl = 3.24 ft
i = 0.219 i(criticial) = 1.018
FSpiping = 4.65

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.35e-006	0.02	0.39
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress
Total Head Contours



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' buttress.gsz

Note:
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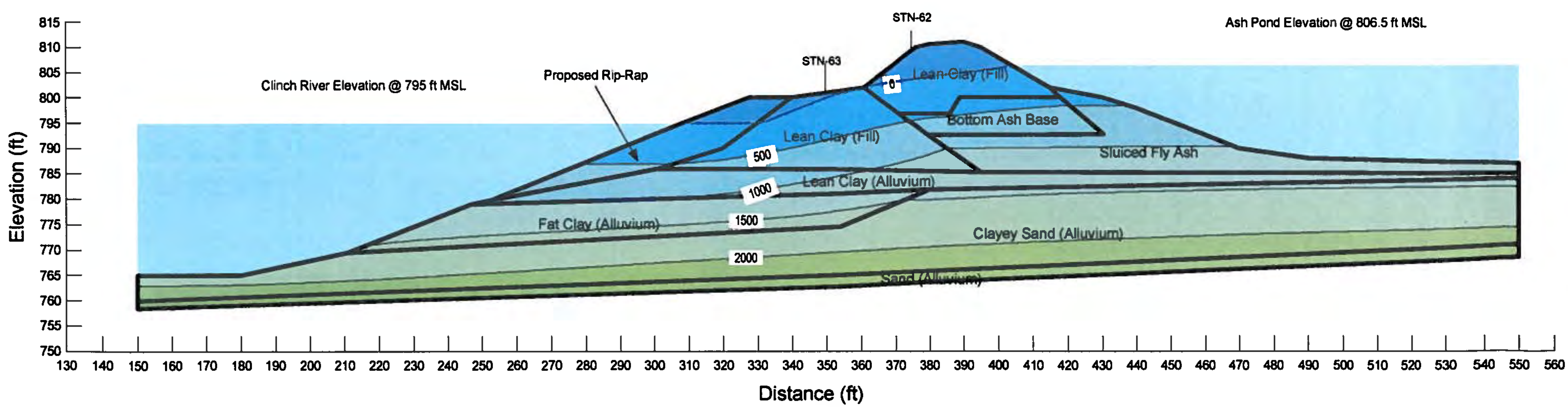
Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.71 ft
dH = 0.71 ft   dl = 3.24 ft
i = 0.219 i(criticial) = 1.018
FSpiping = 4.65

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.35e-006	0.02	0.39
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress
Pore Water Pressure Contours



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Slope Stability

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Slope W Section O-O' buttress.gsz

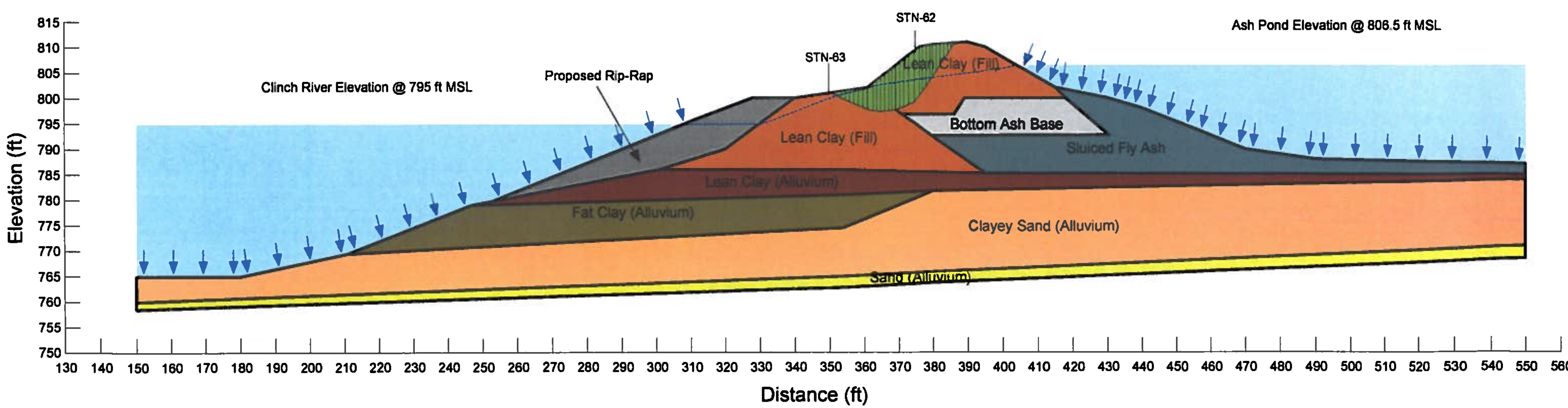
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.8
Center: (365, 821.5) ft
Radius: 18.63288 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Lean Clay (Alluvium)	123	123	0	31
Fat Clay (Alluvium)	117	121	0	30
Clayey Sand (Alluvium)	112	112	0	33
Bottom Ash Base	100	105	0	33
Sand (Alluvium)	120	120	0	33
Rip Rap	115	115	0	40

Proposed Rip-Rap Buttress

Global Failure



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' existing conditions Pool 801.5.gsz

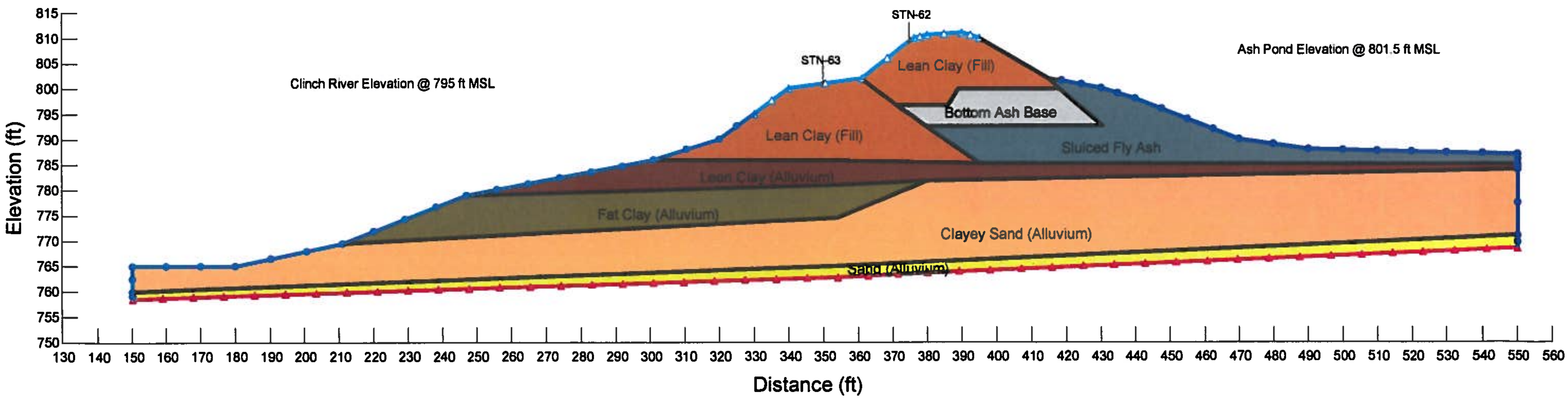
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.4 ft
dH = 0.4 ft   dl = 3.24 ft
i = 0.123   i(criticial) = 1.018
FSpiping = 8.28

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.35e-006	0.02	0.39

Ash Pond Pool Lowered to Elevation 801.5'

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' Ash Pond Pool 801.5 (Global).gsz

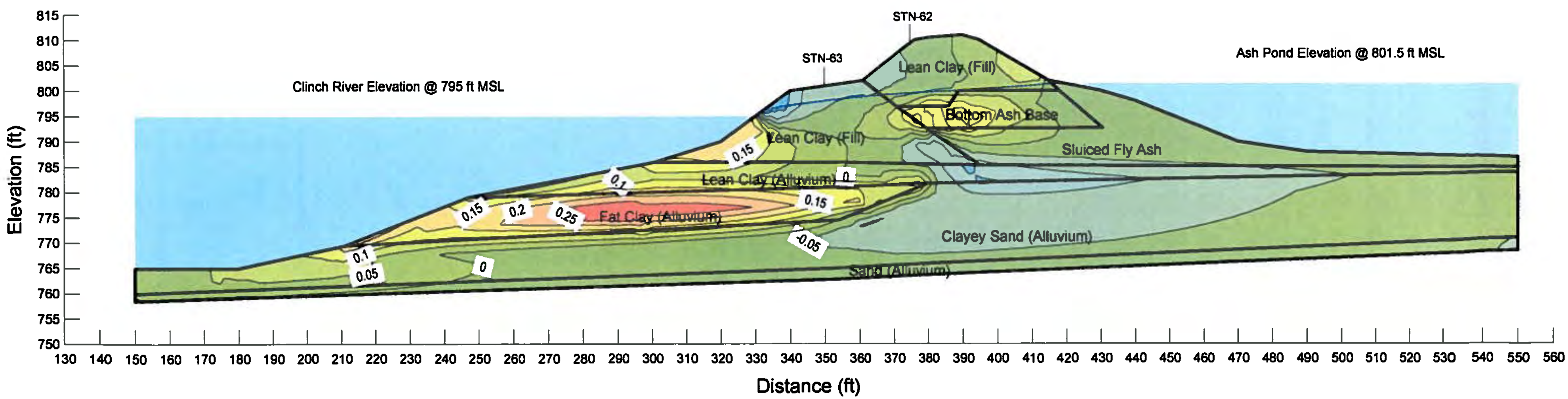
Piping Potential
Maximum Exit Gradient occurs at (214,770.29)
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.4 ft
dH = 0.4 ft dl = 3.24 ft
i = 0.123 i(criticial) = 1.018
FSpiping = 8.3

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Alluvium)	4.6e-007	0.05	0.41
Fat Clay (Alluvium)	3.7e-008	0.05	0.41
Clayey Sand (Alluvium)	1.6e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.3e-006	0.02	0.39

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Pool Lowered to Elevation 801.5'

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' existing conditions Pool 801.5.gsz

Note:
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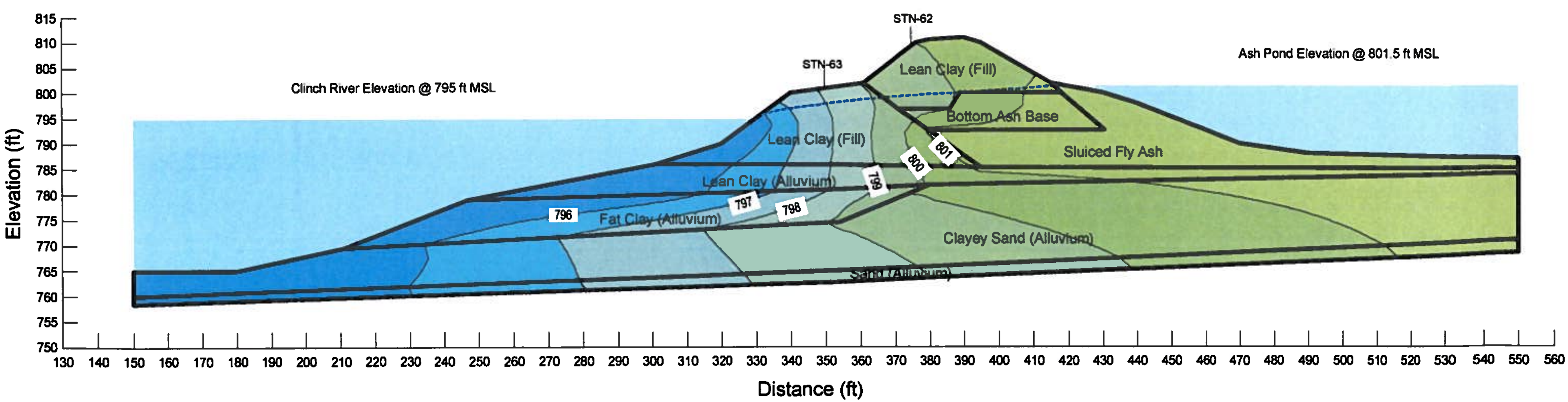
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.4 ft
dH = 0.4 ft   dl = 3.24 ft
i = 0.123   i(criticial) = 1.018
FSpiping = 8.28

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.35e-006	0.02	0.39

Ash Pond Pool Lowered to Elevation 801.5'

Total Head Contours



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SEEP/W Analysis

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section O-O' existing conditions Pool 801.5.gsz

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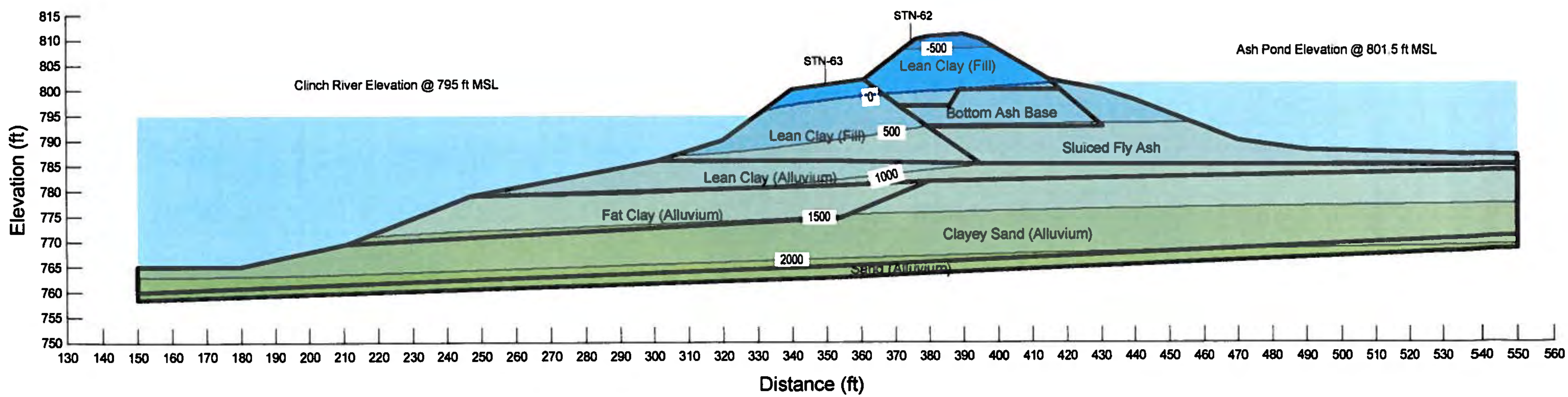
Total Head = 795 ft
At (213.74,767.05)
Total Head = 795.4 ft
dH = 0.4 ft dl = 3.24 ft
i = 0.123 i(criticial) = 1.018
FSpiping = 8.28

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sluiced Fly Ash	1.607e-005	0.02	0.46
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Fat Clay (Alluvium)	3.674e-008	0.05	0.41
Clayey Sand (Alluvium)	1.64e-006	0.02	0.39
Bottom Ash Base	6.5e-008	0.04	0.46
Sand (Alluvium)	5.35e-006	0.02	0.39

Ash Pond Pool Lowered to Elevation 801.5'

Pore Water Pressure Contours



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Slope Stability (Entry-Exit)

Cross-Section O-O'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Slope W Section O-O' Ash Pond Pool 801.5 (Global).gsz

Note:
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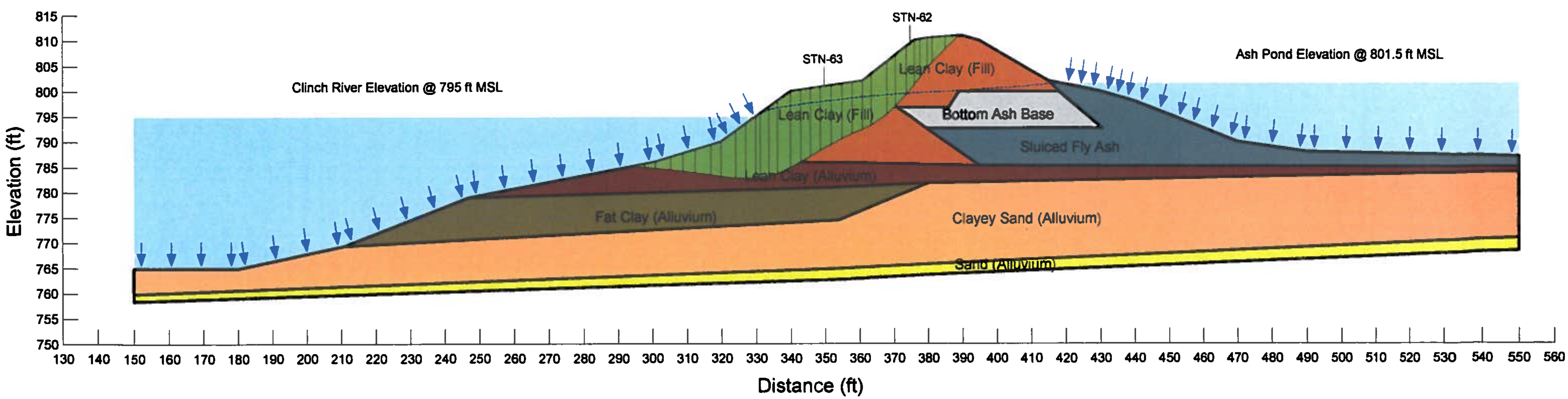
Factor of Safety: 1.6
Center: (319.858, 881.623) ft
Radius: 45.778 ft
Minimum Slip Surface Depth: 15 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Lean Clay (Alluvium)	123	123	0	31
Fat Clay (Alluvium)	117	121	0	30
Clayey Sand (Alluvium)	112	112	0	33
Bottom Ash Base	100	105	0	33
Sand (Alluvium)	120	120	0	33

Ash Pond Pool Lowered to Elevation 801.5'
Global Failure



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 796.09 ft
dH = 1.09 ft dl = 3.49 ft
i = 0.312 i(criticial) = 1
FSpiping = 3.2

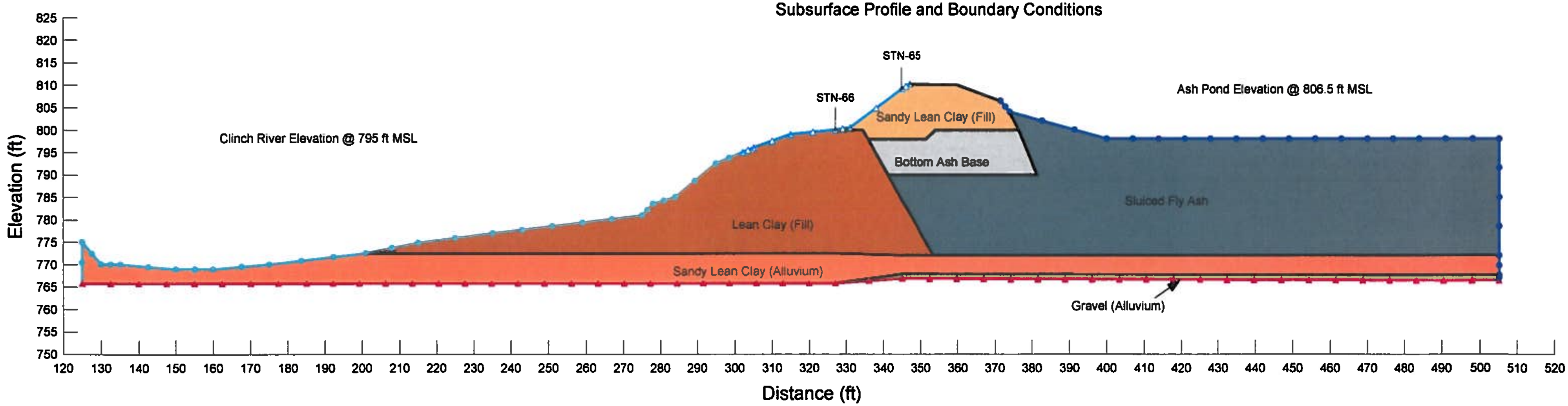
February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' existing conditions (Non-global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Gravel (Alluvium)	5.3e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 796.09 ft
dH = 1.09 ft dl = 3.49 ft
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February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' existing conditions (Non-global).gsz

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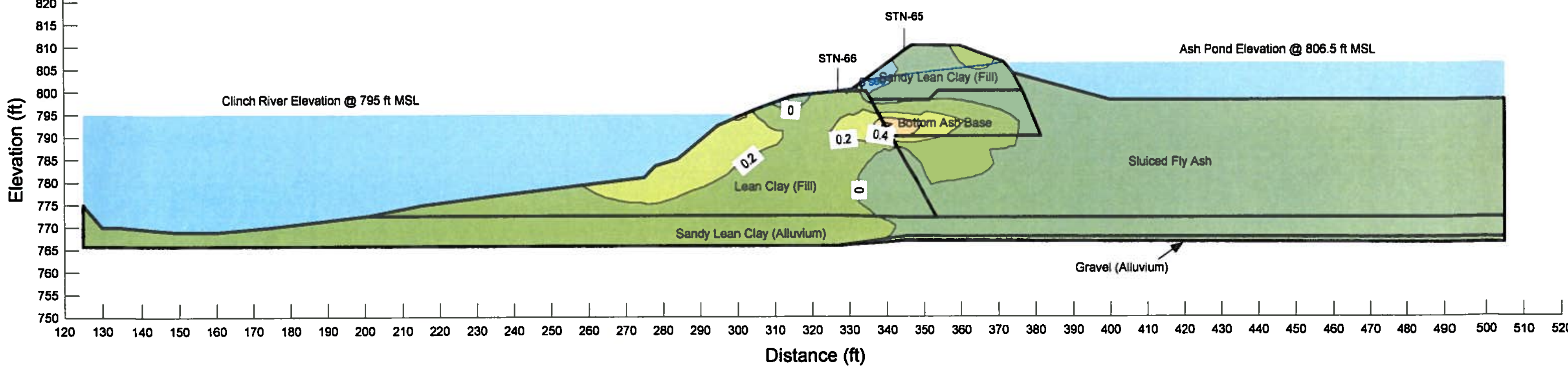
Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Gravel (Alluvium)	5.3e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' existing conditions (Non-global).gsz

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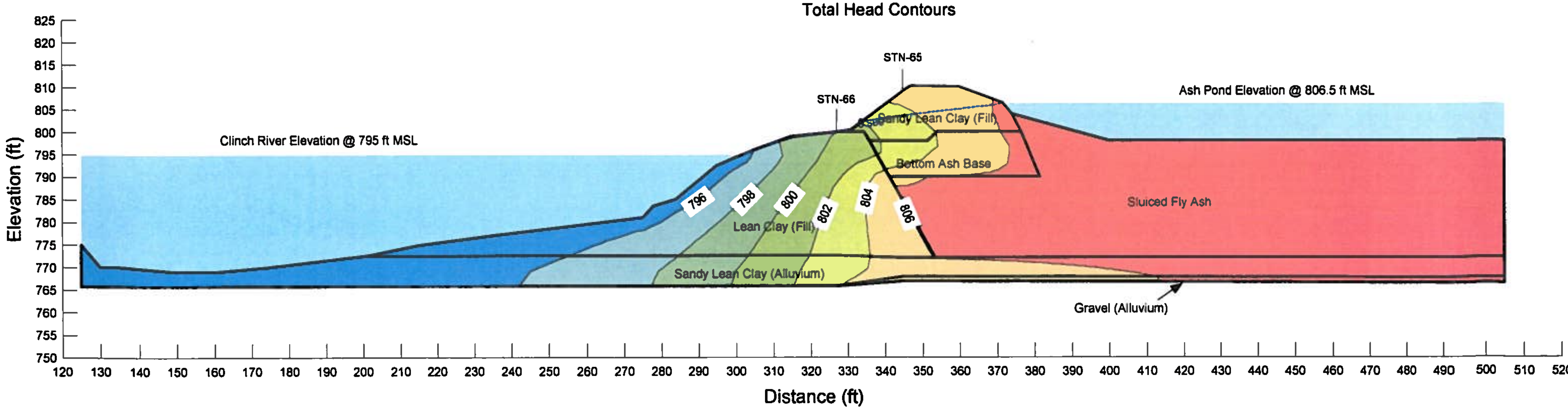
Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 796.09 ft
dH = 1.09 ft   dl = 3.49 ft
i = 0.312   i(criticial) = 1
FSpiping = 3.2

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Gravel (Alluvium)	5.3e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Total Head Contours



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 796.09 ft
dH = 1.09 ft   dl = 3.49 ft
i = 0.312   i(criticial) = 1
FSpiping = 3.2

February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' existing conditions (Non-global).gsz

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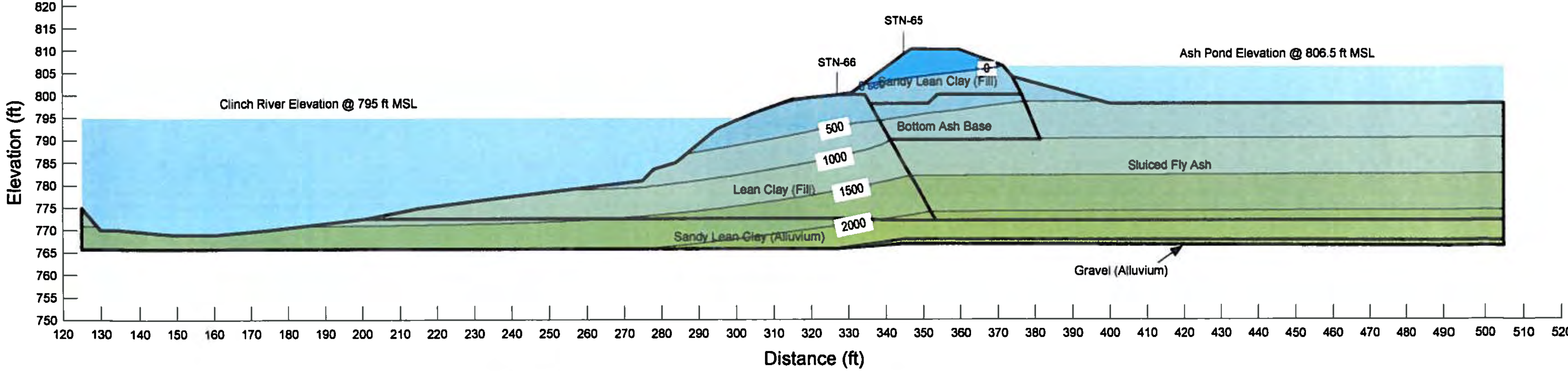
Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Gravel (Alluvium)	5.3e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Existing Conditions

Pore Water Pressure Contours



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Slope Stability

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

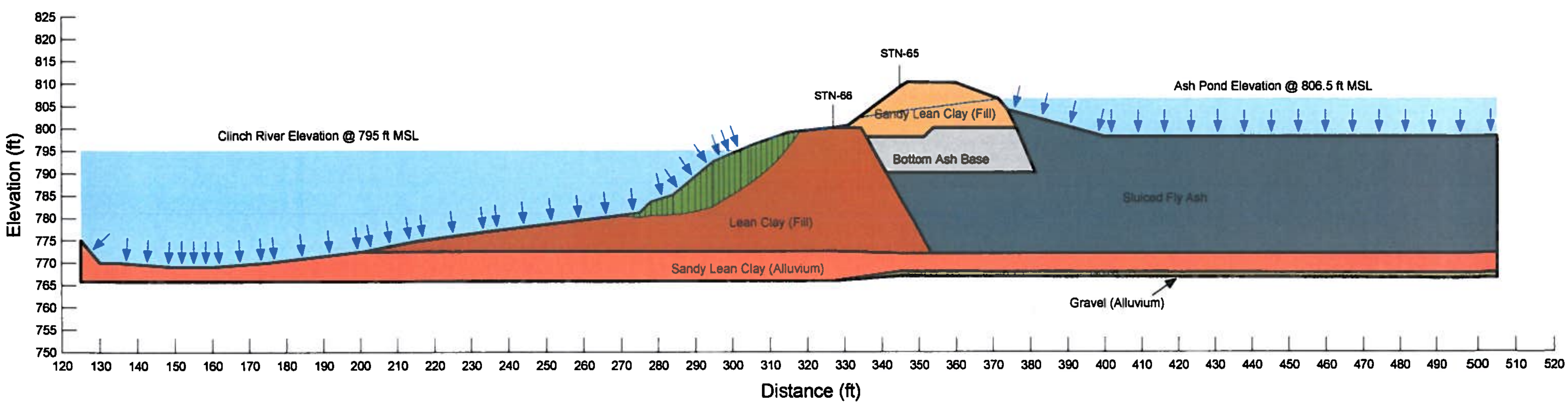
Factor of Safety: 1.0
Center: (280, 828) ft
Radius: 27.92882 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: Slope W Section R-R' existing conditions (Non-global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sandy Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Alluvium)	126	127	0	33
Gravel (Alluvium)	135	135	0	40
Bottom Ash Base	100	105	0	33

Existing Conditions
Non-Global Failure



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Slope Stability

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

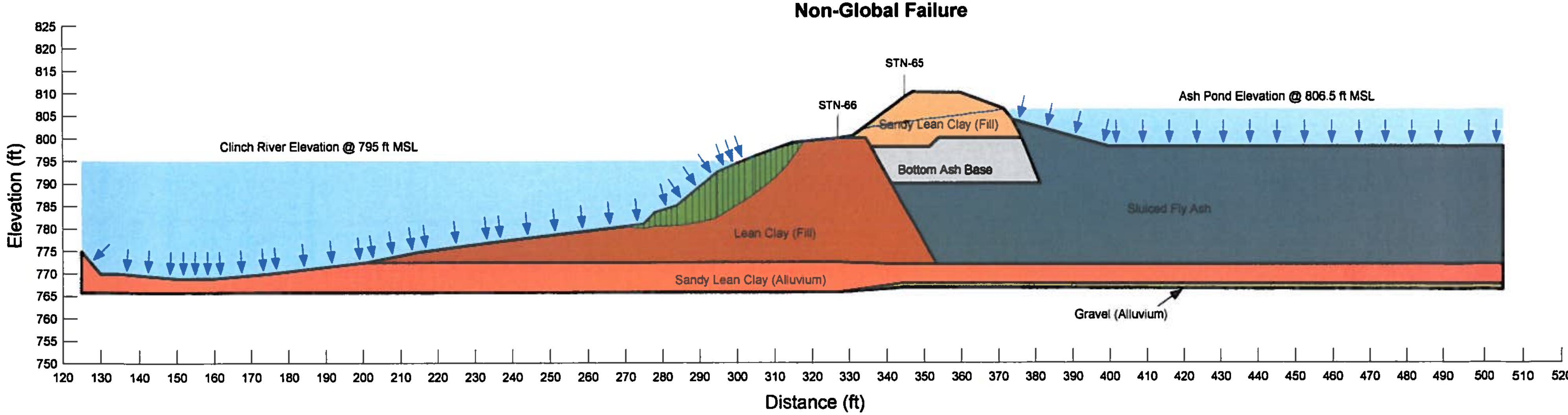
Factor of Safety: 1.0
Center: (280, 828) ft
Radius: 27.92882 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: Slope W Section R-R' existing conditions (Non-global).gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sandy Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Alluvium)	126	127	0	33
Gravel (Alluvium)	135	135	0	40
Bottom Ash Base	100	105	0	33

Existing Conditions
Non-Global Failure



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

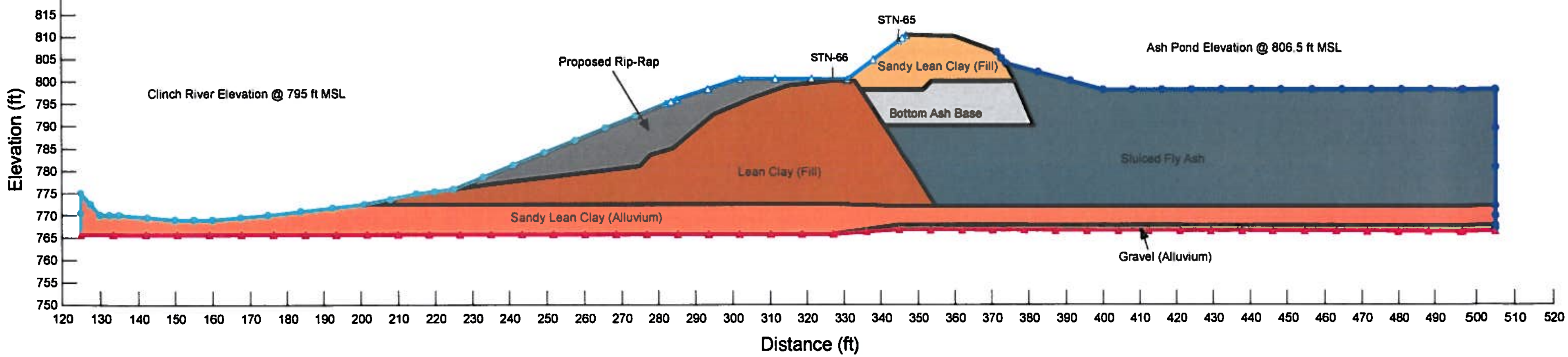
February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' buttress.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (221.62,775.53)
Total Head = 795 ft
At (222,772.5)
Total Head = 795.17 ft
dH = 0.17 ft   dl = 3.03 ft
i = 0.056   i(criticial) = 1
FSpiping = 17.86

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.297e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Rip Rap	0.01	1	0.4
Bottom Ash Base	6.5e-008	0.04	0.46

Proposed Rip-Rap Buttress
Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' buttress.gsz

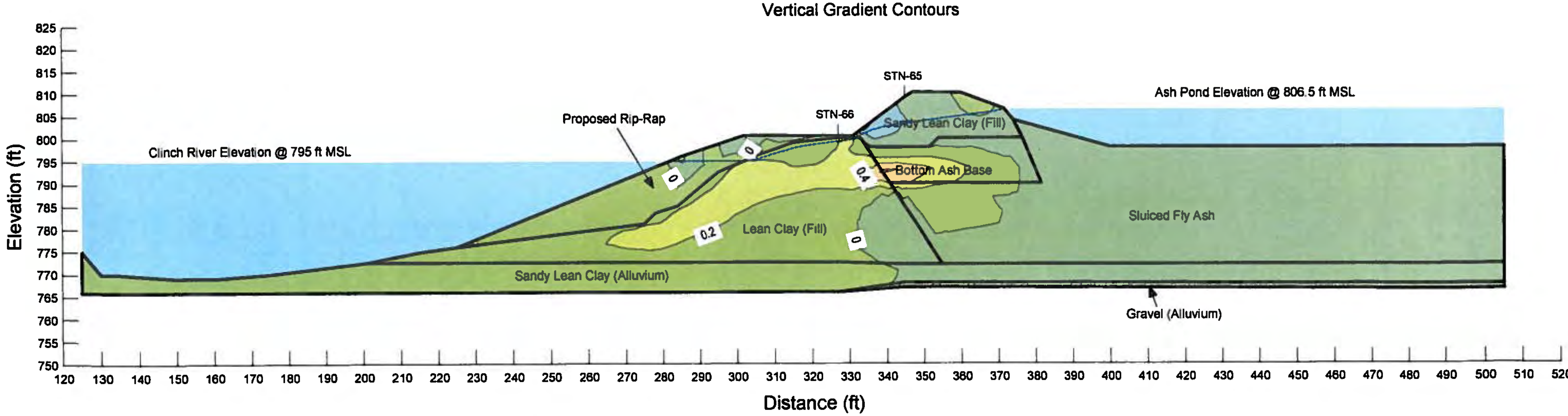
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (221.62,775.53)
Total Head = 795 ft
At (222,772.5)
Total Head = 795.17 ft
dH = 0.17 ft dl = 3.03 ft
i = 0.056 i(criticial) = 1
FSpiping = 17.9

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Gravel (Alluvium)	5.3e-006	0.02	0.23
Rip Rap	0.01	1	0.4
Bottom Ash Base	6.5e-008	0.04	0.46

Proposed Rip-Rap Buttress

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' buttress.gsz

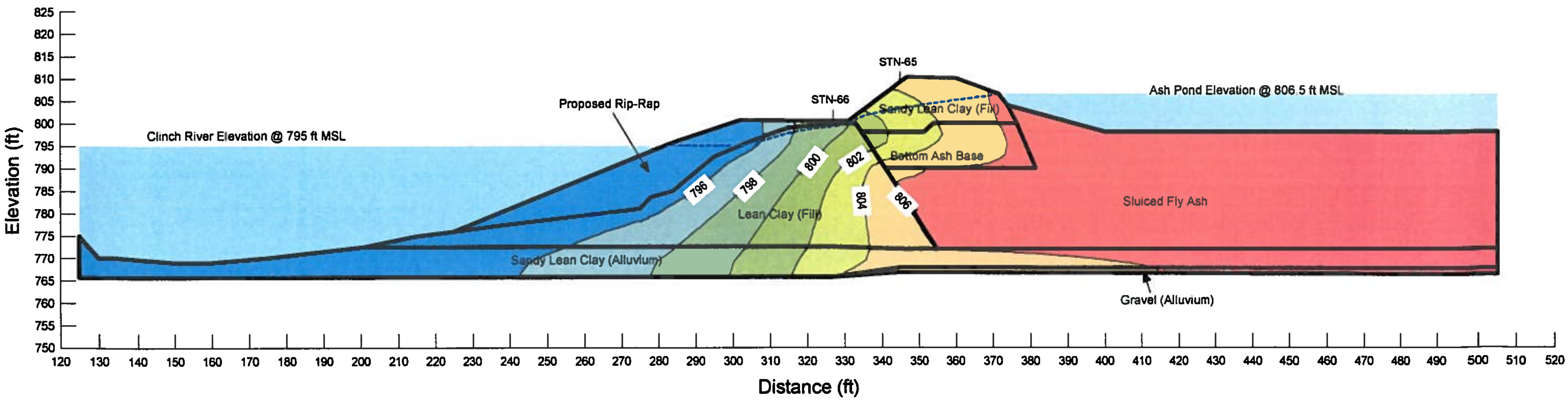
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Maximum Exit Gradient occurs at (221.62,775.53)
Total Head = 795 ft
At (222,772.5)
Total Head = 795.17 ft
dH = 0.17 ft dl = 3.03 ft
i = 0.056 i(criticial) = 1
FSpiping = 17.86

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.297e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Rip Rap	0.01	1	0.4
Bottom Ash Base	6.5e-008	0.04	0.46

Proposed Rip-Rap Buttress

Total Head Contours



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' buttress.gsz

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

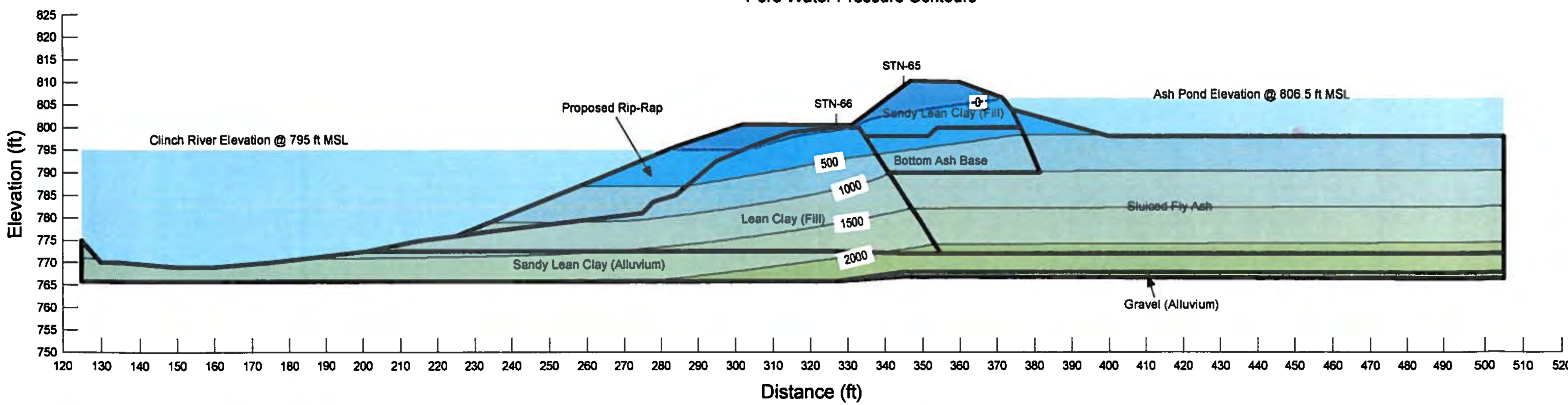
Piping Potential

Maximum Exit Gradient occurs at (221.62,775.53)
Total Head = 795 ft
At (222,772.5)
Total Head = 795.17 ft
dH = 0.17 ft dl = 3.03 ft
i = 0.056 i(criticial) = 1
FSpiping = 17.86

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.297e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Rip Rap	0.01	1	0.4
Bottom Ash Base	6.5e-008	0.04	0.46

Proposed Rip-Rap Buttress

Pore Water Pressure Contours



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Slope Stability

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Factor of Safety: 1.7
Center: (335, 821.5) ft
Radius: 17.56185 ft
Minimum Slip Surface Depth: 10 ft

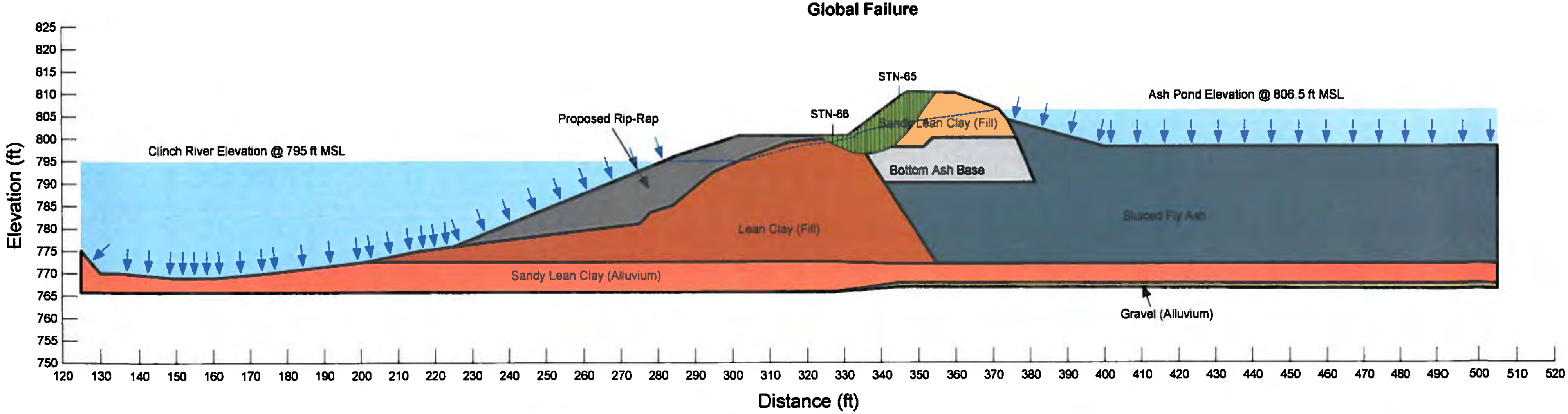
February 2010
Method: Modified Spencer
File Name: Slope W Section R-R' buttress.gsz

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sandy Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Alluvium)	126	127	0	33
Gravel (Alluvium)	135	135	0	40
Rip Rap	115	115	0	40
Bottom Ash Base	100	105	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Rip-Rap Buttress

Global Failure



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 795.66 ft
dH = 0.66 ft dl = 3.49 ft
i = 0.189 i(criticial) = 1
FSpiping = 5.29

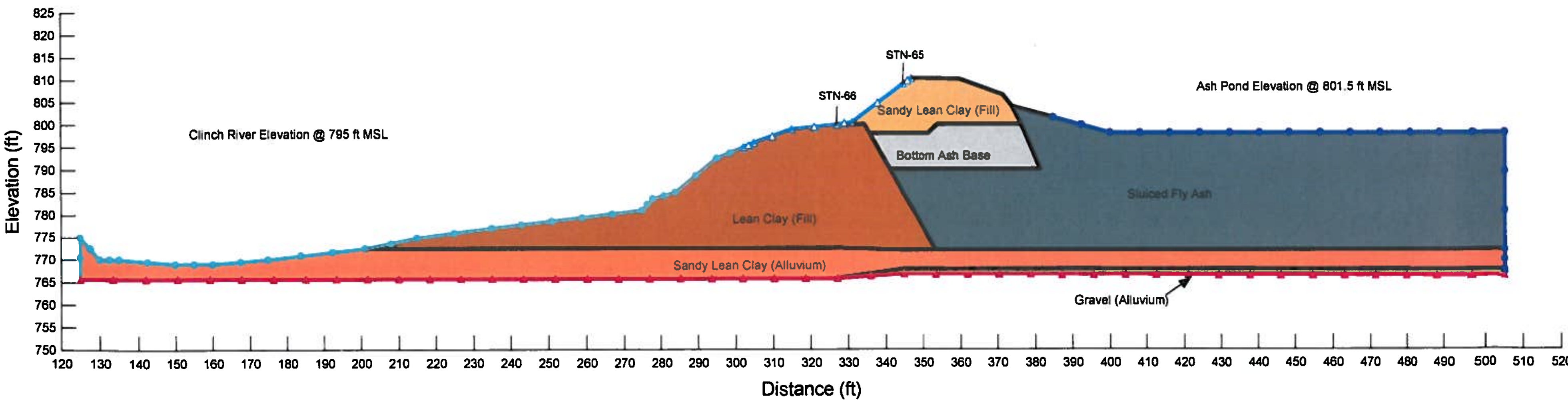
February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' existing conditions Pool 801.5'.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.297e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Pool Lowered to Elevation 801.5'

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 795.66 ft
dH = 0.66 ft dl = 3.49 ft
i = 0.189 i(criticial) = 1
FSpiping = 5.3

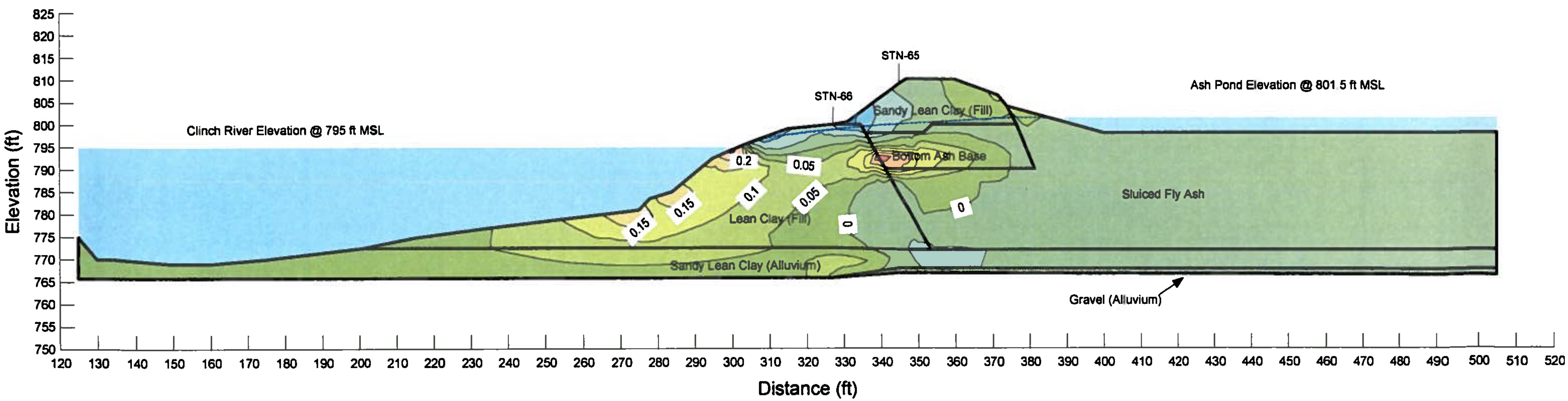
February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' Ash Pond Pool 801.5'.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.3e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.8e-007	0.1	0.38
Sluiced Fly Ash	1.6e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.8e-007	0.05	0.38
Gravel (Alluvium)	5.3e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Pool Lowered to Elevation 801.5'

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 795.66 ft
dH = 0.66 ft dl = 3.49 ft
i = 0.189 i(criticial) = 1
FSpiping = 5.29

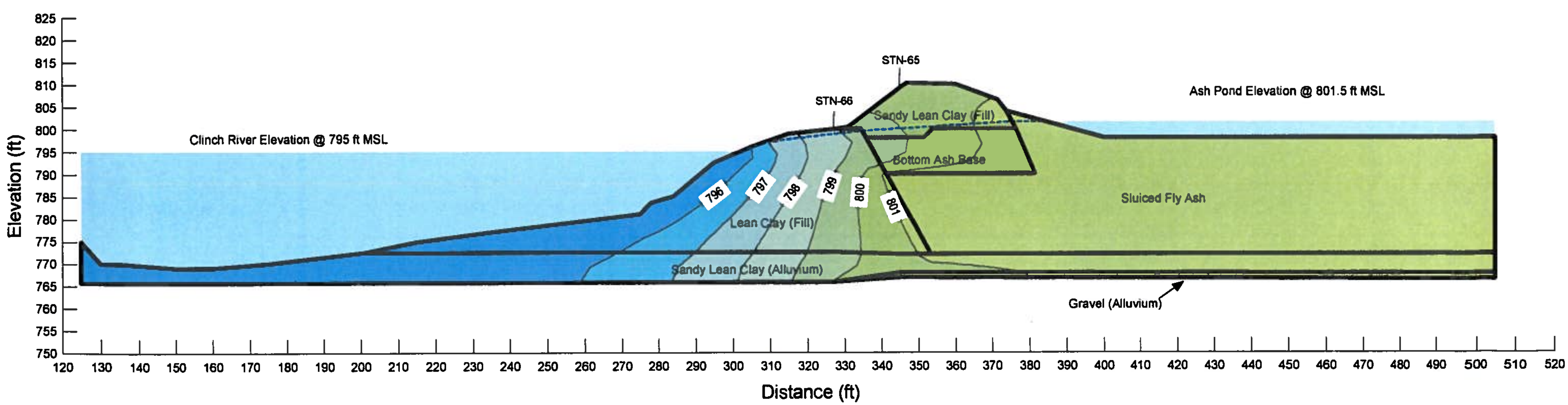
February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' existing conditions Pool 801.5'.gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.297e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Pool Lowered to Elevation 801.5'

Total Head Contours



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SEEP/W Analysis

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section R-R' existing conditions Pool 801.5'.gsz

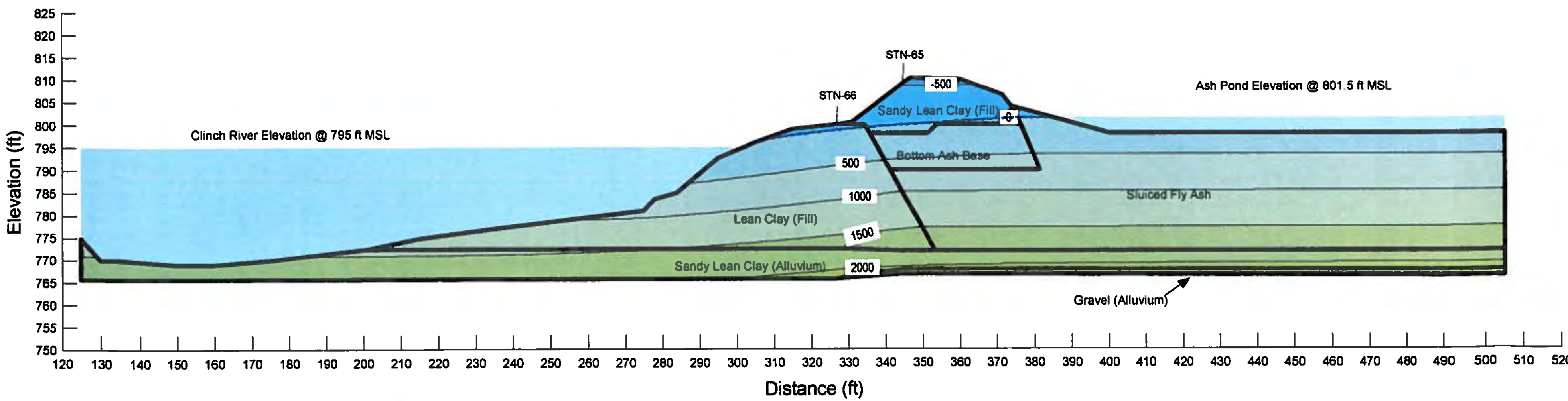
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (299.76,794.17)
Total Head = 795 ft
At (298.51,790.68)
Total Head = 795.66 ft
dH = 0.66 ft dl = 3.49 ft
i = 0.189 i(criticial) = 1
FSpiping = 5.29

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Lean Clay (Fill)	2.297e-007	0.1	0.41
Sandy Lean Clay (Fill)	2.7887e-007	0.1	0.38
Sluiced Fly Ash	1.6076e-005	0.02	0.46
Sandy Lean Clay (Alluvium)	2.7887e-007	0.05	0.38
Gravel (Alluvium)	5.3477e-006	0.02	0.23
Bottom Ash Base	6.5e-008	0.04	0.46

Ash Pond Pool Lowered to Elevation 801.5'

Pore Water Pressure Contours



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Slope Stability dMin=20

Cross-Section R-R'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Slope W Section R-R' Ash Pond Pool 801.5'.gsz

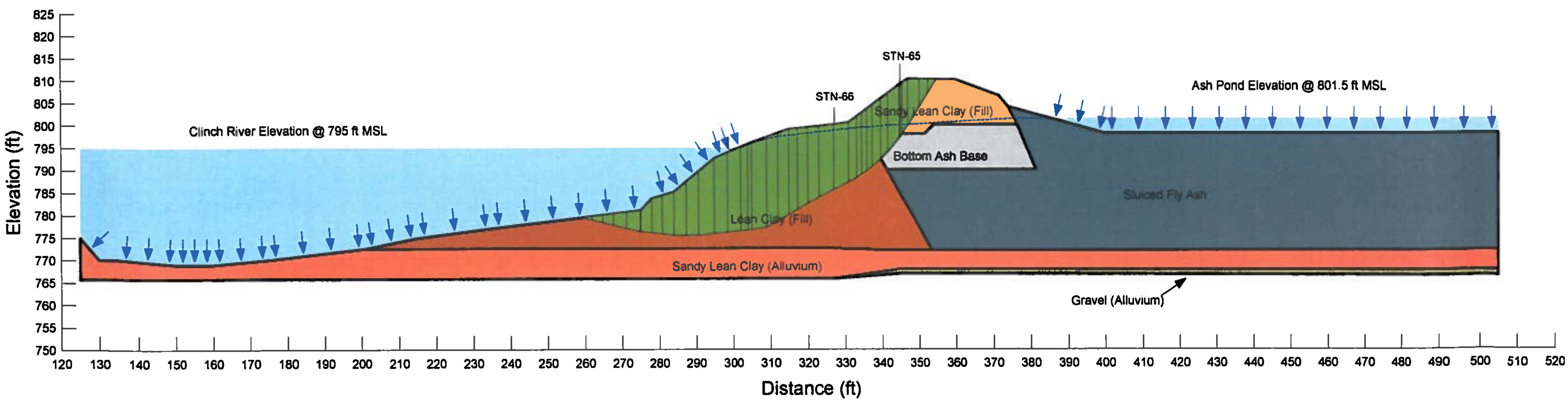
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.5
Center: (290, 855) ft
Radius: 50.76405 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill)	125	126	0	33
Sandy Lean Clay (Fill)	125	126	0	33
Sluiced Fly Ash	100	105	0	25
Sandy Lean Clay (Alluvium)	126	127	0	33
Gravel (Alluvium)	135	135	0	40
Bottom Ash Base	100	105	0	33

Ash Pond Pool Lowered to Elevation 801.5'

Global Failure



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (313.17,793)
Total Head = 795 ft
At (316.37,789.16)
Total Head = 796.63ft
dH = 1.63 ft dl = 3.84 ft
i = 0.424 i(criticial) = 1
FSpiping = 2.4

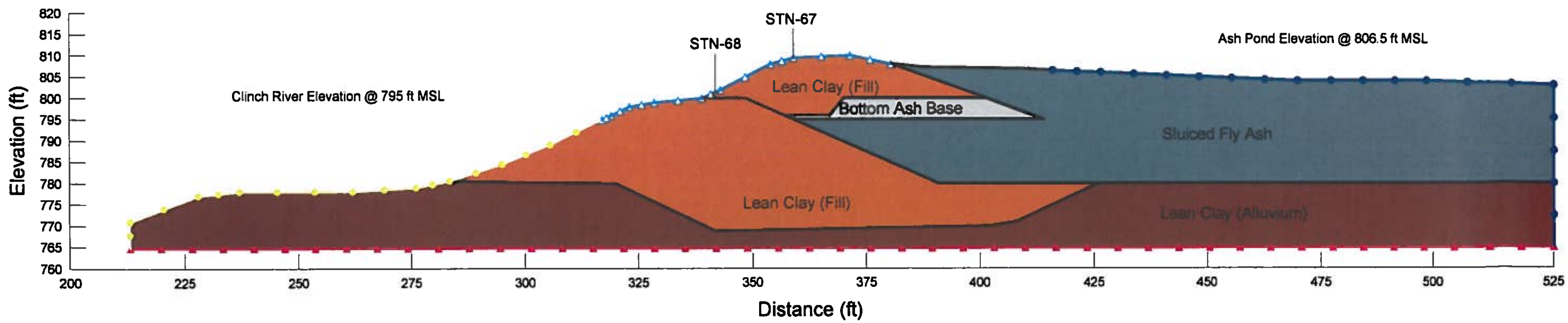
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' existing conditions (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (313.17,793)
Total Head = 795 ft
At (316.37,789.16)
Total Head = 796.63ft
dH = 1.63 ft dl = 3.84 ft
i = 0.424 i(criticial) = 1
FSpiping = 2.4

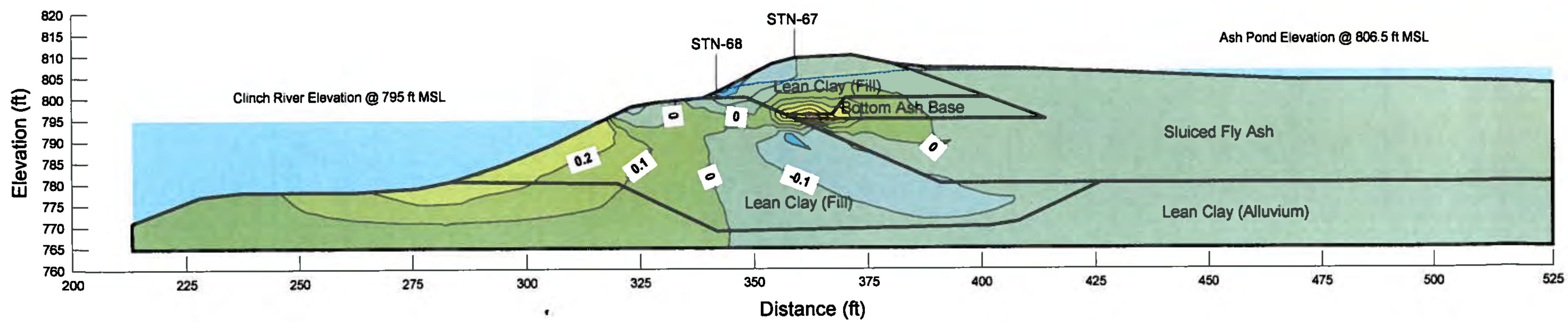
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' existing conditions (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (313.17,793)
Total Head = 795 ft
At (316.37,789.16)
Total Head = 796.63ft
dH = 1.63 ft dl = 3.84 ft
i = 0.424 i(criticial) = 1
FSpiping = 2.4

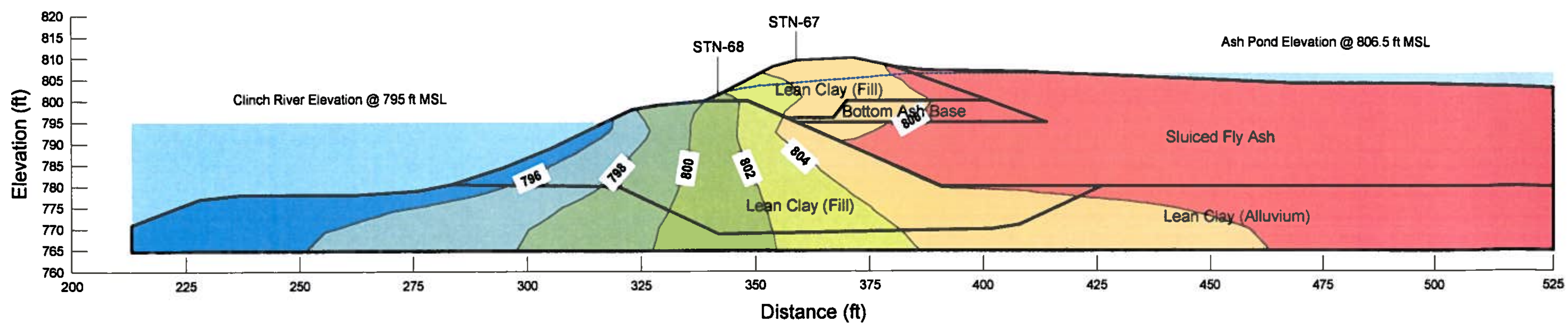
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' existing conditions (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Total Head Contours



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (313.17,793)
Total Head = 795 ft
At (316.37,789.16)
Total Head = 796.63ft
dH = 1.63 ft dl = 3.84 ft
i = 0.424 i(criticial) = 1
FSpiping = 2.4

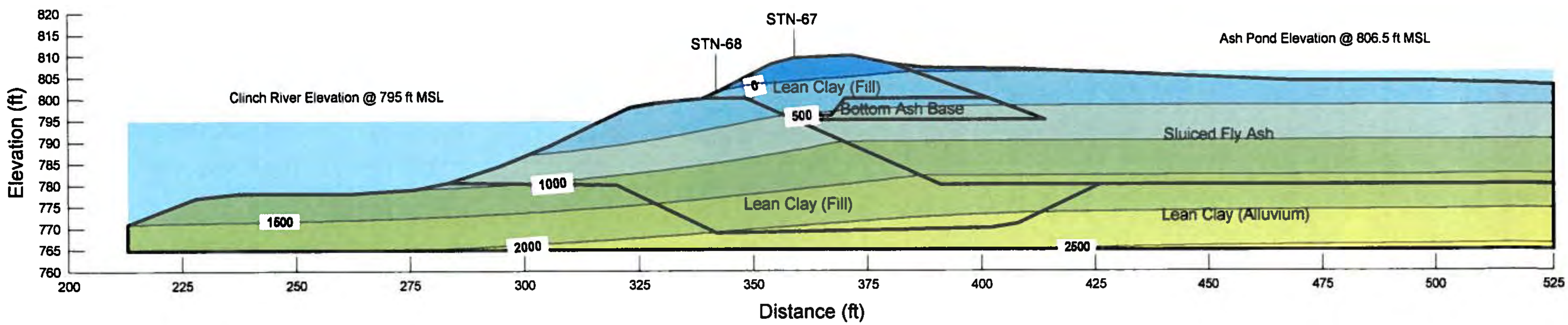
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' existing conditions (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions

Pore Water Pressure Contours



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Slope Stability (Entry-Exit)

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

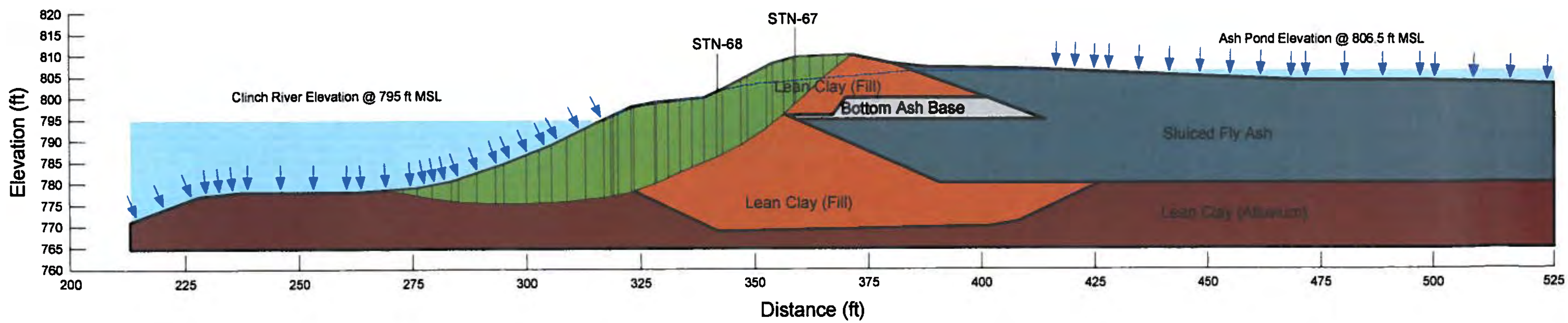
Factor of Safety: 1.2
Center: (296.129, 871.931) ft
Radius: 52.70431 ft
Minimum Slip Surface Depth: 20 ft

February 2010
Method: Modified Spencer
File Name: Slope W Section S-S' existing conditions (Global).gsz

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions
Global Failure



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Slope Stability

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

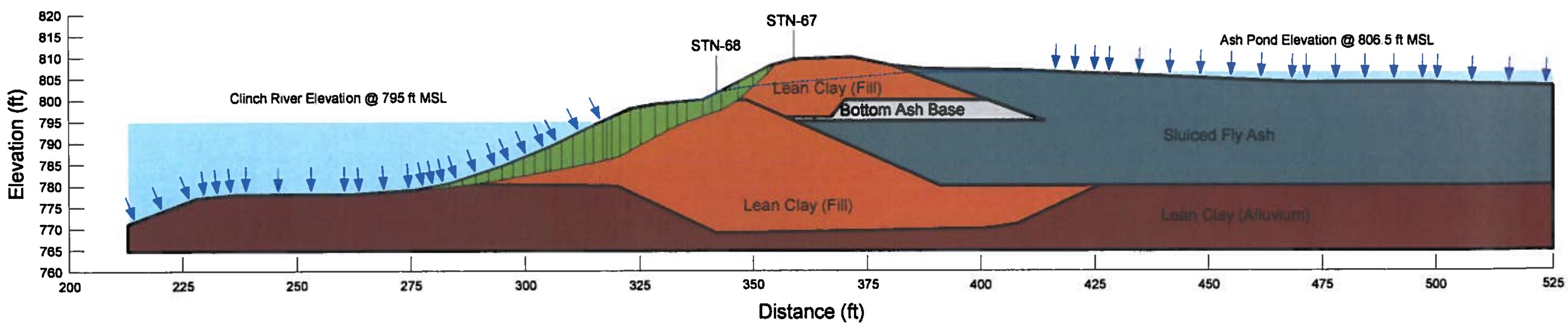
Factor of Safety: 1.1
Center: (281, 889.75) ft
Radius: 42.5393 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: Slope W Section S-S' existing conditions (Non-global).gsz

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Conditions
Non-Global Failure



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' buttress.gsz

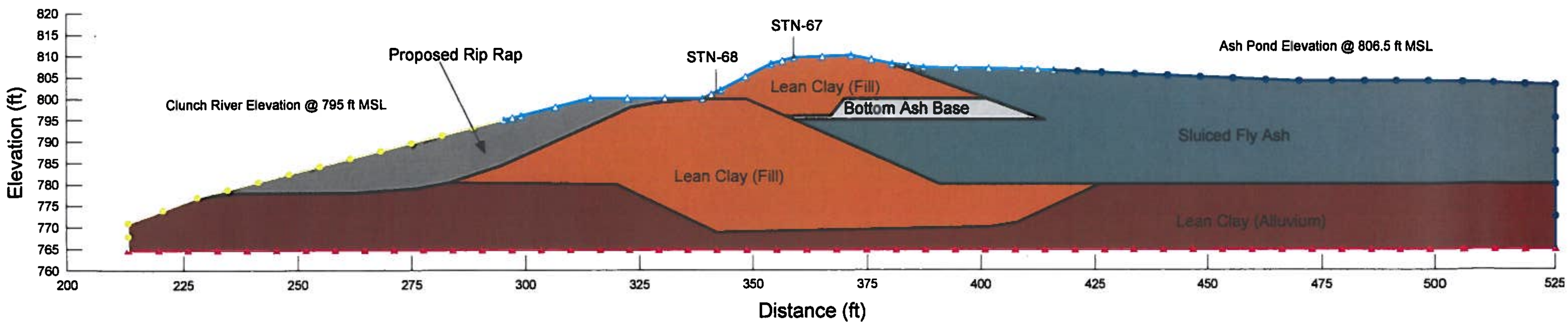
Piping Potential
Maximum Exit Gradient occurs at (213,771)
Total Head = 795 ft
At (213,764.8)
Total Head = 795.51 ft
dH = 0.51 ft dl = 6.2 ft
i = 0.082 i(criticial) = 1
FSpiping = 12.2

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Rip-Rap Buttress

Subsurface Profile and Boundary Conditions



SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' buttress.gsz

Piping Potential
Maximum Exit Gradient occurs at (213,771)
Total Head = 795 ft
At (213,764.8)
Total Head = 795.51 ft
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Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
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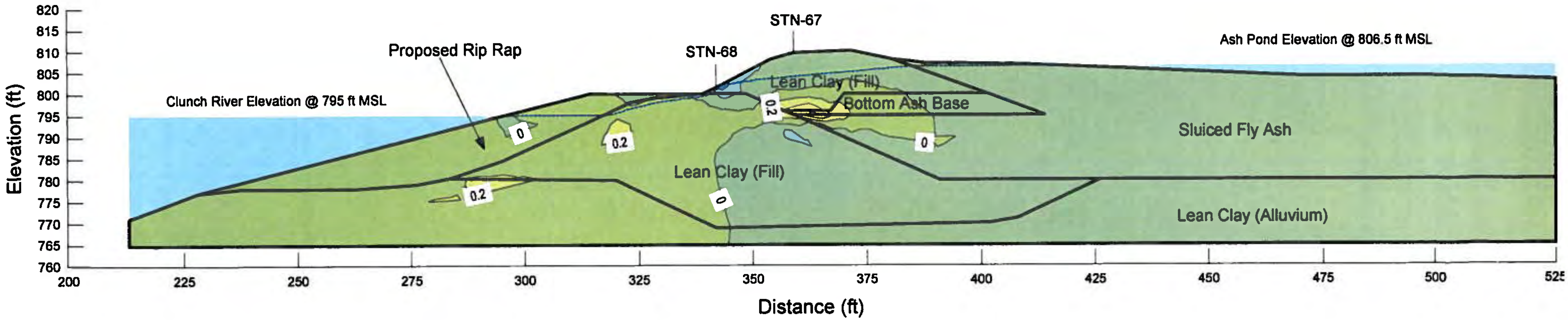
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Rip-Rap Buttress

Vertical Gradient Contours



SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' buttress.gsz

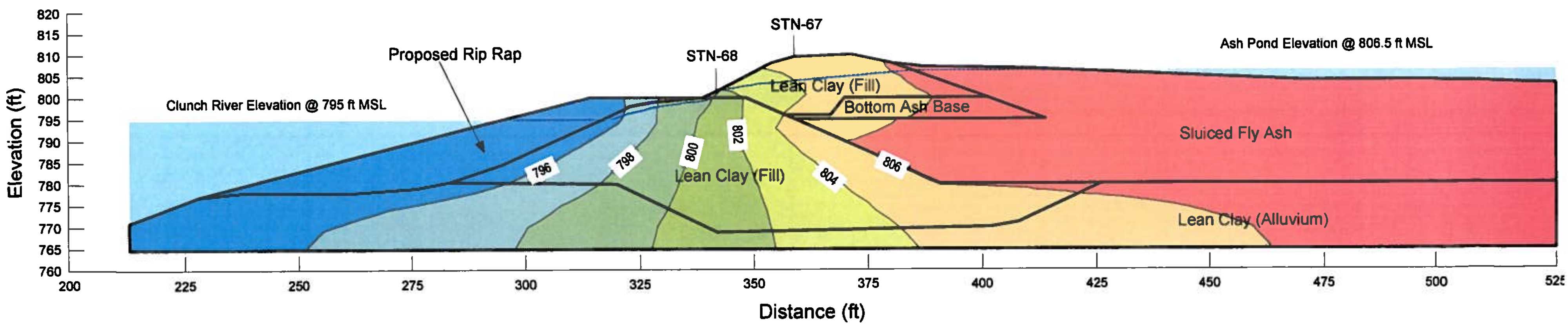
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (213,771)
Total Head = 795 ft
At (213,764.8)
Total Head = 795.51 ft
dH = 0.51 ft dl = 6.2 ft
i = 0.082 i(criticial) = 1
FSpiping = 12.2

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Proposed Rip-Rap Buttress

Total Head Contours



SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' buttress.gsz

Piping Potential
Maximum Exit Gradient occurs at (213,771)
Total Head = 795 ft
At (213,764.8)
Total Head = 795.51 ft
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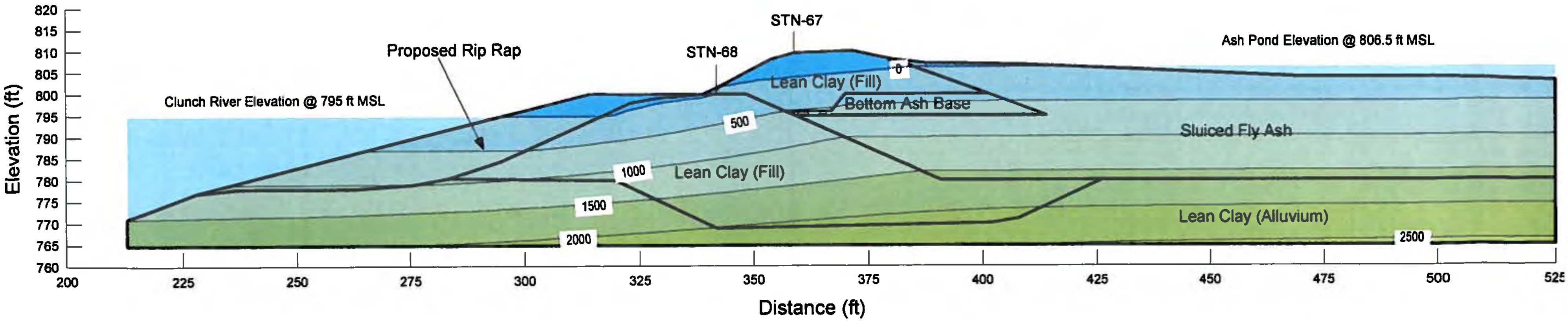
FSpiping = 12.2

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Rip-Rap Buttress

Pore Water Pressure Contours



Slope Stability

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

January 2010
Method: Modified Spencer
File Name: Slope W Section S-S' buttress.gsz

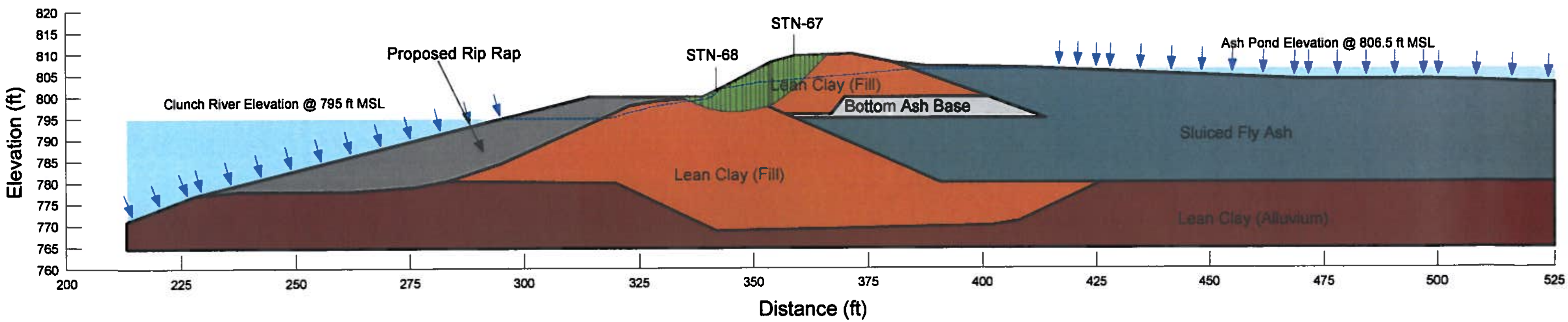
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.7
Center: (347.725, 816.64) ft
Radius: 17.38605 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33
Rip Rap	115	115	0	40

Proposed Rip-Rap Buttress

Global Failure



SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (313.17,793)
Total Head = 795 ft
At (316.37,789.16)
Total Head = 795.97 ft
dH = 0.97 ft dl = 3.84 ft
i = 0.253 i(criticial) = 1
FSpiping = 4.0

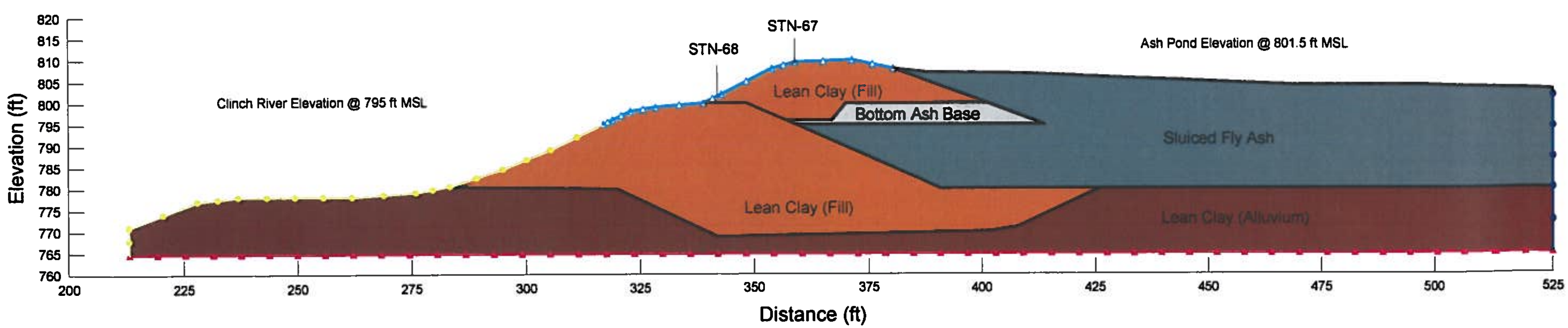
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' Ash Pond Pool 801.5' (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Water Level Lowered to Elevation 801.5'

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (313.17,793)
Total Head = 795 ft
At (316.37,789.16)
Total Head = 795.97 ft
dH = 0.97 ft dl = 3.84 ft
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FSpiping = 4.0

February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' Ash Pond Pool 801.5' (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
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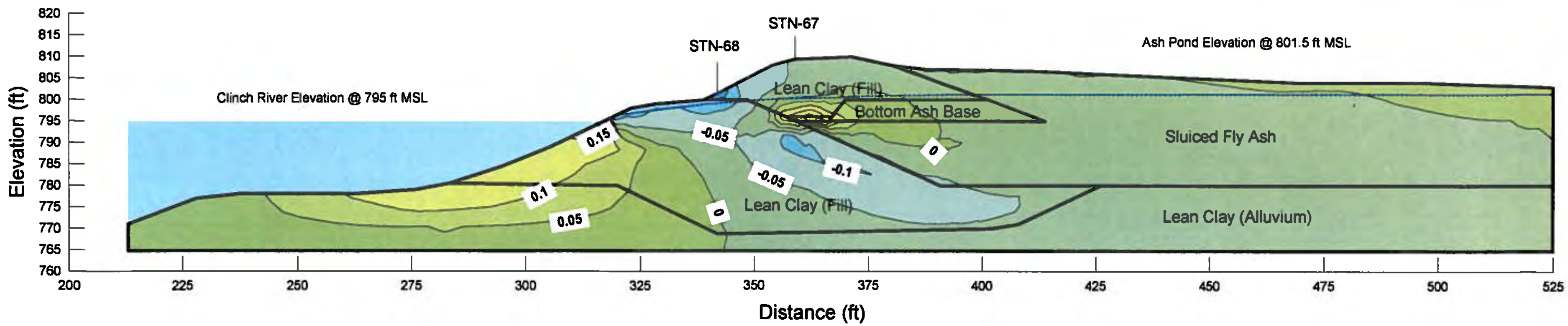
Ash Pond Water Level Lowered to Elevation 801.5'

Vertical Gradient Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect S-S'\Slope\Slope W Section S-S' Ash Pond Pool 801.5' (Global).gsz

SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (313.17,793)
Total Head = 795 ft
At (316.37,789.16)
Total Head = 795.97 ft
dH = 0.97 ft dl = 3.84 ft
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FSpiping = 4.0

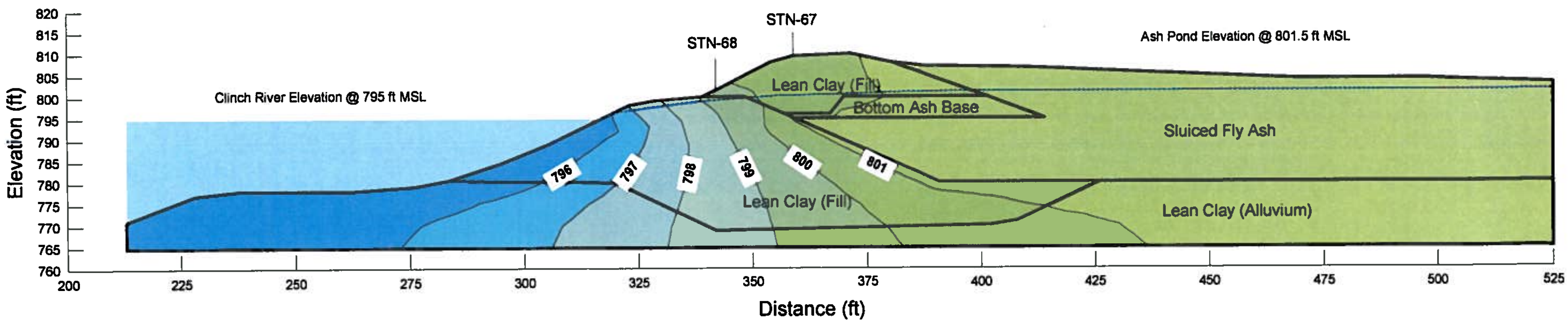
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' Ash Pond Pool 801.5' (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Water Level Lowered to Elevation 801.5'

Total Head Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect S-S'\Slope\Slope W Section S-S' Ash Pond Pool 801.5' (Global).gsz

SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
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Total Head = 795 ft
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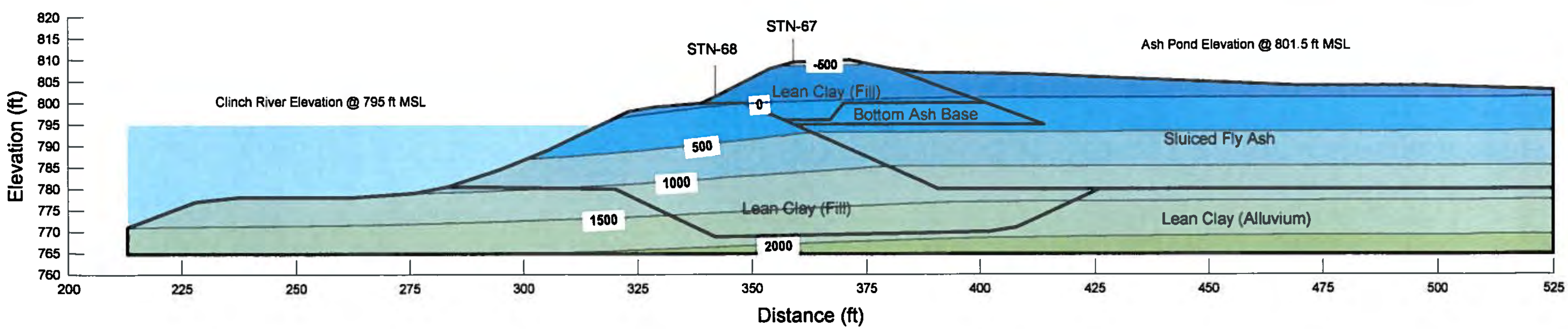
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' Ash Pond Pool 801.5' (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Water Level Lowered to Elevation 801.5'

Pore Water Pressure Contours



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Slope Stability (Entry-Exit)

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

February 2010
Method: Modified Spencer
File Name: Slope W Section S-S' Ash Pond Pool 801.5' (Global).gsz

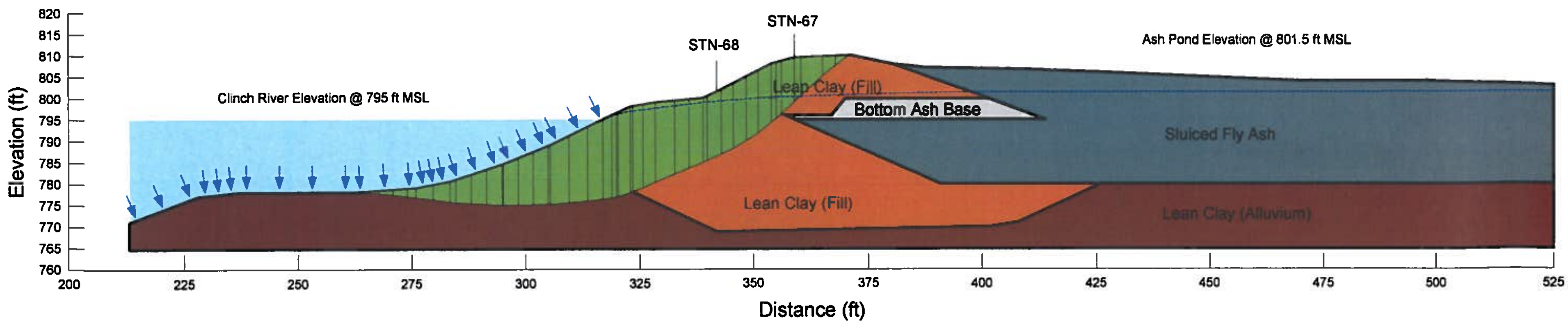
Factor of Safety: 1.4
Center: (294.972, 872.705) ft
Radius: 54.48379 ft
Minimum Slip Surface Depth: 20 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Ash Pond Water Level Lowered to Elevation 801.5'

Global Failure



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (276,779)
Total Head = 795 ft
At (276.19,774.43)
Total Head = 795.98 ft
dH = 0.98 ft dl = 4.57 ft
i = 0.214 i(criticial) = 1
FSpiping = 4.7

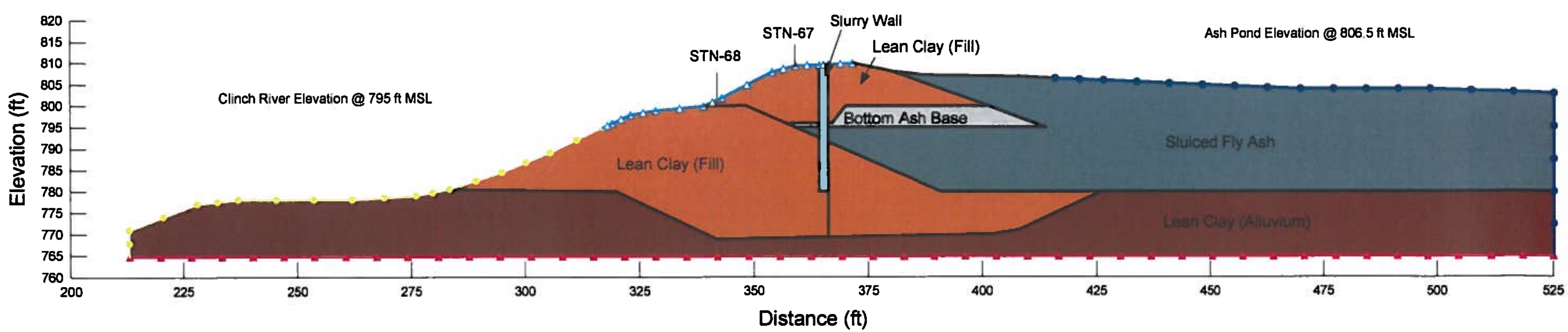
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' 30' slurry wall (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the area explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Slurry Wall

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (276,779)
Total Head = 795 ft
At (276.19,774.43)
Total Head = 795.98 ft
dH = 0.98 ft dl = 4.57 ft
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FSpiping = 4.7

February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' 30' slurry wall (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
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Note:
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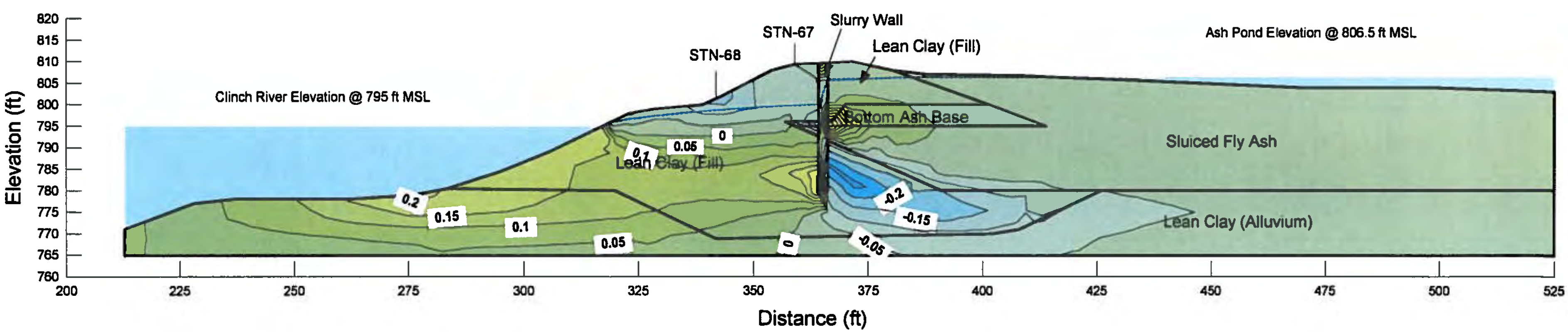
Proposed Slurry Wall

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (276,779)
Total Head = 795 ft
At (276.19,774.43)
Total Head = 795.98 ft
dH = 0.98 ft   dl = 4.57 ft
i = 0.214   i(criticial) = 1
FSpiping = 4.7

February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' 30' slurry wall (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
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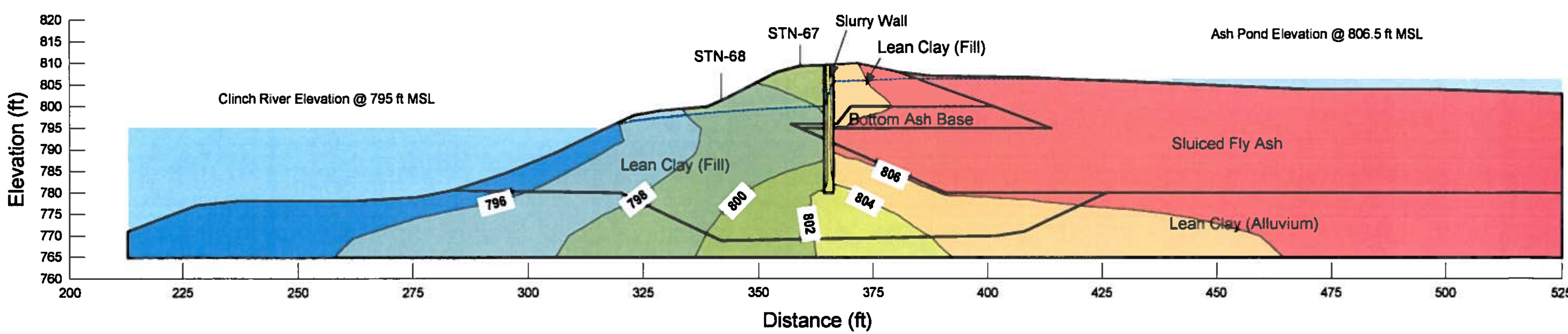
Proposed Slurry Wall

Total Head Contours



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (276,779)
Total Head = 795 ft
At (276.19,774.43)
Total Head = 795.98 ft
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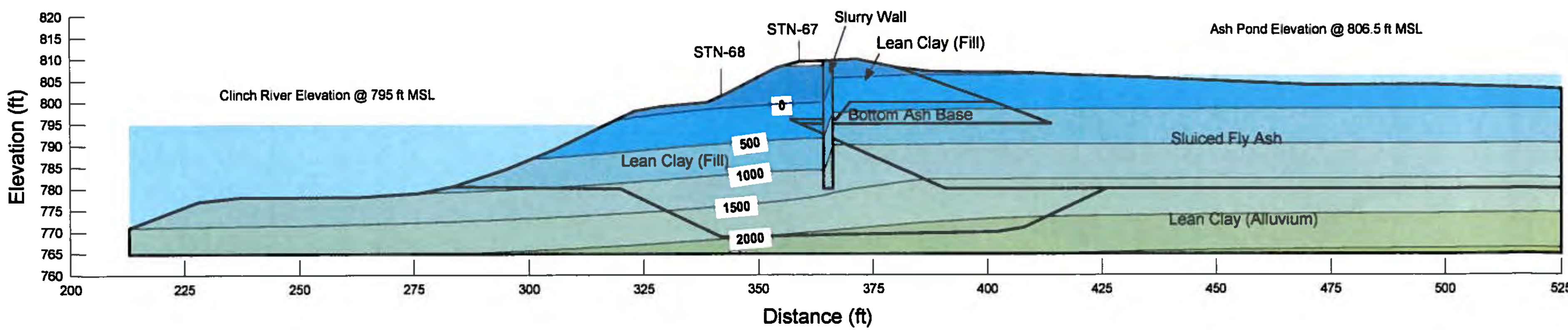
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' 30' slurry wall (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the area explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Slurry Wall

Pore Water Pressure Contours



V:\1714\active\171468118\environmental\Bull Run - 172679015\Report\Engineering Analysis\Sect S-S'\Slope\Slope W Section S-S' 30' slurry wall (Global).gsz

Slope Stability (dMin=20)

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Factor of Safety: 1.4
Center: (298.25, 849.5) ft
Radius: 52.25045 ft
Minimum Slip Surface Depth: 20 ft

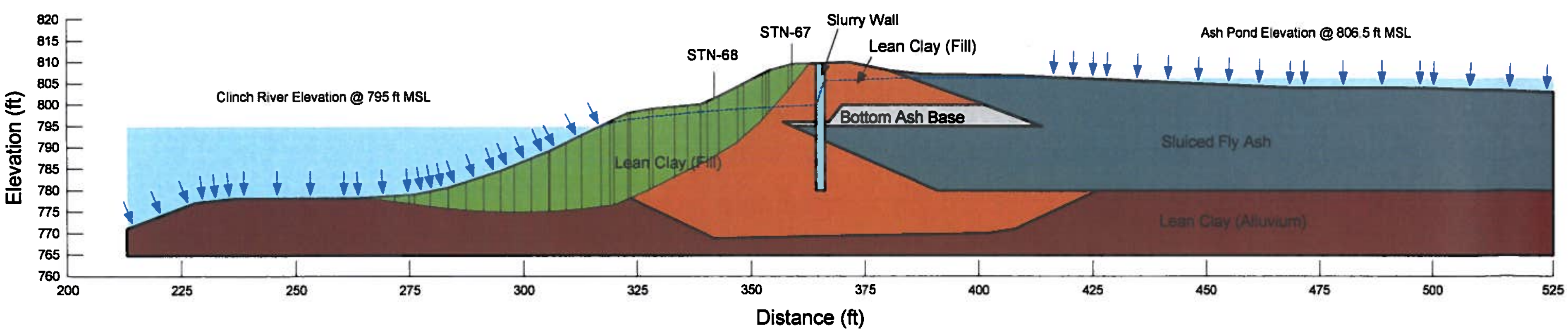
January 2010
Method: Modified Spencer
File Name: Slope W Section S-S' 30' slurry wall (Global).gsz

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the area explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Slurry Wall

Global Failure



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum Exit Gradient occurs at (276,779)
Total Head = 795 ft
At (276.19,774.43)
Total Head = 795.55 ft
dH = 0.55 ft dl = 4.57 ft
i = 0.12 i(criticial) = 1
FSpiping = 8.3

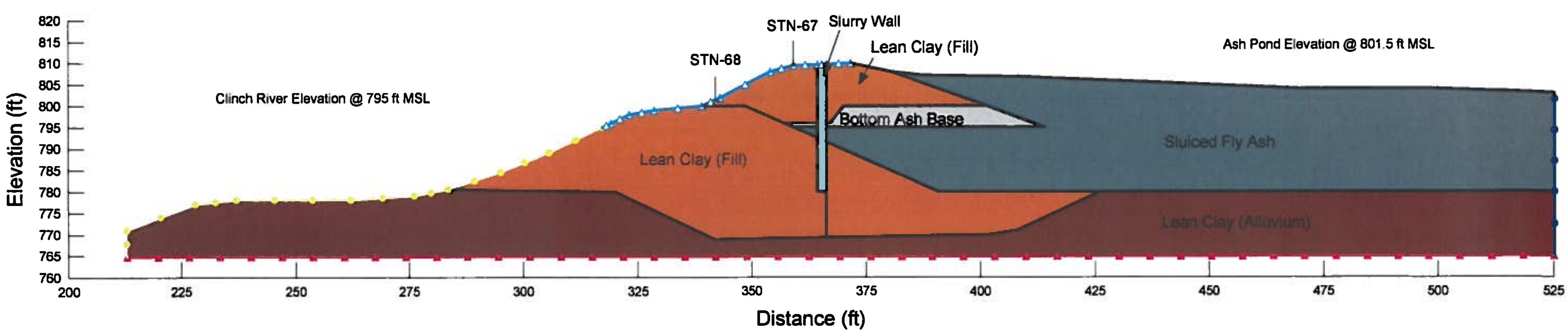
February 2010
Method: Steady-State Seepage
File Name: Slope W Section S-S' 30' slurry wall Pool 801.5' (Global).gsz

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Sluiced Fly Ash	1.6e-005	0.02	0.46
Lean Clay (Fill)	2.3e-007	0.1	0.41
Lean Clay (Alluvium)	2.3e-007	0.05	0.41
Bottom Ash Base	6.5e-008	0.04	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Slurry Wall and Ash Pond Pool Lowered to Elevation 801.5'

Subsurface Profile and Boundary Conditions



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Piping Potential
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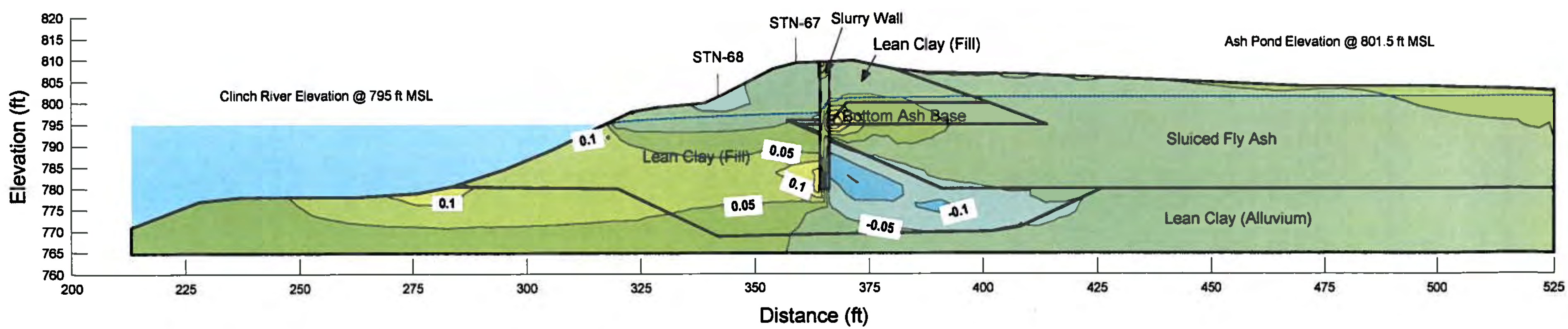
Proposed Slurry Wall and Ash Pond Pool Lowered to Elevation 801.5'

Vertical Gradient Contours



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

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February 2010
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Note:
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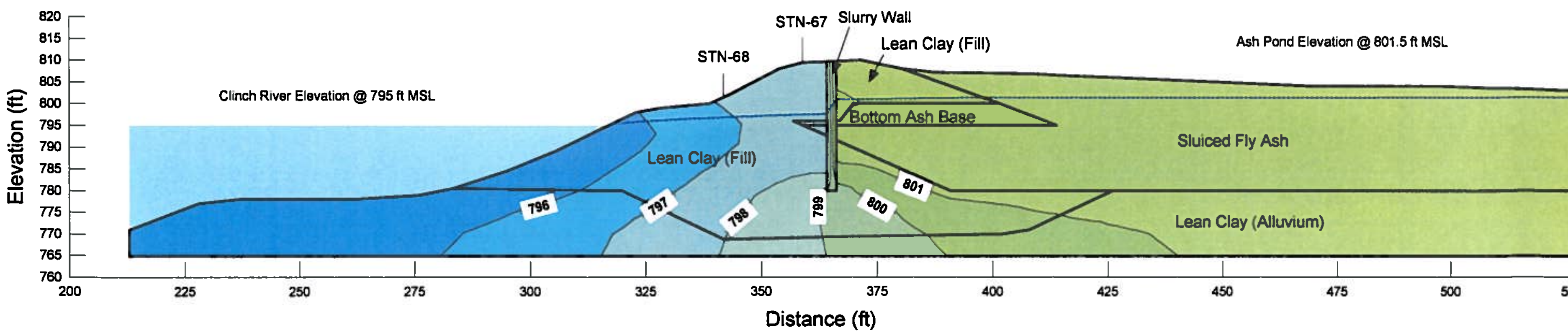
Proposed Slurry Wall and Ash Pond Pool Lowered to Elevation 801.5'

Total Head Contours



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SEEP/W Analysis

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

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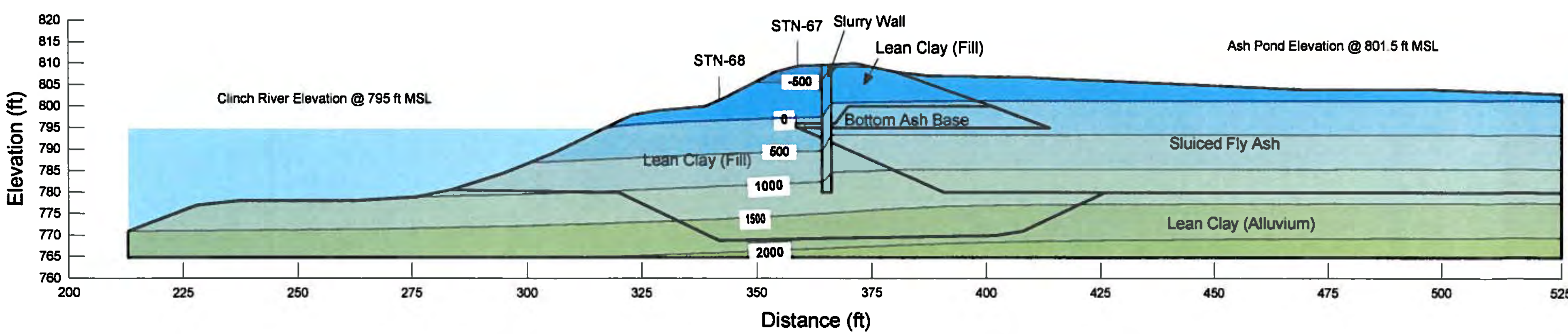
Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Slurry Wall and Ash Pond Pool Lowered to Elevation 801.5'

Pore Water Pressure Contours



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Slope Stability (dMin=20)

Cross-Section S-S'
Fly Ash Disposal Area 2

Bull Run Fossil Plant
Tennessee Valley Authority

Factor of Safety: 1.5
Center: (298.25, 855.25) ft
Radius: 52.4 ft
Minimum Slip Surface Depth: 20 ft

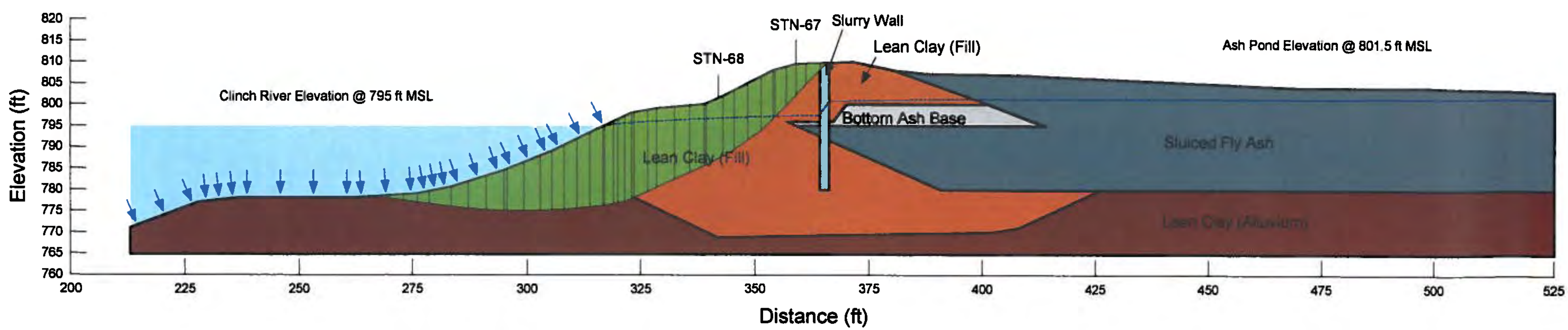
February 2010
Method: Modified Spencer
File Name: Slope W Section S-S' 30' slurry wall Pool 801.5' (Global).gsz

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	100	105	0	25
Lean Clay (Fill)	125	126	0	33
Lean Clay (Alluvium)	123	123	0	31
Bottom Ash Base	100	105	0	33

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Slurry Wall and Ash Pond Pool Lowered to Elevation 801.5'

Global Failure



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APPENDIX A

Document 6

Stantec. (February 15, 2012). Results of Pseduostatic Slope Stability Analysis

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

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

Bull Run Fossil Plant
(BRF)

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

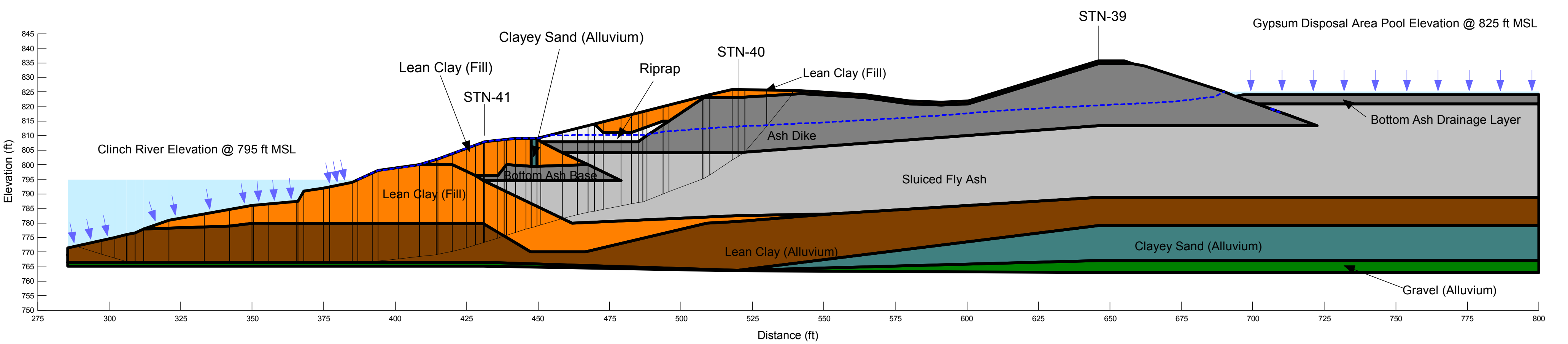
Section I - Gypsum Disposal Area 2A
Bull Run Fossil Plant
Clinton, Tennessee

Note:
The results of the 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 conditions between the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	105 pcf	100 psf	18.4 °
Lean Clay (Fill)	126 pcf	700 psf	17.6 °
Gravel (Alluvium)	135 pcf	100 psf	30 °
Clayey Sand (Alluvium)	112 pcf	100 psf	23 °
Lean Clay (Alluvium)	123 pcf	350 psf	21.1 °
Bottom Ash Base	105 pcf	0 psf	33 °
Ash Dike	105 pcf	0 psf	33 °
Rip Rap	115 pcf	0 psf	40 °

Factor of Safety: 1.0

Horizontal Seismic Coefficient Kh = 0.131 g
2500 year Return Period Event



Date of Assessment - 11/4/2011

Project No. 175551015

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

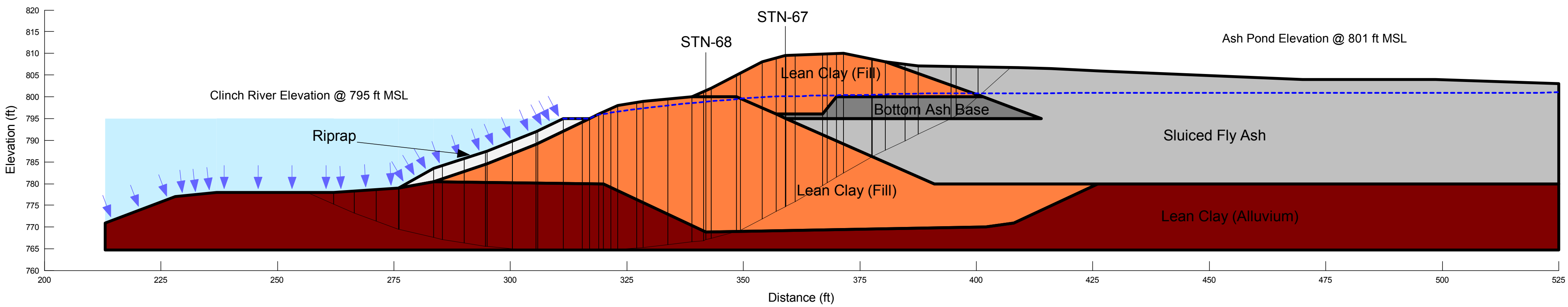
Section S - Fly Ash Disposal Area 2
Bull Run Fossil Plant
Clinton, Tennessee

Material Type	Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	105 pcf	100 psf	18.4 °
Lean Clay (Fill)	126 pcf	700 psf	17.6 °
Lean Clay (Alluvium)	123 pcf	350 psf	21.1 °
Bottom Ash Base	105 pcf	0 psf	33 °
Rip-Rap	105 pcf	0 psf	40 °

Note:
The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warrenties can be made regarding the continuity of subsurface conditions between the borings.

Additional remediation measures taken from URS plans dated 08/13/2010

Factor of Safety: 1.4
Horizontal Seismic Coefficient Kh = Value: 0.131 g
2500-year Return Period Event



Date of Assessment - 11/4/2011

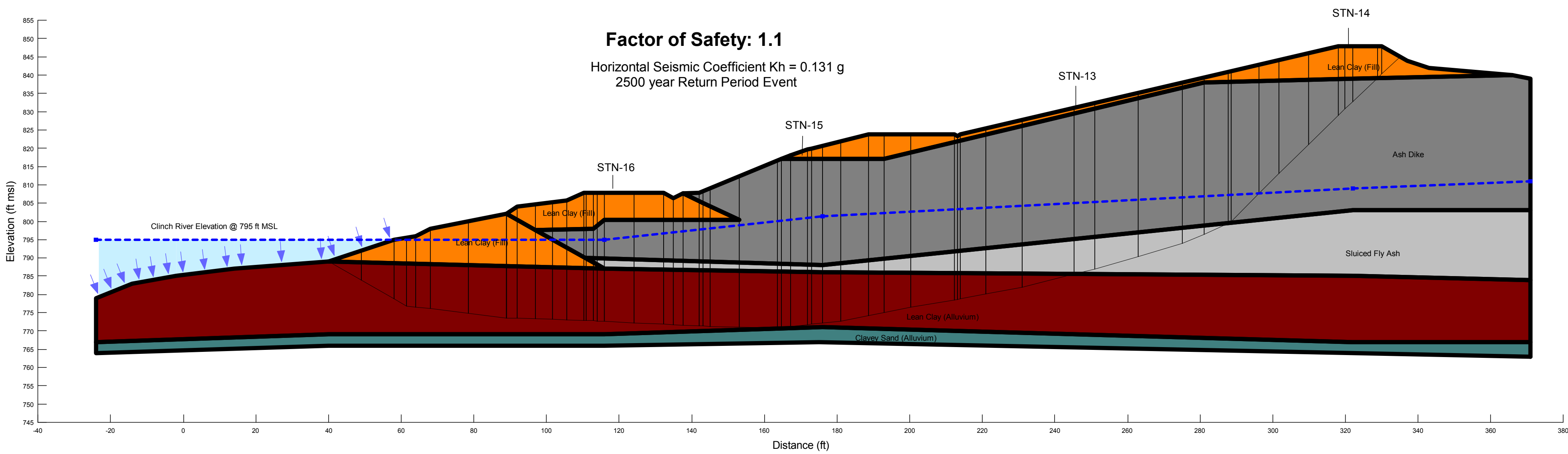
Project No. 175551015

DRAFT
Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section D - Bottom Ash Disposal Area 1
Bull Run Fossil Plant
Clinton, Tennessee

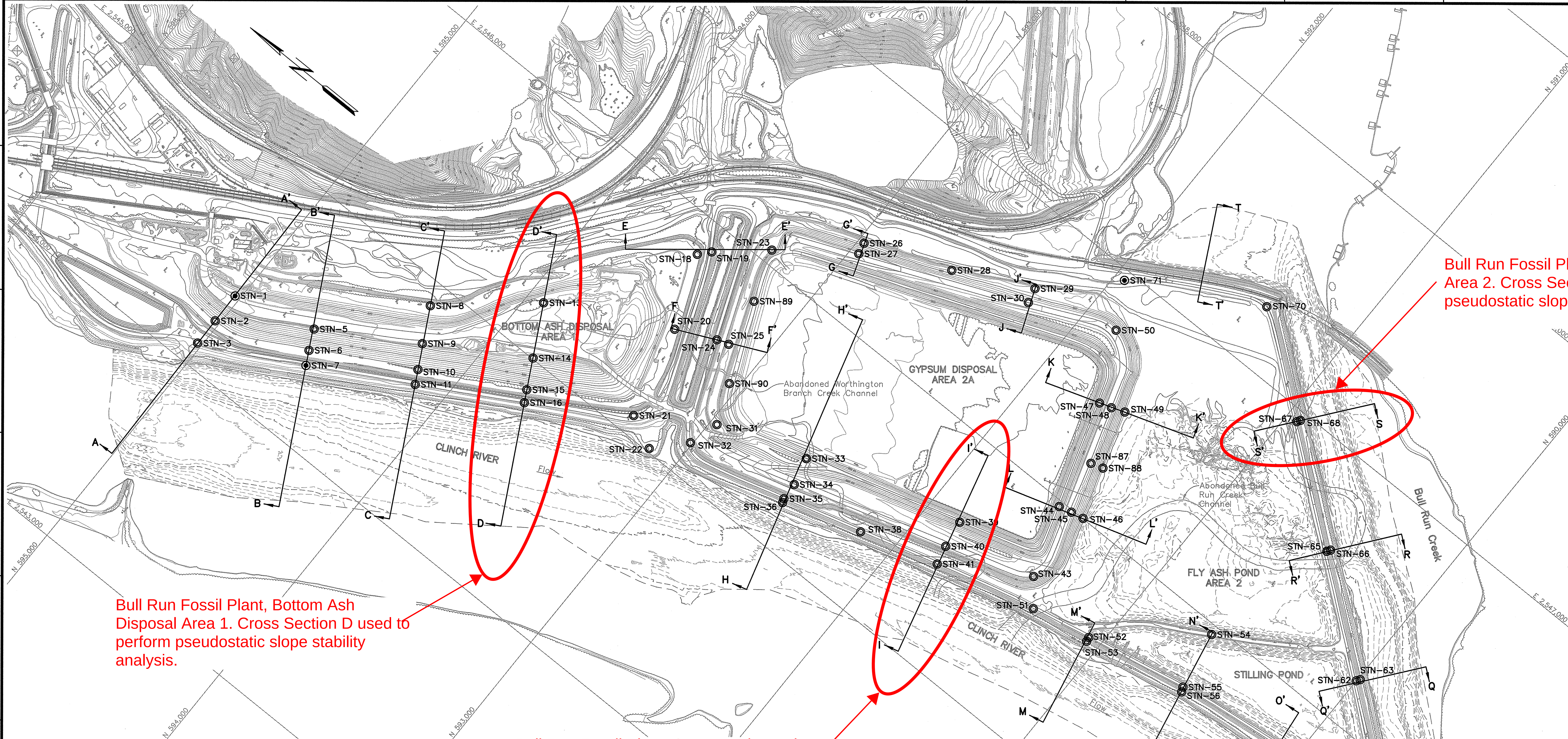
Note:
The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warrenties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill) - Lower Confinement	126	1000 psf	0 °
Lean Clay (Fill) - Higher Confinement	126	50 psf	17.6 °
Ash Dike	105	0 psf	33 °
Sluiced Ash	105	100 psf	18.4 °
Lean Clay (Alluvium) - Lower Confinement	123	528 psf	0 °
Lean Clay (Alluvium) - Higher Confinement	123	20.5 psf	21.1 °
Clayey Sand (Alluvium)	112	100 psf	23°



Date of Assessment - 11/22/2011

Project No. 175551015



Bull Run Fossil Plant, Fly Ash Disposal Area 2. Cross Section S used to perform pseudostatic slope stability analysis.

Bull Run Fossil Plant, Bottom Ash Disposal Area 1. Cross Section D used to perform pseudostatic slope stability analysis.

Bull Run Fossil Plant, Gypsum Disposal Area 2A. 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.

LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core

NOTES:

1. The topographic mapping presented on this drawing was developed by TVA Surveying and Project Services, in April, 2009. This plan view was prepared to support development of the geotechnical exploration program and should not be used for construction.
2. A hydrographic survey was performed on the Clinch River in September, 2009 and on the Area 2 ponds in February, 2006.
3. 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.

BORING LOCATION TABLE

Boring	Northing	Easting	Elev. (ft.)	Boring	Northing	Easting	Elev. (ft.)
STN-1	595,024.10	2,544,375.85	832.4	STN-39	591,840.77	2,545,638.39	835.7
STN-2	595,022.62	2,544,232.15	819.4	STN-40	591,821.33	2,545,513.41	825.8
STN-3	595,020.59	2,544,104.02	810.2	STN-41	591,800.67	2,545,427.16	809.7
STN-5	594,652.96	2,544,484.24	841.0	STN-43	591,427.25	2,545,657.42	825.0
STN-6	594,610.05	2,544,394.75	818.2	STN-44	591,537.09	2,545,975.54	835.7
STN-7	594,577.54	2,544,332.94	809.5	STN-45	591,478.25	2,545,990.45	824.8
STN-8	594,312.72	2,544,896.21	821.0	STN-46	591,420.20	2,546,001.83	808.2
STN-9	594,232.56	2,544,740.10	837.5	STN-47	591,691.40	2,546,454.06	835.7
STN-10	594,173.80	2,544,636.59	817.9	STN-48	591,636.19	2,546,471.30	825.8
STN-11	594,140.80	2,544,576.48	808.6	STN-49	591,576.97	2,546,494.42	808.5
STN-13	593,923.78	2,545,228.66	831.3	STN-50	591,841.40	2,546,757.19	825.1
STN-14	593,802.44	2,545,004.48	848.7	STN-51	591,336.60	2,545,543.56	809.8
STN-15	593,734.18	2,544,875.42	818.1	STN-52	591,060.68	2,545,599.52	809.8
STN-16	593,705.67	2,544,823.03	808.0	STN-53	591,057.48	2,545,580.54	801.3
STN-18	593,524.13	2,545,835.46	821.7	STN-54	590,638.72	2,545,959.39	810.1
STN-19	593,480.64	2,545,884.32	810.2	STN-55	590,589.87	2,545,693.73	810.1
STN-20	593,389.26	2,545,507.73	819.6	STN-56	590,580.44	2,545,673.06	800.2
STN-21	593,286.66	2,545,087.68	808.0	STN-58	590,091.97	2,545,756.90	810.3
STN-22	593,138.35	2,545,015.84	799.0	STN-59	590,089.21	2,545,731.11	800.0
STN-23	593,275.52	2,546,061.35	835.0	STN-60	589,601.84	2,545,827.99	810.2
STN-24	593,211.79	2,545,589.93	809.9	STN-61	589,536.98	2,545,830.43	799.9
STN-25	593,158.33	2,545,607.45	826.2	STN-62	590,000.07	2,546,208.94	809.4
STN-26	592,971.96	2,546,347.19	817.3	STN-63	589,989.70	2,546,223.76	801.2
STN-27	592,960.52	2,546,295.43	831.3	STN-65	590,472.00	2,546,579.19	809.1
STN-28	592,587.48	2,546,501.20	816.8	STN-66	590,462.23	2,546,593.73	799.8
STN-29	592,243.83	2,546,673.33	816.8	STN-67	590,946.92	2,546,949.33	809.5
STN-30	592,227.12	2,546,605.60	826.2	STN-68	590,938.03	2,546,963.83	800.8
STN-31	592,969.83	2,545,291.84	823.8	STN-70	591,380.61	2,547,267.77	809.4
STN-32	593,010.17	2,545,153.51	808.2	STN-71	591,954.22	2,546,956.25	809.1
STN-33	592,559.31	2,545,426.43	836.1	STN-87	591,549.15	2,546,217.62	825.3
STN-34	592,527.95	2,545,300.77	825.6	STN-88	591,493.79	2,546,234.83	808.6
STN-35	592,523.92	2,545,221.40	808.9	STN-89	593,192.06	2,545,830.78	836.1
STN-36	592,517.47	2,545,204.09	800.5	STN-90	593,043.65	2,545,471.40	838.4
STN-38	592,160.74	2,545,322.53	808.6				

Northing, Easting and Ground Surface Elevations were provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27 (Tennessee Lambert)
Vertical Datum: NGVD29

GRAPHIC SCALE: 1"=200'
CONTOUR INTERVAL = 2'

RECORD DRAWING

For Supporting Design Calculations see FPGBRFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
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RECORD DRAWING											

DISCIPLINE INTERFACE

SCALE: 1"=200' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION BORING LAYOUT

HUGO R. APARICIO REGISTERED ENGINEER AGRICULTURE COMMERCE No. 113685 STATE OF TENNESSEE

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 04/09/10 | 49 | C | 10W507–01 | R 0

PLOT DATE: 04/09/2010 USER: BOND, PJ

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

49 C 10W507–01

APPENDIX A

Document 7

Stantec. (September 29, 2011). Results of Seismic Slope Stability Analysis

Stantec Consulting Services Inc.
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Louisville, KY 40223-5301
Tel: (502) 212-5000
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September 29, 2011 ltr_006_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
Bull Run 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 Bull Run Fossil Plant (BRF) 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 BRF's active disposal facilities, which include Gypsum Disposal Area 2A, Fly Ash Disposal Area 2, and Bottom Ash Disposal Area 1.

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 BRF, the following closure time frames are currently planned: Gypsum Disposal Area 2A – 2018 to 2019, Fly Ash Disposal Area 2 – 2017 to 2018, Bottom Ash Disposal Area 1 – 2019 to 2020.

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; Bottom Ash Disposal Area 1, Gypsum Disposal Area 2A, Fly Ash Pond Area 2; Bull Run Fossil Plant; Anderson County, Tennessee; April 12, 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 coefficient. 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 14 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 1.4 for Gypsum Disposal Area 2A, 1.9 for Fly Ash Disposal Area 2, and 1.6 for Bottom Ash Disposal Area 1. These 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

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

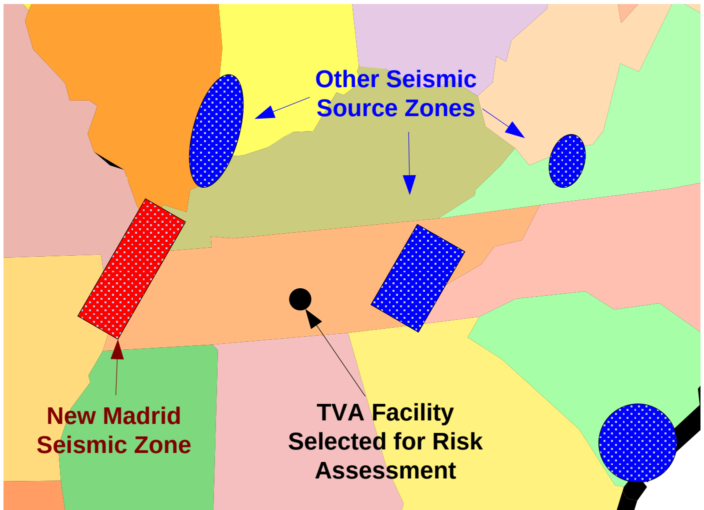
TVA Risk Event Probability Rating Scale		
Score	Rating	Description
5	Virtually Certain	95% probability that the event will occur in the next 3 years /10 years
4	Very Likely	75% probability that the event will occur in the next 3 years/10 years
3	Even Odds	50% probability that the event will occur in 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

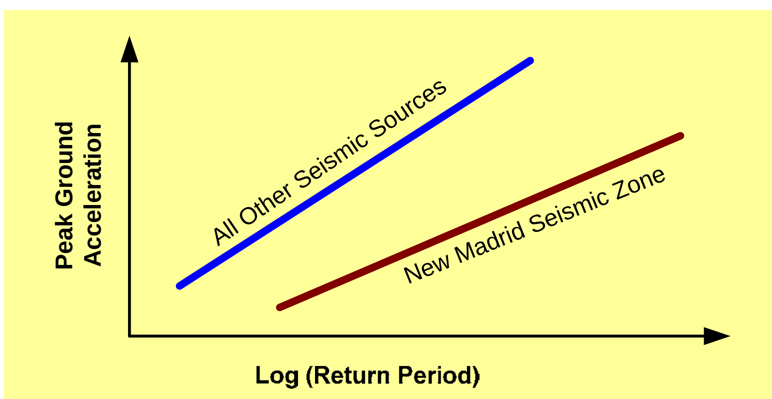


Figure 2. Typical Seismic Hazard Curves for Proposed Probabilistic Assessment of TVA Facilities

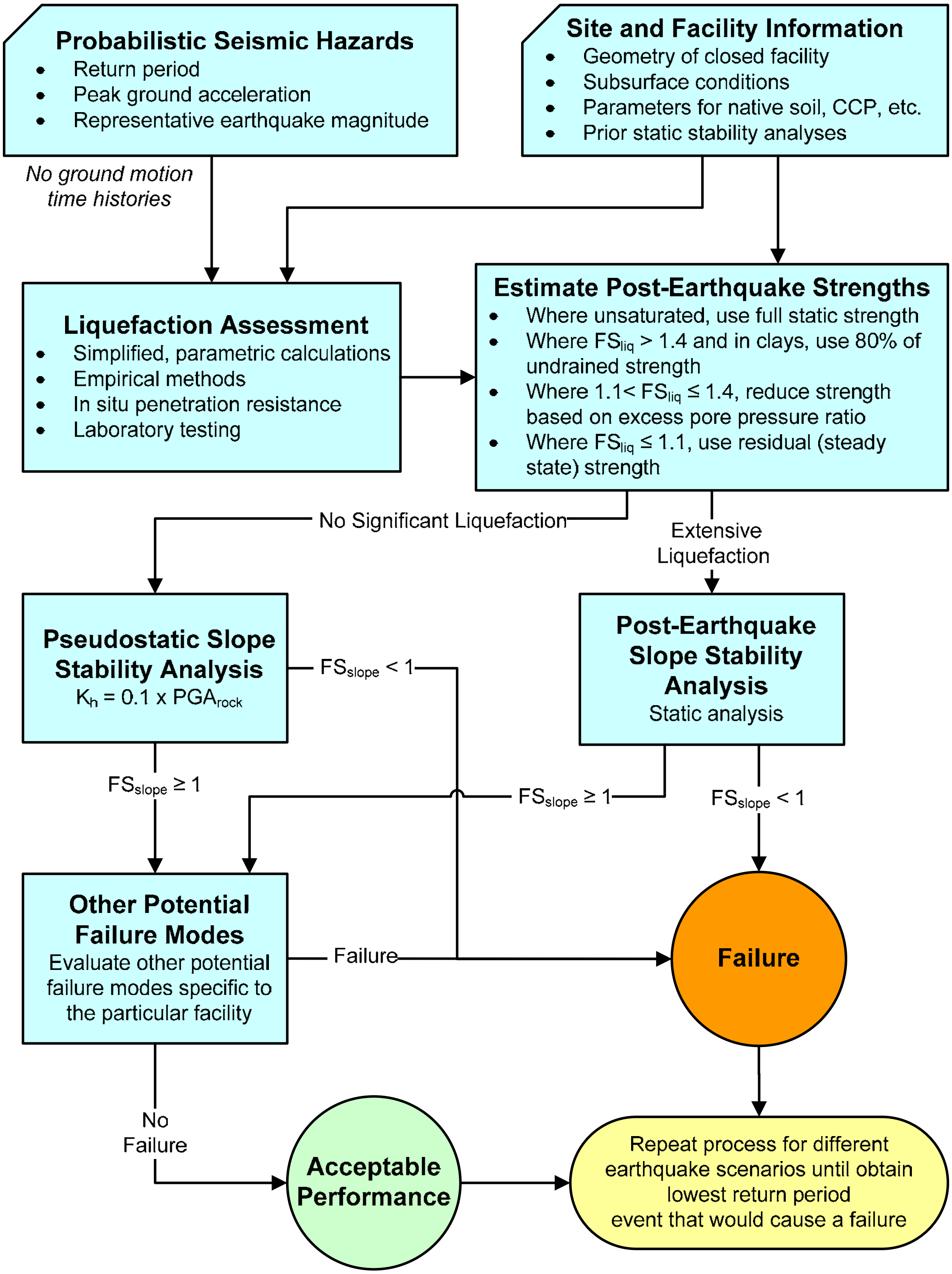


Figure 3. Simplified Flowchart for Assessing Facility Performance During a Probabilistic Seismic Event in Phase A

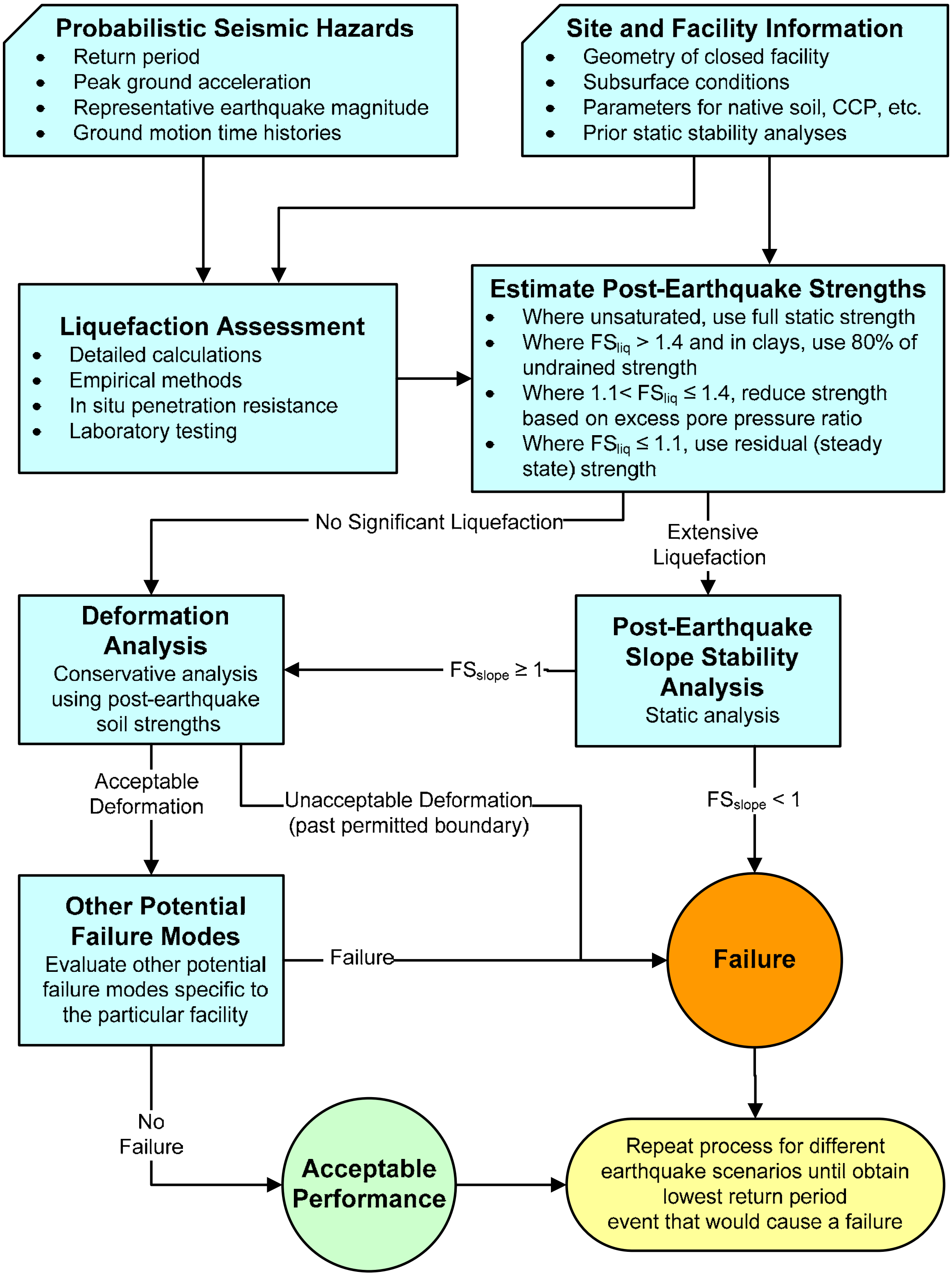


Figure 4. Simplified Flowchart for Assessing Facility Performance During a Probabilistic Seismic Event in Phase B

Enclosure B

Pseudostatic Analysis Results

Bull Run 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)**	**Factor of Safety**	
Gypsum Disposal Area 2A	Wet Stack	I	Southwest Side	0.043	1.4	Mitigation activities to Gypsum Disposal Area 2A include flattening the upper clay perimeter dike slope, constructing a french drain within the upper clay perimeter dike, and buttressing the ash dike slope using crushed stone and clay fill. Section I represents these mitigation efforts.
Fy Ash Disposal Area 2	Impoundment	S	East Side		1.9	Mitigation activities to Fly Ash Disposal Area 2 include lowering the permanent operating pool elevation from 806.5 feet to 801 feet, and adding a blanket of rip-rap along the lower dike slope in the river. Section S represents these mitigation efforts.
Bottom Ash Disposal Area 1	Stack	D	Southwest Side		1.6	Mitigation activities to Bottom Ash Disposal Area 1 include regrading the lower slope of the Ash Dike and providing positive drainage. Section D represents these mitigation efforts.

Notes:

1) Acceleration is 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

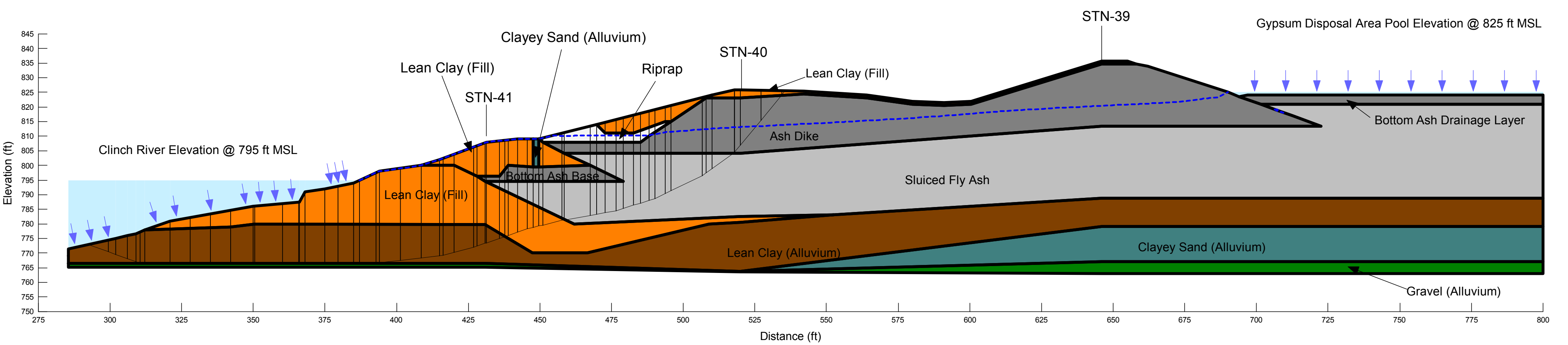
Section I - Gypsum Disposal Area 2A
Bull Run Fossil Plant
Clinton, Tennessee

Note:
The results of the 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 conditions between the borings.

Material Type	Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	105 pcf	100 psf	18.4 °
Lean Clay (Fill)	126 pcf	700 psf	17.6 °
Gravel (Alluvium)	135 pcf	100 psf	30 °
Clayey Sand (Alluvium)	112 pcf	100 psf	23 °
Lean Clay (Alluvium)	123 pcf	350 psf	21.1 °
Bottom Ash Base	105 pcf	0 psf	33 °
Ash Dike	105 pcf	0 psf	33 °

Factor of Safety: 1.39

Horizontal Seismic Coefficient Kh = 0.043 g
500 year Return Period Event



Date of Assessment - 09/14/2011

Project No. 175551015

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section S - Fly Ash Disposal Area 2
Bull Run Fossil Plant
Clinton, Tennessee

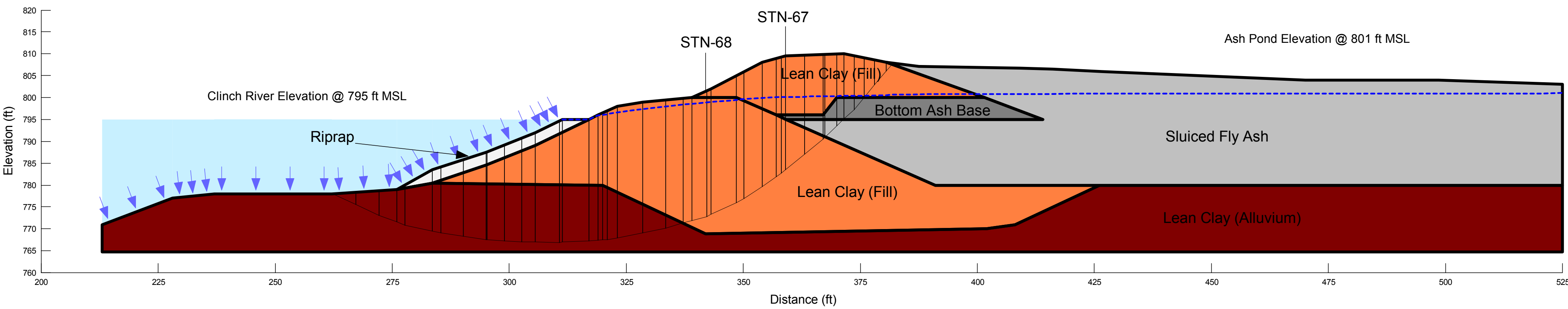
Stantec

Material Type	Unit Weight	Cohesion	Friction Angle
Sluiced Fly Ash	105 pcf	100 psf	18.4 °
Lean Clay (Fill)	126 pcf	700 psf	17.6 °
Lean Clay (Alluvium)	123 pcf	350 psf	21.1 °
Bottom Ash Base	105 pcf	0 psf	33 °
Rip-Rap	105 pcf	0 psf	40 °

Note:
The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warrenties can be made regarding the continuity of subsurface conditions between the borings.

Additional remediation measures taken from URS plans dated 08/13/2010

Factor of Safety: 1.85
Horizontal Seismic Coefficient Kh = Value: 0.043 g
500-year Return Period Event



Date of Assessment - 09/09/2011

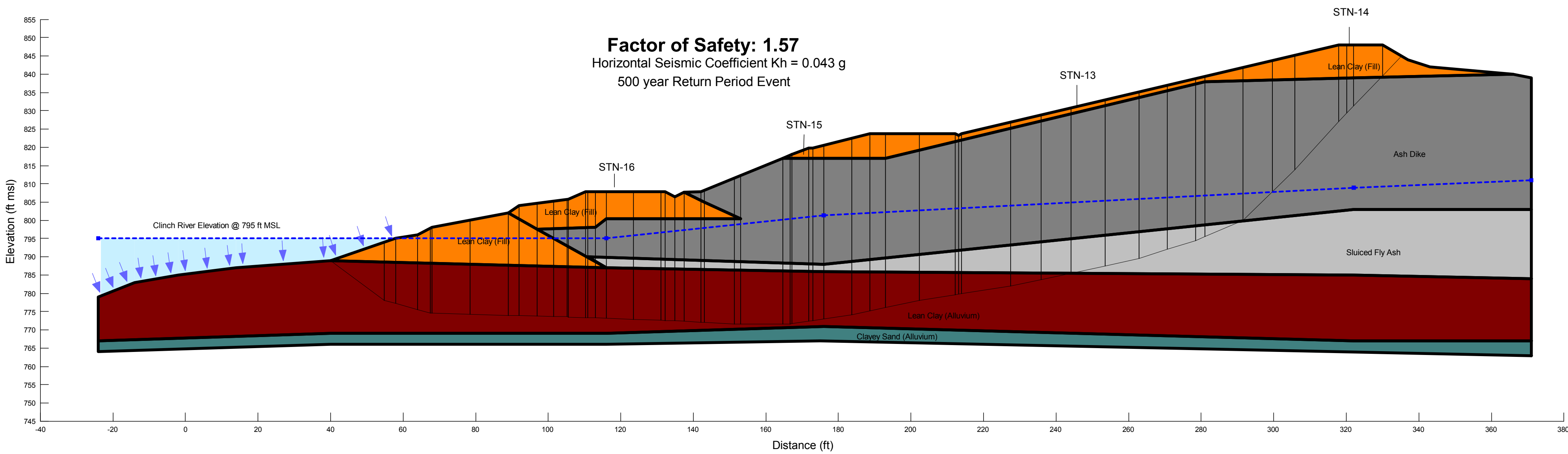
Project No. 175551015

DRAFT
Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section D - Bottom Ash Disposal Area 1
Bull Run Fossil Plant
Clinton, Tennessee

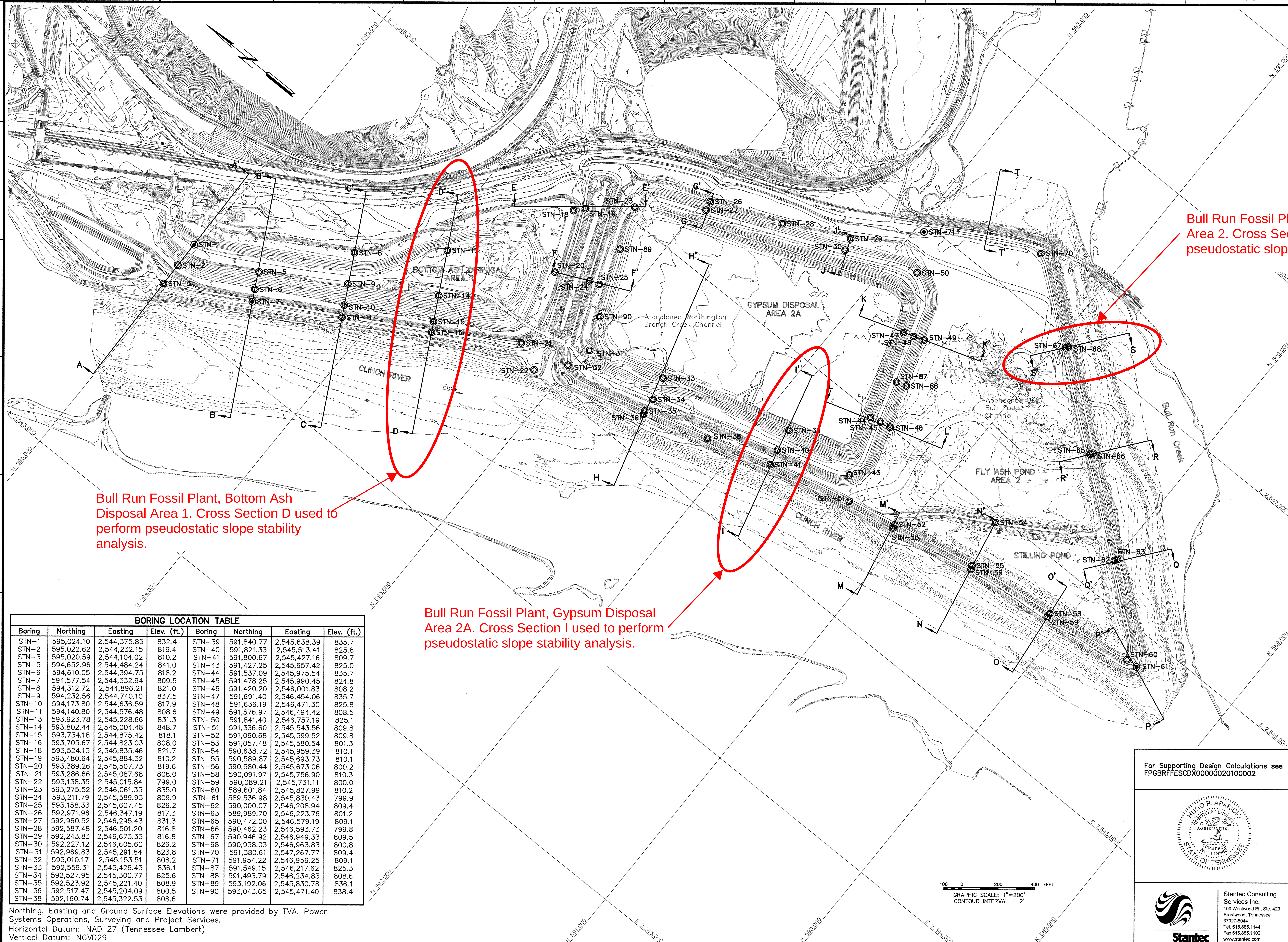
Material Type	Unit Weight	Cohesion	Friction Angle
Lean Clay (Fill) - Lower Confinement	126	1000 psf	0 °
Lean Clay (Fill) - Higher Confinement	126	50 psf	17.6 °
Ash Dike	105	0 psf	33 °
Sluiced Ash	105	100 psf	18.4 °
Lean Clay (Alluvium) - Lower Confinement	123	528 psf	0 °
Lean Clay (Alluvium) - Higher Confinement	123	20.5 psf	21.1 °
Clayey Sand (Alluvium)	112	100 psf	23°

Note:
The results of the analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warrenties can be made regarding the continuity of subsurface conditions between the borings.



Date of Assessment - 09/14/2011

Project No. 175551015



FOR INFORMATION ONLY
This Record Drawing which has been previously submitted to TVA is provided for Information Only.

LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core

NOTES:

1. The topographic mapping presented on this drawing was developed by TVA Surveying and Project Services, in April, 2009. This plan view was prepared to support development of the geotechnical exploration program and should not be used for construction.
2. A hydrographic survey was performed on the Clinch River in September, 2009 and on the Area 2 ponds in February, 2006.
3. 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.

RECORD DRAWING

BORING LOCATION TABLE

Boring	Northing	Easting	Elev. (ft.)	Boring	Northing	Easting	Elev. (ft.)
STN-1	595,024.10	2,544,375.85	832.4	STN-39	591,840.77	2,545,638.39	835.7
STN-2	595,022.62	2,544,232.15	819.4	STN-40	591,821.33	2,545,513.41	825.8
STN-3	595,020.59	2,544,104.02	810.2	STN-41	591,800.67	2,545,427.16	809.7
STN-5	594,652.96	2,544,484.24	841.0	STN-43	591,427.25	2,545,657.42	825.0
STN-6	594,610.05	2,544,394.75	818.2	STN-44	591,537.09	2,545,975.54	835.7
STN-7	594,577.54	2,544,332.94	809.5	STN-45	591,478.25	2,545,990.45	824.8
STN-8	594,312.72	2,544,896.21	821.0	STN-46	591,420.20	2,546,001.83	808.2
STN-9	594,232.56	2,544,740.10	837.5	STN-47	591,691.40	2,546,454.06	835.7
STN-10	594,173.80	2,544,636.59	817.9	STN-48	591,636.19	2,546,471.30	825.8
STN-11	594,140.80	2,544,576.48	808.6	STN-49	591,576.97	2,546,494.42	808.5
STN-13	593,923.78	2,545,228.66	831.3	STN-50	591,841.40	2,546,757.19	825.1
STN-14	593,802.44	2,545,004.48	848.7	STN-51	591,336.60	2,545,543.56	809.8
STN-15	593,734.18	2,544,875.42	818.1	STN-52	591,060.68	2,545,599.52	809.8
STN-16	593,705.67	2,544,823.03	808.0	STN-53	591,057.48	2,545,580.54	801.3
STN-18	593,524.13	2,545,835.46	821.7	STN-54	590,638.72	2,545,959.39	810.1
STN-19	593,480.64	2,545,884.32	810.2	STN-55	590,589.87	2,545,693.73	810.1
STN-20	593,389.26	2,545,507.73	819.6	STN-56	590,580.44	2,545,673.06	800.2
STN-21	593,286.66	2,545,087.68	808.0	STN-58	590,091.97	2,545,756.90	810.3
STN-22	593,138.35	2,545,015.84	799.0	STN-59	590,089.21	2,545,731.11	800.0
STN-23	593,275.52	2,546,061.35	835.0	STN-60	589,601.84	2,545,827.99	810.2
STN-24	593,211.79	2,545,589.93	809.9	STN-61	589,536.98	2,545,830.43	799.9
STN-25	593,158.33	2,545,607.45	826.2	STN-62	590,000.07	2,546,208.94	809.4
STN-26	592,971.96	2,546,347.19	817.3	STN-63	589,989.70	2,546,223.76	801.2
STN-27	592,960.52	2,546,295.43	831.3	STN-65	590,472.00	2,546,579.19	809.1
STN-28	592,587.48	2,546,501.20	816.8	STN-66	590,462.23	2,546,593.73	799.8
STN-29	592,243.83	2,546,673.33	816.8	STN-67	590,946.92	2,546,949.33	809.5
STN-30	592,227.12	2,546,605.60	826.2	STN-68	590,938.03	2,546,963.83	800.8
STN-31	592,969.83	2,545,291.84	823.8	STN-70	591,380.61	2,547,267.77	809.4
STN-32	593,010.17	2,545,153.51	808.2	STN-71	591,954.22	2,546,956.25	809.1
STN-33	592,559.31	2,545,426.43	836.1	STN-87	591,549.15	2,546,217.62	825.3
STN-34	592,527.95	2,545,300.77	825.6	STN-88	591,493.79	2,546,234.83	808.6
STN-35	592,523.92	2,545,221.40	808.9	STN-89	593,192.06	2,545,830.78	836.1
STN-36	592,517.47	2,545,204.09	800.5	STN-90	593,043.65	2,545,471.40	838.4
STN-38	592,160.74	2,545,322.53	808.6				

Northing, Easting and Ground Surface Elevations were provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27 (Tennessee Lambert)
Vertical Datum: NGVD29

For Supporting Design Calculations see FPGBRFFESCDX00000020100002

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	04/09/10	WRM	TJ	PVK	SF	HRA	HRA	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=200' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
BORING LAYOUT

HUGO R. APARICIO REGISTERED ENGINEER AGRICULTURE COMMERCE No. 113685 STATE OF TENNESSEE

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 04/09/10 | 49 | 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

PLOT DATE: 04/09/2010 USER: BOND, PJ

APPENDIX A

Document 8

Stantec. (June 25, 2010). Seepage Action Plan

Stantec

Seepage Action Plan (SAP)

Bull Run Fossil Plant
Anderson County, Tennessee

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1409 North Forbes Road
Lexington, KY 40511-2050
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www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

June 25, 2010

Seepage Action Plan (SAP)

Bull Run Fossil Plant
Anderson County, Tennessee

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Seepage Action Plan (SAP)

Bull Run Fossil Plant
Anderson County, 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 Gypsum Stack, Ash Pond, and Dry Fly Ash Stack. 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.

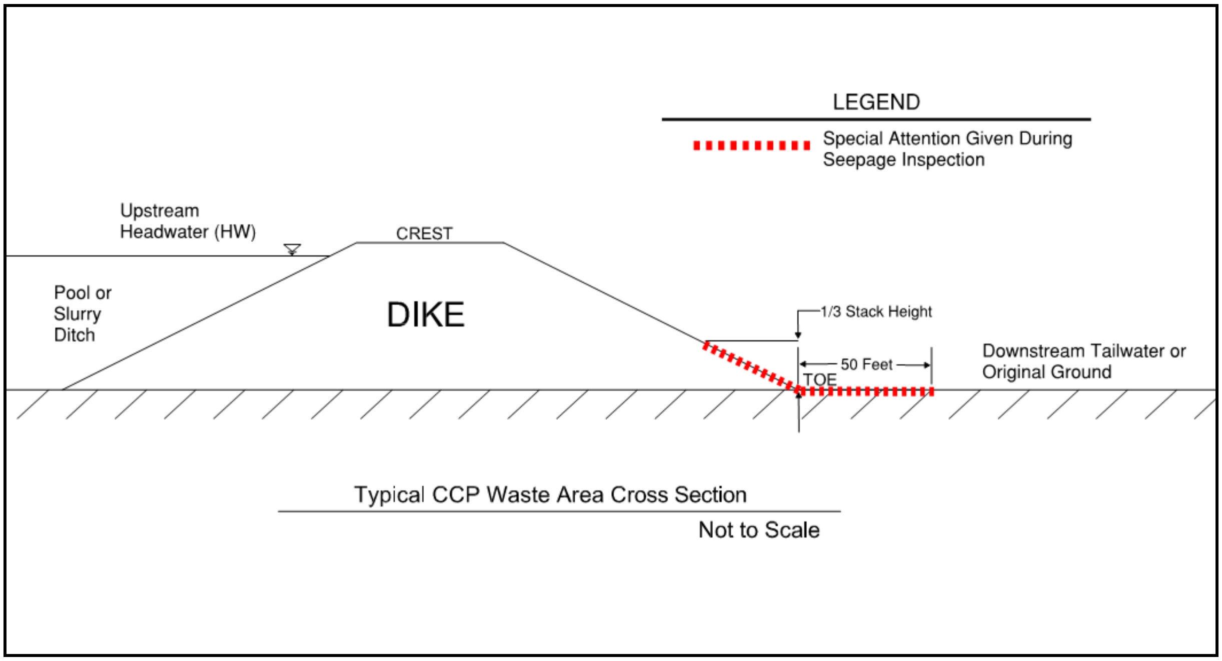


Figure 1. Seepage Inspection Location

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 Bull Run Fossil Plant serve as an impoundment for ash and gypsum slurry, it is imperative to maintain the embankments and prevent any possible failure from occurring. If a failure were to occur, the CCP Mixture could potentially contaminate Bull Run Fossil Plant and the Clinch River.

2.3. Primary Responsibility and Frequency of Dike Safety Inspections

1. TVA RHO&M Field Supervisor for Bull Run Fossil Plant (**Field Supervisor**)

2. TVA RHO&M East Region Construction Manager

3. TVA RHO&M Program Manager for Bull Run 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

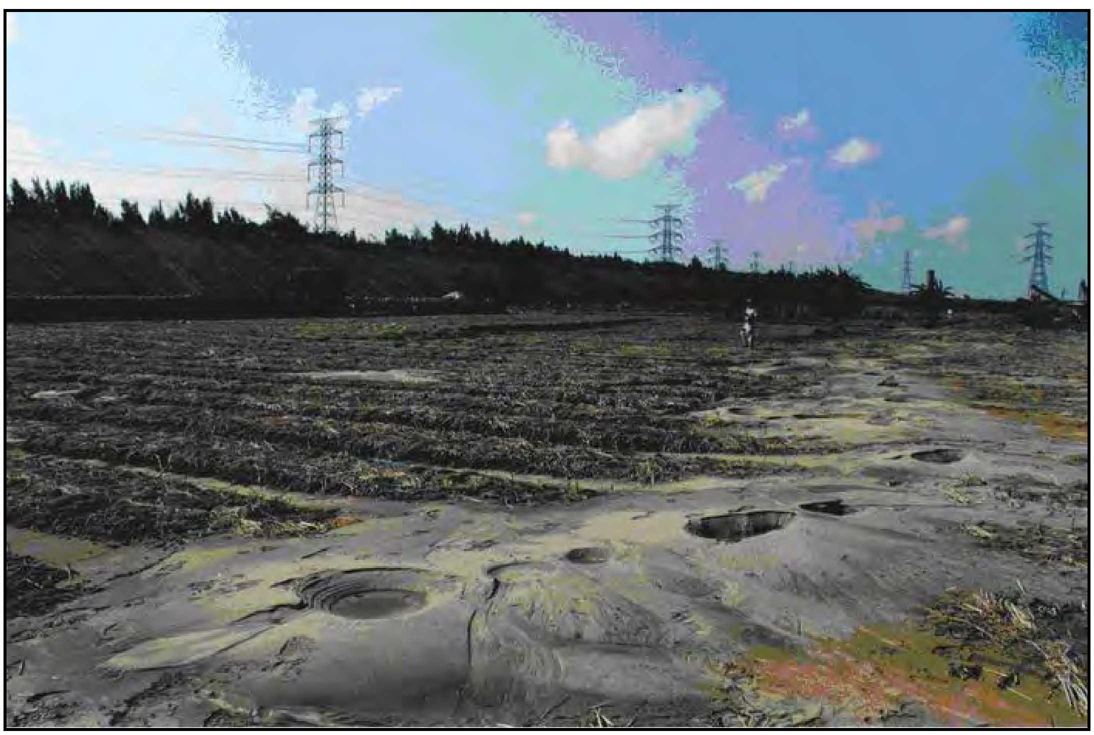


Figure 5. Example of Action Level 3 – Deposition of Sediment from Dike

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. 89 Stone
  - Two feet 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. 89 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 at the north end of the Bottom Ash Disposal Area near the railroad crossing. 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 Bull Run 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 BRF 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 BRF 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.

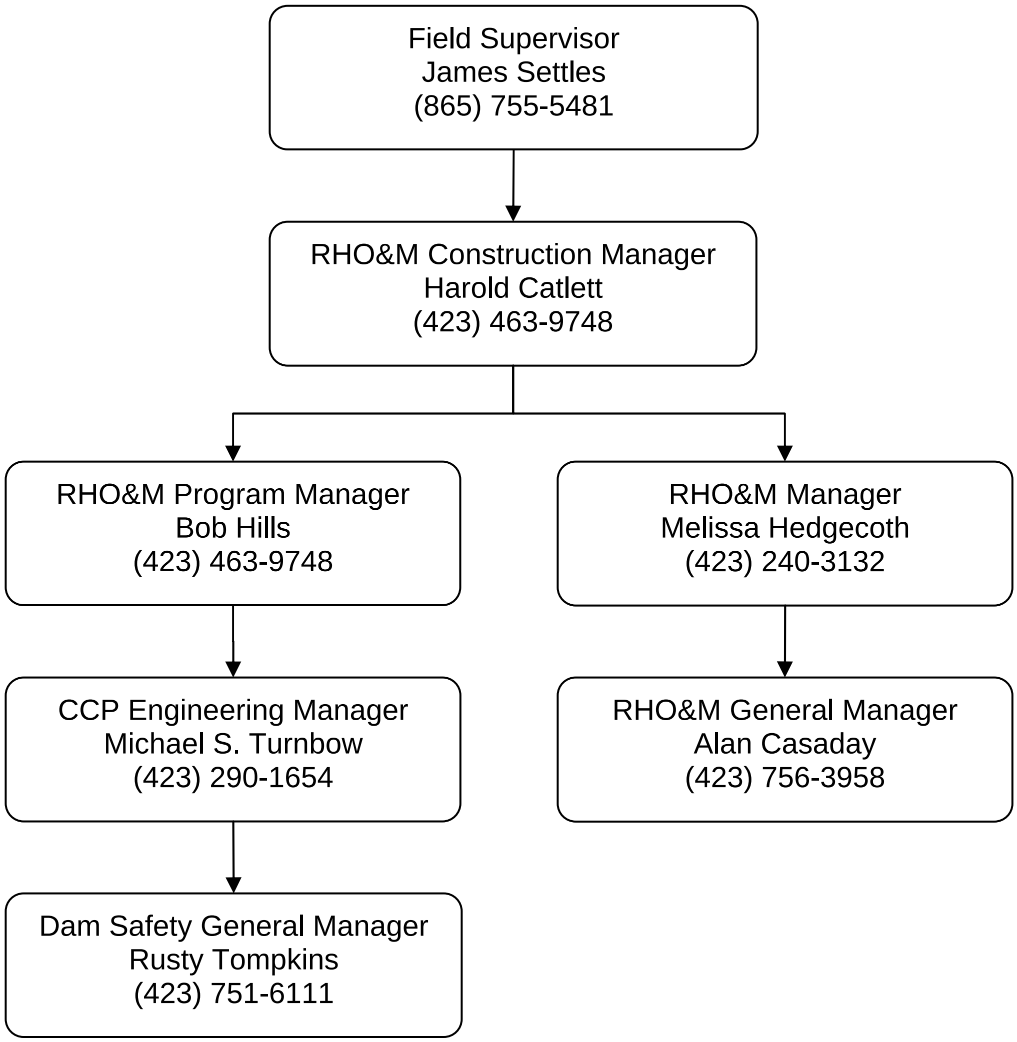


Figure 8. Level 2 Emergency Contact Flowchart

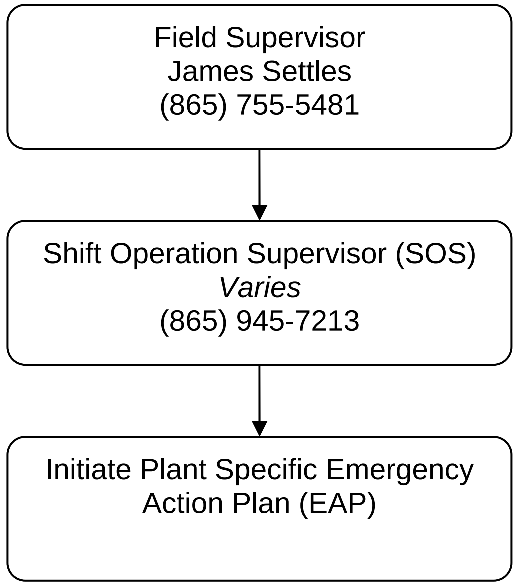
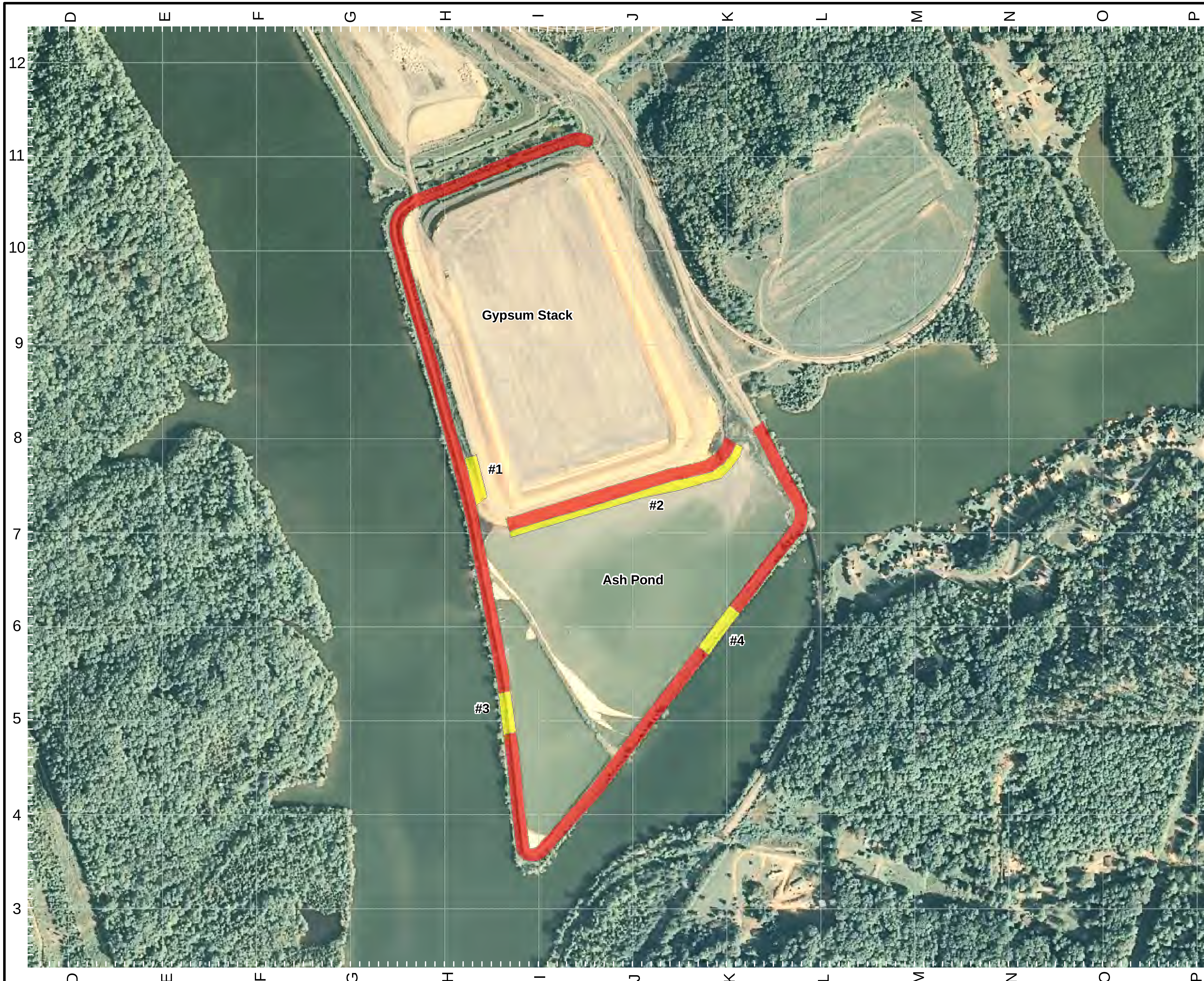


Figure 9. Level 3 Emergency Contact Flowchart

Appendix A

Gypsum Stack, Ash Pond and Dry Fly Ash Stack



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

0 250 500 Feet

STANTEC CONSULTING SERVICES INC.

1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

SEEPAGE ACTION PLAN

Tennessee Valley Authority
Bull Run Fossil Plant
Clinton, Anderson County, Tennessee

PROJECT NO.	175560021
DATE	MAY 2010
DRAWN BY	AMG
CHECKED BY	
CHECKED BY	
SCALE	1"=500'
REVISED	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

SHEET

1 OF 3

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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

0 250 500 Feet

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

SEEPAGE ACTION PLAN

Tennessee Valley Authority
Bull Run Fossil Plant
Clinton, Anderson County, Tennessee

PROJECT NO.	175560021
DATE	MAY 2010
DRAWN BY	AMG
CHECKED BY	
CHECKED BY	
SCALE	1"=500'
REVISED	
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	

SHEET

2 OF 3

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

0 250 500 Feet

STANTEC CONSULTING SERVICES INC.

1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

SEEPAGE ACTION PLAN

Tennessee Valley Authority
Bull Run Fossil Plant
Clinton, Anderson County, Tennessee

PROJECT NO.	175560021
DATE	MAY 2010
DRAWN BY	AMG
CHECKED BY	
CHECKED BY	
SCALE	1"=500'
REVISED	
1.	
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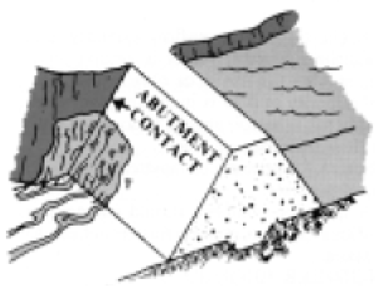
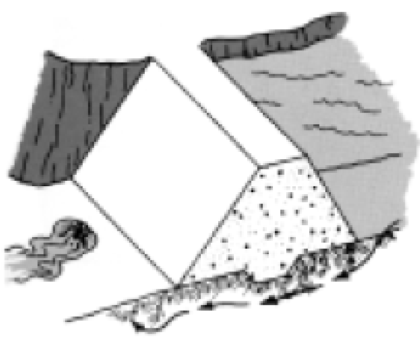
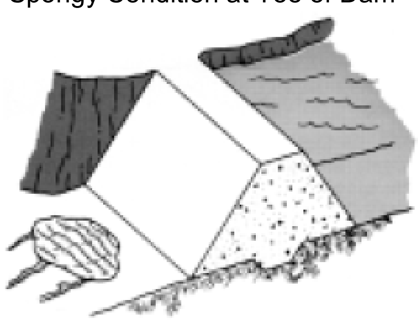
SHEET

3 OF 3

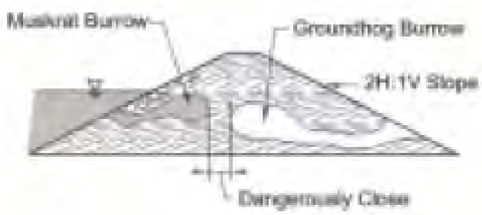
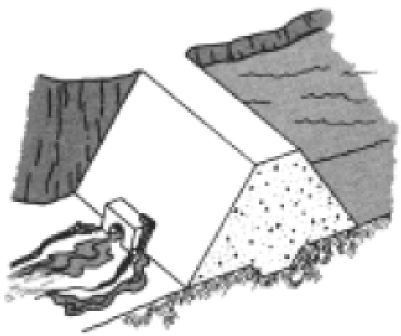
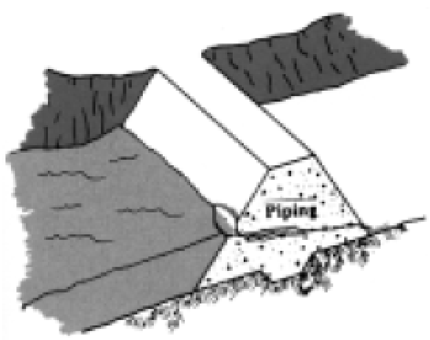
Appendix B

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

<table>
<tr><th>Seepage Problem</th><th>Recommendations</th></tr>
<tr><td>Trees and Brush

</td><td>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.</td></tr>
</table>

Source: Connecticut Department of Environmental Protection, Guidelines for Inspection and Maintenance of Dams, September 2001.

Appendix C

Seepage Log

BRF Seepage Log

Bull Run Fossil Plant
Clinton, Tennessee
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	591513.72	2545520.93	3/27/2010	N/A	No known survey, identified as being less than 1 foot section of ditch	3	Identified by Stantec personnel - seep carrying fine ash to surface noted in a drainage ditch at the toe of the embankment of the gypsum stack.	Area sandbagged and a graded filter was placed over the seep. The entire slope is currently being designed to have a graded filter and underdrain system installed as part of the Stantec and URS design.
2	591523.97	2546308.78	3/28/2010	N/A	No known survey, boils identified and toe saturated several feet along entire length of south slope.	3	Identified by Stantec personnel - boils were noted at the toe of the south slope directly below the spillway pipe outlets. Additionally, the entire length of the south dike is consistently wet with seepage.	A graded filter overlain with a rock buttress is being constructed along the entire length of the south slope toe.
3	590458.85	2545687.56	1/14/2009	N/A	No known survey, numerous wet areas identified.	1	Noted during the Phase 1 Inspection on January 14, 2009. Numerous wet areas along exterior slopes of the southwest dike of the ash pond have been identified during prior TVA Annual Inspections.	URS is currently implementating remediation and closure plans of the Ash Pond and it's dikes.
4	590639.12	2546732.66	1/14/2009	N/A	No known survey, numerous wet areas identified.	1	Noted during the Phase 1 Inspection on January 14, 2009. Numerous wet areas along exterior slopes of the northeast dike of the ash pond have been identified during prior TVA Annual Inspections.	URS is currently implementating remediation and closure plans of the Ash Pond and it's dikes.
5	600474.93 600433.31 600304.82 600144.62	2548789.25 2548883.98 2549153.55 2549124.96	1/15/2009	N/A	No known survey, numerous wet areas identified.	1	Noted during the Phase 1 Inspection on January 15, 2009. Wet areas and possible seepage along exterior slopes of the northeast dike of the Dry Fly Ash Stack have been identified during prior TVA Annual Inspections from 2004 - 2006.	Stantec is currently performing alaysis of the Dry Fly Ash Stack and may address wet areas in the report.

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

3/27/2010
Seep carrying ash fines to surface noted in a drainage ditch at the toe of the ash embankment.

Area of Concern 2

3/28/2010
Boils noted at the toe of the south slope directly below the spillway outlets.

Area of Concern 3

1/14/2009
Wet areas along exterior slopes noted during Phase 1 Inspections.

Area of Concern 4

1/14/2009
Wet areas along exterior slopes noted during Phase 1 Inspections.

Area of Concern 5

1/15/2009
Wet areas and possible seepage noted during Phase 1 Inspections.

Appendix D

BRF CCP Emergency Action Plan

APPENDIX A

Document 9

Tennessee Department of Environment and Conservation Division of Solid Waste Management. (January 11, 2006). TVA Bull Run Fossil Plant Ash Landfill #2 – Permit No. IDL 01-0208

Document Type: Solid Waste Permits/Appl.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Solid Waste Management
Fifth Floor, L & C Tower
401 Church Street
Nashville, Tennessee 37243 - 1535
615-532-0780

January 11, 2006

Mr. Joseph R. Bynum, Executive VP
Tennessee Valley Authority Fossil Power Group
1101 Market Street
Chattanooga, TN 37402-2801

CERTIFIED MAIL
7005 1820 0001 5863 4499
RETURN RECEIPT REQUESTED

RE: Final Permit Decision – Class II Landfill
TVA Bull Run Fossil Plant Ash Landfill #2 – IDL 01-0208

Dear Mr. Bynum:

The Tennessee Department of Environment and Conservation is hereby issuing the enclosed permit to you for construction and operation of the referenced disposal facility.

Please contact O. J. Wingfield of the TDEC Financial Assurance Section at (615) 532-0877 for assistance or for questions regarding financial assurance.

I appreciate your interest in complying with state statutes and look forward to working with you again. If you have any questions, please contact Elizabeth A. Cates at (615) 532-0834 or by email: Elizabeth.A.Cates@state.tn.us

Sincerely,

J M Apple

Mike Apple
Director

Enclosures – 1

cc: Larry Bowers, TVA, via email: lcbowers@tva.gov
Elizabeth A. Cates, DSWM/Nashville Central Office
Bassam Faleh, DSWM/Nashville Central Office
O.J. Wingfield, TDEC Financial Assurance/Nashville Central Office
Buddy Kelly, TDEC Fiscal Services, Nashville Central Office
Larry Cook, DSWM/EAC-Knoxville Field Office
Mark Penland, TDEC/Knoxville Field Office
Ms. Jane A. Giles, Director, Clinton Public Library, 118 South Hicks Street, Clinton TN 37716
DSWM Central Files/Nashville Central Office

State of Tennessee
Department of Environment
and Conservation
Division of Solid Waste Management

Solid Waste Management Program
401 Church Street
5th Floor L & C Tower
Nashville, Tennessee 37243-1535
615-532-0780

REGISTRATION AUTHORIZING SOLID WASTE DISPOSAL ACTIVITIES IN TENNESSEE

Registration Number: IDL 01-0208

Date Issued: January 11, 2006

Issued to: Tennessee Valley Authority Bull Run Fossil Plant

Activities Authorized: Construction, operation, closure, and post-closure care of a Class II disposal facility, to be known as the TVA Bull Run Fossil Plant Ash Landfill #2, located in Anderson County, at 1265 Edgemoor Road near Clinton, Tennessee, for the disposal of site-generated industrial waste consisting of coal combustion fly ash and bottom ash, in addition to gypsum produced as a by-product from scrubbers in the coal-fired power plant air pollution control system at the TVA Bull Run Fossil Plant.

By my signature this registration is issued in compliance with the provisions of the Tennessee Solid Waste Disposal Act (Tennessee Code Annotated, Section 68-211-101, et seq.), and applicable regulations developed pursuant to this law and in effect; and in accordance with the conditions and other terms set forth in this registration document and attached Registration Conditions.

Mike Apple, Director
Division of Solid Waste Management

Registration Number ___ IDL 01-0208

PERMIT TERMS AND CONDITIONS

1. Re-certification by Permittee for Facilities Whose Initial Operation is Delayed - If the facility does not initiate construction and/or operation within one year of the date of this permit, the permittee must re-certify the application in accordance with Rule 1200-1-7-.02(2)(d).

2. Duty to Comply - The permittee must comply with all conditions of this permit, unless otherwise authorized by the Department. Any permit noncompliance, except as otherwise authorized by the Department, constitutes a violation of the Act and is grounds for enforcement action, or for permit termination, revocation and re-issuance, or modification.

3. Need to Halt or Reduce Activity Not a Defense - It shall not be a defense for a 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.

4. Duty to Mitigate - In the event of noncompliance with the permit, the permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent adverse impacts on human health or the environment.

5. Proper Operation and Maintenance - The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

6. Permit Actions - This permit may be modified, revoked and re-issued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and re-issuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any existing permit condition.

7. Property Rights - This permit does not convey any property rights of any sort, or any exclusive privilege.

8. Duty to Provide Information - The permittee shall furnish to the Commissioner, within a reasonable time, any relevant information which the Commissioner may request to determine whether cause exists for modifying, revoking and re-issuing, or terminating this permit, or to determine compliance with this permit. The permittee must also furnish to the Commissioner, upon request, copies required to be kept by this permit. All records, including a copy of this permit and the approved Part I and Part II application, must be maintained at the facility or other locations as approved by the Commissioner.

9. Inspection and Entry - The permittee shall allow the Commissioner, or an authorized representative, to:

   (i) Enter at any reasonable time the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

   (ii) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

   (iii) Inspect at any reasonable time any facilities, equipment (including monitoring and control equipment), practices or operations regulated or required under this permit (Note: If requested by the permittee at the time of sampling, the Commissioner shall split with the permittee any samples taken.);

   (iv) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Act any substances or parameters at any location; and

   (v) Make photographs for the purpose of documenting items of compliance or noncompliance at waste management units, or where appropriate to protect legitimate proprietary interests, require the permittee to make such photos for the Commissioner.

10. Monitoring and Records

   (i) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.

   (ii) The permittee shall retain records of all required monitoring information. The permittee shall maintain records for all groundwater monitoring wells and associated ground-water surface elevations, for the active life of the facility, and for the post-closure care period as well. This period may be extended by request of the Commissioner at any time.

   (iii) Records of monitoring information shall include:

      (I) The date, exact place, and time of sampling or measurements;

      (II) The individual(s) who performed the sampling or measurements;

      (III) The date(s) analyses were performed;

      (IV) The individual(s) who performed the analyses;

      (V) The analytical techniques or methods used (including equipment used); and

      (VI) The results of such analyses.

11. Reporting Requirements

(i) The permittee shall give notice to the Commissioner as soon as possible of any planned physical alterations or additions to the permitted facility.

(ii) Monitoring results shall be reported at the intervals specified elsewhere in this permit.

(iii) The permittee shall report orally within 24 hours from the time the permittee becomes aware of the circumstances of any release, discharge, fire, or explosion from the permitted solid waste facility which could threaten the environment or human health outside the facility. Such report shall be made to the Tennessee Emergency Management Agency, using the 24-hour toll-free number 1-800-262-3300.

(iv) Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Commissioner, it shall promptly submit such facts or information.

12. Periodic Survey

(i) Within 60 days of his receipt of the written request of the Commissioner to do so, the permittee shall cause to be conducted a survey of active and/or closed portions of his facility in order to determine if operations (e.g., cut and fill boundaries, grades) are being conducted in accordance with the approved design and operational plans. The permittee must report the results of such survey to the Commissioner within 90 days of his receipt of the Commissioner's request.

(ii) The Commissioner may request such a survey:

(I) If he has reason to believe that operations are being conducted in a manner that significantly deviates from the approved plans; and/or

(II) As a periodic verification (but no more than annually) that operations are being conducted in accordance with the approved plans.

(iii) Any survey performed pursuant to this part must be performed by a qualified land surveyor duly authorized under Tennessee law to conduct such activities.

13. Duration of Permits - This permit shall be effective for the operating life of the facility.

14. Effect of Permit - The issuance of this permit does not authorize the permittee to injure persons or property or to invade other private rights, or to violate any local law or regulations.

15. Transfer, Modification, Revocation and Re-issuance, and Termination of Permits - This permit may be transferred, modified, revoked or reissued, or terminated as set forth in 1200-1-7-.02(5).

16. Applicable Standards - All applicable facility standards of Rule Chapter 1200-1-7, Solid Waste Processing and Disposal Amendments shall be considered conditions of this registration.

17. Penalties - Any violation of the conditions or other terms of this registration may subject the registrant to the penalties set forth in Tennessee Code Annotated Section 68-211-114 and 68-211-117.

18. Hazardous Waste Restriction - No hazardous waste, as regulated by the Tennessee Hazardous Waste Management Act (TCA Section 68-212-101, et seq.), and the Rules adopted pursuant to that Act, shall be accepted at this facility.

19. Construction and Operation - The permittee shall construct and operate the facility in accordance with the approved engineering plans and operations manual which becomes a condition of this permit as Attachment I.

20. Financial Assurance - Prior to beginning operation, the permittee must file a Financial Assurance Instrument in accordance with Rule 1200-1-7-.03.

21. Special Waste - Except as specifically provided for in the Facility-Specific Conditions of this permit, the permittee may not accept for disposal any special waste unless approved to do so in writing by this Department.

22. Automobile Batteries - This facility is specifically prohibited from accepting automobile batteries for disposal.

Registration Number <u>IDL 01-0208</u>

VARIANCES AND WAIVERS

The following variances or waivers from standards or requirements in Rule 1200-1-7, <u>Solid Waste Processing and Disposal Amendments</u>, are hereby granted in accordance with Rule 1200-1-7-.01(5):

1. Rule 1200-1-7-.04 (4) (b) requires a geologic buffer of low-permeability soil between the bottom of the liner to the top of the seasonal high water table or uppermost unconfined aquifer. This requirement is waived because much of the site is covered with previously-disposed coal combustion waste extending below the water table.

2. Rule 1200-1-7-.04(3)(b) requires that fill areas of Class II landfills must be located a minimum of 200 feet from the normal boundaries of springs, streams, and lakes. This requirement is waived, because the entire southwest side of the fill and all of "Area 1-A" are within 200 feet of Melton Hill Lake, and all affected areas have been previously filled or disturbed by waste disposal activities.

3. Rule1200-1-7-.04(2)(k)2. prohibits disposal of any bulk or non-containerized liquids in a landfill, other than domestic waste or leachate or gas condensate collected from the landfill. This requirement is waived, because the waste will consist of wet-sluiced ash and gypsum in the early stages of development. The Permittee has demonstrated that a stable fill can be constructed by placing liquid or semi-solid materials inside solid embankments with a dewatering system, and has also demonstrated that no harmful leachates will be created by this practice. The Permittee has also disposed the same waste streams using similar methods in permitted landfills at other locations.

Registration Number IDL 01-0208

FACILITY-SPECIFIC PERMIT CONDITIONS

The following conditions of this permit are established pursuant to Rule 1200-1-7-.02(4)(b):

1. All drainage blankets and columns and dewatering structures and systems shall be constructed or installed at the proper time in the development sequence, under the supervision of a professional engineer.

2. Since there are several possible options for disposal of coal ash and gypsum, either as monofills or in combination, the Permittee shall notify the Division of Solid Waste Management of the option for waste placement that will be used in each fill area or sub-area, within forty-five (45) days prior to beginning waste placement.

3. An Aquatic Resources Alteration Permit (ARAP) issued by the TDEC Division of Water Pollution Control must be in effect before placement of culverts and clay fill in "Area 1A".

TVA/COO	FORM A – DESIGN CHANGE NOTICE				Page 1 of 2
1. a. DCN Type ☒ Base DCN ☐ PIC for Base/ Parent DCN No.: N/A	b. Class Routine Design Change ☒ Documentation Only ☐ Material Equivalency ☐ c. Advance Authorization ☐ Yes ☒ No	2.	DCN No.	BRF-06-1052	Rev 0
		3.	Plant/TL/SUB/ Facility	BRF	
			Unit/TL/SUB No.	0	
		4.	System(s)	14, 300	

PART I - REQUESTED CHANGE

5.	Authorizing Documents	
6.	Requested Change or Problem Statement	The dry ash stack north of the plant is near capacity. TVA is adding an SO2 scrubber to the plant that generates gypsum as a waste product. A disposal site for the gypsum is required in addition to more ash disposal capacity.

7.	John Albright		751-3981	8.	H.L. Petty	
	Initiator's Name (Print)	Organization	Phone		Supervisor/Principal Engr	Date

PART II - INITIATION APPROVAL
(Skip blocks 9 and 10 for Advance Authorization Approval)

9.	R.E. Purkey		10.		
	Reviewed INITIATOR'S DEPARTMENT MANAGER	Date		Approved ENGRG/OPERATIONS MANAGER	Date

PART III - APPROVED CHANGE/DETAILED DESIGN

11.	Approved Change Description	☒ Planned at Initiation	☐ As Issued (If different than planned, line through below and update on continuation sheet.)
	Design and permit a new disposal site within the old ash pond for the gypsum and ash.		
12.	Advanced Authorization Approval (If applicable, otherwise mark N/A.)	RE or Manager	Date
13.	Does this change contain any assumptions or constraints that require confirmation before RTO?		☐ Yes ☐ No
14.	Does this change address the full scope of the authorizing document?		☐ Yes ☐ No

15.	RE	Phone	Date	16.	Civil Lead	Date
17.	Electrical/I&C Lead		Date	18.	Mechanical Lead	Date
19.	Operations		Date	20.	Maintenance	Date
21.	System Engineer		Date	22.	Implementing Organization	Date
23.	Telecommunications		Date	25.	Plant / Site Manager	Date
24.	Engrg or Site Engrg Manager		Date	26	**ISSUE EDMS #**	

PART IV - DCN CLOSURE

27.	Facility Manager or Engrg Manager	Date	29.	**CLOSURE EDMS #**
28.	RE Signature for DCN Closure	Date		

Mark "N/A" in any blocks not applicable.

TVA/COO	FORM A - DESIGN CHANGE NOTICE	Page 2 of 2

DCN REVISION LOG

Revision Number	Effective Date	Pages Affected	Description of Revision
0	2/9/2006	All	Initial Issue

DCN CONTINUATION SHEET

6. Cont'd Requested Change or Problem Statement	
11. Cont'd Approved Change Description	

RELATED DCNS REQUIRED TO COMPLETE THIS MODIFICATION

TENNESSEE VALLEY AUTHORITY

BULL RUN FOSSIL PLANT

OPERATIONS MANUAL GYPSUM AND ASH DISPOSAL AREAS 1, 1A & 2A VOLUME 1

NOVEMBER 2004

REVISED—JULY 2005

Prepared By

Tennessee Valley Authority
Fossil Engineering Services

Title: OPERATIONS MANUAL GYPSUM AND ASH DISPOSAL AREAS 1, 1A & 2A				DCN # Plant/Unit: BULL RUN FOSSIL PLANT
Vendor	Contract No.	Key Nouns: Permit, Closure/Post-Closure Plan		
Applicable Design Documents	REV	EDMS NUMBER	DESCRIPTION	
References	R0	**B65 041029 250**	November 2004 Parsons Engineering IDL 01-0208	
	R1	**B65 050713 260**	July 2005 Response to TDEC NOD's	
	R2	**B65 050908 255**	Sept 2005 Response to TDEC NOD's	

TENNESSEE VALLEY AUTHORITY
FOSSIL POWER GROUP
FOSSIL ENGINEERING SERVICES
SITE AND ENVIRONMENTAL ENGINEERING

HAROLD L. PETTY
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 015576
STATE OF TENNESSEE

Harold L. Petty

9/9/05

	Revision 0	R1	R2
Date	November 2004	July 2005	Sept 2005
Prepared	D.R. Smith	D.R. Smith	M. S. Hughes
Checked	W.R. Taylor	W.R. Taylor	L. C. Bowers
Supervised	Harold L. Petty	Harold L. Petty	Harold L. Petty

OPERATIONS MANUAL
AREA 1, 1A AND 2A ASH AND GYPSUM DISPOSAL
TENNESSEE VALLEY AUTHORITY
BULL RUN FOSSIL PLANT

Prepared By:
Tennessee Valley Authority
1101 Market Street
Chattanooga, TN 37401-2801

Revision 2
September 12, 2005

TABLE OF CONTENTS

1 SITE INFORMATION

1.1 Responsible Officials

The following is a list of responsible parties involved with the permitting, design, operation, maintenance, quality control/assurance of the Gypsum and Ash Disposal within Areas 1, 1A, and 2A at the Bull Run Fossil Plant (BRF).

1. Owner: Tennessee Valley Authority (TVA)
   Contact: Plant Manager
   Tennessee Valley Authority
   Bull Run Fossil Plant
   1265 Edgemoor Road
   Clinton, TN 37716-6270
   (423) 945-7212

As of the date of this revision, the plant manager is Mr. Nathan Burris.

2. State: Tennessee Department of Environment and Conservation
   Knoxville Environmental Assistance Center
   Division of Solid Waste Management (DSWM)
   2700 Middlebrook Pike, Suite 220
   Knoxville, TN 37921
   Phone: (865) 594-6035
   Fax: (865) 594-6115

The contact as of the date of this manual is Mr. Larry Cook, Manager.

Tennessee Department of Conservation
Division of Solid Waste Management
Central Office
401 Church Street
5th Floor, L&C Tower
Nashville, Tennessee 37243-1535
Phone:(615) 532-0780
Fax:(615) 532-0886

The contact as of the date of this report is Mr. Mike Apple, Division Director.

1.2 Site Location

Bull Run Fossil Plant (BRF) is located in Anderson County, Tennessee on the Clinch River (Melton Hill Reservoir) at approximate river mile 48 above the confluence of the Clinch and Tennessee rivers. Access to the site is by state highway 170 (Edgemoor Road). Refer to drawing 10W297-2, which depicts the plant layout and location of Areas 1 & 2A.

1.3 Site Description

The sites selected for the disposal facilities are the existing Area 1 (bottom ash disposal), and Area 2A (former dredged ash disposal area to be utilized for future gypsum disposal). The area located between Areas 1 and 2A is planned to be utilized for bottom and fly ash disposal, and is designated Area 1A. All disposal areas are entirely within the BRF Reservation. Existing benchmarks are located as shown on the drawings.

The area surrounding the BRF is primarily industrial and rural in nature (refer to Drawing 10W297-2). The fossil plant powerhouse is located north of the proposed location for these disposal facilities.

The methods of placement of gypsum and coal ash in this facility are discussed in subsequent sections of this operations manual. BRF is equipped with a dry ash handling system, and fly ash is currently stacked at a different site (under a separate solid waste permit) within the BRF Reservation. Occasionally, the plant sluices fly ash and discharges in a shallow pond adjacent to Area 1, where it is conveyed via a ditch to a fly ash pond located south of Area 2 (10W297-3). Currently, bottom ash is conveyed from the plant to the shallow pond located adjacent and east of Area 1 (10W297-3). From that point the bottom ash is reclaimed from the shallow pond by equipment (scrapers and/or trackhoes), and this material has been stacked in Area 1. Recently, bottom ash has been placed in Area 2 as well by the same means used to place ash in Area 1.

1.4 Site Geology and Hydrogeology

BRF is located in the Valley and Ridge Province of the Appalachian Highlands. Physiographically, this subregion is characterized by narrow ridges and somewhat broader intervening valleys trending northeast. The ridges are typically parallel and have relatively level tops. They are composed of resistant sandstones and less soluble limestones and dolomites; whereas, the valleys between are developed in the more easily weathered shales and more soluble limestones and dolomites.

The Appalachian Valley is a region of highly deformed but unmetamorphosed sedimentary rocks of Paleozoic age. Although limestone, dolomites, and calcareous shales predomimate, argillaceous shales, siltstones, and some sandstones are present. These rocks range in age from early Cambrian to Pennsylvanian, but the Cambrian and Ordovician rocks are the most abundant.

The various formations crop out in relatively narrow, linear belts of the northeast trend, each formation being repeated several times at the surface from the southeast to the northwest across the Appalachian Valley. This outcrop pattern is the result of folding and faulting of the originally near-horizontal strata, followed by truncation of the resulting structures by erosion. The rocks were folded and faulted by forces from the southeast. Individual folds were tightly compressed, overturned to the northwest, and finally broken by thrust faults along the axial planes of the folds. The structure of the Appalachian Valley, therefore, is characterized by a series of overlapping linear fault blocks that dip to the southeast.

The stratigraphy and lithology of geologic formations underlying the BRF site is extremely complex. Petrologic, lithologic, and structural features greatly influence all aspects of groundwater genesis, and anthropogenic effects further complicate our understanding of the subsurface. Unconsolidated material overlying bedrock at the site vary in thickness and composition as a result of natural depositional and weathering processes, and from disturbance of the materials during plant construction activities. Likewise, lithologic properties vary significantly throughout the site. This is a result of a combination of several factors: (1) the original physiochemical character of the various rock types, (2) the structural deformation which the rocks have been subjected to in the geologic past, (3) the effects of drilling, blasting, and excavation during construction activities.

The lithologic formations of interest to these disposal areas are the Rome Formation and Mid-Cambrian part of the Conasauga Formation that underlie Areas 1, 1A, and 2A respectively.

The unconsolidated material overlying bedrock can be divided in to alluvial clays, silts, and gravels deposited by the Clinch River and its tributaries, and a regolith of residuum and saprolite derived from the decomposition of the parent bedrock. Alluvial material mantel the main floodplain of the Clinch River west of the CSX mainline railroad and extend northwestward up the small tributary valleys (i.e., Bull Run Creek and Worthington Branch). The majority of the alluvium is composed of yellow sandy silt to silty sand containing lenses of gravel. Weathering of the different rocks at the site has produced a layer of residuum that is variable in thickness due to variations in bedrock lighology, topographic relief, removal by natural erosion, and human activities. A thick layer of residuum is usually developed on the ridges and knobs, and a thin layer on the valley floor. However, there is no evidence of residual soils underlying Areas 1, 1A, and 2A.

In bedrock, water-bearing (active) fractures in bedrock are ubiquitous below the water table, but enlarged fractures are common only at shallow depths. The upper bedrock zone can be described as consisting of closely spaced, connected fractures in an otherwise impermeable bedrock. Additional information regarding geology and hydrogeology is contained in Appendix E.

1.5 Buffer Zone Compliance

Development of Areas 1 and 2A is in compliance with all applicable buffer zone standards listed in Tennessee Rule 1200-1-7-.04(3), with one exception. Reference is made to drawing 10W297-3. Specifically, the waste disposal facility is at least 100 feet from the TVA reservation boundary, and at least 500 ft from any residences. No constructed appurtenances for the fill area are located within 50 ft of the TVA reservation boundary. However, this facility is being permitted on top of former dredge cells constructed about the time the plant began operation. These dredge cells are located adjacent to Melton Hill Lake (Clinch River), and are within the 200 foot boundary. Also Area 1A will overlie a new culvert which will convey stormwater flow from upland areas to Melton Hill Lake. Prior to constructing this culvert, TVA will obtain Section 404 and ARAP permits as needed. No private water-supply wells exist down-gradient of the site. Furthermore, there is no potential for development of such wells because Melton Hill Lake bounds the ash pond on two sides. Water wells within a two-mile radius of the proposed disposal facility are listed in the hydrogeological evaluation for this facility (see Appendix E).

Tennessee Rule 1200-1-7-.04 (3) requires a 200 foot buffer from lakes and streams. The facility is being permitted on top of former ash dredge cells that were constructed years ago. The former dredge cells lie within the 200 foot boundary. Since this is a previously disturbed ash disposal area, TVA requests a waiver of the buffer zone requirements in the areas of dredge cells 1, 1A and 2A

1.6 Geologic Buffer System

A mantle of predominantly alluvial soils generally lies above the bedrock in the area included within the footprint of the disposal facilities, as described in Appendix E. Soil thickness is highly variable, ranging from about 2 feet to a maximum of 24 feet, with an average of about 18 feet in thickness. The alluvial deposits are unconsolidated and lenticular, and consist of clay, silt, and sand with occasional gravel.

The ash and ash-soil fill materials present above the alluvium/bedrock range up to about 30 feet in thickness.

On January 28, 2005 TVA received a notice from TDEC that a waiver from geologic buffer requirements, Rule 1200-1-7-.04(4)(b), would be required. On February 10, 2005 TVA requested this waiver. Following this request, TDEC issued a Notice of Completeness on March 22, 2005.

1.7 Access Control

Areas 1 and 2A are located within the TVA BRF Reservation. Access to this facility is via internal plant roads. During normal operating hours, operations personnel are at the site performing ash disposal operations, maintenance, and inspections as required. TVA security maintains 24-hour surveillance at the plant.

2 DESCRIPTION OF SOLID WASTES, DISPOSAL CAPACITY, AND FACILITY LIFE

2.1 Types of Waste

The plant has one coal fired unit with a generating capacity of 950 megawatts. On-site construction of the Bull Run Steam Plant started in April 1962. The plant was placed in commercial operation in June 1967.

The only wastes that will be disposed of in the waste disposal areas are ash and gypsum from coal combustion at the BRF or other TVA fossil generation facilities. Material removed from the coal yard runoff pond will also be disposed of within Areas 1 and 1A. No other waste materials from any non-TVA sources or plants will be accepted for disposal.

Coal combustion ash is composed of the non-combustible mineral components contained within the coal during its formation. Fly ash and bottom ash are inert, non-combustible, and does not decay biologically. The combustion of coal for the purpose of generating electricity results in the production of by-products that include fly ash and bottom ash. Approximately 2.2 million tons of coal are burned each year at Bull Run Fossil Plant, producing fly ash and bottom ash. This Permit Plan is for the Ash and Gypsum Disposal Area, consisting of, Area 1, Area 1A, and Area 2A (including the ash pond), is approximately 164 acres located southwest of the generating facility. Additional data regarding the typical characteristics of fly ash and testing of BRF ash samples is included in Appendix A.

TVA is proposing to construct and operate a wet scrubber system to remove SO_3 emissions from the flue gas emissions from the plant. This system is expected to become operational in FY 2008. Wet gypsum will be sluiced to the ash pond where the Phase 2 and 3 disposal cells will be constructed as depicted on the 10W297 series drawings. The pH of the sluiced gypsum will range between 5.5 and 7.5. Depending on market availability, TVA may be able to market up to 90% or more of the gypsum generated at BRF to private companies involved in the manufacture of various products. It is uncertain as to the actual percentage of gypsum that can be marketed; therefore, life projections will be made for worst case. Gypsum is inert, non-combustible, and does not decay biologically. It is utilized in the manufacture of gypsum wallboard. Additional data regarding the typical characteristics of gypsum and typical chemical composition (based on TVA's Cumberland Fossil Plant Gypsum) is included in Appendix A.

It should also be noted that this facility is also designed to accept fly ash only without gypsum. The stability analysis (Appendix G) analyzed the facility for both gypsum and ash, or ash only. Stacking configurations and limitations are discussed in Appendix G, and herein.

Since wet sluicing of gypsum is integral to TVA's gypsum disposal practices, TVA requests a waiver of Tennessee Rule 1200-1-7-.04 (2), regarding disposal of bulk or non-containerized liquids in a landfill.

2.2 Anticipated Volumes and Facility Life

Fly and Bottom Ash

As described in the attached Closure/Post Closure Plan, TDEC will be notified prior to TVA undertaking any closure activities. Closure is expected to be completed within about two years.

The combustion of coal for the purpose of generating electricity results in the production of by-products that include fly ash and bottom ash. Approximately 2.2 million tons of coal are burned each year at Bull Run Fossil Plant, producing approximately 221,500 tons of fly ash and 24,600 tons (21,700 cy @ 84 pcf or 0.88 cy/ton) of bottom ash annually (this assumes a 90 percent and 10 percent split between flyash and bottom ash respectively). During normal operation, fly ash is collected in silos and is currently disposed on-site under a separate solid waste disposal permit. This dry ash will continue to be disposed at these areas, and will not be disposed of within Areas 1, 1A, and 2A. The plant also sluices 44,300 tons fly ash (49,000 cy @ 67 pcf or 1.11 cy/ton) to the ash pond located south of Area 2A. This pond may require periodic hydraulic dredging of the ash pond to maintain compliance with the NPDES Permit free water volume requirement. When ash is removed from the ash pond, it will be placed in either Areas 1A or 2A.

Bottom ash is sluiced to a shallow pond located adjacent to Area 1, where it is removed with equipment and transported to Area 1 and Area 1A, when developed.

In the recent past, fly ash has been transported to off-site locations and placed as structural fill. TVA continually evaluates ways to market fly and bottom ash, and should marketing be successful for any of these waste streams, the timeframes for waste disposal could be extended.

Gypsum

For planning purposes, gypsum production for BRF is expected to be 250,000 tons (220,000 cy @ 84 pcf or 0.88 cy/ton) per year. It is uncertain at this time whether TVA will be able to market any gypsum from BRF, but has set a target of up to 100 percent as an upper limit. The following sections discuss disposal of each waste stream individually with respect to expansion, and the last section presents projections for facility life using the worst- and best-case waste disposal scenarios.

2.2.1 Area 1

Drawings 10W297-7 and-8 depicts the existing configuration of Area 1. The final grade for Area 1 is shown on drawings 10W297-14 and –15, with final grading of Areas 1 and 1A shown on 10W297-23 and -24. As of March 2004, there are 267,750 cy of disposal capacity available. Assuming a disposal rate of 21,700 cy annually bottom ash), there are approximately 12 years of capacity remaining.

2.2.2 Existing Ash Pond

Approximately 49,000 cy of fly ash is sluiced to the fly ash pond each year. Based on recent survey information from June 2004, there is 325,000 cy of capacity in excess of the free water requirement remaining in the pond. TVA is planning on dredging 100,000 cy every other year from the pond to Area 2A, or to a dredge cell constructed in the pond as shown on drawing 10W297-40. Ash can be removed from the dredge cell and dry stacked in Area 1A.

2.2.3 Area 1A

In order to provide additional fly ash disposal capacity, TVA is constructing an additional expansion of Area 1 located between Areas 1 and 2A. Area 1A is expected to have 876,500 cy of disposal capacity available. If bottom ash is only disposed in Area 1A, it should provide an additional 40 years of disposal capacity for bottom ash. However, TVA may place fly ash dredged from the pond (approximately 100,000 cy every other year), which would reduce the capacity to about 23 years. Table 2.1 shows the stage-storage volume of Area 1A.

Table 2.1

Stage	Volume (cy)[1]
Stage 0 (Below El 835)	181,042
Stage 1 (835 - 865)	358,866
Stage 2 (865- 895)	237,829
Stage 3 (895 – 925)	86184
Stage 4 (925-948)	12580
Total	876,500

[1]Capacity includes approximately 43,500 cy for a 1.5 ft thick cover

2.2.4 Area 2A

The disposal capacity of Area 2A is approximately 2,743,400 cy. Assuming 220,000 cy per year (no marketing) would provide 12.5 years of capacity. If 400,000 cy of ash is dredged from the ash pond, the facility would provide 10.5 years of capacity. Table 2.2 presents the disposal volume and area of each stage.

Table 2.2

Stage	Volume (cy)[1]
Stage 1 (835 - 865)	1,327,106
Stage 2 (865- 895)	809,935
Stage 3 (895 – 925)	433,829
Stage 4 (925-955)	172,450
Total	2,743,400

[1]Capacity includes approximately 56,400 cy for a 1.5 ft thick cover

2.2.5 Projections for Facility Life

The following table depicts the overall life of the facility over time. Table 2.3 assumes 100 percent gypsum disposal and continued fly and bottom ash disposal. Table 2.2 includes the annual gypsum production volumes available based on the current fuel plan.

If a percentage of gypsum is marketed, the facility life will increase, but this is not included in the table at this time.

Table 2.3

Area	*Facility*	*Waste*	*Start Date*	*End Date*	*Comments*
1	Existing Bottom Ash Disposal Area 1	Dry stacked bottom ash	2005	2016	
1A	Area 1A	Dry stacked bottom ash only	2017	2056	
	Area 1A	Dry stacked bottom ash and fly ash from fly ash pond	2017	2028	
2A	Gypsum Disposal only in Area 2A	Wet gypsum to el. 925	2008	2019	
	Gypsum Disposal only in Area 2A	Dry gypsum in remaining area	2019	2020	
2A	Gypsum and ash disposal	Wet gypsum/wet ash	2008	2017	Wet gypsum/ash below elev 925
2A	Gypsum and ash disposal	Dry Gypsum	2017	2018	Dry waste above elev 925
2A	Ash disposal only	Wet ash only	2008	2059	Wet gypsum/ash below elev 925
2A	Ash disposal only	Dry Ash	2059	2062	Dry waste above elev 925
Closure	Entire disposal area	Ash, gypsum	2062	2064	2028-2030 if gypsum is placed

2.3 Permitted Area

The area within the ash disposal boundary is depicted on drawing 10W297-3, and is approximately 164.2 acres overall, including the stilling basin. Area 1 occupies approximately 52.4 acres, Area 1A approximately 7 acres (base footprint), Area 2A approximately 56 acres, and the ash pond (including the stilling pond) 48.8 acres. The groundwater compliance boundary is defined by the monitoring wells shown on the drawings included in this permit application.

3 WASTE HANDLING

3.1 Waste Handling Operations

3.1.1 Initial Construction and Operation of Ash Disposal Complex

Areas 1, 2A, and Fly Ash Pond

Areas 1 and 2A are located adjacent to the Clinch River (Melton Hill Lake) south of the powerhouse. Earthen materials were excavated from within the footprint of the area and placed to form two separate diked areas. Area 2A and the Fly Ash Pond were initially constructed as a single area. The stilling basin was constructed by building a dike to form a separate pond, adjacent to ash pond. Bottom and fly ash were sluiced separately through a series of pipes to a location adjacent to what is now termed Area 1. Bottom ash was sluiced into Area 1, while Fly Ash was sluiced to a channel where it was conveyed to the fly ash pond. As both ponds were filled, they were raised to provide additional disposal volume. Fly ash continued to be sluiced to the Fly Ash Pond, and ash dikes were built in the northern portion of the pond to form a dredge cell. The elevation of these dikes is approximately 825. This formed the boundary of what is now Area 2A. A dredge was placed in the southern portion of the pond and ash was hydraulically dredged into this area to about elevation 820. Additional fly and bottom ash has been stacked in the northern portion of Area 2A within the past four years. Drawings 10W297-3 and –4 depict the existing configuration of these areas.

3.1.2 Current Ash Handling Operations

Areas 1 and 2A

BRF over the years has evaluated opportunities for marketing fly and bottom ash, and installed a dry fly ash handling system to accommodate this market. Currently, no ash is being marketed off-site, and dry ash is stacked in a separate permitted on-site disposal area east of the powerhouse. As discussed earlier, approximately 20 percent of fly ash is sluiced to the pond, and the remaining fly ash is stacked in the on-site disposal area.

Currently, bottom ash and fly ash are sluiced separately through a series of pipes to a point southwest of the plant. The bottom ash is sluiced to a small pond adjacent to Area 1, where the coarser particles settle out in this pond. The bottom ash is removed from the pond using scrapers (pans), or draglines, long reach trackhoes. The bottom ash is transported to Area 1 and placed in thin lifts and compacted using the hauling equipment. Occasionally, bottom ash has been placed in Area 2A using the same method. The plant has also recently hauled fly ash from the dry fly ash handing system and dry stacked it into Area 2A along with bottom ash.

Fly Ash Pond

When the plant sluices fly ash, it enters the ditch leading from the shallow bottom ash pond and is conveyed in this ditch which flows on the eastern border of the disposal complex and on to the Fly Ash Pond located south of Area 2A.

Selective Catalytic Reduction

BRF recently installed and began operating a Selective Catalytic Reduction System (SCR) to reduce NO_x emissions generated as part of plant operations. This system utilizes a catalyst to capture NO_x from flue gases in concert with anhydrous ammonia. As the system is operated, the catalyst requires periodic replacement, and ammonia concentrations can build up in collected fly ash as a result of this process. Appendix E contains the results of modeling fate and transport of constituents contained in fly ash, including ammonia. Dry (non-dredged) fly ash collected in the silos at the plant will not be placed in these areas.

3.1.3 Planned Facility Operation for Area 1

As discussed earlier, bottom ash was sluiced into Area 1. As this pond was filled, bottom ash was removed from the shallow pond using scrapers and dry stacked onto Area 1. This method will continue to be used until Area 1 reaches the designated elevations prior to closure.

3.1.4 Gypsum and Ash Handling Operations and Construction of Area 2A

Plugging and Abandonment of Existing Piezometers

Piezometers consist of two inch diameter PVC casing and screen, and have varying overall depths. A neat cement/bentonite grout mixture consisting of 94 lb Portland cement (ASTM C150-69A), four pounds powered bentonite, and 6.5 gallons water shall be used for sealing wells. Bentonite and water shall be thoroughly mixed before cement is added to form grout slurry. The well shall then be pressure grouted from the bottom of the hole to ground surface using a grout pump and tremie pipe system without removal of casing and screen. The overall depth of well shall be measured to determine whether any sediment is present in the bottom of the well. If so, sediment shall be removed by flushing or air-lift pumping. Well casing and screen shall be pressure grouted from the bottom of the well to top of casing using a grout pump and tremie pipe system. Once grout has hardened, casing stickup shall be cut off at ground level. The Constructor is responsible for documenting well abandonment procedures, including well number, measured total depth and static water level prior to grouting, casing schedule and diameter, grout composition and volume injected, and sealing method.

Initial Construction of Area 2A for Gypsum Disposal

The following discussion is an approximate sequence of activities that will occur in the construction for gypsum and flyash disposal in Area 2A. Because the scrubber is not expected to become operational until about FY2008, detailed schedules for construction have not yet been developed. However, this Operation Plan outlines the sequence of construction activities required, and TVA will develop a schedule in concert with Plant Operations staff and TVA Yard Operations/Heavy Equipment Division, the organization that will oversee and implement construction.

The Area 2A expansion will be initially constructed as shown on the drawings. Sections A26 and A27 on drawings 10W297-26 and –27 respectively depicts a typical cross-section for construction of the expansion. The existing discharge weirs located in the southern end of Area 2A will be utilized for drainage during construction of the fly ash base. These will be plugged and abandoned in place when no longer needed for drainage. The discharge weirs and pipes will be inspected and repaired, refurbished, or replaced if necessary prior to construction of the fly ash base.

Trackhoes will excavate fly ash out of the ash pond along the eastern side as ash is continuously sluiced from the plant. Alternately, TVA may build the dredge cell within the existing ash pond, and dredge ash from the ash pond to the dredge cell. Ash will be excavated from the dredge cell and dry stacked as fill within Area 1A. This ash will be dried to a moisture content suitable for placement in dry form. Fly ash will be loaded into dump trucks or scrapers and hauled to the Area 2A construction area. A base of fly ash will be constructed to form the base of Area 2A. Perforated drainage pipes will be installed in the base as part of the drainage layer that will be constructed above the base. The QA/QC plan (Appendix I) contains requirements for construction of the base. The base will slope at a grade less that 1% from the existing dredge cells towards the stilling basin. Initially, bottom ash may be used to create access ramps out into the pond to support equipment for construction of the southern portion of the base that will extend into the existing ash pond. Fly ash will be placed in approximately 6-7 inch loose lifts and compacted using compactors and/or other suitable equipment to achieve the required density as described in the QA/QC Plan. Water trucks will provide moisture control to achieve the desired density as well as suppress dust during construction.

Upon completion of construction of the fly ash base, a drainage filter layer will be constructed on top of the fly ash base. A two and one half-foot thick layer of bottom ash will be placed, with the lower two feet functioning as a drainage layer. Perimeter drains will be placed into the dikes forming the boundary of Area 2A as shown on the drawings. Bottom ash will be obtained from Area 1, and transported to Area 2A by use of scrapers or trackhoes and dump trucks. The drainage layer will be placed in 6-7 inch thick loose lifts and lightly compacted with a roller. A six-inch layer of fly ash will then be placed on top of the bottom ash and the fly ash will then be mixed with the uppermost six-inches of bottom ash to form a 1-foot thick filter layer. Bottom ash will also be utilized to construct starter dikes to enclose a portion of Area 2A area to allow later disposal of gypsum, as described in subsequent paragraphs, and as shown on drawing 10W297-27. A testing program was initiated to study the use of existing materials (fly and bottom ash) as drainage and filter media (Boschuk, 2004). This testing program was developed for a similar design for the Kingston Fossil Plant. Channels will be constructed to allow the facility to receive gypsum sluiced from the dewatering facility without eroding the filter drainage layer. Metal spillways will be installed as shown on the drawings.

<u>Initial Gypsum Placement into Area 2A</u>

A bottom ash dike will be constructed as shown on drawing 10W297-12 and -13 to create a pond for gypsum disposal. Because the bottom will slope, initial filling operations may only partially fill Area 2A. Gypsum slurry will be sluiced from the dewatering facility to the Area 2A expansion area, and allowed to settle. Decant structures (metal spillways) will be installed to maintain the water surfaced at an appropriate level.

After a sufficient amount of gypsum is placed in the pond, the outer dike of the entire Area 2A area will be raised in five-foot increments along with the rim ditch and inner dike. Initially, the rim ditch will only be constructed from the southern end to the northern end of Area 2A, to prevent the likelihood that rim ditch construction could damage the drainage layer. As the height of the gypsum dikes reaches 845, the gypsum dike will be extended around the entire footprint of Area 2A. A spray-on soil stabilizer, such as PosiShell, may be utilized on the unconstructed portions of Area 2A to prevent erosion and to preserve the surface. Because the drainage layer will be installed, accumulated precipitation will seep into the drainage layer and prevent ponding of water in this area.

Construction of the wet cast gypsum dikes will utilize the upstream method of construction. This method has been employed at other TVA plants for gypsum disposal. Trackhoes will excavate the gypsum from the ponded area and stack the gypsum on the outer slope of the bottom ash starter dike. As the outer dike is constructed, a rim ditch and inner dike will be constructed. The outer dike and rim ditch will be constructed around a portion of the periphery of the Area 2A expansion area, as shown on drawings 10W297-12 and -13, and –15 through -16. A cross-section is shown on 10W297-26. A perimeter underdrain will be installed in each 10-foot lift when the outer dikes are raised as shown on drawing 10W297-32. The perimeter drain will be fitted with outlets spaced throughout the circumference of the drain. The drain will be constructed with a nominal one percent slope with the outlets located at low points. The outer dikes will be raised by dipping gypsum out of the rim ditch and wet-stacking the material.

Drawings 10W297-39 and –40 depict different options for waste disposal in Area 2A. The wet cast gypsum dikes will ultimately be raised approximately 10 feet, or to about elevation 845, to allow wet gypsum bypass to the pond when needed. The metal spillways will be raised and rim ditching activities will continue. After the invert elevation of the rim ditch is above elevation 845, the rim ditch can be constructed completely around the periphery of both gypsum ponds A&B. The subsequent operations will involve continued gypsum slucing into the pond through the rim ditch and construction of divider dikes to maintain three separate ponds. Ash or gypsum can be dredged into the center area.

Area 2A will then be subdivided into two (Option 1 on 10W297-39) or three distinct ponds (Option 2), to allow gypsum sluicing operations to continue in one pond while stacking can continue in the inactive pond. If TVA decides to sluice fly ash into Area 2A (Option 2), the third (center) pond can be used for ash disposal, once dikes separating the three ponds are completed, if ash and gypsum segregation is desired. The rim ditches surrounding the gypsum disposal ponds will be elevated above the ponded area to allow the coarser-sized particles to settle out in the rim ditch. It is important that the outlet of the rim ditch remain above the level of the pond. The nominal slope of the rim ditch is 0.25 percent (2.5 feet vertical per 1000 feet horizontal). The ditch will be constructed to the dimensions shown on the drawings. Gypsum slucing will continue to be sluiced into the rim ditch and allowed to decant into the ponded area. The rim ditch can be operated by allowing gypsum to flow along the entire ditch, or the inner wall of the ditch can be breached (sluice cuts) sequentially at various points along the ditch to allow more even distribution of gypsum into the pond. This can be accomplished by plugging existing sluice cuts, and opening new ones opened sequentially throughout the length of the ditch. Another option would be to allow gypsum entry at both the north and south ends of the gypsum area. At the completion of the Stage 1 dikes, the nominal elevation will be 865, less the thickness of the final cover, expected to be between one and one-half and two feet thick. As an alternative to the rim ditch operation, TVA can provide multiple ports to introduce gypsum along various points along the periphery of Area 2A.

Depending on the ability of TVA to market gypsum, the gypsum pond constructed in Area 2A may remain at elevation 850 until such time that gypsum bypassing fills the pond to the point that the dikes need to be raised. Dikes will continue to be raised in five foot increments as needed until Stage 1 is complete (finished top of dike elevation 865).

Dike Raising in Area 2A/Stages 2 and 3

Stage two dike raising will begin by stepping the dike in about 15 feet to create a terrace. This terrace is constructed for both stability and drainage purposes. Gypsum stacking operations will continue in the same manner as described for upper 15 foot portion of Stage 1.

Stage 3 dike raising will likewise continue as described for Stages 1 and 2.

At elevation 895, a bottom ash horizontal blanket drain will be constructed to provide vertical and lateral drainage within the stack to keep the phreatic surface as low as possible. The blanket drains will tied to the perimeter drain, and cross sections for stack development are shown on drawings 10W297-26.

Dike Raising in Stage 4

Above elevation 925 it will be impractical to continue to wet cast gypsum, because the area remaining within the pond will be too small to settle out the gypsum. Therefore, dry gypsum will be hauled and placed in thin lifts and compacted as described in the QA/QC Plan. Because water will not be used, and there is not a pond, the material will simply be stacked on a 3:1 slope. No perpherial drains will be required.

3.1.5 Construction of Dredge Cell in Ash Pond

As part of its ash and gypsum disposal activities, TVA plans to construct a dredge cell in the southeast corner of the fly ash pond (located where shown on drawing 10W297-3), and construction details are depicted on 10W297-40. The dredge cell will be built by constructing bottom ash dikes to create a dredge cell. Ash will be periodically dredged into this cell and later removed by use of trackhoes, loaded into trucks, and hauled for disposal into Area 1A. As the ash is removed, additional dredging will occur and the process repeated. This will ensure that the pond will maintain adequate free water volume for the existing NPDES permit.

3.1.6 Construction and Ash Placement into Area 1A

Area 1A will be constructed prior to closure of Area 1. Because Area 1A is located between Areas 1 and 2A, the progression of stack height for Area 1A will ultimately depend on how high Area 2A is carried.

In order to maintain surface water runoff to the ash pond from the western side of Area 1, ash stacking in Area 1 will be completed, and permanent closure undertaken prior to completing construction of Area 1A. TVA may close the entire portion of Area 1 at that time (except for the portion that ties into Area 1A), or may permanently close the western slope of Area 1 and place 1 foot of cover and provide vegetation, until such time TVA decides to close Area 1 entirely.

Area 1A will be built by constructing a culvert to provide drainage for the stream that separates Area 1 from Area 1A. Hydraulic calculations for these new culverts are included in Appendix L. A cofferdam will be installed and water removed so that the culvert can be constructed. Once the culvert is completed, random fill soil will be placed above the culvert as shown on the drawings. The uppermost three feet of the final layer of soil will be placed in compacted lifts and will be controlled to achieve 1×10^{-6} cm/sec hydraulic conductivity. The base will be sloped away from Melton Hill Lake towards the existing ash sluice ditch, so that runoff from the area during initial operation will be directed away from the lake. Drawing 10W297-12 depicts initial development of this area, and drawing 10W297-24 depicts the final closure.

3.2 Covering Program

3.2.1 Daily and Intermediate Cover

No daily or intermediate cover will be required for this facility. The fly ash and gypsum are inert, physically stable, do not biodegrade, and do not attract animals. Therefore, vector control is not needed.

Temporary cover is already present of the slopes of the existing Area 1 and 2A facing the lake. This cover will continue to be utilized until such time that final closure is required on these slopes.

3.2.2 Final Cover

Final closure of the disposal facility will be undertaken as described in the Closure Plan for this facility (TVA, 2004a). Drawing 10W297-23 through -25 depict final closure contours (including the thickness of the final cover). The fill contours of the ash are at 1.5 to 2 ft below the contours shown.

The final cover will consist of a one foot layer of low-permeability soil compacted to achieve a maximum hydraulic conductivity of 1 x 10^{-6} cm/s overlain by a one foot thick soil layer suitable for sustaining vegetation, as shown on drawing 10W297-34, if a compacted clay liner is constructed. Another option for the final cover consists of the following components (see drawing 10W297-35) placed on top of the final ash and/or gypsum grade: 1) a low density polyethylene geomembrane, 40 mil thick; 2) a geocomposite drainage layer (consisting of an extruded polyethylene net heat bonded on both sides to a non-woven, needlepunched geotextile); 3) a one foot thick layer of soil placed above the geocomposite drainage layer; and 4) a one-half ft thick vegetative soil layer. Material and installation specifications geocomposite materials for the final cover are included as Appendix J to this document.

The design of the final cover meets or exceeds the requirements contained in TDEC Policy Memorandum SW-93 (formerly Policy Memorandum SW-91-2) for coal ash disposal facilities. TVA can obtain soil for the low-permeability soil layer construction from suitable on-reservation borrow areas. The vegetative soil layer will also be constructed using locally available soil from the BRF TVA reservation, or from off-reservation material provided the soil meets the requirements contained in the drawings. Upon placement of the vegetative layer, the soil will be prepared and seeded using the appropriate methods outlined in Appendix B. Additional provisions for quality assurance and quality control are contained in the QA/QC plan for this facility (Parsons, 2004b).

3.3 Operating Equipment

TVA will either contract with a private construction company for placement of dry ash and gypsum in the disposal facilities, or conduct operations using TVA personnel and equipment. It is projected that the following pieces of equipment may be used at this facility:

- long-reach track-hoes or draglines (excavators);
- Hydraulic dredge;
- bulldozers;
- compactors;
- scrapers (pans);
- water trucks;
- other equipment.

TVA can provide additional equipment within 24 hours for disposal operations in the event of equipment breakdown.

Operating equipment for gypsum stacking operations consists of:
- long-reach trackhoes;
- bulldozers
- scrapers (pans);

- water trucks;
- other equipment.

Gypsum will be sluiced to the dredge cell expansion area using pumps located at the proposed dewatering facility. The solids content of gypsum sluice will be approximately 30 percent.

3.4 Dust and Litter Control

Litter control is not applicable to this disposal facility. Ash will not generate litter. During normal operations, gypsum and ash will be sluiced to ponds as discussed earlier. Bottom ash will be removed from the shallow pond and placed in Areas 1 and 1A. Ash will be removed from the ash pond periodically as discussed earlier, and water trucks will control dust. If fly or bottom ash is hauled via trucks to the facility for disposal at any time, dust control measures are provided to prevent a nuisance to adjacent landowners and TVA employees/operations. Water will be used for providing dust suppression when needed. No oil or other chemical substances will be used for dust suppression. Temporary soil cover may be used as needed for dust control. Chemical binding agents, such as Soil Cement or Posi-Shell, may also be used as needed.

3.5 Erosion Control

This site is a former and existing ash pond and construction of new disposal facilities will occur within both former and existing pond areas. Most runoff is directed to the existing stilling basin, however, a portion of Area 1 will drain to Melton Hill Lake. This portion is already covered with soil and vegetation. Storm water controls to be utilized during construction of the final cover for Area 1 and where runoff is diverted offsite. Otherwise, stormwater controls used to prevent erosion of soils (i.e., silt fences, etc) are not required during the construction and operation phase of this project. However, during closure activities, when soil is brought to the site for final cover construction, erosion controls may be utilized to reduce sediment loading to the stilling basin, as described in Appendix H.

3.6 Leachate Control and Management System

A mantle of predominantly alluvial soils generally lies above the bedrock in the ash disposal area, as described in Appendix E. Soil thickness is variable, ranging between five feet and 23 feet. The alluvial deposits are unconsolidated and lenticular, and consist of clay, silt, and sand with occasional gravel. A thin layer of residuum is occasionally present directly above the bedrock. The residuum is composed of clay and silt with weathered shale fragments.

The ash and ash-soil fill materials presently above the alluvium/bedrock range up to approximately 50 feet in thickness. The construction of the new facility will incorporate blanket drains that will collect and channel drainage from within the stack area. The blanket drainage system includes a series of four-inch diameter drain pipes spaced on 50 foot centers as shown on drawings 10W297-26 and –27. The pipe system will be visually inspected at regular intervals during the life of the facilty to ensure that pipes are draining as designed. Cleanouts for these pipes are included on the upstream and downstream ends of the piping system for access in the event that pipes become clogged. Additional information regarding leachate control and management are contained in the Hydrogeological Report (Attachment E).

3.7 Safety Precautions

Ash from the BRF is a by-product produced by the combustion of coal, and therefore poses no threat as a potential fire hazard. Gypsum likewise is an inert material derived from limestone used in the scrubber process, and also poses no threat as a potential fire hazard. However, properly maintained fire suppression equipment will be provided for all ash disposal equipment and vehicles. This will consist of fire extinguishers of the size and type required extinguish the type of fire that may potentially occur in the types of equipment and vehicles required for conducting disposal operations.

3.8 Personnel Facilities

The following personnel facilities are available at the BRF plant site:

- A utility building is on-site for equipment maintenance and yard operations personnel that is accessible by any facility personnel and has adequate screening, heating facilities, and lighting.
- Safe drinking water.
- Sanitary hand-washing facilities.
- Toilet facilities.
- A two-way radio and/or telephone for communications.
- A first aid kit.

All of the above services and facilities are readily available for operations personnel at the BRF.

3.9 Containment of Explosive Gas

Gas collection for coal combustion ash disposal facilities is not applicable per DSWM Policy, February 27, 1991, Item 3 (Appendix C).

3.10 Surface Water Management System

The surface water management system for final closure is depicted on drawings 10W297-23, through 25. Drawing 10W297-37 depicts an overall view with references to ditch details. The majority of Area 1 and Area 1A will discharge to the ash pond. For Area 2A, all storm water and dredge water will collect and discharge through a temporary metal spillway to the ash pond located to the south. The BRF currently discharges various effluents generated during plant operations under NPDES permit number TN0005410 DSN001. Ash pond effluent is discharged from the disposal facility to the Stilling Basin, then through 36-in diameter pipes through an NPDES permitted outfall.

3.10.1 Existing Surface Water Management System

Currently all stormwater runoff is conveyed to the ash pond by ditches.

3.10.2 Area 1 Surface Water Management System

A portion of thc western face of Area 1A (facing the lake) will be permanently closed prior to construction of Area 1A, so that only stormwater runoff will be conveyed to the lake. The remainder of Area 1 is graded to drain to the ash sluice trench and on to the ash pond located south of Area 2A

3.10.3 Area 1A Surface Water Management System

This area will be constructed so that the entire area slopes away from the lake to the ash sluice trench, and on to the Ash Pond. The western face of Area 1 A will be provided with ditches such that runoff from this area drains to the existing ditch at the toe of the existing ash dike that forms Area 2A. This ditch will drain to the ash pond.

3.10.4 Area 2A Surface Water Management System

After completion of the initial Stage 1 dike construction to elevation 835, dredging activities for gypsum disposal for the lateral expansion will commence as shown on drawings 10W297-12. The initial State 1 dike includes ditches along both sides of the toe of the new gypsum dike that will be constructed, to convey stormwater runoff to the existing ash pond. Process flows into the pond formed within Area 2A will flow to the temporary metal spillways and out into the ash pond.

Wet gypsum stacking operations will raise this dike to elevation 865 to complete Stage 1 dike construction. As the Stage 1 dredging operation is completed, the initial Stage 2 dike will be constructed using the wet cast method of construction. This process will be repeated for subsequent stages. Terraces will be constructed at the beginning of each new stage, as discussed earlier. The terraces will be graded to covey storm water to additional let down channels away from dredging operations.

Drawings 10W297-23 through -25 show the final configuration of the closed facility, including drainage features. Terrace ditches will covey storm water from the uppermost portion of the facility to the base of the facility by use of riprap-lined letdown channels, and on to the stilling basin. Surface water drainage was designed in accordance with Rule 1200-1-7, and calculations are included in Appendix D.

4 PLANNED GROUNDWATER MONITORING PROGRAM

4.1 Compliance Monitoring Boundary and Monitoring Program

The groundwater compliance monitoring boundary is defined by the segment of the ash pond area perimeter lying between the three down-gradient monitoring wells. The approximate location of the groundwater monitoring wells are shown on 10W297-6 through -8, and in Appendix E. The approach to the detection groundwater monitoring program is a conventional program of monitoring one up-gradient and four down-gradient wells. The up-gradient monitoring well is 1. The down-gradient monitoring wells are 47, 48, 49, and 50. Construction logs for all wells constructed for this facility are in Appendix E.

4.2 Detection Monitoring Program

4.2.1 Monitoring Well Design and Construction

All monitoring wells for this facility were installed, developed, and sampled previously prior to submittal of the Closure/Post Closure Plan for the existing dredge cells. Monitoring wells were drilled with hollow stem auger and constructed of two-inch diameter PVC casing. Wells generally have a 20 ft length slotted PVC well screen installed in 8 inch diameter boreholes, packed with filter sand and sealed with bentonite and grout. All wells have vented PVC caps, lockable steel outer casing secured in a concrete pad, and are protected with steel bollards set in concrete. Construction logs for monitoring wells are included in Appendix E.

4.2.2 Sampling and Analysis Program

The sampling and analysis program will be conducted at the following frequencies:

Preconstruction – Four independent samples have been collected and analyzed from each monitoring well for the constituents listed below. The results are listed in Appendix E.
Operation, closure, and post-closure period – collect and analyze one sample from each monitoring well for the constituents listed below, on a semi-annual basis.

Should a statistically significant increase in constituent concentrations be observed, TDEC will be contacted in accordance with Rule 1200-1-7-.04 (7).

The samples will be analyzed for the following constituents listed in Tables 1 and 2:

Table 1 - Groundwater Parameter List

Field Analyses

Acidity	Dissolved Oxygen
Alkalinity	Temperature
Conductivity	pH
Depth to Water	ORP

Laboratory Analyses - Unfiltered samples

ICP2: Copper, zinc;
ICP: Barium, beryllium, silver, vanadium;
GFAA: Antimony, arsenic, cadmium, chromium, cobalt, lead, nickel, selenium, thallium;
OTHER: Fluoride, mercury.

Table 2 - Analytical Methods For Specific Parameters

Parameter	Instrument	Method
Fluoride	ISE	1-EPA 340.2
Ag, Ba, Be, Cu, V, Zn	ICP	2-EPA 6010B
As	ICP-MS	2-EPA 6020
Sb	ICP-MS	2-EPA 6020
Cd	ICP-MS	2-EPA 6020
Co	ICP-MS	2-EPA 6020
Cr	ICP-MS	2-EPA 6020
Pb	ICP-MS	2-EPA 6020
Se	ICP-MS	2-EPA 6020
Tl	ICP-MS	2-EPA 6020
Ni	ICP-MS	2-EPA 6020

Hg	CVAA	2-EPA 7470A

Method Key

Code	Reference
1-EPA	Methods for Chemical Analysis of Water and Wastes, EPS-600/4-79-020, Revised March 1983.
2-EPA	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Revision 3, May, 1997.

Samples will be collected according to procedures detailed in TVA's Quality Assurance Procedure *Groundwater Sample Collection Techniques* (See Appendix F). It contains requirements for sample collection, preservation, shipment, chain of custody, and quality assurance and quality control.

4.2.3 Recordkeeping and Reporting

Results for each sample, including analysts' initials, date of analysis, and method number for each parameter will be reported. Records of compliance groundwater sample results will be kept at the facility. Results will be submitted to the Tennessee Division of Solid Waste Management within 30 days after all analyses are completed.

5 ENVIRONMENTAL PROTECTION STATEMENTS

5.1 Floodplain

This facility is not in a 100-year floodplain. An existing access road from the powerhouse to the stilling basin is at elevation 808. The 100-year flood elevation taken from TVA data is 797 feet above mean sea level.

5.2 Other Environmental Impacts

Because construction activities on this project would occur within the existing footprint of disposal facility complex, which is sufficiently removed from Melton Hill Lake, there would be no adverse impacts to sensitive aquatic animals from this proposed project. Environmental impacts to groundwater are addressed in Appendix E.

The construction of this lateral expansion of the dredge cells and the associated operational activities are not expected to have negative effects on any federal- or state-listed plant species or sensitive habitat for such species.

6 RANDOM INSPECTION PROGRAM

A random inspection program for this facility is not required, because the disposal facility will only dispose of ash and gypsum from TVA facilities. Therefore, a random inspection program for unauthorized wastes is not required. See DSWM Policy, February 27, 1991 Item 5 (Appendix C).

7 CLOSURE AND POST CLOSURE

Closure and post-closure provisions for this facility are discussed in the Closure Plan (Parsons, 2004a) appended to this Operations Manual (see Appendix H). The Closure Plan addresses quantities of materials required for facility closure.

8 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance and quality control for construction and closure of this facility are addressed in the Quality Assurance and Quality Control Plan for the BRF Dredge Cell Lateral Expansion Quality Assurance and Quality Control Plan (Parsons, 2004b) appended to this Operations Manual (see Appendix I).

9 REFERENCES

TVA 2004a, *Closure/Post-Closure Plan Area 1 and 2A, Bull Run Fossil Plant*, September 2004

TVA 2004b, *Construction Quality Assurance/Quality Control Plan, Closure Plan Area 1 and 2A Bull Run Fossil Plant*, September 2004

TVA 2004c, *Bull Run Fossil Plant Hydrogeologic Evaluation of Area 1 and 2A*, River System Operations and Environment, Norris, TN.

Boschuk, John 2004, *TVA Kingston Fossil Plant - Dredge Cell Lateral Expansion - Bottom Ash Filter Drain Study, JLT Laboratories*

APPENDIX A

Document 10

URS. (July 20, 2011). Seepage and Slope Stability Remediation

BASIS OF DESIGN

TVA BULL RUN FOSSIL PLANT
BOTTOM ASH DISPOSAL AREA 1
GYPSUM DISPOSAL AREA 2A
ASH DISPOSAL AREA 2

SEEPAGE AND SLOPE STABILITY REMEDIATION

REV. 0

Prepared for:

Tennessee Valley Authority
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July 20, 2011

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Project No. 31854126

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Appendices

This document presents the engineering basis used to design the Seepage and Slope Stability Remediation of the Bull Run Fossil Plant (BRF) Bottom Ash Disposal Area 1 (bottom ash stack), Gypsum Disposal Area 2A (gypsum stack), and Ash Disposal Area 2 (ash pond). Design background information, assumptions, and methodology are summarized and important results are presented and attached. This report documents the design criteria and standards used for the proposed improvements.

1.1 PROJECT DESCRIPTION

The Tennessee Valley Authority (TVA) currently operates wet Coal Combustion Products (CCP) disposal systems at all eleven (11) of its coal burning plants. TVA retained Stantec Consulting Services (Stantec) to evaluate the seepage and slope stability of several of its CCP disposal areas, including the gypsum stack and ash pond at BRF. Stantec produced a report on the investigation of the BRF disposal area, *Report of Geotechnical Investigation – Bottom Ash Disposal Area 1, Gypsum Disposal Area 2A, and Fly Ash Pond Area 2 – Bull Run Fossil Plant, Anderson County, Tennessee* (*Report of Geotechnical Investigation*). Stantec determined that many of the perimeter dike slopes of the gypsum stack and ash pond had slope stability factor of safety (FoS) values of less than 1.5, with several slopes being at or near FoS values of 1.0. The *TVA Coal Combustion Products – Management Program - Master Programmatic Document* (*Programmatic Document*), the document governing future activities at all TVA CCP facilities, specifies a minimum slope stability FoS of 1.5 for all perimeter CCP facility slopes.

TVA retained URS Corporation (URS) to design seepage and slope stability improvements for the BRF CCP disposal areas. URS has designed improvements as required to increase the minimum slope stability FoS to 1.5 for the entirety of the wet CCP disposal areas at BRF.

1.2 EXISTING CONDITIONS (AS OF 2009)

The gypsum stack is approximately 50 acres in area and enclosed by a perimeter dike system extending to a top elevation of approximately 835 ft. The top of the gypsum stack dikes are approximately 40 ft above the normal pool level of the adjacent Clinch River (El. 795 ft). The slopes of the gypsum stack perimeter dikes range from approximately 1H:1V to 3H:1V, with locally flatter slopes in some areas. The gypsum stack was constructed on an existing ash pond in 2006. Gravel access roads are located along the perimeter dikes of the gypsum stack, at multiple elevations.

The ash pond is approximately 40 acres in area and enclosed by a perimeter dike system extending to a top elevation of approximately 810 ft. The top of the ash pond dikes are approximately 15 ft above the normal pool level of the adjacent Clinch River (El. 795 ft). The ash pond was constructed in the 1960's with an original perimeter dike crest elevation of approximately 800 ft. The perimeter dikes were raised to their current elevations in the 1970's.

The bottom ash stack was constructed over the northern portions of the original ash pond. As slope stability analyses showed acceptable FoS values of the bottom ash stack, no remedial actions were taken. Additionally, the ash stack has not shown signs of instability in the past.

Stantec lists the results of slope stability analysis in their *Report of Geotechnical Exploration.* Stantec concluded that the perimeter dikes did not meet the minimum required FoS value of 1.5 listed in the *Programmatic Document.* Stantec's computed FoS values are listed in Table 1. Figure 1 shows the location of each cross section within the ash disposal complex.

Table 1: Computed Factors of Safety from Stantec's *Report of Geotechnical Exploration*

Cross Section	Location	Exterior Slope Global Failure	Pool Elevation
D-D'	Bottom Ash Stack	2.1	Normal Pool
F-F'	Gypsum Stack North Slope	Not Analyzed	Normal Pool
I-I'	Gypsum Stack West Slope	1.2	Normal Pool
K-K'	Gypsum Stack South Slope	1.2	Normal Pool
L-L'	Gypsum Stack South Slope	1.1	Normal Pool
N-N'	Fly Ash Pond West Dike	1.4	Normal Pool
O-O'	Fly Ash Pond West Dike	1.4	Normal Pool
R-R'	Fly Ash Pond South Dike	1.3	Normal Pool
S-S'	Fly Ash Pond South Dike	1.2	Normal Pool

In addition to the low computed factors of safety, both the slopes of the gypsum stack and ash pond have shown physical signs of instability in the past. The problems included the appearance of seeps, ash boils, and shallow slope failures on both perimeter dike systems, as stated in Stantec's *Report of Geotechnical Exploration.*

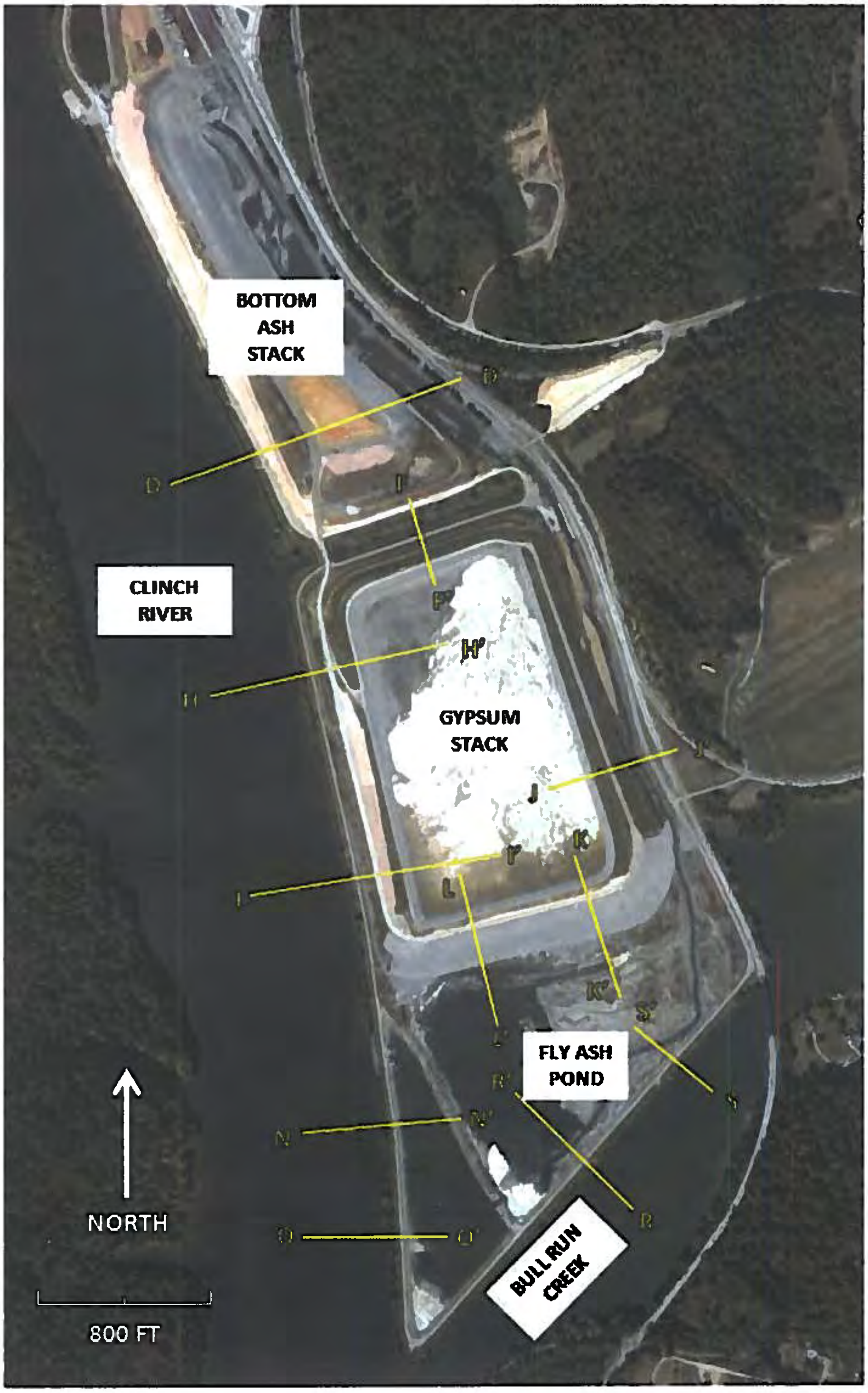

Figure 1: Location of Slope Stability Cross Sections

A stone buttress designed by Stantec and constructed in 2010 addressed excess seepage and slope instability at the southern slope of the gypsum stack. Stantec also designed slope regrading improvements to address stormwater runoff issues at the site. URS designed the other improvements necessary to raise the slope stability factor of safety to at least 1.5 for both the gypsum stack and ash pond.

Stantec noted several other problems with the perimeter dikes during inspections on March 26, 2010. Noted problems include the absence of rip-rap over much of the perimeter dikes and the presence of open pipes penetrating through the perimeter dikes. The rip-rap, placed along the exterior of the perimeter dikes to protect from erosion from the adjacent Clinch River, was either completely or partially missing in many areas. Absence of rip-rap allows for the slow removal of dike material through erosive action of the adjacent water body. The abandoned pipes penetrating through the perimeter dikes are potential seepage pathways and may damage the dikes due to pipe collapse. Historic drawings showed the pipes were abandoned at some point in the past; however the details of the pipe abandonments are unknown.

1.3 PROPOSED IMPROVEMENTS

Perimeter dike improvements were necessary for the bottom ash stack, gypsum stack, and ash pond to mitigate the risk of slope failures and excess seepage. Three (3) drawing sets were submitted by URS for this work, including:

- The Subsurface Drainage and Slope Improvements project (drawing set 10W508) includes the installation of five (5) French drains within the perimeter of the gypsum stack and a small amount of slope regrading. The French drains and slope regrading are designed to increase the slope stability FoS to at least 1.5 for both current conditions and future gypsum stack buildout conditions (maximum pool elevation of 840 ft).

- The Perimeter Maintenance and Improvements project (drawing set 10W509) includes the placement of rip-rap across the perimeter dikes of the ash pond, gypsum stack, and bottom ash stack. The rip-rap is required for erosion protection across all areas and is required to increase the slope stability FoS to at least 1.5 for most of the ash pond.

- The Grouting of Abandoned Pipes project (drawing set 10W213) includes the grouting of five (5) abandoned pipes within the perimeter dikes of the gypsum stack, ash pond, and bottom ash stack. Filling the pipes with grout was required to remove potential preferential seepage pathways through the perimeter dikes of each disposal area.

1.4 DOCUMENT ORGANIZATION

This document is organized into sections corresponding to each of the three (3) drawing sets submitted to TVA. The drawings sets are listed in Section 1.3. Each section describes the proposed improvements, background information, and design basis. Detailed engineering calculations for each drawing set are included in the corresponding Appendices.

This Basis of Design report (BOD) generally follows the recommended organization listed in Section 2.1 of the *Programmatic Document*. However, several sections listed in the *Programmatic Document* are not applicable for the following reasons:

- Construction Cost Estimate and Schedule – General cost estimates and schedules were submitted to TVA in draft form with each of the drawing sets.

- Permits – A Storm Water Pollution Prevention Plan (SWPP) was previously developed for this work and submitted to TVA. US Army Corps permitting materials for the Perimeter Maintenance and Improvements project were also previously submitted to TVA.

- Construction or Implementation Plan – Construction Quality Assurance (CQA) plans were previously submitted to TVA for each of the drawing sets.

The purpose of the Subsurface Drainage and Slope Improvements project is to control seepage and increase the slope stability FoS to at least 1.5 for the west, north, and east slopes of the gypsum stack. The rock buttress designed by Stantec provides an adequate slope stability FoS for the south slope of the gypsum stack. The improvements are designed to maintain a slope stability FoS of 1.5 for both current and future buildout conditions (maximum pool elevation of 840 ft). Stantec has also designed slope grading and surface drainage improvements for the gypsum stack, which were taken into account for the design of the Subsurface Drainage and Slope Improvements project. Figure 2 shows an overview of the Subsurface Drainage and Slope Improvements.

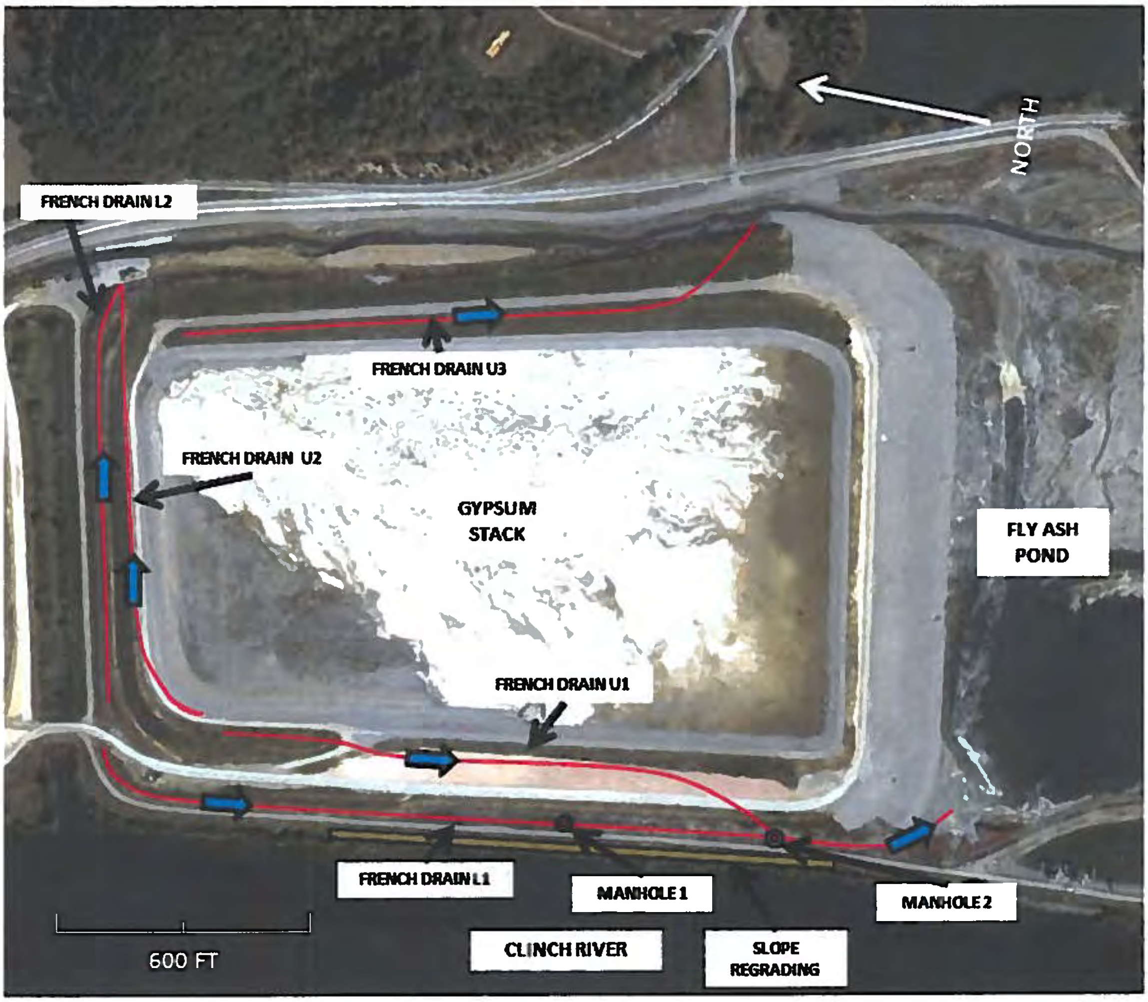

Figure 2: Overview of Subsurface Drainage and Slope Improvements

2.1 DESIGN CRITERIA

2.1.1 Stability Analysis

Stantec performed stability and seepage analyses at cross section I-I' on the gypsum stack as part of their *Report of Geotechnical Exploration*. URS performed stability analyses at cross sections F-F', H-H', I-I', and J-J' (Figure 1), using the stratigraphy, material properties, and ground surface geometry developed by Stantec. Stability analyses were performed using SLOPE/W Version 7.16. The cross sections were modified by installing the expected geometry of the future gypsum stack buildout, with a maximum pool elevation of 840 ft within the gypsum stack and a maximum stack top elevation of 845 ft. Additionally, the slope regrading proposed by Stantec was included in the SLOPE/W model.

Slope stability analyses were performed to find the required depth of French drains to provide a FoS of at least 1.5 for the future buildout condition. Two French drains, an upper and lower, were required for the west and north slopes of the gypsums stack while only an upper French drain was required for the east slope. French drains alone were not able to provide a FoS of at least 1.5 at cross section I-I'. A small amount of slope regrading (material removal) was also required at this location (Figure 2).

A detailed discussion of the analyses used to develop the Subsurface Drainage and Slope Improvements, including SLOPE/W analyses, is located in Appendix 1.

2.1.2 Selection of French Drain Filter Material

The French drain is designed to be backfilled with a single material, TDOT 903.01 concrete sand (ASTM C-33). The French drain pipe was specified as slotted for collecting seepage water from the surrounding concrete sand. The slots in the pipe were specified to meet the AASHTO Class II perforation pattern (slot widths of 0.125 in). The slot width is too large to be filter compatible with concrete sand, so a geotextile filter sock was placed around the pipe to prevent filter sand from entering.

The geotextile filter sock apparent opening size (AOS) was specified to meet the criteria presented by Giroud (1982) and the US Army Corps Task Force 25. The specified AOS is between 0.40 and 0.60 mm. A waiver to use a French drain filter sock for this case was provided by TVA since the French drains are only needed temporarily. The BRF plant is scheduled to be fully converted to dry ash disposal within 5 years. Mechanical and biological clogging of the filter sock was judged not be an issue over the short design life of the French drain.

2.1.3 Selection of French Drain Pipe

French drain pipe was selected for ease of installation and ability to collect and transmit seepage water. Conventional corrugated HDPE pipe with a AASHTO Class II perforation pattern is adequate for this purpose. Six-inch-diameter pipe is specified at all locations other than drain L1 beyond its intersection with drain U2, where an eight-inch-diameter pipe is specified (Figure 2). Pipe size was determined to be adequate to handle 0.2 cfs of flow, the maximum flow expected through any portion of the French drain, based on the amount of water pumped into the gypsum stack during normal operation conditions (approximately 500,000 gallons/day). For design purposes, all water pumped into the gypsum stack was assumed to exit via the French drains.

2.1.4 Placement of Manholes and Cleanouts

French drain L1 collects seepage from the lower bench along the west slope of the gypsum stack. French drain U1 also converges with French drain L1 along this bench, and a separate drainage system designed by Stantec relies on French drain L1 for outflow. This required two manholes to be placed along L1, Manhole 1 at the junction of French drain L1 and Stantec's drainage system, and Manhole 2 at the junction of French drain L1 and U1. The basic layout of the French drain components can be seen in Figure 2.

The design of French drain L1 is also controlled by the required depth below grade to achieve the target FoS and the outlet elevation of the drain in the ash pond. The ash pond will be maintained at El. 801 ft or lower during normal operating conditions. In order to achieve a target slope of 0.5% on the French drain pipe (to allow for drainage and reduce the accumulation of sediment in the drain), the outlet of L1 would be below the surface elevation of the pond, limiting flow. As a result, French drain L1 was designed with a flat slope beyond Sta. 13+11 so the drain invert does not drop below El. 801 ft. A pair of cleanouts was installed between Manholes 1 and 2 to allow for cleaning of this section, as sediments may accumulate due to the flat slope of the drain. The manholes will act as two additional cleanouts.

2.1.5 Slope Regrading

French drains L1 and U1 alone were not sufficient to increase the slope stability FoS to 1.5 for cross section I-I'. A small amount of slope regrading (material removal) was also required at this location. The slope regrading geometry was designed in SLOPE/W by flattening the slope below the access road to an orientation of 3H:1V. The extents of slope regrading were selected by including all areas with similar geometry to cross section I-I' along the west slope of the gypsum stack, resulting in 1200 linear ft of specified slope regrading. The slope regrading extents can be seen in Figure 2.

2.2 DESIGN EXCEPTIONS

French drain L1 is installed beyond Sta. 13+11 (south of Manhole 2) at a slope of 0.0%, which is flatter than the desired 0.5%. Cleanouts have been provided to allow sediments to be removed from the pipe. The flat slope is not expected to impede the low expected quantities of flow.

2.3 DESIGN NARRATIVE

Improvements include the installation of French drains L1 and U1 (west slope), L2 and U2 (north slope), U3 (east slope), and a minor amount of slope regrading on the west slope. The French drains are designed to lower the phreatic (groundwater) surface within the dikes, thereby increasing the slope stability FoS to at least 1.5 for both current and future (buildout) conditions. The French drains should also lower the phreatic surface to limit surface seeps. The minimum installation depths of each drain were determined using SLOPE/W.

Further design of the drains included placement for constructability, and selection of preferred drainage grades (0.5%) to allow for flow and reduce the accumulation of sediments in the drain. Manholes were included where drains L1 and U1 converge and where Stantec plans to install a separate drainage system. Outfall structures were designed at the outlets of each French drain to prevent dike erosion by drain outflow.

Note that seismic slope stability analyses were not performed, as directed by TVA. The analyses used for the design of Subsurfae Drainage and Slope Improvements can be found in Appendix 1.

The purpose of the Perimeter Maintenance and Improvements is to increase the slope stability FoS of at least 1.5 for the fly ash pond perimeter dikes; and to provide erosion protection using rip-rap for the entirety of the bottom ash stack, gypsum stack, and fly ash pond perimeter dikes.

3.1 DESIGN CRITERIA

3.1.1 Seepage and Slope Stability Analyses

Stantec performed stability and seepage analyses at cross sections N-N', O-O', R-R', and S-S' (Figure 1), all located along the ash pond perimeter dikes, in their *Report of Geotechnical Exploration*. URS performed seepage and slope stability analyses at these cross sections, based on modified versions of Stantec's analyses. All analyses were performed using GeoStudio software, with seepage analyses performed using SEEP/W and slope stability analyses performed using SLOPE/W, Version 7.16. Details regarding the seepage and slope stability analyses for the Perimeter Maintenance and Improvements can be found in Appendix 2.

Seepage analyses were performed with an ash pond level of El. 801 ft, the maximum recommended level for future use. Slope stability analyses were used to find the extents and thicknesses of rip-rap buttressing required to achieve a slope stability FoS of at least 1.5, using the pore water pressures from the seepage analysis. Design rip-rap configurations, and the results of SEEP/W and SLOPE/W modeling used to develop the design can be found in Appendix 2.

3.1.2 Selection of Rip-Rap Placement and Extents

Stantec examined the condition of previously placed rip rap erosion protection in March of 2010, during a period of one week while the water level in the Clinch River was lowered approximately 5 ft. Stantec's observations were presented in a drawing labeled *Dike Observations and Monitoring*, dated March 30, 2010. Stantec also prepared a memo titled *Recommended Actions – Slope Conditions of CCP Disposal Areas 2 and 2A* (*Recommended Actions*), dated April 16, 2010, which listed recommended corrective actions for the missing rip rap and other problems at the site.

For rip-rap placement along the bottom ash stack and gypsum stack, URS used Stantec's observations to designate areas where rip-rap was either completely missing, missing in sporadic locations, or intact. Stantec stated in their *Recommended Actions* memo that the perimeter dikes were originally constructed with an 18–inch-thick rip-rap layer. URS recommends the placement of a uniform 18–inch-thick rip-rap layer in all areas Stantec identified as missing all rip-rap, and that the 18–inch-thick rip-rap layer be restored where sporadically missing in areas identified by Stantec as needing some rip-rap. This rip-rap is required for erosion protection only.

For rip rap-placement along the ash pond, URS used the results of seepage and slope stability analyses to designate rip-rap design thicknesses and extents.

3.2 DESIGN EXCEPTIONS

No design exceptions were used in the design of the Perimeter Maintenance and Improvements.

3.3 DESIGN NARRATIVE

Improvements included the removal of woody vegetation from the perimeter dikes and the placement of rip-rap across the periemter dikes of the bottom ash stack, gypsum stack, and ash ponds. The improvments have increased the calculated slope stability FoS to at least 1.5 for the ash pond and protect the perimeter dikes of the other areas from erosion. The rip-rap design extents were determined using SEEP/W and SLOPE/W for the ash pond and using Stantec's *Dike Observations and Monitoring* drawing.

Note that seismic slope stability analyses were not performed, as directed by TVA. The analyses used for the design of Perimeter Maintenance and Improvements can be found in Appendix 2.

The purpose of the Grouting of Abandoned Pipes was to fill abandoned pipes penetrating the perimeter dikes with grout to remove preferential pathways for seepage and to reduce the chance of dike damage due to the structural collapse of an abandoned pipe. Two construction options were presented in Grouting of Abandoned Pipes. Option A used a cast concrete cube to contain grout and was used for construction. Option B used a pneumatic pipe plug to contain grout. Option B was not used for construction, and thus will not be discussed herein. The locations of the abandoned pipes were listed by Stantec in their *Recommended Actions* memo, dated April 16, 2010, and their *Dike Observations and Monitoring* drawing, dated March 30, 2010.

4.1 DESIGN CRITERIA

Pipe grouting using Option A included a concrete cube (bulkhead), cast at the end of each pipe. The cube was designed to resist the thrust (hydraulic force) of a 5foot head of grout within the abandoned pipe through resistance by its weight alone. The design accounted for failure modes of both sliding and overturning. The concrete cube was also designed to be attached to the existing concrete pipes through a system of dowels and epoxy, as a secondary containment measure should the head of grout exceed 5 ft.

Cast within the concrete cube were three pipes, (1) a grout injection port, exiting the top of the cube; (2) a grout vent port, existing the top of the cube, and (3) a drain port, existing the face of the cube.

The grout injection port allows for grout flow into the abandoned pipe, and penetrates through the cube and extends 10 ft into the abandoned pipe, where a 90 degree fitting and nipple raise the outlet of the port 2 ft above the bottom of the abandoned pipe. This was included to allow grout to fill the entirety of the pipe more evenly, and to prevent debris lodging in the outlet port during insertion into the abandoned pipe.

The grout vent port allows grout and water to exit the cube during filling, and verification that the abandoned pipe had been completely filled with grout. The top of the grout vent port was located approximately 1foot above the highest elevation of the pipe. The vent port was designed to be capped after filling.

The drain port, placed at the bottom of the pipe and concrete cube, allows seepage to exit the pipe while the cube was curing.

Detailed design calculations for Option A can be found in Appendix 3.

4.2 GROUT MIX DESIGN

The specified grout mix was selected to meet the following criteria: (1) flowability into the pipe, (2) minimal shrinkage (less than 0.5%); and (3) a minimum unconfined compressive strength of 100 psi after 28 days, to allow for sufficient strength to avoid future pipe collapse.

4.3 DESIGN EXCEPTIONS

No design exceptions were used in the design of the Grouting of Abandoned Pipes project.

4.4 DESIGN NARRATIVE

The design included two options for grouting pipes, Options A and B. The design also specified that the pipes be surveyed using a closed circuit televesion (CCTV) to determine pipe condition, including the presence of any structural defects, risers, or debris within the pipes. The pipes were specified to be cleaned as necessary using high-pressure water or other methods, for proper grout bonding to the abandoned pipe. It was also specified that the contractor should take due care to contain all cleaning water, debris, and grout from entering the Clinch River or Bull Run Creek.

The ash pond must be maintained at a pool elevation of 801 ft or lower to maintain a slope stability FoS of at least 1.5 for the perimeter dikes of the ash pond and gypsum stack. Pool elevations greater than El. 801 will result in the slope stability FoS dropping below 1.5 for wet CCP disposal areas.

All analyses were performed with a pool elevation of 795 ft in the adjacent Clinch River. It is understood that pool elevations may be lowered by up to 5 ft annually. The slope stability factors of safety may drop during this time, however this is acceptable as a temporary condition according to the *Programmatic Document.* However, the ash pond elevations shall not exceed 801 ft while the Clinch River is below El. 795 ft.

The conclusions and recommendations presented in the Basis of Design report are based on the assumptions that our understanding of the existing site conditions and the scope of the project do not change substantially from what is described herein. It is recommended that communication be maintained with URS in order to ensure that the designs described herein are properly interpreted and incorporated into construction.

In the event that changes are made to the nature, design, or location of the proposed improvements, the designs presented herein should not be considered valid, unless URS has reviewed the changes and addresses their impact in the recommendations provided.

The design presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

Seismic conditions were not considered due to direction provided by TVA.

Appendix 1

Design Calculations – Subsurface Drainage and Slope Improvements

TVA Calculation Package

Title BRF - SUBSURFACE DRAINAGE AND SLOPE IMPROVEMENTS

Location Description: *(Optional)* BRF - ASH DISPOSAL AREAS 2A	**Total Pages:** *(including appendices & attachments)* 100

Calculation ID *(All parts required to form a unique ID)*:

Org Code	Location/ Plant Code	Branch Code	Alphanumeric Part = Discipline Code (1) + Type Code (1) + "X" + Unit Field (3) + Sys Code (3) + Year (4) + Sequence No. (4)
FPG	BRF	FES	FPGBRFFESCDX000000201110004

NOTE: When referencing the calculation ID, include all parts without spaces or dashes between them.

Unit(s), Spill gate(s), or Voltages (PSO): 000	**Key Nouns (For CTS/CCRIS):**

Applicable Design Document(s):	**Rev**	**RIMS/EDMS Accession Number** *(Optional)*
	R0	
	R	
UNID System(s):	**R**	
	R	

	R0	R 0	R	R
DCN, PCN, NA				
Prepared: Sign➔	Lucas R Carr			
Print Name	Lucas P. Carr, E.I.			
Checked: Sign➔	Michael S Johnson	Stefanie A. Voss		
Print Name	Michael S. Johnson, P.E.	Stefanie A. Voss, P.E.		
	These calculations contain unverified assumption(s) that must be verified later? ☐ Yes ☒ No These calculations contain special requirements and/or limiting conditions? ☐ Yes ☒ No			
Approved: Sign➔	Kenneth M Berry			
Print Name	Kenneth M. Berry, P.E.			
Approval Date	6/8/2010			
	These calculations contain a design output attachment? ☐ Yes ☒ No			
Revision Applicability	☐ Entire calc	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs
	Computer output Microfiche generated? ☐ Yes ☒ No Number:			

Purpose of the Calculation: BRF - SUBSURFACE DRAINAGE AND SLOPE IMPROVMENTS - THESE CALCUALATIONS WERE USED TO DESIGN FRENCH DRAINS FOR THE GYPSUM STACK (DISPOSAL AREA 2A) AT BRF.

Abstract: The following calculations are included (1) SLOPE/W design of the French drains and (2) geotextile apparent opening size calculations for designing the French drain filter sock.

☒ Electronically file and return calculation to Calculation Library.

☐ Electronically file and return calculation __________ Address: __________

TVA Calculation Coversheet
CTS Input Form

Preparer	Preparer Login ID	Date
Checker	**Checker Login ID**	**Date**

Update Code: ☐ Add ☐ Change ☐ Delete
☐ Rename ☐ Supersede ☐ Duplicate ☐ Verify

The following section applies if a calculation is being renamed, superseded, or has a duplicate.

	Org Code	Plant	Branch	Number	Cur Rev	New Rev
Current Calc ID:						

The following section applies to all calculations.

Calc ID:		BRF				

Firm: *(TVA or Contractor)* URS Corporation

Cross-References

A/C/D	Xref Code	Type	Org Code	Plant	Branch	Number	Rev

TVA Calculation Record of Revision

Calculation Identifier: FPGBRFFESCDX00000020110004

Title BRF - GROUTING OF ABANDONDED PIPES IN PERIMETER DIKES

Revision No.	Description of Revision
0	BRF - SUBSURFACE DRAINAGE AND SLOPE IMPROVMENTS - THESE CALCUALATIONS WERE USED TO DESIGN FRENCH DRAINS FOR THE GYPSUM STACK FPGBRFFESCDX00000020110004(DISPOSAL AREA 2A) AT BRF.

TVA Computer File Storage Information Sheet

Calculation Identifier: FPGBRFFESCDX00000020110004 **Rev.** 0 **Plant:** BRF

Subject: Calculations included limit equilibirum slope stability analyses using SLOPE/W Version 7.16, of the GeoStudio software package. Results of the analyses are attached.

Software Name: SLOPE/W **Revision Level:** 7.16

Vendor Name: GEO-SLOPE International, LTD

Address: Calgary, Alberta, Canada

Executable Files

☒ No TVA developed **executable files** were used in this calculation.

Comments:

☐ TVA developed **executable files** used in this calculation have been stored electronically and sufficient identifying information is provided below for each executable file. *(Any retrieved file requires re-verification of its contents before use.)*

Input Files

☐ Electronic storage of the **input files** for this calculation is not required.

Comments:

☒ **Input files** for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. *(Any retrieved file requires re-verification of its contents before use.)*

TVA Calculation Table of Contents

Calculation Identifier: FPGBRFFESCDX00000020110004

Revision: 0

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URS

By LPC	Date 05/05/2011	Project TVA – BRF	Sheet 1 of 2
Chkd. By KMB	Date 06/02/2011	Description Gypsum Stack Slope Stability & Seepage Improvements	Job # 31854126.40130

Objective

The gypsum stack (Gypsum Disposal Area 2A) at TVA-BRF had perimeter slope stability factors of safety (FoS) values of less than 1.5, as stated by Stantec Consulting Services, Inc. in *Report of Geotechnical Exploration, Gypsum Disposal Area 2A, Bull Run Fossil Plant, Anderson County, Tennessee (Report of Geotechnical Exploration)*, dated April 12, 2010. The low factors of safety were primarily caused by high pore pressures in the disposal area embankment. Design a French drain system to handle seepage water from the gypsum disposal area, reducing pore pressures and increasing the slope stability FoS to at least 1.5 for the entirety of the gypsum disposal area 2A.

Procedure

Use the SLOPE/W stability models prepared by Stantec and provided by TVA as part of Stantec's *Report of Geotechnical Exploration*. Perform analyses at cross section F-F', H-H', I-I', and J-J'. Note that Stantec did not perform slope stability analyses for cross sections H-H', F-F', and J-J'. Use topographic data and boring logs provided by Stantec to develop slope stability models at these locations. Also incorporate the proposed regrading of the gypsum stack as proposed by Stantec, shown in drawing set 10W501.

TVA has stated that they intend to increase the capacity of the gypsum stack through a 10 ft stack raise, effectively raising the maximum height of the perimeter dikes to El. 845 ft and the maximum ash elevation within the stack to El. 840 ft. Incorporate the future stack raise in the SLOPE/W model by adding 10 ft wide dikes with 3H:1V side slopes and water ponded to El. 840 ft.

Design the French drains by manually setting the piezometric line in the analysis at the lateral location where the French drain is to be installed, and iterating depth of the piezometric line below the ground surface until the slope stability FoS is at least 1.5. Perform long-term (i.e. drained) slope stability analysis using Spencer's method and assume a minimum slip surface depth of 10.0 ft. Optimize all design slip surfaces. Use material properties (Table 1) and stratigraphy from Stantec's final *Report of Geotechnical Exploration.*

Civil design of the French drains should ensure that the drains are not installed any shallower beneath the ground surface than the slope stability analyses have determined.

List the minimum invert elevations for French drains and final factors of safety for each cross section.

URS

By LPC Date 05/05/2011 Project TVA – BRF Sheet 2 of 2

Chkd. By KMB Date 06/02/2011 Description Gypsum Stack Slope Stability & Seepage Improvements Job # 31854126.40130

Table 1: Strength Properties Used for Analysis (from Stantec's *Report of Geotechnical Exploration*)

Material	Saturated Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)
Lean Clay Dike (Fill)	126	0	33
Sandy Clay Dike (Fill)	126	0	33
Sluiced Fly Ash	105	0	25
Compacted Ash Dike	105	0	33
Lean Clay Alluvium	123	0	31
Sandy Lean Clay Alluvium	127	0	33
Fat Clay Alluvium	121	0	30
Clayey Sand Alluvium	112	0	33
Silt Alluvium	109	0	28
Sandy Silt to Silty Sand Alluvium	107	0	29
Sand Alluvium	120	0	33
Gravel Alluvium	135	0	40

Results

Table 2 lists the maximum French drain invert elevations and final factors of safety. Note that a lower French drain was not required for Section J-J' to achieve a FoS of 1.5.

Also note that a FoS of 1.5 was not achievable at Section I-I' using a French drain of a reasonable depth. Minor slope regrading (3H:1V from the first change in slope below the access roadway) was required to achieve a FoS of at least 1.5.

Table 2: Results of SLOPE/W Analysis

Cross Section	Minimum French Drain Depth below Ground Surface (ft)		Final Factor of Safety
	Upper Drain	Lower Drain	
F-F'	10	10	1.5
H-H'	10	4	1.6
I-I'	10	6.5	1.6
J-J'	10	Not Req'd	2.0

Attachments

1. SLOPE/W Analyses & Reports
2. Relevant Stantec Boring Logs & Cross Sections

URS **DETAIL CHECK REPORT** Quality

Project Name:	TVA - Bull Run	Project Number:	31854116.00000
Project Location:	Anderson County, Tennessee	Client Name:	TVA
PM Name:	Ken Berry	PIC Name:	Tom Kovacic

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Stefanie A. Voss — Checker's Comments Required by:

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Design of French Drains - Cross Section F-F'

☒ This Detail Check is a check for correctness, completeness and technical accuracy.

☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry — 5-18-2011

Project Manager Signature — **Date**

Detail Check – Part 1: Comments

(This Section is to be completed by the Checker.)

Check box A **or** B:

A. ☐ All items have been found to be correct. Checker has no comments.

or

B. ☒ Checker's comments have been provided on:

☐ Marked directly on Work Product
☐ Comment and Disposition Form (Form 3-5 (MM))
☐ Other Specify: ____

Stefanie Voss — 5-10-11

Checker Signature — **Date**

Detail Check – Part 2: Verification

(This section is to be completed by the Checker after verification of comment resolution, if box B is checked off above.)

Check box C **or** D <u>and</u> then E:

C. ☒ Verification of comment resolution has been performed by Checker AND any significant issues have been resolved between Originator and Checker.

or

D. ☐ Verification of comment resolution has been performed by Checker AND unresolved issues have been submitted to the Project Manager, Principal-in-Charge or designee for resolution.

<u>and</u>

E. ☒ Verification of correct incorporation of resolved comments into final Work Product is complete.

Stefanie Voss — 5-10-11

Checker Signature — **Date**

APPROVAL and DISTRIBUTION

(To be signed after box A or E are completed.)

☒ The Detail Check is complete. Significant issues not resolved between the Checker and the Originator, if any, have been resolved by the Approver.

Kenneth M Berry — 5-18-2011

Project Manager, Principal-in-Charge or Designee Signature — **Date**

Distribution:

Project Central File – Quality file folder

Other Specify: ____

Gypsum Disposal Area 2A
Cross-Section F-F'

Bull Run Fossil Plant
Tennessee Valley Authority

SLOPE/W Stability

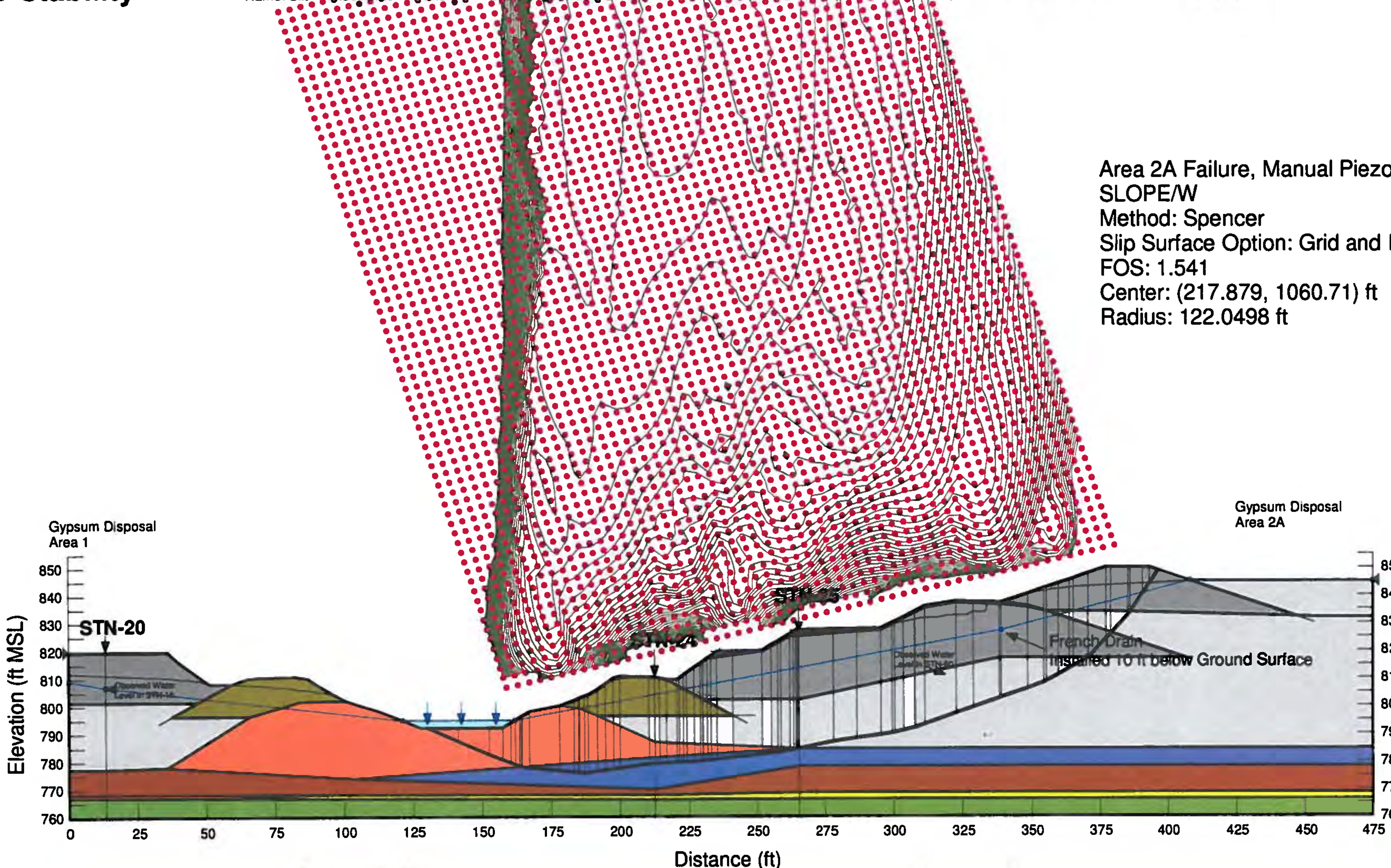
Future Conditions - Gypsum Stack to el. 845' & Stantec Repairs

Analyzed: LPC
Checked: SAV

Date: 5/5/2011

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 128 pcf Cohesion: 0 psf Phi: 3[illegible] ° Phi-B: 0 ° Piezometric Line: 1
Name: Ash Dike Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Rock Model: Bedrock (Impenetrable) Piezometric Line: 1
Name: Sand Alluvium Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 38 ° Phi-B: 0 ° Piezometric Line: 1
Name: Sandy Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 127 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Silt Model: Mohr-Coulomb Unit Weight: 109 pcf Unit Wt. Above Water Table: 108 pcf Cohesion: 0 psf Phi: 28 ° Phi-B: 0 ° Piezometric Line: 1

Area 2A Failure, Manual Piezo
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.541
Center: (217.879, 1060.71) ft
Radius: 122.0498 ft



P:\Geotechnical\TVA Bull Run\Basis of Design Report\Gypsum Stack French Drain Design Analyses\Section F-F' with Stantec repairs & gyp stack to el 845'.gsz

URS

DETAIL CHECK REPORT

Quality

Project Name:	TVA - Bull Run	Project Number:	31854116.00000
Project Location:	Anderson County, Tennessee	Client Name:	TVA
PM Name:	Ken Berry	PIC Name:	Tom Kovacic

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Michael S. Johnson

Checker's Comments Required by:

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Design of French Drains - Cross Section H-H'

☒ This Detail Check is a check for correctness, completeness and technical accuracy.

☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry — 5-18-2011

Project Manager Signature — **Date**

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or

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☐ Marked directly on Work Product

☐ Comment and Disposition Form (Form 3-5 (MM))

☐ Other Specify: _____

Michael S Johnson — 5-18-11

Checker Signature — **Date**

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and

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Checker Signature — **Date**

APPROVAL and DISTRIBUTION

*(To be signed after box A **or** E are completed.)*

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Kenneth M Berry — 5-18-2011

Project Manager, Principal-in-Charge or Designee Signature — **Date**

Distribution:

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Other Specify: _____

SLOPE/W Stability

Gypsum Disposal Area 2A
Cross-Section H-H'

Bull Run Fossil Plant
Tennessee Valley Authority

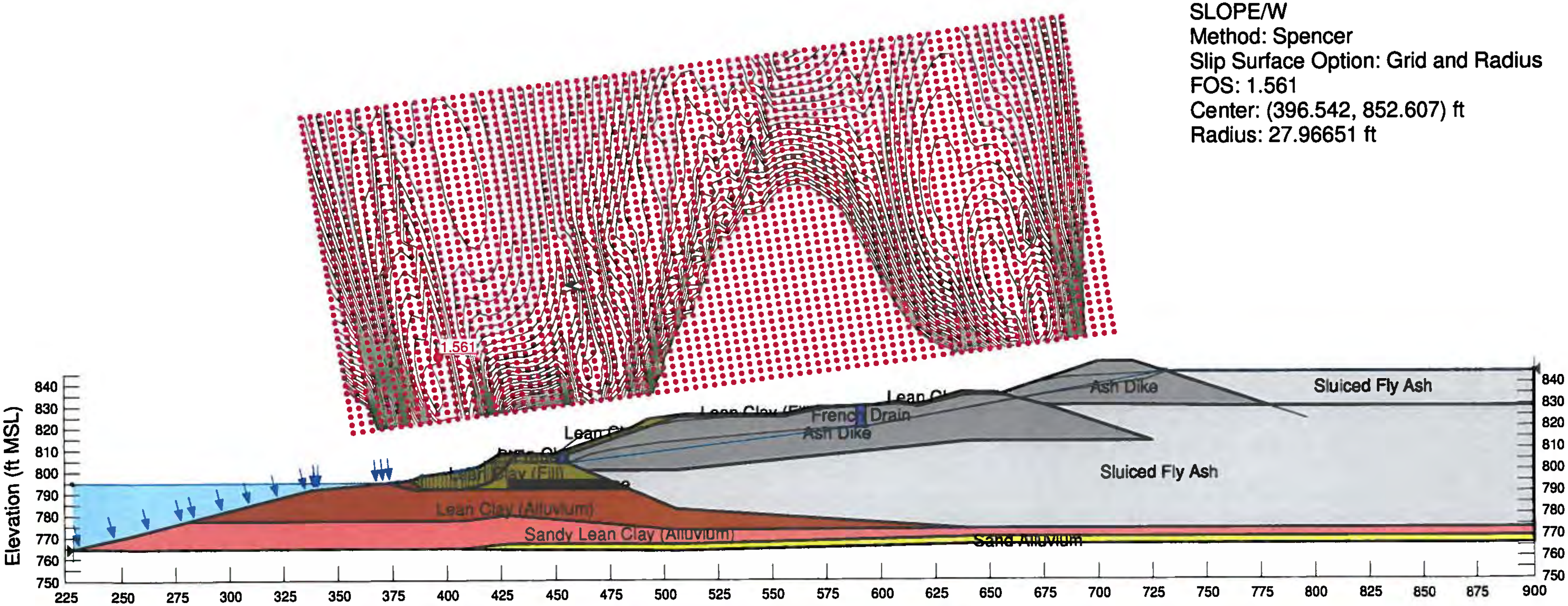
Gypsum Stack Raise to El. 845 ft

Analyzed: LPC
Checked: MSJ

Date: 5/5/2011

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 psf Phi: 31 ° Phi-B: 0 ° Piezometric Line: 1
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Ash Dike Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Sandy Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 127 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Sand Alluvium Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: French Drain Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion: 0 psf Phi: 32 ° Phi-B: 0 ° Piezometric Line: 1

Manual Piezo
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.561
Center: (396.542, 852.607) ft
Radius: 27.96651 ft



P:\Geotechnical\TVA Bull Run\Basis of Design Report\Gypsum Stack French Drain Design Analyses\Section H-H gyp stack to el. 845 w Stantec mods drains.gsz

URS

DETAIL CHECK REPORT

Quality

Project Name:	TVA - Bull Run	Project Number:	31854116.00000
Project Location:	Anderson County, Tennessee	Client Name:	TVA
PM Name:	Ken Berry	PIC Name:	Tom Kovacic

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Michael S. Johnson

Checker's Comments Required by:

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Design of French Drains - Cross Section I-I'

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☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry — 5-18-2011

Project Manager Signature **Date**

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- ☐ Marked directly on Work Product
- ☐ Comment and Disposition Form (Form 3-5 (MM))
- ☐ Other Specify: ____

Michael S. Johnson — 5-18-11

Checker Signature **Date**

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Checker Signature **Date**

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Kenneth M Berry — 5-18-2011

Project Manager, Principal-in-Charge or Designee Signature **Date**

Distribution:

Project Central File – Quality file folder

Other Specify: ____

SLOPE/W Stability

Gypsum Disposal Area 2A
Cross-Section I-I'

Bull Run Fossil Plant
Tennessee Valley Authority

Gypsum Stack Rasied to El. 845 ft with Stantec Modifications and Regrading for FS = 1.5

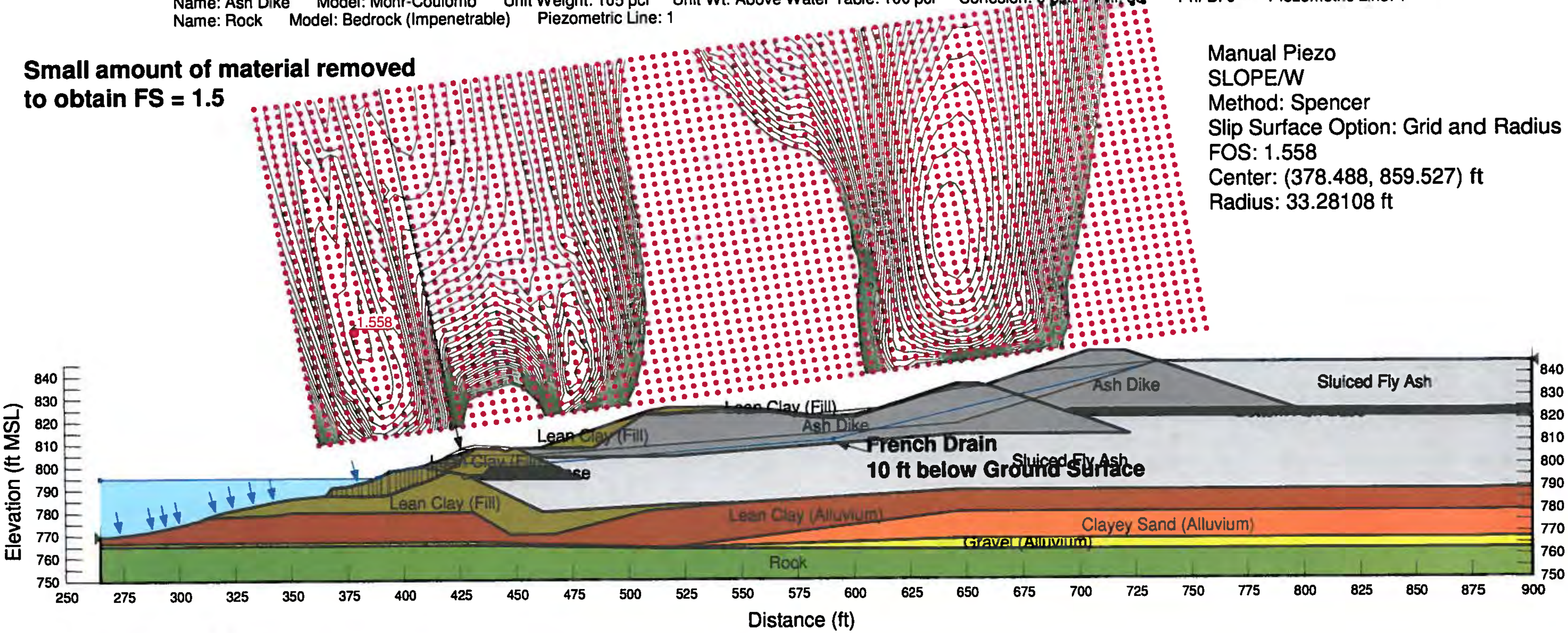
Analyzed: LPC
Checked: MSJ

Date: 5/18/2011

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Gravel (Alluvium) Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 ° Phi-B: 0 ° Piezometric Line: 1
Name: Clayey Sand (Alluvium) Model: Mohr-Coulomb Unit Weight: 112 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 psf Phi: 31 ° Phi-B: 0 ° Piezometric Line: 1
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Ash Dike Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Rock Model: Bedrock (Impenetrable) Piezometric Line: 1

Small amount of material removed to obtain FS = 1.5

Manual Piezo
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.558
Center: (378.488, 859.527) ft
Radius: 33.28108 ft



P:\Geotechnical\TVA Bull Run\Basis of Design Report\Gypsum Stack French Drain Design Analyses\Section I-I gypsum pond to el. 845 ft w Stantec mods & regrade.gsz

URS **DETAIL CHECK REPORT** Quality

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Project Location:	Anderson County, Tennessee	Client Name:	TVA
PM Name:	Ken Berry	PIC Name:	Tom Kovacic

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Work Product Originator: Lucas P. Carr

Work Product to be Checked: Design of French Drains - Cross Section J-J'

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Submitted by: Kenneth M Berry — 5-18-2011
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Stefanie Voss — 5-10-11
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and

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Stefanie Voss — 5-10-11
Checker Signature — **Date**

APPROVAL and DISTRIBUTION

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Kenneth M Berry — 5-18-2011
Project Manager, Principal-in-Charge or Designee Signature — **Date**

Distribution:
Project Central File – Quality file folder
Other Specify: ____

SLOPE/W Stability   Future Conditions - Gypsum Stack to el. 845 ft & Stantec Modifications

Gypsum Disposal Area 2A
Cross-Section J-J'

Bull Run Fossil Plant
Tennessee Valley Authority

Analyzed: LPC
Checked: SAV

Date: 5/5/2011

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 psf Phi: 31 ° Phi-B: 0 ° Piezometric Line: 1
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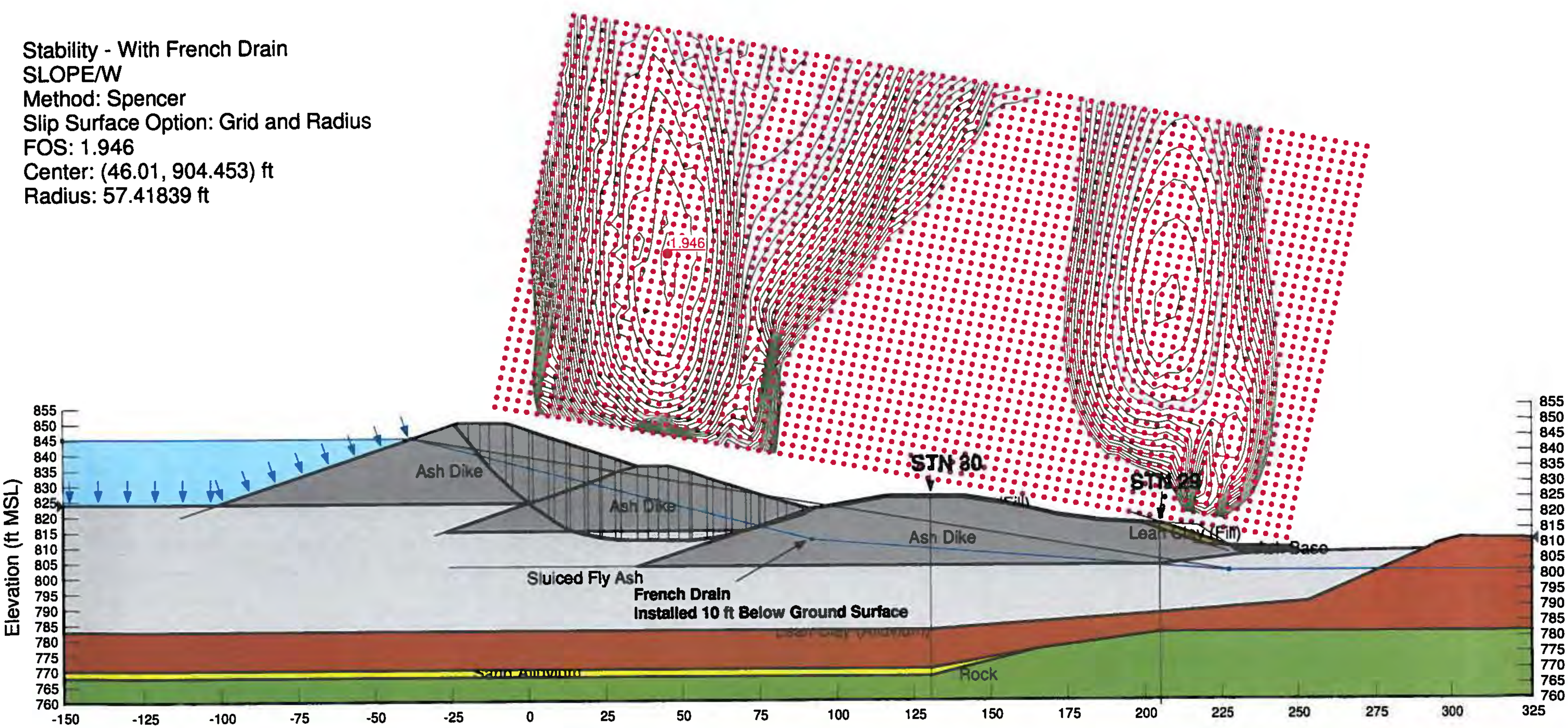
Name: Ash Dike Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1
Name: Rock Model: Bedrock (Impenetrable) Piezometric Line: 1
Name: Sand Alluvium Model: Mohr-Coulomb Unit Weight: 120 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 ° Piezometric Line: 1

Stability - With French Drain
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.946
Center: (46.01, 904.453) ft
Radius: 57.41839 ft



P:\Geotechnical\TVA Bull Run\Basis of Design Report\Gypsum Stack French Drain Design Analyses\Section J-J' Stantec Mods & Gyp Stack to el 845 ft.gsz

URS **DETAIL CHECK REPORT** Quality

Project Name:	TVA - Bull Run	Project Number:	31854116.00000
Project Location:	Anderson County, Tennessee	Client Name:	TVA
PM Name:	Ken Berry	PIC Name:	Tom Kovacic

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Michael S. Johnson — Checker's Comments Required by:

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Geotextile Filter Sock Apparent Opening Size Calculations

☒ This Detail Check is a check for correctness, completeness and technical accuracy.
☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry — 5-18-2011

Project Manager Signature — **Date**

Detail Check – Part 1: Comments

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☐ Other Specify: ____

Michael S Johnson — 5-18-11

Checker Signature — **Date**

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Checker Signature — **Date**

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Kenneth M Berry — 5-18-2011

Project Manager, Principal-in-Charge or Designee Signature — **Date**

Distribution:
Project Central File – Quality file folder
Other Specify: ____

Job: TVA BRF Gypsum Stack | Project No. 31854126.40130 | Sheet 1 of ___
Description: French Drain Filter Sock Criteria | Computed by: LPC | Date: 4/22/2010
Checked by: MST | Date: 4-30-10

Reference

OBJECTIVE: Determine the proper apparent opening size (AOS) for a geotextile sock installed around a French drain pipe retaining TODT 903.01 concrete sand.

PROCEDURE: Use three methods, as shown in Qian et al. (2002):

1. USACE Task Force 25
2. Carroll (1983)
3. Giroud (1982)

CALCULATIONS:

1. USACE Task Force 25

AOS of Fabric $\geq$ No. 30 Sieve $\rightarrow$ ($O_{95} < 0.59$ mm)

- This corresponds to a soil where < 50% of the particles pass the #200 sieve

2. Carroll (1983)

$O_{95} < (2 \text{ or } 3)\, d_{85}$

$d_{85} = 1.18$ mm

$O_{95} < 2.5(1.18) = 2.95$ mm

3. Giroud (1982)

$C_u = \dfrac{D_{60}}{D_{10}} = \dfrac{1.2}{0.2} = 6 \rightarrow C_u > 3$

For Loose Granular Soils:

$O_{95} < (9 \cdot d_{50})/CU$

$d_{50} = 0.5$ mm

$O_{95} < \dfrac{9 \cdot 0.5\text{ mm}}{6} = O_{95} < 0.75$ mm

For Intermediate Granular Soils:

$O_{95} < (13.5 \cdot d_{50})/CU$

$O_{95} < \dfrac{(13.5 \cdot 0.5\text{ mm})}{6} = 1.125$ mM

Job TVA BRF Gypsum Stack
Project No. 31854126.40130
Sheet 2 of ____
Description French Drain Filter Sock Criteria
Computed by LPC
Date 4/22/2010
Checked by MSS
Date 4-30-10
Reference

SUMMARY:

Criteria	$O_{95} <$ (mm)
USACE Task Force 25	0.59
Carroll (1983)	2.95
Giroud (1982) - Loose	0.75
Giroud (1982) - Dense	1.125

Carroll (1983) & Giroud (1982) criteria seem too large.

→ Split the difference between USACE Task Force 25 & Giroud (1982) - Loose criteria.

- No. 30 Sieve = 0.60 mm

→ Specify the following:

AOS ≥ #30 Sieve

$O_{95} <$ 0.60 mm

From: Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction (2006)

SECTION 903-AGGREGATES

903.01-Fine Aggregate for Concrete. Fine aggregate for portland cement concrete or slag modified portland cement concrete shall conform to the requirements of AASHTO M 6, with the following exceptions and added stipulations.

(a) The option regarding alternate freeze-thaw tests for soundness will not be exercised.
(b) The fine aggregate shall be washed in the processing operations.
(c) Fine aggregate manufactured from limestone or dolomite shall be processed from material which has been scalped to remove quarry fines. The material from which the fine aggregate is processed shall have a percentage of wear, AASHTO T 96, of not greater than 40.
(d) The amount of deleterious substances shall not exceed the following limits:

	Maximum Permissible Limits Per Cent by Weight
1. Clay Lumps	0.5
2. Coal and Lignite	0.5
3. *Material Passing the No. 200 (75 µm) Sieve	3.0
4. *Other deleterious substances (such as shale, alkali, mica, coated/grains, soft and flaky particles)	3.0

*If the fine aggregate is manufactured from limestone or dolomite and if the material finer than the No. 200(75 µm) sieve consists of the dust of fracture, essentially free from clay or shale, this limit may be increased to 5%.

(e) Fine aggregate shall be well graded from coarse to fine and when tested by means of laboratory sieves, shall conform to the following requirements:

Sieve Size	Total Per Cent Passing by Weight
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95-100
No. 16 (1.18 mm)	50-90
No. 50 (300 µm)	5-30
No. 100 (150 µm)	0-10
No. 200 (75 µm)	0-3

From: Geotechnical Aspects of Landfill Design & Construction
Qian, Koerner, & Gray (2002)

A = filtration area, usually use 1 ft², 1 acre (1 acre = 43,560 ft²), or 1 m² or 1 hectare (1 ha = 10,000 m²);
ψ_{reqd} = required permittivity of geotextile, sec^{-1};
k_{reqd} = required cross-plane permeability coefficient of geotextile, ft/sec or m/sec;
i = hydraulic gradient;
Δh = liquid head from bottom of geotextile, ft or m;

and

$$\Delta h = H - t \tag{8.12}$$

where H = liquid head on the geomembrane liner, ft or m; and
t = thickness of drainage layer, ft or m.

In landfill design, the liquid head H on the geomembrane liner may be known based on hydrological analysis or regulatory requirement. Then, the liquid head from the bottom of geotextile, Δh, and the required permittivity of geotextile ψ_{reqd} can be determined using the preceding equations.

Using data from Table 8.5, the allowable permittivity or allowable permeability can be calculated from the following equations:

$$\psi_{allow} = \frac{\psi_{ult}}{RF_{SCB} \times RF_{CR} \times RF_{IN} \times RF_{CC} \times RF_{BC}} \tag{8.13}$$

$$k_{allow} = \frac{k_{ult}}{RF_{SCB} \times RF_{CR} \times RF_{IN} \times RF_{CC} \times RF_{BC}} \tag{8.14}$$

The values of ultimate permittivity, ψ_{ult}, and ultimate permeability, k_{ult}, are obtained from the approximate method. Then, the factor of safety that is used to evaluate the filtration capacity of the selected geotextile can finally be obtained:

$$FS = \psi_{allow}/\psi_{reqd} = k_{allow}/k_{reqd} \tag{8.15}$$

Equations 8.10 to 8.15 can be used to calculate the cross-plane flow capacity for the selected geotextile.

8.3.4 Soil Retention

To allow for the required flow of water through a geotextile, the void spaces in it must be adequately large. However, there is a limit, namely, when the upstream soil or fine waste fragment particles start to pass through the fabric voids along with the flowing liquid. This leads to an unacceptable situation called "piping", in which the finer soil particles are carried through the fabric, leaving large residual voids behind. The liquid velocity then increases, accelerating the whole process, until the upgradient structure begins to collapse. This collapse often leads to minute sinkhole-type patterns that grow larger with time.

This entire process can be prevented by making the geotextile voids small enough to retain the soil on the upstream side of the fabric. The coarser soil fraction must initially be retained; this is the targeted soil size in the design process. These particles eventually block the finer sized particles by establishing a bridging mechanism. Fortunately, filtration concepts are well established in the design of soil filters, and those same ideas can be used to design an adequate geotextile filter.

There are a number of approaches for achieving soil retention, all of which use particle sizes that are measured by sieving and are compared with the O_{95} size (the apparent opening size) of the geotextile. The test for apparent opening size (AOS) was developed by the U.S. Army Corps of Engineers to evaluate woven fabrics. The test has since been extended to cover all fabrics, including nonwoven types. The apparent opening size (AOS) or equivalent opening size (EOS) are defined in CW-02215 as the U.S. standard sieve number having openings closest in size to the openings in the fabric. Note that AOS and EOS are equivalent terms. The equivalent ASTM test is designated D4751. The test uses known-sized glass beads designated by number and determines AOS by dry sieving. Sieving is done by using beads of successively smaller size until 5% or less pass through the fabric. The AOS or EOS of the fabric specimen is the "retained on" U.S. standard sieve number of the size. It is sometimes given as the equivalent sieve size opening in millimeters, and when done so is referred to as the 95% opening size or O_{95}. Thus, AOS, EOS, and O_{95} all refer to the same thing, the difference being that AOS and EOS are sieve numbers and O_{95} is the corresponding sieve opening size in millimeters. Table 8.6 gives the interrelated values. Note that as the AOS sieve number increases, the O_{95} particle size value decreases (i.e., they are inversely related to one another).

TABLE 8.6 Conversion of U. S. Standard Sieve Sizes to Equivalent Square Opening Sizes

Sieve Size (no.)	Opening Size mm	Opening Size mil
4	4.750	187.0
6	3.350	132.0
8	2.360	93.7
10	2.000	78.7
12	1.700	66.1
16	1.180	46.9
20	0.850	33.1
30	0.590	23.4
40	0.425	16.5
50	0.297	11.7
60	0.250	9.8
70	0.212	8.3
80	0.180	7.0
100	0.150	5.9
120	0.125	4.9
140	0.106	4.1
170	0.090	3.5
200	0.075	2.9
270	0.053	2.1
400	0.038	1.5

Note: 1 mil = 0.001 in.

From:
Geotechnical Aspects of Landfill Design & Construction
Qian, Koerner, & Gray (2002)

Three approaches for determining soil retention opening size are described below in the subsections that follow.

8.3.4.1 Task Force 25 Method. The simplest of these methods examines the percentage of soil passing the No. 200 sieve (= 0.075 mm). The Task Force 25 [illegible] makes the following recommendations:

1. Particles < 50% passing the No. 200 sieve
   AOS of the fabric > No. 30 sieve (i.e., $O_{95} < 0.59$ mm)
2. Particles > 50% passing the No. 200 sieve
   AOS of the fabric > No. 50 sieve (i.e., $O_{95} < 0.297$ mm)

8.3.4.2 Carroll Method. Slightly more restrictive is the recommendation of Carroll (1983) for the O_{95} size in millimeters, which is

$$O_{95} < (2 \text{ or } 3)d_{85}$$

where d_{85} = the particle size in millimeters for which 85% of sample is finer.

8.3.4.3 Giroud Method. The most conservative method is proposed by Giroud (1982), who presents a method for recommended O_{95} values (i.e., the opening size in millimeters corresponding to the AOS value) in terms of relative density (D_R), coefficient of uniformity (CU), and average particle size (d_{50}) for granular soils and in terms of Plasticity Index (PI) for fine-grained soils. It is presented below for steady-state flow conditions. There is a parallel set of criteria for dynamic-flow conditions, but these are not likely to occur in landfill filtration design situations.

Granular Soils. The definition of granular soils for the Giroud Method is the soil which contains less than 10% fines (less than #200 sieve opening size) or contains more than 10% fines, but the Plasticity Index (PI) is less than 5.

Case 1: For Loose Granular Soils ($D_R < 50\%$)

If $1 < CU < 3$, $O_{95} < (CU)(d_{50})$.
If $CU > 3$, $O_{95} < (9 \cdot d_{50})/CU$.

Case 2: For Intermediate Granular Soils ($50\% < D_R < 80\%$)

If $1 < CU < 3$, $O_{95} < 1.5 \cdot (CU)(d_{50})$.
If $CU > 3$, $O_{95} < (13.5 \cdot d_{50})/CU$.

Case 3: For Dense Granular Soils ($D_R > 80\%$)

If $1 < CU < 3$, $O_{95} < 2 \cdot (CU)(d_{50})$.
If $CU > 3$, $O_{95} < (18 \cdot d_{50})/CU$.

In all cases,

O_{95} = apparent opening size of geotextile, mm (if data is not given by the manufacturer, this value is approximately the AOS sieve value in millimeters);

CU = coefficient of uniformity ($= d_{60}/d_{10}$);
d_{10} = soil particle size corresponding to 10% finer, mm;
d_{60} = soil particle size corresponding to 60% finer, mm; and
d_{50} = soil particle size corresponding to 50% finer, mm.

Fine-Grained Soils. If the soil contains more than 10% fine-size particles and the Plasticity Index is larger than 5 (thus lending cohesion to the soil structure), the soil is considered fine-grained for the Giroud Method. If the soil is determined to be nondispersive by the Double Hydrometer Method (i.e., DHR < 0.5), then O_{95} must be less than 0.21 mm (i.e., less than #70 sieve) opening size. In other words,

$$O_{95} < 0.21 \text{ mm (for fine-grained soils)}.$$

Note that any soil that is used to construct a compacted clay liner must be nondispersive soil.

8.3.5 Long Term Compatibility

Perhaps the most frequently asked question associated with the use of geotextiles in hydraulic related systems is, "Will it clog?" Undoubtedly, some soil particles will embed themselves within the fabric structure. A more relevant question is, "Will it excessively clog?"

A reasonable answer or response to the clogging question is simply to avoid situations that have been known to lead to severe clogging problems. To minimize the risk of clogging, the following precautions are recommended when using geotextiles:

1. Use the largest available opening size geotextile satisfying the retention criteria;
2. For nonwoven geotextiles (recall Tables 8.2 and 8.3): porosity > 40% under the actual stress conditions that the geotextile is serving;
3. For woven geotextiles (recall Table 8.4): percent open area (POA) > 6%.

The porosity of a nonwoven geotextile can be calculated using

$$n = 1 - \mu/(t_g \cdot \rho) \times 100\% \tag{8.16}$$

where n = geotextile porosity or planar porosity, expressed as a percentage;
μ = geotextile mass per unit area;
t_g = geotextile thickness; and
ρ = density of filaments.

Percent open area (POA) is a fabric property that has applicability only for woven fabrics, and even then primarily for monofilament woven fabric. POA is a comparison of the total open area (the void spaces between adjacent fibers) to the total specimen area. Woven monofilament fabrics vary from essentially a closed structure (POA ≈ 0) to some that are quite open (POA = 36%). Many commercial woven geotextiles are in the range of 4 to 20%.

Other situations that have caused excessive clogging problems of geotextiles are filtration of very high alkalinity groundwater. For high pH liquids, the retardation of flow at the fabric interface can cause a calcium, sodium, or magnesium precipitate to

From:
Geotechnical Aspects of
Landfill Design & Construction
Qian, Koerner, & Gray (2002)

be deposited, thereby blinding the fabric's upstream surface. The potential of biological clogging has often been considered, but for groundwater the likelihood is relatively remote. Conversely, for municipal landfill leachate the likelihood is relatively high. Obviously, landfill leachates (particularly for MSW landfills) are a concern. Koerner (1993) has investigated ten geotextile filters and two soil filters, with different leachates, and compared their responses to water as a permeant. The finding was that leachates with more than 2,500 g/ml of TSS or BOD required laboratory simulation to assess the severity of the clogging.

This discussion of soil-to-fabric compatibility assumes the establishment of a mechanisms that are in equilibrium with the flow regime being imposed on the system. Some insights into possible mechanisms have been suggested (McGown, 1978), including upstream soil filter, blocking, arching, and partial clogging. Most likely, a number of them are working together simultaneously, and just what mechanism dominates under what conditions of soil type and flow regime is still an issue that needs further research.

EXAMPLE 8.1

Use Task Force 25, Carroll ($O_{95} < 2 \cdot d_{85}$), and Giroud methods, respectively, to design a needle-punched nonwoven geotextile used in the primary leachate drainage layer (use average values from Table 8.5). The geotextile is placed between protective sand blanket and geonet as drainage layer (shown in Fig. 8.3). The thickness of geonet is 0.25 inch (6.4 mm). The maximum inflow rate is 0.20 inch/hour (5 mm/hour). The liquid head over the geomembrane liner is assumed to be 1.5 inch (38 mm). The soil placed over the geotextile is a clean sand with $d_{85} = 0.95$ mm, $d_{50} = 0.19$ mm, $CU = 5.5$, $D_R = 65\%$, and 9% soil particles passing #200 sieve. The typical properties of commercially available, needle-punched nonwoven geotextile products are listed in Table 8.3.

Solution:
Permeability:

$$r = 0.20 \text{ in/hr} = 1.67 \times 10^{-2} \text{ ft/hr} = 4.630 \times 10^{-6} \text{ ft/sec } (1.4 \times 10^{-3} \text{ mm/sec})$$

$$\Delta h = H - D = 1.5 - 0.25 = 1.25 \text{ inch} = 0.104 \text{ ft } (31.8 \text{ mm})$$

$$\psi_{reqd} = r/\Delta h = (4.630 \times 10^{-6})/0.104 = 4.452 \times 10^{-5} \text{ sec}^{-1} = 0.160 \text{ hr}^{-1}$$

Soil Retention:

1. Task Force 25:
   9% soil particles passing the No. 200 sieve < 50%
   So, AOS of geotextile must be greater than #30 sieve (i.e., $O_{95} < 0.59$ mm).
   Select Geotextile Style (b) ($O_{95} = 0.297$ mm, AOS #50) from Table 8.3.
2. Carroll Method ($O_{95} < 2.5 \cdot d_{85}$):
   $d_{85} = 0.95$ mm;
   $O_{95} < 2.5 \cdot d_{85} = 2.5 \times 0.95 = 2.4$ mm.
   Select Geotextile Style (b) ($O_{95} = 0.297$ mm, AOS #50) from Table 8.3.
3. Giroud Method:
   9% soil particles passing the No. 200 sieve < 10%: Granular Soil
   Granular Soils:
   $50\% < D_R = 65\% < 80\%$: Intermediate Granular Soil;

$CU = d_{60}/d_{10} = 5.5 > 3$;
$d_{50} = 0.19$ mm;
$O_{95} < (13.5 \cdot d_{50})/CU = (13.5 \times 0.19)/5.5 = 0.466$ mm.
Select Geotextile Style (b) ($O_{95} = 0.297$ mm, AOS #50) from Table 8.3.

Long-Term Compatibility:
Style (b) is a needle-punched nonwoven geotextile, and its porosity can be found in Table 8.3:

$$n = 90\% > 40\% \text{ (OK)}.$$

Thus, Style (b) geotextile is selected by all three methods. Check whether Style (b) geotextile has adequate filtration capacity.
Style (b) geotextile, Permittivity $\psi_{ult} = 2.01 \text{ sec}^{-1}$, and using average values of reduction factors from the "landfill filters" row in Table 8.5,

$$\psi_{allow} = \frac{\psi_{ult}}{RF_{SCB} \times RF_{CR} \times RF_{IN} \times RF_{CC} \times RF_{BC}} \tag{8.13}$$

$$= (2.01)/(7.5 \times 1.75 \times 1.1 \times 1.35 \times 7.5)$$
$$= (2.01)/(146)$$
$$= 0.014 \text{ sec}^{-1} = 50 \text{ hr}^{-1}.$$

$$FS = \psi_{allow}/\psi_{reqd} \tag{8.15}$$
$$= (50)/(0.160)$$
$$= 313 \text{ (OK)}.$$

Thus, Style (b) geotextile can meet all requirements of permeability, soil retention, and long-term compatibility.

8.4 GEONET DESIGN FOR LEACHATE DRAINAGE

Biplanar and triplanar geonets are both members of the geosynthetic family. They are indeed net-like materials and are used exclusively for their in-plane (or transmissivity) drainage function. All of the geonets are formed from polyethylene in the specific gravity range of 0.935 to 0.950 gm/cc. Thus they cover the range from medium-to-high density polyethylene (i.e., MDPE-to-HDPE). However, when formulated with carbon black and antioxidants, they are all higher than 0.941 gm/cc and thus in the HDPE category.

8.4.1 Geonet Overview

Geonets are unitized sets of repeating parallel ribs positioned in layers such that liquids can be transmitted within their open spaces. Thus their primary function is drainage. There are two variations of geonets. *Biplanar* geonets have two parallel sets of ribs overlapping one another. Flow is approximately the same in all directions, although slightly greater in the direction of the sets of ribs. *Triplanar* geonets have three parallel sets of ribs. The main (and largest) ribs are in the center where the flow

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LEGEND

- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests
- Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Rock Core

NOTES:

1. The topographic mapping presented on this drawing was developed by TVA Surveying and Project Services, in April, 2008. This plan view was prepared to support development of the geotechnical exploration program and should not be used for construction.
2. A hydrographic survey was performed on the Clinch River in September, 2009 and on the Area 2 ponds in February, 2008.
3. The geotechnical information and data furnished herein are not intended as representations 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.

RECORD DRAWING

BORING LOCATION TABLE

Boring	Northing	Easting	Elev. (ft.)	Boring	Northing	Easting	Elev. (ft.)
STN-1	585,024.10	2,544,375.85	832.4	STN-39	581,840.77	2,545,638.39	835.7
STN-2	585,022.62	2,544,232.18	819.4	STN-40	581,821.33	2,545,513.41	823.8
STN-3	585,020.98	2,544,104.02	810.2	STN-41	581,800.67	2,545,427.18	808.7
STN-5	584,652.96	2,544,484.24	841.0	STN-43	581,427.23	2,545,657.42	825.0
STN-6	584,610.05	2,544,384.75	818.2	STN-44	581,537.09	2,545,875.54	835.7
STN-7	584,577.54	2,544,332.94	808.5	STN-45	581,478.25	2,545,990.45	824.6
STN-8	584,312.72	2,544,896.21	821.0	STN-46	581,420.20	2,546,001.83	808.2
STN-9	584,232.26	2,544,740.10	837.5	STN-47	581,681.43	2,546,454.06	835.7
STN-10	584,173.80	2,544,838.59	817.9	STN-48	581,638.19	2,546,471.30	825.9
STN-11	584,140.80	2,544,576.48	808.6	STN-49	581,576.87	2,546,494.42	808.5
STN-13	583,823.78	2,545,228.66	831.3	STN-50	581,841.40	2,546,757.18	825.1
STN-14	583,802.44	2,545,004.48	848.7	STN-51	581,336.80	2,545,543.56	809.8
STN-15	583,734.18	2,544,875.42	818.1	STN-52	581,060.68	2,545,580.52	809.6
STN-16	583,705.67	2,544,823.03	808.0	STN-53	581,087.48	2,545,580.54	801.3
STN-18	583,524.13	2,545,835.46	821.7	STN-54	580,638.72	2,545,859.38	810.1
STN-19	583,480.64	2,545,884.32	810.2	STN-55	580,589.87	2,545,683.73	810.1
STN-20	583,389.26	2,545,507.73	819.6	STN-56	580,580.44	2,545,673.08	800.2
STN-21	583,288.66	2,545,087.88	806.0	STN-58	582,091.97	2,545,736.90	810.3
STN-22	583,138.35	2,545,015.84	798.0	STN-59	580,089.21	[illegible]	800.0
STN-23	583,275.52	2,546,081.35	835.0	STN-60	589,801.84	2,545,827.98	810.2
STN-24	583,211.78	2,545,589.93	809.9	STN-61	580,536.98	2,545,830.43	799.9
STN-25	583,158.33	2,545,607.45	826.2	STN-62	580,000.07	2,546,208.94	808.4
STN-26	582,971.88	2,546,347.19	817.3	STN-63	580,989.70	2,546,223.78	831.2
STN-27	582,980.52	2,546,295.43	831.3	STN-65	580,472.00	2,546,679.19	809.1
STN-28	582,387.48	2,546,301.20	816.8	STN-66	580,462.23	2,546,583.73	799.8
STN-29	582,243.83	2,546,873.33	816.8	STN-67	580,946.92	2,546,946.33	809.5
STN-30	582,227.12	2,546,805.60	828.2	STN-68	580,838.03	2,546,963.83	800.8
STN-31	582,988.83	2,545,291.84	823.8	STN-70	581,380.81	2,547,267.77	809.4
STN-32	583,010.17	2,545,153.51	808.2	STN-71	581,954.72	2,546,936.25	809.1
STN-33	582,359.31	2,545,426.43	836.1	STN-87	581,348.15	2,548,217.62	825.3
STN-34	582,527.95	2,545,300.77	825.6	STN-88	581,483.79	2,546,234.83	808.6
STN-35	582,523.82	2,545,221.40	808.9	STN-89	583,192.06	2,546,630.76	838.1
STN-36	582,847.47	2,545,204.09	800.5	STN-90	583,043.65	2,545,471.40	838.4
STN-38	582,160.74	2,545,322.53	808.6				

Northing, Easting and Ground Surface Elevations were provided by TVA, Power Systems Operations, Surveying and Project Services
Horizontal Datum: NAD 27 (Tennessee Lambert)
Vertical Datum: NGVD29

GRAPHIC SCALE 1"=200'
CONTOUR INTERVAL = 2'

For Supporting Design Calculations see FPG0WFFESCD0000020100002

Stantec Consulting Services Inc.

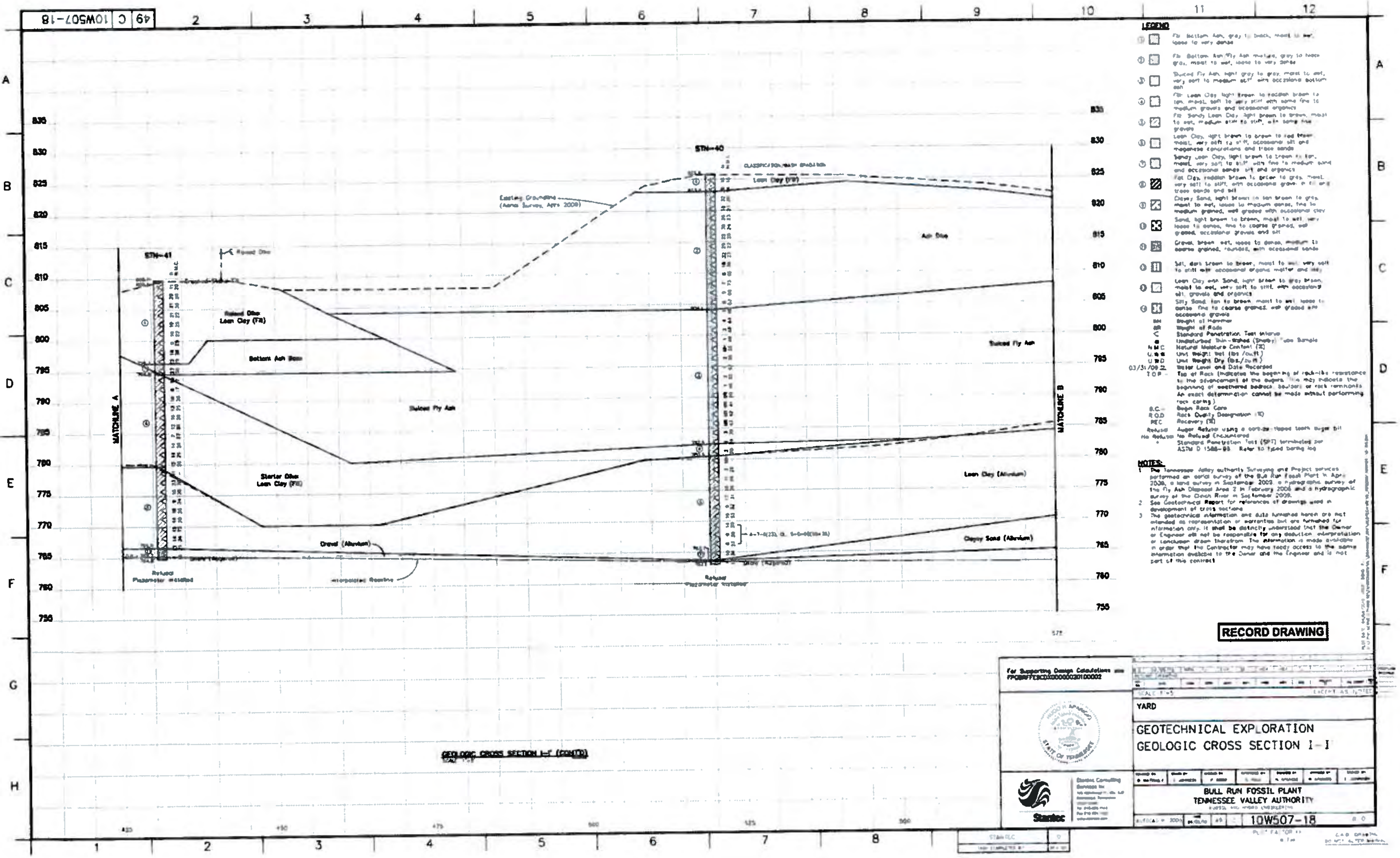
SCALE 1"=200' | EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
BORING LAYOUT

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

10W507-01


10W507-18
C
49
STN-41
STN-40
MATCHLINE A
MATCHLINE B
Existing Groundline
(Aerial Survey, Apr 2009)
Raised Dike
Lean Clay (Fill)
Bottom Ash Dam
Sluiced Fly Ash
Starter Dike
Lean Clay (Fill)
Gravel (Alluvium)
Interpolated Baseline
Refusal
Piezometer installed
Lean Clay (Fill)
Ash Dike
Lean Clay (Alluvium)
Clayey Sand (Alluvium)
LEGEND
NOTES:
RECORD DRAWING
GEOLOGIC CROSS SECTION I-I' (CONT'D)
For Supporting Design Calculations see
YARD
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION I-I
BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
Stantec
10W507-18

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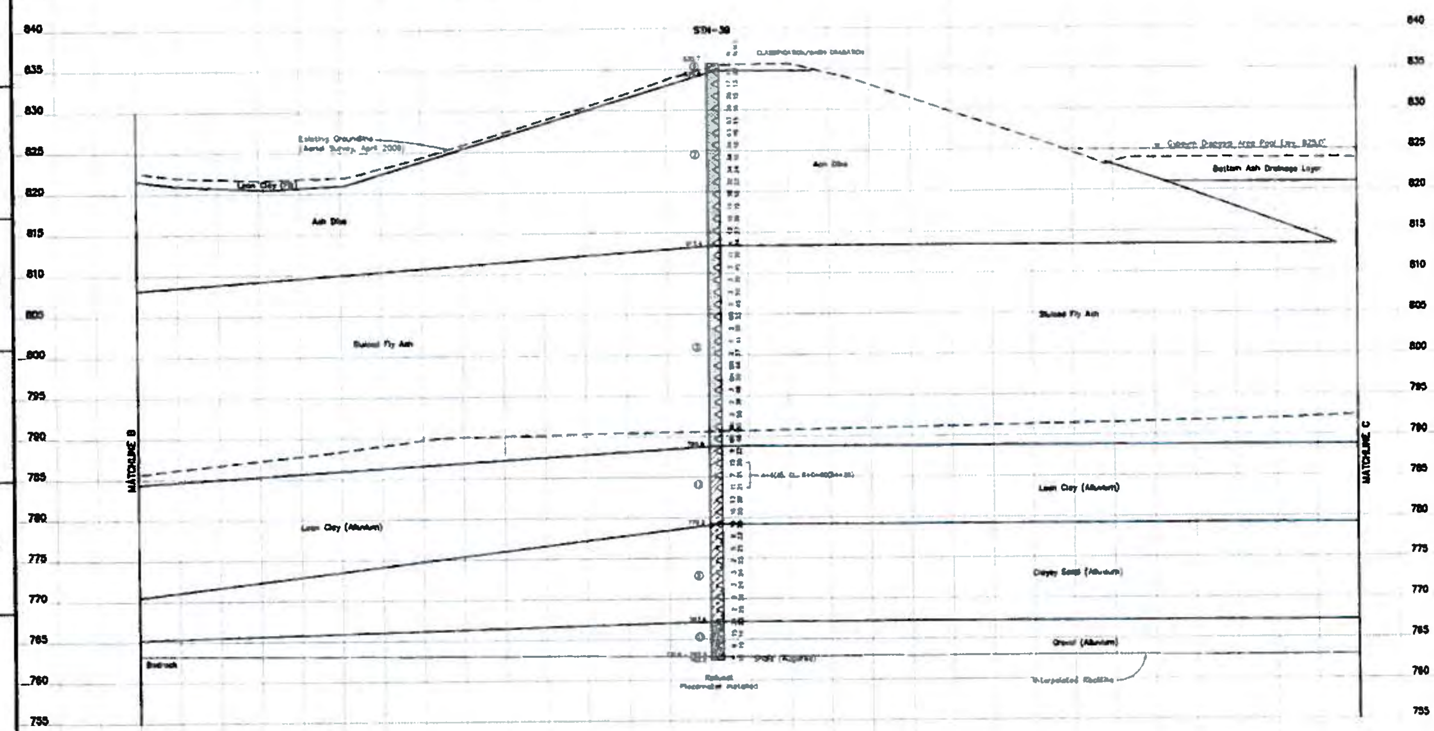

GEOLOGIC CROSS SECTION I-I' (CONT'D)

LEGEND

1. Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
2. Fill: Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
3. Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff, with occasional bottom ash
4. Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
5. Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff with some fine gravels
6. Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
7. Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff with fine to medium sand and occasional sands, silt and organics
8. Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravels and trace sands and silt
9. Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
10. Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
11. Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
12. Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
13. Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff with occasional silt, gravels and organics
14. Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

- Weight of Hammer
- Weight of Rods
- Standard Penetration Test Interval
- Undisturbed Thin-Walled (Shelby) Tube Sample
- N.M.C. Natural Moisture Content (%)
- U.W.W. Unit Weight Wet (lbs./cu.ft.)
- U.W.D. Unit Weight Dry (lbs./cu.ft.)
- 03/31/09 Water Level and Date Recorded
- T.O.R. - Top of Rock (Indicating the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock fragments. An exact determination cannot be made without performing rock coring.)
- B.C. - Begin Rock Core
- R.Q.D. Rock Quality Designation (%)
- REC. Recovery (%)
- Refusal: Auger Refusal using a carbide-tipped tooth auger bit
- No Refusal: No Refusal Encountered
- * Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

NOTES:

1. The Tennessee Valley Authority Surveying and Project services performed an aerial survey of the Bull Run Fossil Plant in April 2008, a land survey in September 2008, a hydrographic survey of the Fly Ash Disposal Area 2 in February 2008 and a hydrographic survey of the Clinch River in September 2009.
2. See Geotechnical Report for references of drawings used in development of cross sections.
3. The geotechnical information and data furnished herein are not intended as representations 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.

RECORD DRAWING

For Supporting Design Calculations see FPG8FFESCDX000000020100002

Stantec

YARD

GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION I-I'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

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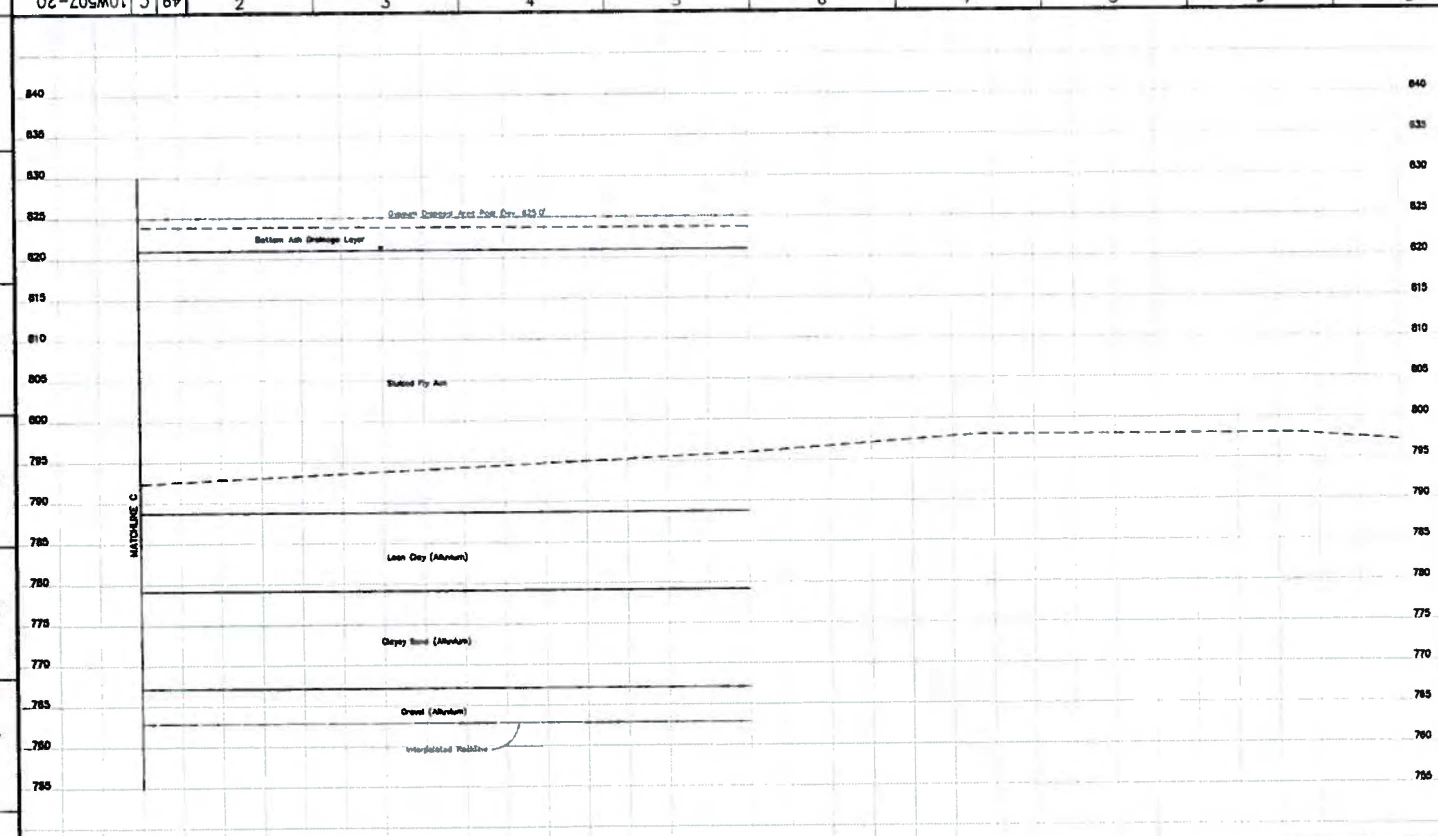
49 | C | 10W507-20



GEOLOGIC CROSS SECTION I-I' (CONT'D)

LEGEND

1. Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
2. Fill: Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
3. Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff with occasional bottom ash
4. Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
5. Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff with some fine gravels
6. Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
7. Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff with fine to medium sand and occasional gravels, silt and organics
8. Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravel ... and trace sands and silt
9. Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional ...
10. Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
11. Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
12. Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
13. Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff, with occasional silt, gravels and organics
14. Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

WH	Weight of Hammer
WR	Weight of Rods
	Standard Penetration Test Interval
	Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
03/31/09	Water Level and Date Recorded
T.O.R. -	Top of Rock (Indicates the beginning of hard line resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. -	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped tooth auger bit
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log

NOTES:

1. The Tennessee Valley Authority Surveying and Project services performed an aerial survey of the Bull Run Fossil Plant in April 2009, a land survey in September 2009, a hydrographic survey of the Fly Ash Disposal Area 2 in February 2008 and a hydrographic survey of the Clinch River in September 2009.
2. See Geotechnical Report for references of drawings used in development of cross sections.
3. 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 the contract.

RECORD DRAWING

For Supporting Design Calculations see FPGBRFYSCCLXXXXXXXX00003

Stantec Consulting Services Inc.

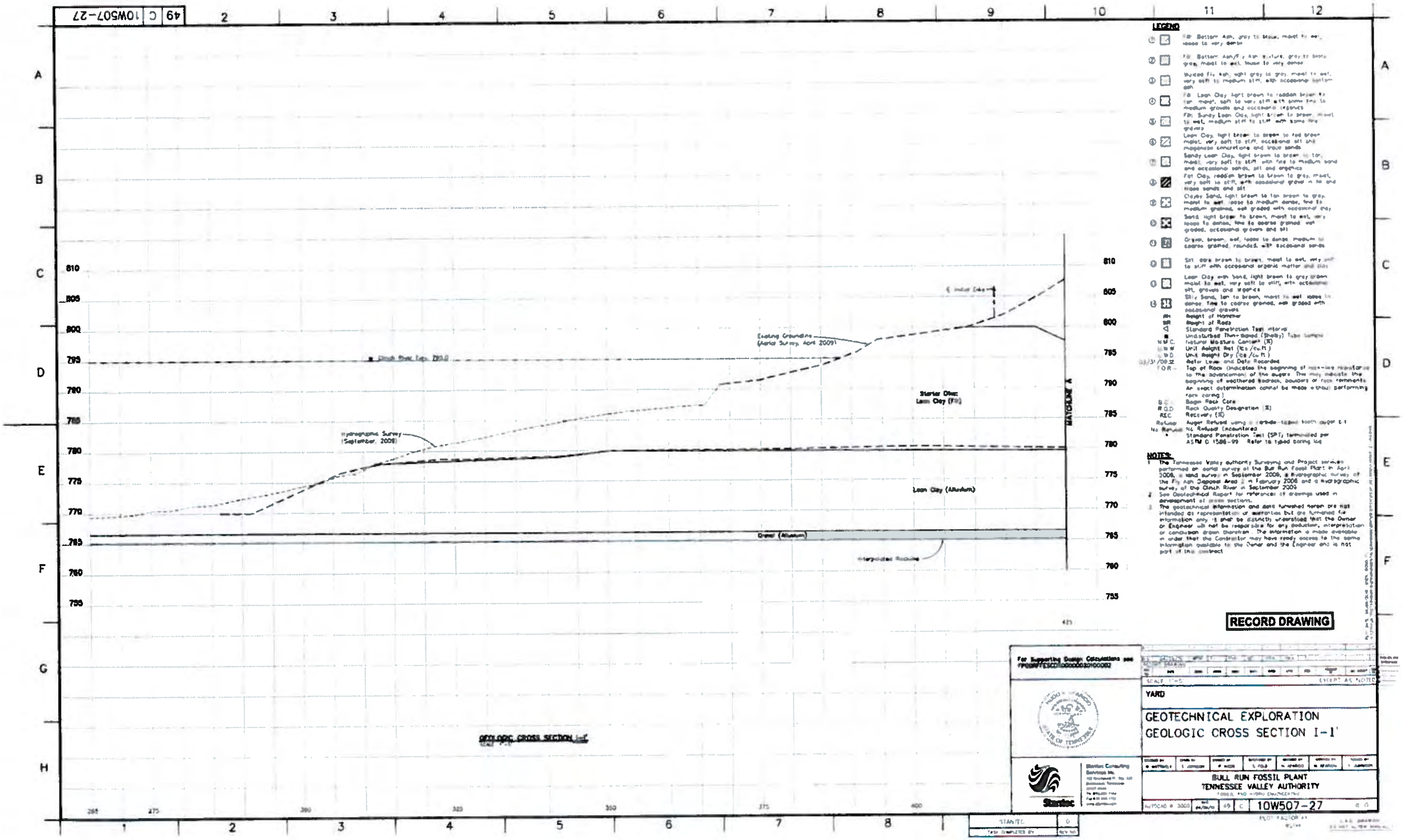
Stantec

YARD

GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION I-I'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

49 | C | 10W507-20


49 C 10W507-27
LEGEND
Weight of Hammer
Weight of Rods
Standard Penetration Test Interval
Natural Moisture Content (%)
Begin Rock Core
Rock Quality Designation (%)
Recovery (%)
NOTES:
Starter Dike: Lean Clay (Fill)
Lean Clay (Alluvium)
Gravel (Alluvium)
Interpolated Rockline
Existing Groundline (Aerial Survey, April 2009)
Hydrographic Survey (September, 2009)
Clinch River Elev. 795.0
MATCHLINE A
810
805
800
795
790
785
780
775
770
765
760
755
GEOLOGIC CROSS SECTION I-I'
RECORD DRAWING
YARD
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION I-I'
BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
10W507-27
Stantec

Appendix 2

Design Calculations – Perimeter Maintenance and Improvements

TVA Calculation Package

Title BRF - PERIMETER MAINTENANCE AND IMPROVEMENTS

Location Description: *(Optional)*	BRF - ASH DISPOSAL AREAS 1, 2A, AND 2	**Total Pages:** *(including appendices & attachments)* 198

Calculation ID *(All parts required to form a unique ID)*:

Org Code	**Location/ Plant Code**	**Branch Code**	**Alphanumeric Part** = Discipline Code (1) + Type Code (1) + "X" + Unit Field (3) + Sys Code (3) + Year (4) + Sequence No. (4)
FPG	BRF	FES	FPGBRFFESCDX00000020110003

NOTE: When referencing the calculation ID, include all parts without spaces or dashes between them.

Unit(s), Spill gate(s), or Voltages (PSO): 000	**Key Nouns (For CTS/CCRIS):**	
Applicable Design Document(s):	**Rev**	**RIMS/EDMS Accession Number** *(Optional)*
	R0	
	R	
UNID System(s):	**R**	
	R	

	R0	**R 0**	**R**	**R**
DCN, PCN, NA				
Prepared: Sign➔ Print Name	Lucas P. Carr, E.I.			
Checked: Sign➔ Print Name	Andrew Z. Boeckmann, P.E.	Stefanie A. Voss, P.E.		
	These calculations contain unverified assumption(s) that must be verified later? ☐ Yes ☒ No These calculations contain special requirements and/or limiting conditions? ☐ Yes ☒ No			
Approved: Sign➔ Print Name	Kenneth M. Berry, P.E.			
Approval Date	6/8/2011			
	These calculations contain a design output attachment? ☐ Yes ☒ No			
Revision Applicability	☐ Entire calc	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs
	Computer output Microfiche generated? ☐ Yes ☒ No Number: ____			

Purpose of the Calculation: BRF - PERIMETER MAINTENANCE AND IMPROVEMENTS - THESE CALCULATIONS WERE USED TO DESIGN RIP-RAP PLACEMENT ZONES ON THE PERIMETER DIKES AT BRF ON ASH DISPOSAL AREAS 1, 2A, AND 2.

Abstract: The following calculations are included (1) SEEP/W seepage analyses and (2) SLOPE/W design of perimeter rock protection.

☒ Electronically file and return calculation to Calculation Library.

☐ Electronically file and return calculation ____ Address: ____

TVA Calculation Coversheet
CTS Input Form

Preparer	Preparer Login ID	Date
Checker	Checker Login ID	Date

Update Code: ☐ Add ☐ Change ☐ Delete ☐ Rename ☐ Supersede ☐ Duplicate ☐ Verify

The following section applies if a calculation is being renamed, superseded, or has a duplicate.

	Org Code	Plant	Branch	Number	Cur Rev	New Rev
Current Calc ID:						

The following section applies to all calculations.

Calc ID:		BRF				

Firm: *(TVA or Contractor)* ______________________

Cross-References

A/C/D	Xref Code	Type	Org Code	Plant	Branch	Number	Rev

TVA Calculation Record of Revision

Calculation Identifier: FPGBRFFESCDX00000020110003

Title BRF - PERIMETER MAINTENANCE AND IMPROVEMETNS

Revision No.	Description of Revision
0	BRF - PERIMETER MAINTENANCE AND IMPROVEMENTS - THESE CALCULATIONS WERE USED TO DESIGN RIP-RAP PLACEMENT ZONES ON THE PERIMETER DIKES AT BRF ON ASH DISPOSAL AREAS 1, 2A, AND 2.

TVA Computer File Storage Information Sheet

Calculation Identifier: FPGBRFFESCDX00000020110003 **Rev.** 0 **Plant:** BRF

Subject: Calculations include finite element seepage analyses using SEEP/W and limit equilibirum slope stability analyses using SLOPE/W. The calclautions were used to deisgn perimeter rock protection. Results of the analyses are attached.

Software Name: SLOPE/W & SEEP/W **Revision Level:** 7.16

Vendor Name: GEO-SLOPE International, LTD

Address: Calgary, Alberta, Canada

Executable Files

☒ No TVA developed **executable files** were used in this calculation.

Comments:

☐ TVA developed **executable files** used in this calculation have been stored electronically and sufficient identifying information is provided below for each executable file. *(Any retrieved file requires re-verification of its contents before use.)*

Input Files

☐ Electronic storage of the **input files** for this calculation is not required.

Comments:

☒ **Input files** for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. *(Any retrieved file requires re-verification of its contents before use.)*

TVA Calculation Table of Contents

Calculation Identifier: FPGBRFFESCDX00000020110003 **Revision:** 0

Table of Contents

URRS

By LPC	Date 05/09/2011	Project TVA – BRF	Sheet 1 of 2
Chkd. By KMB	Date 06/02/2011	Description Perimeter Rock Protection Design Calcs	Job # 31854126.40130

Objective

The ash pond (Ash Disposal Area 2A) at TVA-BRF had perimeter slope stability factors of safety (FoS) values of less than 1.5, as stated by Stantec Consulting Services, Inc. in *Report of Geotechnical Exploration, Gypsum Disposal Area 2A, Bull Run Fossil Plant, Anderson County, Tennessee (Report of Geotechnical Exploration)*, dated April 12, 2010. The low factors of safety were primarily caused by high seepage (pore water) pressures in the perimeter dikes. TVA has stated that the ash pond water elevation will be maintained at 801 ft in the future. Design thin rock buttresses using SEEP/W and SLOPE/W as required to obtain factors of safety (FoS) of at least 1.5 using a pond water elevation of 801 ft.

Procedure

Appropriately modify the SLOPE/W and SEEP/W stability models prepared by Stantec and provided by TVA as part of Stantec's *Report of Geotechnical Exploration*. Perform analyses at cross sections N-N', O-O', R-R', and S-S'.

Note that the SEEP/W analyses have been modified from those prepared from Stantec. The following modifications have been made to SEEP/W analyses at each cross section, compared to the original Stantec analyses:

1. Material properties have been modified, as listed in Table 1
2. Steady-state saturated/unsaturated analyses have been performed (the SEEP/W model takes unsaturated flow and changes in hydraulic conductivity in unsaturated soils into account)
3. Model-end boundary conditions have been extended to the middle of the Clinch River/Bull Run Creek and the middle of the ash pond for each analysis. A vertical no-flow boundary condition has been applied at the end of each model.
4. Mesh has been refined to allow for several elements across each material type in the analysis.

Table 1: SEEP/W Material Properties – Stantec vs. Revised

Material	Hydraulic Conductivity (ft/sec)		Anisotropy Ratio (k_v/k_h)	
	Stantec	Revised URS	Stantec	Revised URS
Sluiced Fly Ash	$8.37x10^{-4}$	$3.28x10^{-6}$	1	0.1
Lean Clay (Fill)	$2.297x10^{-6}$	$3.28x10^{-7}$	0.1	0.25
Gravel (Alluvium)	$2.674x10^{-4}$	$2.674x10^{-4}$	0.02	0.1
Clayey Sand (Alluvium)	$8.2x10^{-5}$	$8.2x10^{-5}$	0.02	0.25
Lean Clay (Alluvium)	$9.19x10^{-6}$	$3.28x10^{-7}$	0.05	0.25
Bottom Ash Base	$1.64x10^{-3}$	$3.28x10^{-4}$	1	0.25
Ash Dike	$1.64x10^{-3}$	$1.64x10^{-5}$	1	0.25
Rock	$1.0x10^{-12}$	$1.0x10^{-12}$	1	1

Perform long-term (i.e. drained) slope stability analysis using Spencer's method and assume a minimum slip surface depth of 10.0 ft. Fully optimize all design slip surfaces. Use material properties (Table 2) and stratigraphy from Stantec's final *Report of Geotechnical Exploration*.

URS

By LPC	Date 05/09/2011	Project TVA – BRF	Sheet 2 of 2
Chkd. By KMB	Date 06/02/2011	Description Perimeter Rock Protection Design Calcs	Job # 31854126.40130

Material properties for the crushed rock buttress fill should be a friction angle of 40 degrees and a unit weight of 115 pcf for stability analyses, and a hydraulic conductivity 0.0328 ft/sec (1 cm/sec) and anisotropy ratio of 1.0 for seepage analyses.

Table 2: Strength Properties Used for Analysis (from Stantec's *Report of Geotechnical Exploration*)

Material	Saturated Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)
Lean Clay Dike (Fill)	126	0	33
Sandy Clay Dike (Fill)	126	0	33
Sluiced Fly Ash	105	0	25
Compacted Ash Dike	105	0	33
Lean Clay Alluvium	123	0	31
Sandy Lean Clay Alluvium	127	0	33
Fat Clay Alluvium	121	0	30
Clayey Sand Alluvium	112	0	33
Silt Alluvium	109	0	28
Sandy Silt to Silty Sand Alluvium	107	0	29
Sand Alluvium	120	0	33
Gravel Alluvium	135	0	40

Results

Table 3 lists the top elevation, bottom elevations, and thickness of rock buttress fill required to obtain a FoS of at least 1.5, and lists the final FoS value.

Table 3: Results of SLOPE/W Analysis

Cross Section	Rock Buttress Fill Dimension			Final Factor of Safety
	Top Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	
N-N'	798	785	1.5	1.6
O-O'	798	785	1.5	1.6
R-R'	795	779	3.0	1.5
S-S'	795	779	3.0	1.5

Civil design of the perimeter rock placement ensured that the rock meets the minimum design dimensions as listed in Table 3. As the analyses dictate two different design dimensions, design reaches were designated in plan based on the geometry of the perimeter dike.

Attachments

1. SLOPE/W Analyses & Reports
2. Relevant Stantec Boring Logs & Cross Sections

URS **DETAIL CHECK REPORT** Quality

Project Name:	TVA - Bull Run	Project Number:	31854116.00000
Project Location:	Anderson County, Tennessee	Client Name:	TVA
PM Name:	Ken Berry	PIC Name:	Tom Kovacic

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Andrew Z. Boeckmann — Checker's Comments Required by:

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Ash Pond Buttress Design - Cross Section N-N', O-O', & S-S'

☒ This Detail Check is a check for correctness, completeness and technical accuracy.
☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry — 5-18-2011

Project Manager Signature — **Date**

Detail Check – Part 1: Comments

(This Section is to be completed by the Checker.)

Check box A or B:

A. ☒ All items have been found to be correct. Checker has no comments.

or

B. ☐ Checker's comments have been provided on:

☐ Marked directly on Work Product
☐ Comment and Disposition Form (Form 3-5 (MM))
☐ Other Specify: _____

A Boeckmann — 6-29-10

Checker Signature — **Date**

Detail Check – Part 2: Verification

(This section is to be completed by the Checker after verification of comment resolution, if box B is checked off above.)

Check box C **or** D <u>and</u> then E:

C. ☐ Verification of comment resolution has been performed by Checker AND any significant issues have been resolved between Originator and Checker.

or

D. ☐ Verification of comment resolution has been performed by Checker AND unresolved issues have been submitted to the Project Manager, Principal-in-Charge or designee for resolution.

<u>and</u>

E. ☐ Verification of correct incorporation of resolved comments into final Work Product is complete.

Checker Signature — **Date**

APPROVAL and DISTRIBUTION

(To be signed after box A or E are completed.)

☒ The Detail Check is complete. Significant issues not resolved between the Checker and the Originator, if any, have been resolved by the Approver.

Kenneth M Berry — 5-18-2011

Project Manager, Principal-in-Charge or Designee Signature — **Date**

Distribution:

Project Central File – Quality file folder
Other Specify: _____

Slope Stability

Cross-Section N-N'

Tennessee Valley Authority
Bull Run Power Plant

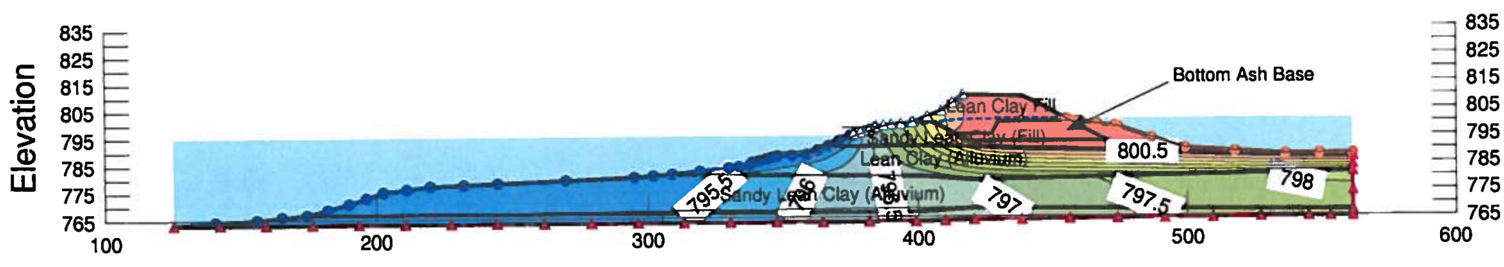
Revised SEEP/W

Calculated By: LPC
Checked By: AZB

5/5/2011

Name: Sluiced Fly Ash   Model: Saturated / Unsaturated   K-Function: Sluiced Fly Ash   Vol. WC. Function: Sluiced Fly Ash   K-Ratio: 0.1   K-Direction: 0 °
Name: Sandy Lean Clay (Fill)   Model: Saturated / Unsaturated   K-Function: Lean Clay (Fill)   Vol. WC. Function: Sandy Lean Clay (Fill)   K-Ratio: 0.25   K-Direction: 0 °
Name: Lean Clay (Fill)   Model: Saturated / Unsaturated   K-Function: Lean Clay (Fill)   Vol. WC. Function: Lean Clay (Fill)   K-Ratio: 0.25   K-Direction: 0 °
Name: Lean Clay (Alluvium)   Model: Saturated Only   K-Sat: 3.28e-007 ft/sec   Volumetric Water Content: 0.41 ft³/ft³   Mv: 4.79e-007 /psf   K-Ratio: 0.25   K-Direction: 0 °
Name: Sand (Alluvium)   Model: Saturated Only   K-Sat: 8.2e-005 ft/sec   Volumetric Water Content: 0.39 ft³/ft³   Mv: 4.79e-007 /psf   K-Ratio: 0.25   K-Direction: 0 °
Name: Sandy Lean Clay (Alluvium)   Model: Saturated Only   K-Sat: 5e-006 ft/sec   Volumetric Water Content: 0.38 ft³/ft³   Mv: 4.79e-007 /psf   K-Ratio: 0.25   K-Direction: 0
Name: Bottom Ash Base   Model: Saturated / Unsaturated   K-Function: Bottom Ash   Vol. WC. Function: Bottom Ash   K-Ratio: 0.25   K-Direction: 0 °

Steady-State Seepage - Ash Pond Level = 801
SEEP/W
Method: Steady-State



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Slope Stability

Cross-Section N-N'

Tennessee Valley Authority
Bull Run Power Plant

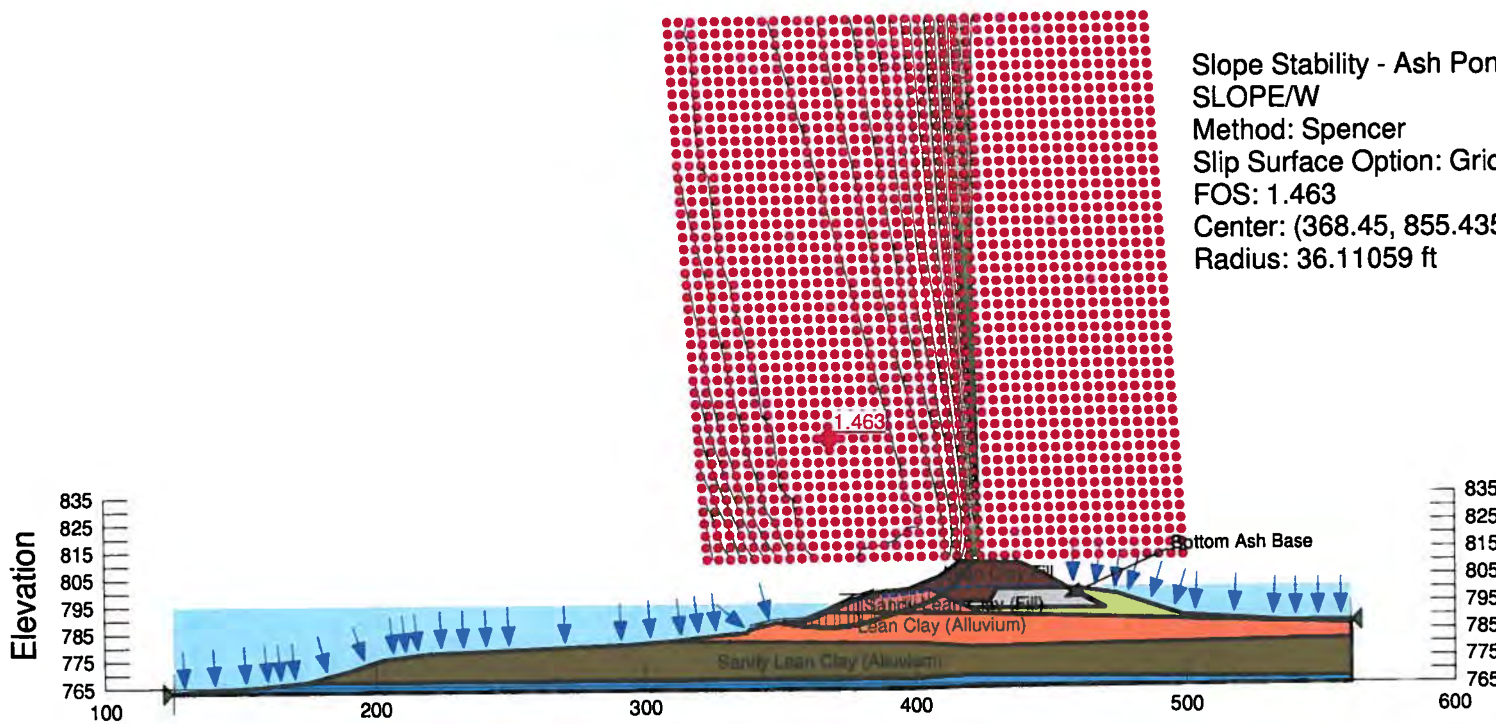
Revised SEEP/W

Calculated By: LPC
Checked By: AZB

5/5/2011

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 °
Name: Sandy Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 °
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 °
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Unit Wt. Above Water Table: 123 pcf Cohesion: 0 psf Phi: 31 °
Name: Sand (Alluvium) Model: Mohr-Coulomb Unit Weight: 120 pcf Unit Wt. Above Water Table: 120 pcf Cohesion: 0 psf Phi: 33 °
Name: Sandy Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 127 pcf Unit Wt. Above Water Table: 126 pcf Cohesion: 0 psf Phi: 33 °
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 °

Slope Stability - Ash Pond Level = 801
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.463
Center: (368.45, 855.435) ft
Radius: 36.11059 ft



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Slope Stability

Cross-Section N-N'

Revised SEEP/W

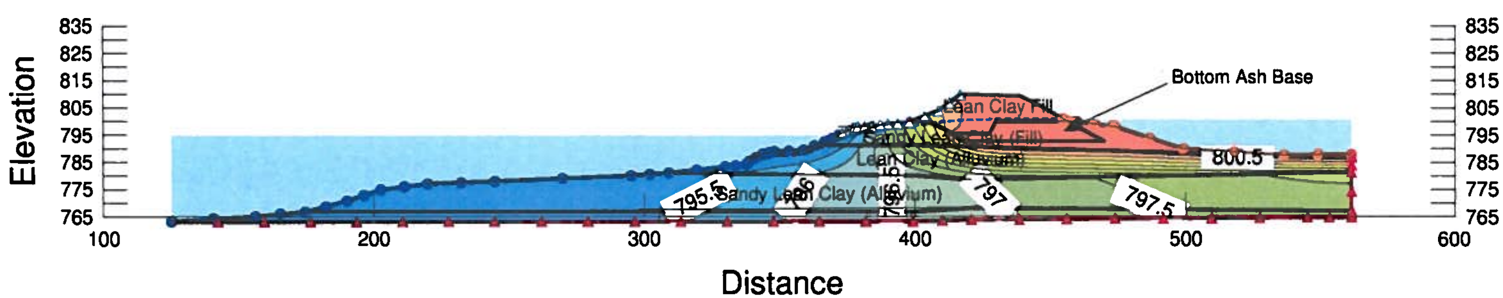
Calculated By: LPC
Checked By: AZB

5/5/2011

Tennessee Valley Authority
Bull Run Power Plant

Name: Sluiced Fly Ash Model: Saturated / Unsaturated K-Function: Sluiced Fly Ash Vol. WC. Function: Sluiced Fly Ash K-Ratio: 0.1 K-Direction: 0 °
Name: Sandy Lean Clay (Fill) Model: Saturated / Unsaturated K-Function: Lean Clay (Fill) Vol. WC. Function: Sandy Lean Clay (Fill) K-Ratio: 0.25 K-Direction: 0 °
Name: Lean Clay (Fill) Model: Saturated / Unsaturated K-Function: Lean Clay (Fill) Vol. WC. Function: Lean Clay (Fill) K-Ratio: 0.25 K-Direction: 0 °
Name: Lean Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.41 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Sand (Alluvium) Model: Saturated Only K-Sat: 8.2e-005 ft/sec Volumetric Water Content: 0.39 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Sandy Lean Clay (Alluvium) Model: Saturated Only K-Sat: 5e-006 ft/sec Volumetric Water Content: 0.38 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0
Name: Bottom Ash Base Model: Saturated / Unsaturated K-Function: Bottom Ash Vol. WC. Function: Bottom Ash K-Ratio: 0.25 K-Direction: 0 °
Name: Rip-Rap Model: Saturated Only K-Sat: 0.0328 ft/sec Volumetric Water Content: 0.4 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 1 K-Direction: 0 °

Steady-State Seepage - Ash Pond Level =801, Buttress
SEEP/W
Method: Steady-State



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Slope Stability

Cross-Section N-N'

Tennessee Valley Authority
Bull Run Power Plant

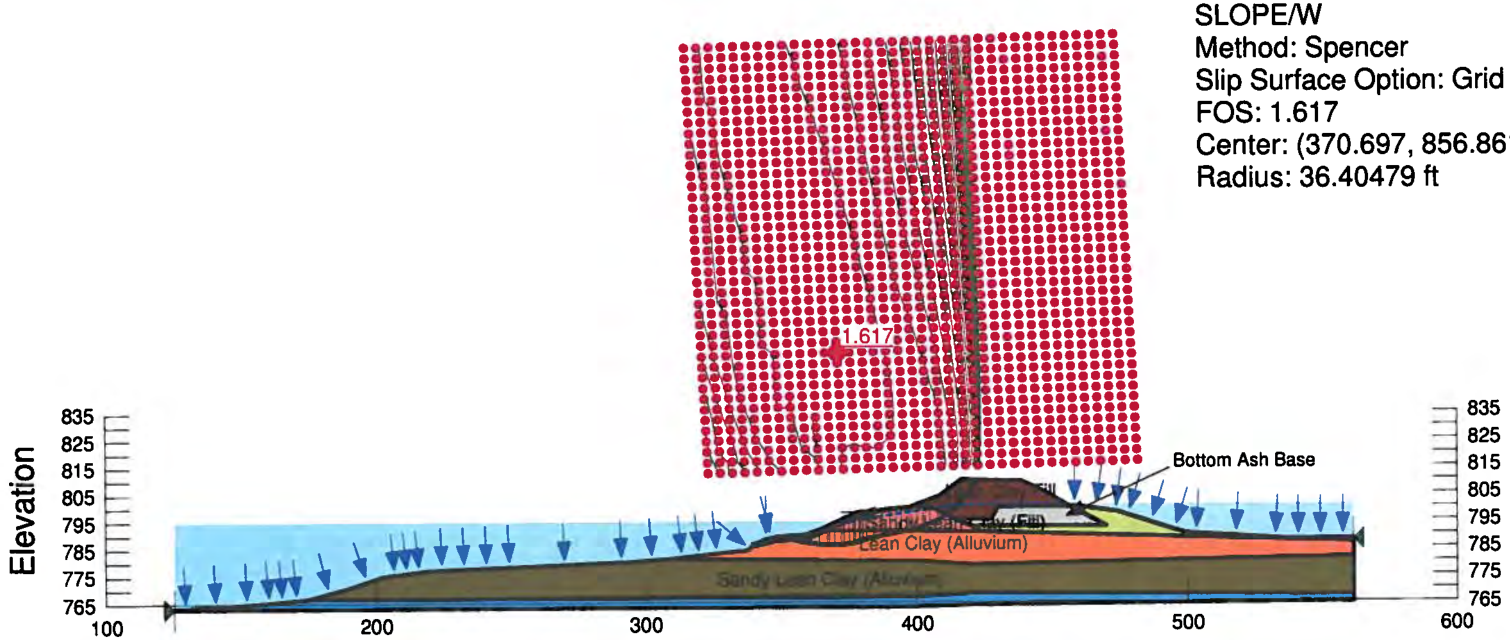
Revised SEEP/W

Calculated By: LPC
Checked By: AZB

5/5/2011

Name: Sluiced Fly Ash   Model: Mohr-Coulomb   Unit Weight: 105 pcf   Unit Wt. Above Water Table: 100 pcf   Cohesion: 0 psf   Phi: 25 °
Name: Sandy Lean Clay (Fill)   Model: Mohr-Coulomb   Unit Weight: 126 pcf   Unit Wt. Above Water Table: 125 pcf   Cohesion: 0 psf   Phi: 33 °
Name: Lean Clay (Fill)   Model: Mohr-Coulomb   Unit Weight: 126 pcf   Unit Wt. Above Water Table: 125 pcf   Cohesion: 0 psf   Phi: 33 °
Name: Lean Clay (Alluvium)   Model: Mohr-Coulomb   Unit Weight: 123 pcf   Unit Wt. Above Water Table: 123 pcf   Cohesion: 0 psf   Phi: 31 °
Name: Sand (Alluvium)   Model: Mohr-Coulomb   Unit Weight: 120 pcf   Unit Wt. Above Water Table: 120 pcf   Cohesion: 0 psf   Phi: 33 °
Name: Sandy Lean Clay (Alluvium)   Model: Mohr-Coulomb   Unit Weight: 127 pcf   Unit Wt. Above Water Table: 126 pcf   Cohesion: 0 psf   Phi: 33 °
Name: Bottom Ash Base   Model: Mohr-Coulomb   Unit Weight: 105 pcf   Unit Wt. Above Water Table: 100 pcf   Cohesion: 0 psf   Phi: 33 °
Name: Rip-Rap   Model: Mohr-Coulomb   Unit Weight: 115 pcf   Cohesion: 0 psf   Phi: 40 °

Slope Stability - Ash Pond Level = 801, Buttress
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.617
Center: (370.697, 856.861) ft
Radius: 36.40479 ft



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Revised SEEP/W

Slope Stability

Cross Section O-O'

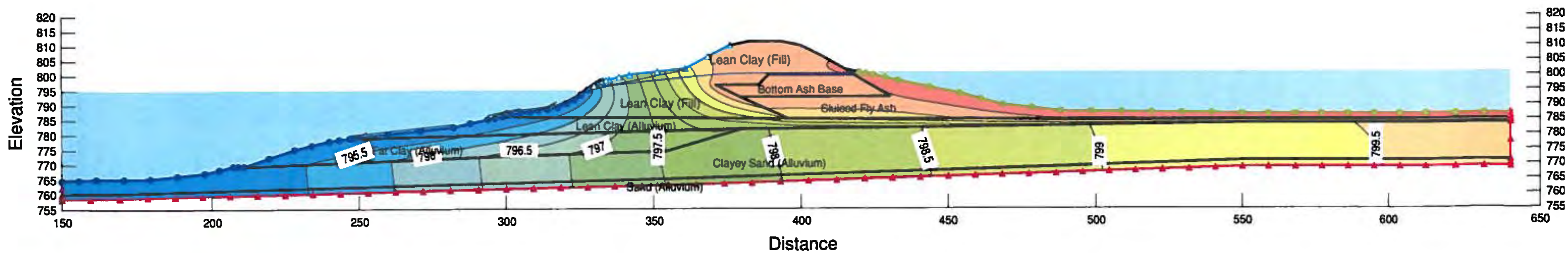
Bull Run Fossil Plan
Tennessee Valley Authority

Calculated By: LPC
Checked By: AZB

5/9/2011

Name: Lean Clay (Fill) Model: Saturated / Unsaturated K-Function: Lean Clay (Fill) Vol. WC. Function: Lean Clay (Fill) K-Ratio: 0.25 K-Direction: 0 °
Name: Sluiced Fly Ash Model: Saturated / Unsaturated K-Function: Sluiced Fly Ash Vol. WC. Function: Sluiced Fly Ash K-Ratio: 0.1 K-Direction: 0 °
Name: Lean Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.41 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Fat Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.41 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Clayey Sand (Alluvium) Model: Saturated Only K-Sat: 8.2e-005 ft/sec Volumetric Water Content: 0.39 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Bottom Ash Base Model: Saturated / Unsaturated K-Function: Bottom Ash Vol. WC. Function: Bottom Ash K-Ratio: 0.25 K-Direction: 0 °
Name: Sand Model: Saturated Only K-Sat: 8.2e-005 ft/sec Volumetric Water Content: 0.39 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °

Seepage - Ash Pond Level = 801
SEEP/W
Method: Steady-State



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Slope Stability

Cross Section O-O'

Bull Run Fossil Plan
Tennessee Valley Authority

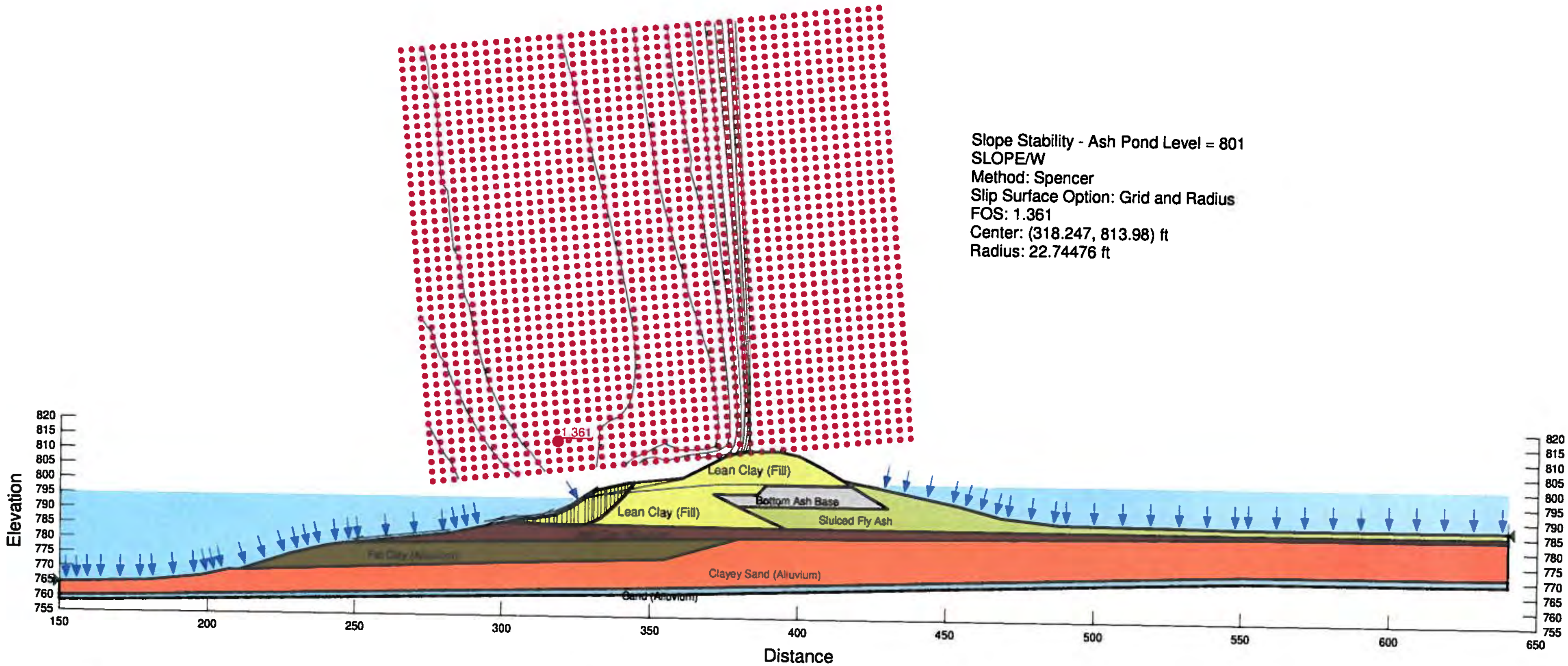
Revised SEEP/W

Calculated By: LPC
Checked By: AZB

5/9/2011

Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 °
Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 °
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Unit Wt. Above Water Table: 123 pcf Cohesion: 0 psf Phi: 31 °
Name: Fat Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 121 pcf Unit Wt. Above Water Table: 117 pcf Cohesion: 0 psf Phi: 30 °
Name: Clayey Sand (Alluvium) Model: Mohr-Coulomb Unit Weight: 112 pcf Unit Wt. Above Water Table: 112 pcf Cohesion: 0 psf Phi: 33 °
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 °
Name: Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Unit Wt. Above Water Table: 120 pcf Cohesion: 0 psf Phi: 33 °

Slope Stability - Ash Pond Level = 801
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.361
Center: (318.247, 813.98) ft
Radius: 22.74476 ft



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Slope Stability

Cross Section O-O'

Bull Run Fossil Plan
Tennessee Valley Authority

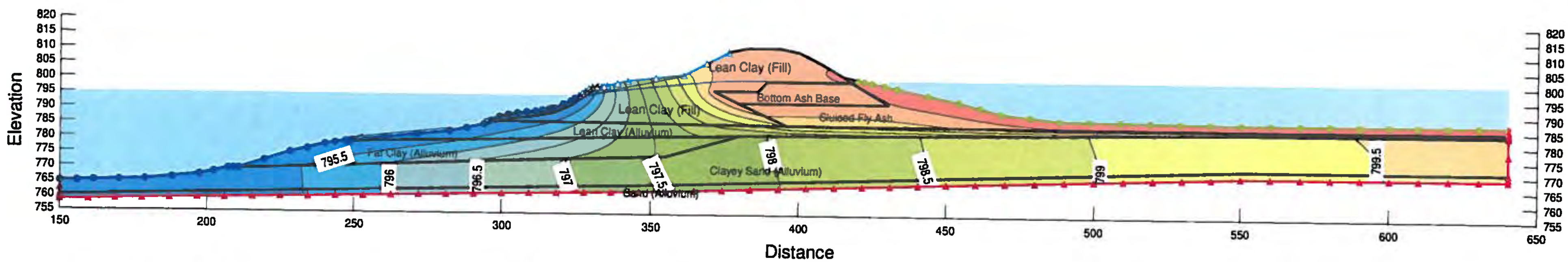
Revised SEEP/W

Name: Lean Clay (Fill) Model: Saturated / Unsaturated K-Function: Lean Clay (Fill) Vol. WC. Function: Lean Clay (Fill) K-Ratio: 0.25 K-Direction: 0 °
Name: Sluiced Fly Ash Model: Saturated / Unsaturated K-Function: Sluiced Fly Ash Vol. WC. Function: Sluiced Fly Ash K-Ratio: 0.1 K-Direction: 0 °
Name: Lean Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.41 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Fat Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.41 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Clayey Sand (Alluvium) Model: Saturated Only K-Sat: 8.2e-005 ft/sec Volumetric Water Content: 0.39 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Bottom Ash Base Model: Saturated / Unsaturated K-Function: Bottom Ash Vol. WC. Function: Bottom Ash K-Ratio: 0.25 K-Direction: 0 °
Name: Sand Model: Saturated Only K-Sat: 8.2e-005 ft/sec Volumetric Water Content: 0.39 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Stone Buttress Model: Saturated Only K-Sat: 0.0328 ft/sec Volumetric Water Content: 0.4 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 1 K-Direction: 0 °

Calculated By: LPC
Checked By: AZB

5/9/2011

Seepage - Ash Pond Level = 801, Buttress
SEEP/W
Method: Steady-State



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Slope Stability

Cross Section O-O'

Bull Run Fossil Plan
Tennessee Valley Authority

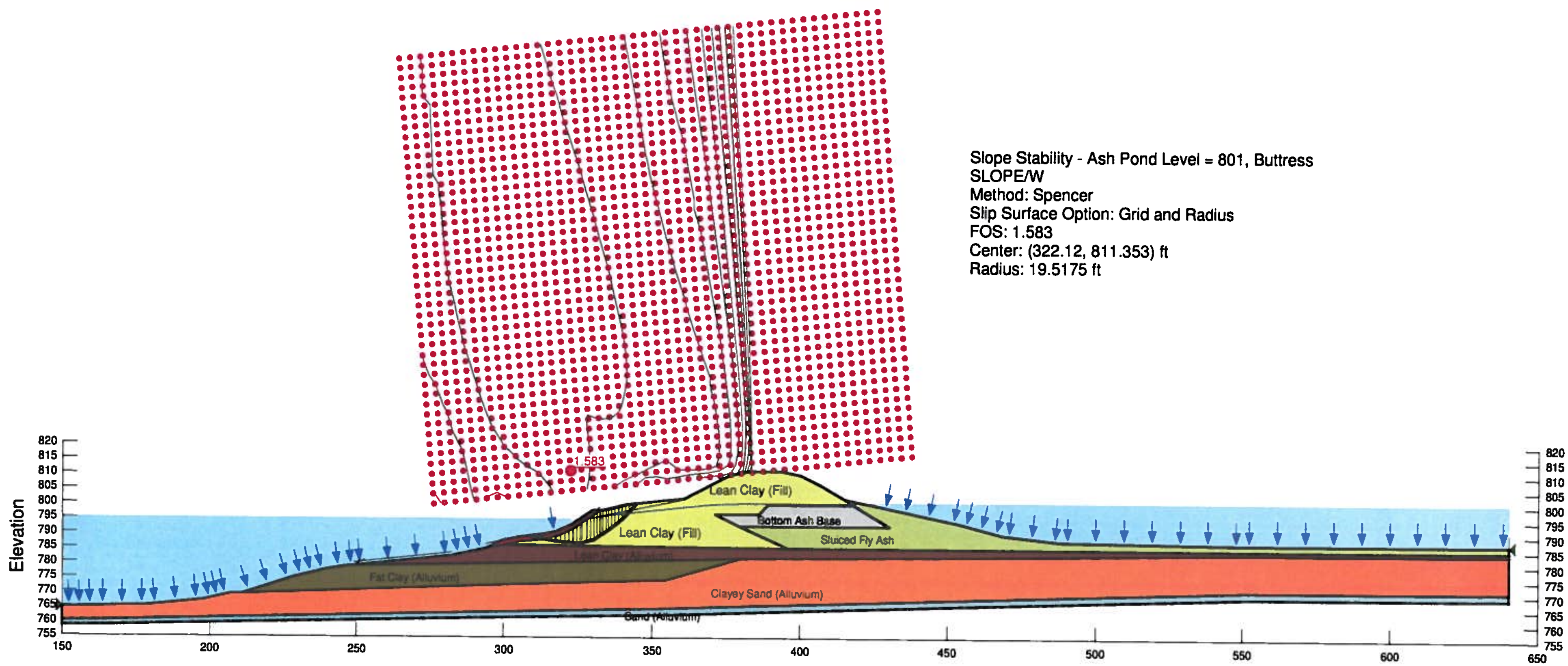
Revised SEEP/W

Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 °
Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 °
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Unit Wt. Above Water Table: 123 pcf Cohesion: 0 psf Phi: 31 °
Name: Fat Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 121 pcf Unit Wt. Above Water Table: 117 pcf Cohesion: 0 psf Phi: 30 °
Name: Clayey Sand (Alluvium) Model: Mohr-Coulomb Unit Weight: 112 pcf Unit Wt. Above Water Table: 112 pcf Cohesion: 0 psf Phi: 33 °
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 °
Name: Sand Model: Mohr-Coulomb Unit Weight: 120 pcf Unit Wt. Above Water Table: 120 pcf Cohesion: 0 psf Phi: 33 °
Name: Stone Buttress Model: Mohr-Coulomb Unit Weight: 115 pcf Unit Wt. Above Water Table: 115 pcf Cohesion: 0 psf Phi: 40 °

Calculated By: LPC
Checked By: AZB

5/9/2011

Slope Stability - Ash Pond Level = 801, Buttress
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.583
Center: (322.12, 811.353) ft
Radius: 19.5175 ft



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URS **DETAIL CHECK REPORT** Quality

Project Name:	TVA - Bull Run	Project Number:	31854116.00000
Project Location:	Anderson County, Tennessee	Client Name:	TVA
PM Name:	Ken Berry	PIC Name:	Tom Kovacic

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Stefanie A. Voss Checker's Comments Required by:

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Ash Pond Buttress Design - Cross Section R-R'

☒ This Detail Check is a check for correctness, completeness and technical accuracy.
☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry 5-18-2011
Project Manager Signature **Date**

Detail Check – Part 1: Comments

(This Section is to be completed by the Checker.)

Check box A **or** B:

A. ☒ All items have been found to be correct. Checker has no comments.

or

B. ☐ Checker's comments have been provided on:

☐ Marked directly on Work Product
☐ Comment and Disposition Form (Form 3-5 (MM))
☐ Other Specify: _____

Stefanie Voss 5-10-11
Checker Signature **Date**

Detail Check – Part 2: Verification

(This section is to be completed by the Checker after verification of comment resolution, if box B is checked off above.)

Check box C **or** D and then E:

C. ☐ Verification of comment resolution has been performed by Checker AND any significant issues have been resolved between Originator and Checker.

or

D. ☐ Verification of comment resolution has been performed by Checker AND unresolved issues have been submitted to the Project Manager, Principal-in-Charge or designee for resolution.

and

E. ☐ Verification of correct incorporation of resolved comments into final Work Product is complete.

Checker Signature **Date**

APPROVAL and DISTRIBUTION

*(To be signed after box A **or** E are completed.)*

☒ The Detail Check is complete. Significant issues not resolved between the Checker and the Originator, if any, have been resolved by the Approver.

Kenneth M Berry 5-18-2011
Project Manager, Principal-in-Charge or Designee Signature **Date**

Distribution:
Project Central File – Quality file folder
Other Specify: _____

SEEP/W Analysis

Gypsum Disposal Area 2A
Cross-Section R-R'

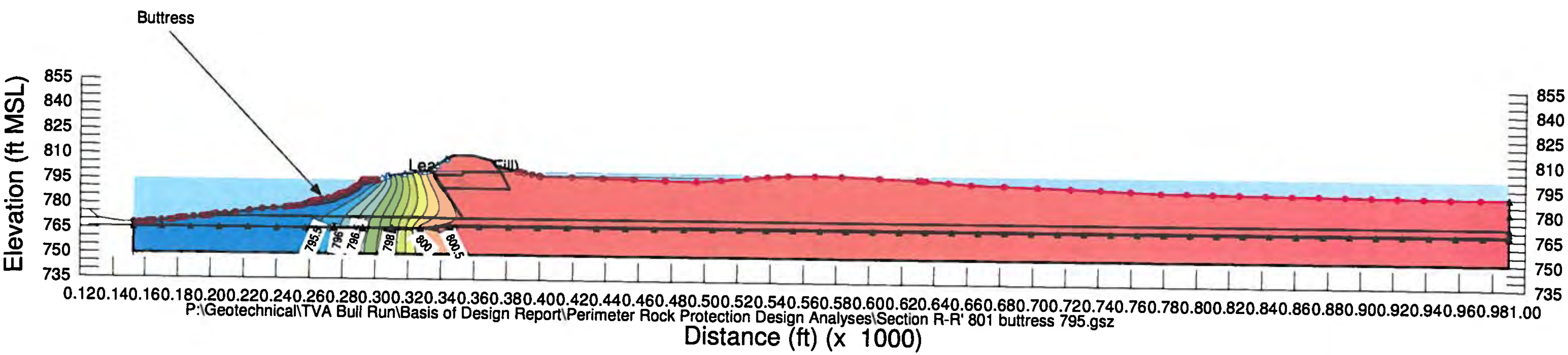
Bull Run Fossil Plant
Tennessee Valley Authority

Revised SEEP/W

Analyzed: LPC
Checked: SAV
Date: 5/9/2011

Name: Sluiced Fly Ash Model: Saturated / Unsaturated K-Function: Sluiced Fly Ash Vol. WC. Function: Sluiced Fly Ash K-Ratio: 0.1 K-Direction: 0 °
Name: Sandy Lean Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.38 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Bottom Ash Base Model: Saturated / Unsaturated K-Function: Bottom Ash Vol. WC. Function: Bottom Ash K-Ratio: 0.25 K-Direction: 0 °
Name: Lean Clay (Fill) Model: Saturated / Unsaturated K-Function: Lean Clay (Fill) Vol. WC. Function: Lean Clay (Fill) K-Ratio: 0.25 K-Direction: 0 °
Name: Bedrock Model: Saturated Only K-Sat: 1e-012 ft/sec Volumetric Water Content: 0 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 1 K-Direction: 0 °
Name: Gravel (Alluvium) Model: Saturated Only K-Sat: 0.0002674 ft/sec Volumetric Water Content: 0.23 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.1 K-Direction: 0 °
Name: Rock Buttress Model: Saturated Only K-Sat: 0.0328 ft/sec Volumetric Water Content: 0.4 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 1 K-Direction: 0 °

Seepage, Ash Pond Level = 801, Buttress



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SLOPE/W Analysis

Gypsum Disposal Area 2A
Cross-Section R-R'

Bull Run Fossil Plant
Tennessee Valley Authority

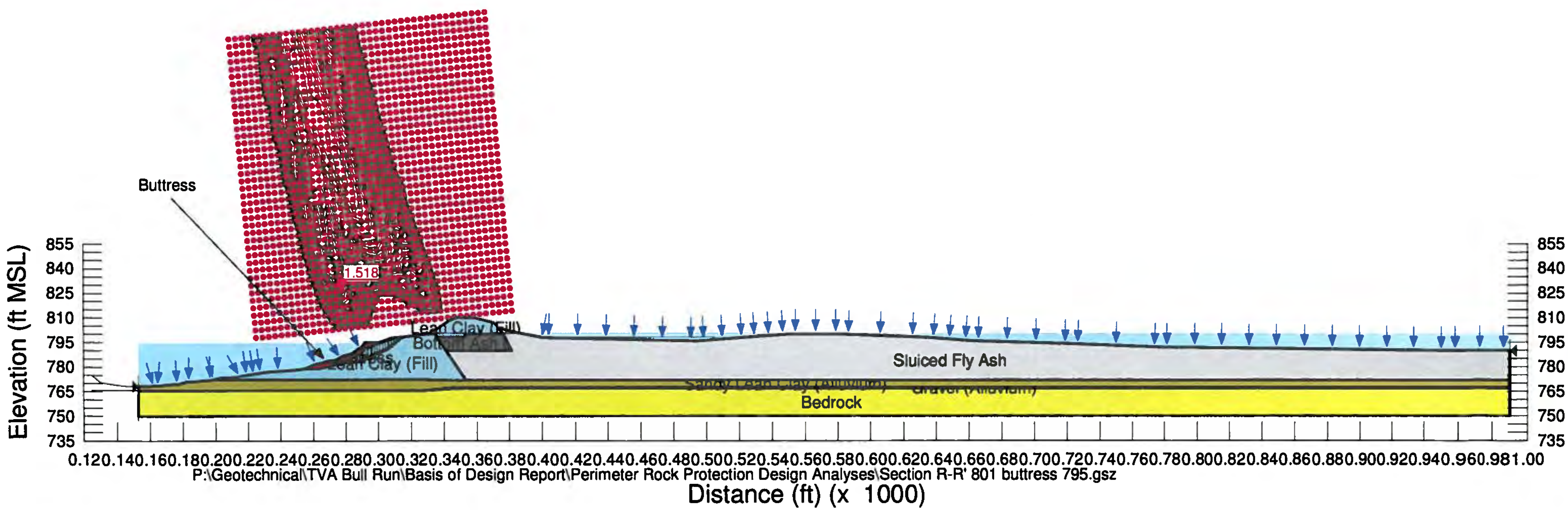
Revised SEEP/W

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 °
Name: Sandy Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 127 pcf Unit Wt. Above Water Table: 126 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °
Name: Bedrock Model: Bedrock (Impenetrable)
Name: Gravel (Alluvium) Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion: 0 psf Phi: 40 ° Phi-B: 0 °
Name: Rock Buttress Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion: 0 psf Phi: 40 ° Phi-B: 0 °

Analyzed: LPC
Checked: SAV
Date: 5/9/2011

Stability, Ash Pond Level = 801, Buttress
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.518
Center: (277.275, 830.945) ft
Radius: 24.17827 ft

Stability, Ash Pond Level = 801, Buttress



SEEP/W Analysis

Gypsum Disposal Area 2A
Cross-Section S-S'

Bull Run Fossil Plant
Tennessee Valley Authority

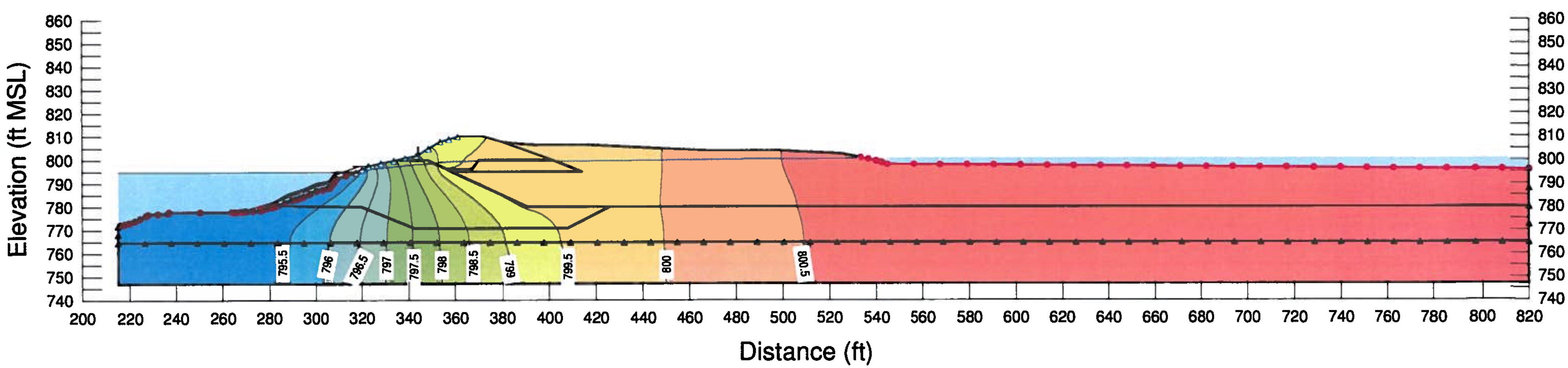
Revised SEEP/W

Name: Sluiced Fly Ash Model: Saturated / Unsaturated K-Function: Sluiced Fly Ash Vol. WC. Function: Sluiced Fly Ash K-Ratio: 0.1 K-Direction: 0 °
Name: Lean Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.41 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Bottom Ash Base Model: Saturated / Unsaturated K-Function: Bottom Ash Vol. WC. Function: Bottom Ash K-Ratio: 0.25 K-Direction: 0 °
Name: Rock Model: Saturated Only K-Sat: 1e-012 ft/sec Volumetric Water Content: 0 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 1 K-Direction: 0 °
Name: Lean Clay (Fill) Model: Saturated / Unsaturated K-Function: Lean Clay (Fill) Vol. WC. Function: Lean Clay (Fill) K-Ratio: 0.25 K-Direction: 0 °

Analyzed: LPC
Checked: AZB

Date: 5/9/2011

Seepage, Ash Pond Level = 801



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SLOPE/W Analysis

Gypsum Disposal Area 2A
Cross-Section S-S'

Bull Run Fossil Plant
Tennessee Valley Authority

Revised SEEP/W

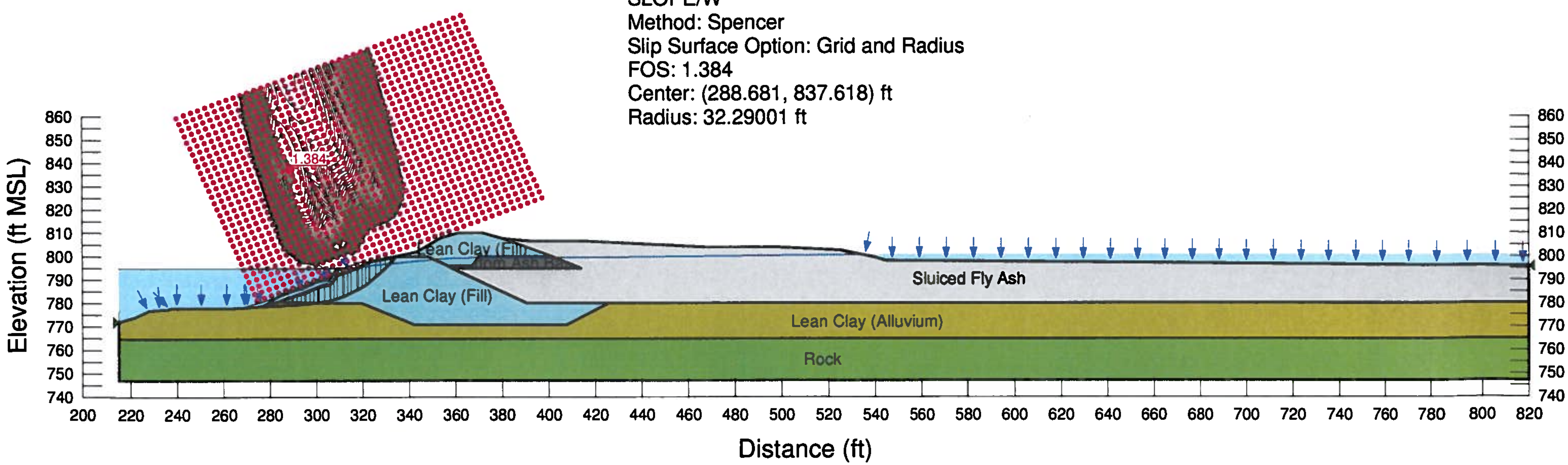
Analyzed: LPC
Checked: AZB

Date: 5/9/2011

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 °
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 psf Phi: 31 ° Phi-B: 0 °
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °
Name: Rock Model: Bedrock (Impenetrable)
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °

Stability, Ash Pond Level = 801

Stability, Ash Pond Level = 801
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 1.384
Center: (288.681, 837.618) ft
Radius: 32.29001 ft



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SEEP/W Analysis

Gypsum Disposal Area 2A
Cross-Section S-S'

Bull Run Fossil Plant
Tennessee Valley Authority

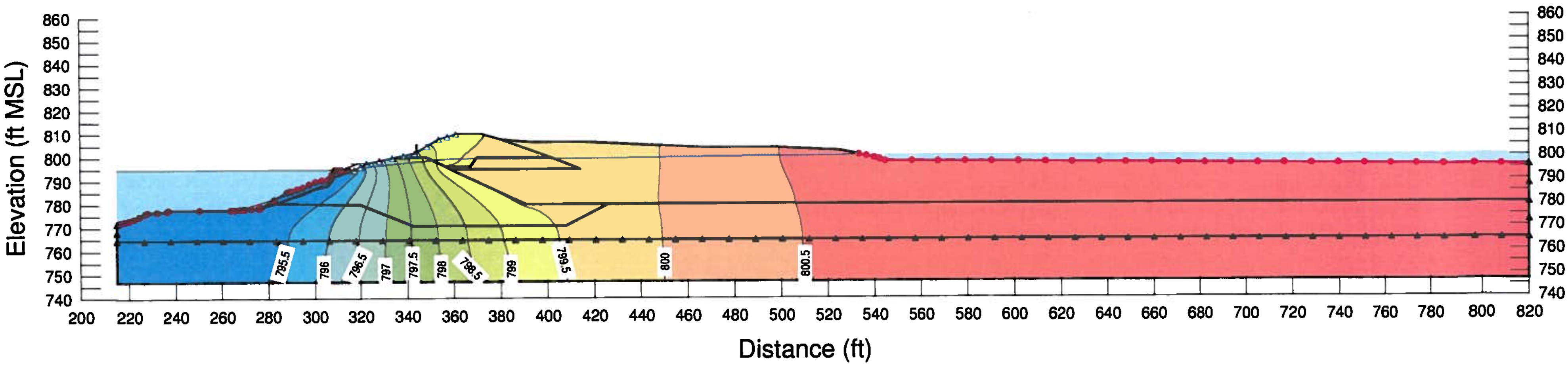
Revised SEEP/W

Name: Sluiced Fly Ash Model: Saturated / Unsaturated K-Function: Sluiced Fly Ash Vol. WC. Function: Sluiced Fly Ash K-Ratio: 0.1 K-Direction: 0 °
Name: Lean Clay (Alluvium) Model: Saturated Only K-Sat: 3.28e-007 ft/sec Volumetric Water Content: 0.41 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 0.25 K-Direction: 0 °
Name: Bottom Ash Base Model: Saturated / Unsaturated K-Function: Bottom Ash Vol. WC. Function: Bottom Ash K-Ratio: 0.25 K-Direction: 0 °
Name: Rock Model: Saturated Only K-Sat: 1e-012 ft/sec Volumetric Water Content: 0 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 1 K-Direction: 0 °
Name: Lean Clay (Fill) Model: Saturated / Unsaturated K-Function: Lean Clay (Fill) Vol. WC. Function: Lean Clay (Fill) K-Ratio: 0.25 K-Direction: 0 °
Name: Rock Buttress Model: Saturated Only K-Sat: 0.0328 ft/sec Volumetric Water Content: 0.4 ft³/ft³ Mv: 4.79e-007 /psf K-Ratio: 1 K-Direction: 0 °

Analyzed: LPC
Checked: AZB

Date: 5/9/2011

Seepage, Ash Pond Level = 801, Buttress



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SLOPE/W Analysis

Gypsum Disposal Area 2A
Cross-Section S-S'

Bull Run Fossil Plant
Tennessee Valley Authority

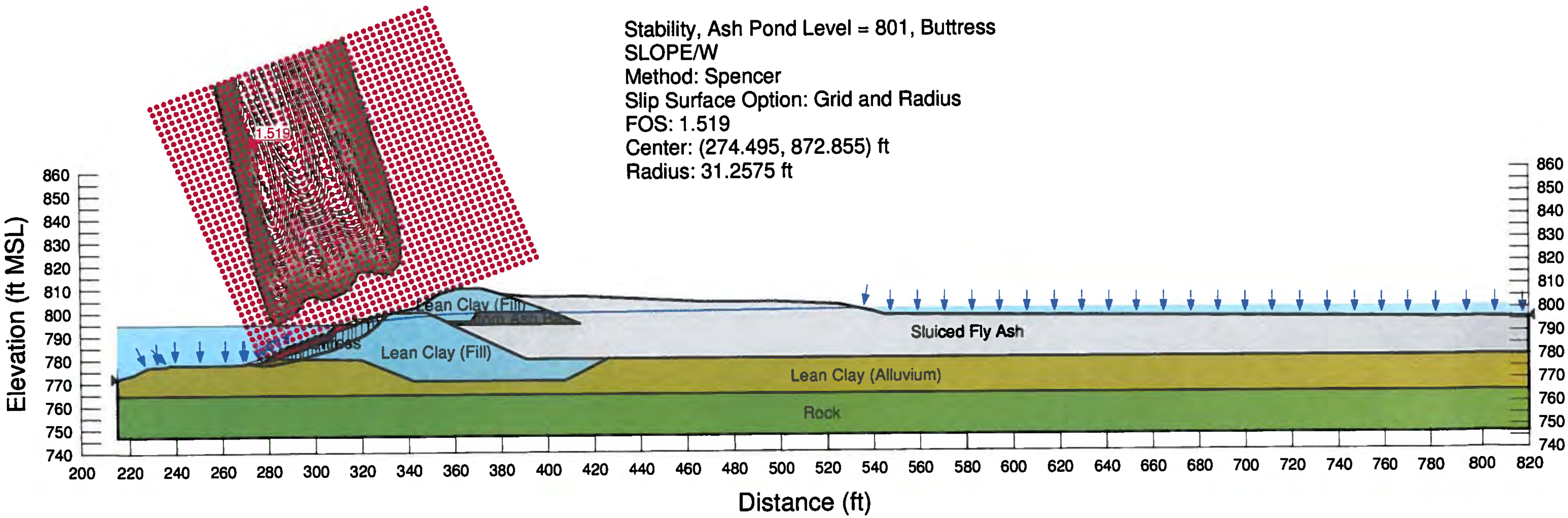
Revised SEEP/W

Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 °
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 0 psf Phi: 31 ° Phi-B: 0 °
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °
Name: Rock Model: Bedrock (Impenetrable)
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °
Name: Rock Buttress Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion: 0 psf Phi: 40 ° Phi-B: 0 °

Analyzed: LPC
Checked: AZB

Date: 5/9/2011

Stability, Ash Pond Level = 801, Buttress



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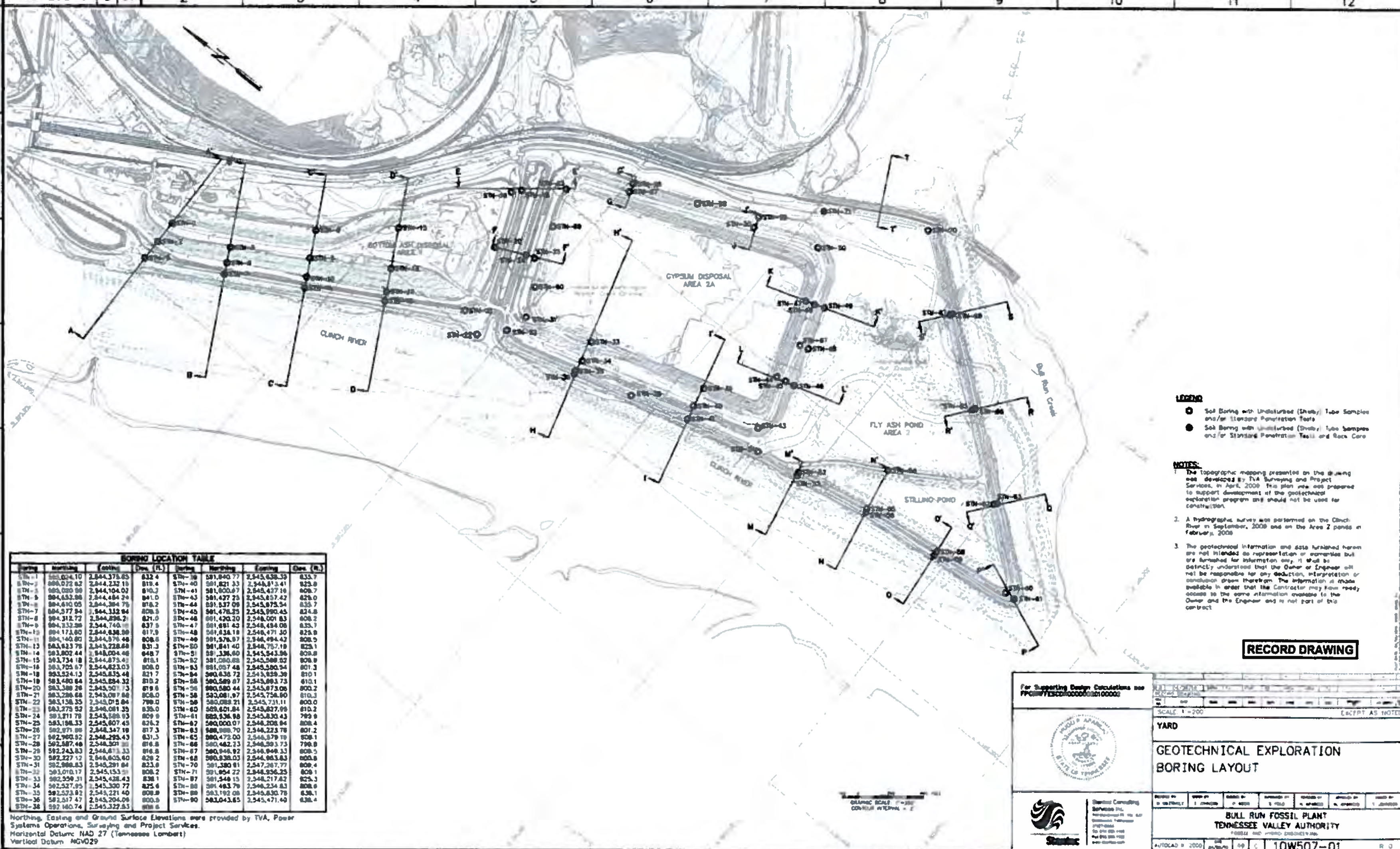
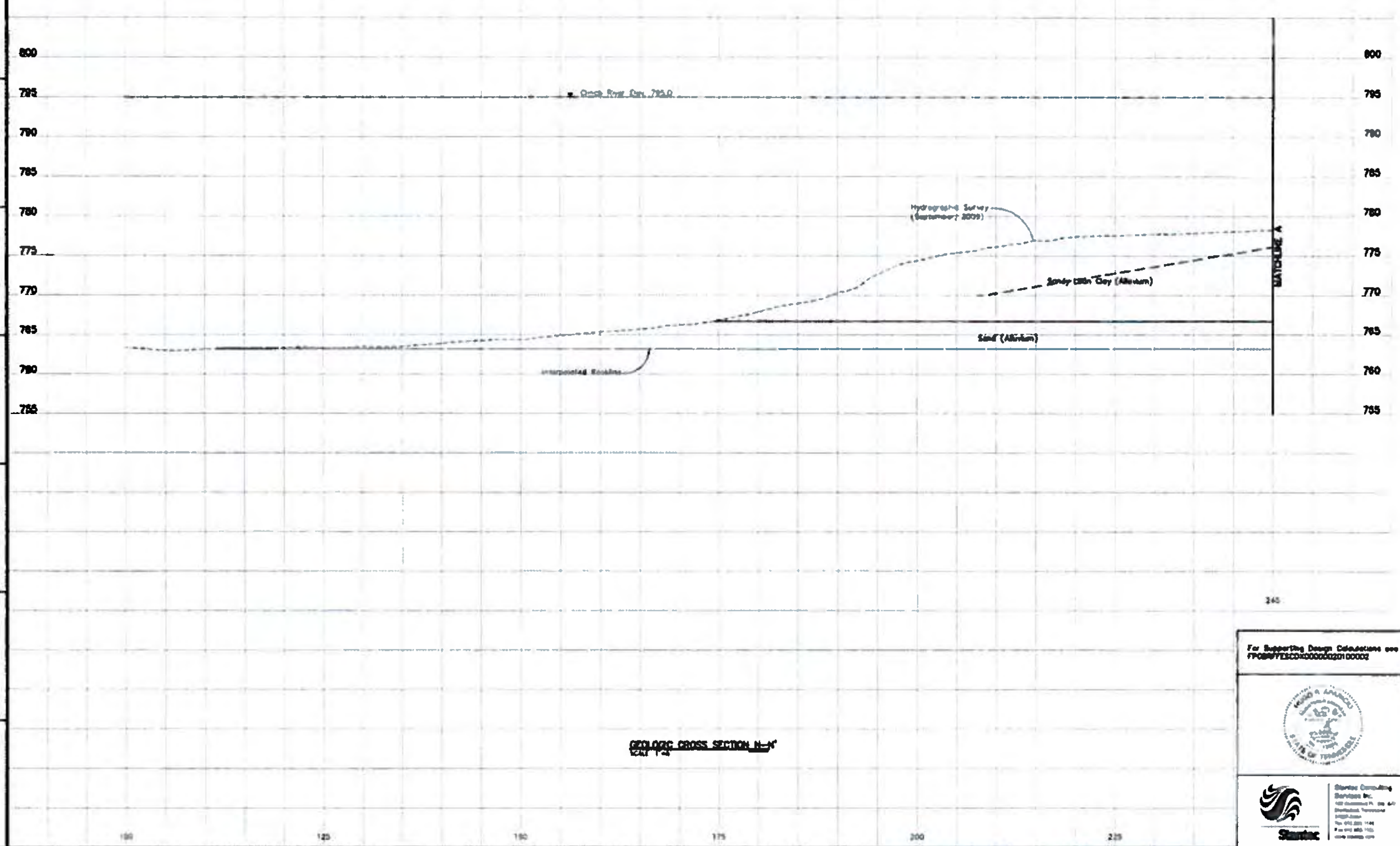


BORING LOCATION TABLE

Boring	Northing	Easting	Elev. (ft.)	Boring	Northing	Easting	Elev. (ft.)
STN-1	584,024.10	2,544,378.85	832.4	STN-39	581,840.77	2,545,638.39	833.7
STN-2	584,072.62	2,544,232.18	819.4	STN-40	581,821.33	2,545,813.41	823.8
STN-3	584,030.98	2,544,104.02	810.2	STN-41	581,800.67	2,545,437.18	809.7
STN-5	584,632.98	2,544,484.24	841.0	STN-43	581,427.23	2,545,657.42	828.0
STN-6	584,610.05	2,544,384.78	818.2	STN-44	581,537.09	2,545,875.54	835.7
STN-7	584,577.94	2,544,332.94	808.5	STN-45	581,478.25	2,545,990.45	824.8
STN-8	584,312.72	2,544,896.21	821.0	STN-46	581,420.20	2,546,001.83	808.2
STN-9	584,232.98	2,544,740.18	837.5	STN-47	581,681.43	2,546,454.08	835.7
STN-10	584,173.80	2,544,838.80	817.9	STN-48	581,638.18	2,546,471.30	825.8
STN-11	584,140.80	2,544,576.48	808.6	STN-49	581,576.87	2,546,494.42	808.5
STN-13	583,823.78	2,545,228.68	831.3	STN-50	581,841.40	2,546,757.18	823.1
STN-14	583,802.44	2,548,004.48	848.7	STN-51	581,338.60	2,545,543.96	809.8
STN-15	583,734.18	2,544,873.42	818.1	STN-52	581,080.88	2,545,588.82	809.9
STN-16	583,705.67	2,544,823.03	808.0	STN-53	581,057.48	2,545,380.54	801.3
STN-18	583,524.13	2,545,835.44	821.7	STN-54	580,838.72	2,545,859.38	810.1
STN-19	583,480.64	2,545,854.32	810.2	STN-55	580,589.87	2,545,893.73	810.1
STN-20	583,388.28	2,545,507.73	819.6	STN-56	580,580.44	2,545,873.06	800.2
STN-21	583,298.68	2,545,087.68	808.0	STN-58	583,081.97	2,545,756.80	810.3
STN-22	583,138.35	2,545,015.84	798.0	STN-59	580,088.21	2,545,731.11	800.0
STN-23	583,275.52	2,546,081.35	835.0	STN-60	580,601.84	2,545,827.09	810.2
STN-24	583,211.78	2,545,588.93	809.9	STN-61	580,536.98	2,545,830.43	799.9
STN-25	583,198.33	2,545,607.45	826.2	STN-62	580,000.07	2,546,208.84	808.4
STN-26	582,971.98	2,548,347.18	817.3	STN-63	580,988.70	2,546,223.78	801.2
STN-27	582,960.92	2,548,295.43	831.3	STN-65	580,472.00	2,546,379.19	808.1
STN-28	582,587.48	2,548,301.30	816.8	STN-66	580,482.23	2,546,393.73	799.8
STN-29	582,243.83	2,544,873.33	816.8	STN-67	580,946.92	2,546,949.33	808.5
STN-30	582,227.12	2,546,805.40	828.2	STN-68	580,838.03	2,546,983.83	800.8
STN-31	582,988.83	2,545,291.84	823.8	STN-70	581,380.81	2,547,267.77	809.4
STN-32	583,010.17	2,545,153.51	808.2	STN-71	581,654.22	2,546,936.23	809.1
STN-33	582,550.31	2,545,428.43	838.1	STN-87	581,549.15	2,548,217.82	825.3
STN-34	582,527.85	2,545,300.77	825.6	STN-88	581,483.79	2,546,234.83	808.6
STN-35	582,523.82	2,545,221.40	808.9	STN-89	583,192.08	2,545,830.78	838.1
STN-36	582,517.47	2,545,204.08	800.8	STN-90	583,043.85	2,545,471.40	838.4
STN-38	582,160.74	2,545,327.93	808.6				

Northing, Easting and Ground Surface Elevations were provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27 (Tennessee Lambert)
Vertical Datum: NGVD29

49 C 10W507-29



GEOLOGIC CROSS SECTION N-N'

LEGEND

①	Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
②	Fill: Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
③	Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff, with occasional bottom ash
④	Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
⑤	Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff, with some fine gravels
⑥	Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
⑦	Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff with fine to medium sand and occasional sands, silt and organics
⑧	Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravel in the and trace sands and silt
⑨	Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
⑩	Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
⑪	Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
⑫	Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
⑬	Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff, with occasional silt, gravels and organics
⑭	Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels
WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu ft.)
U.W.D.	Unit Weight Dry (lbs./cu ft.)
03/31/09	Water Level and Date Recorded
T.O.R. -	Top of Rock (indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. -	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
REC.	Recovery (%)
Refusal	Auger Refusal using a carbide-tipped teeth auger bit
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log

NOTES:

1. The Tennessee Valley Authority Surveying and Project services performed an aerial survey of the Bull Run Fossil Plant in April 2009, a land survey in September 2009, a hydrographic survey of the Fly Ash Disposal Area 2 in February 2009 and a hydrographic survey of the Clinch River in September 2009.
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RECORD DRAWING

For Supporting Design Calculations see FPOBRFFESCDX000000020100002

Stantec

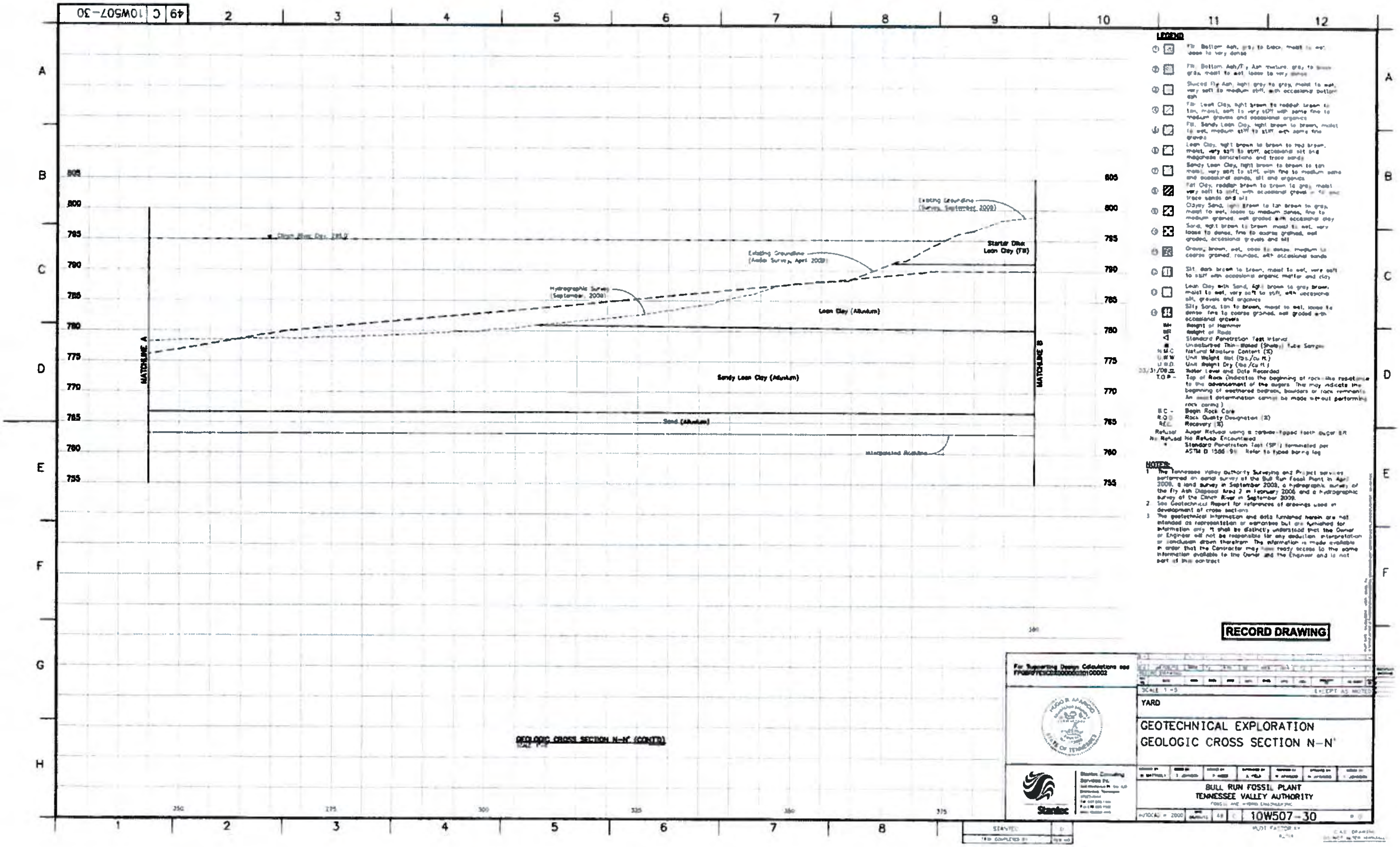
SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION N-N'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 49 | C | 10W507-29


49 C 10W507-30
MATCHLINE A
MATCHLINE B
Existing Groundline (Survey, September 2009)
Existing Groundline (Aerial Survey, April 2009)
Hydrographic Survey (September, 2009)
Starter Dike Lean Clay (Fill)
Lean Clay (Alluvium)
Sandy Lean Clay (Alluvium)
Sand (Alluvium)
Interpolated Bedding
GEOLOGIC CROSS SECTION N-N' (CONT'D)
LEGEND
Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
Fill: Bottom Ash/Fly Ash mixture, gray to brown gray, moist to wet, loose to very dense
Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff, with occasional bottom ash
Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff, with some fine gravels
Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff, with fine to medium sand and occasional sands, silt and organics
Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravel and trace sands and silt
Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff, with occasional silt, gravels and organics
Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels
WH Weight of Hammer
WR Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu ft.)
U.W.D. Unit Weight Dry (lbs./cu ft.)
Water Level and Date Recorded
T.O.R. - Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. - Begin Rock Core
R.Q.D. Rock Quality Designation (%)
REC. Recovery (%)
Refusal Auger Refusal using a carbide-tipped teeth auger bit
No Refusal No Refusal Encountered
Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log
NOTES:
1 The Tennessee Valley Authority Surveying and Project services performed an aerial survey of the Bull Run Fossil Plant in April 2009, a land survey in September 2009, a hydrographic survey of the Fly Ash Disposal Area 2 in February 2006 and a hydrographic survey of the Clinch River in September 2009.
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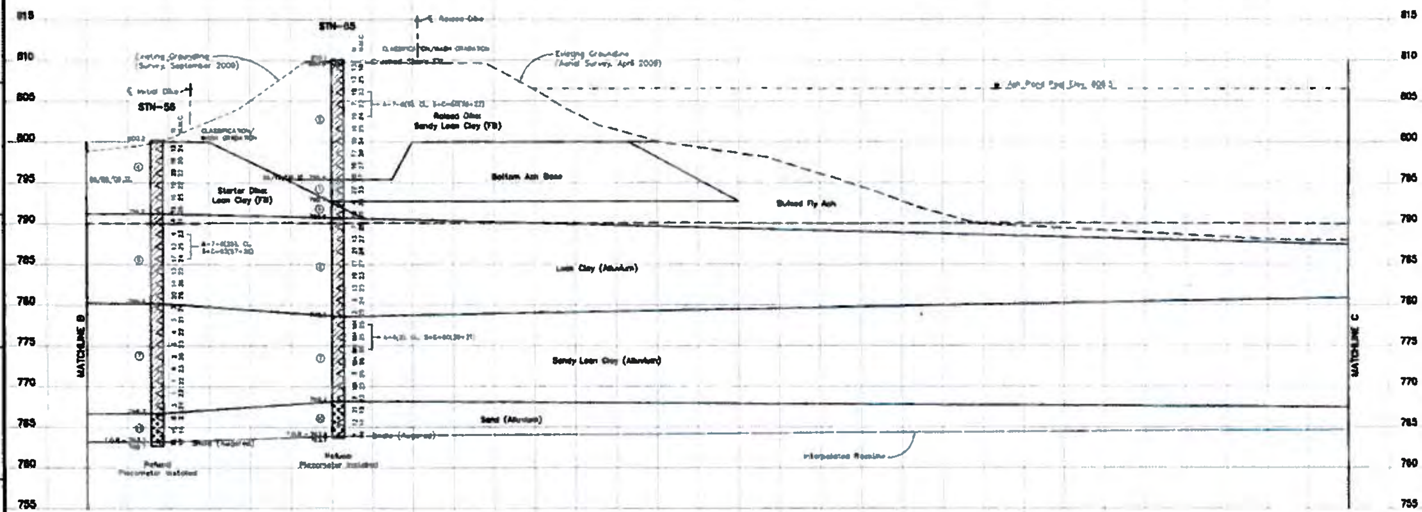
RECORD DRAWING
YARD
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION N-N'
BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
Stantec
10W507-30

49 C 10W507-31



GEOLOGIC CROSS SECTION N-N' (CONT'D)

LEGEND

1. Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
2. Fill: Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
3. Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff with occasional bottom ash
4. Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
5. Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff, with some fine gravels
6. Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
7. Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff with fine to medium sand and occasional sands, silt and organics
8. Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravel in fill and trace sands and silt
9. Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
10. Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
11. Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
12. Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
13. Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff, with occasional silt, gravels and organics
14. Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

WH — Weight of Hammer
WR — Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
03/31/09 — Water Level and Date Recorded
T.O.R. — Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. — Begin Rock Core
R.Q.D. — Rock Quality Designation (%)
REC. — Recovery (%)
Refusal — Auger Refusal using a carbide-tipped teeth auger bit
No Refusal — No Refusal Encountered
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

NOTES:

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RECORD DRAWING

For Supporting Design Calculations see FPGBRFESCOX000000020100002

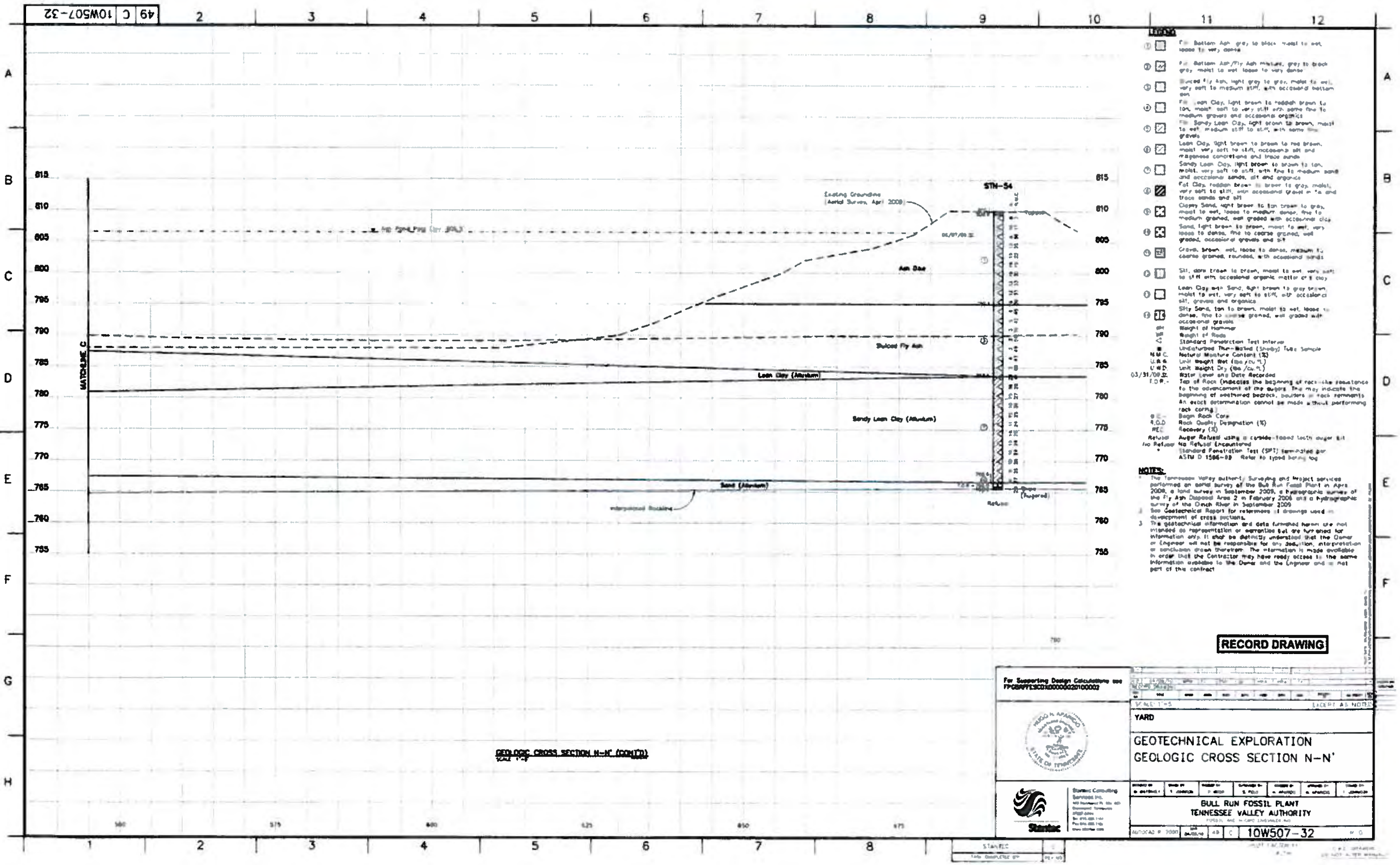
YARD

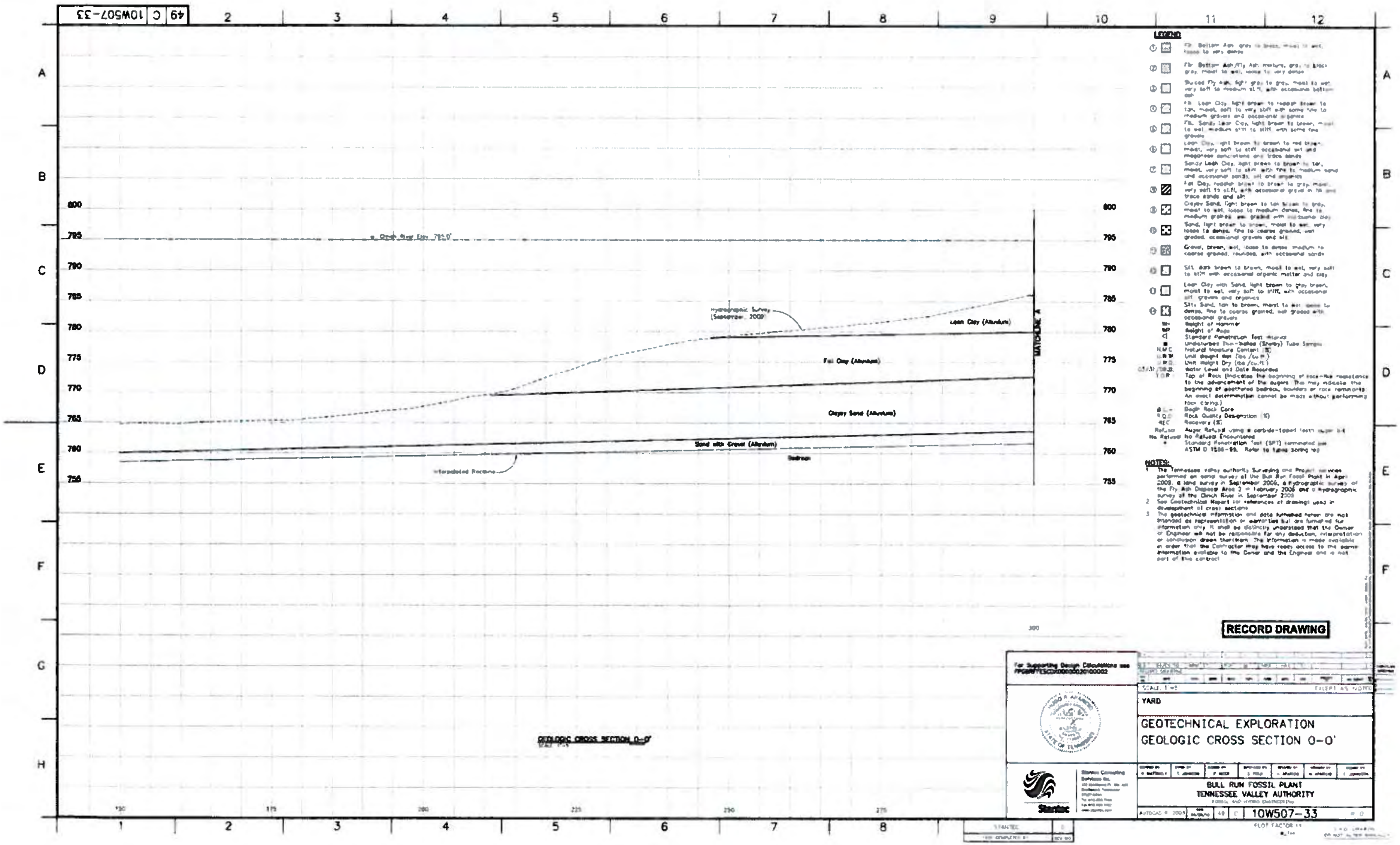
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION N-N'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

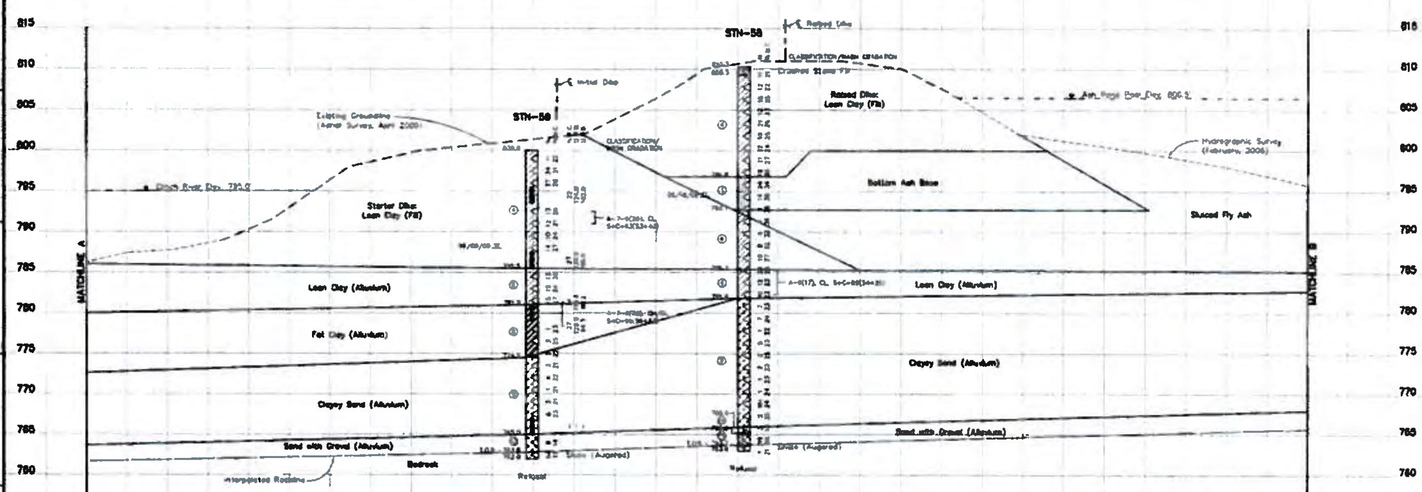
Stantec

49 C 10W507-31


49 C 10W507-32
STN-54
MATCHLINE C
Existing Groundline (Aerial Survey, April 2008)
Ash Dike
Sluiced Fly Ash
Lean Clay (Alluvium)
Sandy Lean Clay (Alluvium)
Sand (Alluvium)
Interpolated Rockline
Refusal
LEGEND
NOTES:
RECORD DRAWING
GEOLOGIC CROSS SECTION N-N' (CONT'D)
YARD
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION N-N'
BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
10W507-32
Stantec


49 C 10W507-33
LEGEND
Weight of Hammer
Weight of Rods
Standard Penetration Test
Natural Moisture Content (%)
Water Level and Date Recorded
Begin Rock Core
Rock Quality Designation (%)
Recovery (%)
Auger Refusal using a carbide-tipped teeth auger bit
No Refusal Encountered
ASTM D 1586-99. Refer to boring log
NOTES:
Clinch River Elev. 795.0'
Hydrographic Survey (September 2009)
Lean Clay (Alluvium)
Fat Clay (Alluvium)
Clayey Sand (Alluvium)
Sand with Gravel (Alluvium)
Bedrock
Interpolated Bedrock
MATCHLINE A
800
795
790
785
780
775
770
765
760
755
GEOLOGIC CROSS SECTION O-O'
RECORD DRAWING
For Supporting Design Calculations see
YARD
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION O-O'
BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
10W507-33
Stantec

49 C 10W507-34



GEOLOGIC CROSS SECTION O-O' (CONT'D)

LEGEND

1. Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
2. Fill: Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
3. Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff with occasional bottom ash
4. Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
5. Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff with some fine gravels
6. Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
7. Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff with fine to medium sand and occasional gravels, silt and organics
8. Fat Clay, reddish brown to brown to gray, moist, very soft to stiff with occasional gravel in fill and trace sands and silt
9. Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
10. Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
11. Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
12. Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
13. Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff, with occasional silt, gravels and organics
14. Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

WOH — Weight of Hammer
WOR — Weight of Rods
Standard Penetration Test interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu ft.)
U.W.D. — Unit Weight Dry (lbs./cu ft.)
03/31/09 — Water Level and Date Recorded
T.O.R. — Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. — Begin Rock Core
R.Q.D. — Rock Quality Designation (%)
REC. — Recovery (%)
Refusal — Auger Refusal using a carbide-tipped tooth auger bit
No Refusal — No Refusal Encountered
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

NOTES:

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RECORD DRAWING

For Supporting Design Calculations see

YARD

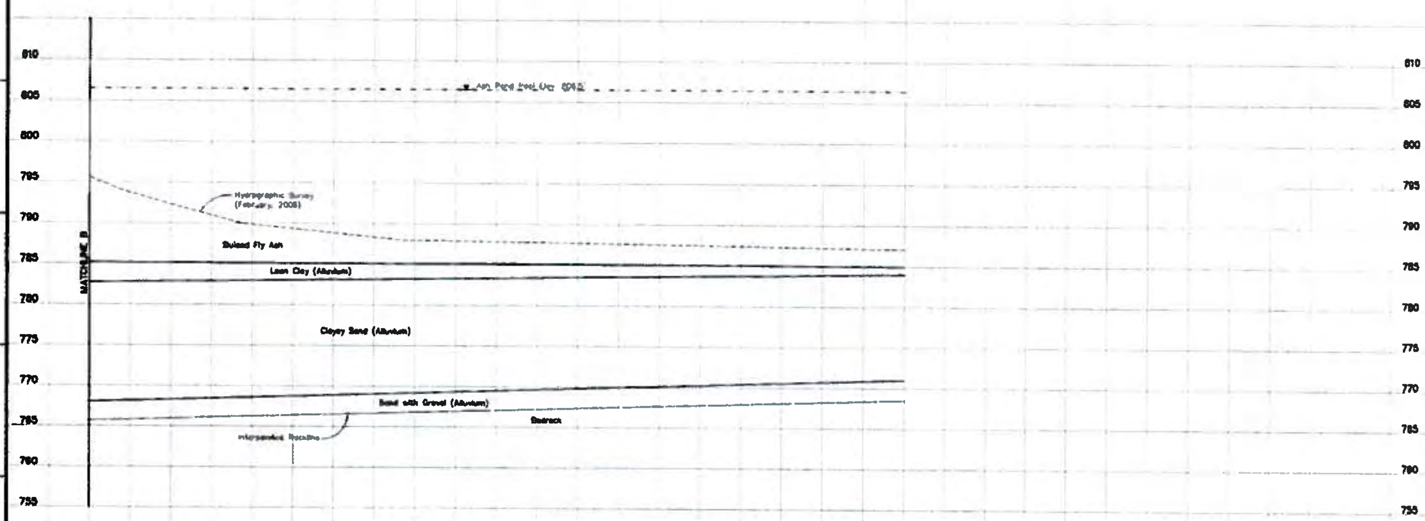
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION O-O'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

Stantec

10W507-34

49 | C | 10W507-35



GEOLOGIC CROSS SECTION O-O' (CONT'D)
SCALE 1"=8'

LEGEND

1. Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
2. Fill: Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
3. Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff with occasional bottom ash
4. Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
5. Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff, with some fine gravels
6. Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
7. Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff, with fine to medium sand and occasional sands, silt and organics
8. Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravel in fill and trace sands and silt
9. Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
10. Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
11. Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
12. Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
13. Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff with occasional silt, gravels and organics
14. Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

WH — Weight of Hammer
WR — Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu ft.)
U.W.D. — Unit Weight Dry (lbs./cu ft.)
03/31/09 — Water Level and Date Recorded
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RECORD DRAWING

For Supporting Design Calculations see FPC88FFESCDX000000020100002

SCALE: 1"=8' | EXCEPT AS NOTED

YARD

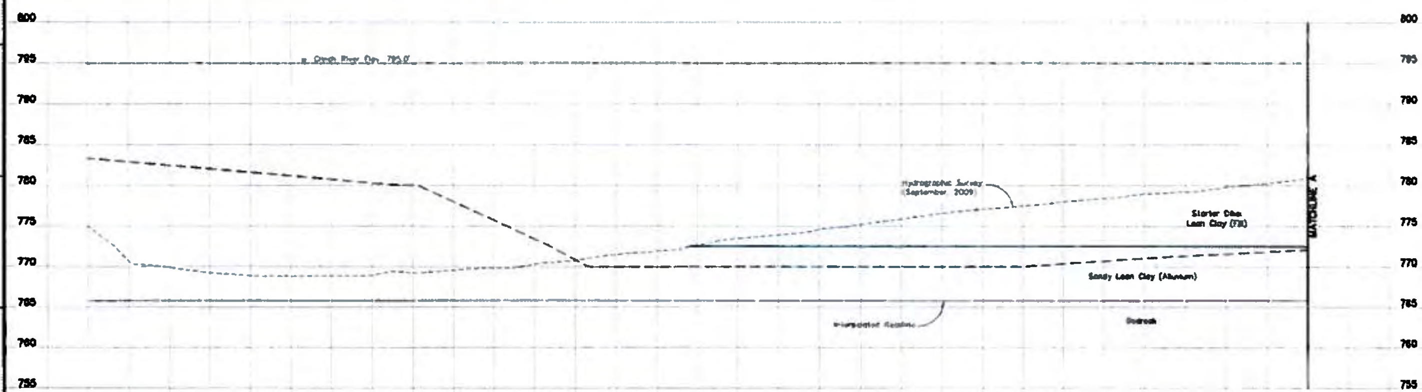
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION O-O'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

Stantec Consulting Services Inc.

10W507-35

49 C 10W507-36



GEOLOGIC CROSS SECTION R-R'
SCALE 1"=

LEGEND

1. Fill, Bottom Ash, gray to black, moist to wet, loose to very dense
2. Fill, Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
3. Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff with occasional bottom ash
4. Fill, Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
5. Fill, Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff, with some fine gravels
6. Lean Clay, light brown to brown to tan brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
7. Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff, with fine to medium sand and occasional gravels, silt and organics
8. Fat Clay, reddish brown to brown to gray, moist, very soft to stiff with occasional gravel in the and trace sands and silt
9. Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
10. Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
11. Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
12. Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
13. Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff, with occasional silt, gravels and organics
14. Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

WH — Weight of Hammer
WR — Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
NMC — Natural Moisture Content (%)
UWW — Unit Weight Wet (lbs/cu.ft.)
UWD — Unit Weight Dry (lbs/cu.ft.)
03/31/09 — Water Level and Date Recorded
T.O.R. — Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
BC — Begin Rock Core
RQD — Rock Quality Designation (%)
REC — Recovery (%)
Refusal — Auger Refusal using a carbide-tipped teeth auger bit
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* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log

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RECORD DRAWING

For Supporting Design Calculations see FPCBRFFESCDX000000020100002

YARD

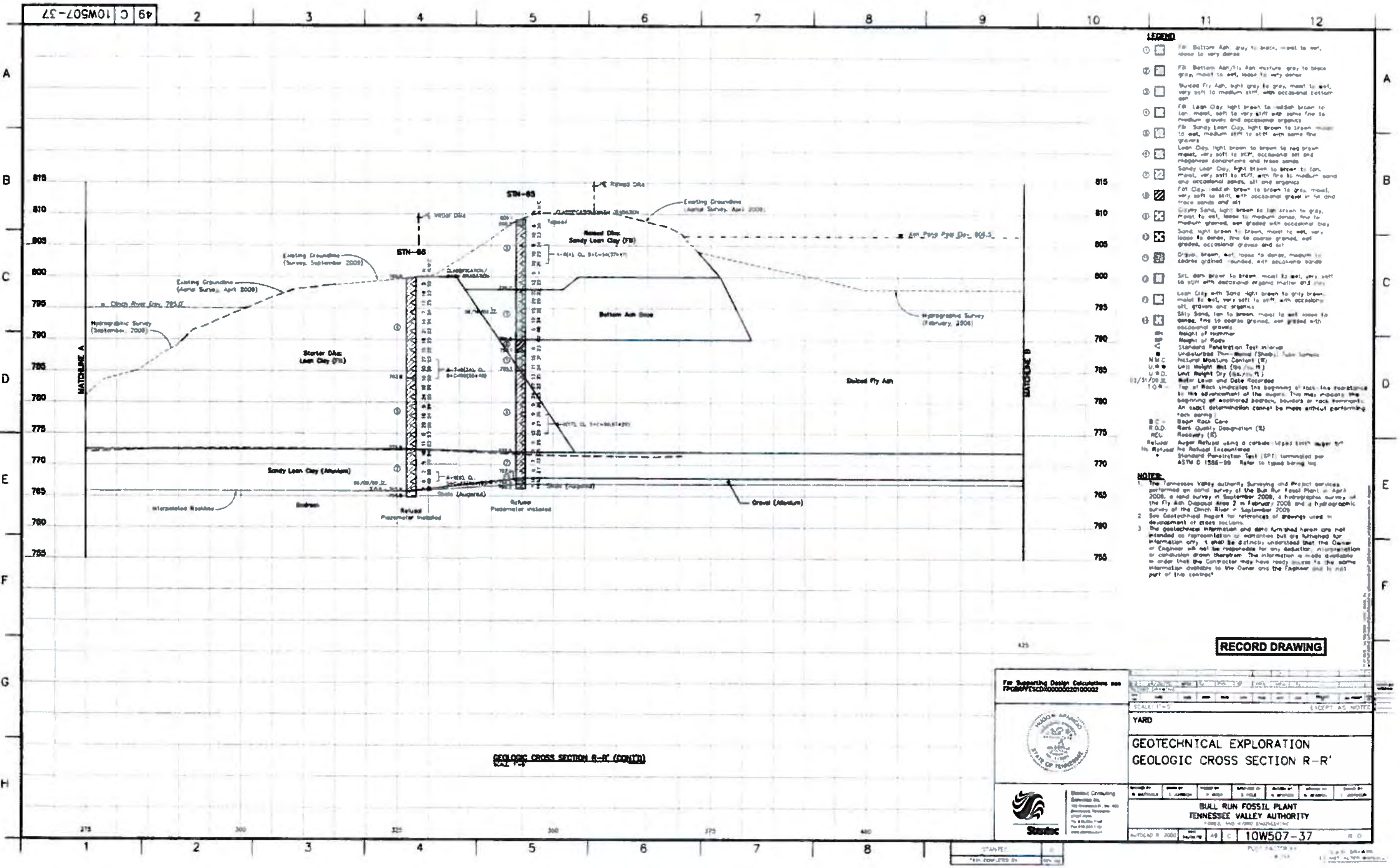
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION R-R'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

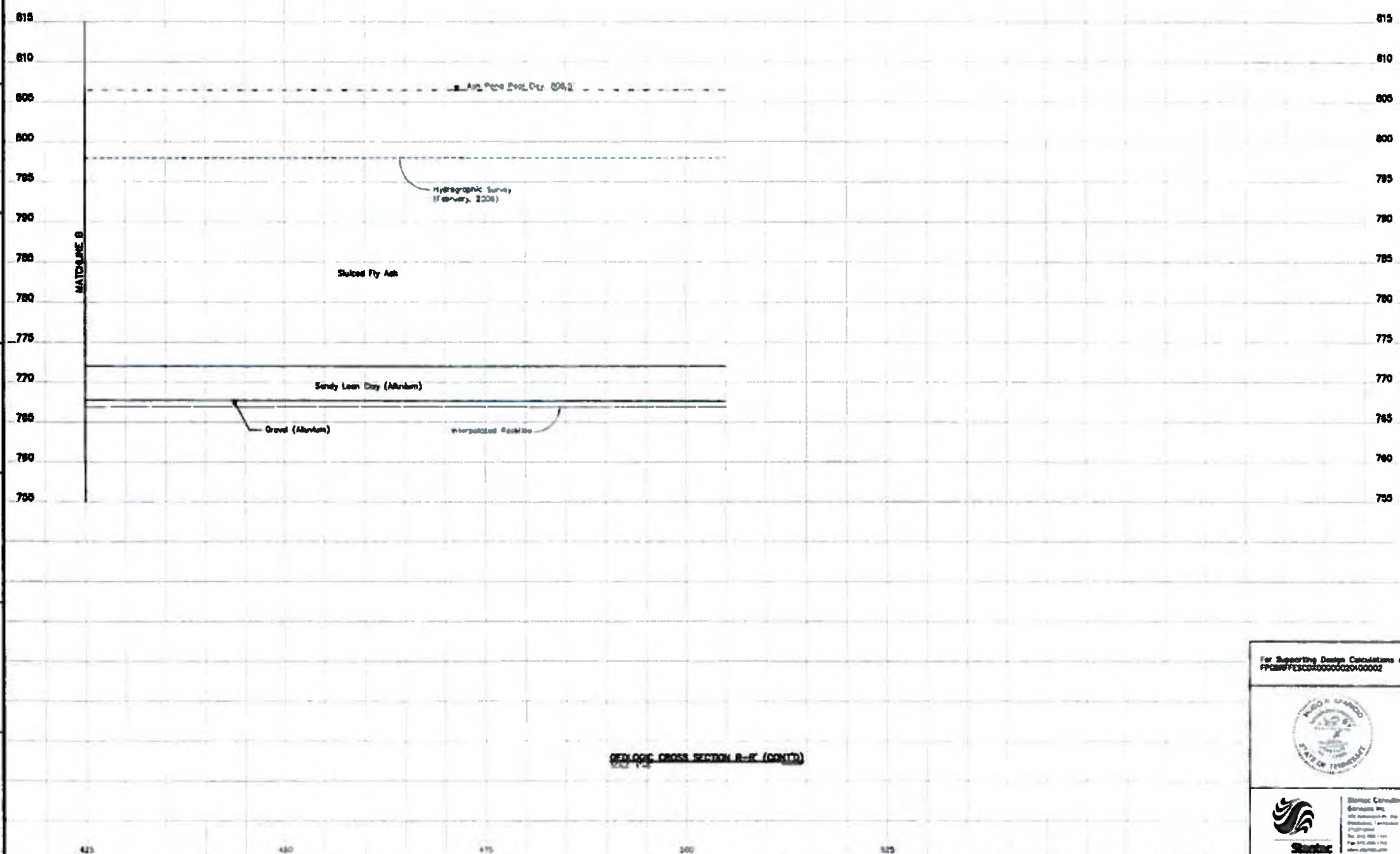
Stantec Consulting Services Inc.

Stantec

10W507-36


10W507-37
LEGEND
STN-65
STN-66
Starter Dike: Lean Clay (Fill)
Raised Dike: Sandy Lean Clay (Fill)
Bottom Ash Slope
Sluiced Fly Ash
Sandy Lean Clay (Alluvium)
Bedrock
Gravel (Alluvium)
Interpolated Bedrock
Refusal
Piezometer Installed
Existing Groundline (Survey, September 2009)
Existing Groundline (Aerial Survey, April 2009)
Hydrographic Survey (September, 2009)
Hydrographic Survey (February, 2009)
MATCHLINE A
MATCHLINE B
NOTES:
RECORD DRAWING
GEOLOGIC CROSS SECTION R-R' (CONT'D)
YARD
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION R-R'
BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
10W507-37
Stantec

10W507-38 | C | 49



GEOLOGIC CROSS SECTION R-R' (CONT'D)

LEGEND

- ① Fill, Bottom Ash, gray to black, moist to wet, loose to very dense
- ② Fill, Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
- ③ Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff, with occasional bottom ash
- ④ Fill, Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
- ⑤ Fill, Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff, with some fine gravels
- ⑥ Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
- ⑦ Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff, with fine to medium sand and occasional gravels, silt and organics
- ⑧ Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravel and fill and trace sands and silt
- ⑨ Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
- ⑩ Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
- ⑪ Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
- ⑫ Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
- ⑬ Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff with occasional silt, gravels and organics
- ⑭ Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

WH — Weight of Hammer
WR — Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
03/31/09 — Water Level and Date Recorded
T.O.R. — Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. — Begin Rock Core
R.Q.D. — Rock Quality Designation (%)
REC — Recovery (%)
Refusal — Auger Refusal using a carbide-tipped tooth auger bit
No Refusal — No Refusal Encountered
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log.

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RECORD DRAWING

For Supporting Design Calculations see FPGBRFFESCDX000000020100002

Stantec Consulting Services Inc.

SCALE: 1"=5' | EXCEPT AS NOTED

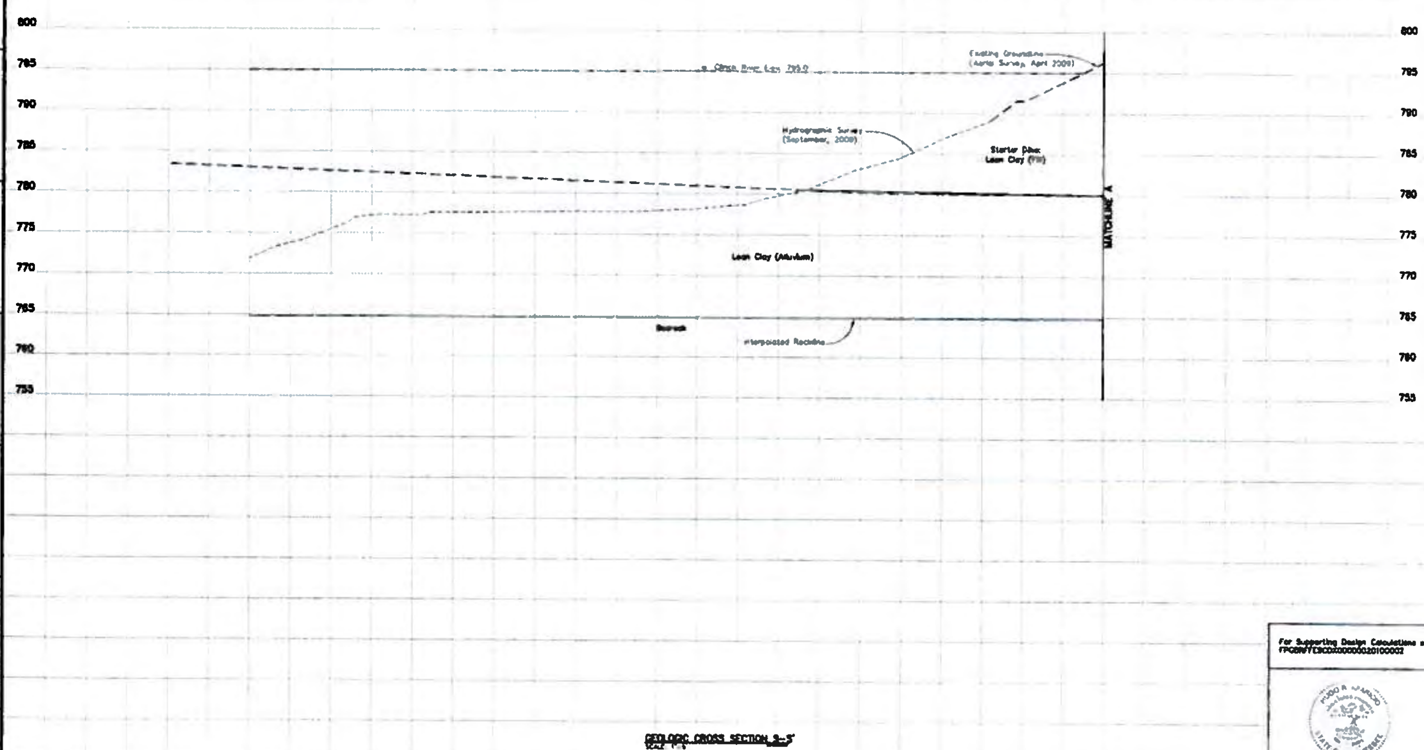
YARD

GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION R–R'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

43 | C | 10W507-38

49 C 10W507-39



LEGEND

1. Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
2. Fill: Bottom Ash/Fly Ash mixture, gray to black gray, moist to wet, loose to very dense
3. Sluiced Fly Ash, light gray to gray, moist to wet, very soft to medium stiff with occasional bottom ash
4. Fill: Lean Clay, light brown to reddish brown to tan, moist, soft to very stiff with some fine to medium gravels and occasional organics
5. Fill: Sandy Lean Clay, light brown to brown, moist to wet, medium stiff to stiff, with some fine gravels
6. Lean Clay, light brown to brown to red brown, moist, very soft to stiff, occasional silt and manganese concretions and trace sands
7. Sandy Lean Clay, light brown to brown to tan, moist, very soft to stiff, with fine to medium sand and occasional sands, silt and organics
8. Fat Clay, reddish brown to brown to gray, moist, very soft to stiff, with occasional gravel in fill and trace sands and silt
9. Clayey Sand, light brown to tan brown to gray, moist to wet, loose to medium dense, fine to medium grained, well graded with occasional clay
10. Sand, light brown to brown, moist to wet, very loose to dense, fine to coarse grained, well graded, occasional gravels and silt
11. Gravel, brown, wet, loose to dense, medium to coarse grained, rounded, with occasional sands
12. Silt, dark brown to brown, moist to wet, very soft to stiff with occasional organic matter and clay
13. Lean Clay with Sand, light brown to gray brown, moist to wet, very soft to stiff with occasional silt, gravels and organics
14. Silty Sand, tan to brown, moist to wet, loose to dense, fine to coarse grained, well graded with occasional gravels

WH — Weight of Hammer
WR — Weight of Rods
— Standard Penetration Test Interval
■ — Undisturbed Thin-Walled (Shelby) Tube Sample
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
03/31/08 — Water Level and Date Recorded
T.O.R. — Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock remnants. An exact determination cannot be made without performing rock coring.)
B.C. — Begin Rock Core
R.Q.D. — Rock Quality Designation (%)
REC. — Recovery (%)
Refusal — Auger Refusal using a carbide-tipped teeth auger bit
No Refusal — No Refusal Encountered
• — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer to typed boring log

NOTES:

1. The Tennessee Valley Authority Surveying and Project services performed an aerial survey of the Bull Run Fossil Plant in April 2009, a land survey in September 2009, a hydrographic survey of the Fly Ash Disposal Area 2 in February 2008 and a hydrographic survey of the Clinch River in September 2009.
2. See Geotechnical Report for references of drawings used in development of cross sections.
3. 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.

RECORD DRAWING

For Supporting Design Calculations see FPCBRFTCBCDX00000020100002

Stantec Consulting Services Inc.

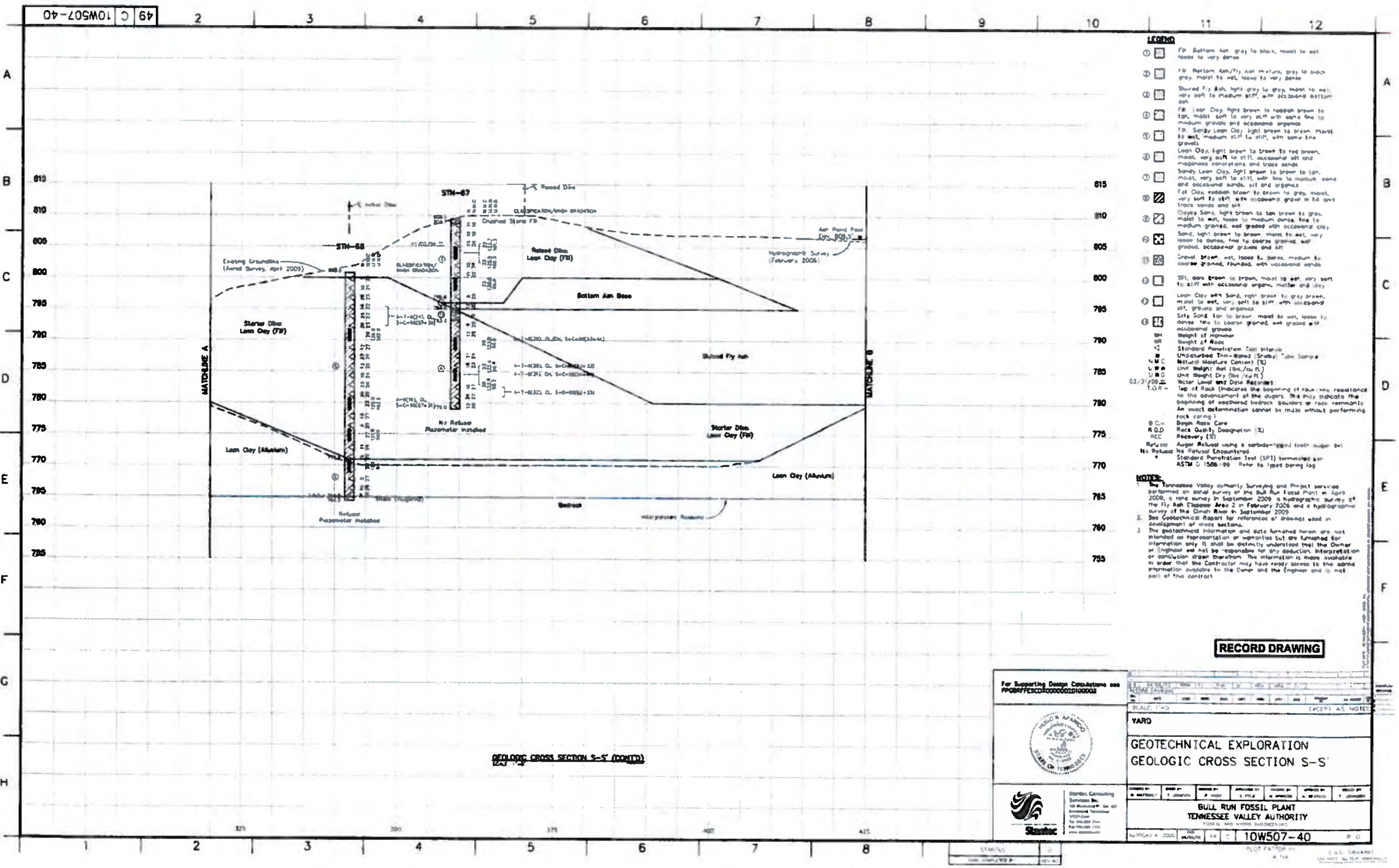
SCALE 1"=5' EXCEPT AS NOTED

YARD

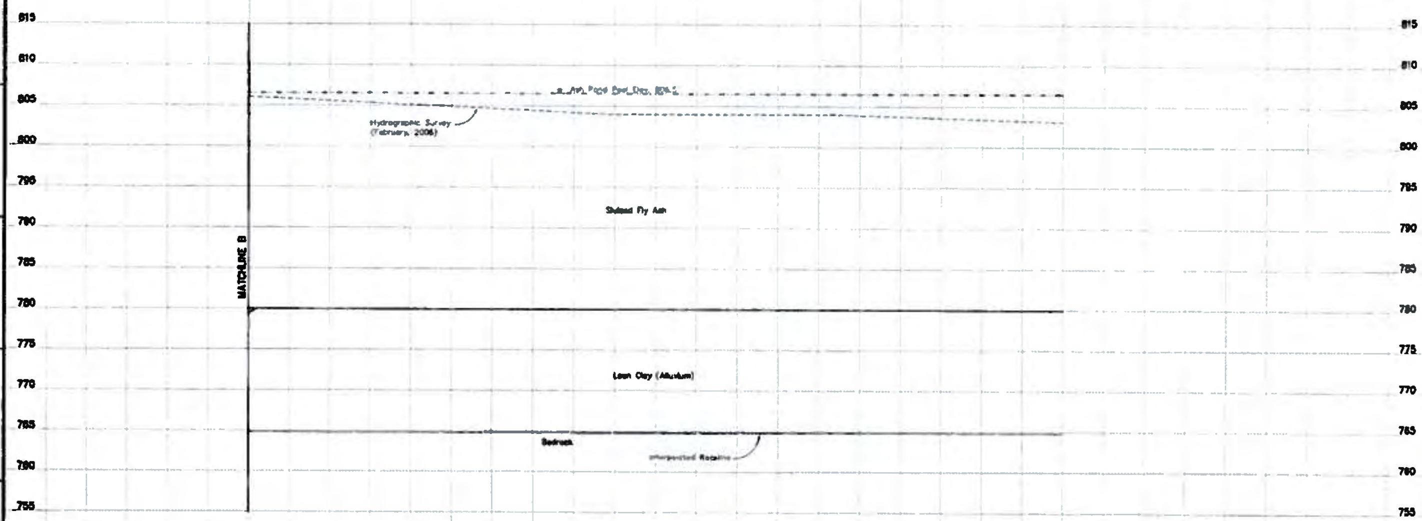
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION S-S'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

10W507-39


10W507-40
STH-87
STH-88
MATCHLINE A
MATCHLINE B
Starter Dike Lean Clay (Fill)
Raised Dike Lean Clay (Fill)
Bottom Ash Base
Sluiced Fly Ash
Lean Clay (Alluvium)
Bedrock
No Refusal Piezometer Installed
Refusal Piezometer Installed
LEGEND
NOTES:
RECORD DRAWING
YARD
GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION S-S'
BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
GEOLOGIC CROSS SECTION S-S' (CONT'D)

10W507-41 | C | 49



GEOLOGIC CROSS SECTION S-S' (CONT'D)

LEGEND

1. Fill: Bottom Ash, gray to black, moist to wet, loose to very dense
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WR	Weight of Rods
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■	Undisturbed Thin-Walled (Shelby) Tube Sample
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U.W.W.	Unit Weight Wet (lbs/cu ft)
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03/31/09	Water Level and Date Recorded
T.O.R.	Top of Rock (Indicates the beginning of rock-like resistance to the advancement of the augers. This may indicate the beginning of weathered bedrock, boulders or rock fragments. An exact determination cannot be made without performing rock coring)
B.R.C.	Begin Rock Core
R.Q.D.	Rock Quality Designation (%)
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RECORD DRAWING

For Supporting Design Calculations see

YARD

GEOTECHNICAL EXPLORATION
GEOLOGIC CROSS SECTION S-S'

BULL RUN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY

Stantec

10W507-41

Appendix 3

Design Calculations – Grouting of Abandoned Pipes

TVA Calculation Package

Title BRF - GROUTING OF ABANDONED PIPES

Location Description: *(Optional)*	BRF - GROUTING OF ABANDONED PIPES IN PERIMETER DIKES	**Total Pages:** *(including appendices & attachments)* 25

Calculation ID *(All parts required to form a unique ID)*:

Org Code	Location/ Plant Code	Branch Code	Alphanumeric Part = Discipline Code (1) + Type Code (1) + "X" + Unit Field (3) + Sys Code (3) + Year (4) + Sequence No. (4)
FPG	BRF	FES	CDX00000020110002

NOTE: When referencing the calculation ID, include all parts without spaces or dashes between them.

Unit(s), Spill gate(s), or Voltages (PSO): 000	**Key Nouns (For CTS/CCRIS):**

	Rev	RIMS/EDMS Accession Number *(Optional)*
Applicable Design Document(s):	R0	
	R	
UNID System(s):	R	
	R	

	R0	R	R	R
DCN, PCN, NA				
Prepared: Sign→	Lucas P. Carr			
Print Name	Lucas P. Carr, E.I.			
Checked: Sign→	Eric J. Glazier			
Print Name	Eric J. Glazier, P.E.			
	These calculations contain unverified assumption(s) that must be verified later? ☐ Yes ☒ No These calculations contain special requirements and/or limiting conditions? ☐ Yes ☒ No			
Approved: Sign→	Kenneth M. Berry			
Print Name	Kenneth M. Berry, P.E.			
Approval Date	2/15/2011			
	These calculations contain a design output attachment? ☐ Yes ☒ No			
Revision Applicability	☒ Entire calc	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs
	Computer output Microfiche generated? ☐ Yes ☒ No Number: ______			

Purpose of the Calculation: BRF - GROUTING OF ABANDONED PIPES IN PERIMETER DIKES - THESE CALCULATIONS ARE FOR THE DESIGN OF GROUTING SYSTEMS FOR ABANDONDED SPILLWAY PIPES AT BRF

Abstract: Two calculations are included: (1) design of pipe grouting systems using pneumatic pipe plugs and (2) design of pipe grouting systems using cast-in-place concrete pipe plugs.

☒ Electronically file and return calculation to Calculation Library.

☐ Electronically file and return calculation ______ Address: ______

TVA Calculation Coversheet
CTS Input Form

Preparer	Preparer Login ID	Date
Checker	**Checker Login ID**	**Date**

Update Code: ☐ Add ☐ Change ☐ Delete ☐ Rename ☐ Supersede ☐ Duplicate ☐ Verify

The following section applies if a calculation is being renamed, superseded, or has a duplicate.

	Org Code	Plant	Branch	Number	Cur Rev	New Rev
Current Calc ID:						

The following section applies to all calculations.

Calc ID:		brf				

Firm: *(TVA or Contractor)* ______________________________

Cross-References

A/C/D	Xref Code	Type	Org Code	Plant	Branch	Number	Rev

TVA Calculation Record of Revision

Calculation Identifier:

Title BRF - GROUTING OF ABANDONDED PIPES IN PERIMETER DIKES

Revision No.	Description of Revision
0	BRF - GROUTING OF ABANDONDED PIPES IN PERIMETER DIKES - THESE CALCULATIONS ARE FOR THE DESIGN OF GROUTING SYSTEMS FOR ABANDONDED SPILLWAY PIPES AT BRF

TVA Computer File Storage Information Sheet

Calculation Identifier: ______ **Rev.** 0 **Plant:** BRF

Subject: NO COMPUTER SOFTWARE WAS USED IN THESE CALCUALTIONS.

Software Name: ______ **Revision Level:** ______

Vendor Name: ______

Address: ______

Executable Files

☒ No TVA developed **executable files** were used in this calculation.

Comments:

☐ TVA developed **executable files** used in this calculation have been stored electronically and sufficient identifying information is provided below for each executable file. *(Any retrieved file requires re-verification of its contents before use.)*

Input Files

☒ Electronic storage of the **input files** for this calculation is not required.

Comments:

☐ **Input files** for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. *(Any retrieved file requires re-verification of its contents before use.)*

TVA Calculation Table of Contents

Calculation Identifier: ____________________ **Revision:** 0

Table of Contents

URS **DETAIL CHECK REPORT** Quality

Project Name:	TVA - BRF	Project Number:	31854136.41000
Project Location:	Clinton, TN	Client Name:	TVA
PM Name:	Kenneth Berry	PIC Name:	

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Eric Glazier — Checker's Comments Required by: 02/16/2011

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Design of Pnuematic and Grout Pipe Plugs for Grouting Abandoned Pipes

☒ This Detail Check is a check for correctness, completeness and technical accuracy.

☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry — 2-15-11

Project Manager Signature — Date

Detail Check – Part 1: Comments

(This Section is to be completed by the Checker.)

Check box A or B:

A. ☒ All items have been found to be correct. Checker has no comments.

or

B. ☐ Checker's comments have been provided on:

☐ Marked directly on Work Product

☐ Comment and Disposition Form (Form 3-5 (MM))

☐ Other Specify: ____

EGlazier — 2-15-11

Checker Signature — Date

Detail Check – Part 2: Verification

(This section is to be completed by the Checker after verification of comment resolution, if box B is checked off above.)

Check box C or D and then E:

C. ☐ Verification of comment resolution has been performed by Checker AND any significant issues have been resolved between Originator and Checker.

or

D. ☐ Verification of comment resolution has been performed by Checker AND unresolved issues have been submitted to the Project Manager, Principal-in-Charge or designee for resolution.

and

E. ☐ Verification of correct incorporation of resolved comments into final Work Product is complete.

Checker Signature — Date

APPROVAL and DISTRIBUTION

(To be signed after box A or E are completed.)

☒ The Detail Check is complete. Significant issues not resolved between the Checker and the Originator, if any, have been resolved by the Approver.

Kenneth M Berry — 2-15-11

Project Manager, Principal-in-Charge or Designee Signature — Date

Distribution:

Project Central File – Quality file folder

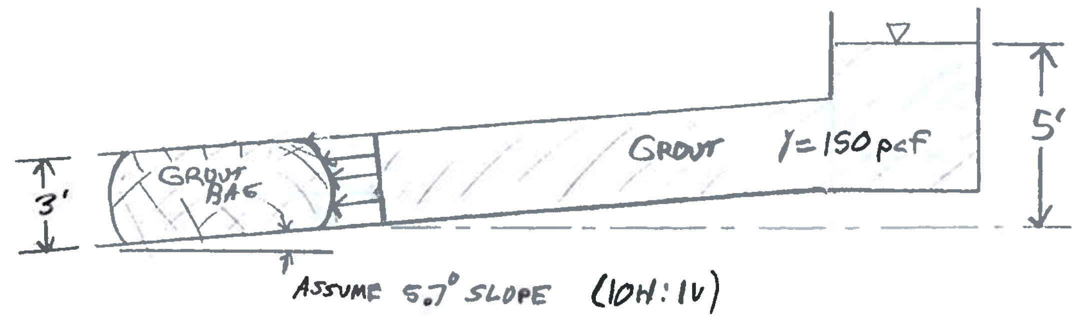
Other Specify: ____

URS

Job: TVA - BRF	Project No. 31854126.40130	Page ___ of ___	
Description: Grout Bag Volume Calcs	Computed by: LPC	Sheet 1 of 4	Date 1/31/2011
	Checked by: EJG		Date 2/15/11
		Reference	

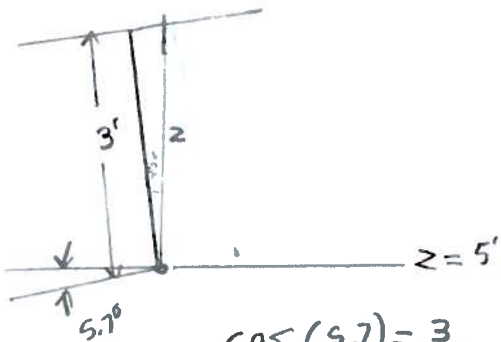
OBJECTIVE: Calculate weight of concrete-filled geotextile bag req'd to resist a 5' head of grout

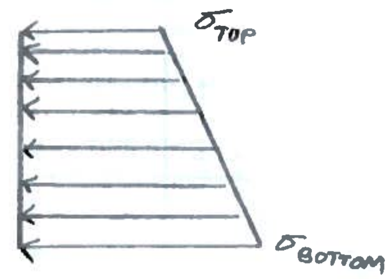
CALCULATIONS:



ASSUME 5.7° SLOPE (10H:1V)

• FIRST, CALCULATE FORCE OF GROUT ON BAG





$\cos(5.7) = \frac{3}{z}$

$z = 3.01' \rightarrow 3'$

$\sigma_{TOP} = (5-3) \cdot 150 = 300$ psf

$\sigma_{BOTTOM} = 5(150) = 750$ psf

$\sigma_{AVG} = (300 + 750)/2 = 525$ psf

F_G = FORCE OF GROUT = $\sigma_{AVG} \cdot A$

$A = \frac{\pi}{4} \cdot 3^2 = 7.1$ ft²

$F_G = 7.1 \cdot 525 = 3728$ lb ✓

• NOW, CALCULATE REQ'D WEIGHT OF BAG

→ ASSUME $\mu_s = 0.20$ (POLYETHYLENE & LUBRICATED STEEL → CONSERVATIVE)

$3728 = 0.20(W)$ ✓

$W = 18640$ lb (FOR FS=1)

FOR FS = 5, 93,200 lb

URS

Job: TVA – BRF	Project No. 31854126.40130	Page ___ of ___	Sheet 2 of 4
Description: Grout Bag Volume Calcs	Computed by: LPC	Date: 1/31/2011	
	Checked by: EJG	Date: 2/15/11	
		Reference	

- FOR FS = 1.0

$$W = 18{,}640 \text{ lb} \rightarrow V = \frac{18{,}640}{150} = 124.3 \text{ ft}^3$$

$$L_{1.0} = \frac{124.3 \text{ ft}^3}{7.1 \text{ ft}^3/\text{ft}} = 17.5 \text{ ft}$$ ✓

- FOR FS = 5.0

$$W = 93{,}200 \text{ lb} \rightarrow V = \frac{93{,}200}{150} = 621 \text{ ft}^3$$

$$L_{5.0} = \frac{621 \text{ ft}^3}{7.1 \text{ ft}^3/\text{ft}} = 87.5 \text{ ft}$$ ✓

3/4

From: http://www.engineeringtoolbox.com/friction-coefficients-d_778.html

Frictional Coefficients for some Common Materials and Materials Combinations

Materials and Material Combinations		Static Frictional Coefficient - μ_s	
		Clean and Dry Surfaces	Lubricated and Greasy Surfaces
Aluminum	Aluminum	1.05 - 1.35	0.3
Aluminum-bronze	Steel	0.45	
Aluminum	Mild Steel	0.61	
Brake material	Cast iron	0.4	
Brake material	Cast iron (wet)	0.2	
Brass	Steel	0.35	0.19
Brass	Cast Iron	0.3[1)]	
Brick	Wood	0.6	
Bronze	Steel		0.16
Bronze	Cast Iron	0.22[1)]	
Bronze - sintered	Steel		0.13
Cadmium	Cadmium	0.5	0.05
Cadmium	Chromium	0.41	0.34
Cadmium	Mild Steel	0.46[1)]	
Cast Iron	Cast Iron	1.1, 0.15[1)]	0.07[1)]
Cast Iron	Oak	0.49[1)]	0.075[1]
Cast iron	Mild Steel	0.4, 0.23[1)]	0.21, 0.133[1)]
Carbon (hard)	Carbon	0.16	0.12 - 0.14
Carbon	Steel	0.14	0.11 - 0.14
Chromium	Chromium	0.41	0.34
Copper-Lead alloy	Steel	0.22	
Copper	Copper	1	0.08
Copper	Cast Iron	1.05, 0.29[1)]	
Copper	Mild Steel	0.53, 0.36[1)]	0.18[1)]
Diamond	Diamond	0.1	0.05 - 0.1
Diamond	Metal	0.1 - 0.15	0.1
Glass	Glass	0.9 - 1.0, 0.4[1)]	0.1 - 0.6, 0.09-0.12[1)]
Glass	Metal	0.5 - 0.7	0.2 - 0.3
Glass	Nickel	0.78	0.56
Graphite	Steel	0.1	0.1
Graphite	Graphite (in vacuum)	0.5 - 0.8	

Graphite	Graphite	0.1	0.1
Ice	Wood	0.05	
Iron	Iron	1.0	0.15 - 0.20
Lead	Cast Iron	0.43[1)]	
Leather	Oak	0.61, 052[1]	
Leather	Metal	0.4	0.2
Leather	Wood	0.3 - 0.4	
Leather	Clean Metal	0.6	
Leather fiber	Cast iron	0.31	
Leather fiber	Aluminum	0.30	
Magnesium	Magnesium	0.6	0.08
Nickel	Nickel	0.7 - 1.1, 0.53[1)]	0.28, 0.12[1)]
Nickel	Mild Steel	0.64[1)]	0.178[1)]
Nylon	Nylon	0.15 - 0.25	
Oak	Oak (parallel grain)	0.62, 0.48[1)]	
Oak	Oak (cross grain)	0.54, 0.32[1]	0.072[1]
Paper	Cast Iron	0.20	
Phosphor-bronze	Steel	0.35	
Platinum	Platinum	1.2	0.25
Plexiglas	Plexiglas	0.8	0.8
Plexiglas	Steel	0.4-0.5	0.4 - 0.5
Polystyrene	Polystyrene	0.5	0.5
Polystyrene	Steel	0.3-0.35	0.3 - 0.35
Polythene	Steel	0.2	0.2
Polystyrene	Polystyrene	0.5	0.5
Rubber	Cardboard	0.5 - 0.8	
Rubber	Dry Asphalt	0.9 (0.5 - 0.8)[1)]	
Rubber	Wet Asphalt	0.25 - 0.75[1)]	
Rubber	Dry Concrete	0.6 - 0.85[1)]	
Rubber	Wet Concrete	0.45 - 0.75[1)]	
Silver	Silver	1.4	0.55
Sapphire	Sapphire	0.2	0.2
Silver	Silver	1.4	0.55
Steel	Steel	0.8	0.16
Straw Fiber	Cast Iron	0.26	
Straw Fiber	Aluminum	0.27	
Tarred fiber	Cast Iron	0.15	

URS

Job: TVA - BRF	Project No. 31854126.40130	Page ___ of ___	
Description: Pnuematic Plug Capacity Calc	Computed by: LPC	Sheet 1 of 3	Date 1/31/2011
	Checked by: EJG		Date 2/15/11
		Reference	

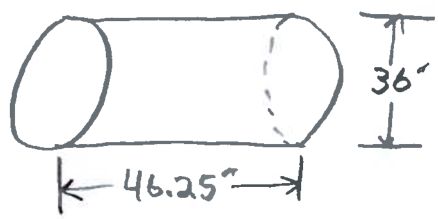
OBJECTIVE: ESTIMATE THE MAXIMUM CAPACITY OF A CHERNE "TEST BALL" PNUEMATIC PIPE PLUG IN A 36" ∅ CONCRETE PIPE (CONC. MAY BE MUDDY)

CALCS: USE CHERNE # 310408 PIPE PLUG

DEFLATED LENGTH = 46.25"

MAX INFLATION σ = 22 psi

→ ASSUME DEFLATED LENGTH = INFLATED LENGTH (CONSERVATIVE)



S = CYLINDER SURFACE AREA

$S = \pi \cdot D \cdot L = \pi \cdot 36 \cdot 46.25 = 5231 \text{ in}^2$ ✓

F = FORCE ON PIPE WALLS @ MAX σ

$F = S \cdot \sigma_{MAX} = 5231 \cdot 22 = 115{,}082 \text{ lb}$ ✓

μ OF RUBBER & WET CONCRETE IS 0.45

→ ASSUME 0.3 FOR CONSERVATISM (MUD ON PIPE WALL)

MAX FORCE RESISTED BY PLUG

$F_{R_{MAX}} = 0.3\ (115{,}082) = 34{,}525 \text{ lb}$ ✓

$FS = \dfrac{F_{R_{MAX}}}{F_{\sigma}} = \dfrac{34{,}525}{3728} = 9.3$ ✓ OK ✓

2/3

Pneumatic Plugs

Pneumatic Plugs

Test-Ball®

The Cherne Test-Ball has been the contractor's choice for over 50 years and continues to be the most trusted pneumatic test ball in the industry. Designed for applications from pressure testing and blocking of residential DWV systems to repair maintenance and installation of municipal infrastructure including storm and sanitary sewer piping systems, The Cherne Test-Ball does it all.

Cherne Test-Balls are durable, rugged and effective in any type of pipe.

- **Multi-size: More options, less inventory**
- **Available with patented field repairable rupture disc technology**
- **¼" Schrader tire valve standard on all plugs**
- **Large plugs feature a removable valve allowing them to be repaired or replaced with quick disconnect fittings**
- **All Test-Balls are bendable to 90°**

Cherne Test-Balls are now available with patented Rupture Disc Technology. This feature prevents over inflation of the pneumatic plug. Rupture Disc Technology also prevents damage to cording. Damaged cording is an unseen condition that compromises plug performance.

Blocking Sewer Flow

Rupture Disc
- Protect investment
- Prevent damage
- Increase safety

Poly-Lift Line with Gauge
Great for plugs from 6" to 60" with removable tire valves

Part	Nominal	Range	Maximum	Inflation	Product	Deflated	Deflated	Inflation	Chain /

3/3

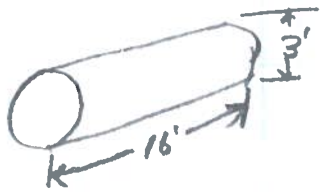
#	SIZE	PIPE DIAM. USEABLE	BACK PRESSURE		INFLATION PRESSURE	WEIGHT	LENGTH	DIAM.	THREAD	EYE BOLTS
395128	6"-12" (150-300 mm)	5.5"-12.25" (140-310 mm)	13 psi (0,9 bar)	30 ft. (9.1 M)	30 psi (2,1 bar)	5.3 lbs (2.4 kg)	26.25" (667 mm)	5.25" (133 mm)	1/4" (1)	3/8" (1)
041386	8" (200 mm)	7"-8.25" (178-210 mm)	17 psi (1,2 bar)	40 ft. (12 M)	25 psi (1,7 bar)	3.4 lbs (1.6 kg)	10.25" (257 mm)	6.75" (172 mm)	1/4" (1)	3/16" (1)
275088	8" - 12" (200-300 mm)	7"-12.25" (178-311 mm)	11 psi (0,75 bar)	25 ft. (8 M)	20 psi (1,4 bar)	6.63 lbs (3 kg)	16" (406 mm)	6.75" (176 mm)	1/4" (1)	3/8" (1)
395168	8" - 16" (200-400 mm)	7.5"-16.25" (186-413 mm)	13 psi (0,9 bar)	30 ft. (9.1 M)	30 psi (2,1 bar)	14.5 lbs (6.5 kg)	29.5" (750 mm)	7.25" (184 mm)	1/4" (1)	3/8" (1)
385168	8" - 16" Short (200-400 mm)	7.5"-16.25" (186-413 mm)	7.5 psi (0,5 bar)	16.75 ft. (5.1 M)	30 psi (2,1 bar)	11 lbs (5 kg)	23" (585 mm)	7.25" (184 mm)	1/4" (1)	3/8" (1)
041394	10" (250 mm)	9"-10.25" (229-260 mm)	17 psi (1,2 bar)	40 ft. (12 M)	25 psi (1,7 bar)	5.6 lbs (2.5 kg)	11.75" (298 mm)	8.75" (221 mm)	1/4" (1)	3/16" (1)
041408	12" (300 mm)	10.5"-12.25" (267-311 mm)	17 psi (1,2 bar)	40 ft. (12 M)	25 psi (1,7 bar)	10.9 lbs (5 kg)	13.75" (351 mm)	10.25" (262 mm)	1/4" (1)	3/16" (1)
275128	12" - 18" (300-450 mm)	10.75"-18.25" (273-464 mm)	11 psi (0,75 bar)	25 ft. (8 M)	25 psi (1,7 bar)	22.4 lbs (10.2 kg)	24" (610 mm)	10.5" (267 mm)	1/4" (1)	3/8" (1)
395248	12" - 24" (300-600 mm)	11"-24.25" (279-616 mm)	13 psi (0,9 bar)	30 ft. (9.1 M)	30 psi (2,1 bar)	28 lbs (12.7 kg)	39.5" (1003 mm)	10.75" (273 mm)	1/4" (1)	3/8" (1)
385248	12" - 24" Short (300-600 mm)	11"-24.25" (279-616 mm)	7.5 psi (0,5 bar)	16.75 ft. (5.1 M)	30 psi (2,1 bar)	24 lbs (11 kg)	33" (839 mm)	10.75" (273 mm)	1/4" (1)	3/8" (2)
410308	15" - 30" (375-750 mm)	14.5"-30.5" (368-775 mm)	**11 psi (0,76 bar)	25 ft. (7.6 M)	25 psi (1,7 bar)	45 lbs (21 kg)	51" (1289 mm)	14" (356 mm)	1/4" & 1/2"	3/8" (2)
310408	20"-40" (500-1000 mm)	19"-40" (475-1000 mm)	8.7 psi (0,6 bar)	20 ft. (6.1 M)	22 psi (1,5 bar)	66 lbs (30 kg)	46.25" (1175mm)	18.5" (470 mm)	1/4" & 1/2"	1/2" (2)
410428	24" - 42" (600-1050 mm)	22.5"-42.5" (570-1080 mm)	**9 psi (0,62 bar)	20 ft. (6.1 M)	25 psi (1,7 bar)	100 lbs (46 kg)	52" (1320 mm)	22" (560 mm)	1/4" & 1/2"	1/2" (2)
310488	24" - 48" (600-1200 mm)	20.5"-50" (521-1270 mm)	**10 psi (0,7 bar)	23 ft. (7 M)	22 psi (2,5 bar)	125 lbs (57 kg)	74.5" (1892 mm)	20" (508 mm)	1/4" & 1/2"	5/8" (3)
	30" - 60"		**10 psi							

URS

Job TVA-BRF	Project No. 31854126.40130	Page ___ of ___	Sheet 1 of 3
Description Pipe Section Capacity Calc	Computed by LPC	Date 2/3/2011	
	Checked by EJC	Date 2/15/11	
		Reference	

OBJECTIVE: A pneumatic pipe plug will be used to hold back a 5' head of grout at BRF. The 5' head of grout will exert a force of 3,728 lb on the pipe plug. Assuming the pipe is 3' Ø & the plug anchors 2 8-ft sections, calculate the FoS on the pipe being pushed out of the slope.

CALCULATIONS: 1. Calculate surface area of pipe



$S = \pi \cdot 3 \cdot 16 = 151\ ft^2$ ✓

2. Calculate distributed load on pipe's surface area

$$\sigma = \frac{3728}{151} = 24.7\ psf$$ ✓

3. Calculate adhesion of soil-pipe & FoS for sliding

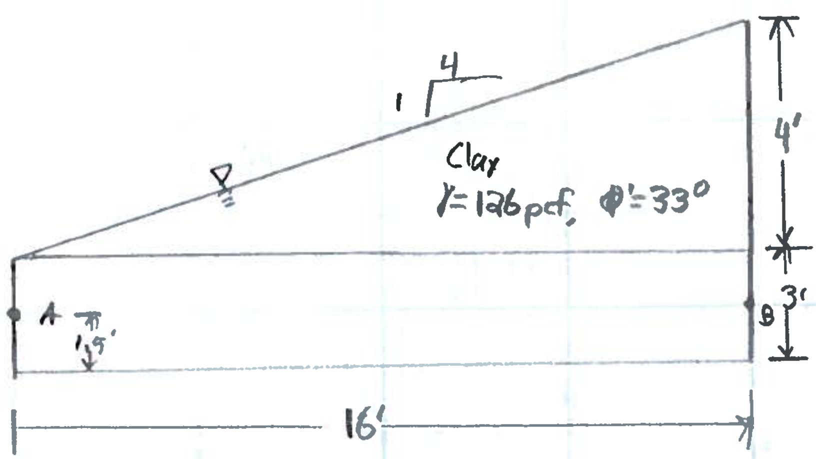
Assume soil is clay & $c = 500$ psf. This is conservative as the soil is compacted clay.

→ Use $\alpha = 0.5$ for further conservatism

$$c_a = \alpha \cdot c = 0.5 \cdot 500\ psf = 250\ psf$$

$$FS = \frac{c_a}{\sigma} = \frac{250}{24.7} = 10.1 \rightarrow \text{Very High}$$ ✓

4. Now, perform an effective stress (drained) analysis



URS

Page ____ of ____

Job TVA - BRF

Project No. 31854126.40130

Sheet 2 of 3

Description Pipe Section Capacity

Computed by LPC

Date

Checked by EJG

Date 2/15/11

Reference

• Assume GWT is @ ground surface & calc effective stress @ middle of pipe

$\sigma' = 3.5 \cdot (126 - 62.4) = 222.6$ psf ✓

• Assume interface friction (ϕ_i) between pipe & soil is 1/2 that of soil

$\phi_i = \tan^{-1}(1/2 \cdot \tan(33)) = 18.0°$ ✓

• Find resisting force

$F_R = 222.6 \cdot \tan(18) \cdot 151 = 10921$ lb ✓

$FS = \frac{10921 \text{ lb}}{3723 \text{ lb}} = 2.92$ ✓

Undrained FoS = 10.1
Drained FoS = 2.92

→ Both calculations are very conservative
→ Pipe is OK w/ 5' grout head assuming 2 sections are anchored.

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Geotechnical Report

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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 Kingston 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 25 degrees was selected for the sluiced ash encountered at the Bull Run disposal facilities based on the DSS plot and comparison with Kingston Fossil Plant data. The saturated and moist unit weights selected for sluiced ash are 105 and 100 pounds per cubic foot, respectively.

The soil parameters for the clay, ash and granular horizons modeled in the slope stability analyses are summarized in Table 17 and shown on the stability analysis results in Appendix I.

Table 17. Selected Strength parameters for Stability Analysis

Soil Horizon	Saturated Unit Weight (pcf)	Effective Stress Strength Parameters	
		C' (psf)	ϕ' (degrees)
Lean Clay Dike (Fill)	126	0	33
Sandy Clay Dike (Fill)	126	0	33
Sluiced Fly Ash	105	0	25
Compacted Ash Dike	105	0	33
Lean Clay Alluvium	123	0	31
Sandy Lean Clay Alluvium	127	0	33
Fat Clay Alluvium	121	0	30
Clayey Sand Alluvium	112	0	33
Silt Alluvium	109	0	28
Sandy Silt to Silty Sand Alluvium	107	0	29
Sand Alluvium	120	0	33
Gravel Alluvium	135	0	40

9.3.3. Slope Stability Results

Using the strength parameters listed in Table 17, in conjunction with the results of the seepage analyses, the existing dike slopes were analyzed at the nine referenced cross-sections of the disposal areas. The slope stability analyses were performed using SLOPE/W 2007 to evaluate the downstream faces of the dike as applicable. The failure surfaces were generated using the "Grid and Radius" method where a wide variation of trial slip surfaces were generated with a defined grid of possible circle centers and a defined range of radii or "Entry and Exit" method where failure circles were analyzed by defining ranges for potential failure circle entry and exit points and a defined range of radii.

Where the surface slope is composed of cohesionless (c' = 0) materials, an infinite slope failure (shallow sliding parallel to the surface) will be critical. While solutions were obtained for this case for two sections, as reported below, there is less concern for this potential failure mechanism. Suction pressures in unsaturated surface soils will often create enough apparent cohesion to prevent this type of failure. If shallow sliding does occur, the resulting

URS **DETAIL CHECK REPORT** Quality

Project Name:	TVA - BRF	Project Number:	31854136.41000
Project Location:	Clinton, TN	Client Name:	TVA
PM Name:	Kenneth Berry	PIC Name:	

Identifying Information

(This section is to be completed by the Project Manager.)

Assigned Checker: Eric Glazier

Checker's Comments Required by: 02/16/2011

Work Product Originator: Lucas P. Carr

Work Product to be Checked: Design of Concrete Cube for Abandoned Pipe Grouting

☒ This Detail Check is a check for correctness, completeness and technical accuracy.

☐ This Detail Check is a technical edit for format, spelling, grammar, pagination and readability.

Submitted by: Kenneth M Berry — 2-15-11

Project Manager Signature — **Date**

Detail Check – Part 1: Comments

(This Section is to be completed by the Checker.)

Check box A **or** B:

A. ☒ All items have been found to be correct. Checker has no comments.

or

B. ☐ Checker's comments have been provided on:

☐ Marked directly on Work Product

☐ Comment and Disposition Form (Form 3-5 (MM))

☐ Other Specify: ____

E Glazier — 2-15-11

Checker Signature — **Date**

Detail Check – Part 2: Verification

(This section is to be completed by the Checker after verification of comment resolution, if box B is checked off above.)

Check box C **or** D and then E:

C. ☐ Verification of comment resolution has been performed by Checker AND any significant issues have been resolved between Originator and Checker.

or

D. ☐ Verification of comment resolution has been performed by Checker AND unresolved issues have been submitted to the Project Manager, Principal-in-Charge or designee for resolution.

and

E. ☐ Verification of correct incorporation of resolved comments into final Work Product is complete.

Checker Signature — **Date**

APPROVAL and DISTRIBUTION

*(To be signed after box A **or** E are completed.)*

☒ The Detail Check is complete. Significant issues not resolved between the Checker and the Originator, if any, have been resolved by the Approver.

Kenneth M Berry — 2-15-11

Project Manager, Principal-in-Charge or Designee Signature — **Date**

Distribution:

Project Central File – Quality file folder

Other Specify: ____

URS

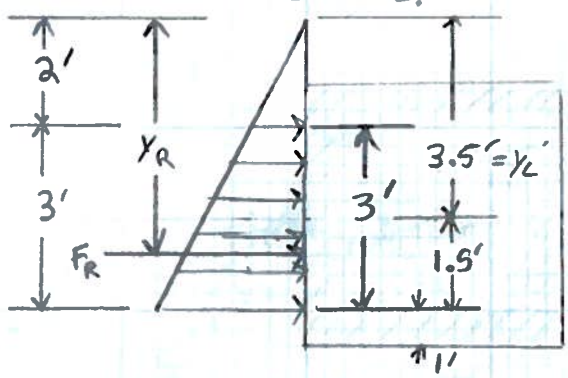
Job: TVA-BRF	Project No. 31854136.41000	Page ___ of ___	
Description: PIPE GROUTING CONCRETE BULKHEAD DESIGN	Computed by: LPC	Sheet 1 of 8	Date 2/10/11
	Checked by: EJG		Date 2/15/11
		Reference	

OBJECTIVE: A 3' ϕ PIPE (HORIZONTAL) IS TO BE GROUTED AT BRF. ONE GROUTING OPTION IS TO CONSTRUCT A CONCRETE BULKHEAD (CUBE SHAPED) AT THE PIPE OUTLET, WITH GROUT TUBES CAST IN THE CUBE.

SIZE THE CONCRETE CUBE FOR FACTORS OF SAFETY OF 1.5 AGAINST SLIDING & OVERTURNING (NAVFAC 1986) & 3.0 FOR BEARING CAPACITY.

CALCS

1. DETERMINE RESULTANT FORCE & LOCATION ON CUBE. ASSUME A 5' HEAD OF 150 pcf GROUT ABOVE THE BOTTOM OF THE PIPE.



$\sigma_1 = 150(2) = 300$ psf

$\sigma_2 = 150(5) = 750$ psf

Y_R = DIST. TO F_R BELOW TOP OF GROUT

$$F_R = 3.5\ ft\left(150\ \frac{lb}{ft^3}\right)\cdot\frac{\pi}{4}\cdot(3\ ft)^2 = 3711\ lb$$

$$Y_R = \frac{I_{XC}}{Y_C A} + Y_C \qquad I_{XC} = \frac{\pi}{4}\cdot r^4 = \frac{\pi}{4}(1.5\ ft)^4 = 3.98\ ft^4$$

$$A = \frac{\pi}{4}(3\ ft)^2 = 7.07\ ft^2$$

$$Y_R = \frac{3.98\ ft^4}{3.5\ ft\cdot 7.07\ ft^2} + 3.5 = 3.66\ ft$$

→ RESULTANT FORCE ACTS 0.16 ft BELOW CENTER OF PIPE

URS

Job TVA-BRF

Description PIPE GROUTING CONCRETE BULKHEAD DESIGN

Project No. 3185 4136.41000

Computed by LPC

Checked by EJG

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Date 2/10/11

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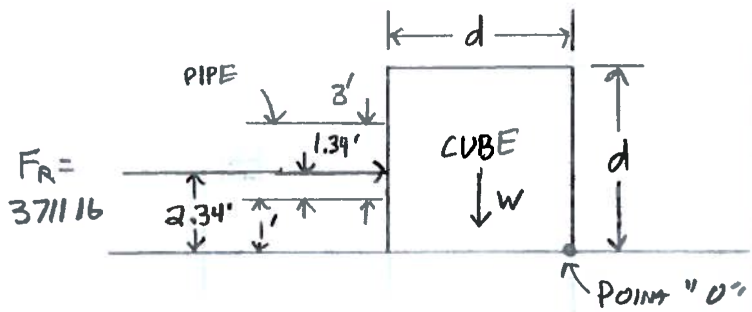
Reference

2. CALCULATE CUBE DIMENSIONS FOR $FS_{OVERTURNING} = 1.6$



$$\Sigma M_O \circlearrowright = 3711\ lb(2.34\ ft) - W\left(\frac{d}{2}\right) = 0$$

$$W = d^3 \cdot 150 \frac{lb}{ft^3}$$

$$3711\ lb\,(2.34\ ft) - d^3 \cdot 150 \frac{lb}{ft^3} \cdot \frac{d}{2} = 0$$

$$8684\ lb\cdot ft - d^4 \cdot 75 \frac{lb}{ft^3} = 0$$

$$d^4 = \frac{8684\ lb\cdot ft}{75 \frac{lb}{ft^3}} = 116\ ft^4$$

$$d = 3.22\ ft \quad \text{for} \quad FS = 1.0$$

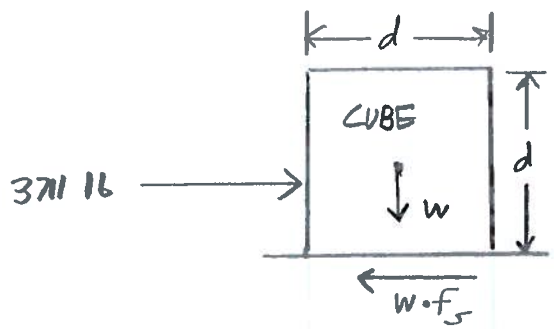
$$FS = \frac{M_R}{M_O} \qquad M_{Or} = 3711\ lb \cdot 2.34\ ft = 8684\ lb\text{-}ft$$

$$M_R = d^4 \cdot 75 \frac{lb}{ft^3}$$

$$1.5 = \frac{75\, d^4}{8684}$$

$$d = 3.63\ ft \quad \text{for} \quad FoS = 1.5$$

3. CALCULATE THE CUBE DIMENSIONS FOR $FS_{SLIDING} = 1.5$



$F_S = 0.45$
(ETL 1110-3-446, TABLE C-1)

$$FS_{SLIDING} = \frac{W \cdot f_S}{3711} = 1.5 \qquad W = 150 \cdot d^3$$

$$1.5 = \frac{150 \frac{lb}{ft^3} \cdot d^3 \cdot 0.45}{3711 \text{ lb}}$$

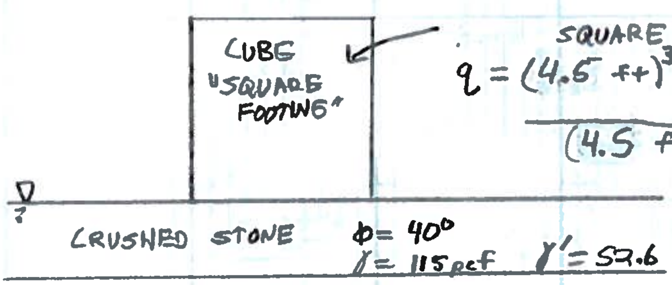
$$5567 \text{ lb} = 67.5 \frac{lb}{ft^3} d^3$$

$$d = 4.35' \text{ ft} \quad \text{FOR } FS = 1.5$$ ✓

→ CONCRETE BLOCK SHOULD BE ≥ 4.35 FT ON ALL SIDES FOR FS = 1.5

→ USE A 4.5 FT CONCRETE CUBE (W = 13,669 lb or 3.4 CY)

4. CHECK BEARING CAPACITY OF THE CUBE



SQUARE

$$q = \frac{(4.5 \text{ ft})^3 \cdot 150 \frac{lb}{ft^3}}{(4.5 \text{ ft})^2} = 675 \text{ psf}$$ ✓

USE MAT'L PROPERTIES FROM CHECKED SLOPE/W ANALYSIS (ATTACHED)

→ NEGLECT PRESENCE OF STONE. IT MAY BE PLACED SUCH THAT IT PINCHES OUT NEAR THE CUBE.

URS

Job	TVA - BRF	Project No. 31854136.41000	Sheet 4 of 8
Description	PIPE GROUTING CONCRETE BULKHEAD DESIGN	Computed by LPC	Date 2/10/11
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Reference

INSTEAD, ASSUME 2' OF STONE CONTRIBUTES TO THE BEARING PRESSURE ON THE CLAY.

$$q = 675 \text{ psf} + (115 \tfrac{\text{lb}}{\text{ft}^3} \cdot 2) = 905 \text{ psf}$$

(STONE ASSUMED TO BE ABOVE WATER TABLE, IN CASE BLOCK IS PLACED IN THE DRY)

$q_u = 9263$ psf (SEE ATTACHED SPREADSHEET)

$$FS_{BC} = \frac{q_u}{q} = \frac{9263 \text{ psf}}{905 \text{ psf}} = 10.2$$

→ BEARING CAPACITY IS OK, WITH CONSERVATIVE ANALYSIS ✓

D_f (ft) =	
B (ft) =	
L (ft) =	
γ (pcf) =	
ϕ' =	
c (psf) =	
β =	

Factor of Safety =

Terzaghi's Bearing Capacity Factors

N_c = 5.70	N_q = 1.00	N_γ = 0.00

Strip Foundation		Square Foundation		Circular Foundation	
q_u (psf) =	7125	q_u (psf) =	9263	q_u (psf) =	9263
σ_{allow} (psf)	2375	σ_{allow} (psf)	3088	σ_{allow} (psf)	3088

Terzaghi's Modified Bearing Capacity Factors

N'_c = 5.70	N'_q = 1.00	N'_γ = 0.00

Strip Foundation		Square Foundation		Circular Foundation	
q_u (psf) =	4750	q_u (psf) =	6177	q_u (psf) =	6177
σ_{allow} (psf)	1583	σ_{allow} (psf)	2059	σ_{allow} (psf)	2059

Bearing Capacity Factors [Vesic (1973)]

N_c = 5.14	N_q = 1.00	N_γ = 0.00

[Shape Factors] De Beer (1970) and Hansen (1970)

F_{cs} = 1.19	F_{qs} = 1.00	$F_{\gamma s}$ = 0.6

[Depth Factors] Hansen (1970)

F_{cd} = 1.00	F_{qd} = 1.00	$F_{\gamma d}$ = 1.00

Inclination Factors [Myerhof (1963), Hanna & Myerhof (1982)]

F_{ci} = 1.00	F_{qi} = 1.00	$F_{\gamma i}$ = 0

q_u (psf) =	7675
σ_{allow} (psf)	2558

Meyerhof (1963)

$$q_u = cN_c F_{cs} F_{cd} F_{ci} + qN_q F_{qs} F_{qd} F_{qi} + \frac{1}{2}\gamma B N_\gamma F_{\gamma s} F_{\gamma d} F_{\gamma i}$$

Terzaghi's Bearing Capacity Equations

$$q_u = cN_c + qN_q + \frac{1}{2}\gamma B N_\gamma$$ Strip

$$q_u = 1.3cN_c + qN_q + 0.4\gamma B N_\gamma$$ Square

$$q_u = 1.3cN_c + qN_q + 0.3\gamma B N_\gamma$$ Circular

Terzaghi's Modified Bearing Capacity Equations
(for local shear failures)

$$q_u = \frac{2}{3}cN'_c + qN'_q + \frac{1}{2}\gamma B N'_\gamma$$ Strip

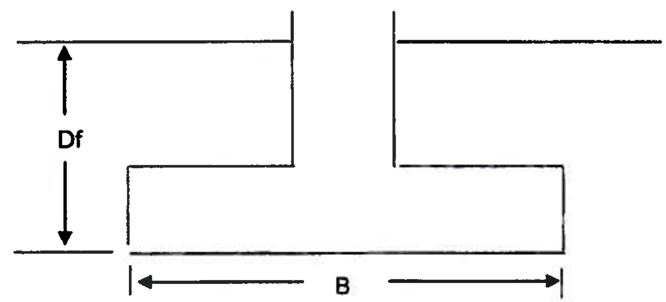
$$q_u = 0.867cN'_c + qN'_q + 0.4\gamma B N'_\gamma$$ Square

$$q_u = 0.867\,cN'_c + qN'_q + 0.3\gamma B N'_\gamma$$ Circular

Estimated Phi Angle

N_{blows} =

		Liao and Whitman (1986)	Skempton(1986)	Seed et al. (1975)	Peck et al. (1974)
	C_N	#DIV/0!	2.0	#NUM!	#DIV/0!
	N_{cor}	#DIV/0!	24.0	#NUM!	#DIV/0!
Hatanaka and Uchida (1996)	ϕ	#DIV/0!	41.9	#NUM!	#DIV/0!
Peck, Hanson, and Thornburn (1974)	ϕ	#DIV/0!	34.0	#NUM!	#DIV/0!



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Project: TVA-BRF
Project No.: 31854136.41
Computed By: LPC Date: 2/10/2011
Checked By: Date:

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TABLE C-1

Friction Coefficient for Concrete Cast on Soil
(reference 4)

Interface Materials	Friction Coefficient, f
Mass concrete on the following foundation materials:	
Clean sound rock	0.70
Clean gravel, gravel--sand mixtures, coarse sand	0.55 to 0.60
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel	0.45 to 0.55
Clean fine sand, silty or clayey fine to medium sand	0.35 to 0.45
Fine sandy silt, nonplastic silt	0.30 to 0.35
Very stiff and hard residual or preconsolidated clay	0.40 to 0.50
Medium stiff and stiff clay and silty clay	0.30 to 0.35

USE 0.45 FOR CONSERVATISM (IN CASE GRAVEL IS DIRTY)

C-4.2. The size of thrust block for downward directed thrust is calculated by;

$$A_B \ \$ \ F_S T_V / q_S$$

where;

A_B = bottom area of thrust block,
T_V = vertical component of thrust force,
q_S = allowable bearing capacity of soil, and
F_S = Factor of Safety.

C-4.3. There is also a horizontal component of thrust (T_H) in vertical bends. The sizing of thrust block for the horizontal component is calculated by the same formula used for horizontal bends, except the term T is replaced by T_H = 2PA Sin 0/2 Cos 0.

C-4.4. These are shown in Figures C-4, C-5, C-6 and C-7.

C--5. Restrained Joints. There are several approaches to this. They all calculate the length of pipe to be restrained on both sides of the joint. The length to be restrained may be determined by;

$$L \ \$ \ F_S(PA \tan 2/2)/(F_f + 0.5\ R\ (_s\ Z\ K_o\ D_o)$$

where;

NOTE: S_u & γ FROM ALLUVIUM RATHER THAN FILL USED IN ANALYSIS, MAT'L IS SATURATED & UNDER LOW CONFINING PRESSURE @ LOCATION OF CONCRETE CUBE, HENCE THE 1800 psf S_u OF FILL MAY BE UNCONSERVATIVE.

SLOPE/W Analysis

Gypsum Disposal Area 2A
Cross-Section S-S'

Bull Run Fossil Plant
Tennessee Valley Authority

Undrained Analysis

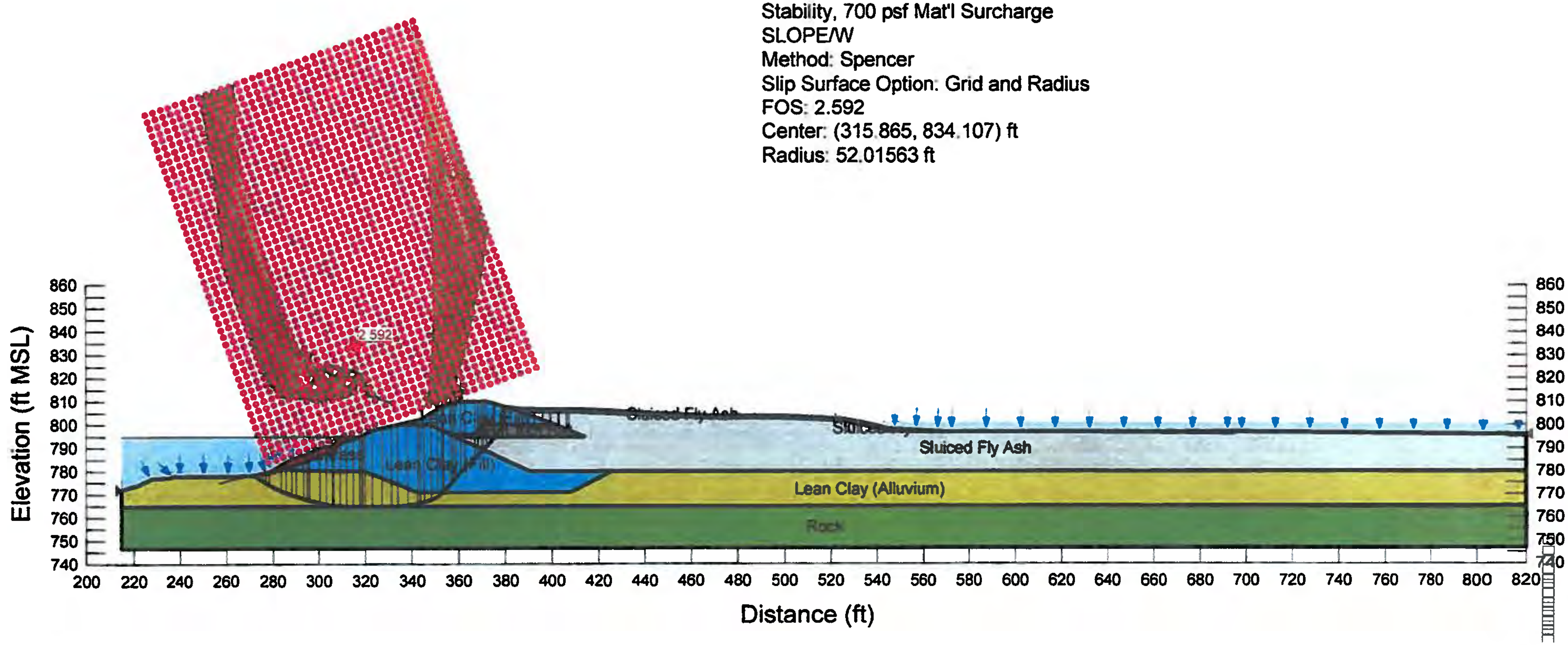
Name: Sluiced Fly Ash Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 25 ° Phi-B: 0 °
Name: Lean Clay (Alluvium) Model: Mohr-Coulomb Unit Weight: 123 pcf Cohesion: 1250 psf Phi: 0 ° Phi-B: 0 °
Name: Bottom Ash Base Model: Mohr-Coulomb Unit Weight: 105 pcf Unit Wt. Above Water Table: 100 pcf Cohesion: 0 psf Phi: 33 ° Phi-B: 0 °
Name: Rock Model: Bedrock (Impenetrable)
Name: Lean Clay (Fill) Model: Mohr-Coulomb Unit Weight: 126 pcf Unit Wt. Above Water Table: 125 pcf Cohesion: 1800 psf Phi: 0 ° Phi-B: 0 °
Name: Rock Buttress Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion: 0 psf Phi: 40 ° Phi-B: 0 °

Analyzed: LPC
Checked: AJW

Date: 1/6/2011

Stability, 700 psf Mat'l Surcharge

Stability, 700 psf Mat'l Surcharge
SLOPE/W
Method: Spencer
Slip Surface Option: Grid and Radius
FOS: 2.592
Center: (315.865, 834.107) ft
Radius: 52.01563 ft



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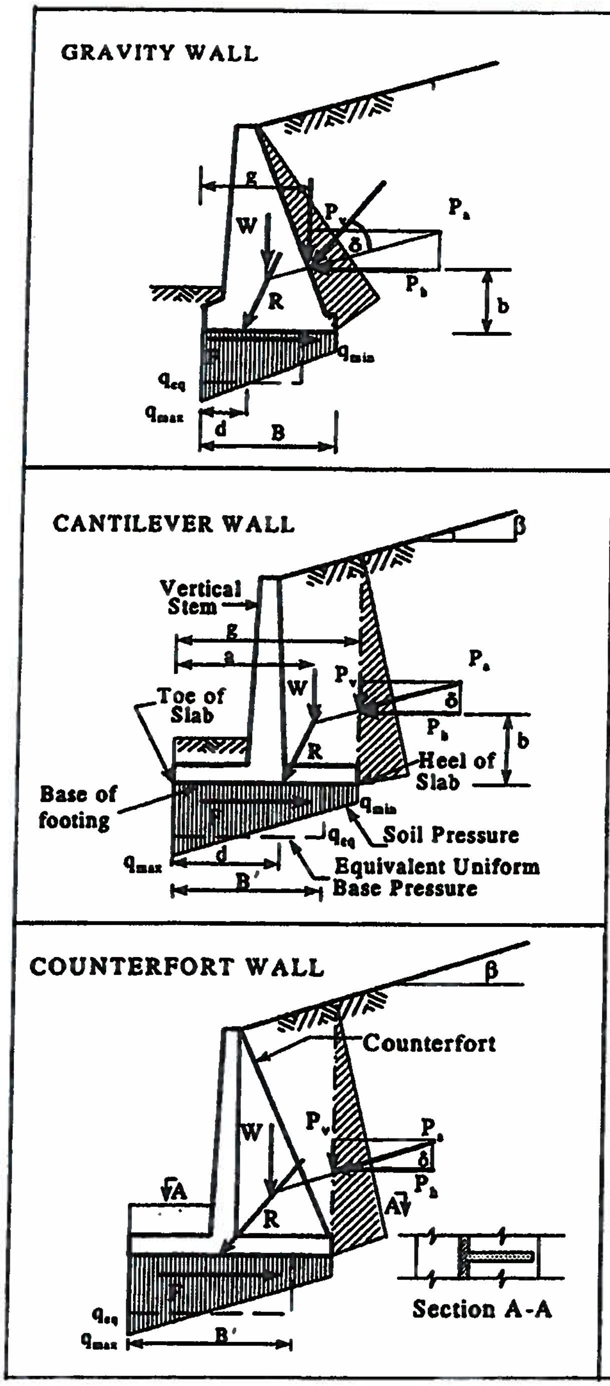


DEFINITIONS

B = Width of the base of the footing

Tan δ_b = Friction factor between soil and base

W = Includes weight of wall for gravity walls. Includes weight of wall and soil above footing for cantilever, counterfort, and buttress walls.

c = cohesion of foundation soil

c_a = Adhesion-concrete on soil

δ = Angle of wall friction

P_p = Passive resistance

LOCATION OF RESULTANT

Moments about toe (assuming $P_p = 0$):

$$d = \frac{Wa + P_v g - P_h b}{W + P_v} \qquad \text{Eccentricity } e = d - \frac{B}{2}$$

OVERTURNING

Moments about toe:

FS, OVERTURNING

$$F_s = \frac{Wa}{P_h b - P_v g} \quad \begin{array}{l} \geq 2.0 \text{ for footings on soils} \\ \leq 1.5 \text{ for footings on rock} \end{array}$$

Ignore overturning if R is within middle third of footing on soil and middle half of footing on rock.

For very rigid walls, e.g., U-walls, soil pressure may be more than active; use at-rest pressure.

RESISTANCE AGAINST SLIDING

FS, SLIDING

$$F_s = \frac{(W + P_v)\mathrm{Tan}\delta_b + c_a B}{P_h} \geq 1.5$$

For coefficients of friction between base and soil see Chapter 2.

CONTACT PRESSURE ON FOUNDATION

Compute maximum (q_{max}) and minimum (q_{min}) pressures at base of the footing as follows:

$$q_{max} = \frac{W + P_v}{B}\left(1 + \frac{6e}{B}\right) \qquad q_{min} = \frac{W + P_v}{B}\left(1 - \frac{6e}{B}\right)$$

For allowable bearing pressure for inclined load on strip foundation, see Module 7. For analysis of deep loads beneath strip foundation, see Module 8. For equivalent uniform bearing pressure:

$$q_{eq} = \frac{W + P_v}{B'}$$

where, $B' = B - 2e$

GLOBAL ROTATION STABILITY

For analysis of global stability, see Module 3.

Figure 4-11. Design Criteria for Cast-In-Place (CIP) Concrete Retaining Walls (after NAVFAC, 1986).

APPENDIX A

Document 11

Tennessee Valley Authority, TVA Calculation Package

TVA Calculation Package

Title BRF- Gypsum Disposal Area 2A South Slope Buttressing and Armoring

Location Description: *(Optional)* BRF-Gypsum Disposal Area 2A	**Total Pages:** *(including appendices & attachments)*

Calculation ID *(All parts required to form a unique ID)*:

Org Code	Location/ Plant Code	Branch Code	Alphanumeric Part = Discipline Code (1) + Type Code (1) + "X" + Unit Field (3) + Sys Code (3) + Year (4) + Sequence No. (4)
FPG	BRF	FES	CDX00000020100001

NOTE: When referencing the calculation ID, include all parts without spaces or dashes between them.

Unit(s), Spill gate(s), or Voltages (PSO): 000	**Key Nouns (For CTS/CCRIS):** CTS	
Applicable Design Document(s):	**Rev**	**RIMS/EDMS Accession Number** *(Optional)*
	R0	
	R	
UNID System(s):	**R**	
	R	

	R0	R	R	R
DCN, PCN, NA	NA-WP			
Prepared: Sign➔	Will Mattingly			
Print Name	Will Mattingly, EIT			
Checked: Sign➔	Sharath Vemuri			
Print Name	Sharath Vemuri, PE			
	These calculations contain unverified assumption(s) that must be verified later? ☐ Yes ☒ No These calculations contain special requirements and/or limiting conditions? ☐ Yes ☒ No			
Approved: Sign➔	Hugo Aparicio			
Print Name	Hugo Aparicio, PE			
Approval Date	04-01-10			
	These calculations contain a design output attachment? ☐ Yes ☒ No			
Revision Applicability	☐ Entire calc	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs	☐ Entire calc ☐ Selected pgs
	Computer output Microfiche generated? ☐ Yes ☒ No Number: ______			

Purpose of the Calculation: Stability and Seepage Analysis, and graded filter calculations for Gypsum Stack south slope Buttressing and Armoring

Abstract:

☒ Electronically file and return calculation to Calculation Library.

☐ Electronically file and return calculation ______ Address: ______

TVA Calculation Coversheet
CTS Input Form

Preparer	Preparer Login ID	Date
Checker	Checker Login ID	Date

Update Code: ☐ Add ☐ Change ☐ Delete ☐ Rename ☐ Supersede ☐ Duplicate ☐ Verify

The following section applies if a calculation is being renamed, superseded, or has a duplicate.

	Org Code	Plant	Branch	Number	Cur Rev	New Rev
Current Calc ID:						

The following section applies to all calculations.

Calc ID:	FPG	BRF	FES	CDX00000020100001	0	0

Firm: *(TVA or Contractor)* ______________________________

Cross-References

A/C/D	Xref Code	Type	Org Code	Plant	Branch	Number	Rev

TVA Calculation Record of Revision

Calculation Identifier: FPGBRFFESCDX00000020100001

Title BRF- Gypsum Disposal Area 2A south slope Buttressing and Armoring

Revision No.	Description of Revision

TVA Computer File Storage Information Sheet

Calculation Identifier: FPGBRFFESCDX00000020100001 **Rev.** 0 **Plant:** BRF

Subject: Buttressing for the south slope of the Gypsum Disposal Area 2A

Software Name: SLOPE/W and SEEP/W **Revision Level:** N/A

Vendor Name: GEO-SLOPE, Ltd

Address: Calgary, Alberta, Canada

Executable Files

☒ No TVA developed **executable files** were used in this calculation.

Comments:

☐ TVA developed **executable files** used in this calculation have been stored electronically and sufficient identifying information is provided below for each executable file. *(Any retrieved file requires re-verification of its contents before use.)*

Input Files

☐ Electronic storage of the **input files** for this calculation is not required.

Comments:

☐ **Input files** for this calculation have been stored electronically and sufficient identifying information is provided below for each input file. *(Any retrieved file requires re-verification of its contents before use.)*

TVA Calculation Table of Contents

Calculation Identifier: FPGBRFFESCDX00000020100001 **Revision:** 0

Table of Contents

Attachment 1

Slope Stability

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

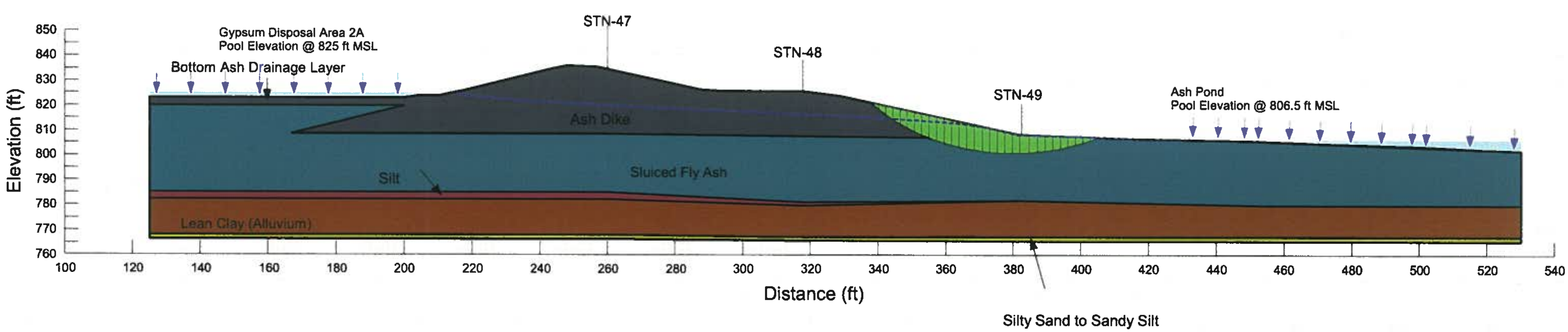
Factor of Safety: 1.2
Center: (380, 855) ft
Radius: 53.802 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: 1A.gsz
(See workplan for file name convention)

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Silty Sand to Sandy Silt (Alluvium)	106	107	0	29
Lean Clay (Alluvium)	123	123	0	31
Silt (Alluvium)	108	109	0	28
Sluiced Fly Ash	100	105	0	25

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Condition



V:\1714\active\171468118\environmental\Bull Run - 172679015\Gypsum Stack South Slope Buttress\Attachments\1A.gsz

SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

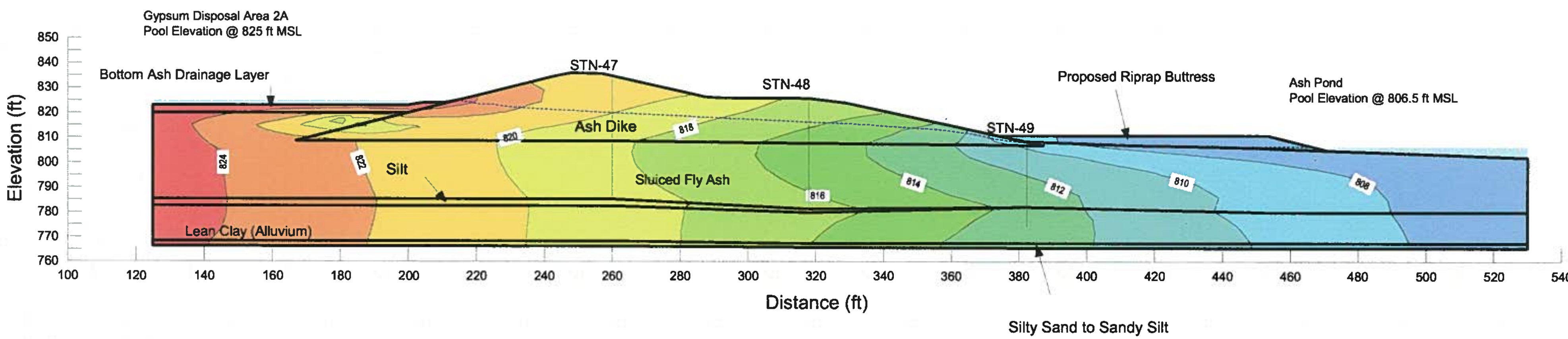
February 2010
Method: Steady-State Seepage
File Name: 1B.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
Total Head = 808.91 ft
At (372.15,807.12)
Total Head = 810.92 ft
dH = 2.01 ft   dl = 3.88 ft
i = 0.518   i(criticial) = 0.708
FSpiping = 1.37

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.36
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.21
Lean Clay (Alluvium)	4.59e-007	0.05	0.26
Silt (Alluvium)	6.95e-005	0.05	0.21
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811'



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Slope Stability

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

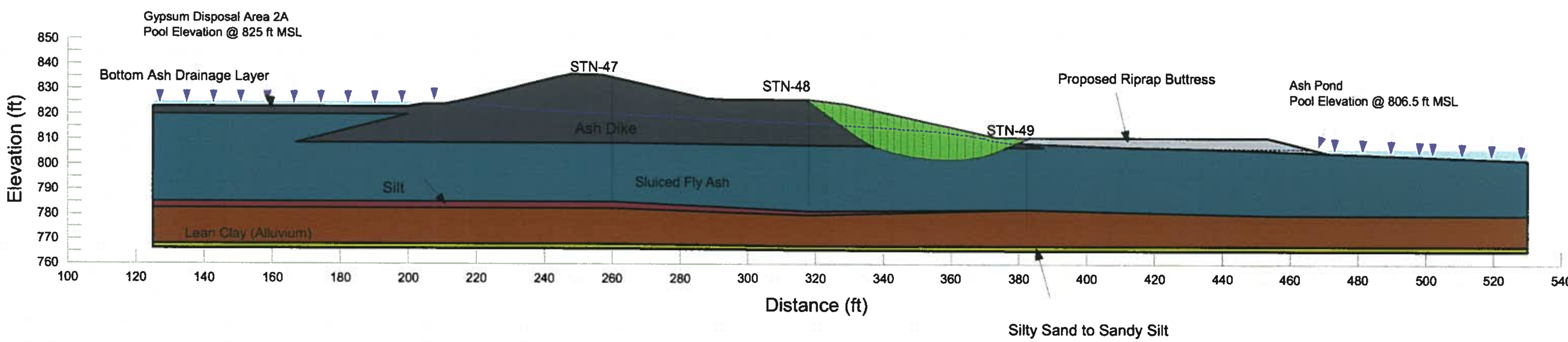
Factor of Safety: 1.7
Center: (357.5, 850) ft
Radius: 32.66393 ft
Minimum Slip Surface Depth: 10 ft

February 2010
Method: Modified Spencer
File Name: 1B.gsz
(See workplan for file name convention)

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Silty Sand to Sandy Silt (Alluvium)	106	107	0	29
Lean Clay (Alluvium)	123	123	0	31
Silt (Alluvium)	108	109	0	28
Sluiced Fly Ash	100	105	0	25

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811'



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SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

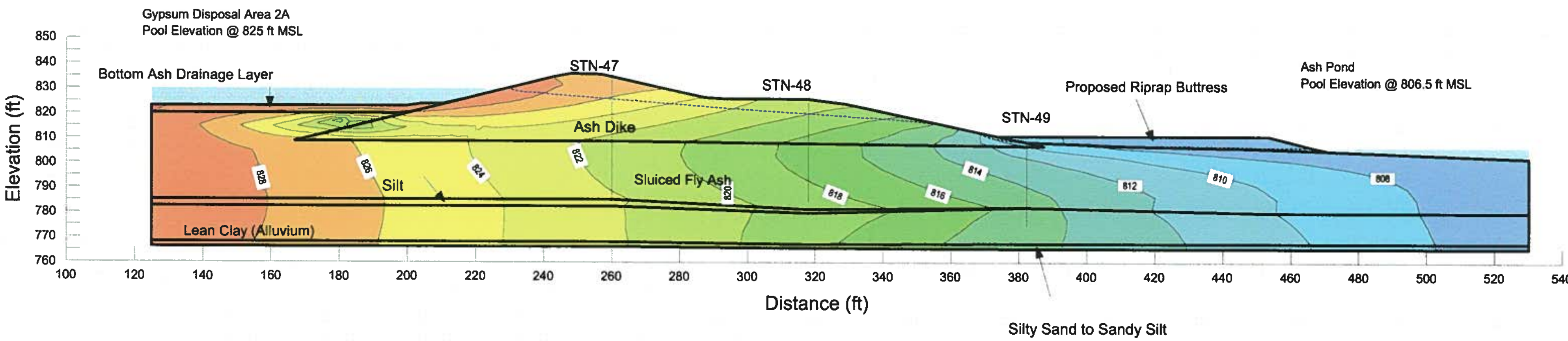
February 2010
Method: Steady-State Seepage
File Name: 1C.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (373.45,811)
Total Head = 809.11 ft
At (372.15,807.12)
Total Head = 811.9 ft
dH = 2.79 ft dl = 3.88 ft
i = 0.719 i(criticial) = 0.708
FSpiping = 0.98

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.36
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.21
Lean Clay (Alluvium)	4.59e-007	0.05	0.26
Silt (Alluvium)	6.95e-005	0.05	0.21
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811' (Gypsum Area Pool Elev. 830')



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Slope Stability

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

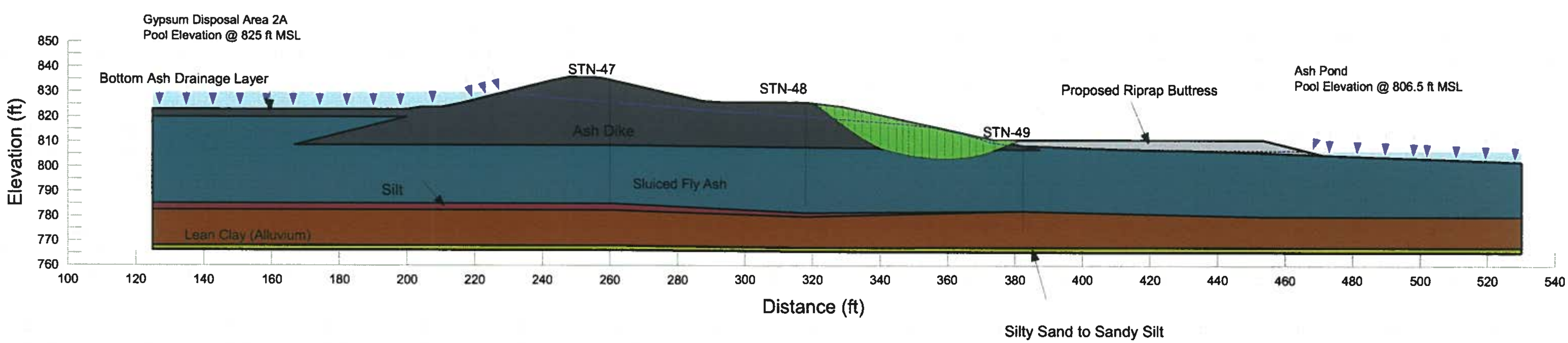
February 2010
Method: Modified Spencer
File Name: 1C.gsz
(See workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.5
Center: (357.5, 850) ft
Radius: 30.56362 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Ash Dike	100	105	0	33
Silty Sand to Sandy Silt (Alluvium)	106	107	0	29
Lean Clay (Alluvium)	123	123	0	31
Silt (Alluvium)	108	109	0	28
Sluiced Fly Ash	100	105	0	25

Proposed Buttress to Elev. 811' (Gypsum Area Pool Elev. 830')



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SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

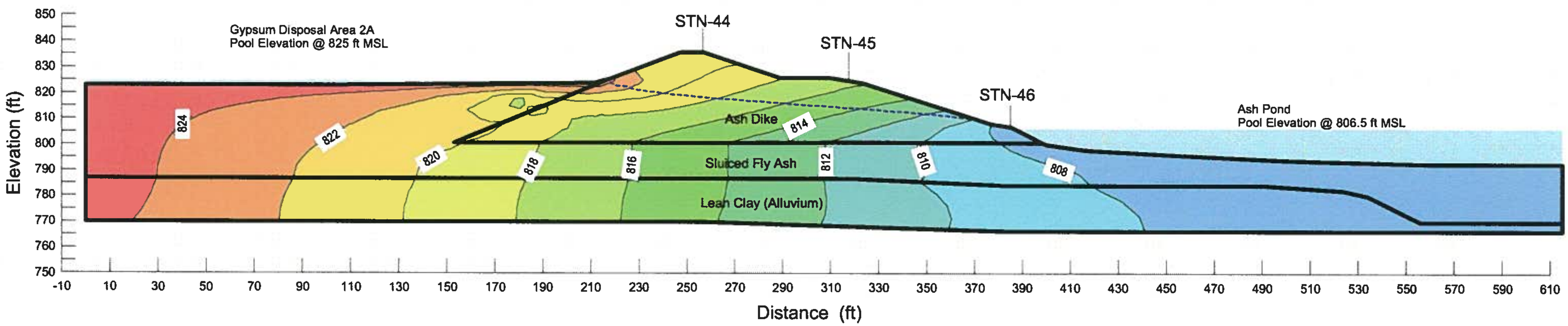
February 2010
Method: Steady-State Seepage
File Name: 2A.gsz
(See Workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Piping Potential
Maximum Exit Gradient occurs at (400,800)
Total Head = 806.50 ft
At (399.44,796.39)
Total Head = 807.50 ft
dH = 1.0 ft dl = 3.61 ft
i = 0.277 i(criticial) = 0.708
FSpiping = 2.6

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46

Existing Condition



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Slope Stability

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

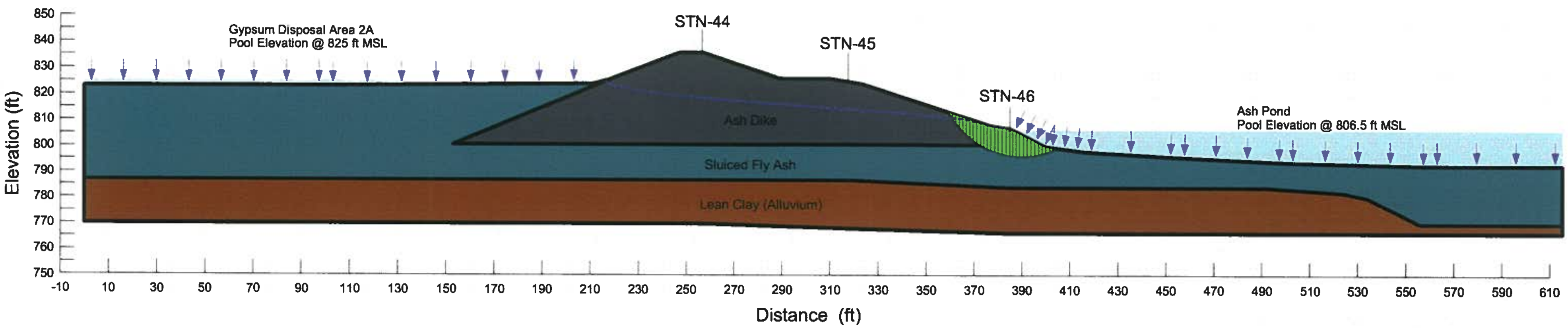
February 2010
Method: Modified Spencer
File Name: 2A.gsz
(See workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 1.1
Center: (390, 832.2) ft
Radius: 35.877 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Alluvium)	123	123	0	31
Sluiced Fly Ash	100	105	0	25
Ash Dike	100	105	0	33

Existing Condition



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SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

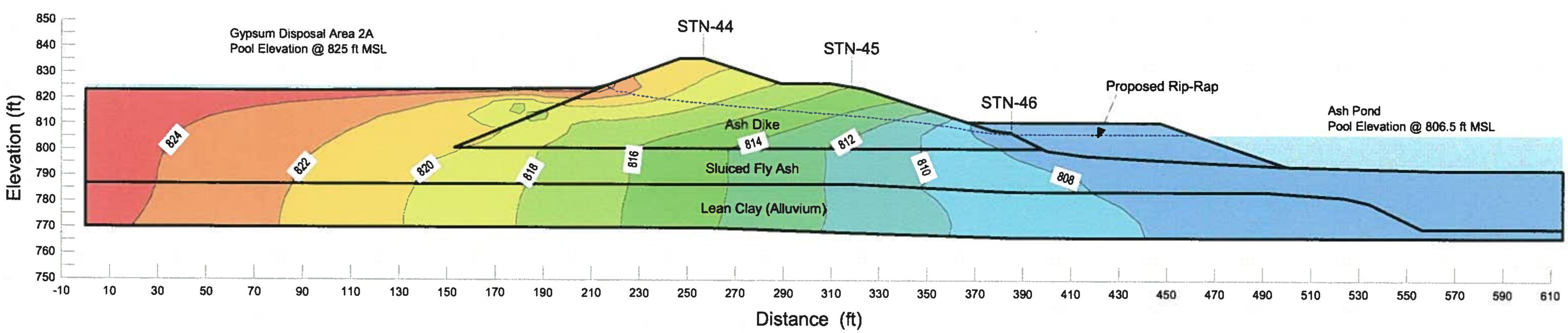
February 2010
Method: Steady-State Seepage
File Name: 2B.gsz
(See workplan for file name convention)

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Piping Potential
Maximum Exit Gradient occurs at (505,793.88
Total Head = 806.50 ft
At (504.07,788.16)
Total Head = 806.73 ft
dH = 0.23 ft dl = 5.72 ft
i = 0.04 i(criticial) = 0.708
FSpiping = 17.7

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811'



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Slope Stability (Slope Failure)

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

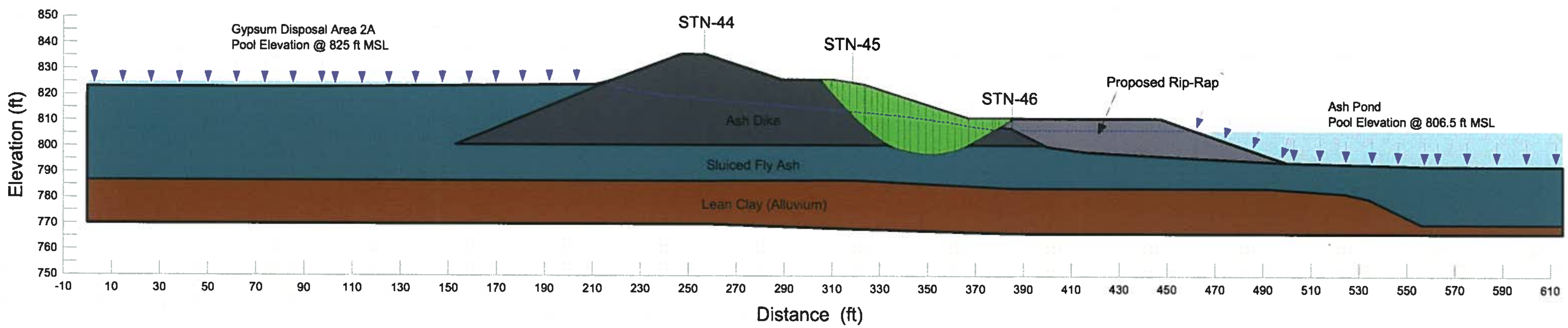
February 2010
Method: Modified Spencer
File Name: 2B.gsz
(See workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 2.3
Center: (350.966, 843.553) ft
Radius: 39.00674 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Alluvium)	123	123	0	31
Sluiced Fly Ash	100	105	0	25
Ash Dike	100	105	0	33
Rip Rap	115	115	0	40

Proposed Buttress to Elev. 811'



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SEEP/W Analysis

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

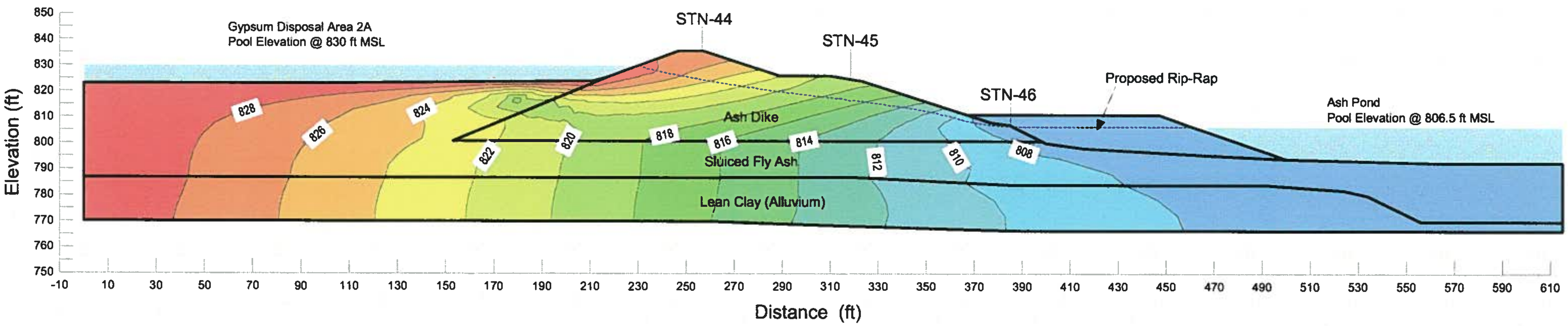
February 2010
Method: Steady-State Seepage
File Name: 2C.gsz
(See workplan for file name convention)

Material Type	Ksat	Kratio	Wsat
Lean Clay (Alluvium)	4.593e-007	0.05	0.41
Sluiced Fly Ash	1.61e-005	0.02	0.46
Ash Dike	6.5e-008	0.04	0.46
Rip Rap	0.01	1	0.4

Piping Potential
Maximum Exit Gradient occurs at (505,793.88)
Total Head = 806.50 ft
At (504.07,788.16)
Total Head = 806.79 ft
dH = 0.29 ft   dl = 5.72 ft
i = 0.05   i(criticial) = 0.708
FSpiping = 14.2

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Proposed Buttress to Elev. 811', Gypsum Pool Area Elev. 830'



V:\1714\active\171468118\environmental\Bull Run - 172679015\Gypsum Stack South Slope Buttress\Attachments\2C.gsz

Slope Stability (Slope Failure)

Cross-Section L-L'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

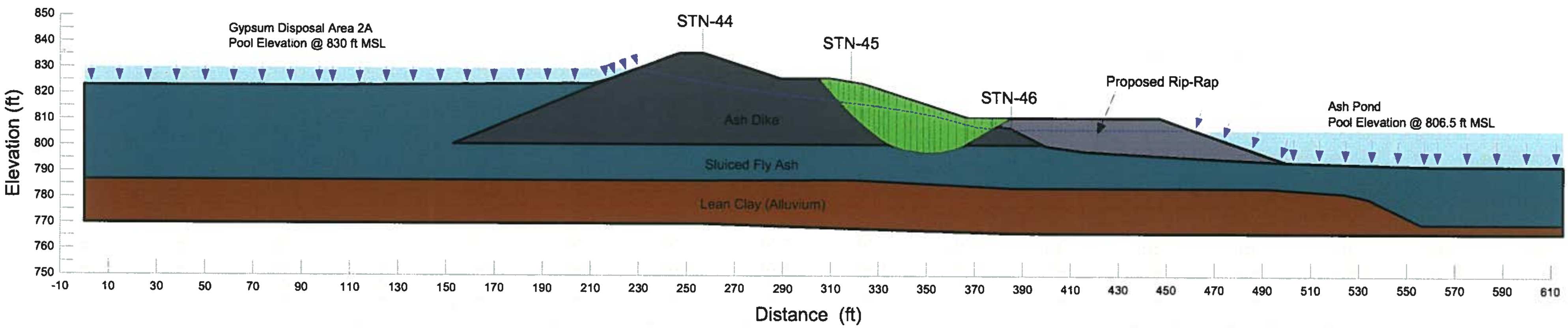
February 2010
Method: Modified Spencer
File Name: 2C.gsz
(See workplan for file name convention)

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Factor of Safety: 2.2
Center: (350.966, 843.553) ft
Radius: 38.62748 ft
Minimum Slip Surface Depth: 10 ft

Material Type	Moist Unit Weight	Saturated Unit Weight	Cohesion	Friction Angle
Lean Clay (Alluvium)	123	123	0	31
Sluiced Fly Ash	100	105	0	25
Ash Dike	100	105	0	33
Rip Rap	115	115	0	40

Proposed Buttress to Elev. 811', Gypsum Pool Area Elev. 830'



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SEEP/W Analysis

Cross-Section K-K'
Gypsum Disposal Area 2A

Bull Run Fossil Plant
Tennessee Valley Authority

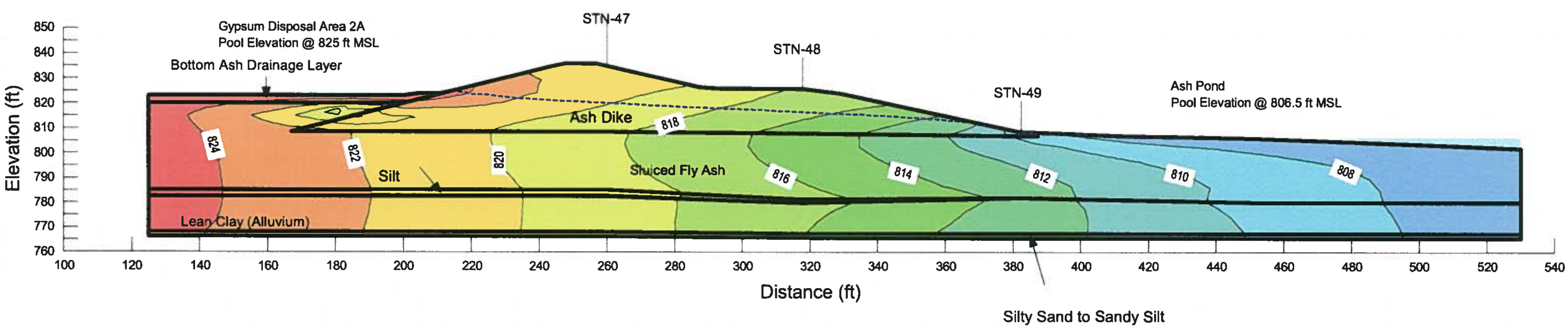
February 2010
Method: Steady-State Seepage
File Name: 1A.gsz
(See workplan for file name convention)

Piping Potential
Maximum Exit Gradient occurs at (387.33,808.25)
Total Head = 808.25 ft
At (387.41,802.10)
Total Head = 810.58 ft
dH = 2.25 ft   dl = 6.15 ft
i = 0.379   i(criticial) = 0.708
FSpiping = 1.9

Material Type	Ksat (ft/s)	Kratio	Wsat (ft3/ft3)
Ash Dike	6.5e-008	0.04	0.46
Silty Sand to Sandy Silt (Alluvium)	0.00226	0.05	0.39
Lean Clay (Alluvium)	4.59e-007	0.05	0.41
Silt (Alluvium)	6.95e-005	0.05	0.39
Sluiced Fly Ash	1.6076e-005	0.02	0.46

Note:
The results of the analysis shown were developed based on available subsurface information from a limited number of exploratory locations, with the assumption that the materials exposed fairly represent the subsurface conditions within the areas explored. No guarantee can be made regarding the subsurface conditions between the explored locations; and such unknown conditions could have an impact on the results of the analyses.

Existing Condition



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Attachment 2

Filter Design Calculations
Proposed Sand Filter
Gypsum Storage Phase Area 2A
Bull Run Fossil Plant
Anderson County, Tennessee

1. Background

The calculations presented here are for the sand filter detail shown in Figure 1. Specifically, this letter addresses the filter design calculations for **Ash Dike Material versus Sand**. The proposed sand filter will be utilized for armoring the south slope of the Gypsum Stack Area 2A.

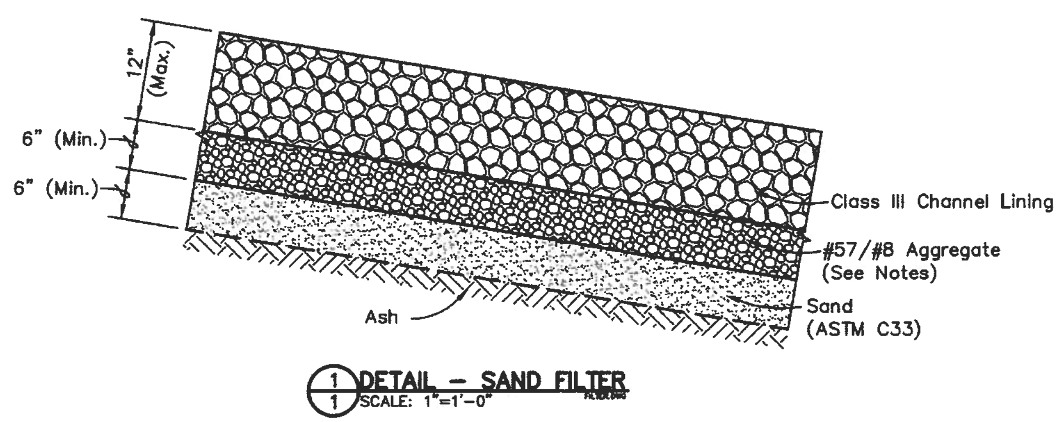


Figure 1: Proposed Sand Filter Detail

For more information regarding the proposed slope armoring repairs please refer to the following work plans issued by Stantec.

Table 1: Related Work Plans

Structure	Slope	Issued Date	Phase[1]	File No.
Gypsum Stack	South	02/17/2010	IFR	let_023_brf_172679015

[1] IFR – Issued for Review

2. Materials

Ash Dike material samples were obtained from the geotechnical exploration performed by Stantec in June and July, 2009. A list of materials tested by Stantec is presented in Table 2.

Table 2: List of Materials

Material	Test Standard	Results
Bottom Ash	ASTM D 422	Appendix A
Sand*	ASTM C 136	Appendix B

*- Sand sample used for current analysis consists of ASTM C33 sand obtained by Stantec for Paradise Fossil Plant project. Sand sample specific to Bull Run Project should be provided to Stantec upon selection of the vendor by TVA

3. Analysis Procedure

3.1. General

The methodology presented herein follows the USACE Engineering Manual EM-1110-2-2300, dated July 2004. Specifically, Appendix B of the above reference was utilized to perform calculations.

3.2. Bottom Ash

A total of two (2) samples of Ash Dike material were analyzed for filter criteria. The laboratory test results are presented in Appendix A. Detailed analysis one of the Bottom Ash samples is presented in this section for use in subsequent calculations.

Table 3: Particle Size Distribution for Bottom Ash Sample [1]

[1] For Sample ID 3150- Appendix A

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.4
No. 4	4.75	93.5
No. 10	2	87.7
No. 40	0.425	72.9
No. 200	0.075	49.6
	0.02	28.7
	0.005	11.5
	0.002	5.4
estimated	0.001	3.0

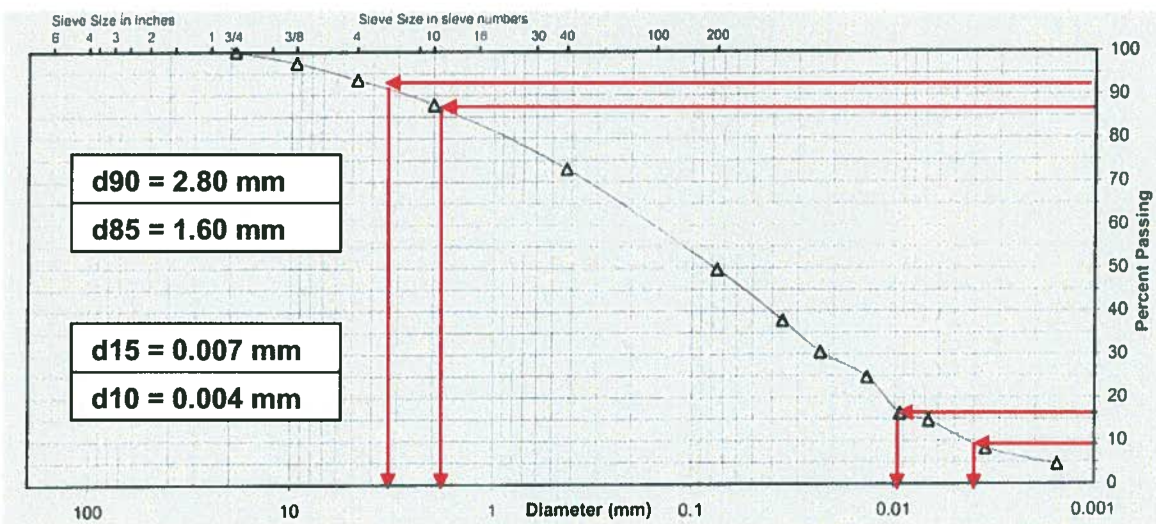


Figure 2: Particle Size Distribution Curve for Bottom Ash Sample [1]
[1] For Sample ID 3150- Appendix A

3.3. Sand

The laboratory test results of sand are presented in Appendix B. The results are analyzed in this section for subsequent calculations. Sand sample used for current analysis consists of ASTM C33 sand obtained by Stantec for Paradise Fossil Plant project. Sand sample specific to Bull Run Project should be provided to Stantec for analysis upon selection of the vendor by TVA. Alternatively, the vendor may provide a certification for sand conforming to ASTM C33 specification.

Table 4: Particle Size Distribution for Sand

Sieve Size	Grams Retained	% Retained	% Passing
3/8"	0.00	0.0	100.0
No. 4	21.68	2.3	97.7
No. 10	151.53	16.2	81.5
No. 20	129.24	13.8	67.7
No. 40	275.04	29.4	38.3
No. 100	352.46	37.6	0.7
No. 200	3.56	0.4	0.3
Pan	2.65	0.3	---

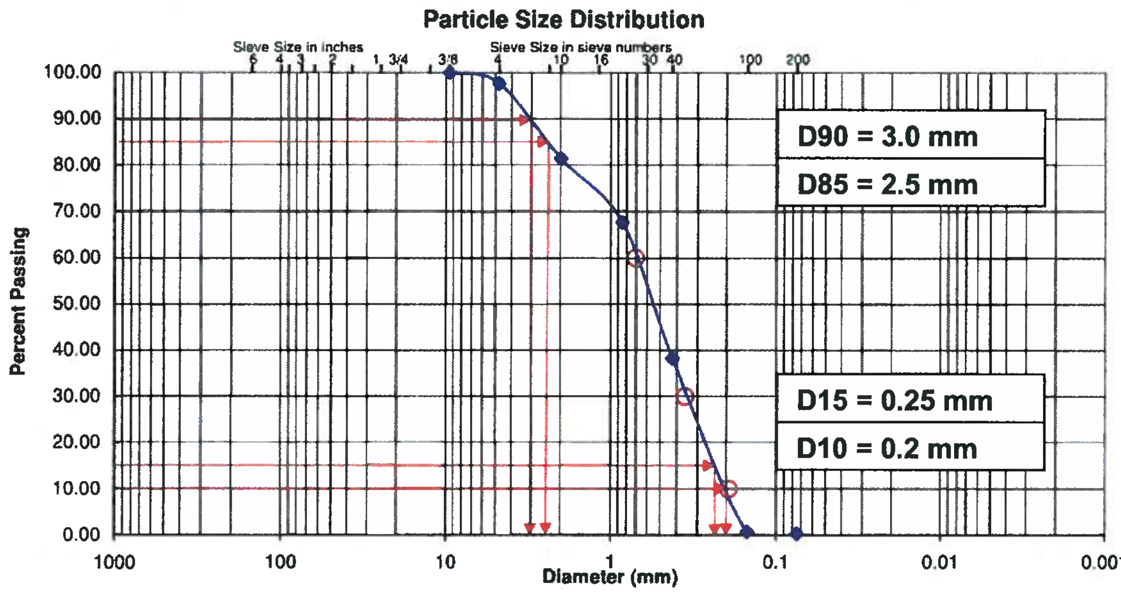


Figure 3: Particle Size Distribution Curve of Sand

Table 5: Summary of Information for Sand

Item	Value	Remarks
D90	3.0 mm	See Figure 3
D85	2.5 mm	See Figure 3
D15	0.25 mm	See Figure 3
D10	0.2 mm	See Figure 3

3.4. Summary of Particle Size Analysis

A summary of particle size analysis is presented in Table 6.

Table 6: Summary for all materials

Material	Lab ID	% Finer than No.200 Sieve	Category(1)	Diameters @ % Passing (mm)			
				90%	85%	15%	10%
Sand	--	--	--	3.00	2.50	0.250	0.200
Bottom Ash	3150	49.6	2	2.80	1.60	0.007	0.004

(1) **Based on Table B-2 of the USACE reference**

4. Analysis

4.1 Cases

A total of two (2) cases were analyzed. Case A is presented in this letter and the remaining case was analyzed using the spreadsheet presented as Appendix C. List of cases is presented in Table 7.

Table 7: Cases Analyzed

Case	Base Soil	Filter Material
A	Bottom Ash (Lab ID 3150)	Sand
B	Bottom Ash (Lab ID 3155)	Sand

4.2 Case A

Check for Permeability

According to Table B-2 of the USACE reference, for Category 2 base soil (in this case Bottom ash), the filter criteria is as follows.

Maximum D15 (of filter material) must be less than or equal to 0.7 times d85 (of base soil). In other words, Maximum D15 (of Sand) must be less than or equal to 0.7 times d85 (of Bottom Ash). Also,

Minimum D15 (of filter material) must be greater than or equal to 3 to 5 times d15 (of base soil). In other words, Minimum D15 (of Sand) must be greater than or equal to 3 to 5 times d15 (of Bottom Ash).

From Table 6, we know

d85	(of Bottom Ash)	=	1.60	mm
0.7xd85	(of Bottom Ash)	=	1.12	mm

d15	(of Bottom Ash)	=	0.007	mm
3xd15	(of Bottom Ash)	=	0.021	mm
5xd15	(of Bottom Ash)	=	0.035	mm

The suggested value for Maximum D15 is less than or equal to 1.12 mm

The suggested value for Minimum D15 is greater than or equal to 0.021 mm

Therefore, the optimum range for D15 is <u>0.021 mm to 1.12 mm</u>

From Table 6, we know

D15	(of Sand)	=	0.25	mm

This falls within the optimum range. [OK]

Another check for permeability is the following ratio.

$$\frac{D15}{d15} \geq 5$$

From Table 6, we know

D15	(of Sand)	=	0.25	mm
d15	(of Bottom Ash)	=	0.007	mm

$$\frac{0.25}{0.007} = 36$$ [OK]

Check for Segregation

From Table 6, we know

D10	(of Sand)	=	0.2	mm
D90	(of Sand)	=	3	mm

Table B-3
D_{10} and D_{90} Limits for Preventing Segregation

If minimum D_{10}, mm	Then maximum D_{90}, mm
<0.5	20
0.5 - 1.0	25
1.0 - 2.0	30
2.0 - 5.0	40
5.0 - 10	50
10 - 50	60

These values satisfy Table B-3 of the reference. [OK]

Using the procedure presented here, the remaining case was analyzed in a spreadsheet. The spreadsheet is presented as Appendix C and results are summarized in Table 8.

4.4 Summary

A brief summary of the filter calculations is presented in Table 8.

Table 8: Summary of Filter Calculations

Case	Base Soil[1]	Filter Material	D15 Check	Permeability Ratio Check	Segregation Check
A	BA (Lab ID 3150)	Sand	Satisfied	Satisfied	Satisfied
B	BA (Lab ID 3155)	Sand	Satisfied	Satisfied	Satisfied

(1) BA Refers to Bottom Ash

3. Conclusion

Based on the results of the filter design calculations, Sand (meeting ASTM C33 Standard) can be used as the filter material for Ash Dike material (representative of the material tested).

Appendices: Appendix A – Particle Size Distribution for Ash Dike Materials
Appendix B – Particle Size Distribution for Sand from PAF
Appendix C – Summary Spreadsheet

Filter Design Calculations
Proposed Sand Filter
Gypsum Storage Phase Area 2A
Bull Run Fossil Plant
Anderson County, Tennessee

1. Background

The calculations presented here are for the sand filter detail shown in Figure 1. Specifically, this letter addresses the filter design calculations for **Fly Ash versus Sand**. The proposed sand filter will be utilized for armoring the south slope of the Gypsum Stack Area 2A.

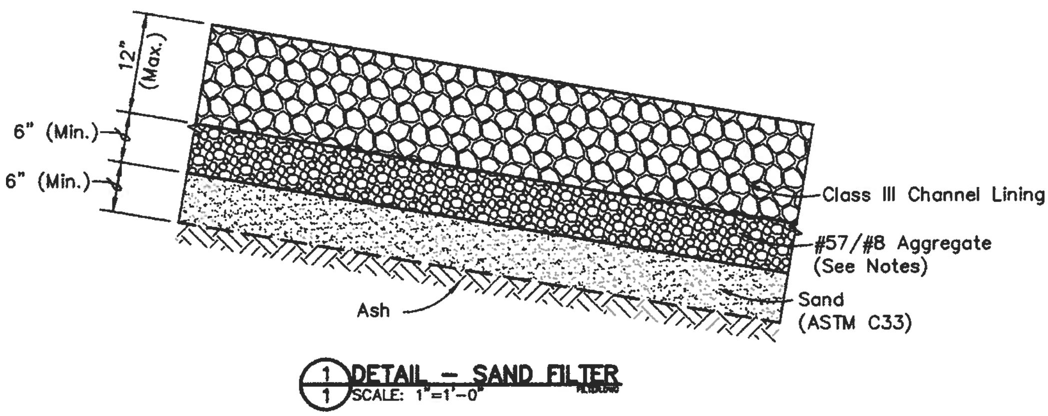


Figure 1: Proposed Sand Filter Detail

For more information regarding the proposed slope armoring repairs please refer to the following work plans issued by Stantec.

Table 1: Related Work Plans

Structure	Slope	Issued Date	Phase[1]	File No.
Gypsum Stack	South	02/17/2010	IFR	let_023_brf_172679015

[1] IFR – Issued for Review

2. Materials

Fly Ash samples were obtained from the geotechnical exploration performed by Stantec in June and July, 2009. A list of materials tested by Stantec is presented in Table 2.

Table 2: List of Materials

Material	Test Standard	Results
Fly Ash	ASTM D 422	Appendix D
Sand*	ASTM C 136	Appendix B

*- Sand sample used for current analysis consists of ASTM C33 sand obtained by Stantec for Paradise Fossil Plant project. Sand sample specific to Bull Run Project should be provided to Stantec upon selection of the vendor by TVA

3. Analysis Procedure

3.1. General

The methodology presented herein follows the USACE Engineering Manual EM-1110-2-2300, dated July 2004. Specifically, Appendix B of the above reference was utilized to perform calculations.

3.2. Fly Ash

A total of five (5) samples of Fly Ash were analyzed for filter criteria. The laboratory test results are presented in Appendix D. Detailed analysis one of the Fly Ash samples is presented in this section for use in subsequent calculations.

Figure 2: Particle Size Distribution Curve for Fly Ash Sample [1]
[1] **For Sample ID STN-49P, 10.0'-10.7'-Appendix D**

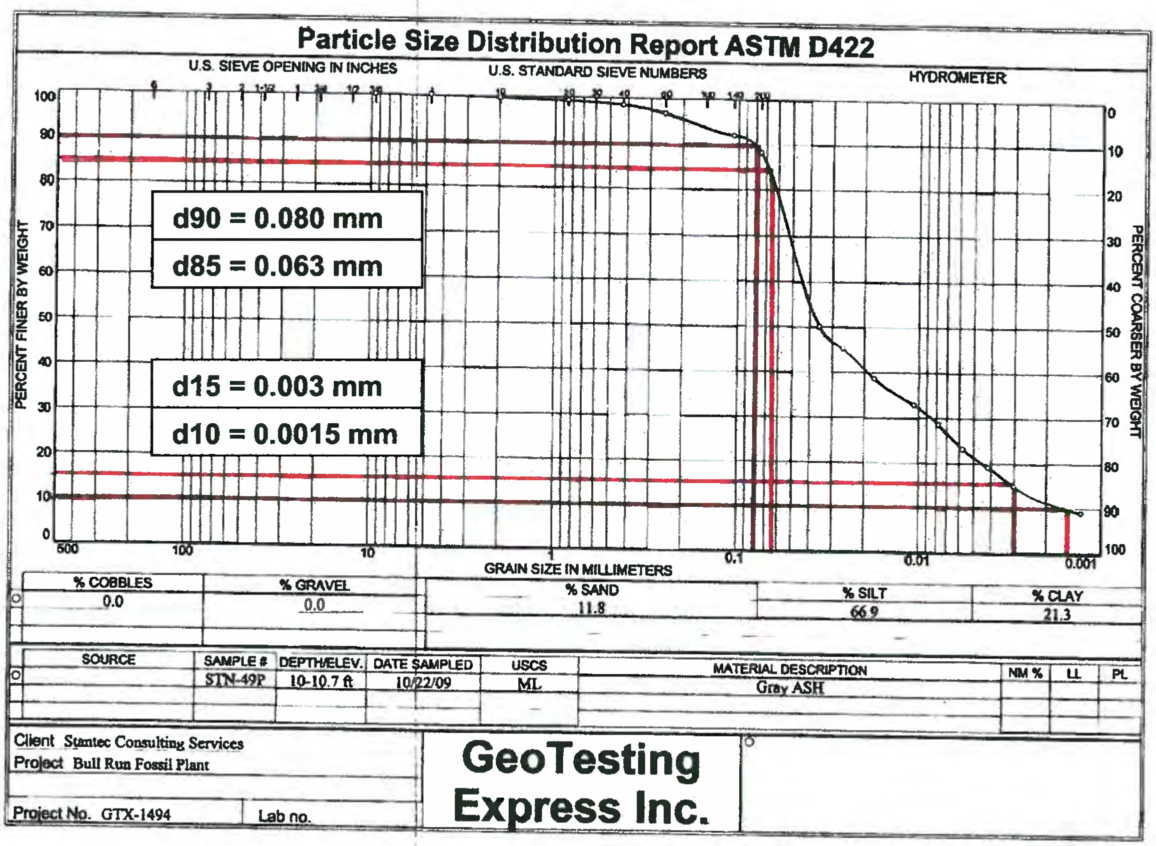


Table 3: Summary of Information for Fly Ash

Item	Value	Remarks
d90	0.080 mm	See Figure 2
d85	0.063 mm	See Figure 2
d15	0.003 mm	See Figure 2
d10	0.0015 mm	See Figure 2

Using similar procedure, four (4) more samples of Fly Ash were also analyzed. Results are presented in Table 6.

3.3. Sand

The laboratory test results of sand are presented in Appendix B. The results are analyzed in this section for subsequent calculations. Sand sample used for current analysis consists of ASTM C33 sand obtained by Stantec for Paradise Fossil Plant project. Sand sample specific to Bull Run Project should be provided to Stantec for analysis upon selection of the vendor by TVA. Alternatively, the vendor may provide a certification for sand conforming to ASTM C33 specification.

Table 4: Particle Size Distribution for Sand

Sieve Size	Grams Retained	% Retained	% Passing
3/8"	0.00	0.0	100.0
No. 4	21.68	2.3	97.7
No. 10	151.53	16.2	81.5
No. 20	129.24	13.8	67.7
No. 40	275.04	29.4	38.3
No. 100	352.46	37.6	0.7
No. 200	3.56	0.4	0.3
Pan	2.65	0.3	---

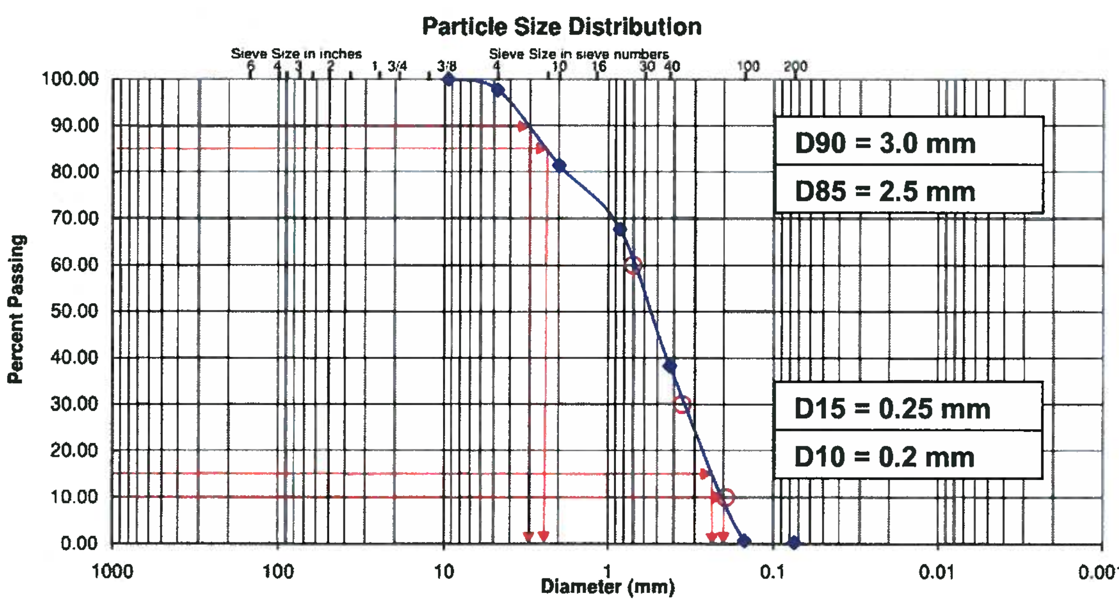


Figure 3: Particle Size Distribution Curve of Sand

Table 5: Summary of Information for Sand

Item	Value	Remarks
D90	3.0 mm	See Figure 3
D85	2.5 mm	See Figure 3
D15	0.25 mm	See Figure 3
D10	0.2 mm	See Figure 3

3.4. Summary of Particle Size Analysis

A summary of particle size analysis is presented in Table 6.

Table 6: Summary for all materials

Material	Boring	Depth (ft)	% Finer than No.200	Category(1)	Diameters @ % Passing (mm)			
					90%	85%	15%	10%
Sand	--	--	--	--	3	2.5	0.25	0.2
Fly Ash	STN-49P	10.0 to 10.7	88	1	0.080	0.063	0.003	0.0015
Fly Ash	STN-49P	14.7 to 15.4	89	1	0.080	0.070	0.003	0.0018
Fly Ash	STN-49P	22.7 to 23.4	93	1	0.082	0.069	0.005	0.0032
Fly Ash	STN-46P	7.5 to 8.0	90	1	0.075	0.065	0.005	0.0033
Fly Ash	SRN-46P	9.5 to 10.0	95	1	0.070	0.065	0.003	0.0014

(1) Based on Table B-2 of the reference

4. Analysis

4.1 Cases

A total of five (5) cases were analyzed. Case A is presented in this letter and the remaining cases were analyzed using the spreadsheet presented as Appendix E. List of cases is presented in Table 7.

Table 7: Cases Analyzed

Case	Base Soil (Depth)	Filter Material
A	Fly Ash (10.0 to 10.7)	Sand
B	Fly Ash (14.7 to 15.4)	Sand
C	Fly Ash (22.7 to 23.4)	Sand
D	Fly Ash (7.5 to 8.0)	Sand
E	Fly Ash (9.5 to 10.0)	Sand

4.2 Case A

Check for Permeability

According to Table B-2 of the reference, for Category 1 base soil (in this case Fly ash), the filter criteria is as follows.

Maximum D15 (of filter material) must be less than or equal to 9 times d85 (of base soil). In other words, Maximum D15 (of Sand) must be less than or equal to 9 times d85 (of Fly Ash). Also,

Minimum D15 (of filter material) must be greater than or equal to 3 to 5 times d15 (of base soil). In other words, Minimum D15 (of Sand) must be greater than or equal to 3 to 5 times d15 (of Fly Ash).

From Table 6, we know

d85	(of Fly Ash)	=	0.063	mm
9xd85	(of Fly Ash)	=	0.567	mm
d15	(of Fly Ash)	=	0.003	mm
3xd15	(of Fly Ash)	=	0.009	mm
5xd15	(of Fly Ash)	=	0.015	mm

The suggested value for Maximum D15 is less than or equal to 0.567 mm
The suggested value for Minimum D15 is greater than or equal to 0.009 mm
Therefore, the optimum range for D15 is <u>0.009 mm to 0.567 mm</u>
From Table 6, we know
D15 (of Sand) = 0.25 mm

This falls within the optimum range. [OK]
Another check for permeability is the following ratio.

$$\frac{D15}{d15} \geq 5$$

From Table 6, we know

D15	(of Sand)	=	0.25	mm
d15	(of Fly Ash)	=	0.003	mm

$$\frac{0.25}{0.003} = 83 \qquad \text{[OK]}$$

Check for Segregation

From Table 6, we know

D10	(of Sand)	=	0.2	mm
D90	(of Sand)	=	3	mm

Table B-3
D_{10} and D_{90} Limits for Preventing Segregation

If minimum D_{10}, mm	Then maximum D_{90}, mm
<0.5	20
0.5 - 1.0	25
1.0 - 2.0	30
2.0 - 5.0	40
5.0 - 10	50
10 - 50	60

These values satisfy Table B-3 of the reference. [OK]

Using the procedure presented here, the remaining cases (B through E) were analyzed in a spreadsheet. The spreadsheet is presented as Appendix E and results are summarized in Table 8.

4.4 Summary

A brief summary of the filter calculations is presented in Table 8.

Table 8: Summary of Filter Calculations

Case	Base Soil(1)	Filter Material	D15 Check	Permeability Ratio Check	Segregation Check
A	FA (10.0 to 10.7)	Sand	Satisfied	Satisfied	Satisfied
B	FA (14.7 to 15.4)	Sand	Satisfied	Satisfied	Satisfied
C	FA (22.7 to 23.4)	Sand	Satisfied	Satisfied	Satisfied
D	FA (7.5 to 8.0)	Sand	Satisfied	Satisfied	Satisfied
E	FA (9.5 to 10.0)	Sand	Satisfied	Satisfied	Satisfied

(1) 'FA' Refers to Fly Ash

3. Conclusion

Based on the results of the filter design calculations, Sand (meeting ASTM C33 Standard) can be used as the filter material for Fly Ash (representative of the material tested).

Appendices: Appendix D – Particle Size Distribution for Fly Ash Material
Appendix E – Summary Spreadsheet

Appendix A

Stantec

Summary of Soil Tests

Project Name: Bull Run Fossil Plant (TVA)
Project Number: 172679015
Source: STN-45, 12.0'-13.5', 15.0'-16.5', 18.0'-19.5', 21.0'-22.5'
Lab ID: 3150

County: Clinton, Tennessee
Date Received: 2-2-10
Sample Type: SPT Comp
Date Reported: 2-10-10

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.4
No. 4	4.75	93.5
No. 10	2	87.7
No. 40	0.425	72.9
No. 200	0.075	49.6
	0.02	28.7
	0.005	11.5
	0.002	5.4
estimated	0.001	3.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	6.5	12.3
Coarse Sand	5.8	14.8
Medium Sand	14.8	---
Fine Sand	23.3	23.3
Silt	38.1	44.2
Clay	11.5	5.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.30

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Appendix A

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Bull Run Fossil Plant (TVA)	Project Number	172679015
Source	STN-45, 12.0'-13.5', 15.0'-16.5', 18.0'-19.5', 21.0'-22.5'	Lab ID	3150

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded and Angular
Particle Hardness: Hard and Durable

Tested By: JF
Test Date: 02-03-2010
Date Received 02-02-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	97.4
No. 4	93.5
No. 10	87.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.3

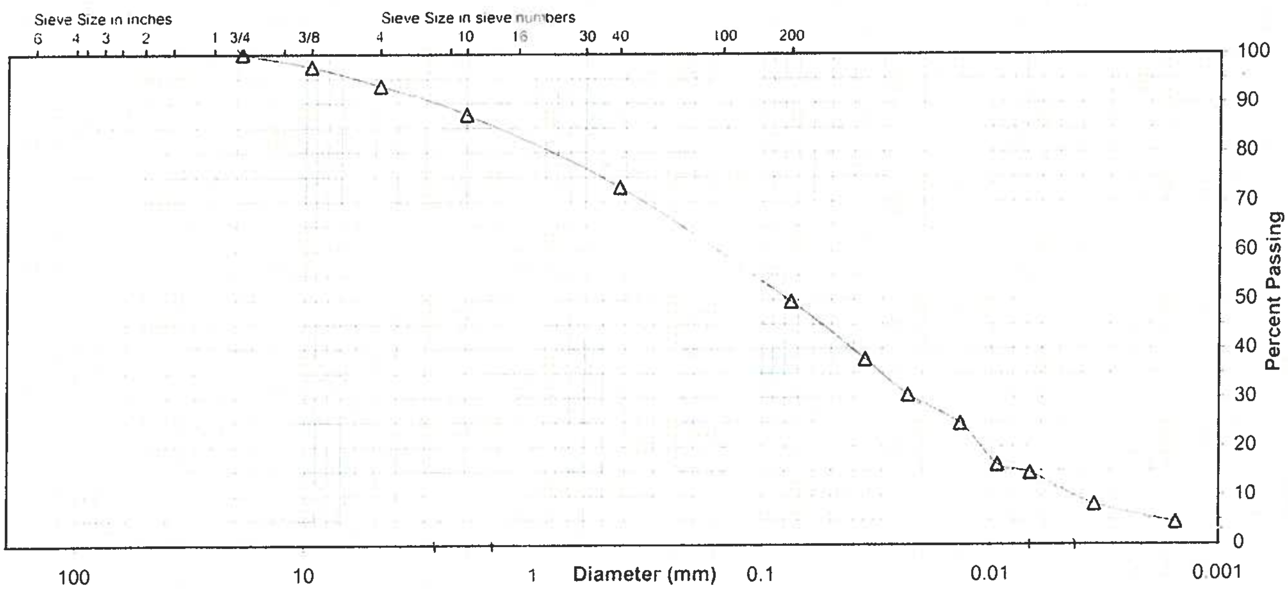
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	72.9
No. 200	49.6
0.02 mm	28.7
0.005 mm	11.5
0.002 mm	5.4
0.001 mm	3.0

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	6.5	5.8	14.8	23.3	38.1	11.5

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	12.3	14.8	23.3	44.2	5.4



Comments

Reviewed By

Appendix A

Stantec

Summary of Soil Tests

Project Name	Bull Run Fossil Plant (TVA)	Project Number	172679015
Source	STN-48, 3.0'-4.5', 6.0'-7.5', 9.0'-10.5', 12.0'-13.5'	Lab ID	3155
County	Clinton, Tennessee	Date Received	2-2-10
Sample Type	SPT Comp	Date Reported	2-10-10

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.3
No. 4	4.75	97.3
No. 10	2	93.2
No. 40	0.425	86.4
No. 200	0.075	74.1
	0.02	46.9
	0.005	15.2
	0.002	5.0
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	2.7	6.8
Coarse Sand	4.1	6.8
Medium Sand	6.8	---
Fine Sand	12.3	12.3
Silt	58.9	69.1
Clay	15.2	5.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Estimated

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.30

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Reviewed by:

Appendix A

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Bull Run Fossil Plant (TVA)	Project Number	172679015
Source	STN-48, 3.0'-4.5', 6.0'-7.5', 9.0'-10.5', 12.0'-13.5'	Lab ID	3155

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: JF
Test Date: 02-04-2010
Date Received 02-02-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.3
No. 4	97.3
No. 10	93.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.3

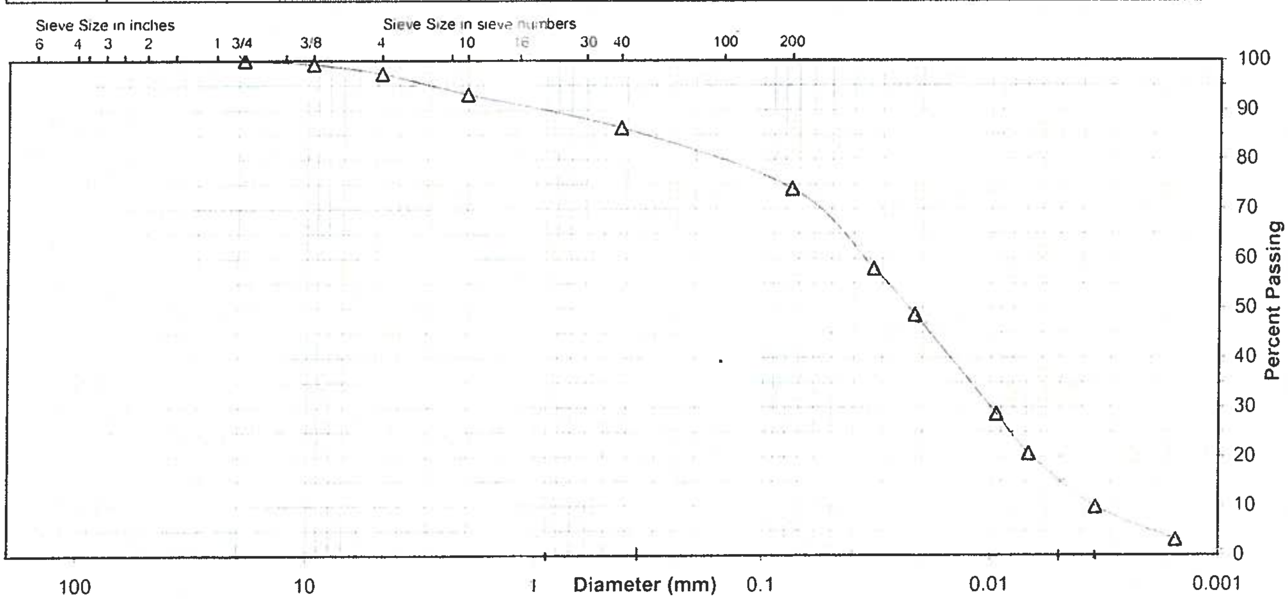
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	86.4
No. 200	74.1
0.02 mm	46.9
0.005 mm	15.2
0.002 mm	5.0
0.001 mm	1.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	2.7	4.1	6.8	12.3	58.9	15.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	6.8	6.8	12.3	69.1	5.0



Comments

Reviewed By

Appendix B

Stantec

Gradation Analysis
ASTM C 136

Project Name Scrubber Sludge Complex Geotechnical Exploration
Source Sand Bag Sample

Project Number 175569040
Lab ID 6
Date Received 11-20-2009
Preparation Date 11-20-2009
Test Date 11-24-2009

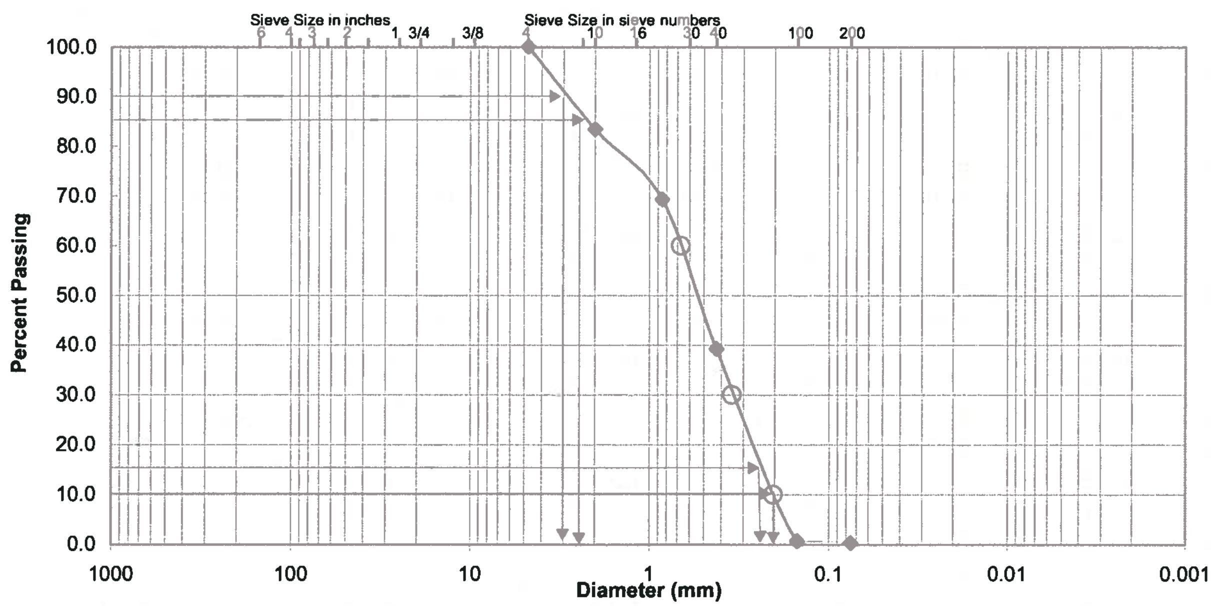
Preparation Method ASTM C 117 Method A
Particle Shape Rounded
Particle Hardness Hard and Durable
Sample Dry Mass (g) 936.16
Moisture Content (%) 4.8

Analysis based on total sample.

Sieve Size	Grams Retained	% Retained	% Passing	Alternate % Passing
3/8"	0.00	0.0	100.0	
No. 4	21.68	2.3	97.7	100.0
No. 10	151.53	16.2	81.5	83.4
No. 20	129.24	13.8	67.7	69.3
No. 40	275.04	29.4	38.3	39.2
No. 100	352.46	37.6	0.7	0.7
No. 200	3.56	0.4	0.3	0.3
Pan	2.65	0.3	---	---

% Gravel	0.0
% Sand	99.7
% Fines	0.3
Fines Classification	N/A
D_{10} (mm)	0.2042
D_{30} (mm)	0.3477
D_{60} (mm)	0.6689
Cu	3.28
Cc	0.89

Particle Size Distribution



Comments

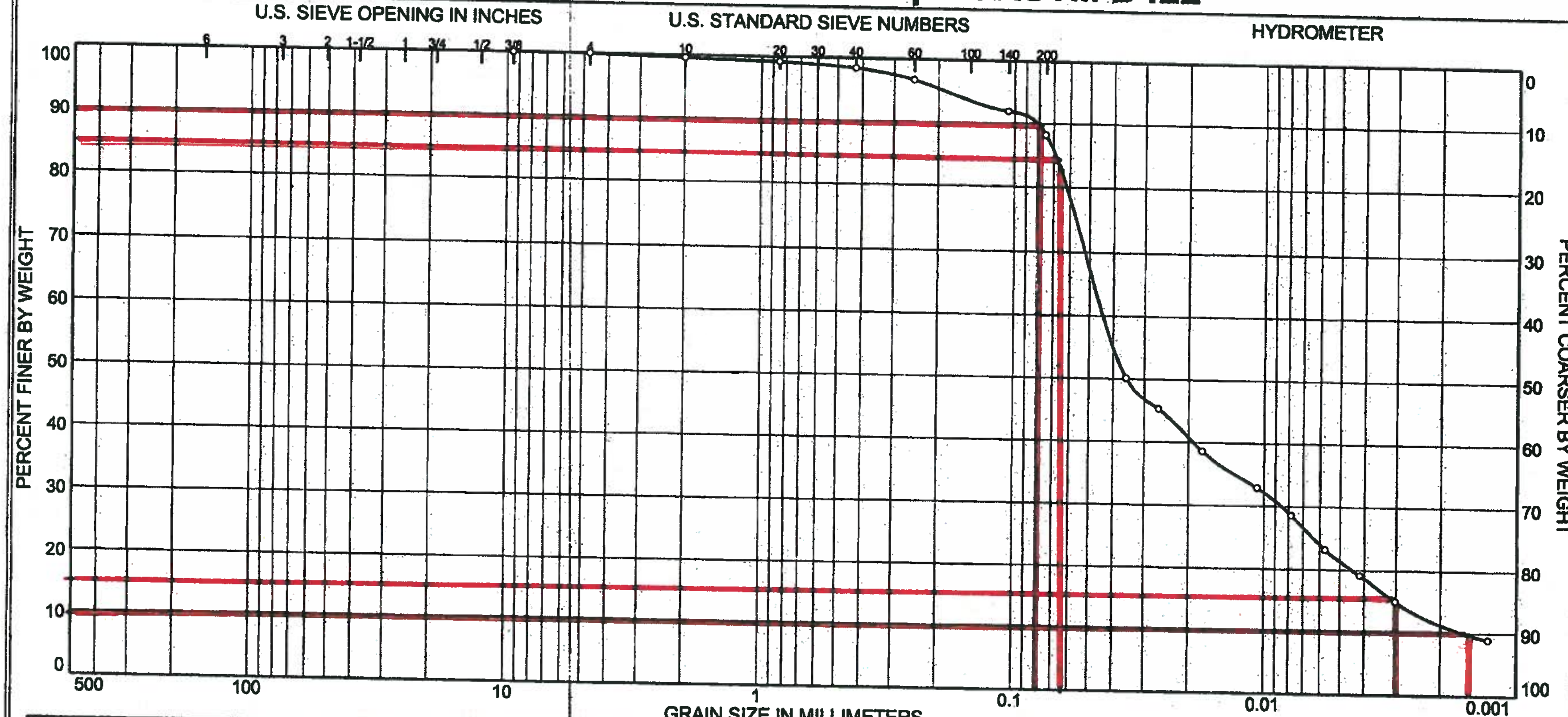
Reviewed By

Appendix C

		Fly Ash				Sand						*Optimum Range for D15 of Sand*				
Case	Lab ID	d90	d85	d15	d10	D90	D85	D15	D10	Base Soil Category	Filter	Max. D15 (≤) [.7 x d85]	Min. D15 (≥) [3 x d15]	D15 Check	Permeability Ratio Check	Segregation Check
		mm	mm	mm	mm	mm	mm	mm	mm			mm	mm			
A	3150	2.8000	1.6000	0.0070	0.0040	3	2.5	0.25	0.2	2	Sand	1.12	0.021	Satisfied-D15 is within Optimum Range	Satisfied-D15/d15 ratio is greater than 5	Satisfies Table B-3
B	3155	0.9000	0.3600	0.0050	0.0035	3	2.5	0.25	0.2	2	Sand	0.25	0.015	Satisfied-D15 is within Optimum Range	Satisfied-D15/d15 ratio is greater than 5	Satisfies Table B-3

Appendix D

Particle Size Distribution Report ASTM D422



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	11.8	66.9	21.3

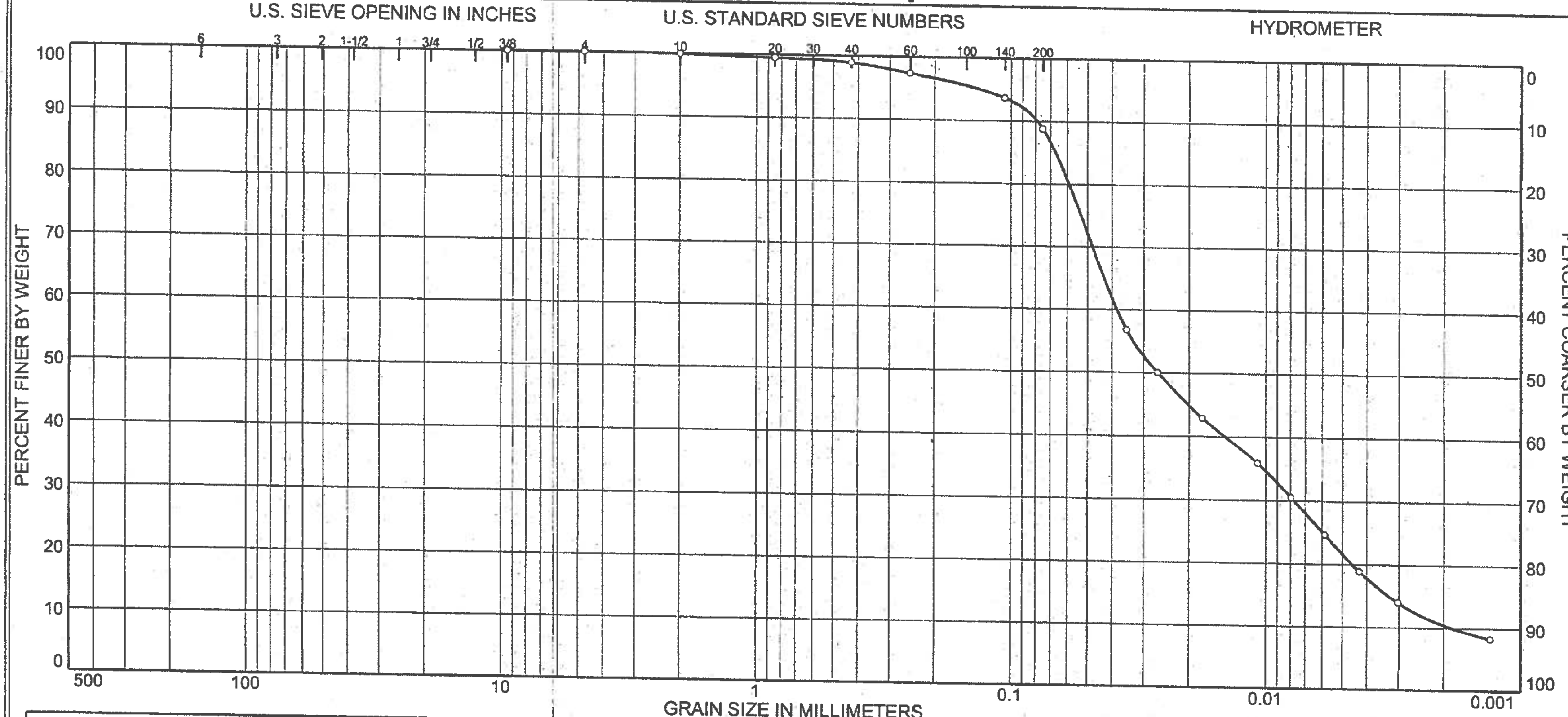
SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
	STN-49P	10-10.7 ft	10/22/09	ML	Gray ASH			

Client Stantec Consulting Services
Project Bull Run Fossil Plant
Project No. GTX-1494 Lab no.

GeoTesting Express Inc.

Appendix D

Particle Size Distribution Report ASTM D422



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	11.2	67.1	21.7

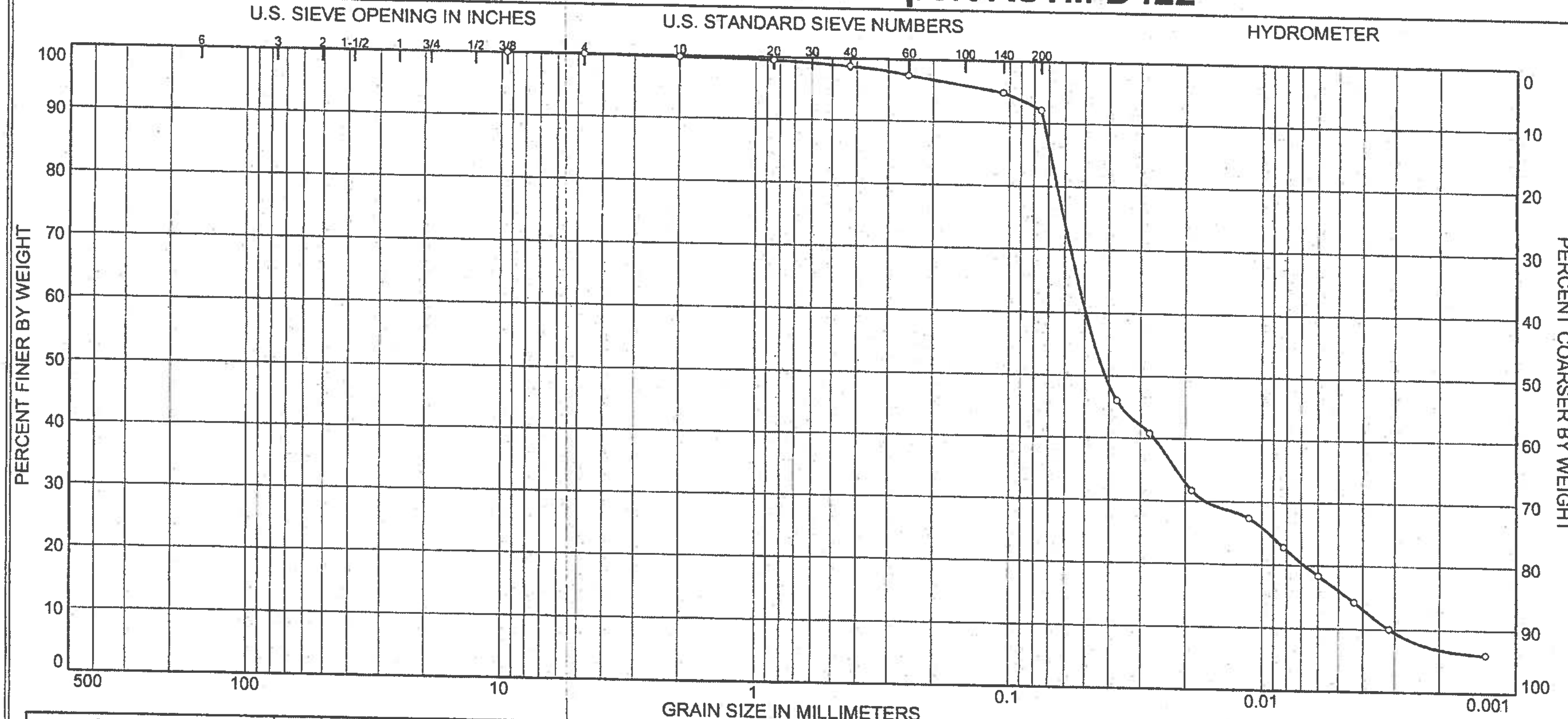
SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
	STN-49P	14.7-15.4 ft	10/22/09	ML	Gray ASH			

Client Stantec Consulting Services
Project Bull Run Fossil Plant
Project No. GTX-1494 Lab no.

GeoTesting Express Inc.

Appendix D

Particle Size Distribution Report ASTM D422



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	7.8	76.2	16.0

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○		STN-49P	22.7-23.4 ft	10/22/09	ML	Gray ASH			

Client Stantec Consulting Services

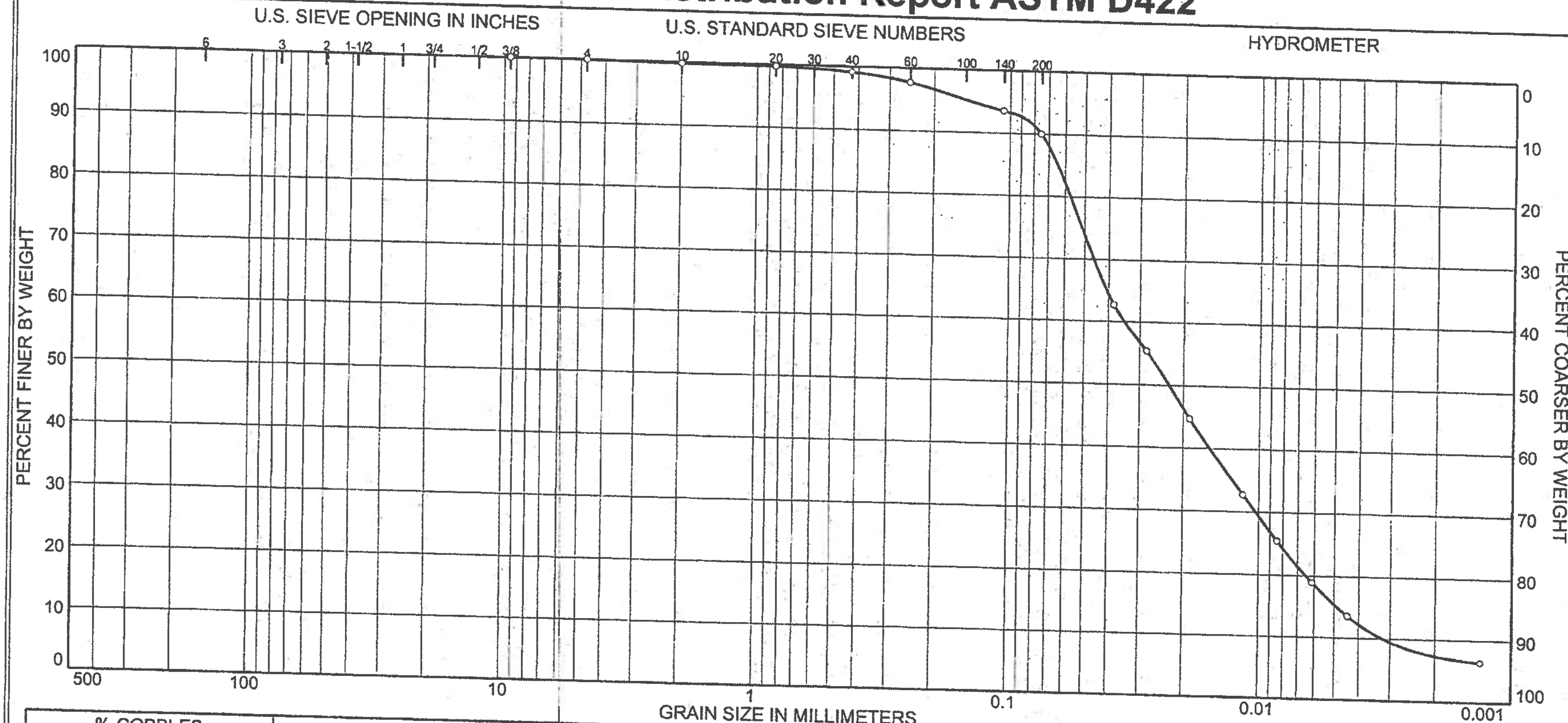
Project Bull Run Fossil Plant

Project No. GTX-1494 Lab no.

GeoTesting Express Inc.

Appendix D

Particle Size Distribution Report ASTM D422



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	10.0	74.7	15.3

SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
	STN-46P	7.5-8 ft	10/21/09	ML	Gray ASH			

Client Stantec Consulting Services

Project Bull Run Fossil Plant

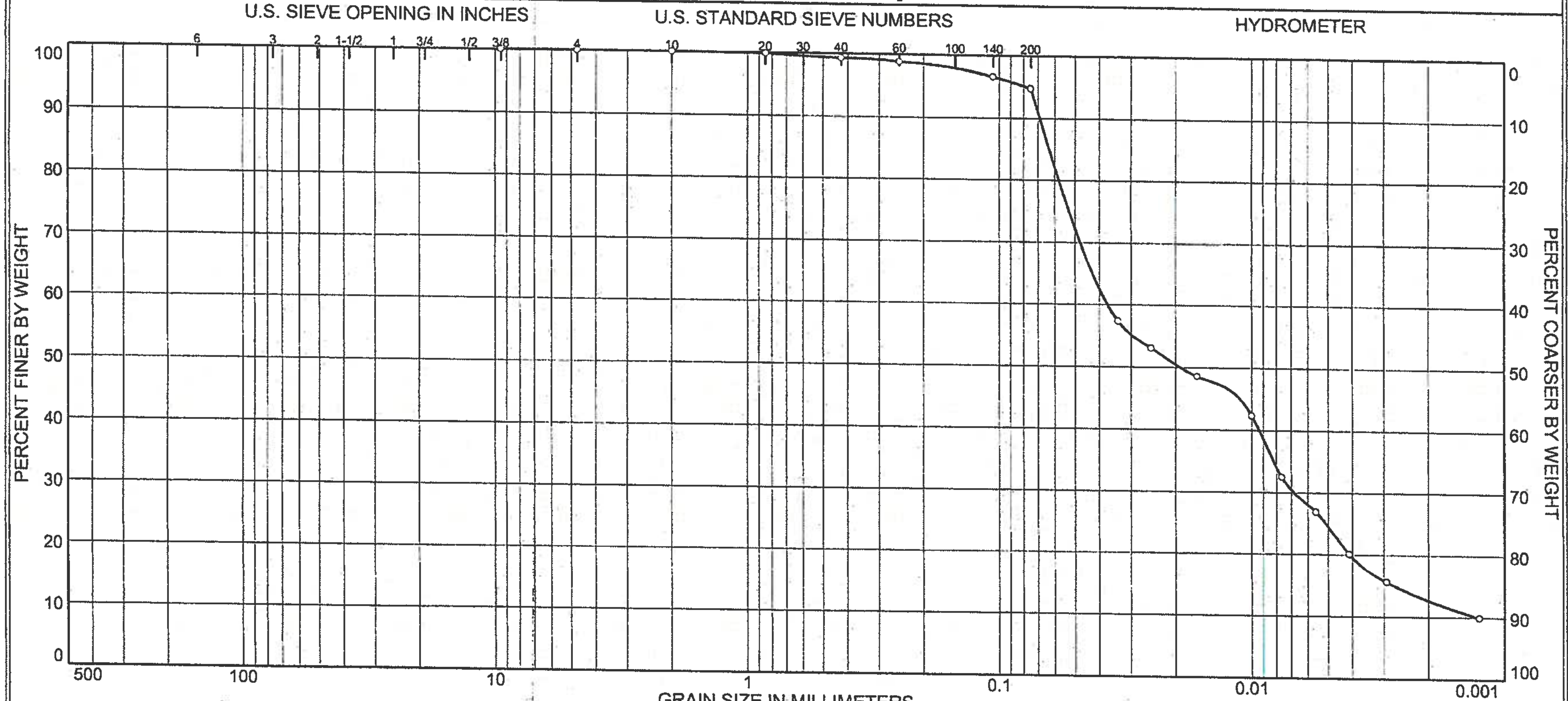
Project No. GTX-1494

Lab no.

GeoTesting Express Inc.

Appendix D

Particle Size Distribution Report ASTM D422



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	0.0	5.2	70.3	24.5

	SOURCE	SAMPLE #	DEPTH/ELEV.	DATE SAMPLED	USCS	MATERIAL DESCRIPTION	NM %	LL	PL
○		STN-46P	9.5-10 ft	10/22/09	ML	Gray ASH			

Client Stantec Consulting Services
Project Bull Run Fossil Plant

Project No. GTX-1494 | Lab no.

GeoTesting Express Inc.

Appendix E

			Fly Ash				Sand						Optimum Range for D15 of Sand				
Case	Boring	Depth (ft)	d90	d85	d15	d10	D90	D85	D15	D10	Base Soil Category	Filter	Max. D15 (≤) [9 x d85]	Min. D15 (≥) [3 x d15]	D15 Check	Permeability Ratio Check	Segregation Check
			mm	mm	mm	mm	mm	mm	mm	mm			mm	mm			
A	STN-49P	10.0 to 10.7	0.0800	0.0630	0.0030	0.0015	3	2.5	0.25	0.2	1	Sand	0.567	0.009	Satisfied-D15 is within Optimum Range	Satisfied-D15/d15 ratio is greater than 5	Satisfies Table B-3
B	STN-49P	14.7 to 15.4	0.0800	0.0700	0.0030	0.0018	3	2.5	0.25	0.2	1	Sand	0.63	0.009	Satisfied-D15 is within Optimum Range	Satisfied-D15/d15 ratio is greater than 5	Satisfies Table B-3
C	STN-49P	22.7 to 23.4	0.0820	0.0690	0.0049	0.0032	3	2.5	0.25	0.2	1	Sand	0.621	0.0147	Satisfied-D15 is within Optimum Range	Satisfied-D15/d15 ratio is greater than 5	Satisfies Table B-3
D	STN-46P	7.5 to 8.0	0.0750	0.0650	0.0045	0.0033	3	2.5	0.25	0.2	1	Sand	0.585	0.0135	Satisfied-D15 is within Optimum Range	Satisfied-D15/d15 ratio is greater than 5	Satisfies Table B-3
E	STN-46P	9.5 to 10.0	0.0700	0.0650	0.0025	0.0014	3	2.5	0.25	0.2	1	Sand	0.585	0.0075	Satisfied-D15 is within Optimum Range	Satisfied-D15/d15 ratio is greater than 5	Satisfies Table B-3

APPENDIX A

Document 12

URS. (May 24, 2011). Bull Run Fossil Plant – Wet Disposal Area Dike Stability Documentation

URS
1375 Euclid Avenue
Cleveland, OH 44115-1808
Tel: 216.622-2400

DRAFT MEMORANDUM

TO:	Rachel Combs - TVA	**DATE:**	May 24, 2011
BY:	Tom Kovacic, P.E. - URS Ken Berry, P.E. - URS	**PROJECT:**	TVA Bull Run Fossil Plant (BRF)
CC:	Richard Simmons – TVA Jeff Ward - TVA Keith Mast - URS David Skeggs – URS Lucas Carr – URS	**JOB NO.:**	31854166

RE: Bull Run Fossil Plant –Wet Disposal Area
Dike Stability Documentation

The purpose of this memorandum is to document the improvement of the stability of the dike system supporting the Wet Disposal Area at the Bull Run Fossil Plant (BRF).

Background

In 2009 at the request of TVA, Stantec Consulting Services, Inc. (Stantec) performed a subsurface exploration and slope stability evaluation of the Wet Disposal Area. Stantec's work is presented in their report entitled "Report of Geotechnical Exploration, Bottom Ash Disposal Area 1, Gypsum Disposal Area 2A and Fly Ash Pond Area 2, Bull Run Fossil Plant, Anderson County, Tennessee", dated April 12, 2010. Stantec's explorations included advancing 93 soil borings, installing geotechnical instrumentation, and performing a program of laboratory testing to establish shear strengths and other engineering properties of the dike materials and underlying foundation strata.

Using the data collected, Stantec performed slope stability evaluations (including limit equilibrium slope stability analyses in conjunction with finite element seepage analyses) of various locations of the dike. Stantec's evaluation indicated that the majority of the dike systems factor of safety against slope instabilities did not meet the requirements of TVA's Programmatic Document (i.e., factor of safety estimated was lower than 1.5 under long term, effective stress and steady-state seepage conditions).

Stantec calculated a global factor of safety for the Bottom Ash Disposal Area to be 2.1. The factors of safety for slopes of the Gypsum Disposal Area (Gypsum Stack), Fly Ash Pond, and Stilling Basin were all less than 1.5. Factors of safety are based upon possible movements that could breach the dikes. There may be surficial zones which, if failed, would produce a maintenance issue. These surficial zones are not included in the 1.5 factor of safety requirement.

Gypsum Stack

Beginning in 2009, TVA retained URS Corporation (URS) to design engineering works to improve and eventually close the Wet Disposal Area. Included in these works were various projects to improve the dike stability. In addition, Stantec designed a rock buttress to stabilize the southern berm of the gypsum stack and regrading of all of the slopes surrounding the Gypsum Stack. The rock buttress was completed in 2010. The regrading of the Gypsum Stack slopes was mainly to improve the site surface water drainage and was not required to improve the slope stability. The regrading is in progress and is expected to be completed this summer.

URS has designed French drains to be installed on the north, east, and west sides of the Gypsum Stack. French drains constructed lower in elevation on the north and west sides of the Gypsum Stack have been completed. These two drains were necessary to achieve slope stability factors of safety of 1.5 or greater for the existing Gypsum Stack geometry. French drains located higher in elevation on the north, east, and west sides are currently being installed. The contractor anticipates completion of the upper French drains by the end of June 2011. The upper French drains are needed to maintain the required factor of safety when a raise in the Gypsum Stack is constructed.

URS also designed minor regrading of the western slope of the Gypsum Stack to achieve the minimum factor of safety of 1.5. This regrading was performed in the Spring of 2011.

Fly Ash Pond and Stilling Basin

Since the beginning of 2010, the operating level of the Fly Ash Pond and Stilling Basin has been pumped down to approximately El. 801 or lower. This is approximately five feet lower than past operational levels. TVA intends to permanently modify the spillway structures to maintain this lower operating elevation by gravity flow. The design of these permanent modifications is currently underway and it is anticipated that construction will be performed within the next six months.

Perimeter rock protection has been added to the exterior of the dikes for the Wet Disposal Area. The rock protection supplements existing rock protection and improves the factor of safety to 1.5 when the pond is operated at elevation 801 or lower. Placement of the rock necessary to improve the factor of safety for the Fly Ash Pond and Stilling Basin was completed in May 2011. There is some additional rock which will be placed on the Fly Ash Pond at the Gypsum Stack during the summer of 2011. This additional rock is being placed for erosion protection only and does not impact the factor of safety for slope stability.

In addition, five partially abandoned pipes that penetrate the perimeter dikes in the Wet Disposal Area have been fully grouted. One pipe penetrated the south dike of the Fly Ash Pond. One pipe penetrated the west dike of the Stilling Basin. One pipe penetrated the west dike of the Fly Ash Pond at the Gypsum Stack, and two pipes penetrated the dikes adjacent to the Bottom Ash Disposal Area.

Conclusion

The operating pool level in the Fly Ash Pond has been lowered to El. 801 and will be maintained at El. 801 or lower. Construction of the French drains, perimeter rock protection, and grading have progressed to the point that the Gypsum Stack, Fly Ash Pond, and Stilling Basin slopes/dikes contain factors of safety greater than 1.5 against slope instabilities for the existing site geometry.

Based on our analyses and on the above summarized information, it is URS's opinion that the minimum factor of safety against global slope instability for the Gypsum Stack, Fly Ash Pond, and Stilling Basin has been improved to meet current TVA Programmatic Document requirements.

APPENDIX A

Document 13

URS (April 3, 2012) Construction Record Documentation Report BRF202207 and BRF 205823

CONSTRUCTION RECORD DOCUMENTATION REPORT

TVA BULL RUN FOSSIL PLANT ASH DISPOSAL COMPLEX

BRF-202207 FLY ASH POND CLOSURE (REMEDIATION SCOPE) BRF-205823 BOTTOM ASH / GYPSUM STACK PERIMETER IMPROVEMENTS

Prepared for:

Tennessee Valley Authority
1101 Market St.
Chattanooga, TN 37402-2801

DRAFT – Revision B

April 3, 2012

URS

1001 Highlands Plaza Dr. W., Ste. 300
St. Louis, Missouri 63116-1337
314-429-0100
Project No. 31854100

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This report summarizes the Construction Quality Assurance (CQA) monitoring activities for TVA Project ID BRF-205823, Bottom Ash Stack / Gypsum Stack Perimeter Improvements and TVA Project ID BRF-202207, Fly Ash Pond Closure (Remediation Scope). These projects were included in Drawings 10W509 and 10W213. Both projects pertain to CCP disposal areas 1, 2A, and 2 (bottom ash stack, gypsum stack, and fly ash pond), for the Tennessee Valley Authority (TVA) Bull Run Fossil Plant (BRF), located in Anderson County, Tennessee. The report is based upon reviews by URS Corporation (URS) and information provided by the contractors and material suppliers during construction and represents a determination that the work is in general conformance with the work plan.

1.1 PROJECT BACKGROUND

TVA retained Stantec Consulting Services (Stantec) to evaluate the seepage and slope stability of several of its CCP disposal areas, including disposal areas 1, 2A, and 2 at BRF. Following geotechnical investigations and analysis, Stantec determined that many of the perimeter dike slopes of the gypsum stack had slope stability factor of safety (FoS) values of less than 1.5. Stantec also determined through field inspection that previously placed rip-rap erosion protection was missing across much of the perimeter slopes. Additionally, Stantec noted five (5) abandoned spillway pipes partially penetrating the perimeter dikes

TVA retained URS Corporation to design outer perimeter dike improvements, including those necessary to raise the slope stability factor of safety to at least 1.5, to restore erosion protection, and to mitigate the risk associated with open abandoned pipe penetrations.

1.2 PROJECT DESCRIPTION

TVA Project ID BRF-205823 – Bottom Ash / Gypsum Stack Perimeter Improvements is covered by Drawings 10W509 and includes the placement and restoration of rip-rap buttressing and erosion protection for the perimeter dikes of the CCP disposal areas at BRF.

TVA Project ID BRF-202207 – Fly Ash Pond Closure (Remediation Scope) is covered by Drawings 10W509 and 10W213. The portion of the project covered by Drawings 10W509 includes the placement and restoration of rip-rap buttressing and erosion protection for the perimeter dikes of the CCP disposal area 2. Thin rip-rap buttressing was required to increase the slope stability FoS to at least 1.5 for ash disposal area 2. The portion of the project covered by Drawings 10W213 includes the grouting of eight (8) abandoned pipes. The open pipes, former spillways abandoned in the 1960's or 1970's, were found to partially penetrate the perimeter dikes of CCP disposal areas 1, 2A, and 2. Grouting of the pipes was required to reduce preferential pathways for seepage through the dikes and to prevent dike damage through structural collapse of the pipes. Five pipes were found and were grouted during construction.

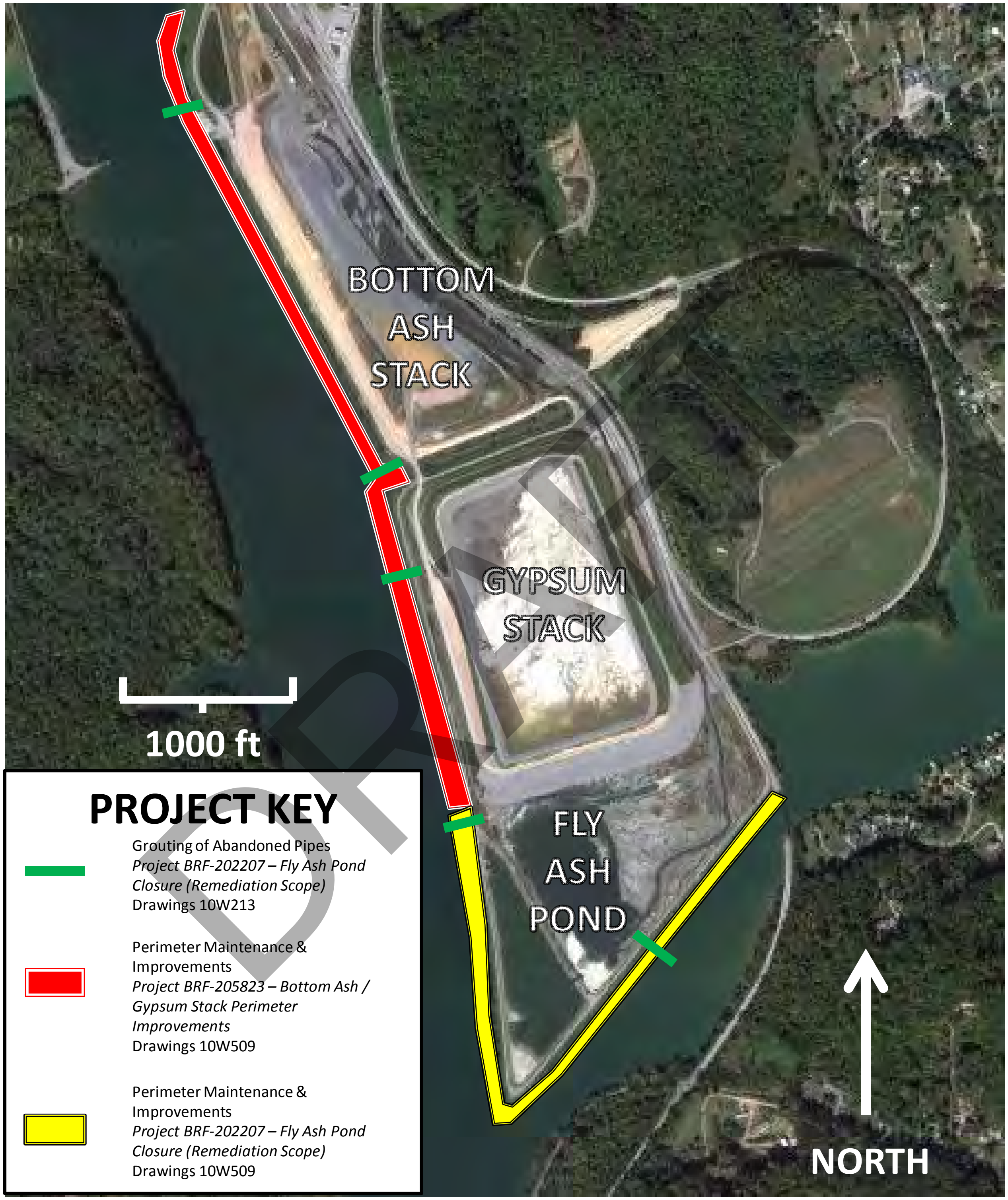

Figure 1 – Plan view of projects BRF-202207 and BRF-205823

Construction quality assurance (CQA) services were provided by URS for these construction activities from March 2011 through January 2012. The locations of each project are shown in Figure 1.

It should be noted that only the portions of TVA Project ID BRF-202207 – Fly Ash Pond Closure covered by Drawings 10W213 and 10W509 have been designed and completed to date. The completed portions refer to the Remediation Scope, or work required to increase the slope stability FoS to at least 1.5 during normal pond operations. The remaining portions of the project, pertaining to final closure of the fly ash pond, will be designed and constructed at a later date.

2.1 CONSTRUCTION QUALITY ASSURANCE PLANS

The purpose of the CQA Plans is to outline the observation and testing requirements needed to document and verify that both the Tennessee Valley Authority (TVA) Projects BRF-202207 (Remediation Scope) and BRF-205823 are constructed in conformance with Work Plan Drawings 10W509-01 through 06 and 10W213-01 through 10, respectively. Two CQA plans were prepared, one for each of the two Work Plan Drawings.

The CQA Plans detail the material requirements, sampling and testing procedures, testing frequency, testing parameters, sampling locations, surveying, required documentation, and procedures to follow in the case of a test failure.

CQA started at the beginning of the projects during preparation of the engineering plans and specifications. At this stage, the CQA plans outline means and actions to be employed by the Owner through the CQA team to evaluate and measure conformity with the design, production (manufacture and fabrication), and installation of materials in accordance with these CQA plans as well as with the design plans and specifications.

CQA includes actions taken by all parties including the designer, client, contractor, and/or installer, to document that their methods, materials, and workmanship are accurate and correct and meet the requirements of regulations, and are in accordance with the approved plans and specifications. CQA is provided by each party for its own work, product, or service.

The CQA Plans developed by URS for TVA Project IDs BRF-202207 (Remediation Scope) and BRF-205823 are provided in **Appendix A**.

2.2 CONSTRUCTION PROJECT PERSONNEL

The project team for the Bull Run Perimeter Maintenance and Improvements and Grouting of Abandoned Pipes Construction Projects include the following personnel and their respective companies:

TVA (Owner)

Richard Simmons, PMP – Project Manager, CCP Projects
Rachel Combs – Program Manager, CCP Engineering
Sam Hixson – Sr. Water Specialist, Environmental
Steed Stagnolia – Program Administrator Environmental (PAE)
Andy Powell – Manager, CCP Construction Projects
Larry Harper – Civil Manager, CCP Projects
Elwyn "Buck" Collins – Assistant Manager, CCP Construction Projects

Civil Projects Group (CPG), (General Contractor)

Steve Cherry – Regional Manager
John Russell – Site Supervisor
Joel Elkins – Operator General Foreman

Subcontractors/Major Suppliers

Aquilex Hydrochem – Abandoned Pipe Cleaning
Crisp & Crisp – Shredding/Chipping of Cleared and Grubbed Vegetation
ESS – Rock Placement by Barge
MacTec – Concrete Testing
PCI – Abandoned Pipe Concrete & Grout Contractor
Rogers Group – Crushed Limestone Aggregate
Sani-Tech – Abandoned Pipe CCTV Inspection
Vaughn & Melton – Surveying

URS (Engineering and CQA)

Tom Kovacic – Project Manager
Ken Berry – Geotechnical Lead
Lucas Carr – Engineering Support
Dave Skeggs– Engineering Support
Tim Hicks – Resident Engineer
Walter Kowalewski – Resident Engineer

The address and phone number for the URS office responsible for the TVA Project ID BRF-202207 – Fly Ash Pond Closure (Remediation Scope) and BRF-205823 – Bottom Ash / Gypsum Stack Perimeter Improvements projects (Drawings 10W509 and 10W213) is:

URS Corporation
1001 Highlands Plaza Drive West
Suite 300
Saint Louis, Missouri 63110-1337
(314) 429-0100

TVA Project ID BRF-202207 – Fly Ash Pond Closure (Remediation Scope) and TVA Project ID BRF-205823 consisted of the following construction activities:

- Clearing and grubbing of woody vegetation along the perimeter dikes of the CCP disposal areas (Projects BRF-202207 [Remediation Scope] and BRF-205823, Drawing Set 10W509);
- Placement of rip-rap as erosion protection and thin buttressing in two zones (1 and 2) (Project BRF-202207 [Remediation Scope], Drawing Set 10W509);
- Placement of rip-rap as erosion protection in eleven zones (3 through 13) (Project BRF-205823, Drawing Set 10W509); and
- Cleaning and grouting of five abandoned spillway pipes (Project BRF-202207, Drawing Set 10W213).

Additionally, a permit for the work was secured from the US Army Corps of Engineers prior to the start of construction. The following sections describe the construction activities completed as part of the project. For more detail on the day-to-day construction activities, refer to the URS Field Representative's Daily Field Reports and Photo Logs provided in **Appendices B and C**. Material test results for the rip-rap material can be found in **Appendix D**. Record drawings versions of drawing sets 10W509 and 10W213 can be found in **Appendix I.**

3.1 CLEARING AND GRUBBING OF VEGETATION

Woody vegetation existed extensively on the perimeter dikes prior to construction, near the normal operating water level of the Clinch River (El. 795 ft) and slightly above. The presence of the vegetation made dike inspections difficult and compromised the integrity of the dikes due to root penetrations. Thus, vegetation removal was specified as part of the Fly Ash Pond Closure (Remediation Scope) and Bottom Ash / Gypsum Stack Perimeter Improvements projects (both covered in drawing set 10W509, and corresponding to TVA Project IDs BRF-202207 and 205823, respectively). The vegetation was removed prior to rock placement, typically using a trackhoe to scrape vegetation from the surface. Removed vegetation was then shredded into mulch prior to disposal. Vegetation removal occurred concurrently with rip-rap placement, with certain zones being cleared while rip-rap placement was underway in other zones.

3.2 PLACEMENT OF RIP-RAP IN ZONES 1 & 2

Rip-rap placement in Zones 1 and 2, included in project BRF-202207 – Fly Ash Pond Closure (Remediation Scope), was required to increase the slope stability FoS of the perimeter dikes of Ash Disposal Area 2 to at least 1.5, when coupled with an ash pond operating level of El. 801 ft. Additionally, the rip-rap added erosion protection to the dikes. As shown in the design drawings, both zones required rip-rap placement (TDOT Class A-1 machined rip-rap) to a thickness of 3 ft over the existing surface of the perimeter dikes. Rip-rap placement in Zone 1 was specified to extend from El. 779 ft to El. 795 ft while rip-rap placement in Zone 2 was specified to extend from El. 785 to El. 798 ft.

As rip-rap placement in Zones 1 and 2 was required to satisfy stability criteria, these zones were completed first, several months ahead of the rest of the remaining zones. Rip-rap placement for these zones began on March 24, 2011. CPG placed rip-rap from land using long-stick excavators. Rip-rap which was out of the reach of the excavators was placed from a barge using a clamshell bucket by ESS. A turbidity curtain was used to contain suspended sediments from construction activities. The location of the turbidity curtain was adjusted as necessary to contain all areas of the river where construction activities were occurring. All construction equipment used for rip-rap placement was equipped with GPS, with the intent of placing rip-rap to the final contours shown in the 10W509 drawing set. However, the final design contours in the drawing set were based off a limited amount of survey data in the river, and the actual design notes specified a minimum thickness of rip-rap over the actual existing field grade, rather than the surface shown in the drawings. Prior to April 9, 2011 URS field personnel viewed rip-rap placement and approved rip-rap placement based on both visual assessments (construction buckets were marked at 3' intervals to determine rip-rap thickness) and surveyed cross-sections of rip-rap placement provided by Vaughn & Melton. Vaughn & Melton began surveying both the existing ground surface and the final rip-rap surface after April 9, 2011, and provided cross-sections showing both surfaces. URS approved all rip-rap placement using this data thereafter. Final approval was made by URS, TVA CCP and TVA CPG for each cross section. Signed approval forms are located in **Appendix F**. Additional rock was required to meet the design requirements and was satisfactorily added from Sta. 69+50 to 70+50. Rip-rap placement in Zones 1 and 2 was completed on May 19, 2011.

3.3 PLACEMENT OF RIP-RAP IN ZONES 3 THROUGH 13

Rip-rap placement in Zones 3 through 13, project BRF-205823 – Bottom Ash / Gypsum Stack Perimeter Improvements, was only required to provide erosion protection to the perimeter dikes, and was not required to enhance the slope stability FoS, as the perimeter dikes contained in Zones 3 through 11 already had slope stability FoS of at least 1.5. As shown in the design drawings, each of the zones required rip-rap placement (TDOT Class A-1 Machined rip-rap) to a thickness of 1.5 ft from El. 788 ft to El. 798 ft. The plans identified that several of the zones were missing rip-rap completely (3, 6, 8, and 10) while the remaining zones were missing rip-rap sporadically (4, 5, 7, 9, 11, 12, and 13). The zones of completely or sporadically missing rip-rap were based on a field survey performed by Stantec and submitted to TVA in a memo titled *Recommended Actions – Slope Conditions of CCP Disposal Areas 2 and 2A*, dated April 16, 2010. It should be noted that although the memo title only references disposal areas 2 and 2A, missing rip-rap information for disposal area 1 was included in the memo.

The design drawings specified placement of a uniform layer of rip-rap across Zones 3, 6, 8, and 10 and allowed placement on an as-needed basis for Zones 4, 5, 7, 9, 11, 12, and 13. However, the as-needed basis was contingent on the rip-rap placement occurring while the adjacent Clinch River (Melton Hill Reservoir) was at a low pool level, and required a uniform placement of rip-rap otherwise. Rip-rap placement occurred while the Clinch River was at a normal pool level, so rip-rap was placed in a uniform 1.5 ft thick layer for the entirety of Zones 3 through 13, with only minor deviations.

Rip-rap placement for Zones 3 through 13 began on August 24, 2011. All rip-rap placement was performed using long stick excavators and dozers, with tracked dump trucks transporting rip-rap from onsite stockpile locations. Rip-rap placement proceeded by first constructing an access road near the toe of the perimeter dikes in areas where vegetation had been cleared and grubbed. The access road was constructed of rip-rap and No. 2 stone and provided a stable platform for equipment to work from and for rip-rap to be transported. Additionally, the access road functioned as the design top elevation of the rip-rap, as it was located at El. 798 ft. Turbidity curtains were used in the same manner as for Zones 1 and 2, with the curtains containing all areas of the river where construction was occurring. Vaughn & Melton provided surveyed cross-sections of the completed rip-rap, which were approved by URS after any necessary rip-rap additions were made. Final approval was made by URS, TVA CCP and TVA Civil Projects for each cross section. Signed approval forms are located in **Appendix F**.

A smaller amount of rip-rap was placed from Sta. 34+00 to 36+50 in Zone 7. This area is the "cove" or "horseshoe", where a drainage channel flowing between disposal areas 1 and 2A enters into the Clinch River. The reduction in rip rap, placed from approximately El. 793 ft to El. 798 ft, was approved by URS due to 1) the presence of a 72" CMP transferring flow into the Clinch River, which would have been obstructed by rip-rap placement using the design extents and 2) the presence of a thick layer of soft sediments in the cove area, indicating that excess quantities of rip-rap would be needed and minimal to no erosion has occurred in the area in the past. In addition, the design drawings included the removal of woody vegetation along the channel between the Bottom Ash Stack and the Gypsum Stack. TVA elected not to perform this portion of the work due to this work being scheduled under a separate future TVA project.

Rip-rap placement was increased in Zone 12, where an existing access ramp in the Clinch River was cleared of vegetation and covered with rip-rap to the same extents shown in the other zones. Rip-rap placement was not specified in this area in the design drawings due to potential use by others.

Two seepage zones were found during the rip-rap placement, both on the perimeter dikes of disposal area 2. One of the seeps was located around El. 798 ft and occurred in Zones 3 and 4, from Sta. 54+00 to Sta. 55+32. The other seep was located at the joint in previously-grouted Pipe 2, which is located in Zone 3. URS recommended placing reverse filters over both seepage zones. The reverse filter design was the same used by Stantec in their south toe buttress design for disposal area 2A, and consisted of 1 ft of ASTM C-33 concrete sand overlain by 1 ft of No. 57 stone and 1.5 ft of rip-rap.

Rip-rap placement in Zones 3 through 13 was completed on January 9, 2012. Various access roads constructed to provide access to the rip-rap zones were left in place to allow for easier future access to the zones. URS monitored construction activities as related to the site Storm Water Pollution Prevention Plan (SWPPP) throughout the placement of rip-rap in Zones 1 through 13. Documentation of this monitoring is attached in **Appendix G.** A project punchlist, listing completed dates of various items requiring attention near the end of the project, is attached in **Appendix H.**

3.4 CLEANING AND GROUTING OF ABANDONED PIPES

A total of five (5) abandoned spillway pipes were found by Stantec, as listed in a memo titled *Recommended Actions – Slope Conditions of CCP Disposal Areas 2 and 2A*, dated April 16, 2010. URS recommended filling these pipes with grout to reduce preferential seepage pathways through the perimeter dikes and to reduce the risk of perimeter dike damage due to a structural collapse of the pipe. URS also recommended the grouting of an additional three (3) spillway pipes shown on historic drawings. The pipes were grouted as part of Project BRF-202207 – Fly Ash Pond Closure (Remediation Scope). It should be noted that although the title of Project BRF-202207 references only the fly ash pond, abandoned pipes within the perimeter dikes of the bottom ash and gypsum stacks were also grouted as part of the same project.

Pipe grouting activities were performed between March 25th and April 3rd 2011, while the adjacent Clinch River (Melton Hill Reservoir) pool elevation was lowered. Only 5 of the 8 pipes could be located and were grouted. A detailed description of the pipe grouting is attached in **Appendix E** as a memo from URS titled *Summary of Abandoned Pipe Grouting*, submitted to TVA on April 8th, 2011. Material testing, in the form of unconfined compression tests of pipe grout and concrete, was performed as part of the construction program. Results from these tests, and specifications of the concrete and grout mixes used for the project, are attached in **Appendix D.** Each pipe was inspected using a CCTV survey prior to grouting. Video files of the CCTV inspection are attached as electronic files (DVD's) as **Appendix J.**

The signature of URS's authorized representative on this document represents that to the best of URS’s knowledge, information and belief in the exercise of its professional judgment, it is URS’s professional opinion that the aforementioned information is accurate as of the date of such signature. URS does not guarantee the performance of construction contractors, their materials, or assume responsibility for their failure to perform in accordance with the contract documents or applicable law. Any recommendation, opinion, or decisions by URS are made on the basis of URS's experience, qualifications and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on limited data and that actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care. Any inspection or observation by URS refers to the visual observation of the contractor's work so as to permit URS to render a professional opinion as to whether the contractor performed work in a manner indicating that the completed construction is in reasonable conformance with the contract documents. Further, such inspections, or observations by URS, are limited to spot checking, selective sampling, and similar methods of general observation of the work based on URS’s exercise of professional judgment.

ENGINEER'S CERTIFICATION
URS CORPORATION - MISSOURI, INC.
TVA BULL RUN FOSSIL PLANT
ANDERSON COUNTY, TENNESSEE

I, Kenneth M. Berry, P.E., being a Registered Professional Engineer in accordance with the Tennessee Professional Engineer's Registration do hereby certify to the best of my knowledge, information and belief, that the information contained in the accompanying report has been prepared in accordance with the accepted practice of engineering, is true and correct and is in accordance with the applicable Rules and Regulations of the Tennessee Department of Environment and Conservation.

SIGNATURE ____________________________________ DATE _______________

ADDRESS URS Corporation
1001 Highlands Plaza Drive West, Suite 300
Saint Louis, Missouri 63110-1337
TELEPHONE 314-429-0100

STATE OF MISSOURI
CITY OF SAINT LOUIS

On this, the ____ day of ____________________, 2012 before me a notary public, the above signed personally appeared Kenneth M. Berry known to me (or satisfactorily proven) to be the person whose name is subscribed to the within instrument and acknowledged that he executed the same for purposes therein contained.

In witness whereof, I hereunto set my hand and official seal.

____

NOTARY PUBLIC

Appendix A

Construction Quality Assurance Plans

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN
PERIMETER MAINTENANCE AND IMPROVEMENTS
ASH DISPOSAL AREA

Bull Run Fossil Plant
Anderson County, Tennessee

January 21, 2011
Rev 0

URS
1375 Euclid Ave., Suite 600
Cleveland, OH 44115

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TABLES

LIST OF APPENDICES

The purpose of the Quality Assurance/Quality Control Plan (QA/QC Plan) is to provide a means by which observations and tests that assist in evaluating whether the construction has been performed in accordance with the approved plans are completed and appropriately documented. This QA/QC Plan details the material requirements, sampling and testing procedures, testing frequency, testing parameters and sampling locations, surveying, required documentation and the procedures to follow in the case of a test failure.

The following section addresses QA/QC activities associated with components of the project. These components will include some, but not necessarily all, of the following:

- Materials;
- Construction Tolerances; and
- Submittals.

The construction drawings and specifications are the official documents controlling the QA/QC requirements. In the event of conflicts between information contained in this QA/QC Plan and the Contract Documents (Drawings and/or Specifications), the Contract Documents shall take precedence.

2.1 PERIMETER IMPROVEMENTS

The perimeter improvements consist of the installation of rip rap on the existing berms around the ash disposal area (Clinch River and Bull Run Creek) at the Tennessee Valley Authority (TVA) Bull Run Fossil Plant (BRF). The rip rap is designed to control erosion and increase the slope stability factor of safety to 1.5 or higher for the perimeter berms (when combined with other improvements at the site such as installation of French Drains, regrading at west berm of the Gypsum Stack, and maintaining the fly ash pond level to el. 801 feet or below). As shown in the design drawings, the rip rap will consist of Class A-1 Rip Rap (TDOT Specification Section 709.03). The rip rap will be installed on the west and south berms of the perimeter dikes for the ash pond system. Rip rap will be placed in the Clinch River and Bull Run Creek. The ash ponds are anticipated to be closed within 5 years and will be permanently drained at that time.

3.1 QUALITY ASSURANCE

Construction Quality Assurance (CQA) starts at the beginning of the project during preparation of the engineering plans and specifications. At this stage, the QA/QC plan outlines means and actions to be employed by the Owner through the CQA team to evaluate and confirm conformity with the design, production (manufacture and fabrication), and installation of equipment and materials in accordance with this QA/QC plan as well as with the design plans and specifications.

3.2 QUALITY CONTROL

Quality Control (QC) includes actions taken by all parties including the designer, contractor, manufacturer, fabricator, and/or installer, to document that their methods, materials, and workmanship are accurate and correct and meet the requirements of regulations, and are in accordance with the approved plans and specifications. QC is provided by each party for its own work, product, or service.

3.3 ROLES AND RESPONSIBILITIES

3.3.1 Owner and Operator

The plant and its ancillary functions are owned and operated by the Tennessee Valley Authority (Owner). The Owner will be responsible for overall management of construction activities including contracting and administration. The Owner will designate an on-site representative to serve as Construction Manager (CM). For the purpose of this project, the Project Manager (PM) will serve as the Owner Representative and oversee all aspects of the project.

3.3.1.1 Construction Manager

The role of the CM is solely dependent on the needs and preferences of the Owner. Comprehensive construction managers provide a wide range of services and can be involved in both the design and construction phases of a project. In general, a CM provides leadership to the construction team, and coordinates between the PM, CQA Consultant, and Contractor to plan and oversee the completion of a project. Responsibilities of the CM may include managing the budget, construction progress, schedule, and settling any disagreements between the Resident Engineer (RE) and the Contractor on issues that arise during construction CQA activities.

3.3.2 Contractor

The Contractors for the various work packages at the plant will be selected by the Owner. More than one Contractor may be on site at any given time. Each Contractor shall be responsible for construction activities associated with its project including meeting all of the requirements for project quality as defined in the construction plans and specifications for its work as well as that of the Subcontractors.

3.3.3 CQA Consultant

The CQA Consultant is responsible for making observations to provide written documentation that a facility is constructed in accordance with the applicable plans, specifications, and QA/QC Plan. The CQA Consultant for this project is URS Corporation. URS will contract with third-party testing firms to conduct on-site and laboratory testing, as necessary. The following section provides a description of the typical CQA Consultant team, including each member's roles and responsibilities.

3.3.3.1 Project Engineer

The CQA Project Engineer is responsible for providing engineering and technical support to the field CQA team throughout the construction process. The Project Engineer works closely with the CM to assist with calculations and complete take-offs in support of as-built quantities for payment. The Project Engineer also reviews submittals and Requests For Information from the Contractor, reviews and maintains QA/QC data, and coordinates all supplementary laboratory testing of soils. The Project Engineer will provide the following on-site QA personnel as needed and as directed by the CM:

- Resident Engineer;
- CQA Inspector;

3.3.3.2 Resident Engineer

The RE will monitor work to evaluate conformance with the construction plans and specifications. Specific duties include:

- Review Hold Points with the CM and Project Engineer to confirm critical design parameters and engineering precautions are acceptable before proceeding with construction.
- Coordinate submittals reviews with the Project Engineer for compliance with contract documents.
- Coordinate between the CM, Contractor and Project Engineer to resolve technical issues.
- Coordinate responses to RFIs and other technical issues with the Project Engineer.
- Monitor construction progress and review Contractor's Construction Quality Control (CQC) and as-built documentation on a daily basis.
- Represent the Project Engineer at on-site meetings.
- Plan, schedule and provide oversight of CQA testing and surveying subcontractors.

- Document construction progress and CQA activities with daily reports and photographs.
- Notify the TVA PM, CM and Project Engineer of any deficiency or non-conformance observed and document these deficiencies on a non-conformance form.
- Verify construction work is acceptable and formally release Hold Points.

The RE will distribute copies of test reports and other CQA documentation as directed by the CM.

3.3.3.3 CQA Inspector

The URS CQA Inspector will observe and document construction activities for compliance with the contract documents. Specific duties of the CQA inspector include:

- Observe and document all construction-related activities.
- Monitor delivery, handling and on-site storage of construction materials.
- Evaluate conformance of all borrow source materials.
- Observe material placement and testing (coverage and thickness of rip rap).

Other duties and responsibilities of the URS CQA inspector will be determined by the URS RE and TVA CM as the work progresses. The same person may perform the roles of both the RE and CQA Inspector.

3.4 MANDATORY QC HOLD POINTS

Work may not proceed beyond the following points until a member of the CQA Consultant team has completed the applicable QC test or confirmation and has notified the TVA CM.

Hold Point	Test or Confirmation [1]
Equipment Mobilization to Work Zone	QC Team to confirm stability of work zone to Contractor prior to moving equipment into the zone
Submittals	Approval from the Project Engineer
Install (and maintain) turbidity curtain as required in SWPPP	Confirm completion
Confirm construction survey stake-out	Observation and review of survey stake-out
Rip Rap placement	Confirm correct materials, dimensions and installation method
Vegetation layer	Confirm correct materials and installation method for site restoration
Contractor's Surveys and Accuracy	Confirm acceptable construction tolerances as specified in this CQA Plan

[1] ***Specific testing and acceptance criteria is specified in the Tables found at the end of this CQA Plan***

The CQA Consultant will advise the TVA CM that the Contractor should stop work in situations of recognizable stability issues, deviations from design, and significant cost or schedule impacts. The CM will obtain approval from the PM prior to stopping the Contractor's work. In situations where personnel safety is concerned, the CQA Consultant will advise the Contractor to stop work and notify the TVA CM as soon as possible of that action.

The following section discusses the specific QA/QC requirements for the testing and construction of materials.

4.1 RIP RAP

Rip rap is to be used for erosion protection and the increase of slope stability factors of safety as shown in the drawings.

4.1.1 Material, Construction, and Design Specifications

Material and construction specifications for rip rap are set forth in the project plans and specifications (must meet requirements in TDOT Specification Section 709.03).

4.1.2 Pre-Construction Conformance Testing

Rip rap shall be obtained from approved off-site borrow sources and shall satisfy the requirements in the Contract Documents throughout delivery and use of the materials. The Contractor shall submit certified laboratory test reports for each proposed rip rap source or supplier stating that said material meets or exceeds the requirements set forth in the project plans and specifications.

4.1.3 Construction

Rip rap shall be placed using equipment and methods that protect underlying materials and subgrades. It is anticipated that the contractor will be putting the rip rap in place using trackhoes. Trackhoes will be located both on the existing embankment and on a barge positioned in the river.

4.1.4 Construction Testing

Observation of rip rap placement should document that the correct material is utilized.

5.1 CONTRACTOR'S SURVEYS

Surveying will be performed by the Contractor. The purpose of the surveys is to verify that actual thickness and grades of the construction components are in accordance with the plans and specifications. Surveying of lines and grades will be conducted during construction. Surveying will be performed to provide documentation for record plans, verify quantities of rip rap and assist the Contractor in complying with the required grades. Review of the surveys conducted at the site will be part of the CQA program. The permanent benchmarks at the facility will be used for survey control. Surveying will be performed under the supervision of a qualified, professional Land Surveyor licensed in Tennessee.

Based on the control points provided by the Owner, the Contractor is to provide all temporary and permanent benchmarks, monuments, and increments needed to control work. If during the work, control points set by the Owner are disturbed by the Contractor, the Contractor shall replace same at no cost to the Owner.

It is noted that the rip rap is to be placed at the river's edge. Some rip rap will be placed in the wet. Surveys produced will need to include information for the full extent of the project including that portion out in the river.

5.1.1 As-Built Surveys

The Contractor shall complete as-built surveys in order to document the following:

- Quantities of all materials placed.
- As-built line and grade of all fills.

5.2 ACCURACY REQUIREMENTS & MEASUREMENT SPECIFICATIONS

Every determination of distance shall be made either directly or indirectly in such a manner that the linear error in the distance between any two points (not necessarily adjacent points) shall not exceed the reported distance divided by ten thousand (allowable linear error = reported distance divided by ten thousand) and every angular measurement shall be made in such a manner that the allowable (directional) error, in radians, shall not exceed the allowable linear error divided by the reported distance (allowable (directional) error = allowable linear error divided by reported distance). When the reported distance is less than two hundred feet, the linear error shall not exceed 0.02 feet.

5.3 ACCEPTABLE CONSTRUCTION TOLERANCES

Acceptable construction tolerances from plan dimensions, elevations and grades shall be as shown on the drawings and as indicated in Table 2.

5.4 SURVEYS BY OWNER OR ENGINEER

The Owner or Engineer may conduct additional surveys to monitor or document the work.

The following meetings will be held during the course of the construction phase:

- Construction Progress Meetings – Construction progress meetings will be held at the project site on a schedule established by the CM. A consistent day, time and location will be established. The construction progress meetings are to be attended by the Contractor and all key subcontractor representatives, the RE or other representative of the Project Engineer, the CM and any other Owner representatives as determined by the Owner. These meetings will be held to discuss construction progress, delays, design issues, QA/QC procedures, change orders, and Contractor submittals.

- Safety Meetings – The Contractor will hold safety meetings in accordance with its Site Health and Safety Plan. The Contractor's Site Health and Safety Plan must be submitted to the Owner prior to commencing construction activities. It is anticipated that these meetings will be held at the start of construction and then periodically as conditions change or as determined by the CM. Safety issues must include river safety since work will be performed at or in the river.

- Project Progress Meetings – Progress meetings for the overall project will be held on-site on a schedule (i.e. bi-weekly) established by the PM. The meeting will be attended by the PM, CM, RE, Design Contractor, Construction contractor, plant designated representative(s), and any other representatives determined by the PM. The purpose is to review the overall status of the project, schedule, budget, emerging issues, and any other items deemed necessary. The TVA PM will be responsible for the meeting agenda and the meeting minutes.

7.1 SUBMITTALS

Submittals shall include material data. Product data submittals are required to verify that the correct products will be installed on the project. The product data submittal usually consists of the material product information from the supplier.

A list of required submittals is included as Table 3.

7.1.1 Submittal Procedures

Contractor shall initially submit to the Project Engineer a minimum of 4 copies of all submittals. One copy of the submittal will be returned to Contractor. A letter of transmittal shall accompany each submittal. At the beginning of each letter of transmittal provide a reference heading indicating the following:

- Owner's Name
- Project Name
- Contract No.
- Transmittal No.
- Specification or Drawing Reference

It is the Contractor's responsibility to review submittals made by his suppliers and Subcontractors before transmitting them to the Project Engineer. The Contractor's review is intended to maintain proper coordination of the Work and to determine that each submittal is in accordance with his desires, and that there is sufficient information provided for the Project Engineer to determine compliance with the Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.

7.1.2 Submittal Review and Approval

After the Construction Manager completes his review, submittals will be marked with one of the following notations:

- Approved
- Approved as Corrected
- Revise and Resubmit
- Not Approved

If a submittal is acceptable, it will be marked "Approved" or "Approved as Corrected". Upon return of a submittal marked "Approved" or "Approved as Corrected", Contractor may order the materials included in the submittal, provided it is in accordance with the corrections indicated. If a submittal is unacceptable, 2 copies will be returned to Contractor with one of the following notations: "Revise and Resubmit" or "Not Approved".

Upon return of a submittal marked "Revise and Resubmit", Contractor shall make the corrections indicated and repeat the initial approval procedure. The "Not Approved" notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, Contractor shall repeat the initial approval procedure utilizing acceptable material or equipment. Any related Work performed or equipment installed without an "Approved" or "Approved as Corrected" submittal will be the sole responsibility of the Contractor.

The Construction Manager will review and process all submittals promptly, but a reasonable time should be allowed for this.

7.2 REQUESTS FOR INFORMATION (RFI)

The purpose of this procedure is to define and detail the Request For Information (RFI) process. RFIs must be processed expeditiously in order to avoid the possibility of delay to the project. A RFI is a form established for the Contractor's use to request information and/or clarification related to the plans, specifications, or contract requirements. RFIs are also submitted to request approval for minor deviations from contract requirements that do not involve any time or cost adjustment; and to obtain directions on how to proceed when there are conflicting contract requirements. Please note that the RFI shall not be used as a substitute for items specifically requiring a submittal from the Contractor. RFIs shall not be used to change the design. If a change in the design is needed (i.e., based on an RFI response), then a change order must be issued.

7.2.1 RFI Procedures

The following procedures should be followed for filing, reviewing, and responding to RFI's:

- The Contractor will submit RFI to the CM.
- The CM completes, sequentially numbers, and submits the RFI form to the Project Engineer
- The Project Engineer enters the RFI in a tracking log
- The Project Engineer will review and respond to the RFI or assign to the RE to obtain a response.
- If the RFI will lead to a Change Order, the Project Engineer will submit to the CM for review and to the PM for approval.
- If the RFI does not lead to a Change Order, the Project Engineer will sign and return the RFI to the Contractor.

The RFI form should be agreed upon prior to the start of construction. RFIs may be submitted electronically if all parties agree.

7.3 PROJECT DOCUMENTATION

Project documentation shall be collected and maintained on-site by the CM. The Contractor and RE shall submit project documentation to the CM on a weekly basis. Copies should be maintained by the Contractor and the RE for back-up. Appendix A of this QA/QC Plan includes several examples of Construction Documentation Forms that will be generated by the Contractor and the RE, may including the following:

- Inspector's Daily Report
- Submittal Log
- Red-lined drawings on completed work

These forms represent examples, however may be modified as deemed appropriate based on the requirements of the Owner and/or Project Engineer.

Copies of conformance testing and manufacturer's certificates are to be forwarded to the CM for review and shall be included in the project records.

TABLES

TVA BULL RUN FACILITY
TABLE 1
MINIMUM TESTING REQUIREMENTS FOR MATERIAL COMPONENTS

COMPONENT	REQUIRED TEST OR OBSERVATION	TEST METHOD	MINIMUM FREQUENCY	SAMPLE SIZE	ACCEPTABLE CRITERIA	RESPONSIBLE PARTY
Testing for on-site and off-site sources of rip rap	Particle Size	ASTM D 5519	1/5000 cy	N/A	Section 709.03 of TDOT Standard Specifications	Contractor to obtain documentation from Quarry.

TVA BULL RUN FACILITY
TABLE 2
CONSTRUCTION TOLERANCES

COMPONENT	ACCEPTABLE CRITERIA	RESPONSIBLE PARTY
Excavations and final grades for surfaces and slopes.	$\pm$ 0.25 Feet Vertical	Contractor
	$\pm$ 0.25 Feet Horizontal	Contractor

Notes: 1.) Field determination method will be dependent upon equipment used for installation. The method will need to be approved by the construction manager prior to commencement of rip rap installations.

2.) Minimum testing frequency is once per 50 linear feet.

TVA BULL RUN FACILITY
TABLE 3
SUBMITTALS

SUBMITTAL NUMBER	DESCRIPTION
1	Contractor's Construction Plan and Schedule
2	Contractor's Health and Safety Plan
3	Supplier's certification and test results for rip rap
4	As-built surveys and drawings

APPENDIX A

Construction Documentation Forms

URS

Sheet: ____ of ____
Date: ____

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase:

Job No. | TVA Project ID | Consecutive Report No.

Summary of Construction/Operation Activities:

Construction Manpower:

Equipment:

Summary of Daily Observations (Include any Problems and Resolutions):

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
		ft	ft
		ft	ft

Surveyor's Activities:			Visitors:	Construction Materials/Items Installed:
Weather:	AM:	PM:	Contractor Started Work:	Field Representative Started Work:
Temperature:	AM: deg	PM: deg	Contractor Stopped Work:	Field Representative Stopped Work:
Field Representative:			Field Representative's Signature:	Date:
Reviewed by:			Reviewer's Signature:	Date:

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS
1375 Euclid Ave Suite 600
Cleveland, OH 44115-1808
Tel: 216.622.2400
Fax: 216.622.2428

REQUEST FOR INFORMATION

TO: **DATE:**

PROJECT: **TVA WIDOWS CREEK FOSSIL PLANT**

BY: **RFI NO. :**

RE:

COPIES:

REQUEST:

SIGNED: ______________________

RESPONSE:

SIGNED: ______________________

DATE: ______________________

COMPANY: ______________________

Note: Responses contained herein DO NOT constitute changes to the contract documentation. THIS IS NOT AN AUTHORIZATION TO PROCEED WITH WORK INVOLVING ADDITIONAL COST OR TIME.

URS

SHOP DRAWING / SUBMITTAL LOG

Project: ______________________

Contractor: ______________________

Owner: ______________________

URS Job No. ______________________

Original Submittal				Re-submittal			
Transmittal Number	Date Received	Date Returned	Status	Date Received	Date Returned	Status	Description

COPIES ______________________

____

BY: ______________________

RESIDENT REPRESENTATIVE

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN
GROUTING OF ABANDONDED PIPES IN PERIMETER BERMS
ASH DISPOSAL AREA

Bull Run Fossil Plant
Anderson County, Tennessee

TVA

March 4, 2011
Rev 0

URS
1375 Euclid Ave., Suite 600
Cleveland, OH 44115

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The purpose of the Quality Assurance/Quality Control Plan (QA/QC Plan) is to provide a means by which observations and tests that assist in evaluating whether the construction has been performed in accordance with the approved plans are completed and appropriately documented. This QA/QC Plan details the material requirements, sampling and testing procedures, testing frequency, testing parameters and sampling locations, surveying, required documentation and the procedures to follow in the case of a test failure.

The following section addresses QA/QC activities associated with components of the project. These components will include some, but not necessarily all, of the following:

- Construction Procedures;
- Materials;
- Construction Tolerances; and
- Submittals.

The construction drawings and specifications are the official documents controlling the QA/QC requirements. In the event of conflicts between information contained in this QA/QC Plan and the Contract Documents (Drawings and/or Specifications), the Contract Documents shall take precedence.

2.1 GROUTING OF ABANDONED PIPES

This project includes the final closure by-grouting in-place of eight (8) abandoned pipes and possibly more within the perimeter dikes around the ash disposal area at the Tennessee Valley Authority (TVA) Bull Run Fossil Plant (BRF). The pipe grouting is designed to reduce preferential pathways for seepage through the dikes and to prevent the possibility of future structural collapse of the pipe. The pipe grouting operation includes constructing sandbag cofferdams, if necessary, at the pipe outlets to allow for working space, inspecting and cleaning the pipes, filling the pipes with grout, and restoring the area disturbed by construction.

The abandoned pipes are located at elevations close to the normal pool level of the Clinch River, and some are located in areas where the ground slopes steeply beneath the normal water level of the Clinch River. All pipes are currently either partially or fully submerged. Two methods of pipe grouting are presented within the contract documents, so the more appropriate option can be used at each pipe. Also a second option is available should problems be encountered during grouting using the first option.

3.1 QUALITY ASSURANCE

Construction Quality Assurance (CQA) starts at the beginning of the project during preparation of the engineering plans and specifications. At this stage, the QA/QC plan outlines means and actions to be employed by the Owner through the CQA team to evaluate and confirm conformity with the design, production (manufacture and fabrication), and installation of equipment and materials in accordance with this QA/QC plan as well as with the Contract Documents.

3.2 QUALITY CONTROL

Quality Control (QC) includes actions taken by all parties including the designer, contractor, manufacturer, fabricator, and/or installer, to document that their methods, materials, and workmanship are accurate and correct and meet the requirements of regulations, and are in accordance with the approved plans and specifications. QC is provided by each party for its own work, product, or service.

3.3 ROLES AND RESPONSIBILITIES

3.3.1 Owner and Operator

The plant and its ancillary functions are owned and operated by the Tennessee Valley Authority (Owner). The Owner will be responsible for overall management of construction activities including contracting and administration. The Owner will designate an on-site representative to serve as Construction Manager (CM). For the purpose of this project, the CM will serve as the Owner Representative and oversee all aspects of the project.

3.3.1.1 Construction Manager

The role of the CM is solely dependent on the needs and preferences of the Owner. Comprehensive construction managers provide a wide range of services and can be involved in both the design and construction phases of a project. In general, a CM provides leadership to the construction team, and coordinates between the PM, CQA Consultant, and Contractor to plan and oversee the completion of a project. Responsibilities of the CM may include managing the budget, construction progress, schedule, and settling any disagreements between the Resident Engineer (RE) and the Contractor on issues that arise during construction CQA activities.

3.3.2 Contractor

The Contractors for the various work packages at the plant will be selected by the Owner. More than one Contractor may be on site at any given time. Each Contractor shall be responsible for construction activities associated with its project including meeting all of the requirements for project quality as defined in the construction plans and specifications for its work as well as that of the Subcontractors.

3.3.3 CQA Consultant

The CQA Consultant is responsible for making observations to provide written documentation that a facility is constructed in accordance with the applicable plans, specifications, and QA/QC

Plan. The CQA Consultant for this project is URS Corporation. URS will contract with third-party testing firms to conduct on-site and laboratory testing, as necessary. The following section provides a description of the typical CQA Consultant team, including each member's roles and responsibilities.

3.3.4 Project Engineer

The CQA Project Engineer is responsible for providing engineering and technical support to the field CQA team throughout the construction process. The Project Engineer for this project is URS Corporation. The Project Engineer works closely with the CM to assist with calculations and complete take-offs in support of as-built quantities for payment. The Project Engineer also reviews submittals and Requests for Information from the Contractor, reviews and maintains QA/QC data, and coordinates all supplementary laboratory testing of grout and materials. The Project Engineer will provide the following on-site QA personnel as needed and as directed by the CM:

- Resident Engineer;
- CQA Inspector.

3.3.5 Resident Engineer

The Resident Engineer (RE) will monitor work to evaluate conformance with the construction plans and specifications. The Resident Engineer for this project is URS Corporation. Specific duties include:

- Review Hold Points with the CM and Project Engineer to confirm critical design parameters and engineering precautions are acceptable before proceeding with construction.
- Coordinate submittals reviews with the Project Engineer for compliance with contract documents.
- Coordinate between the CM, Contractor and Project Engineer to resolve technical issues.
- Coordinate responses to RFIs and other technical issues with the Project Engineer.
- Monitor construction progress and review Contractor's Construction Quality Control (CQC) and as-built documentation on a daily basis.
- Represent the Project Engineer at on-site meetings.
- Plan, schedule and provide oversight of CQA testing and surveying subcontractors.
- Document construction progress and CQA activities with daily reports and photographs.
- Notify the TVA Project Manager, CM and Project Engineer of any deficiency or non-conformance observed and document these deficiencies on a non-conformance form.
- Verify construction work is acceptable and formally release Hold Points.

The RE will distribute copies of test reports and other CQA documentation as directed by the CM.

3.3.6 CQA Inspector

The URS CQA Inspector will observe and document construction activities for compliance with the contract documents. Specific duties of the CQA inspector include:

- Observe and document all construction-related activities.
- Monitor delivery, handling and on-site storage of construction materials.
- Evaluate conformance of all construction materials
- Observe grouting operation and testing

Other duties and responsibilities of the URS CQA inspector will be determined by the URS RE and TVA CM as the work progresses. The same person may perform the roles of both the RE and CQA Inspector.

3.3.7 Mandatory QC Hold Points

Work may not proceed beyond the following points until a member of the CQA Consultant team has completed the applicable QC test or confirmation and has notified the TVA CM.

Hold Point	Test or Confirmation [1]
Equipment Mobilization to Work Zone	QC Team to confirm stability of work zone to Contractor prior to moving equipment into the zone
Submittals	Approval from the Project Engineer
Confirm construction survey stake-out	Observation and review of survey stake-out
Confirm pipe survey	Confirm accuracy and completeness of pipe survey
Install (and maintain) cofferdams, if necessary	Confirm completion and maintenance
Confirm pipe cleaning	Confirm effectiveness of pipe cleaning and proper handling of debris
Confirm pipe outlet plugging	Confirm correct methods and installation
Confirm pipe grouting	Confirm correct materials, grouting method, and effectiveness of grouting
Contractor's Surveys and Accuracy Requirements	Confirm acceptable construction tolerances as specified in this CQA Plan

[1] ***Specific testing and acceptance criteria is specified in the Tables found at the end of this CQA Plan***

The CQA Consultant will advise the TVA CM that the Contractor should stop work in situations of recognizable stability issues, deviations from design, and significant cost or schedule impacts. The CM will obtain approval from the TVA PM prior to stopping the Contractor's work. In situations where personnel safety is concerned, the CQA Consultant will advise the Contractor to stop work and notify the TVA CM as soon as possible of that action.

4.1 CONSTRUCTION SCHEDULING

It is anticipated that this work will be completed during the week that the adjacent Melton Hill reservoir pool level is lowered from approximately El. 795 ft to El. 790 ft for annual dock maintenance. It is currently understood that this will occur between March 25th and April 3rd of 2011. However, the contractor shall verify the dates listed.

The contractor may choose to construct work pads and sandbag cofferdams as designed for each pipe during the time the reservoir is lowered, and then perform the actual pipe surveying, cleaning, and grouting at a later date. The appropriateness of using either option of pipe grouting and the use of the sandbag cofferdam will be determined by TVA.

4.2 PIPE LOCATION SURVEY

The outlet locations of Pipes 1, 2, 3, 7, and 8 have been located in the field. The outlet locations of Pipes 4, 5, and 6 have not yet been located, but their expected locations are shown in the Contract Documents.

4.2.1 Pipe Survey – Option A

It is TVA's desire to use Option A for grouting the abandoned pipes, if possible. TVA and the Engineer will make the determination about the removal of the end section of pipe once the reservoir is lowered and the pipe is exposed.

4.2.2 Pipe Survey – Option B

Option B will be used if timing, geometry, or field conditions dictate. TVA will make this determination TVA and the Engineer will make the determination about the removal of the end section of pipe once the reservoir is lowered and the pipe is exposed.

4.3 CCTV PIPE SURVEY

The insides of all pipes shall be surveyed using a closed-circuit television (CCTV) survey. The details of the CCTV pipe are listed in the Contract Documents.

4.4 PIPE CLEANING

Pipes shall be cleaned as necessary prior to the installation or construction of pipe plugs. The details of the required pipe cleaning are listed in the Contact Documents.

The following section discusses the specific QA/QC requirements for the testing and construction of materials.

5.1 SANDBAGS

Sandbags are to be used for constructing cofferdams to isolate the area around the pipe outlets from the river for the following purposes: (1) to provide dry working conditions while the river is at normal operating level, (2) to act as a containment dike for materials removed from the pipe during pipe cleaning, and (3) to contain liquid grout to be placed in the pipe in case the pipe plug is dislodged during grouting. The use of sandbags will be determined by TVA.

5.1.1 Material, Construction, and Design Specifications

Material and construction specifications for sandbags are set forth in the Contact Documents.

5.1.2 Pre-Construction Conformance Testing

Sand for sandbags shall be obtained from approved off-site borrow sources and shall satisfy the requirements in the Contract Documents throughout delivery and use of the materials.

Sandbags used for filling shall satisfy the requirements in the Contract Documents throughout delivery and use of the materials.

5.1.3 Construction

Sandbag cofferdams shall be placed using equipment and methods that protect underlying materials and subgrades. It is anticipated that the contractor will be constructing the sandbag cofferdams while the level in Melton Hill reservoir is lowered using an automatic sandbag filler to fill the bags and manual labor for bag placement.

5.1.4 Construction Testing

Observation of sandbagging construction shall document that the correct materials are utilized and that the sandbags are filled and placed in the correct manner as described in the Contract Documents.

5.1.5 Alternative Methods

The contractor may select an alternative type of cofferdam than sandbags if prior approval is obtained from the Engineer. Alternative cofferdam types include a rip-rap with sandbags or geosynthetics used to prevent water from flowing through the cofferdam. The use of temporary structures such as a portadam are also acceptable.

5.2 CONCRETE CUBES (OPTION A)

Concrete cubes (Option A) are to be constructed at the outlets of the pipes to be grouted. The cubes are to act as a containment structure for grout and to contain piping used for filling the pipe with grout.

5.2.1 Material, Construction, and Design Specifications

Material and construction specifications for concrete cubes are set forth in the Contract Documents.

5.2.2 Construction Testing

Observation of concrete cube construction should document that the cube is cast correctly at the outlet of the pipe, contains the specified reinforcement, and that grout, drainage, and vent pipes are placed correctly. The existing pipe outlet should also be cleaned adequately before the cube is constructed.

5.3 PNEUMTAIC PIPE PLUGS (OPTION B)

Pneumatic pipe plugs are to be placed within the outlets of the pipes to be grouted and are to be used to contain grout.

5.3.1 Material, Construction, and Design Specifications

Material and construction specifications for pneumatic pipe plugs are set forth in the Contract Documents.

5.3.2 Construction Testing

Observation of pneumatic pipe plug placement should document that the pipe plug is placed correctly within the pipe, with the pipe cleaned adequately before plug placement, and that the correct inflation pressure is maintained as set forth in the project plans and specifications.

5.4 GROUT

Grout is to be used to fill abandoned pipes to reduce preferential pathways for seepage within the perimeter dikes as shown in the Contract Documents.

5.4.1 Material, Construction, and Design Specifications

Material and construction specifications for grout are set forth in the Contract Documents.

5.4.2 Pre-Construction Conformance Testing

Grout shall be prepared on- or off-site using materials satisfying the requirements in the Contract Documents. The Contractor shall submit certified laboratory test reports for each component of the grout (Portland cement and sand) or supplier stating that said material meets or exceeds the requirements set forth in the Contract Documents.

5.4.3 Construction Testing

Observation of grouting shall document that the correct material is used and that the pipes are filled completely with grout.

6.1 CONTRACTOR'S SURVEY

Surveying will be performed by the Contractor. The purpose of the surveys is to verify that actual thickness and grades of the construction components are in accordance with the plans and specifications. Surveying of lines and grades will be conducted during construction. Surveying will be performed to provide documentation for record plans, verify quantities of rip rap and assist the Contractor in complying with the required grades. Review of the surveys conducted at the site will be part of the CQA program. The permanent benchmarks at the facility will be used for survey control. Surveying will be performed under the supervision of a qualified, professional Land Surveyor licensed in Tennessee.

Based on the control points provided by the Owner, the Contractor is to provide all temporary and permanent benchmarks, monuments, and increments needed to control work. If during the work, control points set by the Owner are disturbed by the Contractor, the Contractor shall replace same at no cost to the Owner.

It is noted that the sandbag cofferdams are to be placed at the river's edge. Some of the cofferdams may be placed in the wet. Surveys produced will need to include information for the full extent of the project including that portion out in the river.

6.1.1 As-Built Surveys

The Contractor shall complete as-built surveys in order to document the following:

- Quantities of all materials placed.
- As-built line and grade of all fills.

6.1.2 Accuracy Requirements & Measurement Specifications

Every determination of distance shall be made either directly or indirectly in such a manner that the linear error in the distance between any two points (not necessarily adjacent points) shall not exceed the reported distance divided by ten thousand (allowable linear error = reported distance divided by ten thousand) and every angular measurement shall be made in such a manner that the allowable (directional) error, in radians, shall not exceed the allowable linear error divided by the reported distance (allowable (directional) error = allowable linear error divided by reported distance). When the reported distance is less than two hundred feet, the linear error shall not exceed 0.02 feet.

6.1.3 Acceptable Construction Tolerances

Acceptable construction tolerances from plan dimensions, elevations and grades shall be as shown on the drawings and as indicated in Table 2.

6.1.4 Surveys by Owner or Engineer

The Owner or Engineer may conduct additional surveys to monitor or document the work.

The following meetings will be held during the course of the construction phase:

- Construction Progress Meetings – Construction progress meetings will be held at the project site on a schedule established by the CM. A consistent day, time and location will be established. The construction progress meetings are to be attended by the Contractor and all key subcontractor representatives, the RE or other representative of the Project Engineer, the CM and any other Owner representatives as determined by the Owner. These meetings will be held to discuss construction progress, delays, design issues, QA/QC procedures, change orders, and Contractor submittals.
- Safety Meetings – The Contractor will hold safety meetings in accordance with its Site Health and Safety Plan. The Contractor's Site Health and Safety Plan must be submitted to the Owner prior to commencing construction activities. It is anticipated that these meetings will be held at the start of construction and then periodically as conditions change or as determined by the CM. Safety issues must include river safety since work will be performed at or in the river and confined space entry, as applicable.
- Project Progress Meetings – Progress meetings for the overall project will be held on-site on a schedule (i.e. bi-weekly) established by the PM. The meeting will be attended by the PM, CM, RE, Design Contractor, Construction contractor, plant designated representative(s), and any other representatives determined by the PM. The purpose is to review the overall status of the project, schedule, budget, emerging issues, and any other items deemed necessary. The TVA PM will be responsible for the meeting agenda and the meeting minutes.

8.1 SUBMITTALS

Submittals shall include material data. Product data submittals are required to verify that the correct products will be installed on the project. The product data submittal usually consists of the material product information from the supplier.

A list of required submittals is included as Table 3.

8.1.1 Submittal Procedures

Contractor shall initially submit to the Project Engineer a minimum of 4 copies of all submittals. One copy of the submittal will be returned to Contractor. A letter of transmittal shall accompany each submittal. At the beginning of each letter of transmittal provide a reference heading indicating the following:

- Owner's Name
- Project Name
- Contract No.
- Transmittal No.
- Specification or Drawing Reference

It is the Contractor's responsibility to review submittals made by his suppliers and Subcontractors before transmitting them to the Project Engineer. The Contractor's review is intended to maintain proper coordination of the Work and to determine that each submittal is in accordance with his desires, and that there is sufficient information provided for the Project Engineer to determine compliance with the Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.

8.1.2 Submittal Review and Approval

After the Construction Manager completes his review, submittals will be marked with one of the following notations:

- Approved
- Approved as Corrected
- Revise and Resubmit
- Not Approved

If a submittal is acceptable, it will be marked "Approved" or "Approved as Corrected". Upon return of a submittal marked "Approved" or "Approved as Corrected", Contractor may order the materials included in the submittal, provided it is in accordance with the corrections indicated. If a submittal is unacceptable, 2 copies will be returned to Contractor with one of the following notations: "Revise and Resubmit" or "Not Approved".

Upon return of a submittal marked "Revise and Resubmit", Contractor shall make the corrections indicated and repeat the initial approval procedure. The "Not Approved" notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, Contractor shall repeat the initial approval procedure utilizing acceptable material or equipment. Any related Work performed or equipment installed without an "Approved" or "Approved as Corrected" submittal will be the sole responsibility of the Contractor.

The Construction Manager will review and process all submittals promptly, but a reasonable time should be allowed for this.

8.2 REQUESTS FOR INFORMATION (RFI'S)

The purpose of this procedure is to define and detail the Request For Information (RFI) process. RFIs must be processed expeditiously in order to avoid the possibility of delay to the project. A RFI is a form established for the Contractor's use to request information and/or clarification related to the plans, specifications, or contract requirements. RFIs are also submitted to request approval for minor deviations from contract requirements that do not involve any time or cost adjustment; and to obtain directions on how to proceed when there are conflicting contract requirements. Please note that the RFI shall not be used as a substitute for items specifically requiring a submittal from the Contractor. RFIs shall not be used to change the design. If a change in the design is needed (i.e., based on an RFI response), then a change order must be issued.

8.2.1 RFI Procedures

The following procedures should be followed for filing, reviewing, and responding to RFI's:

- The Contractor will submit RFI to the CM.
- The CM completes, sequentially numbers, and submits the RFI form to the Project Engineer
- The Project Engineer enters the RFI in a tracking log
- The Project Engineer will review and respond to the RFI or assign to the RE to obtain a response.
- If the RFI will lead to a Change Order, the Project Engineer will submit to the CM for review and to the PM for approval.
- If the RFI does not lead to a Change Order, the Project Engineer will sign and return the RFI to the Contractor.

The RFI form should be agreed upon prior to the start of construction. RFIs may be submitted electronically if all parties agree.

8.3 PROJECT DOCUMENTATION

Project documentation shall be collected and maintained on-site by the CM. The Contractor and RE shall submit project documentation to the CM on a weekly basis. Copies should be maintained by the Contractor and the RE for back-up. Appendix A of this QA/QC Plan includes several examples of Construction Documentation Forms that will be generated by the Contractor and the RE, may including the following:

- Inspector's Daily Report
- Submittal Log
- Red-lined drawings on completed work

These forms represent examples, however may be modified as deemed appropriate based on the requirements of the Owner and/or Project Engineer.

Copies of conformance testing and manufacturer's certificates are to be forwarded to the CM for review and shall be included in the project records.

TVA BULL RUN FACILITY
TABLE 1
MINIMUM TESTING REQUIREMENTS FOR CONCRETE AND GROUT

COMPONENT	REQUIRED TEST OR OBSERVATION	TEST METHOD	MINIMUM FREQUENCY	ACCEPTANCE CRITERIA	RESPONSIBLE PARTY
Concrete Mix Design	Submit for review	N/A	1 per mix	N/A	Contractor / Supplier
	Compressive Strength	ASTM C 39	3 per mix design	4,000 psi at 28 days	Contractor / Supplier
Cast-in-Place Concrete	Temperature	ASTM C 1064	1 / pour or 1 / 50 cy, whichever is more	$\leq 95°$	Contractor
	Slump	ASTM C 143	1 / pour or 1 / 50 cy, whichever is more	4 inches ± 1 inch	Contractor
	Air Entrainment	ASTM C 231	1 / pour or 1 / 50 cy, whichever is more	6 % ± 1%	Contractor
	Test Cylinders	ASTM C 31	1 set (4) / pour or 1 set (4) / 50 cy, whichever is more	N/A	Contractor
	Compressive Strength	ASTM C 39	1 at 7 days 2 at 28 days 1 spare	Average of 2 tests $\geq$ 4,000 psi at 28 days and each test is $\geq$ 3,800 psi	Contractor
Concrete reinforcing	Visual observation	N/A	All structures	Per Contractor's approved shop drawings	Contractor
Grout Mix Design	Submit for review	N/A	1 per mix	N/A	Contractor / Supplier
	Compressive Strength	ASTM C 942	3 per mix design	100 psi at 28 days	Contractor / Supplier
Grout Test Batch	Submit for Review	N/A	N/A	N/A	Contractor / Supplier
Grout Test Batch Testing	Flow Test	ASTM C 939	1 per test batch	Per Contractor's grouting plan	Contractor
	Shrinkage / Expansion	ASTM C 827	1 per test batch	± 0.5 %	Contractor
	Set Time	ASTM C 403	1 per test batch	Per Contractor's grouting plan	Contractor
	Compressive Strength	ASTM C 942	1 set (4) / pour or 1 set (4) / 50 cy, whichever is more	100 psi at 28 days	Contractor

TVA BULL RUN FACILITY
TABLE 2
CONSTRUCTION TOLERANCES

COMPONENT	ACCEPTABLE CRITERIA	RESPONSIBLE PARTY
Work Pad Cut Elevations	± 0.25 Feet Vertical	Contractor
Cofferdam Minimum Top Elevations	± 0.25 Feet Vertical	Contractor
Concrete Cube (Option A)	± 0.10 Feet Vertical	Contractor
	± 0.10 Feet Horizontal	Contractor
Pneumatic Plug Placement (Option B)	± 0.10 Feet along Pipe	Contractor
Grout Injection & Vent Port Placement (Option B)	± 0.25 Feet Horizontal	Contractor
	± 0.25 Feet Vertical	Contractor

Notes: 1) Field determination method will be dependent upon equipment used for installation. The method will need to be approved by the construction manager prior to commencement of grouting.

TVA BULL RUN FACILITY
TABLE 3
SUBMITTALS

SUBMITTAL NUMBER	DESCRIPTION
1	Contractor's Construction Plan and Schedule
2	Contractor's Health and Safety Plan
3	Supplier's certification and test results for sand, clay, and rip rap
4	Samples of imported soil materials to be used for fill
5	Manufacturer's product data and certified test results for pipe, filter sock, geotextile, and manholes.
6	As-built surveys and drawings

APPENDIX A

Construction Documentation Forms

Sheet: _____ of _____
Date: _______________

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND INSPECTION REPORT

Facility Name:	Project:	Project Phase:
Job No.		Consecutive Report No.

Summary of Construction/Operation Activities:

Summary of Daily Iuspectiou (Include any Problems and Resolutions):

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
		ft	ft
		ft	ft

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM:	PM:	Contractor Started Work:	Inspector Started Work:
Temperature:	AM: ___ deg	PM:___ deg	Contractor Stopped Work:	Inspector Stopped Work:
Inspector:			Inspector's Signature:	Date:
Reviewed by:			Reviewer's Signature:	Date:

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS
1375 Euclid Ave Suite 600
Cleveland, OH 44115-1808
Tel: 216.622.2400
Fax:216.622.2428

REQUEST FOR INFORMATION

TO: **DATE:**

PROJECT: **TVA WIDOWS CREEK FOSSIL PLANT**

BY: **RFI NO. :**

RE:

COPIES:

REQUEST:

SIGNED: ______________________________

RESPONSE:

SIGNED: ______________________________

DATE: ______________________________

COMPANY: ______________________________

Note: Responses contained herein DO NOT constitute changes to the contract documentation. THIS IS NOT AN AUTHORIZATION TO PROCEED WITH WORK INVOLVING ADDITIONAL COST OR TIME.

URS

SHOP DRAWING / SUBMITTAL LOG

Project: ______________________
Contractor: ______________________
Owner: ______________________
URS Job No. ______________________

Original Submittal				Re-submittal			
Transmittal Number	Date Received	Date Returned	Status	Date Received	Date Returned	Status	Description

COPIES ______________________

____

BY: ______________________

RESIDENT REPRESENTATIVE

URS

CONCRETE TESTING LOG

Project: ________________
Contractor: ________________
Owner: ________________
URS Job No. ________________

Specified Slump: ________
Specified Entrained Air: ________
Specified Compressive Strength: ________

Set Number	Sample Date	Ticket Number	Entrained Air (%)	Slump (inches)	Compressive Strength (psi)				Comments
					7 Day	28 Day	28 Day	56 Day	

COPIES ________________

____

BY: ________________

RESIDENT REPRESENTATIVE

Appendix B

Daily Reports

URS

Sheet: 1 of 1
Date: 2011-03-15

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 001

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection – Zones 8 and 9

8:00 am - Cat 320D Excavator with thumb attachment begins clearing vegetation in an effort to locate proposed pipe #6. Clearing is completed from approximate stations 30+00 – 32+50. Vegetation is removed and placed on dike slope within existing silt fence.
11:15 am - Begin placing rip rap to construct access road for equipment access to lower slope of cleared area.
1:00 pm – Attend pre-bid meeting for pipe grouting activities.

CPG Construction Manpower:

1 supervisor, 1 foreman, 2 operators, 2 laborers

Equipment:

In use today:	Idle Equipment:
1 – Case Excavator 1 – Morouka Track Truck 1 – Cat 320D Excavator with thumb attachment 2 – Dump Trucks (bringing rip rap from supplier) 1 – Cat D5 Dozer 1 – 300-ft turbidity curtain	3 – Morouka Track Truck 1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 1 – Cat 324D Long-Stick Hoe

Summary of Daily Observations (Include any Problems and Resolutions):

Pipe #6 was not located after clearing vegetation along the bank. The decision was made to discontinue search for Pipe #6. It is believed that the recently found Pipe #8 may actually be Pipe #6 (Pipe #8 is 24" dia. RCP approximately 200 feet south of area where Pipe #6 was believed to be located)

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	250 ft	250 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
None	None	

Weather:	AM: Rain	PM: Cloudy	Contractor Started Work: 8:30 am	Field Representative Started Work: 7:30 AM
Temperature:	AM: 50 deg.	PM: 55 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:15 PM

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/15/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 3/18/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-03-16

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 002

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection – Zones 8 and 9

8:15 am: CPG begins removing cleared vegetation from dike slopes Sta. 30+00 to 32+50
9:30 am: CPG stockpiling rip rap on south bench of bottom ash stack.
10:30 am: Begins placing rip rap on exterior dike
12:30 pm: Construction of gravel road for equipment access to dike slope
2:00 pm: Completes gravel road construction, resumes placement of rip rap on exterior dike
4:45 pm: CPG completes rock placement – approximate Sta. 31+00 to 32+50

CPG Construction Manpower:

1 supervisor, 1 foreman, 2 operators, 2 laborers

Equipment:

In use today:	Idle Equipment:
1 – Case Excavator	3 – Morouka Track Truck
1 – Morouka Track Truck	1 – Wilco Long-Stick Hoe
1 – Cat 320D Excavator with thumb attachment	1 – Cat 277B Front-End Loader
2 – Dump Trucks (bringing rip rap from supplier)	1 – Cat D6 Dozer
1 – Cat D5 Dozer	1 – Cat 324D Long-Stick Hoe
1 – 300-ft turbidity curtain	

Summary of Daily Observations (Include any Problems and Resolutions):

Observed track truck disturbing dike area outside silt fence and tracking mud into the rip rap being placed. Discussed observations with Larry Harper and Mike Wray. Resolution was placement of gravel access road over disturbed area to stabilize.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	250 ft
	TN DOT 709.03 Class A-1 riprap (quantities provided verbally from contractor)	320 Tons	320 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None	None	

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 8:00 am	Field Representative Started Work: 7:30 AM
Temperature:	AM: 46 deg.	PM: 52 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:15 PM

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/16/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 3/18/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-03-17

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 003

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection – Zones 8, 9, 2 and 3

8:00 am: Track access road and begin placing rip rap on exterior dike – building bench across placement area for equipment access.
10:30 pm: Complete bench construction from Sta. 30+00 to 32+50 – begin pushing bench downslope to create 1.5 ft layer on bank.
2:00 pm: Completes rock protection over disturbed area, operations move to Zone 2/3 limit
2:00 pm: CPG begins excavating soil directly east of French Drain L1 outlet. Excavated soil is placed in gypsum stack.
2:30 pm: Begin placing gravel to fill area being excavated – creating two lane access road at Zone 2/3 limit for future equipment access.
3:00 pm: Turbidity curtain moved from Zones 8 and 9 to location of Pipe #2 (Zone 2) and Pipe #8 (Zone 8).

CPG Construction Manpower:

1 supervisor, 1 foreman, 3 operators, 2 laborers

Equipment:

In use today:	Idle Equipment:
1 – Cat Excavator	2 – Morouka Track Trucks
2 – Morouka Track Trucks	1 – Wilco Long-Stick Hoe
1 – Cat 320D Excavator with thumb attachment	1 – Cat 277B Front-End Loader
2 – Dump Trucks (bringing rip rap from supplier)	1 – Cat D6 Dozer
1 – Cat D5 Dozer	1 – Cat 324D Long-Stick Hoe
1 – 300-ft turbidity curtain	

Summary of Daily Observations (Include any Problems and Resolutions):

Rip rap placement proceeded smootbly today. Discussed potential for removing silt fence along bank to allow better access to rock placement area. Tyler Marshall (Stantec) agreed that this is acceptable as long as pipe outlets along gypsum stack and bottom ash stack are protected.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	250 ft
	TN DOT 709.03 Class A-1 riprap (quantities provided verbally from contractor)	320 Tons	640 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None	Tyler Marshall - Stantec	

Weather:	AM: Fog	PM: Sunny	Contractor Started Work: 8:00 am	Field Representative Started Work: 7:30 AM
Temperature:	AM: 34 deg.	PM: 60 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 PM

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/17/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 3/18/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-03-21

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 004

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

8:00 am: Clearing vegetation at Pipe #8 and Pipe #7 locations – clearing and grubbing approximately 30 ft on either side of pipes.
10:40 am: Track truck tips over on west slope of the stockpile north of the railroad crossing – no one hurt.
1:00 pm: Clearing vegetation at Pipe #2 location.
2:00 pm: Begin rock placement around Pipe #2.
5:30 pm: By end of day, rock placement complete around Pipes #2, #7, #8.

CPG Construction Manpower:

1 supervisor, 1 foreman, 8 operators, 6 laborers

Equipment:

In use today:	Idle Equipment:
1 – Cat Excavator	2 – Morooka Track Trucks
2 – Morooka Track Trucks	1 – Wilco Long-Stick Hoe
1 – Cat 320D Excavator with thumb attachment	1 – Cat 277B Front-End Loader
2 – Dump Trucks (bringing rip rap from supplier)	1 – Cat D6 Dozer
1 – Cat D5 Dozer	1 – Cat 324D Long-Stick Hoe
1 – 300-ft boom – split into 3 sections	2 – Barges and Tug boats for rock placement

Summary of Daily Observations (Include any Problems and Resolutions):

Clearing and rip rap placement around abandoned spillway pipe locations proceeded smoothly today.

Summary of Incidents / Accidents / Health & Safety Issues:

CPG track truck tipped over on stockpile north of railroad crossing. TVA safety personnel were informed and no one was hurt. Track truck was safely removed from slope.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	180 ft	430 ft
	TN DOT 709.03 Class A-1 riprap (quantities provided verbally from contractor)	200 Tons	1382 Tons
	TN DOT No. 2 Stone	0 Tons	223 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 AM
Temperature:	AM: 55 deg.	PM: 78 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 6:00 PM

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/21/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-03-22

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 005

Summary of Construction/Operation Activities:

Rock Protection

No work today – CPG shut down for safety briefings.

CPG Construction Manpower:

Equipment:

In use today:	Idle Equipment:
	4 – Morouka Track Trucks 1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 1 – Cat 324D Long-Stick Hoe 1 – Cat Excavator 1 – Cat 320D Excavator with thumb attachment 1 – Cat D5 Dozer 1 – 300-ft boom – split into 3 sections 2 – Barges and Tug boats for rock placement

Summary of Daily Observations (Include any Problems and Resolutions):

No work today – CPG shut down for safety briefings.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	430 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	1382 Tons
	TN DOT No. 2 Stone	0 Tons	223 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None		

Weather:	AM: Cloudy	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 AM
Temperature:	AM: 55 deg.	PM: 82 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 6:00 PM

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/22/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

***Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.**

URS

Sheet: 1 of 1
Date: 2011-03-23

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 006

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

8:00 am: CPG begins clearing vegetation at Pipe #1
10:30 am: CPG begins placing rock around Pipe #1 – completes rock placement before stopping for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 4 operators, 2 laborers

Equipment:

In use today:	Idle Equipment:
1 – 300-ft boom – split into 3 sections 1 – Cat 320D Excavator with thumb attachment 1 – Cat 324D Long-Stick Hoe 2 – Morooka Track Trucks	2 – Morooka Track Trucks 1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 1 – Cat Excavator 1 – Cat D5 Dozer 2 – Barges and Tug boats for rock placement

Summary of Daily Observations (Include any Problems and Resolutions):

Left early (12:30) due to shutdown of AMS work. CPG continued work until rock placement was completed at Pipe #1.

Summary of Incidents / Accidents / Health & Safety Issues:

10:00 am? – AMS grader accident occurs at the channel between bottom ash and gypsum stack – No one hurt.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	60 ft	490 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	1382 Tons
	TN DOT No. 2 Stone (quantities provided verbally from contractor)	357 Tons	580 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None		

Weather:	AM: Rain	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 am
Temperature:	AM: 60 deg.	PM: 65 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 12:30 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/23/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-03-24

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 007

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

10:00 am: CPG begins adding stone to road on west side of gypsum stack to create 2-way access to Zone 2 area
10:30 am: Placing stone on Zone 1 lower starter dike beginning at railroad tracks and moving west
10:30 am: Clearing vegetation at Pipe #3
1:00 pm: Placing rip rap at Pipe #3
5:00 pm: Complete rock placement at Pipe #3 and stone road placement approximately 400 feet west along Zone 1.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 3 laborers

Equipment:

In use today:	Idle Equipment:
1 –boom – split into sections	2 – Morooka Track Trucks
1 – Cat 320D Excavator with thumb attachment	1 – Wilco Long-Stick Hoe
1 – Cat 324D Long-Stick Hoe	1 – Cat 277B Front-End Loader
3 – Morooka Track Trucks	1 – Cat D6 Dozer
2 - Dump trucks	1 – Cat Excavator
	1 – Cat D5 Dozer
	2 – Barges and Tug boats for rock placement

Summary of Daily Observations (Include any Problems and Resolutions):

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	490 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	1382 Tons
	TN DOT No. 2 Stone (quantities provided verbally from contractor)	597 Tons	1179 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None		

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 am
Temperature:	AM: 40 deg.	PM: 58 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 5:45 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/24/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-03-25

Sun Mon Tues Wed Thurs **Fri** Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 008

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-job briefing and pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI, Sani-Tech, and Aquilex.

Pipe Grouting

8:30 am: Site Walkover with Mike Wray.
9:30 am: Pipe #8 survey (24") – Requires Cleaning, Potential Pipe Collapse @ approx.. 62 feet.
10:45 am: Pipe #1 survey (36") – Pipe clean until approx.. 20 feet, large sticks and debris, cannot see end of pipe.
12:20 pm: Pipe #3 survey (36") – Passes approximately 11 feet, then stuck in mud (40-50% full) – Plug at approx.. 40 ft.
1:00 pm: Pipe #2 survey (36") – Roots/tree at inlet, grate removed, camera passes approx.. 20 feet, can see plug at end of pipe.
1:00 pm: Begin cleaning Pipe #8.
4:00 pm: Pipe #8 post-cleaning survey (24") – Pass 62 feet, pipe is cleaned out past pipe collapse,
5:00 pm: Pipe #7 survey (36") – Camera only passes 5.5 ft, oil cans and bottles block camera view to end of pipe.

CPG Construction Manpower:

1 supervisor, 1 foreman, 2 operators, 4 laborers. Aquilex Hydrochem: approx.. 13 personnel. Sani-Tech: 2 personnel

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 1 – Cat 320D Excavator with thumb attachment 1 – Cat 324D Long-Stick Hoe 1– Morooka Track Truck	3 – Morooka Track Trucks 1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 1 – Cat Excavator	1 – Caterpillar Large Dozer 2 – Barges and Tug boats for rock placement 2 - Dump trucks

Summary of Daily Observations (Include any Problems and Resolutions):

Camera survey went well today – inspected all pipes except Pipes #4, #5 which have not been located. Cleaning required on all pipes prior to grouting

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
Reviewed PCI concrete and grout mixes.	Clearing and Grubbing	0 ft	490 ft
	TN DOT 709.03 Class A-1 riprap (quantities provided verbally from contractor)	1360 Tons	2742 Tons
	TN DOT No. 2 Stone (quantities provided verbally from contractor)	645 Tons	1824 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
None	Ken Berry - URS	

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 am
Temperature:	AM: 35 deg.	PM: 53 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/25/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-03-26

Sun Mon Tues Wed Thurs Fri **Sat**

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 009

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI, Sani-Tech, and Aquilex.

Pipe Grouting

10:45 am: Complete cleaning Pipe #2 and complete post-cleaning camera inspection – root mass at mouth of pipe must be removed.
11:00 am: Begin prepping Pipe #3 for cleaning.
2:00 pm: Second camera survey of Pipe #2 (following manual removal of roots) still shows root mass between 6-10 feet. URS recommends further manual removal of root mass – second attempt of root mass removal is successful.
5:00 pm: Complete cleaning of Pipe #3
5:00 pm: No. 2 stone roadway construction in Zones 1 and 2 is nearly complete at end of the day.
5:20 pm: Post-cleaning camera survey of Pipe #3 – confirms adequate cleaning.
5:20 pm: Framework is nearly completed by PCI on Pipe #8.

CPG Construction Manpower:

1 supervisor, 1 foreman, 2 operators, 4 laborers. Aquilex Hydrochem: approx.. 13 personnel. Sani-Tech: 2 personnel

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 1 – Cat 320D Excavator with thumb attachment 1 – Cat 324D Long-Stick Hoe 1– Morooka Track Truck	3 – Morooka Track Trucks 1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 1 – Cat Excavator	1 – Caterpillar Large Dozer 2 – Barges and Tug boats for rock placement 2 - Dump trucks

Summary of Daily Observations (Include any Problems and Resolutions):

Pipes #4, #5 have not been located – Ken Berry discussed URS recommendation to leave pipes alone with Rachel Combs and Andy Powell. Pipe #2 required heavy cleaning, no root cutter available onsite. Root mass at mouth of pipe removed manually.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
All pipes surveyed require cleaning	Clearing and Grubbing	0 ft	490 ft
Limited vegetative removal and lower bench road widening around monitoring wells	TN DOT 709.03 Class A-1 riprap (quantities provided verbally from contractor)	1758 Tons	4500 Tons
	TN DOT No. 2 Stone (quantities provided verbally from contractor)	442 Tons	2266 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
None	Ken Berry – URS Glen Dieterle - URS	Framework at Pipe #8

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 42 deg.	PM: 50 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 6:00 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/26/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.

URS

Sheet: 1 of 1
Date: 2011-03-27

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 010

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI, Sani-Tech, and Aquilex.

Pipe Grouting

8:00 am: Begin prepping Pipe #1 for cleaning.
10:00 am: Spillway Modification kickoff meeting in DFA trailer.
12:30 pm: Complete Pipe #1 cleaning – large debris (sticks and logs) removed from pipe.
12:45 pm: Post-cleaning camera inspection of Pipe #1 – Some pieces of debris remain, but determined to be adequate for grouting.
1:30 pm: Begin prepping Pipe #7 for cleaning.
5:00 pm: Complete cleaning of Pipe #7.
5:10 pm: Post-cleaning camera inspection of Pipe #7 – adequate for grouting, first joints misaligned.
5:10 pm: By end of day, framework is completed by PCI on Pipes #2, #3, #8.

CPG Construction Manpower:

1 supervisor, 1 foreman, 2 operators, 4 laborers. Aquilex Hydrochem: approx. 13 personnel. Sani-Tech: 2 personnel. PCI: approx. 4 personnel.

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 1 – Cat 320D Excavator with thumb attachment 1 – Cat 324D Long-Stick Hoe 1– Morooka Track Truck	3 – Morooka Track Trucks 1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 1 – Cat Excavator	1 – Caterpillar Large Dozer 2 – Barges and Tug boats for rock placement 2 - Dump trucks

Summary of Daily Observations (Include any Problems and Resolutions):

Pipe cleaning moved smoothly today – cleaning now complete on all pipes to be grouted (#1, #2, #3, #7, #8)

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
No dowels used on Pipe #8 forms due to loose 2nd joint (1st pipe section fell off)	Clearing and Grubbing	0 ft	490 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	4500 Tons
	TN DOT No. 2 Stone	0 Tons	2266 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None	Ken Berry – URS Glen Dieterle - URS	Framework at Pipe #8, #2, and #3

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 am
Temperature:	AM: 34 deg.	PM: 45 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 6:00 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/27/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-03-28

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 011

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI, Sani-Tech, and Aquilex.

Pipe Grouting

7:45 am: Preparing stockpile area for rip rap located east of railroad tracks at south end of gypsum stack.
8:00 am: Constructing ramp into Zone 2 lower bench.
9:00 am: Observe Pipe #2 separated joint.
11:45 am: PCI completing forms on Pipes #1, #7.
5:00 pm: Complete cleaning of Pipe #7.
5:10 pm: Post-cleaning camera inspection of Pipe #7 – adequate for grouting, first joints misaligned.
5:10 pm: By end of day, framework is completed by PCI on Pipes #2, #3.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers. PCI: 4 personnel.

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 1 – Cat 320D Excavator with thumb attachment 1 – Cat 324D Long-Stick Hoe 3– Morooka Track Trucks 1 – Caterpillar Large Dozer 1 – Cat Excavator	1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 2 – Barges and Tug boats for rock placement	

Summary of Daily Observations (Include any Problems and Resolutions):

Observe sagging of first joint of many pipes. Decided to use concrete block to prop up sagging pipes. Extend concrete form into Pipe #7 beyond separated joint. Discussed location and record-keeping for SWPPP Plan.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	490 ft
	TN DOT 709.03 Class A-1 riprap (quantities provided verbally from contractor)	1951 Tons	6451 Tons
	TN DOT No. 2 Stone (quantities provided verbally from contractor)	88 Tons	2354 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
None	Ken Berry – URS Glen Dieterle - URS Mitch Gorodea - URS Mike May - URS	Framework at Pipe #1 and #7

Weather:	AM: Rain	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 am
Temperature:	AM: 40 deg.	PM: 66 deg.	Contractor Stopped Work: 5:30 pm	Field Representative Stopped Work: 6:00 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/28/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-03-29

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 012

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI.

Pipe Grouting

8:30 am: PCI completing form on Pipe #7.
10:00 am: Observe all forms prior to concrete pouring. Valves missing on two pipes – discussed with PCI – valves will be added.
11:15 am: Concrete truck arrives – Testing begins
- Batch Time: 10:16 am, Slump: 3", Temp: 72 deg F, Air: 5%

12:00 pm: Complete pour for Pipe #2, move to Pipe #3.
12:45 pm: Complete pour for Pipe #3, another concrete truck arrives and moves to Pipe #8.
2:30 pm: Complete pour at Pipe #7.
3:00 pm: Observe completed pour at Pipe #1.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers. PCI: 4 personnel. MacTec: 1 personnel (concrete testing)

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 1 – Cat 320D Excavator with thumb attachment 2 – Cat 324D Long-Stick Hoe 3– Morooka Track Trucks 1 – Caterpillar Large Dozer 1 – Cat Excavator	1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 2 – Barges and Tug boats for rock placement	

Summary of Daily Observations (Include any Problems and Resolutions):

Concrete pouring for thrust blocks was completed successfully today on all pipes. CPG continues to stockpile rip rap and No. 2 stone for rock protection work.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	490 ft
	TN DOT 709.03 Class A-1 riprap (quantities provided verbally from contractor)	2207 Tons	8658 Tons
	TN DOT No. 2 Stone (quantities provided verbally from contractor)	44 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None	Ken Berry – URS Mitch Gorodea - URS	Concrete Pours for 5 thrust blocks

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 am
Temperature:	AM: 45 deg.	PM: 66 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/29/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-03-30

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 013

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI.

Pipe Grouting

1:40 pm: Barge appears to be beached at convergence of Bull Run Creek and Clinch River.
1:40 pm: Clearing vegetation beginning at railroad tracks (Zone 1) and moving west.
2:30 pm: Turbidity curtain placed at north edge of Zone 2 and east edge of Zone 1
3:00 pm: Phone conversation with Larry Harper and Hugo Aparicio about cutting 3:1 slope on west side of gypsum stack short – Hugo to send email to Ken Berry – URS to confirm whether slope grading can be shortened.
3:10 pm: Placing rip rap beginning at railroad tracks (Zone 1) and moving west.
4:45 pm: PCI removed forms from Pipes #1, #2, #3. Elbow added to the end of each grout pipe to ease connection to pumper truck.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers. PCI: 4 personnel.

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 2 – Turbidity curtains 1 – Cat 320D Excavator with thumb attachment 2 – Cat 324D Long-Stick Hoe 3– Morooka Track Trucks 1 – Caterpillar Large Dozer 1 – Cat Excavator	1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 2 – Barges and Tug boats for rock placement	

Summary of Daily Observations (Include any Problems and Resolutions):

Rip rap placement for Zone 1 began today. CP intends to place initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.
Agreed to revise grout testing requirements – require 8" slump and compressive strength testing (cubes or cylinders)

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	100 ft	590 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None	Mitch Gorodea – URS	

Weather:	AM: Rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 51 deg.	PM: 55 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: David Skeggs	Field Representative's Signature: DSkeggs	Date: 03/30/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-03-31

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 014

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI.

Pipe Grouting

8:00 am - CPG resumes rip-rap placement from Sta. 93+50 and proceeding west. CPG is also clearing/removing trees and brush in Zone 2 from Sta. 57+50 to 57+90.
9:00 am - PCI begins grouting the pipes starting with Pipe #1. This pipe took aprox. 23cy of grout.
11:15 am - PCI begins grouting Pipe #2. This pipe took aprox. 7cy of grout.
12:25 pm - PCI begins grouting Pipe #3. This pipe took aprox. 8cy of grout. It should also be noted that grout was seen in the vent pipe and at the first joint. See attached photographs.
1:30 pm - PCI begins grouting Pipe #8. This pipe took aprox. 7cy of grout.
2:10 pm - PCI begins grouting Pipe #7. This pipe took aprox. 5cy of grout.
3:30 pm - PCI has completed pipe grouting activities and has demobilized from the site.
4:45 pm: CPG completes rip-rap placement from Sta. 93+50 to 92+50. CPG has also completed the clearing/removing trees and brush in Zone 2 from Sta. 57+50 to 57+90.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers. PCI: 4 personnel.

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 2 – Turbidity curtains 1 – Cat 320D Excavator with thumb attachment 2 – Cat 324D Long-Stick Hoe 3– Morooka Track Trucks 1 – Caterpillar Large Dozer 1 – Cat Excavator	1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 2 – Barges and Tug boats for rock placement	

Summary of Daily Observations (Include any Problems and Resolutions):

Rip rap placement for Zone 1 continues today. CP intends to place initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
The first grout truck had a slump of 10.5".	Clearing and Grubbing (quantities provided verbally from contractor)	300 ft	890 ft
The remaining loads had slumps between	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
8" to 9".	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None	Mitch Gorodea – URS	50cy of flowable fill/grout was pumped into 5 pipes along the perimeter slopes.

Weather:	AM: Cloudy lt. rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 40 deg.	PM: 40 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 03/31/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.

URS

Sheet: 1 of 1
Date: 2011-04-01

Sun Mon Tues Wed Thurs **Fri** Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 015

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI.

Pipe Grouting

8:00 am - CPG resumes rip-rap placement from Sta. 92+50 and proceeding west. CPG is also placing rip-rap in Zone 2 from Sta. 58+00 and proceeding south.
9:00 am - PCI is onsite to remove the piping above the valves and the valves themselves. The remaining pipes were then capped.
10:00 am – PCI completes the valve removal activities from the fill piping and leaves the site.
4:45 pm - CPG completes rip-rap placement from Sta. 92+50 to 90+00. CPG also completes rip-rap placement in Zone 2 from Sta. 58+00 to 59+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers. PCI: 4 personnel.

Equipment:

In use today:	Idle Equipment:	
1 – boom – split into sections 2 – Turbidity curtains 1 – Cat 320D Excavator with thumb attachment 2 – Cat 324D Long-Stick Hoe 3– Morooka Track Trucks 1 – Caterpillar Large Dozer 1 – Cat Excavator	1 – Wilco Long-Stick Hoe 1 – Cat 277B Front-End Loader 1 – Cat D6 Dozer 2 – Barges and Tug boats for rock placement	

Summary of Daily Observations (Include any Problems and Resolutions):

Rip rap placement for Zone 1 continues today. CP intends to place initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	350 ft	1240 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey the 795 elevation in Zone 1.	Mitch Gorodea – URS (8:00am to 10:00am)	

Weather:	AM: Sunny	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 45 deg.	PM: 45 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/01/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.

URS

Sheet: 1 of 1
Date: 2011-04-02

Sun Mon Tues Wed Thurs Fri **Sat**

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 016

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns. Present were all subcontractors, including PCI.

Pipe Grouting

8:00 am - CPG resumes rip-rap placement from Sta. 90+00 and proceeding west. CPG continues to place rip-rap in Zone 2 from Sta. 59+00 and proceeding south.

- CPG moves the turbidity curtain in Zone 1 to 89+50 through 86+50 and in Zone 2 to 59+50 through 61+50.
- Start clearing trees, brush and debris.
- Resume rip-rap placement

4:45 pm - CPG completes rip-rap placement from Sta. 90+00 to 87+00. CPG also completes rip-rap placement from Sta. 59+00 to 60+40.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers. PCI: 4 personnel.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck 2 – Barges and Tug boats for rock placement	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	440 ft	1,680 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey the 795 elevation in Zone 1.		

Weather:	AM: Sunny	PM: Sunny, windy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 55 deg.	PM: 60 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/02/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/5/2011

Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.

URS

Sheet: 1 of 1
Date: 2011-04-04

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 017

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG resumes rip-rap placement from Sta. 87+00 and proceeding west. CPG continues to place rip-rap in Zone 2 from Sta. 60+40 and proceeding south.

- CPG moves the turbidity curtain in Zone 1 to 86+50 through 83+50 and in Zone 2 to 61+50 through 64+00.
- Start clearing trees, brush and debris.
- Resume rip-rap placement

4:45 pm - CPG completes rip-rap placement from Sta. 87+00 to 86+00. CPG also completes rip-rap placement from Sta. 60+40 to 62+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck 2 – Barges and Tug boats for rock placement	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

TVA shut down all construction activities at 3:00pm due to the severe weather conditions.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	260 ft	1,940 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		

Weather:	AM: Sunny, windy	PM: Cloudy, windy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 45 deg.	PM: 60 deg.	Contractor Stopped Work: 3:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/04/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/11/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-05

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 018

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG resumes rip-rap placement from Sta. 86+00 and proceeding west. CPG continues to place rip-rap from Sta. 62+00 and proceeding south.

- CPG moves the turbidity curtain to 83+50 through 80+50.
- Start clearing trees, brush and debris.
- Resume rip-rap placement

3:30 pm – River Ops begins installing the turbidity curtain from 72+50 to 64+00

4:45 pm - CPG completes rip-rap placement from Sta. 86+00 to 83+00. CPG also completes rip-rap placement from Sta. 62+00 to 63+80. River Ops done for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	480 ft	2,420 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		

Weather:	AM: Partly Cloudy	PM: Mostly Sunny, windy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 45 deg.	PM: 52 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/05/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/11/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-06

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 018

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG resumes rip-rap placement from Sta. 83+00 and proceeding west. CPG continues to place rip-rap from Sta. 63+80 and proceeding south.

- clearing trees, brush and debris.
- rip-rap placement

8:00 pm – River Ops continues to install the turbidity curtain.
4:45 pm - CPG completes rip-rap placement from Sta. 83+00 to 80+60. CPG also completes rip-rap placement from Sta. 63+80 to 70+60. River Ops completed the installation of the turbidity curtain (63+75 to 81+00).

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	920 ft	3,340 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 34 deg.	PM: 68 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/06/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/11/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-07

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 018

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. CPG also continues to clear and grub.
11:00 am – River Ops begins placing rip-rap from the river starting at 64+00.
4:45 pm - CPG completes rip-rap placement for the day. River Ops completed rip-rap placement to 64+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	200 ft	3,540 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		

Weather:	AM: Sunny	PM: Partly Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 48 deg.	PM: 68 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/07/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/11/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-08

Sun Mon Tues Wed Thurs **Fri** Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 019

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG and River Op's continue rip-rap placement in Zones #1 & #2. CPG also continues to remove brush, tree, debris, etc. in Zones #1 & #2.

4:45 pm - CPG and River Op's complete activities for the day. CPG has removed all of the brush, trees, debris, etc. In Zones #1 & #2. River Ops completed rip-rap placement from 64+50 to 64+80 today.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing (quantities provided verbally from contractor)	260 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 60 deg.	PM: 73 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/08/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/11/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-09

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 020

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG and River Op's continue rip-rap placement in Zones #1 & #2. CPG also continues to remove brush, tree, debris, etc. in Zones #1 & #2.

10:00 pm – Vaughn & Melton are surveying the rip-rap placed by River Op's from Sta. 64+00 to 65+00. The survey indicates that the thickness of new rock placement has been achieved, but the anticipated finished grade has not. Based on the clam bucket marks and visual observations a minimum of 3ft of rip-rap has been placed. Therefore, this area has met the minimum design requirements and River Op's will continue moving South. The problem is the baseline survey being used is not completely accurate. Vaughn & Melton will begin surveying the slopes prior to River Op's placing rock. This will give us a more accurate rip-rap thickness.

4:45 pm - CPG and River Op's complete activities for the day. Sta. 64+00 to Sta. 65+00 has met the design requirements.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 65 deg.	PM: 80 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/09/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/11/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-11

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 021

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG and ESS (what I was calling River Op's) continue rip-rap placement in Zones #1 & #2.
8:30 am – Vaughn & Melton are surveying the existing conditions and the rip-rap placed to-date.
2:00 pm – ESS down to work on the GPS.
4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	8658 Tons
	TN DOT No. 2 Stone	0 Tons	2398 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		

Weather:	AM: Partly Cloudy	PM: Mostly Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 63 deg.	PM: 75 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/11/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/20/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-12

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 022

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS (what I was calling River Op's) down to work on the GPS.
8:30 am – Vaughn & Melton are surveying the existing conditions and the rip-rap placed to-date.
4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap (quantities provided verbally by contractor)	0 Tons	21,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		21,000 tons reported by CPG at bi-weekly Meeting.

Weather:	AM: Rain	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 50 deg.	PM: 53 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/12/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/20/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-13

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 023

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2, only on the South perimeter. ESS (what I was calling River Op's) down to work on the GPS.
8:30 am – Vaughn & Melton are surveying the rip-rap placed to-date on the West perimeter.
4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	21,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		21,000 tons reported by CPG at bi-weekly Meeting.

Weather:	AM: Heavy Fog	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:30 am
Temperature:	AM: 40 deg.	PM: 62 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/13/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/20/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-14

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 024

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2, only on the South perimeter. ESS (what I was calling River Op's) down to work on the GPS.
8:30 am – Vaughn & Melton are surveying the rip-rap placed to-date in Zones #1 and #2.
4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	21,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.	Tim Hicks offsite @ 3:30pm Laura Cardwell (3:30pm – 5:00pm)	21,000 tons reported by CPG at bi-weekly Meeting.

Weather:	AM: Mostly Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 45 deg.	PM: 62 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/14/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/20/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-04-15

Sun Mon Tues Wed Thurs **Fri** Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 025

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG receiving Class A-1 rip-rap. No rip-rap placement occurred today. ESS (what I was calling River Op's) down to work on the GPS.
4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:
2 – Turbidity curtains 1 – Cat 320D excavator 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	21,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.	Laura Cardwell (8:00am – 5:00pm)	21,000 tons reported by CPG at bi-weekly Meeting.

Weather:	AM: Cloudy	PM: Lt. Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 50 deg.	PM: 55 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/15/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/20/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-04-16

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 026

Summary of Construction/Operation Activities:

Perimeter Maintenance and Improvements

8:00 am – ESS moved the barge to Zone #1, Sta. 93+00 – Sta. 91+00. CPG was not onsite today.
10:00 am – ESS moving a piece of the turbidity curtain to Sta. 93+00 – Sta. 91+00.
2:30 pm – ESS began placing rip-rap in Zone #1, Sta. 93+00 – Sta. 91+00.
4:45 pm - ESS completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 0 operators, 0 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	21,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.	Laura Cardwell (8:00am – 5:00pm)	21,000 tons reported by CPG at bi-weekly Meeting.

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 55 deg.	PM: 55 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/16/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/20/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-18

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 027

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. Moving turbidity curtains. One section is from 93+00 to 91+00 and the other section is from 80+50 to 70+00.

9:00 am - ESS (what I was calling River Op's) placing rip-rap from Sta. 93+00 to 91+00.

4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	21,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		21,000 tons reported by CPG at bi-weekly Meeting.

Weather:	AM: Hazy	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:15 am
Temperature:	AM: 47 deg.	PM: 75 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/18/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/22/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-04-19

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 028

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2.
9:00 am - ESS (what I was calling River Op's) continues placing rip-rap from Sta. 93+00 to 91+00
3:00 am - . Moving one of the turbidity curtains to contain from 64+00 to 57+00.
4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

CPG has placed the initial layer of rip rap following debris removal, then come back and build an approx. 10 ft bench and complete slope into river. River Ops to complete what long-stick cannot reach.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		26,000 tons placed was reported by CPG at bi-weekly meeting. Meeting.

Weather:	AM: Cloudy	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:15 am
Temperature:	AM: 64 deg.	PM: 80 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/19/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/22/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-20

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 029

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

9:00 am - CPG continues rip-rap placement in Zones #1 & #2.
10:00 am - ESS (what I was calling River Op's) continues placing rip-rap from Sta. 93+00 to 91+00
2:00 pm - . Based on the cross-sections an area between Sta. 69+50 to 70+50 required additional rock at the toe. CPG elected to test pit the area to determine if there was three foot rock thickness. At Sta. 69+50 it was determined that there was in fact 2.75 feet of rock. At Sta. 70+00 there was only 2ft of rock at the toe. Therefore, CPG immediately added additional rock from 69+75 to 70+25. Vaughn & Melton will resurvey the area tomorrow.
4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Pending the top bench verification an area from 63+25 to 71+25 meets the design requirements.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		26,000 tons placed was reported by CPG at bi-weekly meeting. Meeting.

Weather:	AM: Thunder-storms	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:15 am
Temperature:	AM: 60 deg.	PM: 68 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/20/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/22/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-21

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 030

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS (what I was calling River Op's) continues placing rip-rap from Sta. 93+00 to 91+00

4:45 pm - CPG completes activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Pending the top bench verification an area from 63+25 to 71+25 meets the design requirements.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		26,000 tons placed was reported by CPG at bi-weekly meeting. Meeting.

Weather:	AM: Partly Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:15 am
Temperature:	AM: 55 deg.	PM: 68 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/21/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 4/22/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-25

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 031

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.

4:45 pm - CPG & ESS complete activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Pending the top bench verification an area from 63+25 to 71+25 meets the design requirements.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		26,000 tons placed was reported by CPG at bi-weekly meeting. Meeting.

Weather:	AM: Partly Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 80 deg.	PM: 85 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/25/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-2-2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-26

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 032

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.

4:45 pm - CPG & ESS complete activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Pending the top bench verification an area from 63+25 to 71+25 meets the design requirements.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		26,000 tons placed was reported by CPG at bi-weekly meeting. Meeting.

Weather:	AM: Cloudy	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 62deg.	PM: 75 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/26/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-2-2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-27

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 033

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.
9:00 am - All site activities shut down due to tornado warnings.
1:00 pm - ESS resumes placing rip-rap in Zone #1.
3:30 pm – ESS shut down for the day due to severe weather.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 58+75, 59+25 to 60+75, 61+75 to 75+50, 76+75 to 77+25, 78+75 to 79+25 & 90+75 to 93+25. This is a total of 2,050 lft out of 3,700 lft which is ~55% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		30,000 tons onsite was reported today by CPG. Meeting.

Weather:	AM: Cloudy	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 73deg.	PM: 75 deg.	Contractor Stopped Work: 9:00 am / 3:30 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/27/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-2-2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-28

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 034

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.
4:45 pm – CPG and ESS complete site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 58+75, 59+25 to 60+75, 61+75 to 75+50, 76+75 to 77+25, 78+75 to 79+25 & 90+75 to 93+25. This is a total of 2,050 lft out of 3,700 lft which is ~55% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.	Laura Cardwell was onsite today to observe the field activities. Tim Hicks was offsite today.	30,000 tons onsite has been reported by CPG.
		.

Weather:	AM:	PM:	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM:	PM:	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/28/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-2-2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-04-29

Sun Mon Tues Wed Thurs **Fri** Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 035

Summary of Construction/Operation Activities:

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Perimeter Maintenance and Improvements

8:00 am - ESS continues placing rip-rap in Zone #1.
4:45 pm – ESS complete site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:
2 – Turbidity curtains 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 58+75, 59+25 to 60+75, 61+75 to 75+50, 76+75 to 77+25, 78+75 to 79+25 & 90+75 to 93+25. This is a total of 2,050 lft out of 3,700 lft which is ~55% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.	Laura Cardwell was onsite today to observe the field activities. Tim Hicks was offsite today.	30,000 tons onsite has been reported by CPG.

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 54 deg.	PM: 65 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 04/29/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-2-2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-02

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 036

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.
4:45 pm – CPG and ESS complete site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 58+75, 59+25 to 60+75, 61+75 to 75+50, 76+75 to 77+25, 78+75 to 79+25 & 90+75 to 93+25. This is a total of 2,050 lft out of 3,700 lft which is ~55% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		30,000 tons onsite has been reported by CPG.

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 61 Deg.	PM: 65 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/02/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/9/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-03

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 037

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.
3:00 pm – CPG and ESS complete site activities for the day due to weather.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 58+75, 59+25 to 60+75, 61+75 to 75+50, 76+75 to 77+25, 78+75 to 79+25 & 90+75 to 93+25. This is a total of 2,050 lft out of 3,700 lft which is ~55% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		30,000 tons onsite has been reported by CPG.
		.

Weather:	AM: Cloudy	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 71 Deg.	PM: 55 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/03/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/9/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-04

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 038

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.
3:00 pm – CPG and ESS complete site activities for the day due to weather.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 58+75, 59+25 to 60+75, 61+75 to 75+50, 76+75 to 77+25, 78+75 to 79+25 & 90+75 to 93+25. This is a total of 2,050 lft out of 3,700 lft which is ~55% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		30,000 tons onsite has been reported by CPG.

Weather:	AM: Cloudy	PM: Partly Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 46 Deg.	PM: 57 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/04/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/9/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-05

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 039

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2. ESS continues placing rip-rap in Zone #1.
3:00 pm – CPG and ESS complete site activities for the day due to weather.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 2 – Barges and Tug boats for rock placement 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 75+50, 76+75 to 78+25, 78+75 to 80+75, 85+75 to 86+75, 89+75 to 90+25 & 90+75 to 93+25. This is a total of 2,600 lft out of 3,700 lft which is ~70% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.		30,000 tons onsite has been reported by CPG.

Weather:	AM: Partly Cloudy	PM: Partly Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 55 Deg.	PM: 57 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/05/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/9/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-06

Sun Mon Tues Wed Thurs **Fri** Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 040

Summary of Construction/Operation Activities:

Perimeter Maintenance and Improvements

8:00 am – ESS begins mobilization activities.
3:00 pm – ESS completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
2 – Turbidity curtains 2 – Barges and Tug boats for rock placement	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer 1 – water truck 1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 75+50, 76+75 to 78+25, 78+75 to 80+75, 85+75 to 86+75, 89+75 to 90+25 & 90+75 to 93+25. This is a total of 2,600 lft out of 3,700 lft which is ~70% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.		30,000 tons onsite has been reported by CPG.

Weather:	AM: Partly Cloudy	PM: Partly Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 55 Deg.	PM: 57 Deg.	Contractor Stopped Work: 3:30 pm	Field Representative Stopped Work: 3:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/06/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/9/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-09

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 041

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2.
4:45 pm – CPG completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 75+50, 76+75 to 78+25, 78+75 to 80+75, 85+75 to 86+75, 89+75 to 90+25 & 90+75 to 93+25. This is a total of 2,600 lft out of 3,700 lft which is ~70% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		40,000 tons onsite has been reported by CPG.

Weather:	AM: Hazy	PM: Hazy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 60 Deg.	PM: 75 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/09/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/16/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-10

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 042

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2.
4:45 pm – CPG completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 78+25, 78+75 to 82+75, 83+75 to 85+25, 85+75 to 87+25, 89+75 to 90+25 & 90+75 to 93+25. This is a total of 3,125 lft out of 3,700 lft which is ~85% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.		40,000 tons onsite has been reported by CPG.

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 70 Deg.	PM: 75 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/10/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/16/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-11

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 043

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2.
4:45 pm – CPG completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 78+25, 78+75 to 82+75, 83+75 to 85+25, 85+75 to 87+25, 89+75 to 90+25 & 90+75 to 93+25. This is a total of 3,125 lft out of 3,700 lft which is ~85% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		40,000 tons onsite has been reported by CPG.

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 65Deg.	PM: 80 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/11/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/16/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-12

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 044

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2.
4:45 pm – CPG completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 78+25, 78+75 to 82+75, 83+75 to 85+25, 85+75 to 87+25, 89+75 to 90+25 & 90+75 to 93+25. This is a total of 3,125 lft out of 3,700 lft which is ~85% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.		40,000 tons onsite has been reported by CPG.

Weather:	AM: Cloudy	PM: Partly Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 65Deg.	PM: 88 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/12/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 2011-05-16

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 045

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zones #1 & #2.
4:45 pm – CPG completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections the following areas have met the design criteria: 57+00 to 78+25, 78+75 to 82+75, 83+75 to 85+25, 85+75 to 87+25, 89+75 to 90+25 & 90+75 to 93+25. This is a total of 3,125 lft out of 3,700 lft which is ~85% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		40,000 tons onsite has been reported by CPG.

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 55Deg.	PM: 60 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/16/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-20-2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-17

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 046

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zone #1.
4:45 pm – CPG completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections and thickness checks the following areas have met the design criteria: 57+00 to 83+25 & 83+75 to 94+00. This is a total of 3,650 lft out of 3,700 lft which is ~99% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.		44,000 tons onsite has been reported by CPG.
		.

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 50Deg.	PM: 53 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/17/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-20-2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-18

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 047

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

8:00 am - CPG continues rip-rap placement in Zone #1.
3:30 pm – CPG completes site activities for the day.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator 1 – Cat 330D excavator 1 – Cat 315C with thumb attachment 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers 1 – Cat 289C Skid steer	1 – Wilco Long-Stick Hoe (Amphib) 1 – Cat 272 skid steer	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections and thickness checks the following areas have met the design criteria: Sta. 57+00 to 94+00. This is a total of 3,700 lft out of 3,700 lft which is 100% complete in Zones #1 and #2.

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton was onsite to survey.		44,000 tons onsite has been reported by CPG.

Weather:	AM: Cloudy	PM: Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 51Deg.	PM: 53 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/18/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-20-2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 2011-05-19

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854101 | TVA Project ID 202207 | Consecutive Report No. 048

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Perimeter Maintenance and Improvements

CPG finish grading the entire length of the perimeter improvements in Zones #1 and #2.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 6 laborers.

Equipment:

In use today:	Idle Equipment:	
1 – Cat 320D excavator	1 – Wilco Long-Stick Hoe (Amphib) 2 – Cat 324D Long-Stick Hoes 4– Morooka Track Trucks 2 – Caterpillar Dozers	

Summary of Daily Observations (Include any Problems and Resolutions):

Based on survey cross-sections and thickness checks the following areas have met the design criteria: Sta. 57+00 to 94+00. This is a total of 3,700 lft out of 3,700 lft which is 100% complete in Zones #1 and #2. (Note that surveys still need to be evaluated.)

Summary of Incidents / Accidents / Health & Safety Issues:

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Clearing and Grubbing	0 ft	3,800 ft
	TN DOT 709.03 Class A-1 riprap	0 Tons	26,000 Tons
	TN DOT No. 2 Stone	0 Tons	0 Tons

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton was onsite to survey.		44,000 tons onsite has been reported by CPG.
		.

Weather:	AM: Partly Cloudy	PM: Partly Cloudy	Contractor Started Work: 7:00 am	Field Representative Started Work: 8:00 am
Temperature:	AM: 55Deg.	PM: 72 Deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:30 pm

Field Representative: Timothy Hicks	Field Representative's Signature: Timothy Hicks	Date: 05/19/2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 5-20-2011

Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.

URS

Sheet: 1 of 1
Date: 08-24-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 049

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

9:00 am: Extended turbidity curtains within Zone 10 an additional 350'. (Approx. Sta. 5+00 to Sta. 8+50)
1:30 pm: Begin placing gravel for access drive at Sta. 46+75 within Zone 11 limit.
3:00 pm: Begin placing gravel for access drive at Sta. 36+00 within Zone 7 limit.

CPG Construction Manpower:

1 supervisor, 1 foreman, 3 operators, 5 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Excavator 2 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat 1 – 350-ft Turbidity Curtain	

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor has commenced preparation for their Access Road to be utilized for work activities. Curtain was extended on the Clinch River in anticipation of the work activities.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
None		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 62 deg.	PM: 91 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 4:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W lsyda A 4	Date: 08-24-2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 8/29/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 08-25-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 050

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

8:30 am: Begin placing gravel for access drive at Sta. 1+00 within Zone 10 limit.
10:30 am: Begin placing gravel for access drive at Sta. 23+00 within Zone 9 limit.

CPG Construction Manpower:

1 supervisor, 1 foreman, 3 operators, 1 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Excavator 2 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor has continued preparation on their Access Road to be utilized for work activities.

Had a discussion with Larry Harper regarding items which will need protection/oversight during operations. The items include monitoring wells, outlet pipe area, and the concrete blocks of the plugged/filled outlet pipe.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton Surveyors were on-site to replace a couple of broken/missing survey markers.		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 72 deg.	PM: 94 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 08-25-2011
Reviewed by: Ken Berry	Reviewer's Signature: Kenneth M Berry	Date: 8/29/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 08-29-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 051

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

8:30 am: Commenced dumping and spreading No. 2 stone for the Access Road starting at Sta. 1+00 and heading south within Zone 10 limit.
8:30 am: Excavator operator conducts a survey of a grove of trees and brush. Broke some branches off the tree and cleared for sight some branches at Sta.1+50 within Zone 10 limit.
9:30 am: Access Road to Sta. 5+00 placed within Zone 10 limit.
10:30 am: Contractor clear a grove of trees and brush Sta. 7+25 to Sta. 8+00 to continue with the access road placement within Zone 10 limit.

Crew extended the Turbidity Curtain from Sta. 8+50 to Sta. 12+00 within Zone 12 limit. 350-ft. extended.

02:30 pm: Access Road completed to Sta. 10+35. Total completed Access Road on this date is 1,035-ft. (Zones 10 and 12)
02:40 pm: Grubbing of trees and brush commences at Sta. 9+95. Crew ended this activity at Sta. 8+40. 155-ft cleared. (Zone 12)

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 5 track truck drivers, and 5 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL Long Stick Excavator, Claw attachment 1 – CAT D6N Dozer 1 – CAT 289C Mini Dozer 5 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor has continued preparation on their Access Road to be utilized for work activities. Rip-Rap stone continues to be delivered on-site.

Conversation with Larry Harper (TVA) regarding the need to discuss with Stantec the areas having Silt Fence Protection. Stantec needs to examine the areas to determine if the Silt Fence Protection is still required.

Track trucks are being counted and considered to have a capacity of 16 tons which is being used to track the work for estimating only.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
Stone placed for Access Road Ramp on August 24, 2011	Rip-Rap Stone Material – Slope Improvements	240 Tons (Est.)	
Stone placed for Access Road Ramp on August 25, 2011	Rip-Rap Stone Material – Slope Improvements	176 Tons (Est.)	
Stone placed for Access Road Ramp on August 29, 2011	Rip-Rap Stone Material – Slope Improvements	32 Tons (Est.)	448 Tons (Est.)

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 08-29-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Stone placed for Access Road Ramp on August 29, 2011			No. 2 Stone Material – Access Road	528 Tons (Est.)	528 Tons (Est.)
Surveyor's Activities:			**Visitors:**	**Construction Materials/Items Installed:**	
Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am	
Temperature:	AM: 64 deg.	PM: 84 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm	
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: W Lajda R [signature]	Date: 08-29-2011	
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 9/1/2011	

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 08-30-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 052

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Contractor cleared and grubbed trees and brush from Sta. 8+40 to Sta. 1+00 within Zones 12 and 10 limits. Second crew commenced the initial placement of rip-rap stone material along the Clinch River shoreline area. Activity started at approx. Sta. 10+00 and ended at Sta. 1+00 within Zones 12 and 10 limits.

CPG Construction Manpower:

1 supervisor, 1 foreman, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 320DL with Claw attachment 1 – CAT D6N Dozer 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

Attended the Weekly Progress Meeting. The following items were discussed:

1. Requested a copy of the Rip-Rap material certification. Mike Wray (CPA) will obtain a copy.
2. Areas which have stone stock-piles are to be protected by silt fence. Two (2) areas in particular need attention. The first being the east slope along the channel between the bottom ash and gypsum stack areas. The second area is a repair on an existing silt fence line along the access road to the Gypsum Disposal Area 2A.
3. The Silt Fence Protection along the Clinch River can be removed in sections to accommodate the placement of the Project's Access Road. Stantec has stated that sufficient amount of vegetation exists along the slope for the fence to be removed. Unfortunately no rain event has occurred to see what affect it would have on the slope.
4. The Turbidity Curtain is to stay in place until the survey data has been collected, reviewed, and all parties are in agreement that the Project's objectives has been achieved.

Contractor commenced to place rip-rap stone material long the Clinch River banks for the initial erosion control. Clearing and Grubbing operation continued to the north and ended at Sta. 1+00. Rip-Rap stone continues to be delivered on-site.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	704 Tons (Est.)	1,152 Tons (Est.)
	No. 2 Stone – Access Road	32 Tons (Est.)	544 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton Surveyors were on-site to relocate missing station marker and to mark pertinent elevations with survey markers.		

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 08-30-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 61 deg.	PM: 84 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A K	Date: 08-30-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 9/1/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 08-31-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 053

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Contractor commenced to clear vegetation from Sta. 3+00 to Sta. 7+50 to elevation 798.00 within Zones 10 and 12 limits.
1:00 pm: Contractor commenced to place rip-rap stone material along the area which was cleared of vegetation.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1-safety representative, 5 operators, 4 tracker truck drivers, and 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT D6N Dozer 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat 1 – CAT 320DL with Claw attachment

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor continued to remove vegetation and place rip-rap stone material within the prepared areas.

Mike Wray indicated that the Project had received all its No. 2 stone material for the Access Road on this date.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	576 Tons (Est.)	1,728 Tons (Est.)
	No. 2 Stone – Access Road	0	544 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 63 deg.	PM: 94 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W. Kowalewski	Date: 08-31-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 9/9/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-01-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 054

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Excavator/loading operation shifting through rip-rap material to eliminate large quantity of fines being incorporated in the stone placement.

9:00 am: Contractor commenced placement of rip-rap stone material in and along the Clinch River bed and portion of the exposed bank area using GPS system data installed in the work equipment. The work was being performed within Sta. 1+00 to Sta. 5+00 Zone 10 limit.

Crew installed silt fence protection along the east slope of the channel between the Bottom Ash and Gypsum Stack areas. The existing silt fence line along the Access Road to the Gypsum Disposal Area 2A was repair.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1-safety representative, 5 operators, 5 tracker truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 289C Mini Dozer 5 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat 1 – CAT 320DL with Claw attachment 1 – CAT D6N Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

Attended the pre-construction meeting where an operator mentioned that during the previous day placement of rip-rap stone material it was observed to contain a large amount of fines within rip-rap material. After the meeting this situation was further examined. The top of the stock pile being used to supply the stone for this activity was observed to have a large amount of fines. Mike Wray (CPG), Larry Harper (TVA), Cannon (CPG), and this Resident Engineer discussed this matter. Mike stated that a representative from the supplier will be on-site. Bill Chesney from Rogers Group, Inc. the quarry providing the stone material arrived and a discussion on this situation ensued. In the interim, this Resident Engineer was given the certified letter from the quarry stating that the material being provided consisted of that per TDOT 709.03. The specifications indicate that the stone shall consist of 2 to 15-inch in size and be free of dust and sand. The specification also indicated that no more than 20% of the load could consist of material less than 4". Bill stated that what we were seeing was the 20% portion of a load consisting of fines and smaller stones. Discussions were made that fines area further generated by delivery and multiple handing of the material. It was determined that the operators would need to shift through the stone pile to mix a pile having a consistency largely made of rip-rap with the load having approx. 20% less of the smaller material. This situation will be re-examined on Tuesday, September 6, 2011.

Mike Wray indicated that the Project had received all its rip-rap stone material for the slope improvements on this date.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	2,736 Tons (Est.)	4,464 Tons (Est.)
	No. 2 Stone – Access Road	0	544 Tons (Est.)

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 09-01-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Surveyor's Activities:			**Visitors:**	**Construction Materials/Items Installed:**	
			Bill Chesney –Rogers Group, Inc.		
Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am	
Temperature:	AM: 67 deg.	PM: 97 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm	
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 09-01-2011	
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 9/9/2011	

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-06-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 055

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Contractor continued placement of rip-rap stone material in and along the Clinch River bed and portions of the exposed bank area using GPS system data installed in the work equipment. The work being performed within Sta. 1+00 to Sta. 7+00 Zone 10 limit.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 5 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT D6N LPG Dozer 1 – CAT 289C Mini Dozer 3 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat 2 – Morooka MST 2200VD Track Trucks

Summary of Daily Observations (Include any Problems and Resolutions):

Attended the Weekly Progress Meeting. The following items were discussed:

1. Project presently on schedule.
2. Issue regarding fines in the rip-rap material was briefly discussed. Equipment Operators are to continue mixing and shifting the storage pile to have a consistence of material.

Contractor continued to place rip-rap stone material along the Clinch River banks for the initial erosion control. Rip-rap material is being delivered and placed along the shoreline in preparation for being spread across the area to Elev. 798.00.

Rock placement under completion along the river bed between Sta. 1+00 to Sta. 5+00. Stone needed to be brought to Elev. 798.00 remaining in this area.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	1.264 Tons (Est.)	5,728 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	544 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 09-06-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Rain	PM: Overcast/Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 62 deg.	PM: 72 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 09-06-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 9/9/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-07-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 056

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Contractor continued placement of rip-rap stone material in and along the Clinch River bed and portions of the exposed bank area using GPS system data installed in the work equipment. The work being performed along the river bed is within Sta. 6+00 to Sta. 7+50. Along the shoreline to Elev. 798.00 work being performed from Sta. 1+00 to Sta. 5+00. Both work areas are within Zone 10 limit.

11:00 am: Vaughn and Melton Surveyors on-site to place section markers along the area currently being worked on.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 5 track truck drivers, 5 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT D6N LPG Dozer 1 – CAT 289C Mini Dozer 5 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat 1 – CAT 336DL Excavator

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor continued to place rip-rap stone material along the Clinch River banks for erosion control. Rip-rap material is being delivered and placed along the shoreline and flat area between the shoreline and Elevation 798.00. This material will be placed and spread across the area to Elev. 798.00.

12:30 pm: Vaughn and Melton Surveyors mentioned that it appears the GPS system being used by the equipment placing the rip rap materials is incorrect due to finished areas having high stone elevation readings. Some field survey points were compared with the GPS points and the GPS points were higher. The area presently needed to be reworked is from Sta. 3+00 to Sta. 5+50. Larry Harper (TVA) was informed of this situation. Justin (TVA) will be on-site Thursday, September 8, 2011 to re-evaluate the data being used by the GPS system in the equipment vehicles.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	1,920 Tons (Est.)	7,648 Tons (Est.)
	No. 2 Stone – Access Road	96 Tons (Est.)	640 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors (See above note for activities performed.)		

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-07-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Drizzle/ Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 61 deg.	PM: 69 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 09-07-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 9/9/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-08-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 057

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Contractor continued placement of rip-rap stone material in and along the Clinch River bed and portions of the exposed bank area using the updated GPS system data installed in the work equipment. The work being performed along the river bed is within Sta. 7+50 to Sta. 10+26. Along the shoreline to Elev. 798.00 work is being performed from Sta. 3+00 to Sta. 5+00. Both work areas are within Zone 10 limit.

7:30 am: Vaughn and Melton Surveyors on-site to place section markers along the remaining work areas yet to be performed.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 5 track truck drivers, 5 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – Gas Motorized Power Boat
1 – CAT 325DL Long Stick Excavator	1 – CAT 336DL Excavator
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT D6N LPG Dozer	
1 – CAT 289C Mini Dozer	
5 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor continued to place rip-rap stone material along the Clinch River banks for the erosion control. Rip-rap material is being delivered and placed along the shoreline then distributed and spread at the proposed elevation.

Justin (TVA) arrived on-site to re-evaluate the data being used by the GPS system in the equipment vehicles. Operators given new data. Operator grading stone and removing excess material due to previous data. Presently the operations for rip rap placement are proceeding per plan.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	416 Tons (Est.)	8,064 Tons (Est.)
	No. 2 Stone – Access Road	48 Tons (Est.)	688 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors (See above note for activities performed.)		

Weather:	AM: Drizzle/ Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 58 deg.	PM: 72 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-08-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-08-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 9/9/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-12-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 058

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Contractor continued placement of rip-rap stone material in and along the Clinch River bed and portions of the exposed bank area using the updated GPS system data installed in the work equipment. The work being performed along the river bed is within Sta. 9+00 to Sta. 10+26, Zone 12 limit. Along the shoreline to Elev. 798.00 work is being performed from Sta. 5+50 to Sta. 9+00, Zones 10 and 12 limits.

7:30 am: Vaughn and Melton Surveyors on-site to survey completed areas.

Boat crew installed 400-ft. of turbidity curtain in the Clinch River from Sta. 12+00 to Sta. 15+50.

CPG Construction Manpower:

CPG – 1 supervisor, 1 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 5 laborer, and 4 man boat crew
Vaughn and Melton – 3 surveyors

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – CAT 336DL Excavator
1 – CAT 325DL Long Stick Excavator	1 – CAT 289C Mini Dozer
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT D6N LPG Dozer	
4 – Morooka MST 2200VD Track Trucks	
1 – Gas Motorized Power Boat	
1 – Gas Motorized Power Boat (Vaughn and Melton)	

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor continued to place rip-rap stone material along the Clinch River banks and spread to proposed elevations.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.
Morning fog, work areas had poor visibility.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	512 Tons (Est.)	8,576 Tons (Est.)
	No. 2 Stone – Access Road	16 Tons (Est.)	704 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors (See above note for activities performed.)		

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 62 deg.	PM: 84 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 09-12-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-12-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 9/22/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-13-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 059

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

7:30 am: Contractor continued placement of rip-rap stone material in and along the Clinch River bed and portions of the exposed bank area using the GPS system data installed in the work equipment. The work being performed along the river bed from Sta. 1+00 to Sta. 3+00, Zone 10 limit and remaining areas from Sta. 9+00 to Sta. 10+26, Zone 12 limit. Areas were checked along the shoreline to Elev. 798.00 from Sta. 3+00 to Sta. 7+50, Zone 10 limit.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 3 track truck drivers, and 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 320DL 3 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat 1 – CAT 324DL Long Stick Excavator (GPS System being examined) 1 – CAT 336DL Excavator 1 – CAT D6N LPG Dozer 1 – CAT 289C Mini Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

Attended the Weekly Progress Meeting. The following items were discussed:

1. Project presently on schedule.
2. Mike Wray stated that 30,344 tons of rip rap and 6,048 tons of No. 2 stone were delivered on-site. As of today, 8,144 tons of rip rap and 736 tons of No. 2 stone has been used on the Project. (Note Cumulative Qty. has been change to reflect this quantity for both items on this report.)
3. At the conclusion of the meeting, Larry Harper (TVA), Mike Wray (CPG), Cannon (CPG), John (CPG), Jason Kennedy (TVA), Ryan Henley (Vaughn & Melton), and this Resident Engineer discussed the preliminary cross-sections taken on Zones 10 and 12. Areas which appeared to be questionable were reexamined for thicken in the field. Areas which need to be reworked and resurveyed are from Sta. 1+00 to Sta. 3+00, Sta. 4+00, Sta. 5+00, Sta. 6+50 and Sta. 10+00 to Sta. 10+26.

Contractor continued to place rip-rap stone material along the Clinch River banks and spread to proposed elevations.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.
Morning fog, work areas had poor visibility.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	320Tons (Est.)	8,464 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	736 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on-site to attend Weekly Progress Meeting after which the preliminary survey sections of Zones 10 and 12 were discussed.		

****Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 09-13-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 60 deg.	PM: 85 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 09-13-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 9/22/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-14-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 060

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Field Operation Notes (Zone 13):

1. Crew commenced to remove Silt Fence Protection from Sta. 12+75 to Sta. 15+50.
2. Operator removed vegetation for placement of the Access Road.
3. No. 2 stone was placed on the Access Road.
4. Clearing and grubbing operation commenced along Sta. 12+75 to Sta. 15+50.
5. Brush groves, trees, and roots were removed.
6. Operator spread an initial layer of rip rap material along the shoreline for erosion control measures.

Crew continued to perform final grading in Zones 10 and 12.

Crew installed 600-ft. of turbidity curtain along the Clinch River from Sta. 15+50 to Sta. 21+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 3 track truck drivers, 4 laborer, 4 man boat crew

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – CAT 336DL Excavator
1 – CAT 325DL Long Stick Excavator	1 – CAT D6N LPG Dozer
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
3 – Morooka MST 2200VD Track Trucks	
1 – Gas Motorized Power Boat	

Summary of Daily Observations (Include any Problems and Resolutions):

Contractor removed silt fence, removed vegetation, installed No. 2 stone Access Road, cleared and grubbed area, and placed initial rip rap material within Sta. 12+75 to Sta. 15+50.

Crew installed turbidity curtain along the Clinch River.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	496 Tons (Est.)	8,960 Tons (Est.)
	No. 2 Stone – Access Road	144 Tons (Est.)	880 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 60 deg.	PM: 87 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 9:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-14-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 09-14-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 9/22/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 09-15-2011

Sun Mon Tues Wed <u>Thurs</u> Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 061

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

<u>Rock Protection</u>

Crew continued to perform final grading in Zones 10 and 12.

At the start of the day, the Crew noticed that the turbidity curtain had separated in a couple of places. The curtain installer was contacted and the sections were joined. At the end of the day, the same situation occurred, being that the curtain had again been separated. The Crew returned and correction the latest occurrence. Separation may have been caused by heavy winds persisting throughout the day. The curtains were being torn at their eyelet connection.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 3 track truck drivers, 4 laborer, and 4 man boat crew

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 3 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT 336DL Excavator 1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

Cannon (CPG) had questioned an area just north of Sta. 12+75, the Barge Ramp area going out to Clinch River. The plans did not indicate that the area needed to be cleared of its brush or trees and, in addition, does not call for stone. This issue will be further discussed at the Weekly Progress Meeting.

Due to the recent turbidity curtain performance in the Clinch River, the contractor has elected to replace the curtain with one that has a cable both on its top and bottom portion to prevent separation from occurring. The present submittal for the proposed curtain did not have a product data sheet so a comparison to the TDOT Standard Drawing was not confirmed. Contractor to provide this information on Friday, September 16, 2011 for review.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	<u>Today's</u> Qty:	<u>Cumulative</u> Qty:
	Rip-Rap Stone Material – Slope Improvements	112 Tons (Est.)	9,072 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	880 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Overcast / Slight Drizzle / Windy	PM: Overcast / Windy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 09-15-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Temperature:	AM: 66 deg.	PM: 74 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 6:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A K	Date: 09-15-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 9/22/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-19-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 062

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew commenced to perform work in Zone 13.

Work Activities being performed include:

1. Crew commenced to remove Silt Fence Protection from Sta. 15+50 to Sta. 23+00.
2. Operator removed vegetation for placement of the Access Road within the above stations.
3. No. 2 stone was placed on the Access Road from Sta. 15+50 to Sta. 23+00.
4. Clearing and grubbing operation commenced along Sta. 15+50 to Sta. 16+50.
5. Brush groves, trees, and roots were removed.
6. Operator spread an initial layer of rip rap material along the shoreline for erosion control measures up to Sta. 16+50.

Crew installed turbidity curtain along the Clinch River with its final span being from Sta. 12+00 to Sta. 25+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 3 track truck drivers, 4 laborer, 4 turbidity curtain installers.

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL with Claw attachment 1 – CAT 289C Mini Dozer 3 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT 336DL Excavator 1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

Vaughn and Melton returned on-site to resurvey reworked areas along Zones No. 10 and No. 12. The stations were from Sta. 1+00 to Sta. 3+50, Sta. 4+00, Sta. 5+00, Sta. 6+50, Sta. 10+00, and Sta. 10+26.

Turbidity curtain discussions occurred during the day. The Contactor was informed to provide product data sheets for the curtain used on Zones 01 and 02.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	32 Tons (Est.)	9,104 Tons (Est.)
	No. 2 Stone – Access Road	224 Tons (Est.)	1,104 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton – Review above for work performed.		

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-19-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 62 deg.	PM: 77 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 6:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 09-19-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-20-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 063

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13.

Work Activities being performed include:

1. Clearing and grubbing operation commenced along Sta. 16+50 to Sta. 21+50.
2. Brush groves, trees, and roots were removed.
3. Operator spread an initial layer of rip rap material along the shoreline for erosion control measures up to Sta. 21+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – CAT 336DL Excavator
1 – CAT 325DL Long Stick Excavator	1 – CAT D6N LPG Dozer
1 – CAT 324DL Long Stick Excavator	1 – Gas Motorized Power Boat
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended the Weekly Progress Meeting. The following topics were discussed:

1. The Project activities performed up to date were discussed. Project 21% complete.
2. Issue regarding the Barge Ramp area was discussed. Area to be further evaluated. TVA will determine if the area is to be cleared of its shrubs and placed with stone.
3. Turbidity curtain issue was discussed. The curtain spec. falls under the Corp. of Engineering guidelines.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	896 Tons (Est.)	10,000 Tons (Est.)
	No. 2 Stone – Access Road	80 Tons (Est.)	1,184 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Overcast	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 61 deg.	PM: 76 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-20-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-20-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-21-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 064

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13.

Work Activities being performed include:

1. Clearing and grubbing operation commenced along Sta. 21+50 to Sta. 23+50.
2. Brush groves, trees, and roots were removed.
3. Operator spread an initial layer of rip rap material along the shoreline for erosion control measures up to Sta. 21+50.
4. Crew commenced rip rap stone placement into Clinch River starting at Sta. 12+75. Activity proceeding in the south direction.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – CAT 336DL Excavator
1 – CAT 325DL Long Stick Excavator	1 – CAT D6N LPG Dozer
1 – CAT 324DL Long Stick Excavator	1 – Gas Motorized Power Boat
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	928Tons (Est.)	10,928 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,184 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Rain	PM: Rain / Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 65 deg.	PM: 78 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-21-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-22-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 065

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13. Work proceeding with Operators placing rip rap stone into Clinch River from the north and south ends of the clearing limits. North end from Sta. 12+75 to Sta. 14+50. South end from Sta. 23+50 to Sta. 22+25.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 3 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – CAT 336DL Excavator
1 – CAT 325DL Long Stick Excavator	1 – CAT D6N LPG Dozer
1 – CAT 324DL Long Stick Excavator	1 – Gas Motorized Power Boat
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
3 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	768 Tons (Est.)	11,696 Tons (Est.)
	No. 2 Stone – Access Road	16 Tons (Est.)	1,200 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Foggy / Slight Drizzle	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 65 deg.	PM: 83 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-22-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-23-2011

Sun Mon Tues Wed Thurs **Fri** Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 066

Summary of Construction/Operation Activities:

Rock Protection

Vaughn and Melton Surveyors were on-site to place survey markers designating Elevation 798.00 bench between Sta. 12+75 to Sta. 23+50.

CPG Construction Manpower:

Equipment:

In use today:	Idle Equipment:
	1 – CAT 336DL Excavator 1 – CAT D6N LPG Dozer 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

No work activities performed on this date.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	11,696 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,200 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton were on-site. See above for activity performed.		

Weather:	AM: Overcast / Rain	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 67 deg.	PM: 77 deg.	Contractor Stopped Work: 2:00 pm	Field Representative Stopped Work: 2:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-23-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 09-26-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility
Project: Perimeter Maintenance and Improvements
Project Phase: Ash Disposal Area

Job No. 31854171
TVA Project ID 10W509
Consecutive Report No. 067

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13. Work proceeding with Operators placing rip rap stone into Clinch River from the north and south ends of the clearing limits. North end from Sta. 12+75 to Sta. 16+50. South end from Sta. 22+50 to Sta. 21+50.

CPG Construction Manpower:

CPG – 1 supervisor, 1 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer
Vaughn and Melton – 3 surveyors

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT 336DL Excavator 1 – CAT 320DL 1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

High winds had pushed the turbidity curtain close to the Clinch River shoreline. Contractor informed of this matter. Crew will be scheduled to push and re-anchor curtain during the week. Issue presently does not impede the placement of rip rap material along the river shoreline.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	592 Tons (Est.)	12,288 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,200 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on site to perform preliminary survey of Zone 13.		

Weather:	AM: Overcast / Windy	PM: Overcast / Drizzle / Windy	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 68 deg.	PM: 82 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 09-26-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-27-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 068

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13. Work proceeding with Operators placing rip rap stone into Clinch River from the north and south ends of the clearing limits. North end from Sta. 12+75 to Sta. 15+50. South end from Sta. 22+50 to Sta. 21+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT 336DL Excavator 1 – CAT 320DL 1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended Weekly Progress Meeting. Following items were discussed:

1. Project is currently on schedule.
2. Silt fence at the horseshoe area (approx. Sta. 34+00 to 35+00) may need to remain in place once the work activity reaches the area due to fines coming along the Bottom Ash Disposal Area access ramp. This issue will require further examination from TVA.
3. The amount of rip rap material presently in place to date is 11, 696 Tons and 1,200 Tons of No. 2 stone. The Cumulative Qty. summary has been updated to reflect these new totals.
4.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	672 Tons (Est.)	12,368 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,200 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 60 deg.	PM: 78 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 09-27-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-27-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 09-28-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 069

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13. Work proceeding with Operators placing rip rap stone into Clinch River from the north and south ends of the clearing limits. North end from Sta. 15+50 to Sta. 17+00. South end from Sta. 21+50 to Sta. 20+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 3 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 289C Mini Dozer 3 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT 336DL Excavator 1 – CAT 320DL 1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	544 Tons (Est.)	12,912 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,200 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 57 deg.	PM: 79 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 09-28-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 09-29-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 070

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13. Work proceeding with Operators placing rip rap stone into Clinch River from the north and south ends of the clearing limits. North end from Sta. 17+00 to Sta. 18+00. South end from Sta. 22+00 to Sta. 21+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 3 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – CAT 336DL Excavator
1 – CAT 325DL Long Stick Excavator	1 – CAT 320DL
1 – CAT 324DL Long Stick Excavator	1 – CAT D6N LPG Dozer
1 – CAT 289C Mini Dozer	
3 – Morooka MST 2200VD Track Trucks	
1 – Gas Motorized Power Boat	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Rip-Rap Stone Material – Slope Improvements	416 Tons (Est.)	13,328 Tons (Est.)
	No. 2 Stone – Access Road	32 Tons (Est.)	1,232 Tons (Est.)

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 57 deg.	PM: 80 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 09-29-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/3/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 10-03-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 071

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Crew continued to perform work in Zone 13. Work proceeding with Operators placing rip rap stone into Clinch River from the north and south ends of the clearing limits. Work being performed between Sta. 18+00 to Sta. 21+00. At the end of the day, Zone 13 had been completed and was ready for the Surveyors to perform cross-sections.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 330DL Excavator	1 – CAT 336DL Excavator
1 – CAT 325DL Long Stick Excavator	1 – CAT D6N LPG Dozer
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	
1 – Gas Motorized Power Boat	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	608 Tons (Est.)	13,936 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,232 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton on-site to perform preliminary cross-sections on areas completed in Zone 13.		

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 39 deg.	PM: 69 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 10-03-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/11/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-04-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 072

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Operators checked Zone 13 from Sta. 12+75 to 23+50 for potential high and low areas. Areas encountered were corrected.

A section of turbidity curtain was connected to the present curtain along Zone 13. The additional curtain spanned from Sta. 23+50 to Sta. 29+50

CPG Construction Manpower:

1 supervisor, 2 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer, and 3 turbidity curtain crew members

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended the Weekly Progress Meeting. The following items were discussed:

1. Project has completed 48% of its work activities.
2. Zone 13 is complete and ready for the Surveyor to perform cross-sections. Surveyors will be on-site Wednesday, October 12, 2011 to perform cross-sections.
3. Issue regarding possible work to be performed on the Barge Ramp area. Billy Simpson (TVA) will be preparing a letter with recommendations.
4. Discussion regarding the horseshoe area of the project site. Slope changes will be encountered. TVA requested for guidance.
5. Silt fence removal. Stantec to be contacted. Presently, silt fence is being removed only in area were the turbidity curtain is in-place.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	192 Tons (Est.)	14,128 Tons (Est.)
	No. 2 Stone – Access Road	48 Tons (Est.)	1,280 Tons (Est.)

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-04-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Surveyor's Activities:			**Visitors:**	**Construction Materials/Items Installed:**
Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 42 deg.	PM: 76 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 10-04-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 10/11/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 10-05-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 073

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

Vaughn and Melton Surveyors were on-site to obtain cross-sections on Zone 13 on this date.

CPG Crew performed the following work activities:

1. Silt fence was removed from Sta. 23+50 to Sta. 29+50.
2. Vegetation was removed for the Access Road within the above-mentioned limits.
3. No. 2 stone was placed for the Access Road within the above-mentioned limits.

CPG Construction Manpower:

1 supervisor, 2 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator	1 – CAT D6N LPG Dozer
1 – CAT 330DL Excavator	1 – Gas Motorized Power Boat
1 – CAT 325DL Long Stick Excavator	
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	48 Tons (Est.)	14,176 Tons (Est.)
	No. 2 Stone – Access Road	304 Tons (Est.)	1,584 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors – See above for activity being performed.		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 42 deg.	PM: 63 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 6:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 10-05-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/11/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-06-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 074

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator performed clearing and grubbing activity from Sta. 23+50 to Sta. 29+50.
2. Operator placed initial rip rap stone material for erosion protection.

CPG Construction Manpower:

1 supervisor, 2 foreman, 1 safety representative, 4 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator	1 – CAT D6N LPG Dozer
1 – CAT 330DL Excavator	1 – Gas Motorized Power Boat
1 – CAT 325DL Long Stick Excavator	
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Received and reviewed Zone 13 cross-sections. All sections appear to be satisfactory. The following sections were field verified and found to be acceptable:

In Zone 10:

Sta. 1+50 (Offset 110') — Top of Rip Rap Elevation: 788.80; Ground Elevation: 785.00

In Zone 12:

Sta. 9+00 (Offset 100') — Top of Rip Rap Elevation: 785.20; Ground Elevation: 783.85

Sta. 10+26 (Offset 80') — Top of Rip Rap Elevation: 791.20; Ground Elevation: 788.55

Sta. 10+26 (Offset 96.7') — Top of Rip Rap Elevation: 785.20; Ground Elevation: 784.00

In Zone 13:

Sta. 16+00 (Offset 70') — Top of Rip Rap Elevation: 792.25; Ground Elevation: 789.40

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-06-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Sta. 18+50 (Offset 85') Top of Rip Rap Elevation: 787.50
Ground Elevation: 784.50

Sta. 19+00 (Offset 75') Top of Rip Rap Elevation: 789.75
Ground Elevation: 788.30 (Bedrock)

Sta. 22+50 (Offset 85') Top of Rip Rap Elevation: 792.70
Ground Elevation: 790.45

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	352 Tons (Est.)	14,176 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,584 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors – See above for activity being performed.		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 47 deg.	PM: 81 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 6:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W ladyslaw A K	Date: 10-06-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 10/11/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-10-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 075

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators commenced to place rip rap material along the east bank of the Clinch River. The initial placement of the rip rap stone material will be used as a bench area in order to reach the intended edge limits of the fill area. The bench placement currently being installed from Sta. 23+50 to Sta. 24+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	496 Tons (Est.)	14,672 Tons (Est.)
	No. 2 Stone – Access Road	128 Tons (Est.)	1,712 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors – Surveyor on-site to locate and stake Elev. 798.00.		

Weather:	AM: Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 57 deg.	PM: 73 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 10-10-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/3/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 10-11-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 076

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew moved the turbidity curtain to be located between Sta. 22+00 to Sta. 40+00.
2. Operators continued to place rip rap stone material along the east bank of the Clinch River. The placement of the rip rap stone material will be used as a bench area in order to reach the intended edge limits of the fill area. The bench placement continued to be installed from Sta. 23+50 to Sta. 24+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborer, 4-turbidity curtain placement crew

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	432 Tons (Est.)	15,104 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	1,712 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Overcast / Rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 59 deg.	PM: 66 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 10-11-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/3/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 10-12-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 077

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew removed the silt fence from Sta. 29+50 to Sta. 33+50. Vegetation was removed and No. 2 stone was placed within these limits for the Access Road.
2. Crew performing clearing and grubbing operations between Sta. 29+00 to Sta. 30+00. Crew placed initial rip rap stone material for erosion control within these limits.
3. Existing rip rap stone material is present between Sta. 30+50 to Sta. 32+50. This area will be cleared of vegetation and will receive rip rap stone material as-needed on order to achieve the 1.5-ft. required fill.
4. Operators continued to place rip rap stone material along the east bank of the Clinch River. The placement of the rip rap stone material will be used as a bench area in order to reach the intended edge limits of the fill area. The bench placement continued to be installed from Sta. 24+50 to Sta. 26+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended the Weekly Project Progress Meeting. The following items were discussed:

1. 43% completion on project activities per the Project Schedule.
2. Currently the Crew is working within Zone 9. Benches made from rip rap stone material are being placed along the east bank of the Clinch River in order for the Operator to reach the intended limit of the fill area.
3. The Barge Ramp RFI has been addressed. At the present time, no work date has been assigned for this activity.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	320 Tons (Est.)	15,424 Tons (Est.)
	No. 2 Stone – Access Road	64 Tons (Est.)	1,776 Tons (Est.)

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 10-12-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Surveyor's Activities:			**Visitors:**	**Construction Materials/Items Installed:**
Weather:	AM: Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 57 deg.	PM: 73 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A K	Date: 10-12-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 11/3/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-13-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 078

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew performing clearing and grubbing operations between Sta. 30+00 to Sta. 34+00. Crew placed initial rip rap stone material for erosion control within these limits.
2. Operators continued to place rip rap stone material along the east bank of the Clinch River. The placement of the rip rap stone material will be used as a bench area in order to reach the intended edge limits of the fill area. The bench placement continued to be installed from Sta. 24+50 to Sta. 26+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	464 Tons (Est.)	15,888 Tons (Est.)
	No. 2 Stone – Access Road	96 Tons (Est.)	1,872 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Drizzle / Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 57 deg.	PM: 73 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 10-13-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/3/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 10-17-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 079

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River. Work commenced along the north side of the east bank between Sta. 23+75 to Sta. 25+00. Along the south side between Sta. 32+00 to Sta. 33+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	1,200Tons (Est.)	17,088 Tons (Est.)
	No. 2 Stone – Access Road	48Tons (Est.)	1,920 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 55 deg.	PM: 80 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 10-17-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-18-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 080

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River. Work continued along the north side of the east bank between Sta. 23+75 to Sta. 24+50. Along the south side between Sta. 31+00 to Sta. 31+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended the Weekly Progress Meeting. The following items were discussed:

1. 58% of the project has been completed based on the schedule.
2. December 8, 2011 is the anticipated date for the completion of the project.
3. Contactor has requested if there was a need for an Excavation Permit for work to be performed at the Barge Ramp area. Larry Harper (TVA) will look into this matter.

Contractor request 50-ft. cross-sections of the area spanning from Sta. 32+00 to Sta. 38+00. These stations encompass a horseshoe area of the east bank along the Clinch River. The Contractor needs the cross sections to determine the limits of the rip rap stone placement within the area. Ken Berry (URS) was contacted for this request.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	880Tons (Est.)	17,968 Tons (Est.)
	No. 2 Stone – Access Road	0Tons (Est.)	1,920 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-18-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 56 deg.	PM: 79 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 10-18-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.

URS

Sheet: 1 of 1
Date: 10-19-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 081

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River. Work continued along the north side of the east bank between Sta. 23+75 to Sta. 25+00. Along the south side between Sta. 28+50 to Sta. 31+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	1,120 Tons (Est.)	19,088 Tons (Est.)
	No. 2 Stone – Access Road	96Tons (Est.)	2,016 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 58 deg.	PM: 57 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 10-19-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-20-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 082

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River. Work continued along the north side of the east bank between Sta. 25+00 to Sta. 26+50. Along the south side between Sta. 28+50 to Sta. 30+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

1. Received requested cross-sections. Cross-sections did not have limits of rip-rap placement, only existing ground was shown. Contacted Ken Berry (URS) and requested that the limits of the rip-rap stone material be shown on the drawings.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	768 Tons (Est.)	19,856 Tons (Est.)
	No. 2 Stone – Access Road	144Tons (Est.)	2,160 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Windy / Overcast	PM: Windy / Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 43 deg.	PM: 56 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 6:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W Władysław A. K	Date: 10-20-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-24-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 083

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River. Work continued along the north side of the east bank between Sta. 25+50 to Sta. 26+50 removing the bench used to reach the outer limits of the stone placement area. Along the south side between Sta. 28+50 to Sta. 30+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	864 Tons (Est.)	20,720 Tons (Est.)
	No. 2 Stone – Access Road	80 Tons (Est.)	2,240 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 46 deg.	PM: 71 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 10-24-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 10-25-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 084

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator commenced to remove vegetation and clear brush from the Barge Ramp area. Once this was performed, Larry Harper (TVA) requested that the Contractor lay-back the slope 1.5:1 in order to lay down rip rap stone material on its surface. The slope was lay-back and covered with rip rap stone material. An 18-ft Jersey Barrier was placed in front of the ramp to deter vehicle from driving into the Clinch River.
2. Operators placed rip rap stone material along the east bank of the Clinch River. Work continued along the north side of the east bank between Sta. 25+50 to Sta. 26+50 removing the bench used to reach the outer limits of the stone placement area. Along the south side work continued between Sta. 28+50 to Sta. 30+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator	1 – CAT D6N LPG Dozer
1 – CAT 330DL Excavator	1 – Gas Motorized Power Boat
1 – CAT 325DL Long Stick Excavator	
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended the Weekly Progress Meeting. Following items were discussed:

1. Contractor was requested to place a stone berm or a section of barrier wall in front of the Barge Ramp once the required work had been performed. This would deter anyone from accidently driving into the Clinch River.
2. Larry Harper (TVA) stated that no Excavation Permit is required to perform the work at the Barge Ramp.
3. This Inspector inquired if anyone had any information regarding the drainage pipe located under the Access Road near the horseshoe area made by the Clinch River (Area between Sta. 34+00 and Sta. 36+00). This item will be examined further.
4. CPG stated that they will require additional rip rap stone material to complete the project. They estimate approx. 2,000 Tons of additional stone material would be required.
5. Discussion regarding the placement of 1-ft. of rip rap stone material within the channel between the Bottom Ash Stack and the Gypsum Stack was discussed. No further action would be required from the Corp. of Engineers if this work activity were to take place.
6. CPG requested that the above-mentioned channel be brushed hog approx. 30 days before their work commences in the area in order to get a better view of their work activities.

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 10-25-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	464 Tons (Est.)	21,184 Tons (Est.)
	No. 2 Stone – Access Road	16 Tons (Est.)	2,256 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 45 deg.	PM: 74 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 10-25-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 10-26-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 085

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator removed silt fence from Sta. 36+00 to Sta. 40+00. Vegetation was removed and No. 2 stone was placed for the access road within these limits.
2. Operators placed rip rap stone material along the east bank of the Clinch River. Work continued along the north side of the east bank between Sta. 26+50 to Sta. 30+00. Along the south side work continued between Sta. 33+00 to Sta. 34+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator	1 – CAT D6N LPG Dozer
1 – CAT 330DL Excavator	1 – Gas Motorized Power Boat
1 – CAT 325DL Long Stick Excavator	
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

With regards to the drainage pipe located under the Access Road near the horseshoe area made by the Clinch River (Area between Sta. 34+00 and Sta. 36+00), Larry Harper had shown this Inspector drawings which indicate that the drainage pipe is a 72-inch CMP with an approximate invert elevation being at 787. CPG was informed of this and requested that their on-site Surveyor locate the pipe. Larry Harper (TVA) will prepare an RFI regarding how work is to proceed in this area.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	1,088 Tons (Est.)	22,272 Tons (Est.)
	No. 2 Stone – Access Road	208 Tons (Est.)	2,464 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on-site to survey cross-section Sta. 23+50 to Sta. 32+00.		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 49 deg.	PM: 76 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-26-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 10-26-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-27-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 086

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator commenced clearing and grubbing activities from Sta. 36+00 to Sta. 40+00. Initial rip rap stone material was placed for erosion control within these limits.
2. Operators performed final grading between Sta. 32+00 and Sta. 34+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	528 Tons (Est.)	22,800 Tons (Est.)
	No. 2 Stone – Access Road	144 Tons (Est.)	2,608 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on site to locate elevation 798 along the new section being cleared.		

Weather:	AM: Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 52 deg.	PM: 64 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W Kowalewski	Date: 10-27-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 10-31-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 087

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap material between Sta. 34+00 and Sta. 36+50.
2. Operators performed final grade checks between Sta. 32+00 to Sta. 34+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

1. Review Cross-Sections from Sta. 23+50 to Sta. 32+00. Cross-Sections were satisfactory. The following Cross-Sections were field verified and found to be satisfactory:

Sta. 26+50

Offset	115'
Top of Rock Elevation	789.75
Ground Elevation	787.60

Sta. 27+00

Offset	110'
Top of Rock Elevation	788.50
Ground Elevation	785.75

2. Discussion regarding RFI on work to be performed in the horseshoe area along the Clinch River. Contractor was instructed to remove vegetation and place rip rap stone material to elevation 798.00 and 1-ft. to 2-ft. into the water's edge from Sta. 34+00 to Sta. 36+50.

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Date: 10-31-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	720 Tons (Est.)	23,520 Tons (Est.)
	No. 2 Stone – Access Road	176 Tons (Est.)	2,784 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on site to locate elevation 798 along the new section being cleared.		

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 38 deg.	PM: 60 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 10:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W[illegible] A. K[illegible]	Date: 10-31-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-01-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 088

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River between Sta. 36+50 and Sta. 40+00.
2. Turbidity curtain was moved between Sta. 32+00 to Sta. 49+50.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer, 3 turbidity curtain crew

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended Weekly Progress Meeting. Following items were discussed:

1. According to the project schedule, 64% of its activities are complete.
2. Internal discussions being made if the channel between the Bottom Ash Stack and Gypsum Stack will receive 1-ft of rip rap stone material. A decision is pending.
3. Discussion regarding addition rip rap stone material required to complete the current project.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	928 Tons (Est.)	24,448 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	2,784 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on-site to survey cross-section Sta. 32+00 to Sta. 34+00.		

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 36 deg.	PM: 60 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

Sheet: 1 of 1
Date: 11-01-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 11-01-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-02-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 089

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator removed silt fence between Sta. 40+00 to Sta. 47+00. Vegetation was removed and No. 2 stone was placed for the Access Road within these limits.
2. Operators placed rip rap stone material along the east bank of the Clinch River between Sta. 38+00 and Sta. 40+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	544 Tons (Est.)	24,992 Tons (Est.)
	No. 2 Stone – Access Road	320Tons (Est.)	3,104 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 35 deg.	PM: 67 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 11-02-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/16/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-03-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 090

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator commenced clearing and grubbing activities between Sta. 40+00 to Sta. 47+00. Rip rap stone material was placed within these limits for initial erosion control.
2. Operators placed rip rap stone material along the east bank of the Clinch River creating a bench area at Sta. 40+00 in order to reach the outer limits of the stone placement.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator	1 – CAT D6N LPG Dozer
1 – CAT 330DL Excavator	1 – Gas Motorized Power Boat
1 – CAT 325DL Long Stick Excavator	
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	800 Tons (Est.)	25,792 Tons (Est.)
	No. 2 Stone – Access Road	32Tons (Est.)	3,136 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Overcast	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 42 deg.	PM: 62 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 11-03-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11-22-2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-07-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 091

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River creating a bench area from the north end between Sta. 41+50 to Sta. 44+00 and from the south end between Sta. 42+50 to 47+00 in order to reach the outer limits of the stone placement.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer, 2 surveyors

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	800 Tons (Est.)	26,592 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	3,136 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyor were on-site to obtain the location, top elevation, and invert of the 72-inch CMP drainage pipe at its east and west ends.		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 38 deg.	PM: 69 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 11-07-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-08-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 092

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River continuing to create a bench area between Sta. 41+50 to Sta. 42+50 in order to reach the outer limits of the stone placement.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	400 Tons (Est.)	26,992 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	3,136 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 26 deg.	PM: 53 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 11-08-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-09-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 093

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operators placed rip rap stone material along the east bank of the Clinch River starting from the north end at Sta. 36+50 moving south and from the south end at Sta. 46+00 moving north.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	1,296 Tons (Est.)	28,288 Tons (Est.)
	No. 2 Stone – Access Road	64 Tons (Est.)	3,200 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Overcast	PM: Overcast / Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 47 deg.	PM: 66 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W. Kowalewski	Date: 11-09-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-10-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 094

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator removing work area bench made from rip rap stone material from Sta. 39+50 to Sta. 42+00 along the east bank of the Clinch River. The removed bench material being used for stone placement at Sta. 47+00 moving north.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator	1 – CAT D6N LPG Dozer
1 – CAT 330DL Excavator	1 – Gas Motorized Power Boat
1 – CAT 325DL Long Stick Excavator	
1 – CAT 324DL Long Stick Excavator	
1 – CAT 320DL	
1 – CAT 289C Mini Dozer	
4 – Morooka MST 2200VD Track Trucks	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Site receiving rip rap stone material from Roger's Group. The Contractor has estimated that they would need 3,000 tons of rip rap stone material to complete the project.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	240 Tons (Est.)	28,528 Tons (Est.)
	No. 2 Stone – Access Road	80 Tons (Est.)	3,280 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 42 deg.	PM: 52 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W. [signature]	Date: 11-10-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 11-14-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 095

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew commenced to remove the silt fence between Sta. 47+00 to 49+00. Vegetation was removed and No. 2 stone aggregate material was placed within these limits for the Access Road.
2. Operators commenced final grading within the limits of Sta. 41+00 to 47+00 along the east bank of the Clinch River.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer, 2 surveyors

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	176 Tons (Est.)	28,704 Tons (Est.)
	No. 2 Stone – Access Road	112 Tons (Est.)	3,392 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors were on-site to perform preliminary cross-sections of the finished area.		

Weather:	AM: Slight Drizzle / Windy / Overcast	PM: Windy / Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 56 deg.	PM: 72 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature:	Date: 11-14-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 11-15-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 096

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew commenced clearing and grubbing activities between Sta. 47+00 to 49+00. Rip rap stone material placement along the east bank of the Clinch River within these limits followed its completion.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer, 3 surveyors

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Discussion regarding vegetation growth along the side slope area between Sta. 43+50 to Sta. 53+50. Vegetation is sparse. Previous e-mails from Stantec have stated that the perimeter project may proceed in the area where the silt fence was installed along the east bank of the Clinch River as long as the turbidity curtain was in-place and the Access Road installed. The Access Road would serve as a silt fence protector once the work in the area was complete and the turbidity curtain moved. Steve Belding (URS) will further examine this issue.

Attended the Weekly Project Progress Meeting. The following items were discussed:

1. URS to include the 72-inch CMP drainage pipe into the plants Pipe Inventory drawings.
2. 75% of the project had been completed per the schedule. Completion date being December 8, 2011.
3. The silt fence along the channel between the Bottom Ash and Gypsum Stacks is to remain in place.
4. CP has an excess amount of No. 2 stone which will not be used once the project is completed. The plant may have access to use the material after the project.
5. The areas where rip rap stone material had been stored and removed will require grass seeding.
6. Calculation had been made to estimate the amount of rip rap stone material to finish off the project. The estimated quantity is 3,000 tons.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 11-15-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	448 Tons (Est.)	29,152 Tons (Est.)
	No. 2 Stone – Access Road	208 Tons (Est.)	3,600 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors were on-site to perform cross-sections of the finished area.		

Weather:	AM: Slight Drizzle / Overcast	PM: Overcast / Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 61 deg.	PM: 70 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 11-15-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-16-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 097

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew commenced final grading of the rip rap stone material along the east bank of the Clinch River between Sta. 47+00 to 49+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

This Inspector reviewed the finished cross-sections from Sta. 32+00 to Sta. 46+50. The cross-sections were reviewed and found to be satisfactory. The following cross-sections required further field examination and were found to be satisfactory:

Sta. 38+50

Offset: 75-ft.
Top of Stone Elevation: 789.55
Ground Elevation: 786.60

Sta. 39+00

Offset: 80-ft.
Top of Stone Elevation: 790.45
Ground Elevation: 787.40

Due to rain conditions occurring on-site, the Contractor had elected to suspend their afternoon operations at 1:30 pm.

Steve Belding (URS) arrived on-site to examine effects the current rain event had on the project.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 11-16-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	29,152 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	3,600 Tons (Est.)

Surveyor's Activities:	Visitors: Steve Belding (URS)	Construction Materials/Items Installed:

Weather:	AM: Rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 61 deg.	PM: 67 deg.	Contractor Stopped Work: 1:30 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 11-16-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-17-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 098

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator installed an Access Ramp at Sta. 57+00.
2. Crew moved the turbidity curtain to be position between Sta. 47+00 and Sta. 57+00.
3. Operator commenced to remove the silt fence from Sta. 49+00 to 53+00. Vegetation was removed and No. 2 stone material was placed within these limits for the Access Road.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer, 3 turbidity curtain crew

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT D6N LPG Dozer

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	29,152 Tons (Est.)
	No. 2 Stone – Access Road	208 Tons (Est.)	3,808 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 40 deg.	PM: 46 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W Kowalewski	Date: 11-17-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/21/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-21-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 099

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Removed silt fence from Sta. 53+00 to Sta. 57+00. Removed vegetation and placed No. 2 stone material for the Access Road within these limits.
2. Commence partial clearing activity within the above station limits.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Seepage area was reviewed by Rachel Combs (TVA), Glen Dieterle (URS), and David Skeggs (URS). The seepage area is at approx. Sta. 56+00 and is occurring along the top portion of the previously plugged outflow structure at this location. Area will be monitored and further discussed internally. Rachel stated that RHO&M would need to be notified if there were any exploratory action being considered to occur at the seepage area.

Contractor indicated to this Inspector that TVA has elected not to remove the trees and vegetation from the channel area between the Bottom Ash and Gypsum Stack area.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	64 Tons (Est.)	29,216 Tons (Est.)
	No. 2 Stone – Access Road	272 Tons (Est.)	4,080 Tons (Est.)

Surveyor's Activities:	Visitors: Rachel Combs (TVA), Glen Dieterle (URS), and David Skeggs	Construction Materials/Items Installed:

Weather:	AM: Foggy / Rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 58 deg.	PM: 71 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-21-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 11-21-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/29/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-22-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 100

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Commenced clearing and grubbing activity between Sta. 49+00 to Sta. 51+25. Once completed the area receive an initial placement of rip rap stone material for erosion control.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Due to field conditions and the constant rain event occurring throughout the day, the Contractor had elected to suspend his operations at 12:30 pm. Work condition will be reevaluated on Wednesday, November 23, 2011 to determine if the work will continue.

Ben Phillips (TVA) arrived on-site to examine the seepage area at approx. Sta. 56+00. Ben had stated that this issue was an engineering matter but would offer any assistance if requested on this issue. Ben contact Rachel Combs (TVA) with regards to this issue.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	160 Tons (Est.)	29,376 Tons (Est.)
	No. 2 Stone – Access Road	64 Tons (Est.)	4,144 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Foggy / Overcast	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 56 deg.	PM: 72 deg.	Contractor Stopped Work: 12:30 pm	Field Representative Stopped Work: 5:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-22-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 11-22-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/29/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 11-23-2011

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 101

Summary of Construction/Operation Activities:

Rock Protection

CPG Crew performed the following work activities:

1. No activities were performed on this date.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative

Equipment:

In use today:	Idle Equipment:
	1 – CAT D6N LPG Dozer 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

Due to field conditions and the constant rain event occurring throughout the day, the Contractor had elected to suspend his operations. Activities will resume on Monday, November 28, 2011.

John (CPG) met with this Inspector to discuss an RFI issued on the seepage area at approx. Sta. 56+00. The area was examined and will be further discussed and possibly performed on Monday, November 28, 2011.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	29,376 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,144 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Overcast	PM: Overcast	Contractor Started Work: N/A am	Field Representative Started Work: 7:00 am
Temperature:	AM: 56 deg.	PM: 72 deg.	Contractor Stopped Work: N/A pm	Field Representative Stopped Work: 12:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W Lagda R K	Date: 11-23-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 11/29/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-28-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 102

Summary of Construction/Operation Activities:

Rock Protection

CPG Crew performed the following work activities:

1. No activities were performed on this date.

CPG Construction Manpower:

1 supervisor

Equipment:

In use today:	Idle Equipment:
	1 – CAT D6N LPG Dozer 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

Due to field conditions and the constant rain event occurring throughout the day, the Contractor had elected to suspend his operations. Conditions will be reevaluated on Tuesday, November 29, 2011 in order to see if work may proceed.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	29,376 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,144 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

Weather:	AM: Rain	PM: Rain	Contractor Started Work: N/A am	Field Representative Started Work: 7:00 am
Temperature:	AM: 53 deg.	PM: 60 deg.	Contractor Stopped Work: N/A pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 11-28-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 12/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 11-29-2011

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 103

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew resumed their clearing and grubbing activities from Sta. 51+00 to Sta. 57+00. Placement of the initial cover of rip rap stone material for erosion control followed suit within these limits.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborer

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat	1 – CAT D6N LPG Dozer 1 – CAT 336DL Excavator 2 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

Attended the Weekly Progress Meeting. The following items were discussed:

1. Contractor stated that they had loss two and half (2.5) days of performing work activities due to rain resulting in soft soil condition. Contractor stated that the time loss will be gain back as the work progressed.
2. 80% of the project schedule of activities has been completed.
3. The activity to be performed on the seepage area at Sta. 56+00 has been placed on hold due to wet soil conditions resulting from the previous rain events.
4. URS has had internal discussion regarding a resolution on the sparse vegetation between Sta. 43+50 and Sta. 53+50. Stantec will be contacted on this issue. This issue resulted in a discussion relating to the closure of the SWPPP Plan upon the completion of the project. Further internal discussion on this matter will be made.
5. *Contractor has stated that as of this date the project has used 31,952 tons of rip rap stone material. The below Cumulative Quantity item has been updated to reflect this amount and includes the quantity used on this date.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	240 Tons (Est.)	*32,192 Tons (Est.)
	No. 2 Stone – Access Road	32 Tons (Est.)	4,176 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-29-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 37 deg.	PM: 42 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 11-29-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 12/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 11-30-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 104

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew commenced the placement of rip rap stone material along the east bank of the Clinch River. Work proceeded with an Operator performing stone placement from the north at Sta. 47+00 to Sta. 50+00. To the south, an Operator placed stone at Sta. 56+50 and Sta. 57+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – CAT 336DL Excavator 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

The Contractor and this Inspector observed a seepage area from Sta. 54+00 to Sta. 54+50. The Contractor was informed to avoid traffic in this area. Work may proceed on either side and to the extent of the long stick equipment reach. Preliminary discussion with URS office indicated that the area will receive the Reverse Filter which will be used for the situation at Sta. 56+00 (Plugged/Filled Outflow Pipe).

Summary of Incidents / Accidents / Health & Safety Issues:

An incident occurred on-site involving a track truck accidently hitting a bollard which protected a water monitoring well site. The corner of the concrete foundation was cracked in the vicinity of the bollard. Contractor to repair damaged area at a later date.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	816 Tons (Est.)	33,008 Tons (Est.)
	No. 2 Stone – Access Road	32 Tons (Est.)	4,208 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on-site to locate 798.00 bench elevation.		

Weather:	AM: Overcast	PM: Overcast / Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 35 deg.	PM: 46 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 11-30-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A K	Date: 11-30-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 12/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-01-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 105

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew continued the placement of rip rap stone material along the east bank of the Clinch River. Work proceeded with an Operator performing stone placement from the north at Sta. 50+00 to Sta. 51+75. To the south, an Operator placed stone at Sta. 57+00 working in the northern direction.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – CAT D6N LPG Dozer 1 – CAT 336DL Excavator 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

A meeting was held at the seepage areas. During the meeting those in attendance (Rachel Combs (TVA), Ben Phillips (TVA), Chris (TVA) and this Inspector) had observed an additional area south of the seepage area previously found from Sta. 54+00 to Sta. 54+50. The new area spanned from Sta. 54+50 to Sta. 55+22. All were in agreement that a Reverse Filter would be the acceptable treatment of this area. As with the preceding area, the Contractor was informed to avoid traffic in this area. Work may proceed on either side and to the extent of the long stick equipment reach. The new limits being from Sta. 53+90 to Sta. 55+32. This includes the 10-ft. distance on either side of the seepage area. Further discussions were made regarding excavating a portion of the sloped area. Rachel (TVA) stated that she will prepare an e-mail regarding this issue and request that URS submit an RFI with their recommendations.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	1,056 Tons (Est.)	34,064 Tons (Est.)
	No. 2 Stone – Access Road	16 Tons (Est.)	4,224 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on-site to locate 798.00 bench elevation and locate/record seepage areas.	Rachel Combs (TVA), Ben Phillips (TVA), and Chris (TVA)	

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-01-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 29 deg.	PM: 54 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 12-01-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 12/5/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-05-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 106

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew continued the placement of rip rap stone material along the east bank of the Clinch River. Work proceeded with an Operator performing final grading from the north at Sta. 50+00 to Sta. 51+75 with placement proceeding to Sta. 52+00. To the south, an Operator placed stone at Sta. 55+50 to Sta. 57+00 working in the northern direction.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 336DL Excavator 1 – CAT 320DL 1 – CAT D6N LPG Dozer 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Crisp & Crisp were on-site to make mulch of the vegetation, shrubs, and trees removed during the Clearing and Grubbing Operation. Crew consisted of one (1) operator and one (1) commercial size shedder.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	800 Tons (Est.)	34,864 Tons (Est.)
	No. 2 Stone – Access Road	64 Tons (Est.)	4,288 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on-site to locate 798.00 bench elevation and locate/record seepage areas.		

Weather:	AM: Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 50 deg.	PM: 64 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W Kowalewski	Date: 12-05-2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-05-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 12/12/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-06-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 107

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew performed final grading from the north at Sta. 51+00 to Sta. 52+00. To the south, an Operator performed final grading from Sta. 55+50 to Sta. 57+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 6 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 336DL Excavator 1 – CAT 320DL 1 – CAT D6N LPG Dozer 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Due to the wet site conditions, the Contractor elected to perform final grading in areas where rip rap stone material had been placed.

Steve Belding (URS) and this Inspector examined the perimeter project slope for areas containing sparse vegetation. See RFI regarding Areas of Sparse Vegetation it locations and recommendation. Andy Powell (TVA) will determine who will be involved to perform the corrective work.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	34,864 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,288 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn and Melton Surveyors on-site.	Steve Belding (URS)	

Weather:	AM: Rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 55 deg.	PM: 62 deg.	Contractor Stopped Work: 3:30 pm	Field Representative Stopped Work: 5:00 pm

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-06-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 12-06-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 12/12/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-07-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 108

Summary of Construction/Operation Activities:

Rock Protection

CPG Crew performed the following work activities:

1. No activities were performed on this date.

CPG Construction Manpower:

1 supervisor

Equipment:

In use today:	Idle Equipment:
	1 – CAT D6N LPG Dozer 1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 336DL Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

Due to field conditions and the constant rain event occurring throughout the day, the Contractor had elected to suspend his operations. Conditions will be reevaluated on Thursday, December 08, 2011 in order to see if work may proceed.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	34,864 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,288 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton Surveyors were on-site performing miscellaneous work activities.		

Weather:	AM: Rain	PM: Rain	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 43 deg.	PM: 37 deg.	Contractor Stopped Work: 9:00 am	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W Kowalewski	Date: 12-07-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 12/12/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 12-08-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 109

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew commenced the placement of rip rap stone material along the east bank of the Clinch River. Work proceeded with an Operator performing placement of the stone material from Sta. 52+00 to Sta. 54+00. To the south, an Operator placed stone from Sta. 55+50 to Sta. 54+50 working in the northern direction.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 336DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks	1 – Gas Motorized Power Boat 1 – CAT D6N LPG Dozer 1 – CAT 320DL

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	832 Tons (Est.)	35,696 Tons (Est.)
	No. 2 Stone – Access Road	64 Tons (Est.)	4,352 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton Surveyors were on-site performing miscellaneous work activities.		

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 27 deg.	PM: 47 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 12-08-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 12/12/2011

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 12-12-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 110

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator completed the placement of rip rap stone material between Sta. 54+00 to Sta. 54+50. Operators proceeding to perform final grading from Sta. 52+00 to Sta. 57+00 in preparation for the final cross-section surveys to be performed on Tuesday, December 13, 2011.
2. Crew placed top soil along the area of the Gypsum Stack where the rip rap material was being stock-piled. Once in-place, the area will be seeded and covered with straw matting. Initially the area was cleared of remaining stone which were removed and disposed of at the Bottom Ash Outflow Pipe location.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer	1 – Gas Motorized Power Boat 1 – CAT 336DL Excavator

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Discussions between John Russell (Superintendent), Cannon (Foreman), and this Inspector regarding the approached to be taken when performing work on the Seepage areas. Particular interest was the area which the contact drawings indication a possible abandoned piezometer and monitoring well being located at Sta. 54+00. Drawings indicate these items as STN 51, STN 51A, and STN 51P. The Contractor has in-stock a 40 lbs. bag of bentonite material to plug any hole (possible diameter of the hole would be 4-inches) which would be encountered and bags of ready mix concrete material to cap the holes. Seepage area will be excavated and examined; on-site sand and No. 57 stone material will be utilized for this activity. If these material have been used up, addition material of each item will be order and delivered respectively. Rip rap stone material will be delivered to the site.

Discussions were made regarding the format of the Final As-Builts. Vaughn & Melton are to submit the As-Builts on CAD and the drawings are to be stamped by a Professional Surveyor. In addition, URS is to receive a Point File and/or CSV of the project.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	64 Tons (Est.)	35,760 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,352 Tons (Est.)

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 12-12-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Surveyor's Activities:			**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton Surveyors were on-site performing miscellaneous work activities.				
Weather:	AM: Sunny / Overcast	PM: Sunny / Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 33 deg.	PM: 48 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 12-12-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 12/19/2011

*** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 12-13-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 111

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator commenced to excavate the seepage area at the plugged outfall pipe located at approx. Sta. 56+00. A portion of the area approx. 14-ft. (length) x 15-ft. (width) x 2.5-ft. (depth (the extra 6-inches of excavation was for the access road) was excavated. A portion of the area along the top of the pipe was hand removed to reveal the pipe joint. Once exposed and cleaned, it was revealed that the flow was coming from the pipe joint connection and not from along the edge of the bank. The excavation work at this location was then suspended and the area was later filled with the required Reverse Filter Materials (1-ft of sand base, covered by 1-ft. of No. 57, with the remaining area being covered by rip rap stone material). The pipe joint was further exposed and will be examined and discussed during the Project Walk-Through which will occur on Wednesday, December 14, 2011. Final length of the exposed area was from Sta. 56+00 to Sta. 56+14.
2. Operator commenced to excavate the south end section (Sta. 55+36 to Sta. 54+66) of the seepage area spanning from Sta. 55+36 to Sta. 53+90. Area was excavated and the Reverse Filter Material was placed as instructed per the RFI.
3. Crew continued to place top soil along the area of the Gypsum Stack where the rip rap material was being stock-piled. Once in-place, the area will be seeded and covered with straw matting.
4. Operator continued final grading from Sta. 55+00 to Sta. 57+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer	1 – Gas Motorized Power Boat 1 – CAT 336DL Excavator

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Note: Material removed from the Seepage Areas excavation activity was taken to the Bottom Ash Outflow Pipe Area for disposal.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	35,760 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,352 Tons (Est.)
	Rip-Rap Stone Material – Seepage Area	80 Tons (Est.)	80 Tons (Est.)
	No. 57 Stone – Seepage Area	32 Tons (Est.)	32 Tons (Est.)
	Sand – Seepage Area	32 Tons (Est.)	32 Tons (Est.)

**** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 12-13-2011

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Surveyor's Activities:			**Visitors:**	**Construction Materials/Items Installed:**
Vaughn & Melton Surveyors were on-site to obtain cross-sectional areas from Sta. 47+00 to Sta. 57+00 which have been completed. Crew was able to obtain only data along the river shore line. Crew will return on Wednesday, December 14, 2011 with a boat to obtain the remaining data.				
Weather:	AM: Overcast	PM: Overcast	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 44 deg.	PM: 58 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: W. Kowalewski	Date: 12-13-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 12/19/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-14-2011

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 112

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator commenced to excavate the north remaining end (Sta. 54+66 to Sta. 53+90) of the seepage area spanning from Sta. 55+36 to Sta. 53+90. Area was excavated and the Reverse Filter Material was placed as instructed per the RFI. The Reverse Filter Materials consisting of 1-ft of sand base, covered by 1-ft. of No. 57, with the remaining area being covered by rip rap stone material. The Crew was unable to place the rip rap stone material. The stone will be placed on Thursday, December 15, 2011.
2. Crew seeded and placed straw matting on a portion of the area of the Gypsum Stack where the rip rap material was being stock-piled.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer	1 – Gas Motorized Power Boat 1 – CAT 336DL Excavator

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Note: Material removed from the Seepage Areas excavation activity was taken to the Bottom Ash Outflow Pipe Area for disposal.

Received and reviewed the Cross-Sections for the remaining area spanning from Sta. 47+00 to Sta. 57+00. Will conduct field examination on some sections on Thursday, December 15, 2011.

Walk-Through for the Perimeter Project (Zones 1 through 13) occurred on this date. The Punchlist has been updated and will be distributed to all appropriate parties.

Observations:

1. The following are observation of areas which will require attention but are considered not part of the Project Punchlist. They consist of repairing and placing rip rap stone material at the downstream end of the Perimeter Access Road drainage pipe. The area where the water exits the rip rap stone trench and empties out onto the Construction Access Road. The locates are at Sta. 20+00, Sta. 23+75, and Sta. 30+00.

2. Discussions were made to incorporate sections of the Turbidity Curtain at locations where the Clinch River water is clouded with sediment from flows entering the river from the Perimeter Access Road Drainage Pipes. The final resolution on this issue was that the Turbidity Curtain will not be installed in the Clinch River and that measures will be taken upstream of the drainage flow to prevent sediment from entering the river.

3. Discussions regarding repairing the Perimeter Access Road resulting from Construction Activities. The access road was

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

DAILY ACTIVITY AND OBSERVATION REPORT

utilized by both Contractors (E&T and Civil Group) to perform their required work. This item will involve internal plant discussion on how the repair work will be performed.

4. Those in attendance examined the leak coming from the plugged outflow pipe joint located at approx. Sta. 56+00. URS will further discuss this issue internally and will issue its recommendations once a course of action has been determined.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	35,760 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,352 Tons (Est.)
	Rip-Rap Stone Material – Seepage Area	0 Tons (Est.)	80 Tons (Est.)
	No. 57 Stone – Seepage Area	48 Tons (Est.)	80 Tons (Est.)
	Sand – Seepage Area	64 Tons (Est.)	96 Tons (Est.)

Surveyor's Activities:	**Visitors:** Rachel Combs (TVA), Richard Simmons (TVA), Ben Phillips (TVA), Buck Collin (TVA), Patrick Knox (TVA), John Russell (TVA), Anthony (TVA), and Ken Berry (URS)	**Construction Materials/Items Installed:**
Vaughn & Melton Surveyors were on-site to obtain the remaining cross-sectional areas data from Sta. 47+00 to Sta. 57+00.		

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 42 deg.	PM: 65 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: W lagda A K	Date: 12-14-2011
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 12/19/2011

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Date: 12-15-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 113

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator completed the placement of rip rap stone material along the north remaining end (Sta. 54+66 to Sta. 53+90) of the seepage area spanning from Sta. 55+36 to Sta. 53+90.
2. Operator commenced the removal of the construction access ramp at Sta. 57+00.
3. Operator commenced placing rip rap stone material along areas which the cross-sections indicated shallow coverage from Sta. 50+25 to Sta. 52+75.
4. Crew placed No. 2 stone material along the edge of elevation of 798.00 from approx. Sta. 3+00 to Sta. 7+00. The edge had some exposed ground areas. The No. 2 stone material covered all the exposed ground areas and will now make it accessible for vehicles to drive on in order to perform perimeter maintenance.

CPG Construction Manpower:

1 supervisor, 1 foreman, 1 safety representative, 5 operators, 4 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer	1 – Gas Motorized Power Boat 1 – CAT 336DL Excavator

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

1. During the field examination of the cross-sections, it was discovered that the GPS system cut short the Operator's outer most limit on the rip rap stone material placement. Operator will need to return and check the rock placement from Sta. 47+00 to Sta. 57+00 to insure the material was placed to its plan limits.
2. An RFI was issued from URS instructing the Contractor to place a Reverse Filter along the joint of the plugged outflow pipe at approx. Sta. 56+00.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	288 Tons (Est.)	36,048 Tons (Est.)
	No. 2 Stone – Access Road	112 Tons (Est.)	4,464 Tons (Est.)
	Rip-Rap Stone Material – Seepage Area	208 Tons (Est.)	288 Tons (Est.)
	No. 57 Stone – Seepage Area	0 Tons (Est.)	80 Tons (Est.)
	Sand – Seepage Area	0 Tons (Est.)	96 Tons (Est.)

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-15-2011

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

<table>
<tr><td colspan="3">Surveyor's Activities:</td><td>Visitors:</td><td>Construction Materials/Items Installed:</td></tr>
<tr><td colspan="3">Vaughn & Melton Surveyors were on-site to perform miscellaneous work activities.</td><td></td><td></td></tr>
<tr><td>Weather:</td><td>AM: Slight Drizzle / Overcast</td><td>PM: Overcast</td><td>Contractor Started Work: 7:00 am</td><td>Field Representative Started Work: 7:00 am</td></tr>
<tr><td>Temperature:</td><td>AM: 46 deg.</td><td>PM: 65 deg.</td><td>Contractor Stopped Work: 5:00 pm</td><td>Field Representative Stopped Work: 5:00 pm</td></tr>
<tr><td colspan="3">Field Representative: Wladyslaw A. Kowalewski</td><td>Field Representative's Signature:
Wladyslaw A. K</td><td>Date: 12-15-2011</td></tr>
<tr><td colspan="3">Reviewed by: Kenneth Berry</td><td>Reviewer's Signature:
Kenneth M Berry</td><td>Date:
12/19/2011</td></tr>
</table>

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-19-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 114

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Crew continued to seed and place straw matting on areas of the Gypsum Stack where the rip rap material was being stock-piled. 75% of the approx. 800-ft. (length) x 30-ft (width) area has been completed.
2. Crew removing mulch pile to its designated area.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 2 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 325DL Long Stick Excavator 1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 4 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer	1 – Gas Motorized Power Boat 1 – CAT 336DL Excavator

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended a meeting with Andy Powell (TVA), Buck Collin (TVA), Patrick Knox (TVA), and John Russell (TVA Civil) to discuss the Punchlist and work being performed during the holiday period. The Contractor will complete this week with miscellaneous work being performed from the Punchlist including but not limited to clearing and placing No. 2 stone in the mulch area, continue to place top soil/seed/place straw mat on rip rap stone material stock-pile area, and receive rip rap stone material which will be used to continue placement along the west bank of the Clinch River. No work will be performed during the week of December 26, 2011. Work will resume on Tuesday, January 03, 2012.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	36,048 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,464 Tons (Est.)
	Rip-Rap Stone Material – Seepage Area	0 Tons (Est.)	288 Tons (Est.)
	No. 57 Stone – Seepage Area	0 Tons (Est.)	80 Tons (Est.)
	Sand – Seepage Area	0 Tons (Est.)	96 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton Surveyors were on-site to perform miscellaneous work activities.		

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 12-19-2011

Sun **Mon** Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Foggy / Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 36 deg.	PM: 62 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 12-19-2011
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 1-9-2012

Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.

URS

Sheet: 1 of 1
Date: 01-03-2012

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 115

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator resumed the placement of rip rap stone material in areas indicated on the cross-sections as having insufficient amount of material. Work being performed from Sta. 51+00 to Sta. 52+25.
2. Operator removed the remaining rip rap stone material from the construction access ramp at Sta. 57+00.
3. Crew installed the Reverse Filter at and around the concrete plugged outflow pipe at Sta. 56+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 2 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 2 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer	1 – Gas Motorized Power Boat

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended a meeting with John Russell (TVA Civil), Jason Kennedy, (TVA), and Cannon Elkins (TVA Civil) to discuss the December 14, 2011 cross-section, specifically the outer limit point. Previous discussion regarding an error in the Operator's GPS system resulted in the Operators having to back-track their work in order to verify that the rip rap stone material was placed to the proper limits. A meeting was prompted due to a call received from an Operator stating that some of the outer most areas would be receiving 2-ft. to 3-ft. of stone material. Examination of the plans, provide cross-sections, and field exploration indicated that the GPS system in the equipment had varying outer limit values. Jason stated that this was part of the interpolation process made between URS plan drawings and programing the GPS. Further discussions were made regarding the survey conducted on the entire project before the contact work had commenced. Jason stated that due to the new survey the contract outer limit value had to be achieved and the elevation not so. An attempt was made to have a conference call with Kenneth Berry (URS) regarding this issue. This attempt was unsuccessful. This Inspector examined the cross-sections and looked at the per plan end point to see if there was sufficient coverage. Eight cross-sections were identified as having insufficient coverage which include Sta. 49+00 (62-ft. approx. offset), Sta. 50+50 (64-ft.), Sta. 52+50 (63-ft.), Sta. 53+00 (64-ft.), Sta. 53+50 (64-ft.), Sta. 54+00 (67-ft.), Sta. 55+50 (86-ft.), and Sta. 56+00 (97-ft.). The Contractor was instructed to go 25-ft. in either direction from the plan end point for its stone placement.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	176 Tons (Est.)	36,224 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,464 Tons (Est.)
	Rip-Rap Stone Material – Seepage Area	16 Tons (Est.)	304 Tons (Est.)

***** *Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.***

URS

Sheet: 1 of 1
Date: 01-03-2012

Sun Mon **Tues** Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

	No. 57 Stone – Seepage Area	16 Tons (Est.)	96 Tons (Est.)
	Sand – Seepage Area	16 Tons (Est.)	112 Tons (Est.)
Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**	

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 23 deg.	PM: 31 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 01-03-2012
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 1-9-2012

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 01-04-2012

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility | Project: Perimeter Maintenance and Improvements | Project Phase: Ash Disposal Area

Job No. 31854171 | TVA Project ID 10W509 | Consecutive Report No. 116

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator resumed the placement of rip rap stone material in areas indicated on the cross-sections as having insufficient amount of material at its outermost limit.
2. Operator graded the access road with No. 02 stone material in the vicinity of the previously removed construction access ramp at Sta. 57+00.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 2 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 2 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer 1 – Gas Motorized Power Boat	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Attended a teleconference meeting with Ken Berry (URS), John Russell (TVA Civil), Jason Kennedy, (TVA), Cannon Elkins (TVA Civil), Buck Collin (TVA), Matt Banks (V&M) to discuss the December 14, 2011 cross-sections specifically the outer limit point. With regards to the per plan and cross-section outer limit point issue. It was determine that the work would be sufficient to the per plan limit. Minor differences of a couple of tenth in the elevation were considered to be okay. The contractor will proceed as discussed in the January 03, 2012 Daily Report.

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	Mat'l. Description	Today's Qty:	Cumulative Qty:
	Rip-Rap Stone Material – Slope Improvements	304 Tons (Est.)	36,528 Tons (Est.)
	No. 2 Stone – Access Road	0 Tons (Est.)	4,464 Tons (Est.)
	Rip-Rap Stone Material – Seepage Area	0 Tons (Est.)	304 Tons (Est.)
	No. 57 Stone – Seepage Area	0 Tons (Est.)	96 Tons (Est.)
	Sand – Seepage Area	0 Tons (Est.)	112 Tons (Est.)

Surveyor's Activities:	Visitors:	Construction Materials/Items Installed:
Vaughn & Melton Surveyors were on-site to obtain cross-section data from Sta. 47+00 to Sta. 57+00.		

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 01-04-2012

Sun Mon Tues **Wed** Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 21 deg.	PM: 44 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm
Field Representative: Wladyslaw A. Kowalewski			Field Representative's Signature: Wladyslaw A. K	Date: 01-04-2012
Reviewed by: Kenneth Berry			Reviewer's Signature: Kenneth M Berry	Date: 1-9-2012

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 01-05-2012

Sun Mon Tues Wed **Thurs** Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Facility Name: Bull Run Facility — Project: Perimeter Maintenance and Improvements — Project Phase: Ash Disposal Area

Job No. 31854171 — TVA Project ID 10W509 — Consecutive Report No. 117

Summary of Construction/Operation Activities:

At 7:00 am – TVA Civil Projects Group (CPG) conducted a morning pre-construction safety discussion to brief employees on today's work activities and safety concerns.

Rock Protection

CPG Crew performed the following work activities:

1. Operator removing excess rip rap stone material from the Gypsum Stack laydown area to location designated for emergency plant stockpile area. Completed seeding and placing a straw mat over the stone storage area at the Gypsum Stack.
2. Regrading the Construction Access Road area from Sta. 47+50 to Sta. 57+00 using No. 02 stone material.

CPG Construction Manpower:

1 supervisor, 1 foreman, 5 operators, 2 track truck drivers, 4 laborers

Equipment:

In use today:	Idle Equipment:
1 – CAT 324DL Long Stick Excavator 1 – CAT 330DL Excavator 1 – CAT 320DL 1 – CAT 289C Mini Dozer 2 – Morooka MST 2200VD Track Trucks 1 – CAT D6N LPG Dozer	

Summary of Daily Observations (Include any Problems and Resolutions):

See above Field Operation Notes.

Reviewed cross-sections from Sta. 47+00 to Sta. 57+00. All sections were found to be satisfactory. The following cross-sections were field verified and found to be satisfactory:

Sta. 48+00
Offset 30-ft.
Top of Rock Elevation 794.75
Grade Elevation 792.35

Sta. 48+50
Offset 45-ft.
Top of Rock Elevation 791.60
Grade Elevation 790.30

Sta. 49+00
Offset 45-ft.
Top of Rock Elevation 792.30
Grade Elevation 790.75
and
Offset 60-ft.
Top of Rock Elevation 788.50
Grade Elevation 787.00

Sta. 54+00
Offset 30-ft.
Top of Rock Elevation 796.20
Grade Elevation 794.50

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

URS

Sheet: 1 of 1
Date: 01-05-2012

Sun Mon Tues Wed Thurs Fri Sat

DAILY ACTIVITY AND OBSERVATION REPORT

Summary of Incidents / Accidents / Health & Safety Issues:

No incidents to report.

Directives Given / Approvals Provided:	**Mat'l. Description**	**Today's Qty:**	**Cumulative Qty:**
	Rip-Rap Stone Material – Slope Improvements	0 Tons (Est.)	36,528 Tons (Est.)
	No. 2 Stone – Access Road	192 Tons (Est.)	4,656 Tons (Est.)
	Rip-Rap Stone Material – Seepage Area	0 Tons (Est.)	304 Tons (Est.)
	No. 57 Stone – Seepage Area	0 Tons (Est.)	96 Tons (Est.)
	Sand – Seepage Area	0 Tons (Est.)	112 Tons (Est.)

Surveyor's Activities:	**Visitors:**	**Construction Materials/Items Installed:**

Weather:	AM: Sunny	PM: Sunny	Contractor Started Work: 7:00 am	Field Representative Started Work: 7:00 am
Temperature:	AM: 30 deg.	PM: 50 deg.	Contractor Stopped Work: 5:00 pm	Field Representative Stopped Work: 5:00 pm

Field Representative: Wladyslaw A. Kowalewski	Field Representative's Signature: Wladyslaw A. K	Date: 01-05-2012
Reviewed by: Kenneth Berry	Reviewer's Signature: Kenneth M Berry	Date: 1-9-2012

** Attach sketches of observed features on an inspection location map. Also attach other pertinent information on separate sheets, as necessary.*

APPENDIX B

Document 14

Dam Inspection Checklist Form – Area 1

Site Name:	**Bull Run Fossil Plant**	Date:	**September 14, 2011**
Unit Name:	**Bottom Ash Pond**	Operator's Name:	**Tennessee Valley Authority**
Unit I.D.:	**Area 1**	Hazard Potential Classification:	**High** ☐ **Significant X Low** ☐
	Inspector's Name:	Stan Notestine, PE and Jim Filson, PE	

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		Yes	No
1. Frequency of Company's Dam Inspections?	X		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	801.1		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	N/A		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		X	Is water entering inlet, but not exiting outlet?	N/A	
5. Lowest dam crest elevation (operator records)?	810		Is water exiting outlet, but not entering inlet?	N/A	
6. If instrumentation is present, are readings recorded (operator records)?	X		Is water exiting outlet flowing clear?	N/A	
7. Is the embankment currently under construction?	X		21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	X		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)	X		At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	N/A		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?	N/A	
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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
#1	Inspection – 5 yrs, Annual, quarterly, monthly, weekly, daily and special conditions
#6	Monitoring wells and Piezometers
#9	Tree and shrubs growing along bank of Clinch River – Work currently ongoing (removing trees and shrubs and placing new layer of riprap to prevent wave scour.
#3 #12	The Decant inlet elevation is 801' but it is located in Area 2 and it has a trashrack and is clear.
#20	Decant pipe located in Area 2
#23	Clinch River located along toe (East side) and ditch (WOUS on the South side)

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit TN0005410 **INSPECTOR**

Date November 1, 2010
Impoundment Name Area 1 – Bottom Ash

Impoundment Company TVA-Bull Run Fossil Plant (BRF)
EPA Region Region 4

State Agency (Field Office) Address Tennessee Department of Environment and Conservation
Name of Impoundment Area 1

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☐ **Update** X

	Yes	No
Is impoundment currently under construction?	X	☐
Is water or ccw currently being pumped into the impoundment?	X	☐

IMPOUNDMENT FUNCTION: Bottom Ash settlement, surface runoff and equipment cleaning runoff

Nearest Downstream Town Name: Oak Ridge, TN

Distance from the impoundment: Approximately 10 miles

Location:

Latitude	36	Degrees	00	Minutes	37.90	Seconds	**N**
Longitude	84	Degrees	09	Minutes	23.96	Seconds	**W**

State Tennessee **County** Anderson

	Yes	No
Does a state agency regulate this impoundment?	☐	X

If So Which State Agency? N/A

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.

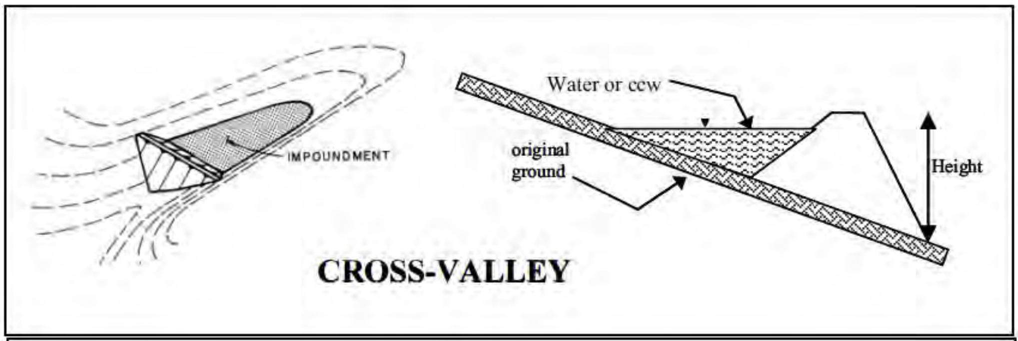
X **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

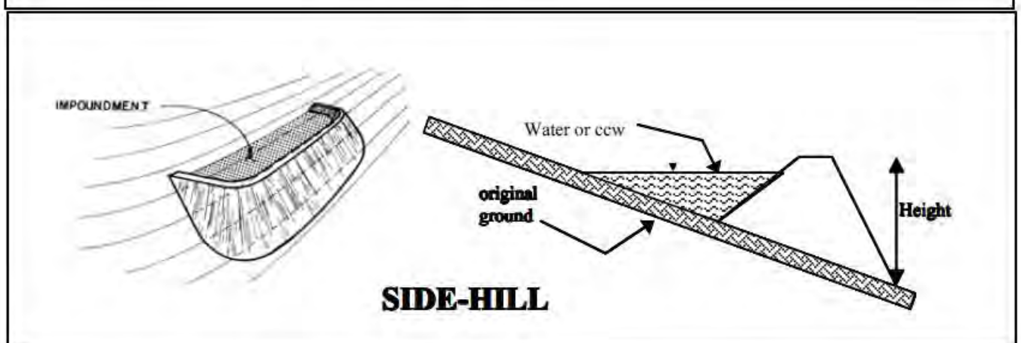
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

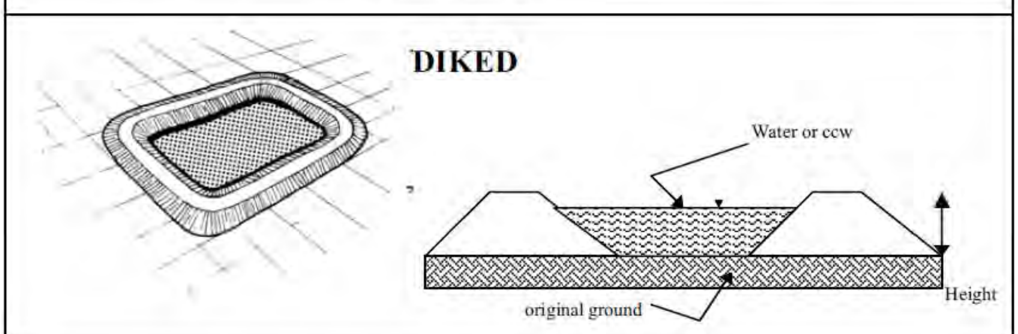
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

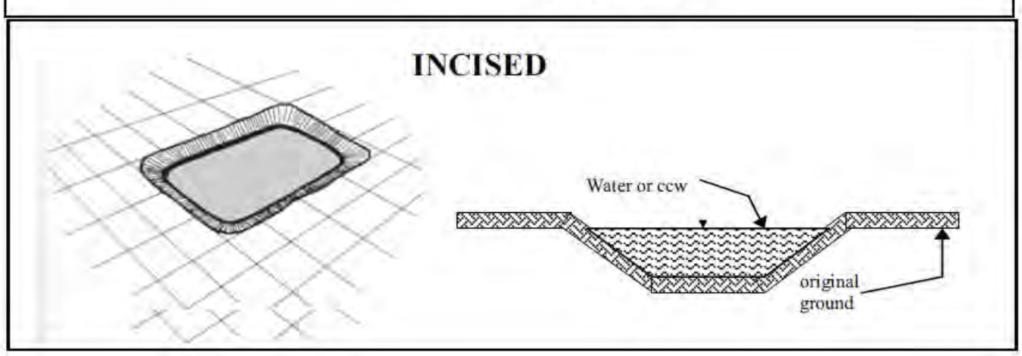
Significant Hazard Potential due to possible impact to significant infrastructure downstream (water intakes) and the environment. Although these impacts are possible, no probable loss of human life is expected.

CONFIGURATION:









☐ Cross-Valley X Side-Hill ☐ Diked

☐ Incised (form completion optional) ☐ Combination Incised/Diked

Embankment Height (ft) – top of Stack = 65; At area 2 = 13-15

Embankment Material Bottom Ash (Note- Safety Factors are 1.5 or higher)

Pool Area (ac) 4.7

Liner None

Current Freeboard (ft) 7-8 ft

Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

N/A Open Channel Spillway

☐ Trapezoidal

☐ Triangular

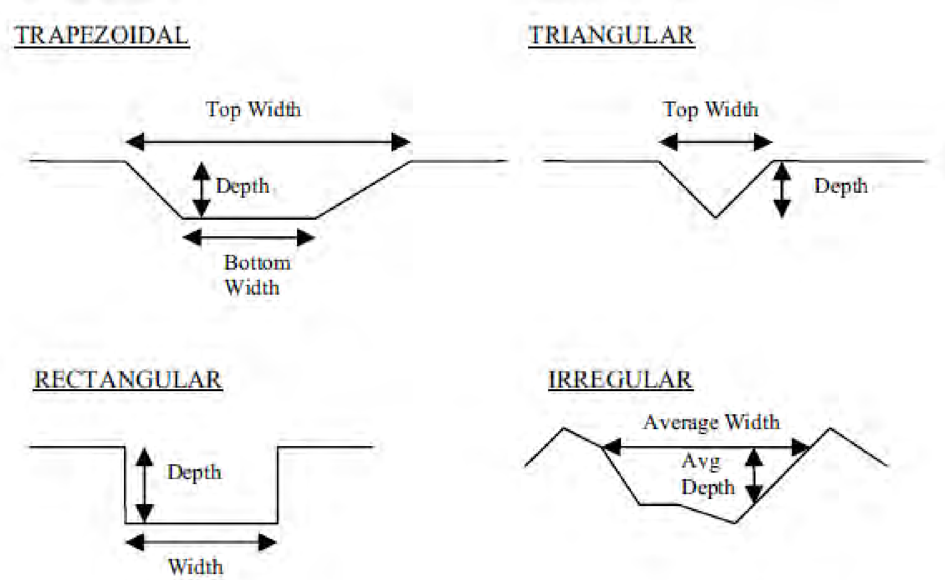
☐ Rectangular

☐ Irregular

depth (ft)

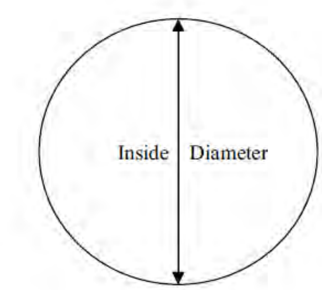
average bottom width (ft)

top width (ft)



X Outlet

Open Channel –approx. 35' top width and approx. 20' bottom width. Connects Area 1 to Area 2



Material

☐ corrugated metal

☐ welded steel

☐ concrete

☐ plastic (hdpe, pvc, etc.)

X other (specify): Earth with riprap along side slopes

	Yes	No
Is water flowing through the outlet?	X	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By **Tennsessee Valley Authority**

	Yes	No
Has there ever been a failure at this site?	☐	**X**
If So When?		

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	☐	X
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?	☐	X
If so, which method (e.g., piezometers, gw pumping,...)?		

If So Please Describe :

<u>**ADDITIONAL INSPECTION QUESTIONS**</u>

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.

Interioral embankments built on Ash. Perimeter dikes built on natural ground

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 Checklist Form – Area 2

Site Name:	**Bull Run Fossil Plant**	Date:	**September 14, 2011**
Unit Name:	**Fly Ash Pond/Stilling Pond**	Operator's Name:	**Tennessee Valley Authority**
Unit I.D.:	**Area 2**	Hazard Potential Classification:	**High** ☐ **Significant X** **Low** ☐
	Inspector's Name:	Stan Notestine, PE and Jim Filson, PE	

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		Yes	No
1. Frequency of Company's Dam Inspections?	X		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	801.1		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	805		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		X	Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	810		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?		X	From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?	X		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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
#1	Inspection – 5 yrs, Annual, quarterly, monthly, weekly, daily and special conditions
#6	Monitoring wells and Piezometers
#3 #7	Riser Structure being lowered to 801; currently at 805
#23	Clinch River located along toe (Southwest side) and Bull Run Creek (Southeast side)

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit TN0005410 **INSPECTOR**

Date November 1, 2010
Impoundment Name Area 2 – Fly Ash/Stilling Pond

Impoundment Company TVA-Bull Run Fossil Plant (BRF)
EPA Region Region 4

State Agency (Field Office) Address Tennessee Department of Environment and Conservation
Name of Impoundment Area 2

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☐ **Update** X

	Yes	**No**
Is impoundment currently under construction?	X	☐
Is water or ccw currently being pumped into the impoundment?	X	☐

IMPOUNDMENT FUNCTION: Bottom Ash settlement, fly ash, gypsum surface runoff and equipment cleaning runoff

Nearest Downstream Town Name: Oak Ridge, TN

Distance from the impoundment: Approximately 10 miles

Location:

Latitude	36	Degrees	00	Minutes	3.86	Seconds	**N**
Longitude	84	Degrees	09	Minutes	9.95	Seconds	**W**

State Tennessee **County** Anderson

	Yes	No
Does a state agency regulate this impoundment?	☐	X

If So Which State Agency? N/A

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.

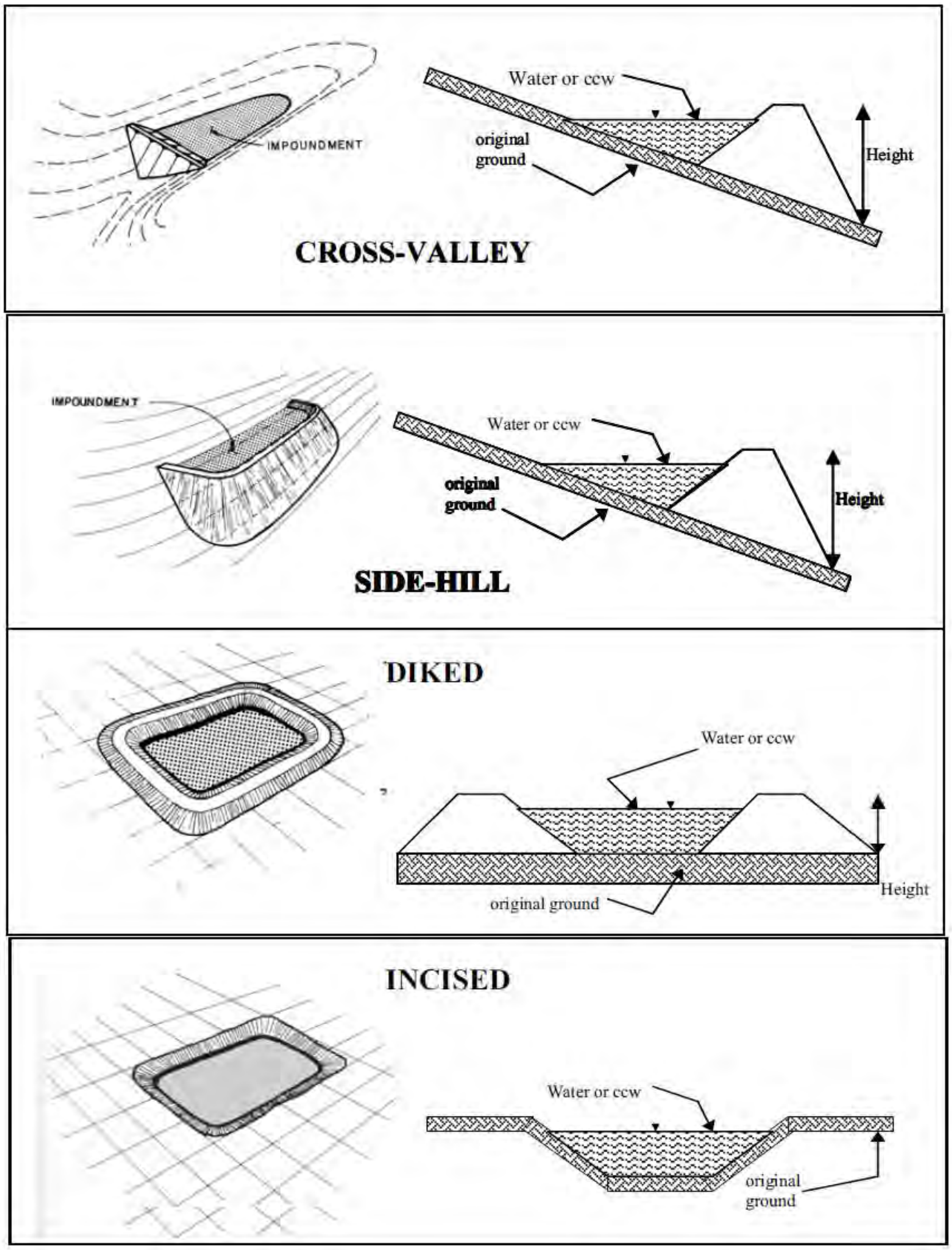
X **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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:

Significant Hazard potential due no possible loss of life, but impact to environmental.

CONFIGURATION:



- [ ] Cross-Valley
- X Side-Hill
- [ ] Diked
- [ ] Incised (form completion optional)
- [ ] Combination Incised/Diked

Embankment Height (ft) – 13-15

Pool Area (ac) 19.65

Current Freeboard (ft) 9-10 ft

Embankment Material Clay

Liner None

Liner Permeability N/A

TYPE OF OUTLET (Mark all that apply)

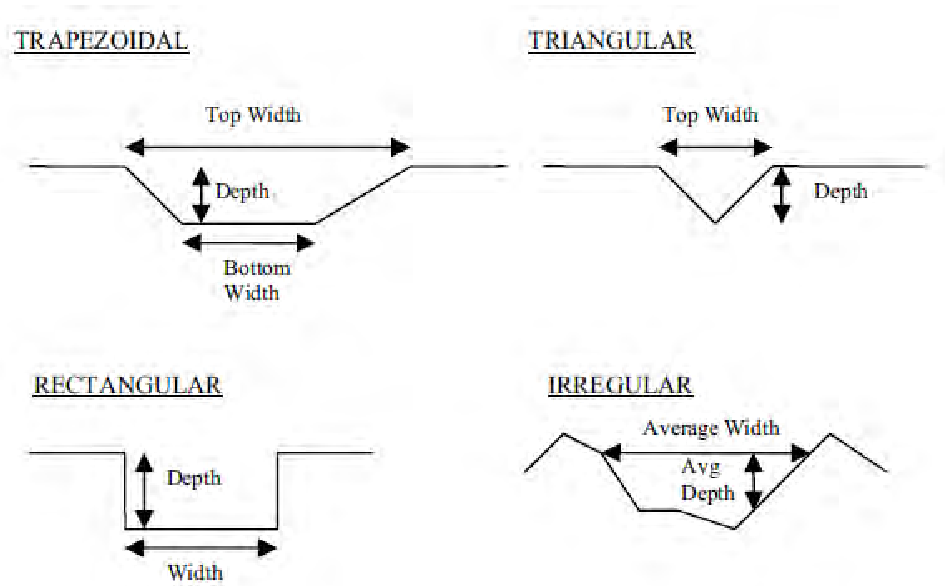
N/A **Open Channel Spillway**

- ☐ Trapezoidal
- ☐ Triangular
- ☐ Rectangular
- ☐ Irregular

depth (ft)

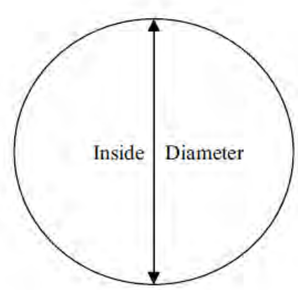
average bottom width (ft)

top width (ft)



X **Outlet**

3 – 36 inch Pipes (inside diameter)



Material

- ☐ corrugated metal
- ☐ welded steel
- X concrete
- ☐ plastic (hdpe, pvc, etc.)
- ☐ other (specify):

NOTE - During Assessment flow was being pumped to outlet

	Yes	No
Is water flowing through the outlet?	X	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By **Tennsessee Valley Authority**

	Yes	No
Has there ever been a failure at this site?	☐	**X**
If So When?		

If So Please Describe :

	Yes	No
Has there ever been significant seepages at this site?	X	☐
If So When?	Approx. 2008	

If So Please Describe :

Small seepage location on Southeast dike – location is being monitoring and after bulkhead installation area is currently dry and pool elevation currently being lowered to meet the safety factor of 1.5

	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?	☐	X
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 16

Dam Inspection Check List Form – Area 2A

Site Name:	**Bull Run Fossil Plant**	Date:	**September 14, 2011**
Unit Name:	**Gypsum Disposal Area**	Operator's Name:	**Tennessee Valley Authority**
Unit I.D.:	**Area 2A**	Hazard Potential Classification:	**High** ☐ **Significant X Low** ☐
	Inspector's Name:	Stan Notestine, PE and Jim Filson, PE	

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		Yes	No
1. Frequency of Company's Dam Inspections?	X		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	824.5		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	825		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?		X	Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	835/825		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X		Is water exiting outlet flowing clear?	X	
7. Is the embankment currently under construction?		X	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation, stumps, topsoil in area where embankment fill will be placed)?	N/A		From underdrain?		X
9. Trees growing on embankment? (If so, indicate largest diameter below)		X	At isolated points on embankment slopes?		X
10. Cracks or scarps on crest?		X	At natural hillside in the embankment area?		X
11. Is there significant settlement along the crest?		X	Over widespread areas?		X
12. Are decant trashracks clear and in place?		X	From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X	"Boils" beneath stream or ponded water?		X
14. Clogged spillways, groin or diversion ditches?		X	Around the outside of the decant pipe?		X
15. Are spillway or ditch linings deteriorated?		X	22. Surface movements in valley bottom or on hillside?		X
16. Are outlets of decant or underdrains blocked?		X	23. Water against downstream toe?	X	
17. Cracks or scarps on slopes?		X	24. Were Photos taken during the dam inspection?	X	

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
#1	Inspection – 5 yrs, Annual, quarterly, monthly, weekly, daily and special conditions
#5	Top of stack and top of external dike
#6	Monitoring wells and Piezometers
#23	Clinch River located along toe (West), Area 2 (South side), Channel (WOUS on North side) and connection ditch from Area 1 to 2 (East side)

Coal Combustion Waste (CCW)

Impoundment Inspection

Impoundment NPDES Permit TN0005410 **INSPECTOR**

Date November 1, 2010
Impoundment Name Area 2A – Gypsum Disposal Area

Impoundment Company TVA-Bull Run Fossil Plant (BRF)
EPA Region Region 4

State Agency (Field Office) Address Tennessee Department of Environment and Conservation
Name of Impoundment Area 2A

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☐ **Update** X

	Yes	No
Is impoundment currently under construction?	☐	X
Is water or ccw currently being pumped into the impoundment?	X	☐

IMPOUNDMENT FUNCTION: Gypsum

Nearest Downstream Town Name: Oak Ridge, TN

Distance from the impoundment: Approximately 10 miles

Location:

Latitude	36	Degrees	00	Minutes	19.08	Seconds	**N**
Longitude	84	Degrees	09	Minutes	13.83	Seconds	**W**

State Tennessee **County** Anderson

	Yes	No
Does a state agency regulate this impoundment?	☐	X

If So Which State Agency? N/A

<u>**HAZARD POTENTIAL**</u> *(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.

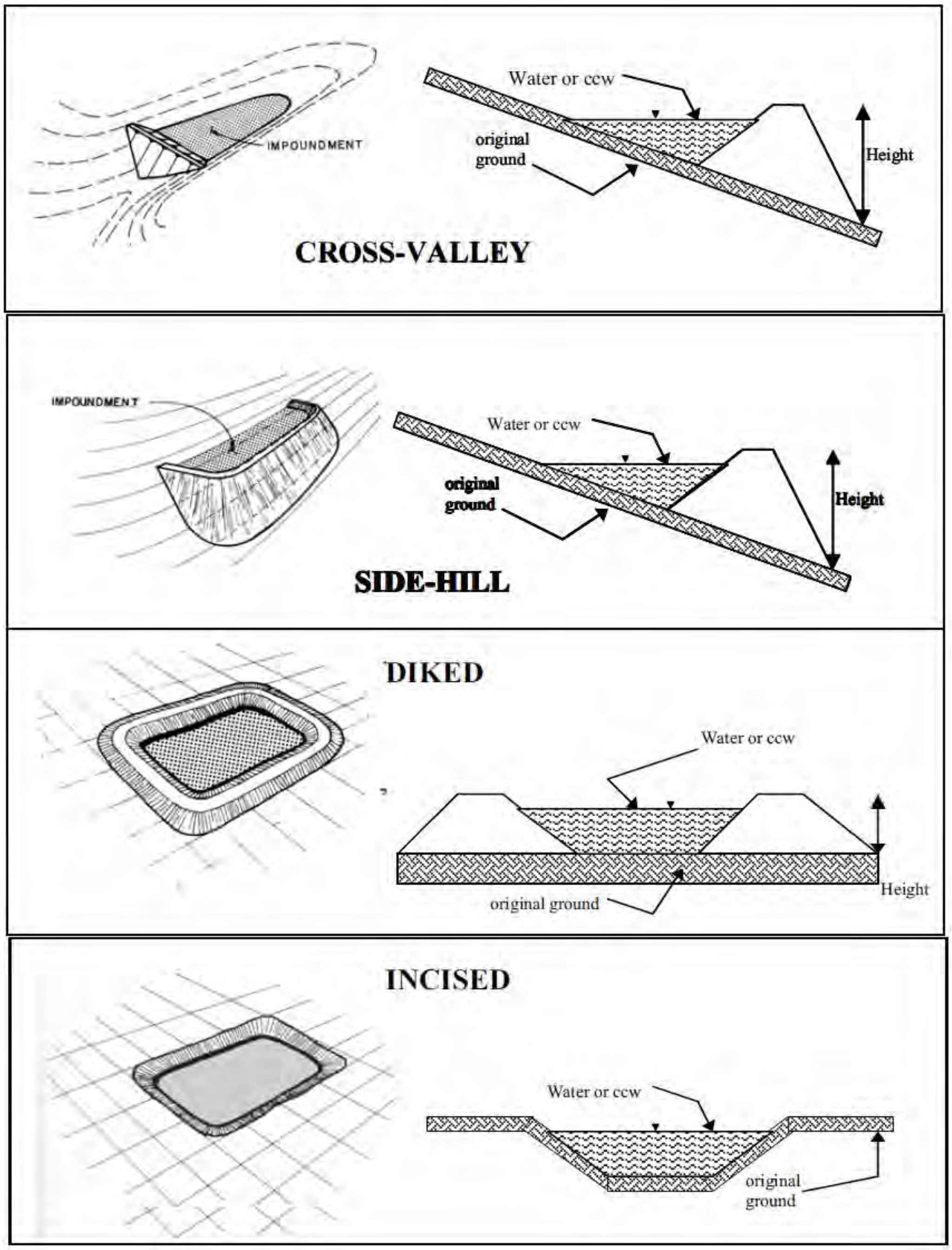
X **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. 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.

<u>DESCRIBE REASONING FOR HAZARD RATING CHOSEN:</u>

Significant Hazard potential due no possible loss of life, but impact to environmental in Clinch River.

CONFIGURATION:



☐	Cross-Valley	☐	Side-Hill	X	Diked
☐	Incised (form completion optional)			☐	Combination Incised/Diked

Embankment Height (ft) –	38	**Embankment Material**	Ash and Clay (Note Safety factors are 1.5 or higher))
Pool Area (ac)	22	**Liner**	None
Current Freeboard (ft)	10 ft	**Liner Permeability**	N/A

TYPE OF OUTLET (Mark all that apply)

N/A Open Channel Spillway

☐ Trapezoidal

☐ Triangular

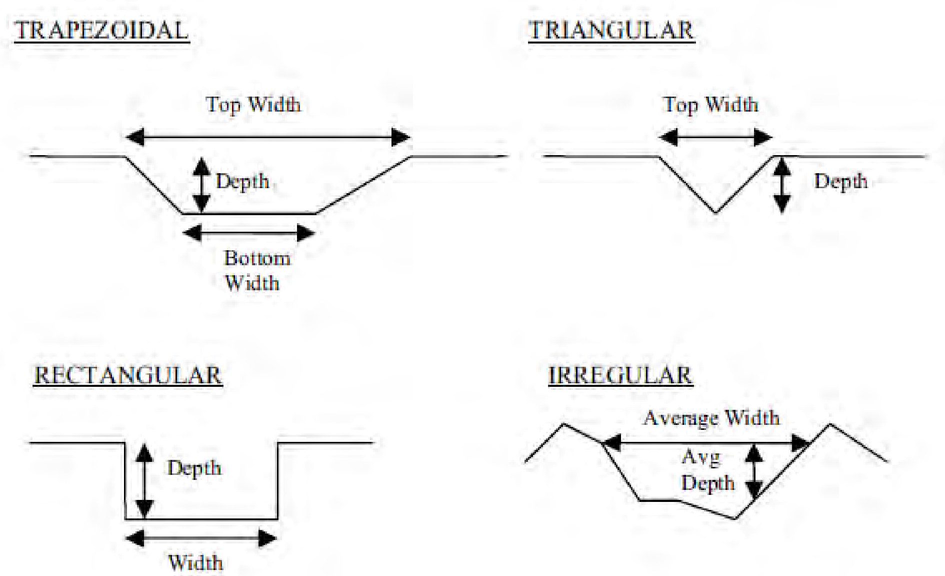
☐ Rectangular

☐ Irregular

depth (ft)

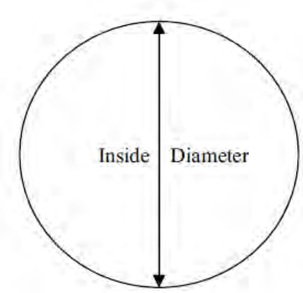
average bottom width (ft)

top width (ft)



X Outlet

2 – 24 inch Pipes (inside diameter) Note - 24" connected to Corrugated 30"



Material

☐ corrugated metal

☐ welded steel

☐ concrete

X plastic (hdpe, pvc, etc.)

☐ other (specify):

	Yes	No
Is water flowing through the outlet?	X	☐

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By **Tennsessee Valley Authority**

	Yes	No
Has there ever been a failure at this site?	**X**	☐

If So When? 207 and 2008

If So Please Describe :

Toe Slough on south side embankment – was repaired both times. Note – No gypsum spillage during failure.

	Yes	No
Has there ever been significant seepages at this site?	☐	X
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?	☐	**X**
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.

Sluice Ash

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 17

Liquefaction: Qualitative Assessment Memo
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.

Memorandum

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.