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Coal Combustion Residue Impoundment

Round 11 - Dam Assessment Report

Allen Fossil Plant

Tennessee Valley Authority
Memphis, 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 Allen Fossil Plant coal combustion residue management units is based on a review of available documents and on the site assessment conducted by Dewberry personnel on September 19, 2011. We found the supporting technical documentation to be generally adequate, although there is some deficiency (Section 1.1.3). As detailed in Section 1.2.5, there are 5 minor recommendations based on field observations that may help to maintain a safe and trouble-free operation.

In summary, the Allen Fossil Plant CCR management unit, East Ash Pond, is **SATISFACTORY** for continued safe and reliable operation. The rating reflects studies performed by TVA in 2012. Specifically, in a letter report dated October 11, 2012, TVA provided seismic stability results that showed the East Ash Pond dikes met minimum required safety factors. There are no other recognized existing or potential management unit safety deficiencies. The inactive West Ash Pond was not rated.

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.

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

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

<u>LIMITATIONS</u>

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

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1.0 CONCLUSIONS AND RECOMMENDATIONS

1.1 CONCLUSIONS

The following conclusions pertain principally to the East Ash Pond at the Allen Fossil Plant. There also is an inactive West Ash Pond at the plant, which impounds no water. The West Ash Pond has been viewed in the field but no technical documentation is available for the dike embankments that enclose this pond. Conclusions are based on visual observations from a one-day site visit on September 19, 2011, and review of technical documentation provided by the Tennessee Valley authority (TVA).

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

Based on a review of the engineering data provided by TVA's technical staff and Dewberry engineers' observations during the site visit, the East Ash Pond dike embankments, spillway and outlets appear to be structurally sound under static loading conditions. Furnished static and seismic stability technical documentation shows that the dike embankments meet minimum factors of safety. The embankments are shown to meet long term static stability with values of 2.8, well above the 1.5 minimum. For seismic stability the embankments have a Factor of Safety of 1.0, which is equal to minimum FS standards. Liquefaction can occur at this site, particularly with its proximity to the New Madrid fault. Liquefaction displacement is calculated to range from 0.7 – 2.3 inches. Structural stability after displacement is essentially unchanged and meets minimum FS values.

From visual assessment in the field the inactive West Ash Pond dike embankments and outlet structure appeared to be stable under the prevailing normal static conditions in which it impounds no water. Even though this pond is inactive, TVA should continue surveillance and maintenance of the dike embankments and ensure that the inactive pond does not impound water.

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

Furnished documentation shows that the East Ash Pond under current conditions should be able to pass the full 6-hour PMP event without overtopping the perimeter dike. Therefore, on the basis of furnished hydrologic/hydraulic documentation, the East Ash Pond has satisfactory hydrologic/hydraulic safety for the designed event.

Simple calculations show that the empty inactive West Ash Pond could safely contain 100 percent of the rainfall of the 6-hour PMP over its catchment area. Therefore, in its current condition the inactive West Ash Pond appears to have satisfactory hydrologic safety.

1.1.3 Conclusions Regarding the Adequacy of Supporting Technical Documentation

The supporting technical documentation for the East Ash Pond is adequate, based on the October 2012 updated studies and letter report (Appendix A, Doc 18). Engineering documentation reviewed is referenced in this report and selected parts of the documentation are included in Appendix A.

For the inactive West Ash Pond there currently appears to be no need for technical documentation as long as this pond remains inactive and does not impound a significant amount of water. However, if this pond should be brought back into service, stability and seepage analyses and hydrologic/hydraulic analysis should be performed to evaluate and document its safety for in-service scenarios.

An abandoned 60-inch concrete sewer line runs east-west across the southern boundary of the ponds (East Dredge Cell, East Ash Pond and East Ash Stilling Pond). TVA reported that there were no construction documents available. The depth of the pipe is not known. See Doc 02 in Appendix A for location of sewer line. Based on the sewer line being abandoned in place and there is no history of problems, no additional recommendations are warranted.

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

The description of the management units provided by TVA is 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 dike embankments, spillway, and outlet structures were observed to have no signs of overstress, significant settlement, shear failure, or other signs of instability. The dike embankments visually appeared structurally sound. There are no apparent indications of unsafe conditions or conditions needing emergency remedial action. Some minor maintenance is needed (see Subsection 1.2.5).

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 CCR management units. There was no evidence of significant undocumented embankment repairs or prior releases observed during the field inspection.

1.1.7 Conclusions Regarding the Adequacy of the Surveillance and Monitoring Program

The surveillance program is adequate. The piezometer monitoring program is adequate. In the absence of problem or suspect conditions, there is no need for additional performance monitoring instrumentation at this time.

1.1.8 Classification Regarding Suitability for Continued Safe and Reliable Operation

The East Ash Pond is SATISFACTORY for continued safe and reliable operation. No existing or potential management unit safety deficiencies are recognized in the field assessment and review of furnished operations, maintenance, surveillance, and monitoring information. Acceptable performance is expected under applicable static and seismic loading conditions and hydrologic conditions in accordance with the applicable criteria.

The inactive West Ash Pond is not rated at this time.

1.2 RECOMMENDATIONS

1.2.1 Recommendations Regarding the Structural Stability

No recommendations are warranted at this time.

1.2.2 Recommendations Regarding the Hydrologic/Hydraulic Safety

No recommendations for physical or operational modifications to enhance hydrologic/hydraulic capacity appear warranted at this time.

1.2.3 Recommendations Regarding the Supporting Technical Documentation

No recommendations appear warranted at this time.

1.2.4 Recommendations Regarding the Description of the Management Unit(s)

No recommendations appear warranted at this time.

1.2.5 Recommendations Regarding the Field Observations

Based on the field observations, some recommendations were provided in the DRAFT Dam Assessment Report as follows:

1) Repair gully erosion on the divider dike;

2) Add crushed stone surfacing material in worn shallow depression on the dike crest south side where haul trucks turn into the dredge cell;

3) Avoid mowing the slopes when the ground is still wet from rainfall to minimize mower ruts on the slopes;

4) Observe over time the wet area at the toe of the north side exterior slope to verify that the puddle is not due to seepage. If the water source is found to be seepage, then repair the slope with an inverted filter. If the water is not from seepage, then re-grade or fill the slight depression with crushed stone surfacing material.

5) Paint corroded metal parts and hardware at the spillway in the divider dike and on the gates and gate-operators at the discharge end of the primary outlet conduits.

It is understood that TVA has addressed these recommendations (see Stantec's letter dated October 11, 2012 in Appendix A Doc 18).

1.2.6 Recommendations Regarding Continued Safe and Reliable Operation

No additional recommendations appear warranted at this time.

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1.3 PARTICIPANTS AND ACKNOWLEDGEMENT

1.3.1 List of Participants

*Stanley W. Notestine, Dewberry
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*John Dizer, TVA
Glen Civera, TVA
*David Thorpe, TVA
*Scott Turnbow, TVA
*Shannon Bennett, TVA
*R.J. Rodocker, TVA
*Jacob Horton, TVA
*Griffin Lifsey, TVA
*Patrick Kiser, Stantec
*Steven Field, Stantec

*Participated in dike field observations

1.3.2 Acknowledgement and Signature

We acknowledge that the management unit referenced herein was assessed on September 19, 2011.

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/2012

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

2.1 LOCATION AND GENERAL DESCRIPTION

The Allen Fossil Plant (Allen) is physically located on the south bank of Lake McKellar in the southwest part of Memphis, Tennessee, and lies approximately 3 miles west southwest of interstate highway I-55 at its closest point. The Allen Plant draws cooling water from Lake McKellar. The lake is the principal receiving body for discharge from the Stilling Pond cell of the active East Ash Pond. See Appendix A Doc 01 for the location of the Allen Fossil Plant site on an aerial map.

The Allen Fossil Plant has one active CCR management unit, the East Ash Pond. The pond is designed and permitted to contain fly ash, bottom ash/boiler slag, storm water, and plant process water. As its name implies, the East Ash Pond lies on the east side of the plant generating facilities; the coal pile lies between them. The East Ash Pond has three areas, including a dredge cell in the western part, an ash pond in the central part, and a stilling pond in the eastern part that is a separate cell formed by an interior dike constructed of ash on the west side of the stilling pond. The sluice lines from the plant discharge into the northwest portion of the dredge cell area and water is channeled to the ash pond area. All drainage from the dredge cell/ash pond areas is to the stilling pond through a concrete discharge structure in the interior divider dike near the south end of the dike. Discharge from the stilling pond is to Lake McKellar through two discharge pipes through the north perimeter dike near the northeast corner; there are two additional discharge pipes through the east perimeter near the northeast corner that can be used for emergency discharge to a cutoff channel to Horn Lake to the south. The normal water level in the stilling pond is currently maintained 4 feet lower than the water level in the ash pond. See Appendix A Doc 02 for an aerial view of the East Ash Pond, dike locations, and other features.

On the west side of the generating facilities there is an inactive ash pond called the West Ash Pond; this pond has been inactive since 1992. It was the original ash pond for the plant, which was used until 1978 when sluicing of ash into the pond was discontinued. However, in May 1991 ash sluicing was reactivated after excavating and hauling 173,000 cubic yards of ash from the pond to use for fill in a US Army Corps of Engineers (USACE) levee. Ash sluicing was again discontinued in October 1992. Water was pumped out, and the pond has remained inactive since that time. In the field the West Ash Pond appeared to still have substantial unused storage volume remaining. It was also observed to contain no impounded water, even though there currently is no way for storm water to flow out of the pond area. The top of the precast concrete pipe riser outlet located at the west end of the pond appeared to be at least 16 feet above the current dry pond bottom. See Appendix A Doc 03 for an aerial view of the West Ash Pond, dike locations, and other features.

Table 2.1 shows a summary of the size and dimensions of the ash pond perimeter dikes.

Table 2.1: Summary of Perimeter Dike Dimensions and Size

	East Ash Pond	West Ash Pond
Maximum Dike Height (ft)	25 N. Side	28 N. Side
Minimum Crest Width (ft)	20 E. Side	18 N. Side
Approximate Length (ft)	8,600[1]	3,550
Steepest Side Slope (inside) H:V	3:1 E. Side	3:1 N., E., W. Sides
Steepest Side Slope (outside) H:V	3:1 E., S. Sides	2.5:1 N. Side

[1]*Around all cells including E. Stilling Pond; excludes divider dike, which is 1,450.'*

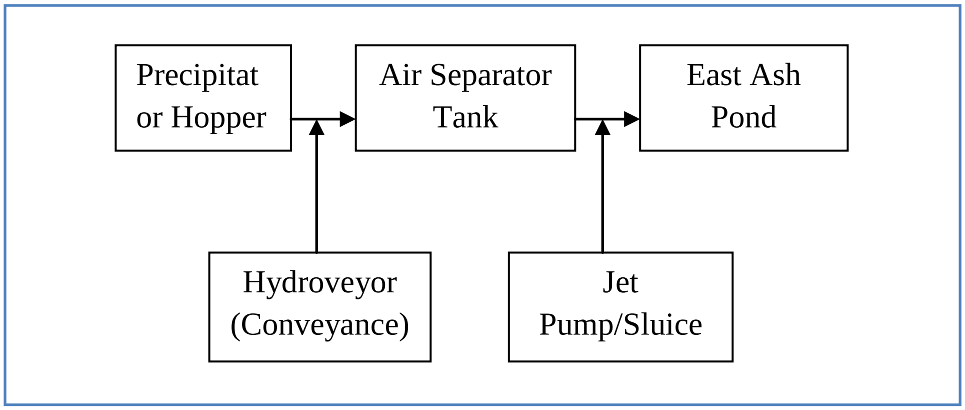
Since the West Ash Pond no longer impounds water or a substantial volume of ash and is inactive, this report principally covers the active East Ash Pond.

2.2 COAL COMBUSTION RESIDUE HANDLING

2.2.1 Fly Ash

Fly ash is collected and sluiced to the East Ash Pond via a closed system process. Fly ash collected in a precipitator hopper is removed with a hydroveyor to an air separator tank, where ash slurry is created. A jet pump is used to convey the slurry through a sluice line (pipe) to the ash pond. There is one fly-ash sluice line for each of the three boilers at Allen. Settled fly ash in the Dredge Cell of the ash pond is excavated into piles to drain and dry out. During the dry season, the dried fly ash is loaded onto trucks and hauled to a nearby site where it is used as structural fill. Some residual fly ash not captured by excavation in the Dredge Cell eventually settles in the central part of the ash pond. See Image 2.1 for the general fly ash collection flow path.

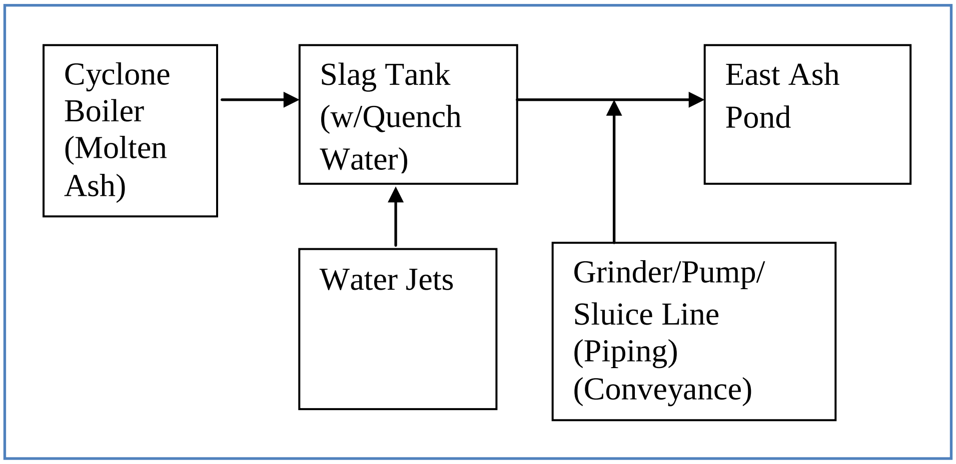
Image 2.1: Fly Ash Collection System Flow Path



2.2.2 Bottom Ash

In the Cyclone Boilers used at Allen, boiler slag is the predominant combustion residual that accumulates in the boilers along with some bottom ash. The CCR becomes molten and flows through an orifice in the bottom of the furnace and into the slag tank, which contains quench water. The molten ash fractures into granular pellets upon contact with the quench water. Although TVA did not specifically list process equipment such as water jets and clinker grinders, it is presumed that such equipment is used to facilitate removal of slag from the tank and grind it into suitable size for efficient sluicing. The boiler slag/bottom ash is formed into a slurry and sluiced, presumably with a jet pump, through a pipe to the ash pond. There is one boiler slag/bottom-ash sluice line for each of the three boilers at Allen. The boiler slag/bottom ash handling system is a closed system process. Settled boiler slag/bottom ash in the Dredge Cell of the ash pond is excavated into piles to drain and dry out. The dried material is sold for beneficial reuse, accounting for approximately 90 percent of the boiler slag/bottom ash sluiced to the pond on an annual basis. See Image 2.2 for general boiler slag/bottom ash collection flow path.

Image 2.2: Boiler Slag/Bottom Ash Collection System Flow Path



2.2.3 Boiler Slag

See Subsection 2.2.2 above.

2.2.4 Flue Gas Desulfurization Sludge

Allen does not have equipment used for flue gas desulfurization sludge (FGD) collection, handling and disposition.

2.3 SIZE AND HAZARD CLASSIFICATION

Size classification is based on storage capacity (of water) and maximum dam height, see Table 2.2a. See Tables 2.1 and 2.3 for embankment height and estimated pond storage capacity (East Ash Pond).

The East Ash Pond currently has a Small Size Classification according to the USACE Size Classification criteria. However, it is noted that the capacity for water storage (to top of dike) would exceed 1,000 acre feet if a substantial volume of ash (on the order of 365 acre-feet or 589,000 cubic yards) were permanently removed; this would increase the size classification to Intermediate, based on available water storage capacity.

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

The Allen ash pond embankments are not regulated for dam safety by a federal or state agency. Therefore, the ash ponds do not have federal or state hazard classifications. The TVA has assigned a Significant Hazard potential classification for the East Ash Pond. Dewberry concurs with this hazard potential classification on the basis of the hazard potential classification system adopted by USEPA. The classification system and the hazard potential determination are presented on the field observation checklist for the Allen East Ash Pond, included in Appendix B (also see Table 2.2b). The basis is that failure of the East Ash Pond perimeter dike embankment would discharge CCR into the adjacent Lake McKellar and low-lying shoreline areas. Failure would not likely cause loss of life but would cause environmental damage and possible disruption of the important waterway to the Memphis Port at Presidents Island.

Table 2.2b: Hazard Classification (FEMA Federal Guidelines for Dam Safety)

	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)

Since the West Ash Pond is inactive and does not impound water, no size and hazard potential determinations have been made.

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

Figures on the amount of CCRs stored in the ash ponds were not provided. However, the amount of CCRs currently stored in the East Ash Pond was roughly estimated along with total volume capacity and remaining volume capacity, as summarized in Table 2.3 with other data. No estimates were made for the inactive West Ash Pond. However, it appeared in the field to have substantial remaining volume capacity. When the West Ash Pond was reactivated in 1991, while the East Ash Pond was taken off-line, the West Ash Pond received sluiced ash for 18 months before it was again deactivated. The CCRs included fly ash and boiler slag/bottom ash.

Table 2.3: Estimated Capacity and other Data for the Unit	
East Ash Pond	
Surface Area (acre)[1]	80
Current Amount of Ash Stored (acre-feet)	990 (v. approx.)
Current Remaining Volume Capacity (level to top of dike) (acre-feet)	300 (v. approx.)[2]
Total Volume Capacity (level to top of dike) (acre-feet)	1,230 (v. approx.)
Minimum Crest Elevation (feet)	237.5 (236.5 Stilling Pond)
Normal Pond Level (feet)	230 (226 Stilling Pond)

[1]*Includes 10 acres for the separate Stilling Pond*
[2]*Excludes Stilling Pond Vol Capacity of 152 acre-feet (v. approx.)*

The current daily amount of ash sluiced to the East Ash Pond is 450 tons, including 90 tons of fly ash and 360 tons of boiler slag/bottom ash. TVA's projected ash disposal amounts through the year 2015 are summarized in Appendix A Doc 04. TVA plans to eventually close the wet disposal pond and dispose of dried ash (and gypsum after scrubbers are installed) in a permitted landfill. TVA's Master Strategy for the Allen plant is provided in Appendix A Doc 05.

2.5 PRINCIPAL PROJECT STRUCTURES

2.5.1 Earth Embankment

The East Ash Pond is formed by a perimeter dike and one divider dike that separates the stilling pond at the east end from the intermediate ash pond area and the dredge cell at the west end, as illustrated in the aerial view of the East Ash Pond in Appendix A Doc 02. The perimeter dike embankment is constructed primarily of sandy silt. The divider dike embankment is constructed of compacted bottom ash. A summary of the perimeter dike dimensions is presented in Table 2.1. The table gives the minimum crest dimension and maximum (steepest) slopes. The crest width actually varies from the 20 feet minimum shown in the table; for example it is 30 to 40 feet wide along most of the north side and is more than 100 feet wide on the south side. The crest on the south side accommodates a railroad siding. The perimeter dike exterior slope varies to as flat as 3.5 horizontal (H) to 1 vertical (V), and the interior slope varies to as flat as 4 H to 1 V. The divider dike crest width ranges from 22 to 25 feet, and both side slopes of the divider dike are typically 2 H to 1 V. A topographic plan of the East Ash Pond is shown on the Boring Plan and Instrumentation Plan included in Appendix A Doc 06. Cross sectional views of the perimeter and divider dikes are illustrated by the analysis sections included in Appendix A Doc 07 and Doc 08.

The dimensions for the West Ash Pond perimeter dike are also summarized in Table 2.1. These dimensions exclude the east part of the original pond footprint, where a Chemical Pond now exists as shown on the aerial view of the West Ash Pond in Appendix A Doc 03.

2.5.2 Outlet Structures

Water in the ash pond area flows into the stilling pond through a concrete spillway located in the divider dike near its south end. The concrete spillway has 2 bays that can be fitted with stop-log gates over the concrete weirs and skimmer plates in the forebays. No drawing was provided for this structure. In the field the south bay appeared to be on the order of 8 feet wide and the north bay somewhat less. The stop-log gate remains in place in the north bay to force all flow through the south bay (with stop-log gate removed). It is understood from TVA personnel that this is done to allow more efficient pH adjustment of water flowing into the stilling pond.

The stilling pond has four decant structures, each consisting of 48-inch diameter reinforced concrete pipe (RCP) risers with bottom discharge into 36-inch diameter conduits that pass through the perimeter dike. Two of these are the primary spillways that pass through the north perimeter dike to discharge into a concrete-lined flume leading to Lake McKeller. The other two decant structures are emergency spillways that pass through the east perimeter dike to discharge to the Horn Lake Cutoff, which is a channel that leads to Horn Lake to the south. All the riser overflows are fitted with skimmers. The two primary spillway conduits are fitted with sluice gates at the outlet ends. The gates are closed only to prevent backflow when the water in Lake McKeller threatens to rise above the discharge elevation during floods. There also are three 18-inch diameter DR-17 high density polyethylene (HDPE) siphon pipes, which were installed to provide dewatering of the stilling pond during construction of improvements that had recently been made. The stilling pond outlet structures are shown in the remedial improvements plans; selected drawings from the plans are included in Appendix A Doc 09 for reference.

2.6 CRITICAL INFRASTRUCTURE WITHIN FIVE MILES DOWN GRADIENT

“Critical” infrastructure includes facilities such as schools, hospitals, fire stations, police stations, etc. There are some 29 such facilities that may be considered critical or potentially critical infrastructure located within a 5-mile radius of the plant. These facilities are noted on the 5-mile radius map and accompanying listing of the critical infrastructure included in Appendix A Doc 01. Most are located in Memphis on what appears to be higher ground in an arc extending from southeast to northeast of the plant and a few are across the Mississippi River in West Memphis, Arkansas. None of these facilities would be threatened or directly impacted by failure of the dikes at the Allen plant. In general, the land use around Allen is industrial. Flood and CCR released from a postulated failure of the East Ash Pond perimeter dike would primarily impact Lake McKellar and/or the Horn Lake Cutoff channel and surrounding low-lying ground.

3.0 SUMMARY OF RELEVANT REPORTS, PERMITS, AND INCIDENTS

3.1 SUMMARY OF REPORTS ON THE SAFETY OF THE MANAGEMENT UNIT

Soon after the December 2008 failure of the CCR impoundment facility at the Kingston Fossil Plant, TVA engaged Stantec Consulting Services Inc. (Stantec) to visit and assess all of TVA's CCR impoundment facilities, including the ash-pond dikes at the Allen Fossil Plant. Stantec's initial field assessment was conducted on February 17, 2009 and subsequently reported in a Phase 1 report, which is included in Appendix A Doc 10 for reference. The Phase 1 report did not identify any conditions or issues that would immediately threaten the stability and safety of the dikes at the East Ash Pond or the West Ash Pond. The Phase 1 report listed a number of notable observations and concerns and gave maintenance recommendations that are routine in nature, as well as Phase 2 engineering and programmatic recommendations (see the Phase 1 report). The engineering recommendations centered on evaluating current conditions and preparing record drawings. Stantec recommended that hydrologic and hydraulic analyses be performed for the East Ash Pond (stilling pond), as well as the inactive West Ash Pond. Stantec's Phase 1 field assessment noted an area of standing water along the outside toe of the east side perimeter dike of the East Ash Pond (stilling pond), but could not determine if it was due to seepage because of dense vegetation in the subject toe area. Stantec also noted dense vegetation and trees in the interior of the West Ash Pond and on the outside slope of the north side perimeter dike of the West Ash Pond.

Stantec has performed additional engineering studies since the Phase 1 assessment. Furnished documentation reviewed includes Stantec's: "Report of Geotechnical Exploration and Evaluation of Slope Stability Northern Perimeter Dike East Active Ash Pond" dated March 25, 2010, "Geotechnical Report for the Evaluation of Dike Stability Remedial Measures for the Eastern Perimeter Dike East Stilling Pond" dated May 11, 2011, and "Results of Seismic Stability Analysis" dated October 3, 2011. See Section 7.0 for discussion of structural stability. Stantec has also prepared a "Seepage Action Plan (SAP)" dated June 25, 2010 that provides guidelines for controlling different levels of seepage, should seepage be observed in routine inspections. Maintenance has been performed at both the East and West Ash Ponds, and remedial improvements have been made at the stilling pond of the East Ash Pond as a result of engineering studies, as described in Subsection 4.1.3.

A furnished daily report dated August 4, 2011, monthly inspection report dated August 10, 2011, and quarterly inspection report dated May 22, 2011, prepared by

TVA personnel indicate no major structural or operational issues. See Appendix A Doc 11 for typical quarterly and monthly inspection reports, as well as daily field reports. No significant deterioration was indicated in the documentation reviewed. Stantec's 2011 annual inspection report dated April 4, 2011, indicated no major structural or operational issues. Observations typically were of eroded areas caused by surface runoff and wave erosion, bare spots lacking good vegetative growth (at West Ash Pond), animal burrows, some standing water at the outside toe of the north side perimeter dike at both the East Ash Pond (outside dredge cell) and the West Ash Pond, possible seep area at standing water along outside toe of the east side perimeter dike of the East Ash Pond (stilling pond), and a 25-foot long shallow tension crack and slough on the inside slope of the east side perimeter dike of the East Ash Pond (stilling pond). Stantec provided recommendations for repair or monitoring of all these conditions.

3.2 SUMMARY OF LOCAL, STATE, AND FEDERAL ENVIRONMENTAL PERMITS

Discharge from the impoundments is regulated by the Tennessee Department of Environment and Conservation (TDEC). The Allen Fossil Plant has been issued a National Pollutant Discharge Elimination System Permit No. TN0005355 with effective date of January 1, 2008 and expiration date of August 3, 2010. TVA reapplied for the permit before the expiration date and is awaiting response from TDEC Division of Water Control.

3.3 SUMMARY OF SPILL/RELEASE INCIDENTS

Data reviewed by Dewberry indicate that there have been small releases of ash slurry due to piping gasket leaks, associated with the East Ash Pond operations. There is no information describing these releases or subsequent cleanup.

4.0 SUMMARY OF HISTORY OF CONSTRUCTION AND OPERATION

4.1 SUMMARY OF CONSTRUCTION HISTORY

4.1.1 Original Construction

The Allen Fossil Plant was built in the 1950s by the Memphis Light, Gas, and Water Division. TVA leased the plant beginning in 1965 and purchased it in 1984. No construction records of the original East Ash Pond or West Ash Pond are available. Therefore, little is known of the original construction other than the approximate time frames that the ponds were built. TVA historical information indicates that the West Ash Pond was built sometime between 1955 and 1963 and was the original pond used for wet disposal of sluiced ash. The East Ash Pond was originally constructed in the 1960s and began to receive sluiced ash in 1969. The northern perimeter dike of the East Ash Pond was originally constructed by the USACE in the early 1960s to serve as a flood-control levee. Material for levee construction was obtained from within the footprint of the East Ash Pond. The northern perimeter dike (levee) was made a part of the East Ash Pond when the pond was expanded in the early 1970s. Before incorporating it, however, the upstream (inside) face of the levee was covered with a 3-foot thick clay liner, apparently as a design measure to minimize potential seepage through the levee. The dike embankments at both the West Ash Pond and the East Ash Pond were constructed to crest elevations that currently exist. That is, the dikes have not been raised since original construction. The original East Ash Pond did not include the area that is now occupied by the stilling pond.

An abandoned 60-inch concrete sewer line runs east-west across the southern boundary of the ponds (East Dredge Cell, East Ash Pond and East Ash Stilling Pond). TVA reported that there were no construction documents available (indicating depth). TVA reported that there was minimum amount of water was in the pipe and no erosion around the pipe is anticipated. See Doc 02 in Appendix A for location of sewer line.

4.1.2 Significant Changes/Modifications in Design since Original Construction

The only significant change to the East Ash Pond was expansion in 1978 to include the 10 acres now occupied by the stilling basin at the east end. The expansion included construction of the current portion of the perimeter dike around the stilling pond, the divider dike, the two primary spillways to Lake McKellar, and the two auxiliary spillways to the Horn Lake Cutoff. Since there appears to be no vestiges of the original east side perimeter dike, it is speculated that the soil in this dike may have been reused in the new portion of perimeter dike around the stilling pond, but there is no furnished information to confirm this.

In 1977 the Chemical Pond at the plant was constructed in a portion of the West Ash Pond footprint at the east end. The Chemical Pond was constructed to have a surface area of 3 acres, maximum dike height of 14 feet, and dike length of 700 feet. The West Ash Pond was first deactivated in 1978, but was temporarily reactivated for approximately 18 months beginning in May 1991, when the East Ash Pond was taken off-line. Prior to sluicing ash into the West Ash Pond, 173,000 cubic yards of ash were removed and used by the U.S. Army Corps of Engineers (USACE) as levee fill material. The West Ash Pond was once again deactivated in October 1992 and has been inactive since that time.

4.1.3 Significant Repairs/Rehabilitation since Original Construction

Recent remedial improvements have been made at the East Ash Pond (stilling pond) to permanently lower the normal operating water level by 4 feet (from elevation 230 feet to 226 feet msl) for the purpose of improving a deficient slope stability factor of safety of the outside slope of the east side perimeter dike to meet or exceed a criterion of 1.5, as well as improve stability against potential piping (internal erosion) due to seepage. The work principally included lowering the principal and emergency riser overflow elevations and other measures to allow this construction, such as: installing additional stop logs on the concrete weir of the divider dike, installing a sediment control curtain, constructing a riprap blanket on the east slope of the divider dike, and installing siphons for lowering the stilling pond water level to elevation 224 feet msl during construction. See the selected drawings of the remedial improvement plans in Appendix A Doc 09.

A small slump or slough occurred on the inside slope of the north side perimeter dike of the East Ash Pond in 2009; it was repaired with riprap and crushed stone. The slump had occurred during excavation of the interior rim ditch, which over-steepened the slope and caused it to locally slump down. Because there was concern that the excavation penetrated the 3-foot thick impermeable layer that had been placed on the interior slope of the dike (levee) during development of the East Ash Pond, the

TVA and the USACE requested that Stantec perform an investigation to evaluate the effect of the known excavations through the layer, determine if excavations have been made elsewhere through the layer, and determine their limits. Stantec's investigation, which included test borings and laboratory testing, as well as installation of piezometers, found that the soil material in the dike embankment itself meets the specification requirements for the material used in the 3-foot liner. Stantec's evaluation, based on visual observation of no seepage at the toe and review of piezometer monitoring data, indicated that the phreatic surface through the dike remained below the dike toe. Stantec concluded that "*although the impermeable layer has been compromised in some areas, it does not appear to have altered the impervious nature of the dike*." Stantec recommended continued monitoring to check for seepage and to check for changes in the phreatic line or for signs of instability. The investigation is presented in a report by Stantec titled, "Geotechnical Engineering Report – Evaluation of East Ash Pond Liner" dated December 11, 2009.

Investigation of a depression that had developed in the ash surface in the dredge cell of the East Ash Pond in early December 2010 led to the discovery of damage to the active 30-inch diameter ductile iron pipe (DIP) sanitary sewer line that passes under the cell. Plans to construct a temporary bypass with a 30-inch HDPE line were developed by Stantec, as shown by selected drawings in Appendix A Doc 12. Construction of the bypass had been essentially completed by the time of Dewberry's site visit. The new 30-inch runs south to north across the majority of the East Ash Pond. A protective dike is over the line with a minimum cover of 2 feet. The bottom of the pipe is above the normal pool elevation.

In November 2010 a riprap blanket was installed on most of the inside slope of the south side perimeter dike of East Ash Pond to repair and protect against wave erosion.

There has been no significant repairs/rehabilitation made to the inactive West Ash Pond since original construction, although there has been significant recent vegetation maintenance to clear a thick growth of bushes and trees on the dry interior of the pond and on the outside slope of the north side perimeter dike.

4.2 SUMMARY OF OPERATIONAL PROCEDURES

4.2.1 Original Operational Procedures

Furnished documents do not include the original operational procedures. The ponds are man-made basins designed and operated primarily to contain fly ash, boiler slag/bottom ash, ash sluice water, storm water, and plant process water. It is presumed that both the West Ash Pond and East Ash Pond were originally operated as wet ponds wherein CCR wastes were transported and placed by sluicing with water into the ponds, the suspended particles were allowed to settle out, and the water detained temporarily in the pond for neutralization and equalization prior to discharge through the gravity-flow overflow structures. It is further presumed that interior ditches/swales were maintained to promote drainage.

4.2.2 Significant Changes in Operational Procedures since Original Startup

The manner of transporting and placing the fly ash and boiler slag/bottom ash into the East Ash Pond by the wet sluicing method has basically not changed since original startup. A significant change in operational procedures since original startup includes separating off the western part of the pond with ash embankments and constructing a diversion trench to create a dredge cell for excavating and stacking the ash in piles or rows for drying. This change occurred in January 2005.

4.2.3 Current Operational Procedures

The East Ash Pond continues to receive sluiced fly ash, boiler slag/bottom ash, sluice water, storm water, and plant process water, as in the past. Currently, the boiler slag/bottom ash is excavated and dewatered at the dredge cell and sold for beneficial reuse. Reportedly 90 percent of it is sold. The fly ash also is excavated and dewatered at the dredge cell. The dried fly ash is beneficially used in a structural fill project at the nearby Frank Pidgeon Industrial Park, which is owned by the Memphis and Shelby County Port Commission. Even though most of the ash is now reused, a small percentage of the ash bypasses the dredging operation and flows to the ash settling area in the central part of the East Ash Pond.

4.2.4 Other Notable Events since Original Startup

During the time frame that the West Ash Pond was re-activated, the East Ash Pond was taken off-line and 453,000 cubic yards of ash were removed from this pond. The ash material removed from both ponds was used as fill material in a USACE levee.

5.0 FIELD OBSERVATIONS

5.1 PROJECT OVERVIEW AND SIGNIFICANT FINDINGS

Dewberry personnel Stanley W. Notestine, P.E. and Fred Tucker, P.E. performed a site visit on Monday, September 19, 2011 in company with the participants listed in Section 1.3.1.

The site visit began at 09:00 AM. The weather conditions during the visit were cloudy with intermittent light rainfall and mild temperatures. Ground conditions were wet. Photographs were taken of conditions observed. Please refer to the "Coal Combustion Dam Assessment Checklist Form" in Appendix B for additional information concerning the ponds. Selected photographs are included here for ease of visual reference. Digital photographs were taken by Dewberry personnel during the site visit and provided to TVA.

The visual assessment concluded the dikes were in satisfactory condition with no significant findings.

5.2 EARTH EMBANKMENT

5.2.1 Crest

The crest of the East Ash Pond (EAP) perimeter dike is accessible by automobile. The crest of the perimeter dike south side was observed to be extra wide, accommodating the ash/gravel-surfaced crest road as well as railroad siding, as shown in Photo 5.1. The embankment at the railroad siding is minimum, See Photo 5.1. TVA reported that the tracks are rarely used. The majority of the coal is barged in. This photo also shows water ponded in a wide shallow depression. The shallow depression appeared to be due to wear of the surface caused by haul trucks turning into the dredge cell. A more typical view of the crest condition is shown by Photo 5.2, which is a view of the crest on the perimeter dike north side. Overall, the perimeter dike crest was observed to be in good condition. No major depressions (caused by settlement), sags, tension cracks, or other signs of significant settlement or mass soil movement were observed.

The crest of the divider dike between the perimeter dike south side and the spillway was observed to be eroded at the south end, as shown in Photo 5.3. The crest of the divider dike between the spillway and the perimeter dike north side appeared to be in satisfactory condition.

The crest of the inactive West Ash Pond perimeter dike was observed to be in satisfactory condition.

Photo 5.1: EAP Perimeter dike crest south side, looking east. Note ponded water.

Photo 5.2: EAP Perimeter dike crest north side, looking east.

Photo 5.3: EAP Divider dike crest south end, looking north. Note gully erosion in the bottom ash embankment.

5.2.2 Inside Slope and Pond Area

The visible parts of the inside slopes of the East Ash Pond perimeter dike above ash and water levels were observed to be in satisfactory condition with no areas of major erosion and no obvious signs of slumps, slides, bulges, tension cracks, or animal holes. No woody vegetation was observed on the inside slopes. The inside slope of the perimeter dike south side was observed to be heavily armored with the riprap that was placed in 2010 to protect against wave erosion, as shown in Photo 5.4. The inside slope of the perimeter dike east side of stilling basin was observed to have a well-maintained cover of grass, as shown in Photo 5.5. Formerly, the normal water level was maintained 4 feet higher than observed during the site visit. Evidence of the higher water level was visible by a line of minor wave-wash erosion on the inside slopes around the stilling pond. The area of slump repair on the upper part of the inside slope of the perimeter dike north side was observed to be in satisfactory condition, as shown in Photo 5.6. The lower part of the inside slopes in most of the East Ash Pond are covered with settled ash.

Photo 5.4: EAP Perimeter dike inside slope south side, looking east. Note riprap that was placed in 2010 to protect against wave erosion.

Photo 5.5: EAP Perimeter dike inside slope east side (stilling pond), looking north.

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Photo 5.6: EAP Perimeter dike inside slope north side, looking east southeast in area of recent slump repair. Note crushed stone material used in the repair.

Photo 5.7: EAP Divider dike slope east side, looking southwest. Note minor gully erosion in slope above riprap blanket.

The slopes of the divider dike were observed to be steeper than those of the perimeter dike. The slope on the stilling basin side of the divider dike was observed to have a partial-height blanket of small riprap that was placed during recent remedial construction. The remaining surfaces of the divider dike slopes (and most of the crest) were observed to be covered with a thin layer of crushed stone. Minor gully erosion in the slope of this ash embankment above the new riprap blanket was observed, as shown in Photo 5.7. The fly ash excavation operation was observed in the dredge cell, as shown in Photo 5.8. The visible part of the sanitary sewer temporary bypass recently constructed in the dredge cell was observed where it ties into the manhole in the south part of the dredge cell, as shown in Photo 5.9. A view of the ash sluice lines to the East Ash Pond were observed, as shown in Photo 5.10.

Photo 5.8: EAP Excavation of fly ash in dredge cell, looking south. Note greenish stockpile of boiler slag/bottom ash in background.

Photo 5.9: EAP South end of temporary bypass construction for active sanitary sewer under dredge cell.

Photo 5.10: EAP View of ash sluice lines and plant process water line (leftmost) extending from the plant to the active pond, looking east. Rightmost line is abandoned.

Photo 5.11: WAP Typical view perimeter inside slope west side, viewed north.

Photo 5.12: WAP Typical view of inactive pond area, viewed south.

Photo 5.13: WAP View of apparent ash fill at east end of pond, viewed southeast. Note stone piles as deterrent for Least Tern nesting.

At the West Ash Pond (WAP) the inside slopes were observed to have a well-maintained cover of grass, as shown by the typical view in Photo 5.11. The inside slopes were in satisfactory condition. The interior of the inactive pond was observed to have some scattered trees, but the area was clear of brush and undergrowth and covered with a well-maintained grass cover, as shown in Photo 5.12. It was observed that the eastern part had been filled in with what appeared to be dry ash, as shown in Photo 5.13. The piles of stones on the barren surface had been placed to discourage nesting of the Least Tern in close proximity to the plant.

5.2.3 Outside Slope and Toe

The outside slopes of the East Ash Pond perimeter dike were observed to be in satisfactory condition with no areas of major erosion and no obvious signs of slumps, slides, bulges, tension cracks, significant seepage, or animal holes. No woody vegetation was observed on the outside slopes. A view of the outside slope of the perimeter dike east side is shown in Photo 5.14 and is typical of the outside slopes. The area of a previously observed seep, posted with a sign, at the toe of the perimeter dike east side is shown in Photo 5.15. At the time of the site visit there appeared to be no seep or wet soil in this area, although tall grass and weeds in the area hindered clear observation. TVA personnel indicated that the adjacent area to the east is a natural wetland that has standing water during the wet season. A minor mower rut was observed on the outside slope of the perimeter dike north side, as shown in Photo 5.16.

Photo 5.14: EAP Perimeter dike outside slope east side, looking north.

Photo 5.15: EAP Perimeter dike outside toe east side, identified seep area.

Photo 5.16: EAP Perimeter dike outside slope north side, looking west. Note mower rut.

Surface water was observed in a puddle at the one location along the outside toe of the perimeter dike north side, as shown in Photo 5.17. There appeared to be no flowing seepage associated with this puddle.

Photo 5.17: EAP Perimeter dike outside toe north side. Note ponded water.

Photo 5.18: WAP Perimeter dike outside slope north side. Note dumpsters for cleanup of debris from spring flooding.

At the West Ash Pond the outside slopes were observed to be in satisfactory condition. The outside slope of the perimeter dike north side was observed to have a well-maintained cover of grass, as shown in Photo 5.18. At the time of the site visit debris from flooding earlier in the year was still being removed from the slope and placed in dumpsters, visible in Photo 5.18. It was observed that the outside slopes on the north and west sides of West Ash Pond are the only well-defined exterior slopes around this pond. The chemical pond and filled areas exist on the east side. The south side is a broad relatively level area that extends over to the municipal waste water treatment plant. The rim elevation on this side is higher than the dike crest on the north side. Even on the west side the outside slope does not have substantial height above the outside toe area, which appeared to be a broad fill extending to a low brushy and wooded area to the west.

5.2.4 Abutments and Groin Areas

Since the ponds are formed within a ring dike system, there are no natural abutments. No significant erosion or displacements were observed where the divider dike intersects the perimeter dike embankments at the East Ash Pond or at the inside bends in the perimeter dikes at both the East Ash Pond and the West Ash Pond.

5.3 OUTLET STRUCTURES

5.3.1 Spillway and Overflow Structures

The visible parts of the spillway and overflow structures at the East Ash Pond were observed to be in satisfactory condition. Water was flowing into the stilling pond through the south bay of the spillway in the divider dike, as shown in Photo 5.19. The concrete spillway structure appeared to be sound. Much of the metalwork (e.g., handrails, skimmer plates, channel guides, etc.) was observed to be rusty but currently sound and functional. No obvious sinkholes or dropouts were observed in the ash embankment fill next to the sides of the spillway structure.

All that could be seen of the overflow risers at the north end of the stilling pond were the skimmers on top of the risers, as shown in Photo 5.20. The skimmers appeared to be new or newly refurbished.

The old overflow riser at the West Ash Pond is shown in Photo 5.21. The RCP sections that form the riser were observed to be weathered, but they appeared sound. The skimmer structure had been taken off the top of the riser, along with a metal-grate walkway, to allow placement of an extra section of pipe on top of the riser to raise the overflow elevation. TVA personnel indicated that this was done to prevent reverse overflow into the pond from backflow during extreme flood events when water levels in the Mississippi River and Lake McKellar are elevated, as occurred earlier this year.

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Photo 5.19: EAP South bay of concrete spillway in divider dike, discharging into stilling pond.

Photo 5.20: EAP View of skimmers atop overflow risers in stilling pond, looking south.

Photo 5.21: WAP View of old overflow riser in inactive pond, looking east. Note extra RCP section on top of riser.

5.3.2 Primary Outlet Conduits

Photo 5.22: EAP View of outlet ends of primary spillway conduits, looking south.

At the East Ash Pond (stilling pond) water that overflows the two 48-inch diameter primary riser structures discharges through two 36-inch diameter RCP conduits that pass through the perimeter dike north side to outfall into the flume that leads to Lake McKellar. Water was discharging from these primary outlet conduits at the time of the site visit, as shown in Photo 5.22. The concrete-lined flume is shown in Photo 5.23. The primary conduits were observed to be lined with polyvinyl chloride (PVC). The conduits appeared to be sound and functional. No sinkholes or dropouts were observed along the alignment of the conduits through the dike embankment. The concrete end wall structure with mounted floodgates appeared sound, although the metal gates and hardware were observed to be rusty. One of the operator stem guide brackets (for west gate) was observed to be bent down. TVA personnel indicated that the floodgates normally remain open and are closed only to prevent backflow when Lake McKellar is elevated during extreme floods. The concrete-line flume was observed to have some cracks and surface deterioration but appeared to be functional.

Photo 5.23: EAP View of flume to Lake McKellar, looking north. Note outlet ends of siphons.

At the West Ash Pond the end of the outlet conduit was not observed. However, no evidence of past sinkholes or dropouts was observed along the alignment of the conduit through the perimeter dike west side.

5.3.3 Emergency Outlet Conduits

Water that overflows the two 48-inch diameter emergency riser structures discharges through two 36-inch diameter RCP conduits that pass through the perimeter dike east side to outfall into a ditch that leads to the Horn Lake Cutoff channel. The outlet ends of the two emergency outlet conduits were observed to be more than half submerged, as shown in Photo 5.24. No water was flowing through these conduits at the time of the site visit. TVA personnel indicated that preferences are to pump from the stilling pond rather than discharge through the emergency conduits, when the floodgates have to be closed at the primary outlet conduits. These emergency conduits were observed to be lined with PVC and appeared to be sound and functional. No sinkholes or dropouts were observed along the alignment of the emergency conduits through the dike embankment. The blanket of small riprap used for erosion control around the outlet ends of the emergency conduits was observed to be in satisfactory condition.

Photo 5.24: EAP View of outlet ends of emergency spillway conduits, looking west.

5.3.4 Low Level Outlet (Siphons)

None of the overflow structures has a low level outlet. However, there are three 18-inch diameter HDPE siphon pipes that were installed to lower the stilling pond to elevation 224 feet msl during construction of remedial improvements at the stilling pond and will remain in place. The siphons and associated gate valves are shown in Photos 5.25 and 5.26 (see also outlet ends of siphons in Photo 5.23). The siphons and associated gates and hardware were observed to be in satisfactory condition.

Photo 5.25: EAP Partial view of siphons, looking west.

Photo 5.26: EAP Gate valves in siphons, looking west.

6.0 HYDROLOGIC/HYDRAULIC SAFETY

6.1 SUPPORTING TECHNICAL DOCUMENTATION

6.1.1 Flood of Record

No documentation has been provided about the maximum water surface elevations in the ash ponds. Both the active East Ash Pond and the inactive West Ash Pond are contained within perimeter dikes and do not receive off-site natural drainage. Therefore, they do not receive flood inflows from off-site. The source of water into the ash ponds is sluicing water, plant drainage, and Coal Yard runoff to the East Ash Pond and minor plant drainage to the West Ash Pond, plus precipitation that falls directly into the ponds. Historic climate data available on-line from the National Weather Service (NWS) indicate that the highest recorded 24-hour precipitation in the Memphis area since original construction of the ash ponds was 6.84 inches on November 28-29, 2001, which at the time was the highest recorded in the previous 50 years of record; the total for the multi-day storm was 10.67 inches. Near record flooding of the Mississippi River occurred in the Memphis area in early May 2011, causing Lake McKellar to rise to high levels that encroached substantially onto the outside slopes of the perimeter dikes of both the East Ash Pond and the West Ash Pond, primarily on the north side. From high water marks indicated by some remaining flood debris on the slopes, it appeared that the elevated water level in Lake McKellar reached up to approximately one-third the height of the north side exterior slope of the East Ash Pond perimeter dike and more than mid height of the north side exterior slope of the West Ash Pond perimeter dike.

6.1.2 Inflow Design Flood

For the “small” size and “significant” hazard potential classification assigned to the East Ash Pond dikes, the USACE hydrologic evaluation guidelines (ER-1110-2-106 26 Sept 1979 “Recommended Guidelines for the Safety Inspection of Dams”) recommend a spillway design flood (SDF) of 100-year frequency to 1/2 Probable Maximum Flood (1/2 PMF), where the magnitude selected most closely relates to the involved risk. For comparison, the Tennessee Dam Safety Laws and Regulations (2007) require (for existing dams) use of a Freeboard Design Storm of 1/3 Probable Maximum Precipitation (1/3 PMP) (6-hour duration) to develop the design flood.

Stantec performed a hydrologic and hydraulic (H & H) analysis of the East Ash Pond, including the separate ash and stilling ponds. The analysis is presented in the H & H report dated September 30, 2010, which is included in Appendix A Doc 13 for reference. Their analysis evaluated the performance of the ash and stilling ponds for the 1-, 10-, 25-, 50- and 100-year 24-hour SCS Type II storms and the 6-hour PMP. The results of the analysis for the 6-hour PMP indicate the following:

- Ash pond pool el 234.8 ft, leaves 2.7 ft freeboard
- Stilling pond pool el 232.7 ft, leaves 3.8 ft freeboard
- Stilling pond tailwater el 225.0 ft

No inflow design flood has been provided for the inactive West Ash Pond.

6.1.3 Spillway Rating

Spillway rating curves were developed by Stantec for the East Ash Pond spillway and outlet structures. Rating curves for the ash pond and the stilling pond for each storm event are presented in Appendix C of Stantec's H & H report (see Appendix A Doc 13).

A spillway rating for the West Ash Pond outlet structure has not been provided, which reflects the assumption that there is no outflow from the pond during the design storm.

6.1.4 Downstream Flood Analysis

No downstream flood analysis has been provided for the ash ponds. A general qualitative analysis based on field observations and review of available data is as follows:

Failure of the East Ash Pond perimeter dike would most likely occur through the east side or north side and discharge water and coal combustion residue onto low-lying outside toe areas. Water released through a breach in the dike would likely carry eroded ash into Lake McKellar causing environmental damage, as well as property damage, and potentially disrupting Memphis Port traffic. The failure would not likely cause loss of life.

If the West Ash Pond impounds a large volume of storm water during a rain event, or become active, then failure of the West Ash Pond perimeter dike would most likely occur through the north side with consequences similar to those described above.

6.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

The hydrologic/hydraulic documentation for the East Ash Pond is adequate. No hydrologic/hydraulic analyses have been provided for the inactive West Ash Pond. However, rigorous analyses are not be needed to document hydrologic safety of the inactive West Ash Pond, which is contained within a perimeter dike system and does not receive off-site natural drainage. Simple calculations summarized in the following section should be sufficient.

6.3 ASSESSMENT OF HYDROLOGIC/HYDRAULIC SAFETY

For assessment purposes the appropriate design storm for the East Ash Pond may be taken as 1/3 PMP, 6-hour duration (see Subsection 6.1.2). Stantec's analysis shows that the East Ash Pond under current conditions should be able to pass the full 6-hour PMP event without overtopping the perimeter dike. Therefore, on the basis of furnished hydrologic/hydraulic documentation, the East Ash Pond has satisfactory hydrologic/hydraulic safety. However, Stantec noted that if the weir at the spillway between the ash pond and stilling pond is raised to elevation 231 ft msl, the ash pond could overtop during the 6-hour PMP event and advised that a minimum 6-foot freeboard be maintained in the ash pond area. Stantec further noted that during a closure scenario the stilling pond would not be able to pass the 6-hour PMP event and advised that consideration be given to installing an emergency spillway between the stilling pond and Lake McKellar for the closure condition, or close both the ash pond area and the stilling pond area at the same time.

The West Ash Pond does not impound water and, according to TVA personnel, storm water does not gradually build up in it, even though there is no mechanism for storm water to flow out of the pond. It is assumed that the pond bottom has high infiltration capacity. As it currently exists, the pond bottom appears to be at least 15 feet below the dike crest north side. The inactive pond does not receive uncontrolled inflows from off-site. By inspection, the empty West Ash Pond could safely contain 100 percent of the rainfall depth (29.8 inches or approximately 2.5 feet) of the 6-hour PMP over its catchment area. Therefore, in its current condition the inactive West Ash pond appears to have satisfactory hydrologic safety. However, if this pond should be brought back into service, hydrologic/hydraulic analysis should be performed to evaluate and document its safety for in-service scenarios.

7.0 STRUCTURAL STABILITY

7.1 SUPPORTING TECHNICAL DOCUMENTATION

7.1.1 Stability Analyses and Load Cases Analyzed

TVA's consultant, Stantec performed geotechnical explorations and analyses of the East Ash Pond, focusing mainly on the north perimeter dike and the east perimeter dike, since these appear to have the more critical embankments. The divider dike was also investigated under the scenario of permanently lowering the normal water level in the stilling pond to 226 feet msl while maintaining 230 feet msl in the ash pond. Stantec's stability assessment included analyses of static slope stability, seepage/piping potential, and simplified seismic slope stability using the pseudo-static method[1]. Computer software programs commonly used in the geotechnical profession were used in the analyses. The exploration results and/or analyses are presented in the following Stantec reports:

1. "Report of Geotechnical Exploration and Evaluation of Slope Stability - Eastern Perimeter Dike East Stilling Pond" dated February 4, 2010.
2. "Report of Geotechnical Exploration and Evaluation of Slope Stability - Northern Perimeter Dike East Active Ash Pond" dated March 25, 2010.
3. "Report of Geotechnical Exploration and Evaluation of Slope Stability – Remedial Measures for Eastern Perimeter Dike East Stilling Pond" dated May 11, 2011.
4. "Results of Seismic Slope Stability Analysis Active CCP Disposal facilities - Allen Fossil Plant" dated October 3, 2011.
5. Response To Recommendations USEPA CCR Impoundment Assessment Report, Allen Fossil Plant, October 11, 2012.

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

The load cases analyzed for the northern perimeter dike included:

1. Static steady-state seepage, ash pond normal pool el 230 ft
2. Static steady-state seepage, ash pond max storage pool el 233 ft
3. Static steady-state seepage, ash pond max surcharge pool el 237 ft
4. Rapid drawdown from the McKellar Lake design flood el 232.5 ft to median lake water surface el 185 ft
5. Earthquake w/ yield acceleration = 0.185g, normal pool el 230 ft

The load cases initially analyzed for the eastern perimeter dike included cases 1 and 2 above. However, unacceptable factors of safety were obtained in both the slope stability analysis and the seepage analysis. Consequently, the normal water level in the stilling pond was lowered to 226 feet msl and load cases 1 and 5 were re-analyzed.

The divider dike was analyzed for the following static slope stability conditions:

1. Long term, original configuration, upper pool el 230 ft, lower pool el 226 ft
2. Long term, original configuration w/ 4-ft riprap blanket on east toe, upper pool el 230 ft, lower pool el 226 ft
3. Short term (construction) condition, original configuration, upper pool el 230 ft, lower pool el 225 ft (for construction)
4. Short term (construction) condition, original configuration w/ 4-ft riprap blanket on east toe, upper pool el 230 ft, lower pool el 225 ft (for construction)

The various static stability analyses are illustrated in the analysis sections in Appendix A Doc 07 and Doc 08. The pseudo-static analysis is summarized and illustrated in Enclosure B of Stantec's October 3, 2011 report; this enclosure is included in Appendix A Doc 14 for information. However, in response to recommendations in Dewberry's DRAFT *Coal Combustion Residue Impoundment Dam Assessment Report, Allen Fossil Plant, Tennessee Valley Authority, Memphis, Tennessee* dated September 2012, (DRAFT Dam Assessment Report), TVA engaged Geocomp Consulting, Inc. (Geocomp) to perform additional investigations and analyses to assess the likely performance of the facility during the design earthquake. Geocomp evaluated the seismic response of a representative cross section of the East Ash Pond dike using state-of-practice methods.

A summary of Geocomp's assessment approach and results are presented in a letter report dated October 10, 2012, which is included in Appendix A Doc 18 for reference. Geocomp's results supplant the earlier pseudo-static analysis by Stantec. Stantec's letter of Responses to Recommendations dated October 11, 2012 is also included in Doc 18.

No stability documentation has been provided for the inactive West Ash Pond dike embankments.

7.1.2 Design Parameters and Dam Materials

At the East Ash Pond the perimeter dike embankment soils consist of predominantly sandy silts and silty sands with the silty sands more prevalent in the northern perimeter dike (the original levee). The divider dike consists primarily of compacted bottom ash. The dikes are immediately founded on a variable thickness layer of sandy silt or silt and sandy silt underlain by a thick layer of lean and fat clays that extends down to a deeper layer of silt and sandy silt and sandy silt to silty sand. Based on laboratory testing, design properties and parameters used in the static stability analyses were as shown in the following Table 7.1:

Table 7.1: Design Properties and Parameters of Materials used in the Static Stability Analyses by Stantec

Material	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Drained Strength Parameters	
			C´ (psf)	Ø´ (deg)
Dike Fill-Core	---	125	0	31
Dike Fill-Shell	---	124	0	31
Hydraulically Placed Ash	---	105	0	25
Bottom Ash	---	123	0	34
Divider Dike Fill-Sand	---	120	0	34
Riprap	---	120	0	38
Alluvial Clay	---	115	0	26
Sandy Silt to Silty Sand Alluvium	---	115	0	28

See analysis sections in Appendix A Doc 07 & Doc 08 for source of information in this table.

It appears that fully drained strength parameters were used in all the cases of static stability analysis. Design properties and parameters used in the pseudo-static stability analyses are shown in Table 7.2:

Table 7.2: Design Properties and Parameters of Materials used in the Pseudo-Static Stability Analyses by Geocomp				
Material	Unit Wt. (pcf)	Undrained Strength Parameters		PZ Line
		C (psf)	Ø (deg)	
Dike Fill-Sandy Silt	125	0	30	1
Dike Fill-Silty Clay	125	2000	0	1
Dike Fill-Silty Sand	125	0	25	1
Dike Fill-Silty/Sandy Clay	125	2000	0	1
Hydraulically Placed Ash	105	0	0	1
Sandy Silt	125	0	20.5	3
Lean Clay	115	1000	0	2
Fat Clay	115	1000	0	7
Lean Clay (2)	115	1000	0	5
Silty Sand	125	0	35	4
Silty Sandy (2)	125	0	24.5	6

See analysis section (Fig. 3) in Appendix A Doc 18 for source of information in this table.

Design properties and parameters used in post-quake stability analyses are shown in Table 7.2a:

Table 7.2a: Design Properties and Parameters of Materials used in Post-Quake Stability Analyses by Geocomp				
Material	Unit Wt. (pcf)	Post-Quake Strength Parameters		PZ Line
		C (psf)	Ø (deg)	
Dike Fill-Sandy Silt	125	0	30	1
Dike Fill-Silty Clay	125	2000	…	1
Dike Fill-Silty Sand	125	245	…	1
Dike Fill-Silty/Sandy Clay	125	1600	…	1
Hydraulically Placed Ash	105	c/p' = 0.06	…	1
Sandy Silt	125	225	…	3
Lean Clay	115	1000	…	2
Fat Clay	115	1000	…	7
Lean Clay (2)	115	1000	…	5
Silty Sand	125	0	35	4
Silty Sandy (2)	125	609	…	6
Silty Sandy (3)	125	693	…	6
Silty Sandy (4)	125	581	…	6
Silty Sandy (5)	125	672	…	6
Silty Sandy (6)	125	1052 + 6.5/ft	…	6
Silty Sandy (7)	125	444	…	6
Silty Sandy (8)	125	658	…	6
Silty Sandy (9)	125	489	…	6
Silty Sandy (10)	125	810	…	6

See analysis section (Fig. 4) in Appendix A Doc 18 for source of information in this table.

7.1.3 Uplift and/or Phreatic Surface Assumptions

The phreatic surface in the embankment slope stability analysis sections by Stantec was assumed to extend through the embankment section down from the pond water elevation to the toe of the embankment section and from upper pond water elevation to lower pond water elevation in the case of the divider dike (see analysis sections in Appendix A Doc 07, Doc 08, and Doc 14).

From piezometers installed in Geocomp's additional investigation it was determined that pore pressures are significantly less than hydrostatic throughout the cross section, evidently due to the downward component of the seepage gradient through the dike cross section. As noted in Geocomp's letter, "This means that effective stresses are higher and correspondingly soil strengths are higher than what is obtained if pore pressures are assumed to be hydrostatic below the top phreatic surface. In Geocomp's analyses an appropriate piezometric line (PZ Line in Tables 7.2 and 7.2a) that defines the pore-pressure conditions was determined for each soil layer.

From visual observations in the field, the phreatic surface was not observed to crop out on the outside slope of the dikes. A puddle of water was observed at the outside toe of the northern perimeter dike near the mid-point the north side. Based on the flat topography and worn surface of the unpaved toe access road in the area, and wet ground conditions from recent rainfall, the wet puddle appeared to be due to poor surface drainage.

7.1.4 Factors of Safety and Base Stresses

The computed factors of safety for the load cases analyzed in the slope stability analyses of the perimeter dike are shown in the Table 7.3 and Table 7.4 below for the northern perimeter dike and eastern perimeter dike, respectively. Conventional minimum FS criteria are 1.5 for static long-term stability and 1.0 for earthquake stability (by pseudo-static method). The USACE (EM 1110-2-1902) allows a minimum factor of safety of 1.4 for maximum surcharge events and minimum factors of safety of 1.1 for rapid drawdown from maximum flood pool and 1.3 for rapid drawdown from maximum storage pool. The computed minimum factors of safety for static stability of the divider dike are 1.5 or greater for the most critical section E-E' after remedial improvements, which have been made.

FINAL

Table 7.3: Slope Stability Factors of Safety (Outside Slope) – Northern Perimeter Dike	
Load Case	**Calculated Minimum[1] Factor of Safety (FS)**
1. Static Steady State, Pond El 230 Ft	1.97 Deep; 2.17 Shallow
2. Static Steady State, Pond El 233 Ft	1.85 Deep; 1.80 Shallow
3. Static Steady State, Pond El 237 Ft	1.62 Deep; 1.44 Shallow
4. Rapid Drawdown, Lake MeKellar El 232.5 Ft to El 185 Ft	1.63
5. Earthquake - 0.185 Horiz Seismic Coef	1.014

[1]For the critical Section A-A' for static stability & critical Section B-B' for earthquake (pseudo-static) stability. Inside slope FS all higher than outside slope FS. *Source: Stantec report dated March 25, 2010 and Geocomp letter dated October 10, 2012.*

Table 7.4: Slope Stability Factors of Safety (Outside Slope) – Eastern Perimeter Dike After Remedial Improvements	
Load Case	**Calculated Minimum[1] Factor of Safety (FS)**
1. Static Steady State, Pond El 230 Ft	1.50 Deep; 1.50 Shallow
2. Static Steady State, Max Storage Pool	Not Analyzed
3. Static Steady State, Max Surcharge Pool	Not Analyzed
4. Rapid Drawdown	Not Analyzed
5. Earthquake	Not Analyzed – Northern Dike Section More Critical

[1]For the critical Section E-E'. Inside slope not analyzed. *Source: Stantec report dated May 11, 2011.*

It is noted that Geocomp performed a baseline static (steady state) stability analysis of the critical Section B-B' at the northern perimeter dike and obtained a minimum FS = 2.8, which is higher than the minimum FS computed in Stantec's analysis of the generally comparable Section A-A'. The difference appears to be due to the determination in Geocomp's additional investigation that pore pressures are significantly less than hydrostatic, resulting in higher effective stresses and thus higher soil strength.

In Geocomp's pseudo-static analysis the yield acceleration (that at FS = 1.0) was determined to be 0.185g. Using a design earthquake with a recurrence interval of 2,500 years and hard rock motions provided by AMEC Geomatrix, and the equivalent linear program, Quad4M, peak average horizontal accelerations for the analysis section were determined to range from 0.210g to 0.339g with an average of 0.259g. As Geocomp noted, "This means the yield acceleration for the slope would be momentarily exceeded by the average horizontal acceleration, which would result in some permanent deformation of the slope. If the yield acceleration is exceeded only for several short intervals of time, the permanent displacements can be quite small." Geocomp went on the compute the permanent displacements using two different analyses: the non-linear OpenSees analysis, which produced maximum displacements in the range of 1.9 to 3.7 inches with an average of 2.3 inches; and the Newmark sliding block displacement analysis using the yield acceleration from the pseudo-static stability analysis, which yielded estimated permanent displacements ranging from 0.1 inch to 1.2 inches with an average of 0.7 inch. Thus, on the basis of these two different analyses the permanent displacements "can be expected to be quite small – on the order of only a few inches."

Seepage exit gradients were computed and compared with a critical gradient of 0.98 to calculate a factor of safety against piping (FS_{piping} = i_{crit}/i). The minimum computed FS_{piping} = 4.45 under surcharge pool conditions (case 3 loading) for the more critical analysis section of the northern perimeter dike. The minimum computed FS_{piping} = 4.7 and 6.9 for the eastern perimeter dike and divider dike, respectively, under the new, lowered normal pool elevation of 226 feet msl that now occurs in the stilling pond after implementation of remedial improvements. Stantec adopted a minimum factor of safety criterion of 3.0 against piping. This is compatible with factor of safety criterion on the order of 2.5-3.0 proposed in 1977 by Cedergren and noted in the USACE's EM 1110-2-1901.

7.1.5 Liquefaction Potential

Initially, no liquefaction potential analyses were provided, since TVA intended that liquefaction potential would be addressed as part of a comprehensive risk/consequences-based evaluation of seismic failure risks being conducted in closure design. TVA's approach is described in a "Seismic Risk Assessment White Paper" provided in Stantec's report dated October 3, 2011. However, in response to recommendations in the DRAFT Dam Assessment Report, TVA had Geocomp perform an analysis of liquefaction potential. The analysis included calculations to determine the factor of safety against liquefaction versus depth. Recommendations of Youd et al. (2001) and blow count data from test borings made in Geocomp's field investigation were used to determine the cyclic resistance ratio (CRR), and the cyclic stress ratio (CSR) was determined from dynamic analyses used in Geocomp's evaluation of the site's seismic response. The calculations show that the low blow-count native silty sand layers in the analysis section have factors of safety less than 1.0, indicating that they would likely liquefy during design earthquake shaking. Therefore, the post-shaking (post-quake) stability of the section was analyzed for static conditions with reduced shear strengths. The pseudo-static strength values were used for the soils that do not liquefy, and residual shear strengths determined by the method of Idriss and Boulanger (2007) were used for the soils that may potentially liquefy. The post-quake stability analysis yields a minimum factor of safety of 1.1, which is considered acceptable for this condition. Geocomp concluded that, "While some of the soils, the native silty sands, have factors of safety against liquefaction that are less than 1, the representative cross section has sufficient strength to resist a shear slide even with soil strengths reduced for repeated loading and liquefaction." (See Geocomp's letter dated October 10, 2012 in Appendix A Doc 18 for more description and discussion of their liquefaction potential analysis, along with seismic response evaluation of the site.)

7.1.6 Critical Geological Conditions

The Allen Fossil Plant and ash ponds are located on the 0.62-mile thick sediment-filled trough known as the Mississippi Embayment, which approximately underlies the Mississippi Valley. The sedimentary deposits include layers of sand, silt, clay, gravel, and various mixes of these soil types. Geologic information in Stantec's reports, based on the Geologic

Map of the Fletcher Lake Quadrangle, Tennessee, published by the Tennessee Department of Conservation, Division of Geology, 1978, indicates that manmade fills and Quaternary age alluvial deposits immediately underlie the plant and surrounding areas. The fill is generally composed of alluvial soil dredged from the floodplain (or loess in some areas) and is tens of feet thick in the industrial areas in the floodplain of the river. The alluvium is noted to consist of irregular lenses of fine sand, silt, and clay in the upper part and coarse sands, gravelly sands, and sandy gravels in the lower part. The alluvium varies in thickness from about 45 feet to 90 feet adjacent to the loess bluffs along the eastern edge of the quadrangle to as much as 175 feet well out into the floodplain. The alluvium is noted to be underlain by a series of highly consolidated clays and dense sands of the Claiborne Group. The East Ash Pond is noted to be underlain by the alluvial deposits and surrounded by manmade fill.

The main hazard associated with the geology of the area is the potential for the presence of very soft and very loose soils that may behave unsatisfactorily under certain cases of loading, particularly seismic loading. As previously mentioned, many of Stantec's test borings penetrated very soft to soft alluvial soils immediately beneath the East Ash Pond dike embankment.

Seismicity – The Allen Fossil Plant is located on the southeast edge of the New Madrid Seismic Zone. This zone is an area considered to have high seismic hazard, based on the historical record of strong earthquakes occurring in this area. At the edge of this zone, where the plant and ash ponds are located, the seismic hazard is considered to be moderate. From the USGS Interactive Deaggregation website, based on the USGS Seismic-Hazard Maps for Central and Eastern United States, dated 2008, the East Ash Pond is at a location anticipated to experience 0.556g peak (horizontal) ground acceleration (PGA) with a 2-percent probability of exceedance in 50 years (2,475-year exceedance return time), assuming uniform firm-rock site conditions, i.e., a site with average shear wave velocity of 2,500 feet per second (fps) in the upper 100 feet below the ground surface. The alluvial soils that form the foundation for the dike embankment would be expected to have a lower shear wave velocity than 2,500 fps; therefore, the actual PGA at the site may be different than indicated above. USGS documentation for the Memphis area indicates that the very thick sequence of sediments in the Mississippi Embayment de-amplify the strongest ground motions for rapidly oscillating waves (shorter periods) and amplifies motions for slower oscillating (longer period) waves.

TVA uses seismic hazard results from the TVA Dam Safety Seismic Hazard Model developed by AMEC Geomatrix, 2004. Values of PGA from this model for the Allen plant are 0.389g for 2,475-year exceedance return time. The TVA values are based on “hard rock” rather than the “uniform firm-rock” site conditions assumed for the USGS Seismic-Hazard Maps. According to TVA’s documentation, the hard rock to uniform firm rock amplification factor for PGA is 1.52. Therefore the TVA PGA values would need to be multiplied by this amplification factor to compare with the USGS PGA values. Using this factor, the values are comparable. The site-specific response analysis performed by Geocomp yields a lower peak average horizontal acceleration than that obtained from the USGS Seismic-Hazard Maps, which generally cannot account for site specific factors.

7.2 ADEQUACY OF SUPPORTING TECHNICAL DOCUMENTATION

The supporting technical documentation for structural stability of the East Ash Pond dikes at the Allen Fossil Plant is adequate. The methods used in the static slope stability, seismic (pseudo-static) slope stability, underseepage, and liquefaction potential analyses are acceptable. Material properties and parameters and other assumptions used in the analyses appear to be reasonable.

The cases of loading analyzed for the eastern perimeter dike are more limited than those analyzed for the northern perimeter dike. For example, the rapid drawdown case was not analyzed even though Stantec’s hydrologic/hydraulic analyses indicate a tailwater elevation of 225 feet msl would occur on the exterior slope of the eastern perimeter dike under flooding from the 6-hour PMP, which would create rapid drawdown conditions when the tailwater subsides. The rapid drawdown case analyzed for the northern perimeter dike, which involved drawdown from a higher elevation (232.5 feet msl), resulted in a satisfactory factor of safety. Thus, it appears that the lower drawdown case for the eastern perimeter dike was reasonably considered not to be as severe and therefore no drawdown stability analysis of this slope was needed, since the slopes and soil parameters were similar. The maximum storage pool case was not analyzed for the eastern perimeter dike apparently because the revised lower normal water elevation (226 feet msl) in the stilling pond after remedial improvement measures were implemented is the maximum operating water elevation. The maximum surcharge pool case also was not analyzed for the eastern perimeter dike. This case represents the maximum flood pool condition; it apparently was not analyzed because the high tailwater elevation (225 feet msl) during PMP flooding makes it less critical than the normal pool elevation case (226 feet msl and no tailwater), due to less differential head between stilling pond maximum pool elevation and the tailwater elevation. The seismic (pseudo-static) stability of the eastern perimeter dike was not evaluated in the latest analyses performed by Geocomp as it appears the eastern perimeter dike section is not more critical than that analyzed for the northern perimeter dike.

No structural stability documentation is available for the inactive West Ash Pond dike embankments. There appears to be no need for this documentation as long as this pond remains inactive and does not impound a significant amount of water.

7.3 ASSESSMENT OF STRUCTURAL STABILITY

The structural stability of the East Ash Pond dike embankments appears to be satisfactory based on the following:

- Documented static slope stability analyses showing satisfactory factors of safety against both deep and shallow potential circular arc shear failures under all credible loading conditions.
- Documented seismic response evaluation of a representative section of the East Ash Pond under design earthquake with 2,500-year recurrence interval, including pseudo-static stability analysis, dynamic analyses, deformation analyses showing very small (acceptable) permanent displacements, liquefaction potential analysis, and post-quake analysis using reduced soil strengths showing an acceptable factor of safety for post-quake conditions.
- Documented seepage analyses and evaluation of exit gradients showing satisfactory factors of safety against a piping failure.
- No indications of scarps, sloughs, major depressions or bulging anywhere along the slopes of the dike.
- No indications of boils, sinks, or uncontrolled seepage along the outside slope or toe of the dike.
- No major depressions and no significant vertical or horizontal alignment variations in the crest of the dike.

The spillway and outlet structures appeared to be in generally sound and stable condition with no evidence of significant structural deterioration of the limited visible parts of the structures that could be seen. At the East Ash Pond some of the metal parts and hardware at the spillway in the divider dike and at the floodgates at the discharge end of the primary outlet conduits were observed to be rusty. In the DRAFT Dam Assessment Report it was noted that it would be prudent to perform maintenance cleaning and painting of the metal items to arrest the deterioration and protect against future corrosion. It is understood that this maintenance has been completed (see Stantec's letter dated October 11, 2012 in Appendix A Doc 18).

From visual assessment in the field the inactive West Ash Pond dike embankments and outlet structure appeared to be stable under the prevailing normal static conditions in which it impounds no water. Even though this pond is inactive, TVA should continue surveillance and maintenance of the dike embankments and ensure that the inactive pond does not impound water.

8.0 ADEQUACY OF MAINTENANCE AND METHODS OF OPERATION

8.1 OPERATING PROCEDURES

The ash pond receives sluiced ash from both the boiler slag/bottom ash handling system and the fly ash handling system. Each of the three boilers at the plant has two sluice pipes, one for fly ash and one for boiler slag/bottom ash, running to the East Ash Pond (total of 6 sluice lines). There is an additional line that carries plant process water to the pond. All the sluice lines currently discharge into a rim ditch in the northwest part of the dredge cell at the west end of the East Ash Pond. The ash may also be sluiced into a "mini" dredge cell that lies on the west side of the main dredge cell. The Coal Yard runoff also drains to the East Ash Pond into a small cell at the southwest corner.

In the rim ditch a long-reach excavator scoops out the ash and places it in piles or rows to drain, as previously shown (Figure 5.8). After dewatering the ash is loaded onto dump trucks suitable for on-road travel and hauled to final disposition. The dried fly ash is used in a structural fill at a nearby industrial park and the dried boiler slag/bottom ash is marketed. Excavation operations in the dredge cell are restricted from getting closer than 50 feet from the alignment of the active sanitary sewer line that passes under the dredge cell, as well as transmission towers located in the pond. Dust suppression systems are used when needed on ash/gravel haul roads. Paved plant roads used by the haul trucks are kept clean with a sweeper truck. The ash excavation, drying, and hauling operations are contracted out. TVA's written operations procedures are included in Appendix A Doc 15.

The normal water level in the central settling area of the East Ash Pond is maintained at elevation 230 feet msl, which allows for at least 7.5 feet of freeboard. The normal water level in the stilling pond has recently been lowered to 226 feet msl, which allows for at least 10.5 feet of freeboard. Water discharges are monitored according to NPDES Permit requirements; pH adjustments are made at the spillway in the divider dike.

The West Ash Pond is inactive and there currently are no operations related to ash disposal at this pond.

8.2 MAINTENANCE OF THE DAM AND PROJECT FACILITIES

Maintenance of the dike embankments and outlet works of the ash ponds, and essential operating equipment, such as the piping (ash sluice lines), pumps, and other equipment (e.g., gates, valves, etc.), are performed, as determined by routine inspections performed by plant personnel. Vegetation on the embankment slopes is scheduled to be mowed at least three times during the growing season. Any woody vegetation is removed. Erosion repairs are made and animal holes filled as needed. TVA's written maintenance procedures are included in Appendix A, Doc 15. TVA also follows written guidelines for repair of routine maintenance problems, such as gully and rill erosion repair, burrow repair, wave erosion repair, etc., as shown in Appendix A, Doc 16.

8.3 ASSESSMENT OF MAINTENANCE AND METHODS OF OPERATIONS

8.3.1 Adequacy of Operating Procedures

Based on field observations and review of operations pertaining to CCR containment, operating procedures at the active East Ash Pond appear to be adequate.

8.3.2 Adequacy of Maintenance

Maintenance of the impounding embankments and outlet works of the active East Ash Pond appears to be adequate. Maintenance of the inactive West Ash Pond currently appears to be adequate. No major maintenance issues were noted from review of dike inspection reports. Based on field observations, some minor maintenance is advised (see Subsection 1.2.5).

9.0 ADEQUACY OF SURVEILLANCE AND MONITORING PROGRAM

9.1 SURVEILLANCE PROCEDURES

TVA has a program of conducting, daily, weekly, monthly, quarterly, and annual inspections of the active East Ash Pond. The inspections are documented with checklist forms and written reports. Any deficiencies requiring correction or maintenance are reported and tracked. The Seepage Action Plan previously mentioned is used to track seeps and determine the level of repair necessary. Signs are in-place at pipe penetrations and known seeps to aid during inspections. In summary:

- Daily inspections are conducted by the on-site Contractor and by or under the supervision of the Field Supervisor and documented in a Daily Field Report and Ash Haul Operations Checklist.
- The weekly inspections are carried out by the Field Supervisor and documented on a Weekly Facility Observation Form.
- The monthly inspections are conducted by the Construction Manager and documented on a Monthly/Quarterly/Special Facility Inspection Form.
- The quarterly inspections are performed by the Routine Handling Operations and Maintenance (RHOM) team led by the RHOM Manager and documented on the Monthly/Quarterly/Special Facility Inspection Form. Conditions requiring engineering recommendations are reported to Coal Combustion Products (CCP) Engineering or to a geotechnical engineer to provide recommendations for the repair.
- Unscheduled inspections are also performed after special events such as heavy rainfall and earthquake and documented on the Monthly/Quarterly/Special Facility Inspection Form.
- The annual inspections focus on structural integrity and are performed by a qualified geotechnical engineer (e.g., Stantec) under the responsibility of CCP Engineering. The inspection includes both active ash ponds (e.g., East Ash Pond) and inactive ash ponds (e.g., West Ash Pond). The annual inspection is documented in a written report. Recommendations for any needed repairs or maintenance or needed studies are included in the annual report.

TVA's inspection and reporting program are included in Appendix A, Doc 15.

9.2 INSTRUMENTATION MONITORING

Dam performance monitoring instrumentation includes 18 piezometers in place along the perimeter dike on most of the north side, east side (next to stilling pond), and south side of the stilling pond. The piezometers had been installed in many of the test borings made by Stantec, which were located primarily on the crest, although two were located on the upper part of the inside slope of the north side dike, two were located at the outside toe of the north side dike, and five were located at the outside toe of the east side dike. The locations of the piezometers are shown on the instrumentation plan included in Appendix A, Doc 06. The piezometer water levels are typically measured monthly, although more frequent readings appear to have been taken in the first month or so after installation, during flooding events, and when the normal water level was lowered in the stilling pond. The piezometer water-level readings and elevations for the 2-year period of record from July 20, 2009 to July 25, 2011 are tabulated in Appendix A, Doc 17. The piezometer water levels appear to have fluctuated up and down, depending on seasonal variations in rainfall and water levels in Lake McKellar, particularly in the piezometers in the outside toe areas. The two piezometers in the outside toe area of the north side dike were actually covered with water in May 2011 due to Mississippi River flooding and extremely elevated water level in Lake McKellar. Since lowering of the normal water level in the stilling pond there appears to have been a gradual trend of lowering water levels in the east side perimeter dike piezometers.

Visual monitoring of seep areas is performed and documented in a Seepage Log. Any needed actions are taken according to the Seepage Action Plan.

9.3 ASSESSMENT OF SURVEILLANCE AND MONITORING PROGRAM

9.3.1 Adequacy of Inspection Program

TVA’s inspection program for the ash pond dikes is appropriate and adequate. No major safety issues were noted in any of the inspection reports or check forms reviewed (see discussion in Section 3.1).

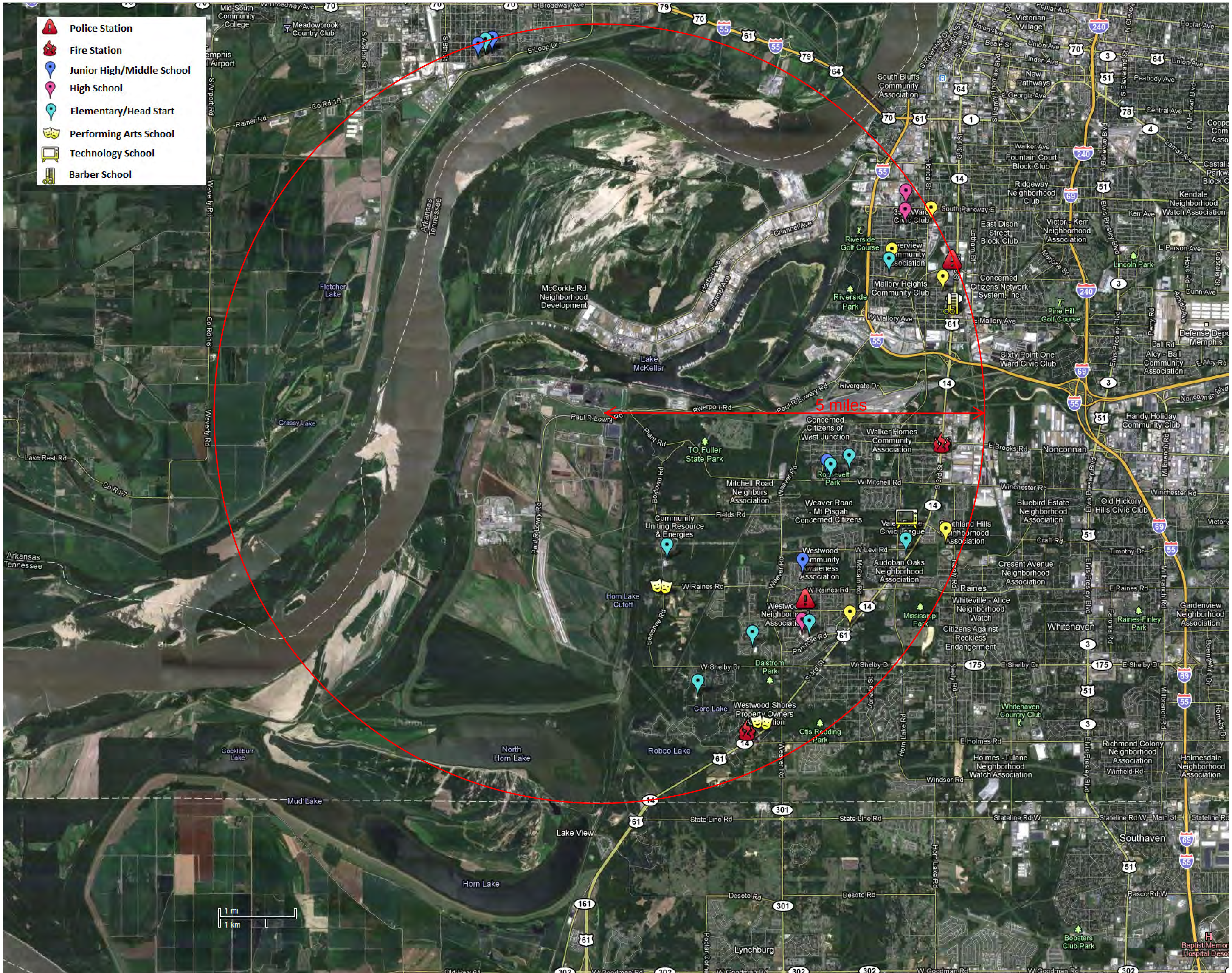
9.3.2 Adequacy of Instrumentation Monitoring Program

The instrumentation monitoring program is adequate. No problem or suspect condition, such as excessive settlement, major seepage, shear failure, or displacement was observed in the field that might be reason for installation of additional or different instrumentation. In the absence of stability problems or major seepage issues, there is no need for additional performance monitoring instrumentation at this time.

APPENDIX A

Document 1

Allen Fossil Plant Aerial Vicinity Map and 5-Mile Radius


Police Station
Fire Station
Junior High/Middle School
High School
Elementary/Head Start
Performing Arts School
Technology School
Barber School
5 miles
1 mi
1 km
Lake McKellar
Arkansas
Tennessee
Southaven
Whitehaven
Horn Lake
Lynchburg
Nonconnah

Whites Chapel Elementary School
Christopher D. Wison
Coro Lake Elementary School
Memphis Performing Arts Ministry
Double Tree Elementary School: City Schools
Chickasaw Junior High School
Ford Road Elementary School
Mitchell Middle/High School
Headstart
Southwest Career and Technology Center
Levi Elementary School
Westwood High School
Westwood Elementary School
Senior Clara Muhammad School
St Joseph Catholic School
Last Minute Cuts Sch-Brbrng
Mallory Heights School
Riverview Elementary School
Memphis City Sch Board of Edu
Carver High School
Florida Street School
Carver High School
Wonder Elementary School
Wonder Junior High
Wonder Junior High School
Memphis Police Westwood
Memphis Police Department
Firehouse 45
Firehouse 36

APPENDIX A

Document 2

East Ash Pond Aerial View – Stantec Map

Stantec
STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Plan View 1 - ALF

Tennessee Valley Authority
Allen Fossil Plant
Memphis, Shelby County, Tennessee

PROJECT NO.	171468118
DATE	MARCH 2009
DRAWN BY	AMG
CHECKED BY	HJK
CHECKED BY	DAG
SCALE	AS SHOWN
REVISED	

SHEET

1 OF 2

APPENDIX A

Document 3

West Ash Pond Aerial View – Stantec Map

STANTEC CONSULTING SERVICES INC.
1409 N. Forbes Rd.
Lexington, Kentucky
40511-2050
859-422-3000

Stantec

Plan View 2 - ALF

Tennessee Valley Authority
Allen Fossil Plant
Memphis, Shelby County, Tennessee

PROJECT NO.	174681118
DATE	MARCH 2009
DRAWN BY	AMG
CHECKED BY	RJK
CHECKED BY	DAG
SCALE	AS SHOWN
REVISED	
1	
2	
3	
4	
5	
6	
7	
8	

SHEET

2 OF 2

APPENDIX A

Document 4

Allen Fossil Plant – Long Term Disposal Plan

ALLEN FOSSIL PLANT - LONG TERM DISPOSAL PLAN
April 15, 2011

FISCAL YEAR ENDING	PROJECTED COAL BURN (TONS)	FLY ASH PRODUCTION (TONS)	BOILER SLAG PRODUCTION (TONS)	BOILER SLAG RECOVERED (TONS)	TOTAL ASH TO POND (CY)	CUMULATIVE STOCKPILED (CY)	DREDGED VOLUME (CY)	ASH POND CAPACITY (CY)	CAPITAL COSTS ($)	O & M COSTS ($)	TOTAL COSTS ($)
2011	2,855,136	53,941	109,923	70,000	144,851	0	0	162,890	2,553,000	1,458,034	4,011,034
2012	2,914,157	55,056	112,195	70,000	150,078	0	0	12,812	851,000	1,494,485	2,345,485
2013	2,813,405	53,152	108,316	70,000	141,155	0	0	(128,343)	3,015,000	1,531,847	4,546,847
2014	2,696,320	50,940	103,808	70,000	130,785	0	0	(259,128)	2,852,000	1,570,143	4,422,143
2015	1,683,897	31,813	64,830	70,000	41,116	0	0	(300,244)	40,279,752	1,609,397	41,889,149
2016	0	0	0	0	0	0	0	0	21,899,752		21,899,752
2017	0	0	0	0	0	0	0	0	4,000,000		4,000,000
2018	0	0	0	0	0	0	0	0	0		0
2019	0	0	0	0	0	0	0	0	0		0
2020	0	0	0	0	0	0	0	0	0		0
2021	0	0	0	0	0	0	0	0	0		0
2022	0	0	0	0	0	0	0	0	0		0
2023	0	0	0	0	0	0	0	0	0		0
2024	0	0	0	0	0	0	0	0	0		0
2025	0	0	0	0	0	0	0	0	0		0
2026	0	0	0	0	0	0	0	0	0		0
								TOTAL =	**75,450,504**	**7,663,905**	**83,114,409**

Assumptions:
1) Ash production is based on the January 2011, Budget Case Coal Burn Forecast
2) Ash content is 5.50% plus 14.5% unburned carbon, based upon past 3 year average
3) 30% of the total ash is fly ash, the remaining 70% is boiler slag
4) 100% of the boiler slag and fly ash are sluiced to the East Ash Pond, approximately 70,000 tons of boiler slag is marketed (per Mike Sutton
5) Approximately 30% of the fly ash and boiler slag fines are dipped from the channel prior to reaching the ash ponc
6) Ponded ash density = 60 lb/c.f.; Stacked ash density = 75 lb/c.f.
7) The remaining capacity in the ash pond allows for the free water volume requirement of 162,408 c.y
8) Inflation rate = 2.5%.
9) Capital Cost are based on the FGD&C FY11 Budget 3/23/11

APPENDIX A

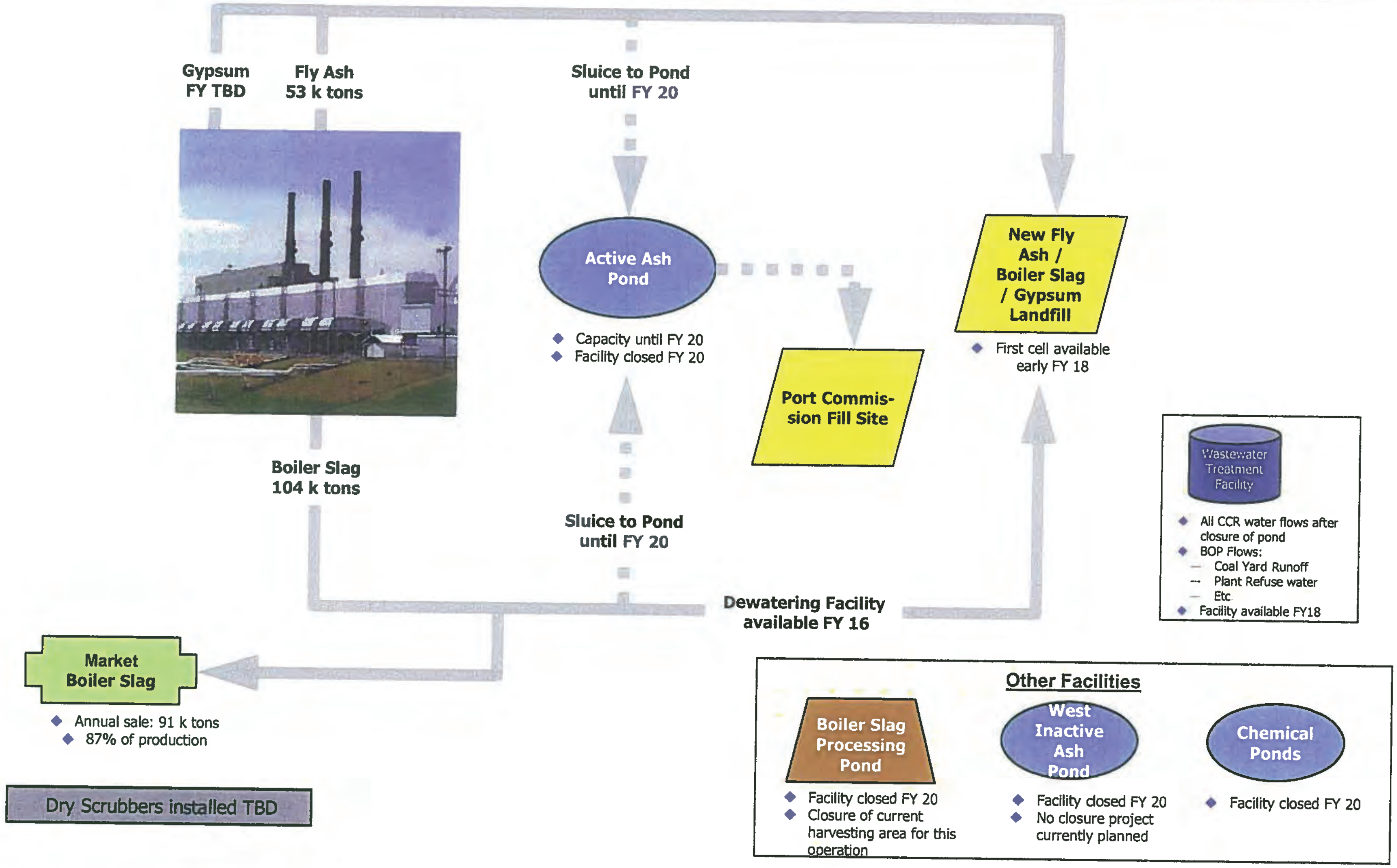
Document 5

Allen Fossil Plant – Master Strategy

TVA

Coal Combustion Products – Projects and Engineering

Allen Fossil Plant – Master Strategy



04/04/2011

APPENDIX A

Document 6

Boring Plan and Instrumentation Plan East Ash Pond

LEGEND

- SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS
- EXISTING SOIL BORING WITH UNDISTURBED (SHELBY) TUBE SAMPLES AND/OR STANDARD PENETRATION TESTS
- EXISTING SOIL BORING (HAND AUGER)

BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEVATION (FEET)
STN-1	274,580.31	762,195.58	215.5
STN-2	274,441.99	762,201.92	238.8
STN-3	274,411.16	762,192.94	234.5
STN-4	274,367.46	762,679.46	237.5
STN-5	274,364.82	763,202.51	218.0
STN-6	274,263.61	763,180.87	236.5
STN-7	274,235.39	763,163.82	235.5
STN-8	274,166.09	763,641.32	237.8
STN-9	274,009.16	763,820.47	221.2
STN-9R	274,031.78	763,804.13	223.8
STN-10	274,009.41	763,758.03	237.4
STN-11	273,517.12	763,687.47	237.9
STN-11R	273,523.33	763,667.20	236.0
STN-11S	273,500.68	763,688.37	237.5
STN-12	273,018.83	763,676.83	217.2
STN-12R	272,998.01	763,677.51	216.0
STN-13	273,020.94	763,619.04	237.2
STN-14	272,761.04	763,351.79	236.6
STN-15	273,523.32	763,754.75	216.8
STN-16	274,129.01	763,457.76	235.9
STN-16A	273,851.95	763,434.09	236.0
STN-17	273,591.08	763,387.10	236.2
STN-18	273,016.94	763,307.74	235.7
STN-18A	273,170.63	763,328.95	235.5
HA-1	274,226.34	763,209.32	235.7
HA-2	274,202.98	763,201.48	230.5
HA-3	274,265.91	762,999.17	234.2
HA-4	274,333.93	762,669.73	233.6
HA-5	274,409.74	762,201.44	233.7
HA-6	274,395.67	762,191.04	232.5
HA-7	274,398.58	762,201.29	232.4
HA-8	274,392.70	762,251.17	232.1
HA-9	273,021.67	763,612.37	237.0
HA-10	274,010.59	763,748.55	237.2

LOCATIONS FOR STN 1-14 AND HA 1-10 WERE TAKEN FROM DRAWING NO. 10W504-01 R0.

RECORD DRAWING

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

NOTES:

1. THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES. THIS PLAN VIEW WAS PREPARED TO SUPPORT DEVELOPMENT OF THE GEOTECHNICAL EXPLORATION PROGRAM AND SHOULD NOT BE USED FOR CONSTRUCTION.
2. 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.

GRAPHIC SCALE: 1" = 100'
CONTOUR INTERVAL = 1'

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R0 05/06/11 RECORD DRAWING

SCALE: 1"=100' EXCEPT AS NOTED

YARD
EAST DIKE
REMEDIAL MEASURES
EAST STILLING POND
BORING PLAN

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-01 | R 0

PLOT FACTOR 100

C.A.D. DRAWING DO NOT ALTER MANUALLY

38 C 10W506-01

LEGEND

- PIEZOMETER
- EXISTING PIEZOMETER

NOTES:

1. THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES. THIS PLAN VIEW WAS PREPARED TO SUPPORT DEVELOPMENT OF THE GEOTECHNICAL EXPLORATION PROGRAM AND SHOULD NOT BE USED FOR CONSTRUCTION.
2. 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.

INSTRUMENTATION LOCATION TABLE

INSTRUMENT	NORTHING	EASTING	TOP OF CASING ELEVATION (FEET)	GROUND SURFACE ELEVATION (FEET)
PZ-1	274,580.31	762,195.58	218.2	215.5
PZ-2	274,441.99	762,201.92	238.7	238.8
PZ-3	274,411.16	762,192.94	237.4	234.5
PZ-4	274,367.46	762,679.46	237.3	237.5
PZ-5	274,364.82	763,202.51	220.7	218.0
PZ-6	274,263.61	763,180.87	238.4	238.5
PZ-7	274,235.39	763,163.82	235.4	235.5
PZ-8	274,166.09	763,641.32	237.7	237.8
PZ-9	274,009.16	763,820.47	224.2	221.2
PZ-9R	274,031.78	763,804.13	227.0	223.8
PZ-10	274,009.41	763,758.03	237.1	237.4
PZ-11	273,517.12	763,687.47	237.8	237.9
PZ-11S	273,500.68	763,688.37	237.5	237.5
PZ-12	273,018.83	763,676.83	220.1	217.2
PZ-12R	272,998.01	763,677.51	219.8	216.0
PZ-13	273,020.94	763,619.04	237.0	237.2
PZ-14	272,761.04	763,351.79	236.4	236.6
PZ-15	273,523.32	763,754.75	219.8	216.8

LOCATIONS FOR PZ 1-14 WERE TAKEN FROM DRAWING NO. 10W504-10 R0.

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R0 05/06/11 PHW PS SZR HRA SEB WST JCK
RECORD DRAWING

SCALE: 1"=100' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES EAST STILLING POND INSTRUMENTATION PLAN

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-14 | R0

PLOT FACTOR:100
W_TVA

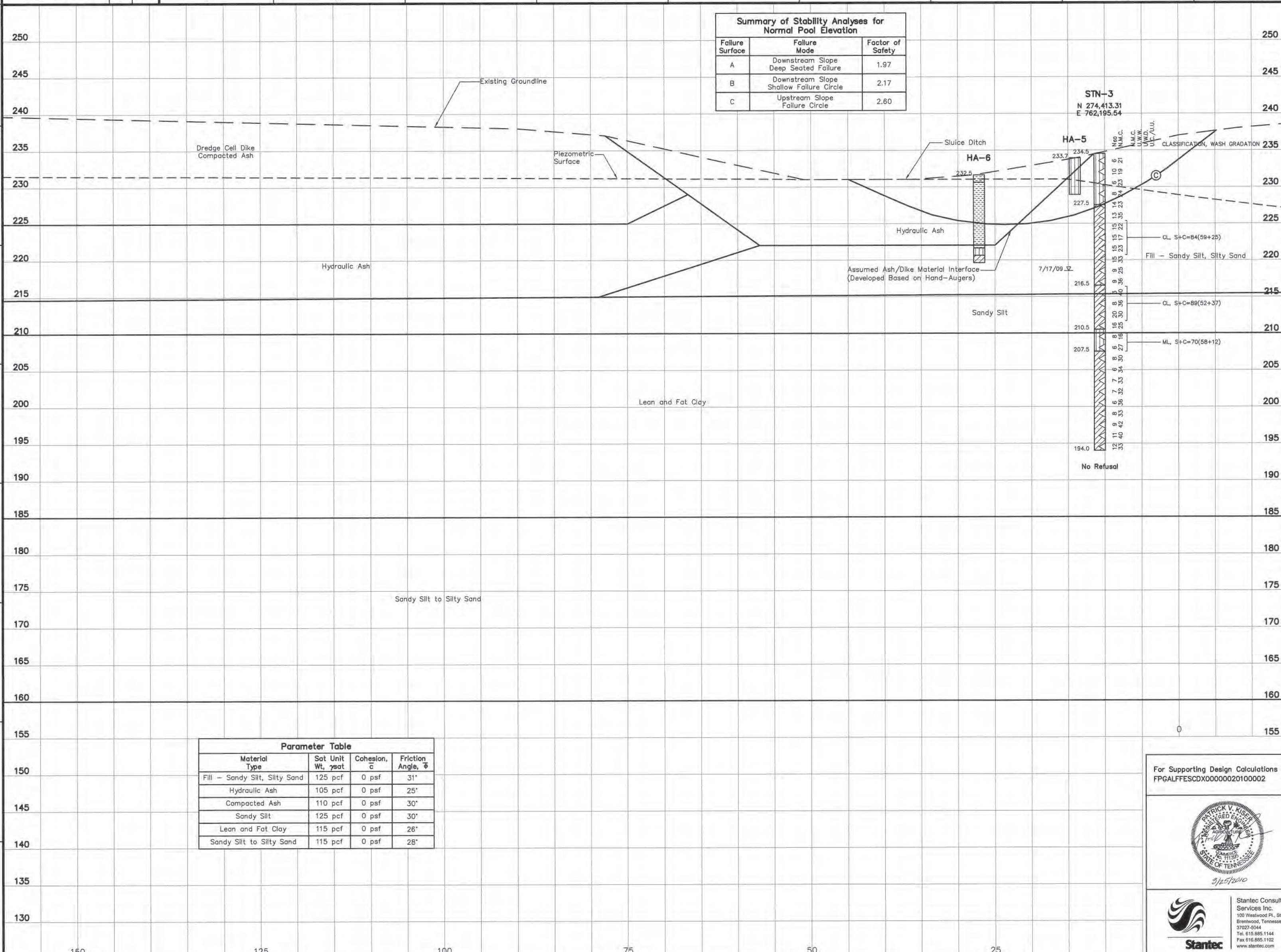
C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0
TASK COMPLETED BY: | REV NO.

APPENDIX A

Document 7

Analysis Sections – North Perimeter Dike East Ash Pond



Summary of Stability Analyses for Normal Pool Elevation

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.97
B	Downstream Slope Shallow Failure Circle	2.17
C	Upstream Slope Failure Circle	2.60

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Hydraulic Ash	105 pcf	0 psf	25°
Compacted Ash	110 pcf	0 psf	30°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH – Weight of Hammer
WR – Weight of Rods
◁ – Standard Penetration Test Interval
■ – Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} – Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} – Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. – Natural Moisture Content (%)
U.W.W. – Unit Weight Wet (lbs./cu.ft.)
U.W.D. – Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. – Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

REV NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD
R 0	03/25/10 RECORD DRAWING	PVK	PS	SF	HRA	HRA	PVK	TJ

SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION USACE LEVEE – EAST ASH POND CROSS SECTION A–A'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
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Fax 615.885.1102
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ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

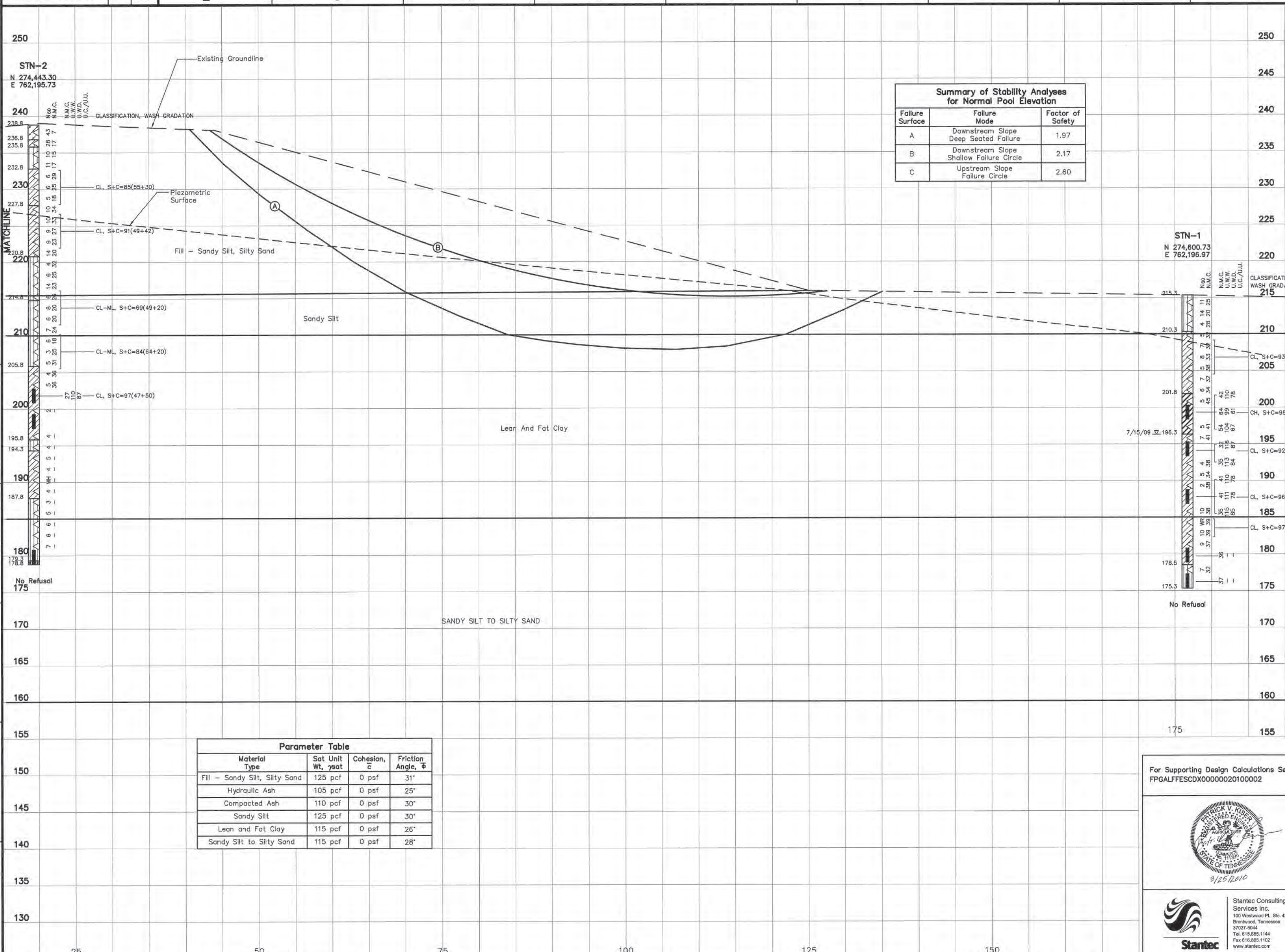
AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-04 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

38 | C | 10W504-04



Summary of Stability Analyses for Normal Pool Elevation		
Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.97
B	Downstream Slope Shallow Failure Circle	2.17
C	Upstream Slope Failure Circle	2.60

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Hydraulic Ash	105 pcf	0 psf	25°
Compacted Ash	110 pcf	0 psf	30°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH Weight of Hammer
WR Weight of Rods
Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu.ft.)
U.W.D. Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
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Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

R 0 03/25/10 PVK PS SF HRA HRA PVK TJ
RECORD DRAWING
SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
CROSS SECTION A–A'

DESIGNED BY: P. KISER | DRAWN BY: P. SILPACHARN | CHECKED BY: S. FIELD | SUPERVISED BY: H. APARICIO | REVIEWED BY: H. APARICIO | APPROVED BY: P. KISER | ISSUED BY: T. JOHNSON

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

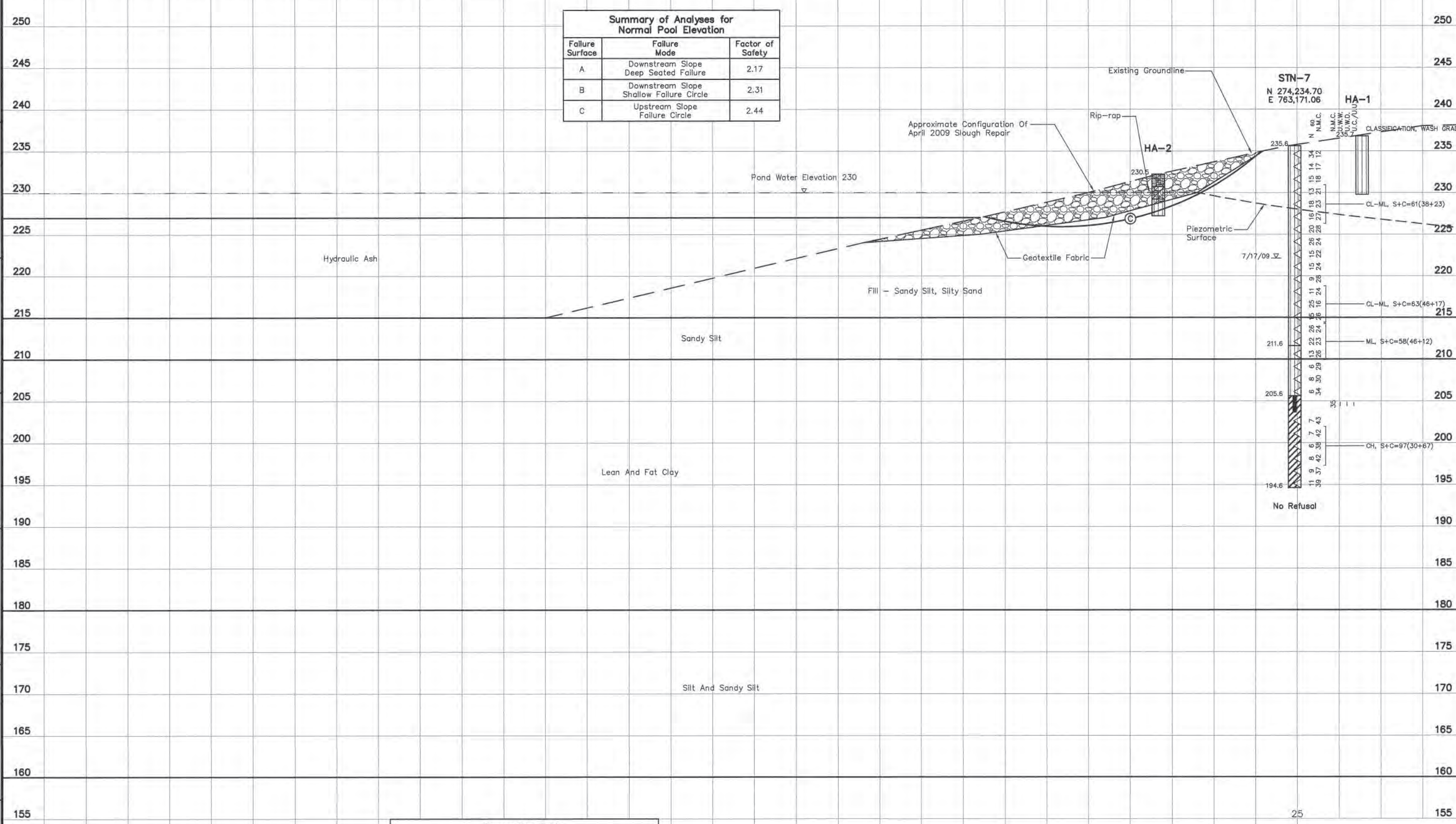
AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-05 | R 0

STANTEC 0
TASK COMPLETED BY: REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

38 | C | 10W504-06



Summary of Analyses for Normal Pool Elevation

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	2.17
B	Downstream Slope Shallow Failure Circle	2.31
C	Upstream Slope Failure Circle	2.44

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c̄	Friction Angle, Φ̄
Fill - Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Rip Rap	140 pcf	0 psf	38°
Hydraulic Ash	105 pcf	0 psf	25°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Silt and Sandy Silt	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH Weight of Hammer
WR Weight of Rods
◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu.ft.)
U.W.D. Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

R 0 | 03/25/10 | RECORD DRAWING | PVK | PS | SF | HRA | HRA | PVK | TJ

SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE - EAST ASH POND
CROSS SECTION B-B'

Designed by: P. KISER | Drawn by: P. SILPACHARN | Checked by: S. FIELD | Supervised by: H. APARICIO | Reviewed by: H. APARICIO | Approved by: P. KISER | Issued by: T. JOHNSON

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

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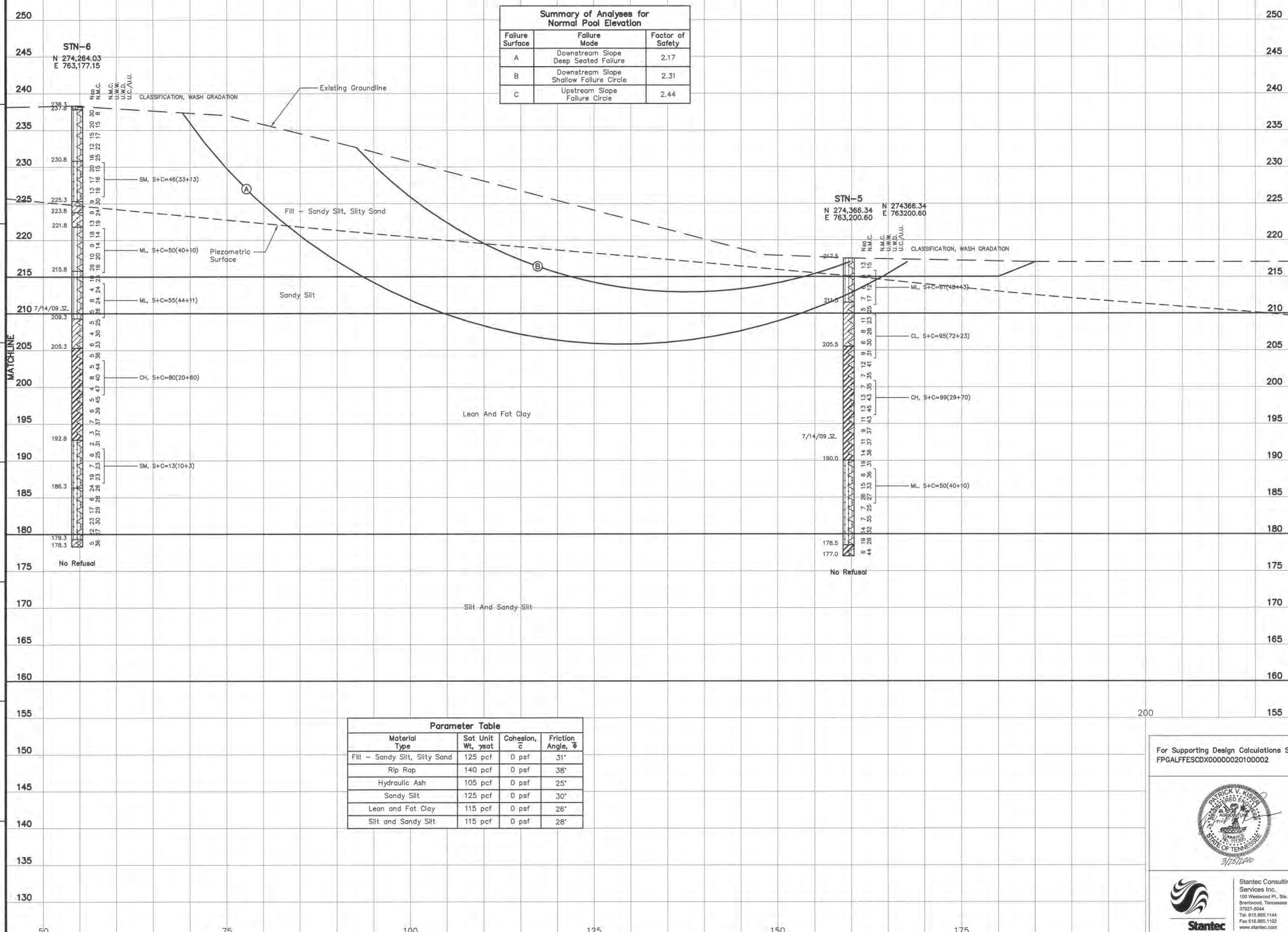
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

AUTOCAD R 2000 | 03/25/10 | 38 | C | 10W504-06 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



Summary of Analyses for Normal Pool Elevation

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	2.17
B	Downstream Slope Shallow Failure Circle	2.31
C	Upstream Slope Failure Circle	2.44

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°
Rip Rap	140 pcf	0 psf	38°
Hydraulic Ash	105 pcf	0 psf	25°
Sandy Silt	125 pcf	0 psf	30°
Lean and Fat Clay	115 pcf	0 psf	26°
Silt and Sandy Silt	115 pcf	0 psf	28°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
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- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH – Weight of Hammer
WR – Weight of Rods
Standard Penetration Test Interval
Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} – Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} – Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. – Natural Moisture Content (%)
U.W.W. – Unit Weight Wet (lbs./cu.ft.)
U.W.D. – Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. – Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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.)
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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.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

R 0 03/25/10 PVK PS SF HRA HRA PVK TJ — RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
CROSS SECTION B-B'

DESIGNED BY: P. KISER | DRAWN BY: P. SILPACHARN | CHECKED BY: S. FIELD | SUPERVISED BY: H. APARICIO | REVIEWED BY: H. APARICIO | APPROVED BY: P. KISER | ISSUED BY: T. JOHNSON

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

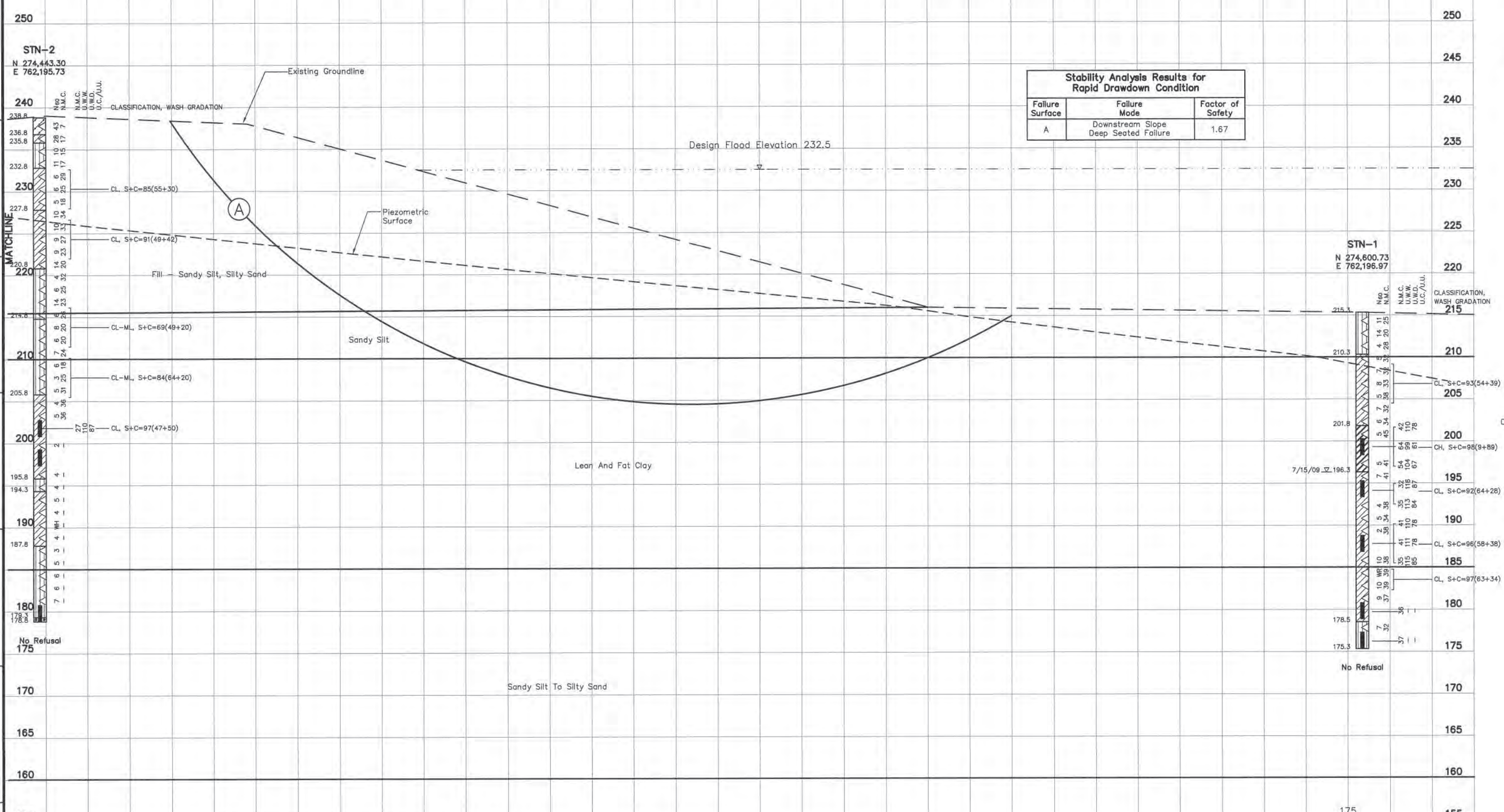
AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-07 | R 0

Stantec Consulting Services Inc.
100 Westwood Pl., Ste. 420
Brentwood, Tennessee
37027-5044
Tel. 615.885.1144
Fax 615.885.1102
www.stantec.com

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



Stability Analysis Results for Rapid Drawdown Condition

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.67

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH	Weight of Hammer
WR	Weight of Rods
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
U.C./U.U.	Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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.

RECORD DRAWING

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ	Total Stress Parameters σKc=Kf	Total Stress Parameters ΨKc=Kf	Undrained Strength Parameters σKc=1	Undrained Strength Parameters ΨKc=1
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°	200 psf	22°	254.6 psf	27.18°
Hydraulic Ash	105 pcf	0 psf	25°	0 psf	10°	0 psf	10.78°
Compacted Ash	110 pcf	0 psf	30°	0 psf	30°	0 psf	30°
Sandy Silt	125 pcf	0 psf	30°	200 psf	22°	256.79 psf	27.41°
Lean and Fat Clay	115 pcf	0 psf	26°	400 psf	12°	443.97 psf	13.27°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°	200 psf	12°	218.07 psf	13.05°

For Supporting Design Calculations See FPGALFFESCDX00000020100002

R 0 03/25/10 PVK PS SF HRA HRA PVK TJ — RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
USACE LEVEE – EAST ASH POND
CROSS SECTION A–A'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
P. KISER	P. SILPACHARN	S. FIELD	H. APARICIO	H. APARICIO	P. KISER	T. JOHNSON

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-08 | R 0

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PATRICK V. KISER
STATE OF TENNESSEE
3/25/10

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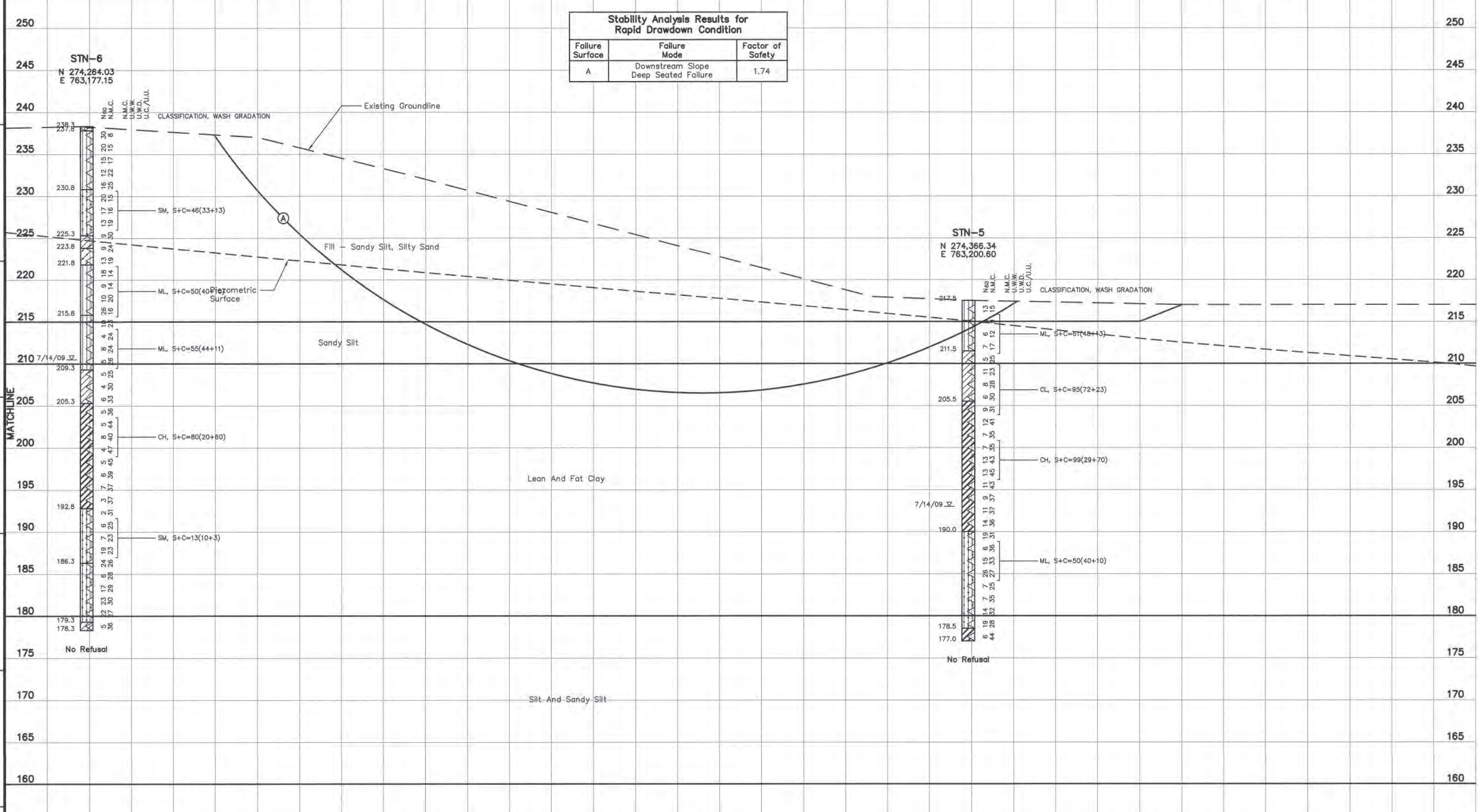
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

38 | C | 10W504-08



Stability Analysis Results for Rapid Drawdown Condition

Failure Surface	Failure Mode	Factor of Safety
A	Downstream Slope Deep Seated Failure	1.74

Parameter Table

Material Type	Sat Unit Wt, γsat	Cohesion, c	Friction Angle, Φ	Total Stress Parameters d/Kc=Kf	Total Stress Parameters Ψ/Kc=Kf	Undrained Strength Parameters d/Kc=1	Undrained Strength Parameters Ψ/Kc=1
Fill – Sandy Silt, Silty Sand	125 pcf	0 psf	31°	200 psf	22°	254.6 psf	27.18°
Rip Rap	140 pcf	0 psf	38°	0 psf	38°	0 psf	38°
Hydraulic Ash	105 pcf	0 psf	25°	0 psf	10°	0 psf	10.78°
Sandy Silt	125 pcf	0 psf	30°	200 psf	22°	256.79 psf	27.41°
Lean and Fat Clay	115 pcf	0 psf	26°	400 psf	12°	443.97 psf	13.27°
Sandy Silt to Silty Sand	115 pcf	0 psf	28°	200 psf	12°	218.07 psf	13.05°

LEGEND

- Topsoil
- Silt to Sandy Silt, brown to gray, moist
- Lean Clay, brown to gray, moist to saturated stiff, with sandy and silty zones
- Fat Clay, brown to grayish brown, moist to saturated
- Bottom Ash, gray to dark gray and black, damp to wet, medium to very coarse grained, poorly sorted, angular
- Fly Ash, gray to dark gray, damp to wet
- Silty Clay, brown to grayish brown, moist to wet
- Gravel with Sand, gray to brown
- Sand to Silty Sand, brown to gray, moist to saturated fined grained

WH – Weight of Hammer
WR – Weight of Rods
◁ – Standard Penetration Test Interval
■ – Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} – Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} – Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. – Natural Moisture Content (%)
U.W.W. – Unit Weight Wet (lbs./cu.ft.)
U.W.D. – Unit Weight Dry (lbs./cu.ft.)
U.C./U.U. – Unconfined Compressive Strength (psf)/ Unconsolidated Undrained Triaxial Test (psf)
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.

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100002

R 0 | 03/25/10 | PVK | PS | SF | HRA | HRA | PVK | TJ
RECORD DRAWING
SCALE: 1"=5' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION USACE LEVEE – EAST ASH POND CROSS SECTION B-B'

Designed by: P. KISER | Drawn by: P. SILPACHARN | Checked by: S. FIELD | Supervised by: H. APARICIO | Reviewed by: H. APARICIO | Approved by: P. KISER | Issued by: T. JOHNSON

ALLEN FOSSIL PLANT
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AUTOCAD R 2000 | DATE 03/25/10 | 38 | C | 10W504-09 | R 0

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TASK COMPLETED BY: | REV NO.

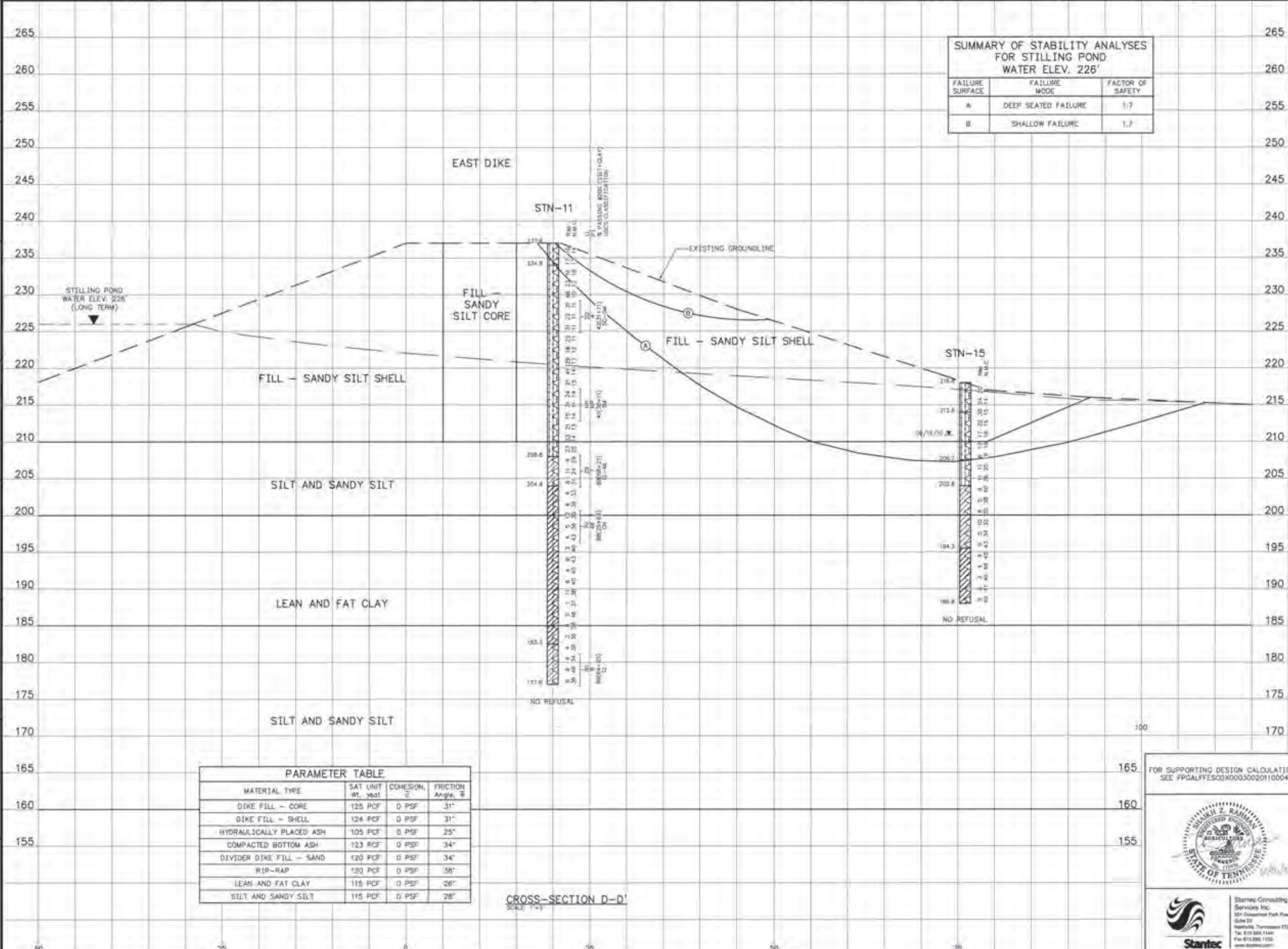
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

APPENDIX A

Document 8

Analysis Sections – East Perimeter Dike East Ash Pond



CROSS-SECTION D-D'
SCALE: 1"=5'

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'		
FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.7
B	SHALLOW FAILURE	1.7

PARAMETER TABLE			
MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, $\bar{c}$	FRICTION Angle, $\bar{\phi}$
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH — WEIGHT OF HAMMER
WR — WEIGHT OF RODS
◁ — STANDARD PENETRATION TEST INTERVAL
■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N(60) — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. — NATURAL MOISTURE CONTENT (%)
U.W.W. — UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. — UNIT WEIGHT DRY (LBS./CU.FT.)
04/21/10 ▼ — 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.)
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 BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING 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. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFES00X00030020110004

R.0 | 08/08/11 | PHW | IPS | SZR | HRA | SEB | MST | JDR
RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION D-D'

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TASK COMPLETED BY | REV NO.

PLOT FACTOR:5
W_TVA

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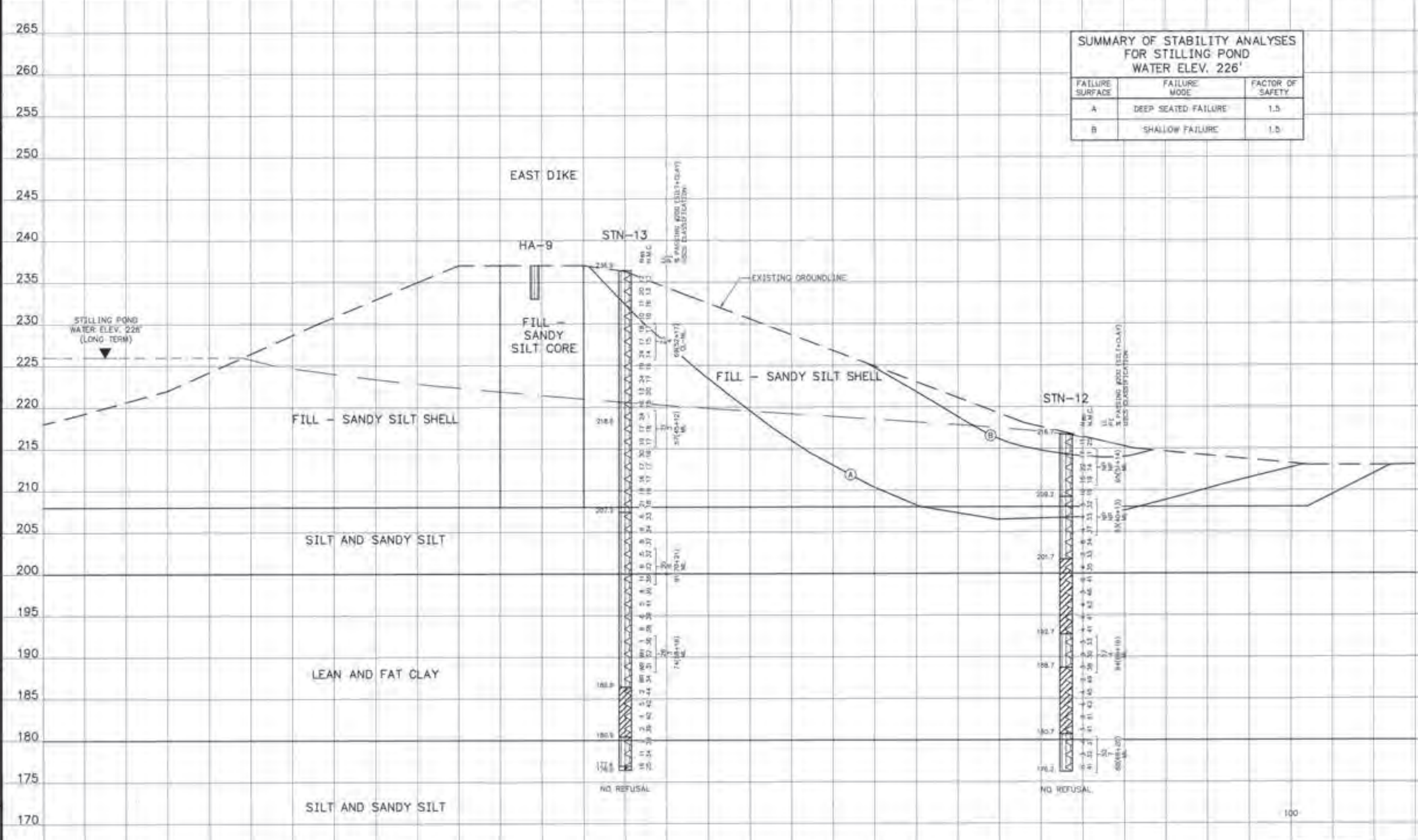

CROSS-SECTION E-E'
SCALE: 1"=5'

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'		
FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.5
B	SHALLOW FAILURE	1.5

PARAMETER TABLE			
MATERIAL TYPE	SAT UNIT Wt. γsat	COHESION, c̄	FRICTION Angle, φ̄
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH — WEIGHT OF HAMMER
WR — WEIGHT OF ROCK
◁ — STANDARD PENETRATION TEST INTERVAL
■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. — NATURAL MOISTURE CONTENT (%)
U.W.W. — UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. — UNIT WEIGHT DRY (LBS./CU.FT.)
04/23/10 ▼ — 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.)
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 BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING 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. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX000030020110004

R0 05/06/11 RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION E-E'

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

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PLOT FACTOR:5

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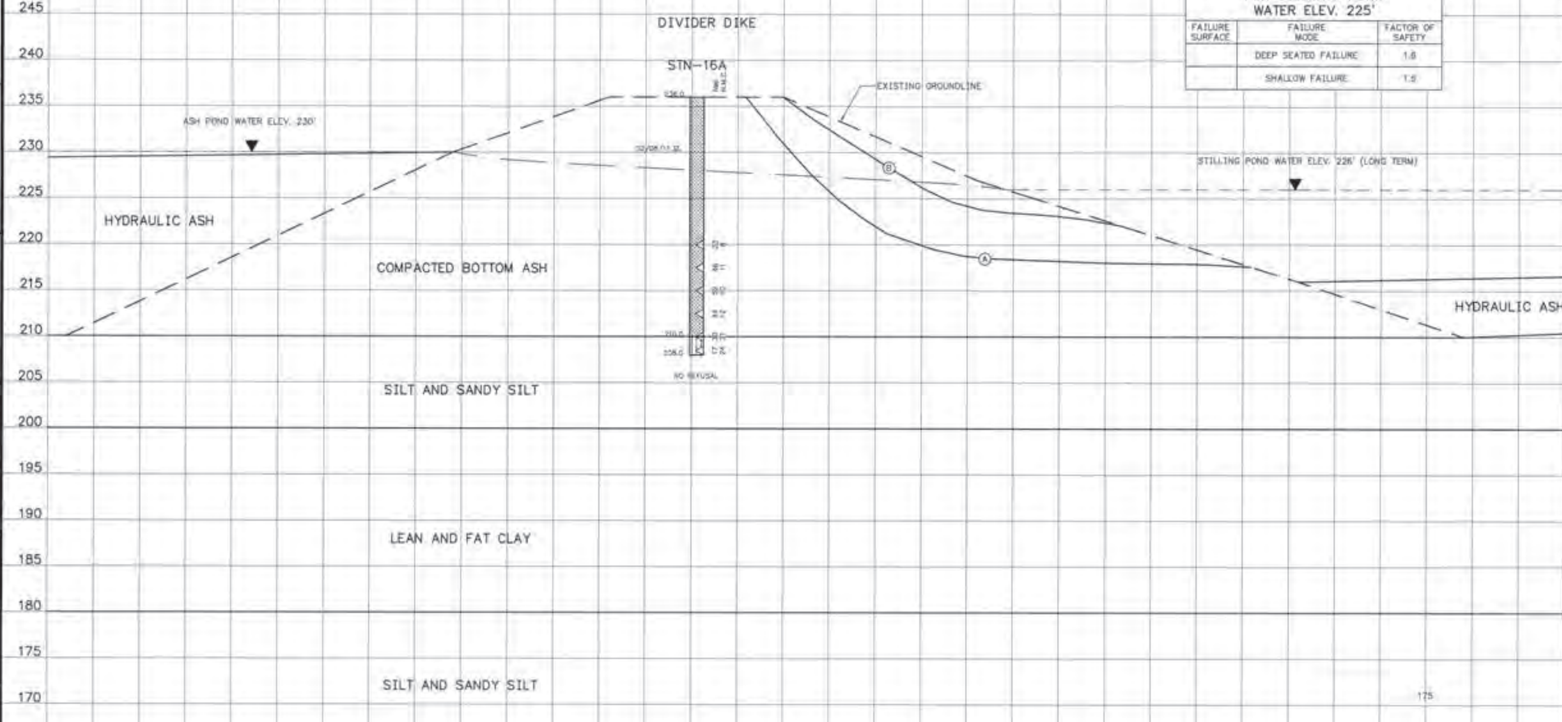
TASK COMPLETED BY: | REV NO.

38 | C | 10W506-08



CROSS-SECTION C-C'
SCALE: 1"=5'

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.7
B	SHALLOW FAILURE	1.5

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.8
	SHALLOW FAILURE	1.5

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, c̄	FRICTION Angle, φ̄
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH — WEIGHT OF HAMMER
WR — WEIGHT OF RODS
◁ — STANDARD PENETRATION TEST INTERVAL
■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
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N.M.C. — NATURAL MOISTURE CONTENT (%)
U.W.W. — UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. — UNIT WEIGHT DRY (LBS./CU.FT.)
04/23/10 ▼ — 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)
REFUSAL — AUGER REFUSAL USING A CARBIDE-TIPPED TOOTH AUGER BIT
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* — STANDARD PENETRATION TEST (SPT) TERMINATED PER ASTM D 1586-99. REFER TO TYPED BORING LOG.

NOTES:

1. THE BORING LOGS AND RELATED INFORMATION SHOWN ON THIS DRAWING 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. ANY CORRELATIONS SHOWN BETWEEN BORINGS ARE GENERALLY BASED ON STRAIGHT LINE INTERPOLATION. ACTUAL CONDITIONS BETWEEN BORINGS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R 0 | 05/06/11 | RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION C-C'

SHAIKH Z. RAHMAN — REGISTERED ENGINEER — STATE OF TENNESSEE

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-08 | R 0

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TASK COMPLETED BY: | REV NO.

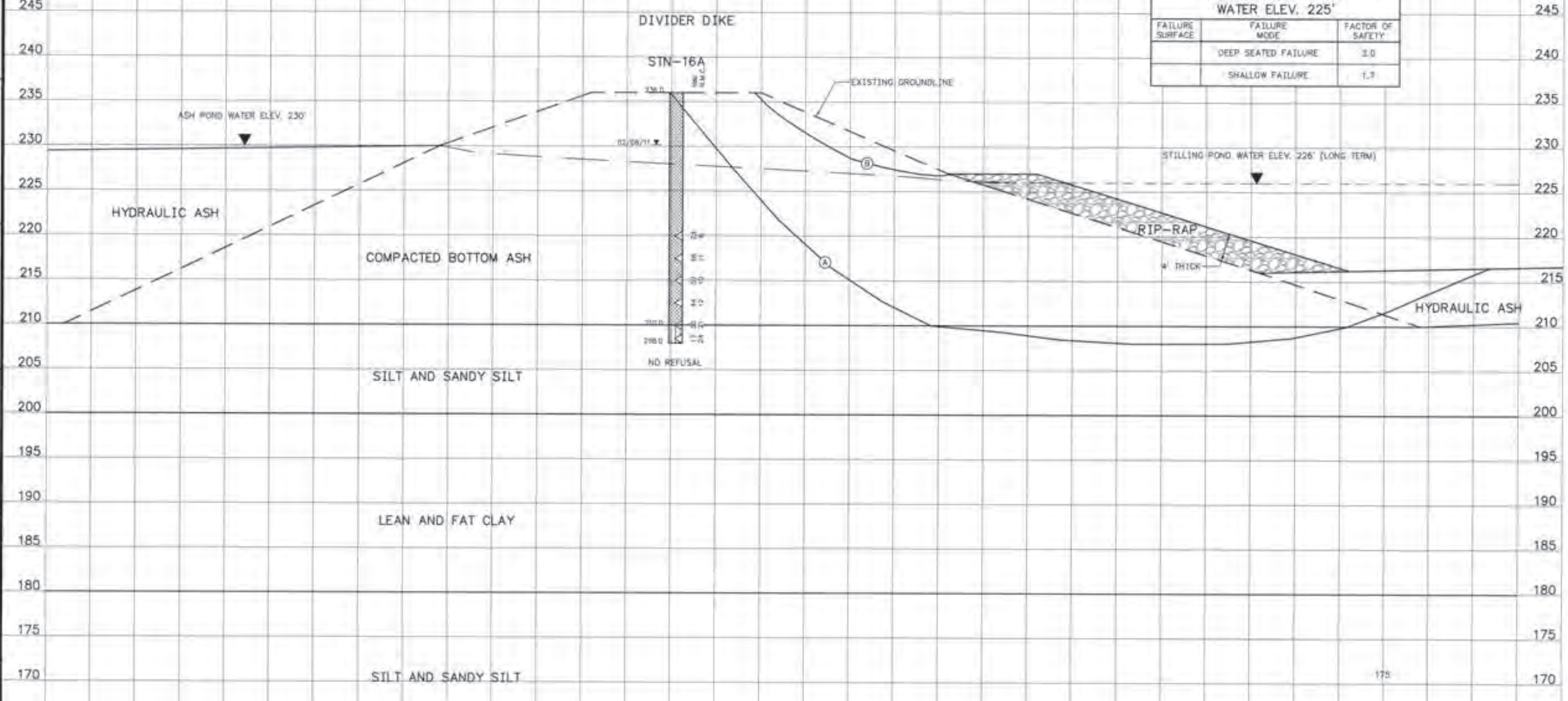
PLOT FACTOR:5
C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	2.0
B	SHALLOW FAILURE	1.7

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	2.0
	SHALLOW FAILURE	1.7



LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH — WEIGHT OF HAMMER
WR — WEIGHT OF RODS
◁ — STANDARD PENETRATION TEST INTERVAL
■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. — NATURAL MOISTURE CONTENT (%)
U.W.W. — UNIT WEIGHT WET (LBS./CU.FT.)
U.W.D. — UNIT WEIGHT DRY (LBS./CU.FT.)
04/23/10 ▼ — 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.)
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

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt. γsat	COHESION, C	FRICTION Angle, Φ
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION C-C'
SCALE: 1"=5'

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFTESCDX00030020110004

RECORD DRAWING
SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE
REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION C-C' WITH RIP-RAP

Stantec

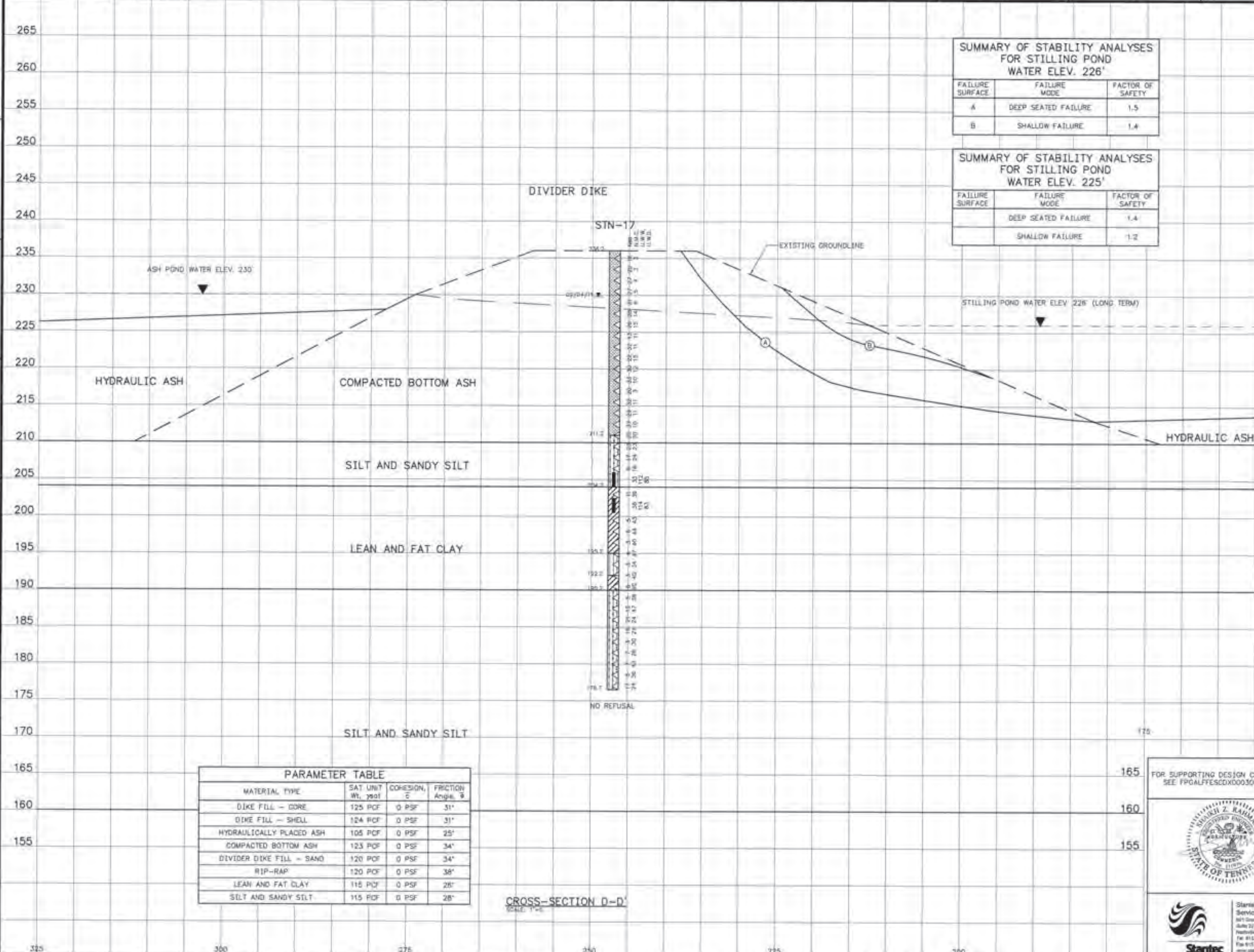
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-09 | R 0

PLOT FACTOR 5
C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC | 0
TASK COMPLETED BY | REV NO.

38 | C | 10W506-09



SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.5
B	SHALLOW FAILURE	1.4

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.4
	SHALLOW FAILURE	1.2

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, c̄	FRICTION Angle, φ̄
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	28°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION D-D'
SCALE: 1"=5'

LEGEND

- FLY ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, VERY LOOSE TO HARD
- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
- LEAN CLAY, BROWN TO GRAY, MOIST, STIFF
- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

WH — WEIGHT OF HAMMER
WR — WEIGHT OF RODS
◁ — STANDARD PENETRATION TEST INTERVAL
■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
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U.W.W. — UNIT WEIGHT WET (LBS./CU.FT.)
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110004

R 0 05/06/11 RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION D-D'

Stantec Consulting Services Inc.

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | 38 | C | 10W506-10 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:5

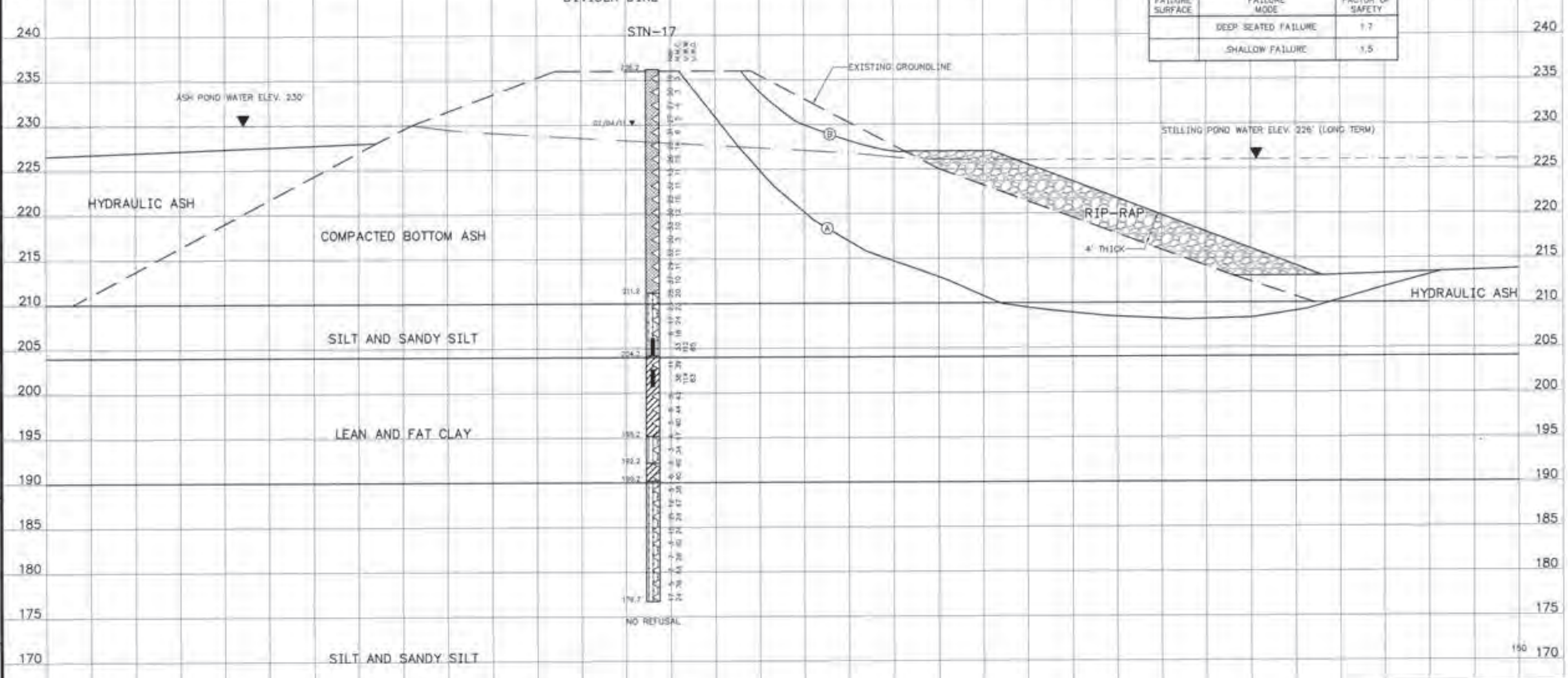
C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.7
B	SHALLOW FAILURE	1.5

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.7
	SHALLOW FAILURE	1.5



PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt, γsat	COHESION, c̄	FRICTION Angle, φ̄
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
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DIVIDER DIKE FILL – SAND	120 PCF	0 PSF	34°
RIP-RAP	120 PCF	0 PSF	38°
LEAN AND FAT CLAY	115 PCF	0 PSF	26°
SILT AND SANDY SILT	115 PCF	0 PSF	28°

CROSS-SECTION D-D'
SCALE: 1"=5'

LEGEND

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- BOTTOM ASH, GRAY TO DARK GRAY, SLIGHTLY MOIST TO SATURATED, MEDIUM DENSE TO VERY DENSE
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- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
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WH — WEIGHT OF HAMMER
WR — WEIGHT OF RODS
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■ — UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPOALFFESCDX00030020110004

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION D-D' WITH RIP-RAP

Stantec Consulting Services Inc.

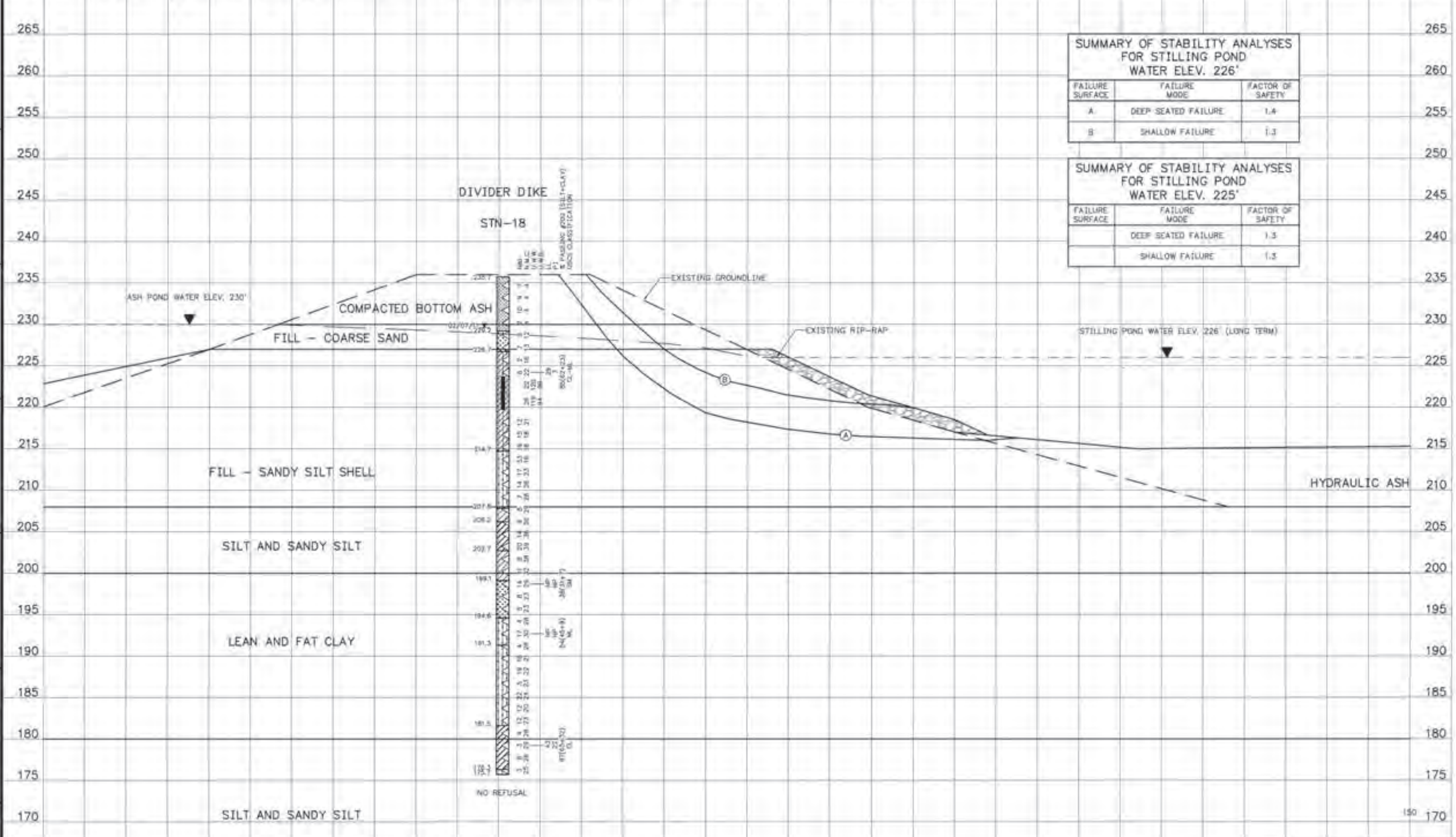
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R. 2000 | 38 | C | 10W506-11 | R 0

STANTEC | 0
TASK COMPLETED BY | REV NO.

PLOT FACTOR:5
R_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.4
B	SHALLOW FAILURE	1.3

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.3
	SHALLOW FAILURE	1.3

PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt. γsat	COHESION, C	FRICTION Angle, Φ
DIKE FILL - CORE	125 PCF	0 PSF	31°
DIKE FILL - SHELL	124 PCF	0 PSF	31°
HYDRAULICALLY PLACED ASH	105 PCF	0 PSF	25°
COMPACTED BOTTOM ASH	123 PCF	0 PSF	34°
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LEAN AND FAT CLAY	115 PCF	0 PSF	26°
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LEGEND

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- FAT CLAY, GRAY, SLIGHTLY MOIST TO SATURATED, SOFT TO VERY STIFF
- SILTY CLAY, GRAY TO GRAY BROWN, MOIST TO VERY MOIST, SOFT TO VERY STIFF
- SAND, GRAY TO BROWN, MOIST, LOOSE TO MEDIUM DENSE
- SANDY SILT TO SILTY SAND, GRAY TO BROWN, MOIST TO SATURATED, SOFT TO VERY STIFF
- SANDY CLAY, GRAY, MOIST, STIFF

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WR — WEIGHT OF RODS
STANDARD PENETRATION TEST INTERVAL
UNDISTURBED THIN-WALLED (SHELBY) TUBE SAMPLE
N60 — STANDARD PENETRATION TEST BLOW COUNT WITH A 140 LB AUTOMATIC HAMMER (BLOWS/FT.)
N.M.C. — NATURAL MOISTURE CONTENT (%)
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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX0003002011000

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE

REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION E-E'

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec

38 C 10W506-12 R 0

PLOT FACTOR:5

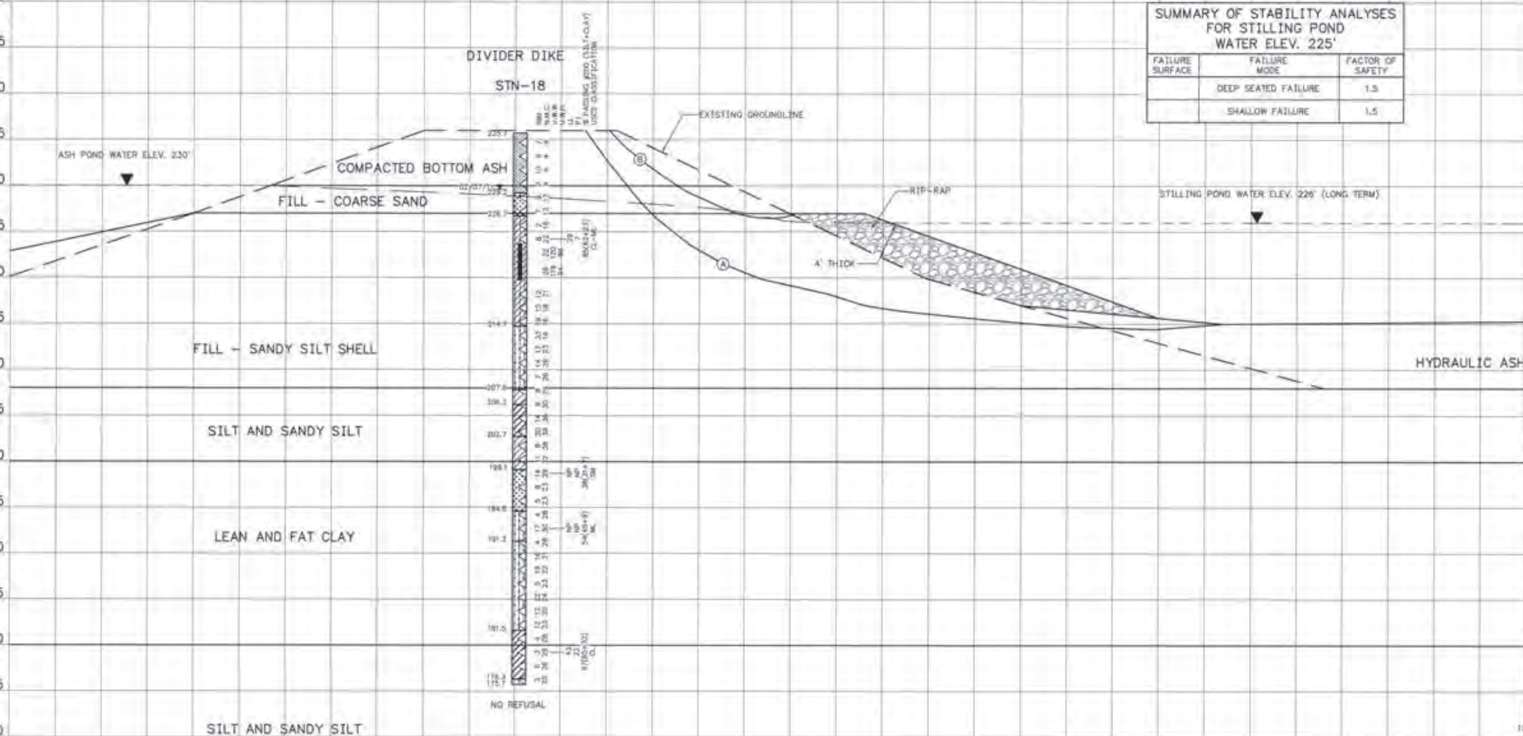
C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 226'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
A	DEEP SEATED FAILURE	1.8
B	SHALLOW FAILURE	1.5

SUMMARY OF STABILITY ANALYSES FOR STILLING POND WATER ELEV. 225'

FAILURE SURFACE	FAILURE MODE	FACTOR OF SAFETY
	DEEP SEATED FAILURE	1.5
	SHALLOW FAILURE	1.5



PARAMETER TABLE

MATERIAL TYPE	SAT UNIT Wt. γsat	COHESION, c	FRICTION Angle, Φ
DIKE FILL – CORE	125 PCF	0 PSF	31°
DIKE FILL – SHELL	124 PCF	0 PSF	31°
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CROSS-SECTION E-E'
SCALE: 1"=5'

LEGEND

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RECORD DRAWING

FOR SUPPORTING DESIGN CALCULATIONS SEE FPOALFFESCDX000300201100004

SCALE: 1"=5' EXCEPT AS NOTED

YARD
EAST DIKE
REMEDIAL MEASURES
EAST STILLING POND
CROSS-SECTION E-E' WITH RIP-RAP

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec Consulting Services Inc.

AUTOCAD R 2000 | 38 | C | 10W506-13

PLOT FACTOR:5

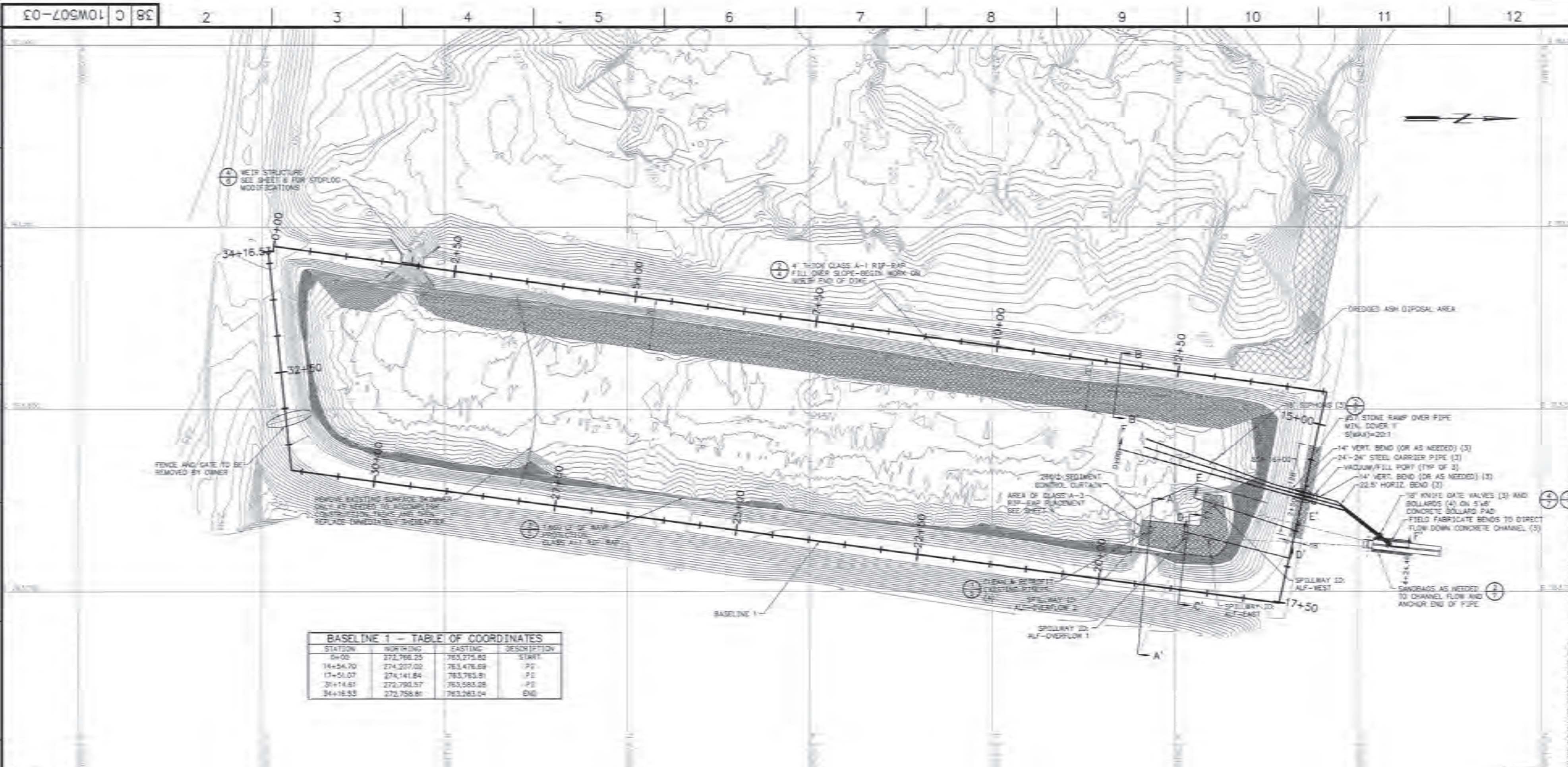
C.A.D. DRAWING DO NOT ALTER MANUALLY

APPENDIX A

Document 9

Remedial Improvement Plans East Stilling Pond – Selected Dwgs

38 | C | 10W507-03



BASELINE 1 – TABLE OF COORDINATES			
STATION	NORTHING	EASTING	DESCRIPTION
0+00	272,766.25	763,275.82	START
14+54.70	274,207.02	763,476.69	PI
17+51.07	274,141.84	763,765.81	PI
31+14.61	272,790.57	763,583.28	PI
34+16.53	272,758.81	763,263.04	END

PLAN VIEW
SCALE: 1"=50'

GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'

SURVEY CONTROL NOTE:

A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8476 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

NOTES:

1. THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES INCLUDING A HYDROGRAPHIC SURVEY DRAWING FILE (AL0009T – APRIL 2011). HORIZONTAL COORDINATES ARE REFERENCED TO TENNESSEE STATE PLANE COORDINATE SYSTEM, NAD 27. ELEVATIONS ARE BASED ON NGVD 29.

SECTION OF DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

ISSUED FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110005

ISSUED FOR CONSTRUCTION

SCALE: 1"=50' EXCEPT AS NOTED

YARD
EAST STILLING POND – EASTERN PERIMETER DIKE

REMEDIAL IMPROVEMENTS
PLAN
WORK PLAN 6 (ALF-110510-WP-06)

Stantec Consulting Services Inc.

Stantec

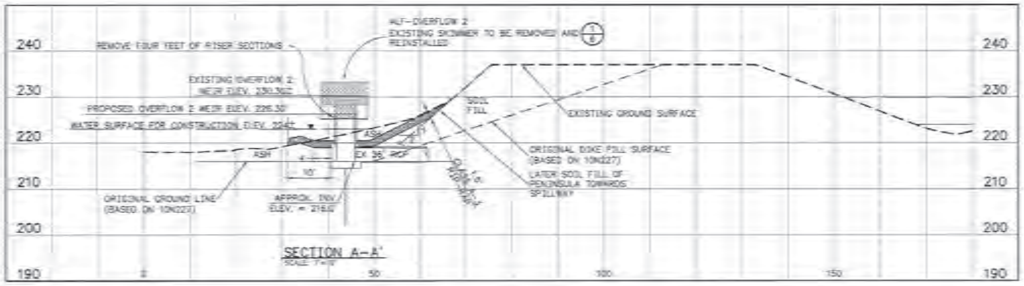
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

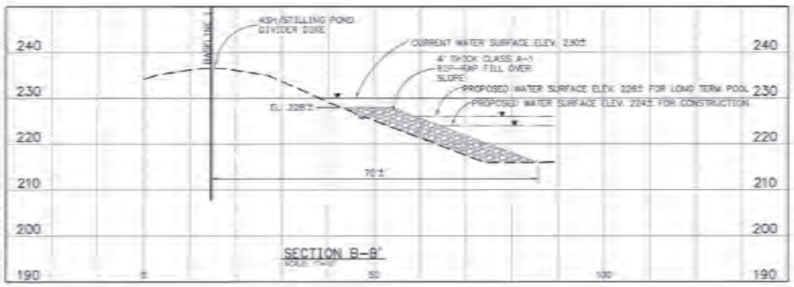
AUTOCAD R. 2000 | 38 | C | 10W507-03

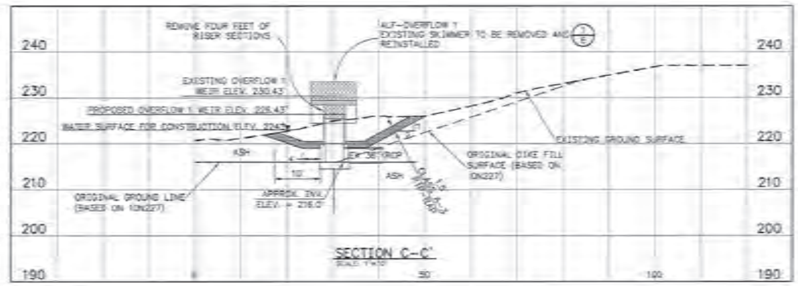
STANTEC | 0
TASK COMPLETED BY | REV NO.

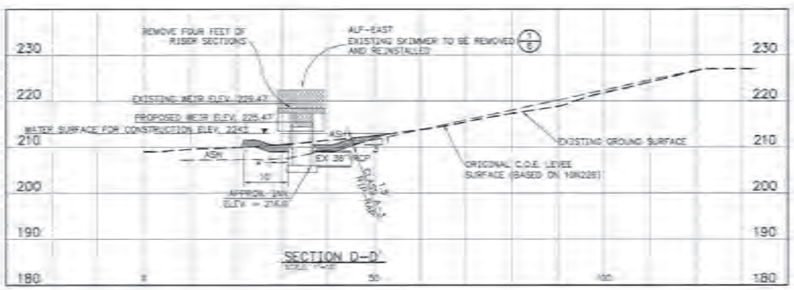
PLOT FACTOR:50

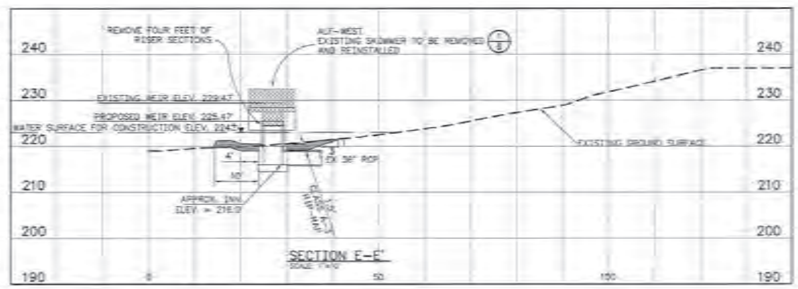
C.A.D. DRAWING
DO NOT ALTER MANUALLY











DREDGING AND STONE PLACEMENT (TYP OF 4):

1. DREDGE ASH TO AN ELEVATION OF 219.0 FEET (1' BELOW TOP OF LOWER SQUARE RISER SECTION) EXTENDING LATERALLY 4' OUT FROM RISER. DREDGING SHALL BE CONDUCTED WITH EXTREME CAUTION WITH USE OF DIVER CONTROLLED SUCTION EQUIPMENT.
2. SLOPE DREDGED ASH SURFACE AT 3:1 OR 2:1 TO DAYLIGHT AS INDICATED IN DRAWING.
3. PLACE 18" OF TDOT CLASS A-3 RIP-RAP OVER CUT ASH SURFACE FROM RISER TO AT LEAST 10' FROM RISER.
4. CONTRACTOR SHALL NOTE THE PRESENCE OF 36" OUTLET PIPE AT BASE OF THE RISER AND SHALL TAKE CARE NOT TO DAMAGE SAME WHEN DREDGING OR PLACING RIP-RAP.

DIVIDER DIKE RIP-RAP PLACEMENT

1. CONTRACTOR SHALL PLACE RIP-RAP ON THE DIVIDER DIKE SLOPE FROM NORTH TO SOUTH AND FROM THE BOTTOM OF THE SLOPE UPWARDS.
2. CONTRACTOR SHALL VERIFY THE THICKNESS AND WIDTH OF THE RIP-RAP PLACEMENT BY A PREFILL SURVEY AND DAILY SURVEY OF PLACED MATERIAL AS WORK PROCEEDS.
3. RIP-RAP SHALL NOT BE STOCKPILED ON THE DIVIDER DIKE EXCEPT IN AREAS ABOVE WHICH THE RIP-RAP FILL HAS BEEN COMPLETED.

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

ISSUED FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPSALFFESCDX000300201I0005

SCALE: 1"=10' EXCEPT AS NOTED

YARD
EAST STILLING POND - EASTERN PERIMETER DIKE
REMEDIAL IMPROVEMENTS
SECTIONS
WORK PLAN 6 (ALF-110510-WP-06)

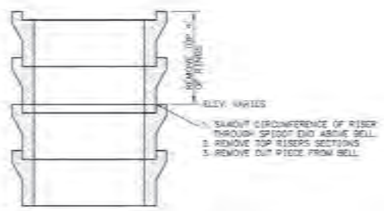
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec

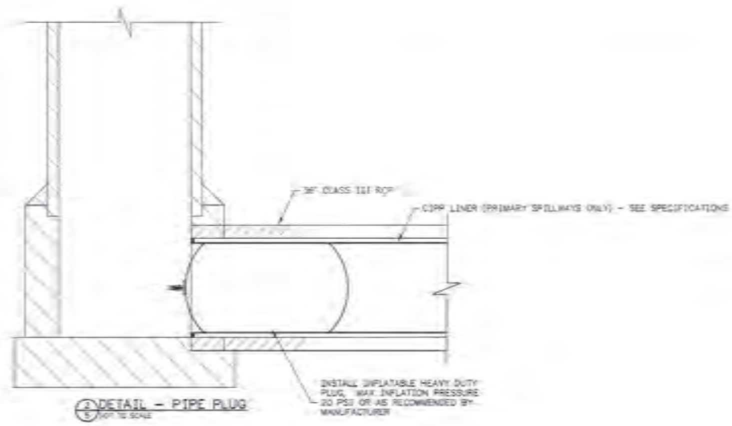
38 C 10W507-04

WEIR ELEVATIONS:

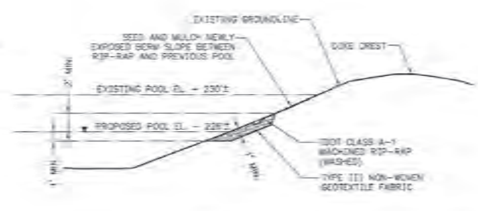
SPILLWAY ID	EXISTING ELEV. (FT)	PROPOSED ELEV. (FT)
ALF-EAST	229.47	225.47
ALF-WEST	229.47	225.47
ALF-OVERFLOW 1	230.45	225.45
ALF-OVERFLOW 2	230.30	226.30



1/5 DETAIL – EXISTING RISER RETROFITS
NOT TO SCALE



2/5 DETAIL – PIPE PLUG
NOT TO SCALE



3/5 DETAIL – WAVE WASH RIP-RAP PROTECTION
NOT TO SCALE

SPILLWAY RETROFIT SEQUENCING:

1. TO BEGIN AFTER STILLING POND WATER SURFACE HAS BEEN LOWERED TO EL. 224±.
2. REMOVE EXISTING SKIMMER, INSPECT CONDITION, COMPLETE RECOMMENDED REPAIRS, AND PRESERVE FOR REINSTALLATION
3. CONFORM STRUCTURAL ADEQUACY OF RISERS WITH THE ENGINEER
4. CLEAN EACH SPILLWAY OUTLET PIPE AND RISER.
5. CCTV OUTLET PIPES. INSTALL CIPP LINER IN PRIMARY SPILLWAY OUTLET PIPES PER RECOMMENDATIONS BY ENGINEER
6. INSTALL PIPE PLUG
7. LINE RISER SEGMENTS TO REMAIN WITH SPECTRASHIELD IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
8. REMOVE EXISTING SPILLWAY WEIR, INSPECT CONDITION, COMPLETE RECOMMENDED REPAIRS, AND PRESERVE FOR REINSTALLATION
9. SAWCUT THE EXISTING RISERS TO ALLOW FOR REMOVAL OF RISER SECTIONS
10. REMOVE FOUR FEET OF RISER FROM EACH SPILLWAY
11. DREDGE ASH NEAR RISERS
12. PLACE RIP-RAP AROUND SPILLWAYS
13. REINSTALL SPILLWAY WEIR
14. REMOVE PIPE PLUG
15. REINSTALL SKIMMER STRUCTURE

INFLATABLE PLUG NOTES:

1. CONTRACTOR SHALL PROVIDE PRESSURE GUAGES AND PRESSURE RELIEF VALVES TO PREVENT INTERIOR PLUG PRESSURES FROM EXCEEDING THE MAXIMUM ALLOWABLE INFLATION PRESSURE

RIP-RAP WAVE PROTECTION NOTES:

1. REMOVE VEGETATION AND LOOSE SOIL FROM SLOPE AREAS TO BE PROTECTED.
2. UNDERCUT TO MINIMUM OF 1.0' BELOW EXISTING GROUND SURFACE. DISPOSE AT ON SITE LOCATION AS APPROVED BY OWNER
3. PLACE NONWOVEN GEOTEXTILE OVER AREA TO BE PROTECTED.
4. RIP-RAP TO EXTEND FROM MINIMUM OF 2.0' ABOVE NORMAL POOL ELEVATION TO 1.0' BELOW NORMAL POOL ELEVATION.
5. PLACE RIP-RAP OVER GEOTEXTILE WITH EXCAVATOR IN LAYERS STARTING FROM BOTTOM.
6. PLACE RIP-RAP THICKNESS TO CONFORM TO ORIGINAL GROUND LINE.

SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

ISSUED FOR CONSTRUCTION

FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX0003002010005

Stantec Consulting Services Inc.

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
EAST STILLING POND – EASTERN DIVIDER DIKE
REMEDIAL IMPROVEMENTS
DETAILS
WORK PLAN 5 (ALF-110510-WP-06)

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

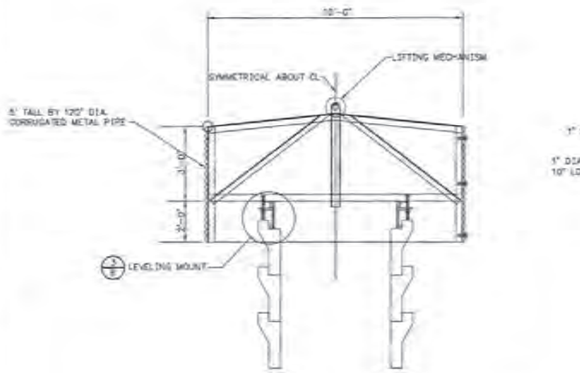
AUTOCAD R 2000 | 38 | C | 10W507-05 | R 0

STANTEC | 0
TASK COMPLETED BY | REV NO.

PLOT FACTOR:1

C.A.D. DRAWING DO NOT ALTER MANUALLY

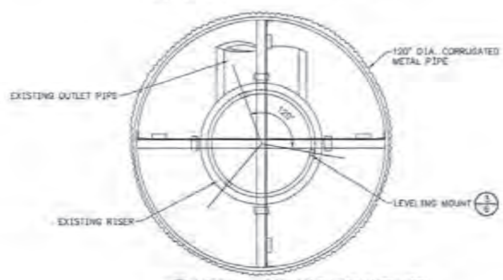
38 | C | 10W507-06



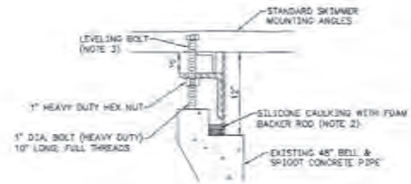
DETAIL - EXISTING SKIMMER
NOT TO SCALE

NOTES:

1. SKIMMER SHALL BE CAREFULLY REMOVED BY CONTRACTOR, PRESSURE WASHED AND STORED FOR REINSTALLATION UPON COMPLETION OF RISER MODIFICATIONS.
2. CONTRACTOR SHALL USE CLEAN WATER ONLY FOR SKIMMER WASHING AND DISCHARGE WATER TO STILLING POND.
3. DETAILS SHOWN ON THESE PLANS ARE FOR CONTRACTOR GENERAL REFERENCE ONLY AND WERE OBTAINED FROM TVA STANDARD DRAWINGS 10N214, 10N229-1, AND 10N229-2.
4. SKIMMERS SHALL BE INSPECTED BY ENGINEER. RECOMMENDED REPAIRS WILL BE COMPLETED PRIOR TO REINSTALLATION.



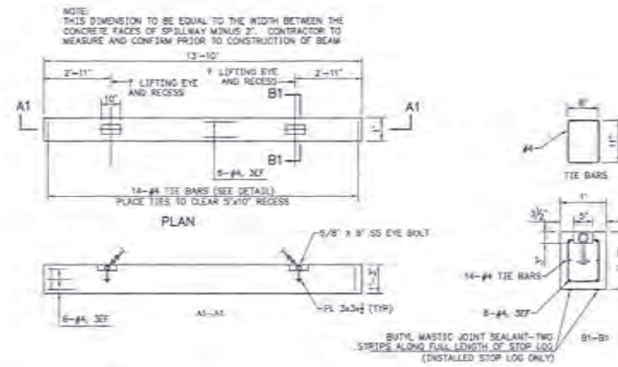
DETAIL - TOP VIEW OF SKIMMER
NOT TO SCALE



DETAIL - LEVELING MOUNT
NOT TO SCALE

NOTES:

1. FOR SKIMMER AND SPILLWAY DETAILS, REFER TO TVA DRAWING 10N229-2.
2. CAULKING SHALL EXTEND COMPLETELY AROUND THE WEIR AND FORM A WATER TIGHT SEAL.
3. WHEN THE WEIR IS REINSTALLED, THE TOP SHALL BE LEVELED WITH THE USE OF LEVELING BOLTS.



DETAIL - PRE-CAST STOP LOG
SCALE: 1"=1' - 2 REQUIRED

NOTES:

1. CONTRACTOR TO FABRICATE PRE-CAST CONCRETE STOP LOGS AS DETAILED
2. ONE NEW STOP LOG TO BE INSTALLED IN SOUTH SPILLWAY CHANNEL. SECOND STOP LOG TO BE STORED ON SITE AS PER OWNER DIRECTION.
3. TOP OF EXISTING STOP LOG IN SOUTH CHANNEL - 228.05' (PER SURVEY DATA PROVIDED BY TRANSASH 5-8-11)
4. HEIGHT OF NEW STOP LOG - 1.25'
5. TOP OF NEW STOP LOG ELEVATION - 229.30'

ISSUED FOR CONSTRUCTION

SECTION OR DETAIL NO.
SHEET WHERE SHOWN

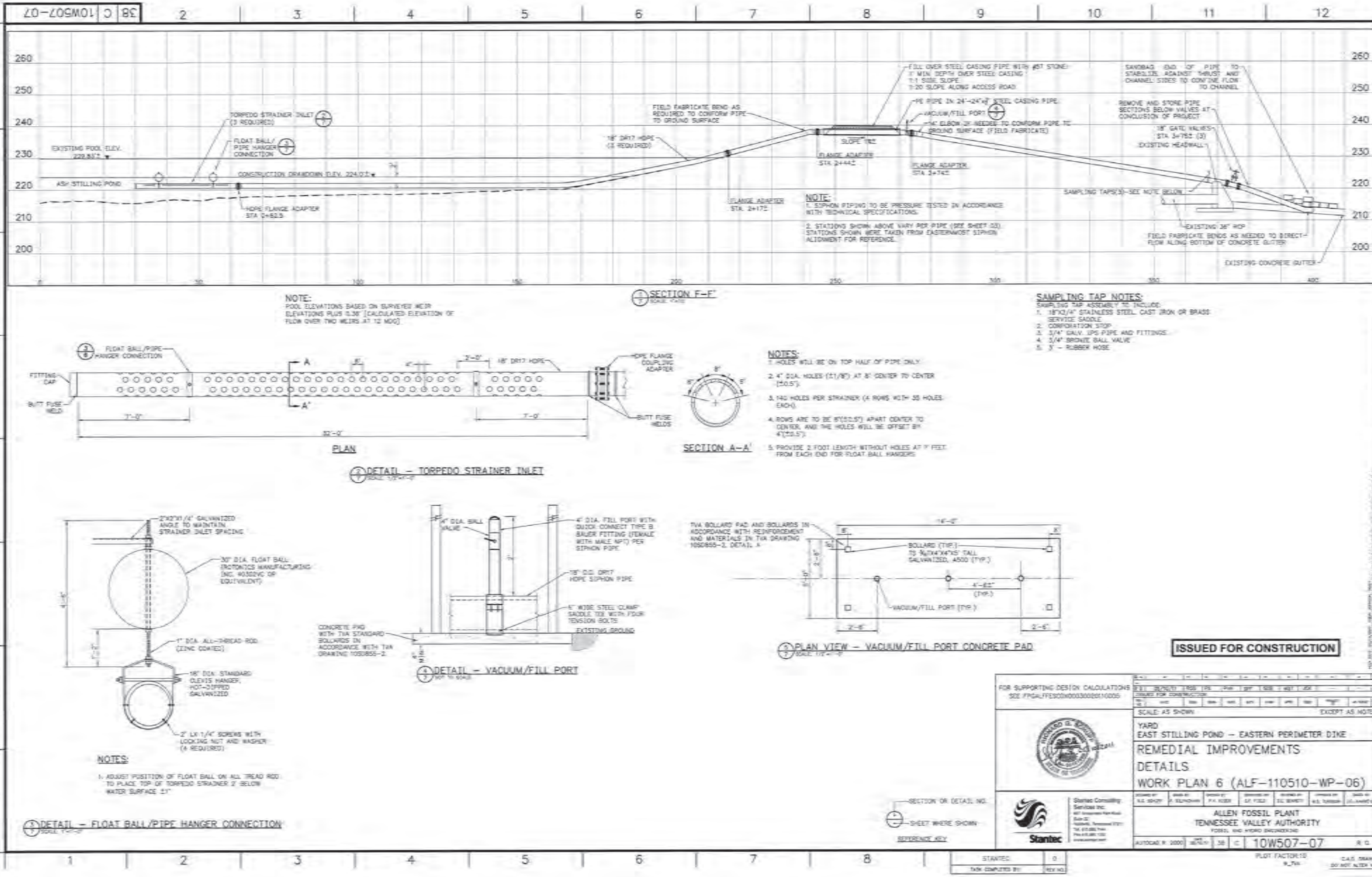
FOR SUPPORTING DESIGN CALCULATIONS SEE FPOALFFESCDX00030020110005

ISSUED FOR CONSTRUCTION

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
EAST STILLING POND - EASTERN PERIMETER DIKE
REMEDIAL IMPROVEMENTS
DETAILS
WORK PLAN 6 (ALF-110510-WP-06)

ALLEN FOSSIL PLANT



SECTION F-F'
NOTE:
POOL ELEVATIONS BASED ON SURVEYED WEIR ELEVATIONS PLUS 0.36' (CALCULATED ELEVATION OF FLOW OVER TWO WEIRS AT 12 MDG)
EXISTING POOL ELEV. 229.83'±
ASH STILLING POND
TORPEDO STRAINER INLET (3 REQUIRED)
FLOAT BALL/ PIPE HANGER CONNECTION
CONSTRUCTION DRAWDOWN ELEV. 224.0'±
HDPE FLANGE ADAPTER STA 0+62.5
18" DR17 HDPE (3 REQUIRED)
FIELD FABRICATE BEND AS REQUIRED TO CONFORM PIPE TO GROUND SURFACE
FLANGE ADAPTER STA. 2+17±
FLANGE ADAPTER STA. 2+44±
SLOPE TBD
FLANGE ADAPTER STA. 3+74±
NOTE:
1. SIPHON PIPING TO BE PRESSURE TESTED IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS.
2. STATIONS SHOWN ABOVE VARY PER PIPE (SEE SHEET 03). STATIONS SHOWN WERE TAKEN FROM EASTERNMOST SIPHON ALIGNMENT FOR REFERENCE.
FILL OVER STEEL CASING PIPE WITH #57 STONE: 1' MIN. DEPTH OVER STEEL CASING 1:1 SIDE SLOPE 1:20 SLOPE ALONG ACCESS ROAD
PE PIPE IN 24"-24" STEEL CASING PIPE
VACUUM/FILL PORT
14" ELBOW IF NEEDED TO CONFORM PIPE TO GROUND SURFACE (FIELD FABRICATE)
SANDBAG END OF PIPE TO STABILIZE AGAINST THRUST AND CHANNEL SIDES TO CONFINE FLOW TO CHANNEL
REMOVE AND STORE PIPE SECTIONS BELOW VALVES AT CONCLUSION OF PROJECT
18" GATE VALVES STA. 3+75± (3)
EXISTING HEADWALL
SAMPLING TAPS(3)-SEE NOTE BELOW
EXISTING 36" RCP
FIELD FABRICATE BENDS AS NEEDED TO DIRECT FLOW ALONG BOTTOM OF CONCRETE GUTTER
EXISTING CONCRETE GUTTER
SAMPLING TAP NOTES:
SAMPLING TAP ASSEMBLY TO INCLUDE:
1. 18"X3/4" STAINLESS STEEL, CAST IRON OR BRASS SERVICE SADDLE
2. CORPORATION STOP
3. 3/4" GALV. IPS PIPE AND FITTINGS
4. 3/4" BRONZE BALL VALVE
5. 3' - RUBBER HOSE
FLOAT BALL/PIPE HANGER CONNECTION
FITTING CAP
BUTT FUSE WELD
18" DR17 HDPE
HDPE FLANGE COUPLING ADAPTER
BUTT FUSE WELDS
PLAN
DETAIL - TORPEDO STRAINER INLET
SECTION A-A'
NOTES:
1. HOLES WILL BE ON TOP HALF OF PIPE ONLY.
2. 4" DIA. HOLES (±1/8") AT 8" CENTER TO CENTER (±0.5").
3. 140 HOLES PER STRAINER (4 ROWS WITH 35 HOLES EACH).
4. ROWS ARE TO BE 8"(±0.5") APART CENTER TO CENTER, AND THE HOLES WILL BE OFFSET BY 4"(±0.5").
5. PROVIDE 2 FOOT LENGTH WITHOUT HOLES AT 7' FEET FROM EACH END FOR FLOAT BALL HANGERS.
2"X2"X1/4" GALVANIZED ANGLE TO MAINTAIN STRAINER INLET SPACING
30" DIA. FLOAT BALL (ROTONICS MANUFACTURING INC. #0300VC OR EQUIVALENT)
1" DIA. ALL-THREAD ROD (ZINC COATED)
18" DIA. STANDARD CLEVIS HANGER, HOT-DIPPED GALVANIZED
2" LX 1/4" SCREWS WITH LOCKING NUT AND WASHER (4 REQUIRED)
NOTES:
1. ADJUST POSITION OF FLOAT BALL ON ALL THREAD ROD TO PLACE TOP OF TORPEDO STRAINER 2' BELOW WATER SURFACE ±1"
DETAIL - FLOAT BALL/PIPE HANGER CONNECTION
4" DIA. BALL VALVE
4" DIA. FILL PORT WITH QUICK CONNECT TYPE B BAUER FITTING (FEMALE WITH MALE NPT) PER SIPHON PIPE
18" O.D. DR17 HDPE SIPHON PIPE
6" WIDE STEEL CLAMP SADDLE TEE WITH FOUR TENSION BOLTS
EXISTING GROUND
CONCRETE PAD WITH TVA STANDARD BOLLARDS IN ACCORDANCE WITH TVA DRAWING 10SD855-2
DETAIL - VACUUM/FILL PORT
TVA BOLLARD PAD AND BOLLARDS IN ACCORDANCE WITH REINFORCEMENT AND MATERIALS IN TVA DRAWING 10SD855-2, DETAIL 4
BOLLARD (TYP.)
VACUUM/FILL PORT (TYP.)
PLAN VIEW - VACUUM/FILL PORT CONCRETE PAD
ISSUED FOR CONSTRUCTION
FOR SUPPORTING DESIGN CALCULATIONS SEE FPGALFFESCDX00030020110005
SCALE: AS SHOWN EXCEPT AS NOTED
YARD
EAST STILLING POND - EASTERN PERIMETER DIKE
REMEDIAL IMPROVEMENTS
DETAILS
WORK PLAN 6 (ALF-110510-WP-06)
ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING
10W507-07
Stantec
SECTION OR DETAIL NO.
SHEET WHERE SHOWN
REFERENCE KEY

APPENDIX A

Document 10

Stantec Phase 1 Report

TVA Disposal Facility Assessment
Phase 1 Plant Summary
Allen Fossil Plant (ALF)

Location: Allen Fossil Plant (ALF)
2574 Plant Road
Memphis, Shelby County, TN 38109

Latitude: 35.074 N **Longitude:** 90.149 W

Plant Contact: Frank Dominioni
System Engineer – Fossil Power Group
Phone: (901) 789-8400 **Email:** FEDominioni@TVA.gov

Facts and Figures: The Allen Fossil Plant has three coal-fired generating units and 20 combustion turbines. The plant construction began in 1956 and was completed in 1959. The plant consumes approximately 7,200 tons of coal per day and generates approximately 4.9-billion kilowatt-hours of electricity annually. The winter net dependable generating capacity is about 753 megawatts. It is located about 10 miles southwest of downtown Memphis, Tennessee just south of Lake McKellar which is directly connected to the Mississippi River.

Coal Combustion Byproduct Disposal: Approximately 85,000 dry tons of fly ash is wet-sluiced to the East Ash Pond every year. The fly ash is then dredged, dewatered and transported to an off-site structural fill project. Approximately 110,000 dry tons of boiler slag is wet-sluiced to the East Ash Pond every year. Approximately 90% of the boiler slag is reclaimed and marketed to outside companies.

Geology and Seismicity:

The Allen Fossil Plant is located in the extreme southwestern corner of Tennessee just west of the city of Memphis. The plant is situated on the south shore of Lake McKellar and the eastern bank of the Mississippi River. Geologic mapping shows the site to be underlain by artificial fills and Quaternary age alluvial deposits. The fill is noted to generally consist of alluvium dredged from the flood plain (or loess in select locations) and range in thickness from a few feet beneath residential areas to tens of feet beneath industrial areas in the floodplain of the river. The alluvial materials are described as consisting of irregular lenses of fine sand, silt, and clay in the upper part, and of coarse sands, gravelly sands, and sandy gravels in the lower part. The alluvium varies from about 45 to 90 feet in thickness adjacent to the loess bluffs along the eastern edge of the quadrangle to as much as 175 feet well out in the flood plain. The mapping indicates the alluvium is underlain by the series of highly consolidated clays and dense sands comprising the Claiborne Group.

Evaluations of seismic hazards affecting western Tennessee, and thus the plant site, are dominated by events emanating from the New Madrid Seismic Zone (NMSZ) of the central Mississippi Valley. The NMSZ is the most active seismic zone east of the Rocky Mountains and the continuing seismicity of the zone is thought to be associated with the reactivation of faults within the Reelfoot Rift System. Although the majority of the events emanating from this zone are too small to be felt at the surface, this zone produced a series of four earthquakes between December 1811 and early February 1812 each exhibiting estimated magnitudes on the order of 7.0 to 8.0. The "Geologic Hazards Map of Tennessee – Environmental Geology Series No. 5" developed and published by the Tennessee Department of Environment and Conservation (TDEC), Division of Geology and compiled by Robert Miller (1978) shows the plant to be located in Seismic Risk Zone 3.

Facilities Reviewed:

East Ash Pond and Dredge Cell
East Ash Stilling Pond
West Ash Pond

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Allen Fossil Plant (ALF)
East Ash Pond and Dredge Cell (EAP and EDC)

1. General Facility Information

Facility Status:	Active	**NID Identification:**	TN15801
Surface Area (inside dikes)	70 Acres	**Maximum Height (toe to top of dike):**	20 feet
Free Water Volume:	Unknown	**Maximum Water Storage:**	140 Acre-feet
Estimated CCB Storage:	Varies	**Dike Length:**	1000 feet
Plant Discharge to Facility:	9.8 MGD	**Current Pool Elevation:**	231 feet

2. Site Visit Information

Stantec Assessment Team:	Rob Kirkbride, PE
TVA Staff Present:	Frank Dominioni
Field Assessment Dates:	February 17, 2009
Weather/Site Conditions:	40 degrees F, cloudy, drizzle, moist ground

3. History/Description of Usage

History and Operation: This facility was originally commissioned in 1967 and expanded in 1978. Approximately 85,000 dry tons of fly ash is wet sluiced to the East Ash Pond annually. The fly ash is dredged, dewatered and transported to an off-site structural fill project. Approximately 110,000 dry tons of boiler slag is wet sluiced to the pond annually. Approximately 90% of the boiler slag is reclaimed and marketed to outside companies. Decant water is transferred into the Ash Stilling Pond through the concrete spillway structure in the southeast corner of the pond.

Past Failures/Releases: No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan: No EAP has been prepared for this facility.

Operations Manual: TVA maintains a By Products Operation Manual for the Allen Fossil Plant.

TVA Maintenance: Exterior slopes are mowed as necessary to keep vegetation minimized.

TVA Inspections: TVA Engineering performs dike inspections and prepares reports annually. Plant personnel make observations throughout the year on a random basis.

Problems Previously Identified During Past TVA Inspections: Some erosion problems at the discharge end of the primary spillway structures that discharge into McKellar Lake.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings: 10N226 R2, 10W208-1 R0,10W208-2 R0, 10W208-3 R0, 10W214-3 R0, 10W225 R6, 10W234-1 R0,10W234-2 R0.

TVA As-Built Drawings: No drawings identified as As-Built.

TVA Construction Testing Records: None available.

TVA Annual Inspection Reports: TVA annual inspection reports from 1967 to 2008.

Geotechnical Data: Limited data includes lab results, but difficult to tell specific locations of soil boring. (File: ALF MEMO TO GLBUCHANAN FROM GENE FARMER ON ALF ASH DISPOSAL AREA DIKES - SOIL INVESTIGATION.pdf)

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Interior Slopes

Vegetation: North - Dense phragmites.
East - Dense phragmites.
West - Dense phragmites.
South - Dense phragmites; Portion where dredging operations have removed all vegetation.

Trees: None observed.

Wave Wash Protection: None observed.

Erosion: Difficult to observe. Numerous minor erosion channels.

Instabilities: Difficult to observe.

Animal Burrows: Difficult to observe.

Freeboard: **Measured:** 6 feet
Design: Unknown

Encroachments: East dredge cell in west portion.

Slope: **Measured:** 2H:1V to 3H:1V
Design: 2H:1V to 3H:1V

6.2. Crest

Crest Cover and Slope: North - Gravel. Relatively level.
South - Paved road and grass covered. Relatively level.
East (divider dike) - Boiler slag with some vegetation. Relatively level.
West - Boiler slag with some vegetation. Relatively level.

Erosion: Minor erosion observed.

Alignment: Appears uniform.

Settlement/Cracking: Very little. Some minor (less than 2 inch) low spots.

Bare Spots/Rutting:	North - Some minor rutting in gravel. South - Paved road and grass covered with some rutting. East (divider dike) - Mostly bare with rutting. West - Mostly bare.	
Width:	**Measured:**	North - 30 to 40 feet South - 100 feet + East (divider dike) - 22 to 25 feet West - 50 feet +
	Design:	North - Unknown (USCOE Levee) South - Unknown (USCOE Levee) East (divider dike) - 16 feet West - Unknown

6.3. Exterior Slopes

Vegetation:	North - Good grass cover South - Good grass cover East (divider dike) - Mostly phragmites West - Mostly phragmites
Trees:	North - Trees at the toe South - None East (divider dike) - None West - None
Erosion:	No significant erosion observed.
Instabilities:	None observed.
Uniform Appearance:	Yes.
Seepage:	None observed.
Benches:	None.
Foundations, Drains, Relief Wells, Instrumentation:	None observed
Animal Burrows:	None observed.

Slope:	**Measured:**	North - 4H:1V South - 4H:1V East (divider dike) - 2H:1V West - varies due to dredge cell
	Design:	North - Unknown (USACE Levee) South - Unknown (USACE Levee) East (divider dike) - 2H:1V West - Unknown
Height:	**Measured:**	North - 20 feet South - 20 feet East (divider dike) - Could not be observed. West - varies due to dredge cell
	Design:	North - Unknown (USACE Levee) South - Unknown (USACE Levee) East (divider dike) - Unknown West - Unknown

6.4. Spillway Weirs/Riser Inlets

Number:	1
Size, Type and Material:	Concrete outlet structure that transfers flow from the ash pond to the stilling pond. Flow is controlled using stop logs. The pool level was approximately 2 to 3 feet below the top of the stop logs.
Height of Riser Inlets:	Unknown.
Access:	Accessible from divider berm.
Joints:	Concrete joints have some deterioration. Could not evaluate stop logs because pool levels on both sides were equal.
Mis-Alignment:	None observed
Closed/Abandoned Conduits:	None known.

6.5. Outlet Pipes

Number: N/A - Concrete spillway structure, see info above.

Size, Type and Material: N/A

Headwall: N/A

Joint Separations: N/A

Mis-Alignment: N/A

Closed/Abandoned Conduits: N/A

7. Notable Observations and Concerns

- There is an active 30-inch public ductile iron sanitary sewer force main pipeline that connects into a 42-inch RCP sanitary sewer that runs north and south across the Ash Pond and Dredge Cell. The approximate top of the 30-inch pipe is at elevation 217.5 and the high point of the 42-inch pipe is at elevation 218.5. TVA drawing 10W208-1 R0 is a plan view showing the pipe locations. Drawing 10W208-3 R0 shows details of the manhole at the connection of the 30-inch pipe to the 42-inch pipe. TVA has an agreement with the City of Memphis to restrict the maximum elevation height of the East Dredge Cell southern dike to 239 feet. Drawing 10W208-3 R0 shows a low dredging elevation of 226 in the area of the pipes, which is approximately 7.5 to 8.5 feet from the top of the pipes.
- There is an inactive 60-inch public sanitary sewer pipeline that runs east and west across the Ash Pond and Dredge Cell. Two of the manholes are located within the Ash Pond. The approximate top of the pipe is at elevation 221 based on drawing 10W208-1 R0. Top elevation of the fly ash is highly variable so the actual depth of material over the pipe is unknown. Notes on the drawings require no dredging be performed within a 50 foot radius of the manholes.
- There are two 161KV electric transmission towers within the Ash Pond and one adjacent to the Ash Pond. Drawing 10W208-1 R0 shows the locations. Notes on the drawings require no dredging be performed within 100 feet of the tower base.
- Erosion is occurring on the interior slope along the south dike. This is considered a secondary issue since the crest width at this location is greater than 100 feet.
- The east slope (divider berm) has steep (approximately 2H:1V) slopes with some erosion.

- There is a seep near the fuel unloader on the bank of McKellar Lake below the USACE Mississippi River Levee and approximately 300 feet from the NW corner of the East Ash Pond. The source of the seep is unknown but suspected to be process water.

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- Evaluate the active and inactive sanitary sewer force mains and determine if rerouting or other measures are feasible or warranted.
- Evaluate current operating procedures for working around the existing electric transmission lines including factor of safety for stability.
- Based on the limited as-built drawings available, it is recommended that a program be established to develop current conditions / as-built drawings to record future modifications to this facility. Construction records should also be included as part of this program to record and quantify construction means, methods and results.
- Due to the limited construction monuments at this facility, it is recommended that additional surveyed construction monuments be established at selected locations. These monuments should be surveyed annually as a minimum.
- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O & M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.

8.2. Maintenance Recommendations

- Cut and maintain heavy/tall vegetation on interior slopes.
- Repair erosion areas where noted and provide rip-rap as necessary.
- Repair / regrade animal paths and burrows and provide seeding and mulching to establish a vegetative cover. Continue to monitor on a regular basis.

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Allen Fossil Plant (ALF)
East Ash Stilling Pond (EASP)

1. General Facility Information

Facility Status:	Active	**NID Identification:**	TN15801
Surface Area (inside dikes)	10 Acres	**Maximum Height (toe to top of dike):**	20 feet
Free Water Volume:	150 Acre-feet	**Maximum Water Storage:**	200 Acre-feet
Estimated CCB Storage:	Unknown	**Dike Length:**	200 feet
Plant Discharge to Facility:	9.8 MGD	**Current Pool Elevation:**	231 feet

2. Site Visit Information

Stantec Assessment Team:	Rob Kirkbride, PE
TVA Staff Present:	Frank Dominioni
Field Assessment Dates:	February 17, 2009
Weather/Site Conditions:	40 degrees F, cloudy, drizzle, moist ground

3. History/Description of Usage

History and Operation: This facility was part of the Ash Pond expansion in 1978. Decant water is transferred from the Ash Pond into the Stilling Pond through the concrete spillway structure in the southwest corner of the pond. There are two primary outlet spillways presumably made of RCP risers and outlet pipes discharge flow into McKellar Lake. Two emergency outlet spillways also presumably consisting of RCP risers and outlet pipes discharge flow through the east dike and eventually into Horn Lake. The emergency spillways are only used when the pool level in McKellar Lake is too high to discharge.

Past Failures/Releases: No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan:	No EAP has been prepared for this facility.
Operations Manual:	TVA maintains a By Products Operation Manual for the Allen Fossil Plant.
TVA Maintenance:	Exterior slopes are mowed as necessary to keep vegetation minimized.
TVA Inspections:	TVA Engineering performs dike inspections and prepares reports annually. Plant personnel make observations throughout the year on a random basis.
Problems Previously Identified During Past TVA Inspections:	Concerns of damaging the existing sanitary sewer line (abandoned) that is below the pond, erosion, rutting and debris blocking the emergency spillway outlets.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings:	10N226 R2, 10N227 R1, 10N228 R1, 10N229-1 R0, 10N229-2 R0, 10W208-1 R0, 10W208-7 R0, 10W211 R0, 10W225 R6, 10W234-1 R0, 10W234-2 R0.
TVA As-Built Drawings:	No drawings identified as As-Built.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA annual inspection reports from 1967 to 2008.
Geotechnical Data:	Limited data includes lab results, but difficult to tell specific locations of soil borings. (File: ALF MEMO TO GLBUCHANAN FROM GENE FARMER ON ALF ASH DISPOSAL AREA DIKES - SOIL INVESTIGATION.pdf)

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Interior Slopes

Vegetation:	All slopes have dense phragmites at lower portion of slope. North, south and east slopes have adequate grass ground cover that has been mowed. The west slope (divider berm) is primarily bare boiler slag.	
Trees:	None.	
Wave Wash Protection:	None.	
Erosion:	Some wave erosion occurring on all slopes. Most is minor, but east slope is more significant with scarp heights of 1 to 2 feet.	
Instabilities:	Only wave erosion observed.	
Animal Burrows:	No burrows, but did observe animal path from the crest to the water surface (15 feet long and 1 foot wide). This path matches the path along crest and down the exterior slope.	
Freeboard:	**Measured:**	6 feet
	Design:	Unknown
Encroachments:	None	
Slope:	**Measured:**	North - 4H:1V East - 3H:1V West (divider berm) - 2H:1V to 3H:1V South - 3H:1V
	Design:	3H:1V

6.2. Crest

Crest Cover and Slope:	North, South and East - Grass covered with no slope. West - Mostly bare boiler slag with no slope.

Erosion:	Primary erosion is on the access ramp located in the southeast corner of the pond. The erosion is 12 to 16 inches wide and approximately 30 feet long. The water drains down the ramp and into an adjacent swale which has also eroded.
Alignment:	Appears uniform.
Settlement/Cracking:	No significant settlement/cracking observed.
Bare Spots/Rutting:	The majority of the west (divider dike) and the access ramp is bare. Minor rutting on all dikes.
Width:	**Measured:** North - 30 to 35 feet East - 12 to 15 feet West (divider berm) - 22 to 25 feet South - 20 feet + **Design:** North - Unknown (USCOE Levee) South - Unknown (USCOE Levee) East - 16 feet West (divider dike) - Unknown

6.3. Exterior Slopes

Vegetation:	North - Good grass cover South - Good grass cover East - Good grass cover. Some phragmites at the toe and 5 to 10 feet up the slope. West (divider dike) - Mostly phragmites
Trees:	None.
Erosion:	No significant erosion observed.
Instabilities:	None observed.
Uniform Appearance:	Yes.
Seepage:	None observed. The toe of the east dike was not observable due to ponding water.
Benches:	None.
Foundations, Drains, Relief Wells, Instrumentation:	None.

Animal Burrows: Numerous small (less than 2 inches) animal burrows throughout the east dike.

Slope:

Measured:
North - 4H:1V
South - 4H:1V
East - 3H:1V
West (divider dike) - 2H:1V

Design:
North - Unknown (USACE Levee)
South - Unknown (USACE Levee)
East - 3H:1V
West (divider dike) - 2H:1V

Height:

Measured:
North - 20 feet
South - 20 feet
East - 20 to 25 feet
West (divider dike) - Unknown

Design:
North - Unknown (USACE Levee)
South - Unknown (USACE Levee)
East - 20 to 25 feet
West (divider dike) - Unknown

6.4. Spillway Weirs/Riser Inlets

Number: 4

Size, Type and Material: The four decant structures are constructed using stacked 48 inch diameter RCP risers. The two primary structures outlet into McKellar Lake via a 36 inch diameter RCP pipe and the secondary (emergency) structures have the same design and outlet downstream of the east dike and flow to the south in a stream channel which outlets into Horn Lake. The base/foundation is designed to be concrete.

Height of Riser Inlets: Approximately 20 feet.

Access: There is no direct access to the spillways, but there is an adjacent catwalk that provides a partial view.

Joints: Could not be observed.

Mis-Alignment: None observed.

Closed/Abandoned Conduits: None.

6.5. Outlet Pipes

Number: 4

Size, Type and Material: The four outlet pipes are 36 inch diameter RCP.

Headwall: The two primary outlets have a headwall with sluice gate controlled openings to prevent backflow of water during flood events. The two emergency outlets discharge into a drainage channel and do not have headwalls.

Joint Separations: Could not be observed.

Mis-Alignment: None observed.

Closed/Abandoned Conduits: None.

7. Notable Observations and Concerns

- The Outlet Structure that transfers flow from the Ash Pond into the Stilling Pond includes stop logs to control pool level. The top of the stop logs are approximately 2 to 3 feet below the crest of the divider berm. The pool levels at the time of the site visit were at nearly the same elevation even though the stop logs were well above the pool level. It is likely that flow is seeping through the divider berm keeping the pool levels at a similar elevation. This structure should be evaluated to determine if there are potential overtopping concerns. See Photo EASP-2.
- The four decant structures are possibly constructed using stacked RCP risers. The two primary structures outlet into McKellar Lake and the secondary (emergency) structures outlet downstream of the east dike and flow to the south in a stream channel which outlets into Horn Lake. The two secondary outlets at the toe of the east dike are partially submerged (see Photo EASP-6). Erosion has occurred at the primary decant structure outlet where the concrete channel flows into McKellar Lake (see Photos EASP-7 and EASP-8).
- There is an inactive 60-inch public sanitary sewer pipeline that runs east and west across the Ash Pond and Dredge Cell. Two of the manholes are located within the Ash Pond. The approximate top of the pipe is at elevation 221 based on drawing 10W208-1 R0. Top elevation of the fly ash is highly variable so the actual depth of material over the pipe is unknown. Notes on the drawings require no dredging be performed within a 50 foot radius of the manholes.
- Water is ponding at the toe of the exterior slope of the east dike making it difficult to evaluate if there is any seepage occurring (see Photo EASP-5).

- Tall vegetation has grown up along the lower portion of the exterior slope of the east dike (see Photo EASP-5).
- Animal paths and small (12 inch) animal burrows were present on the exterior slope of the east dike (see Photo EASP-4).
- The west slope (divider berm) has steep slopes (approximately 2H:1V) with some erosion.
- Wave erosion has occurred along the internal slope of the east dike. The height of the erosion varies from 6 inches up to 2 feet.
- Erosion has occurred on the crest ramp in the southeast corner of the pond (see Photo EASP-3).

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- Evaluate existing topography and drainage conditions at the toe of the east dike at the East Ash Stilling Pond. A hydraulic and hydrologic analysis should be performed to determine if positive drainage is being provided away from the east dike.
- Evaluate the active and inactive sanitary sewer force mains and determine if rerouting and/or abandonment is necessary.
- Evaluate the Inlet / Outlet Structure (within the divider berm) that transfers flow from the East Ash Pond to the East Ash Stilling Pond. A hydraulic and hydrologic analysis should be performed to determine suitability and operation procedures.
- Evaluate the decant structures at the East Ash Stilling Pond for suitability and condition.
- Evaluate current operating procedures for working around the existing electric transmission lines including factor of safety for stability.
- Based on the limited as-built drawings available, it is recommended that a program be established to develop current conditions / as-built drawings to record future modifications to this facility. Construction records should also be included as part of this program to record and quantify construction means, methods and results.
- Due to the limited construction monuments at this facility, it is recommended that additional surveyed construction monuments be established at selected locations. These monuments should be surveyed annually as a minimum.

- Based on observations made during the site visits and review of the documents provided, it is recommended that a hydraulic and hydrologic analysis be performed for this facility. This facility has significant flow concentrations and is critical to operation of the plant.
- Based on the findings of Phase 2 and designs from Phase 3, if performed, Stantec recommends that the existing O&M Manual be reviewed and updated. These updates may include sections on routine monitoring and facility maintenance.

8.2. Maintenance Recommendations

- Cut and maintain heavy/tall vegetation on interior slopes.
- Remove trees and brush from the exterior slope of the east dike.
- Repair erosion areas where noted and provide rip-rap as necessary.
- Repair / regrade animal paths and burrows and provide seeding and mulching to establish a vegetative cover. Continue to monitor on a regular basis.

TVA Disposal Facility Assessment
Phase 1 Coal Combustion Product Disposal Facility Summary
Allen Fossil Plant (ALF)
West Ash Pond (WAP)

1. General Facility Information

Facility Status:	Inactive	**NID Identification:**	Not Available
Surface Area (inside dikes)	23 Acres	**Maximum Height (toe to top of dike):**	28 feet
Free Water Volume:	0	**Maximum Water Storage:**	600 Acre-feet
Estimated CCB Storage:	0	**Dike Length:**	1200 feet
Plant Discharge to Facility:	0	**Current Pool Elevation:**	n/a - Empty

2. Site Visit Information

Stantec Assessment Team:	Rob Kirkbride, PE
TVA Staff Present:	Frank Dominioni
Field Assessment Dates:	February 17, 2009
Weather/Site Conditions:	40 degrees F, cloudy, drizzle, moist ground

3. History/Description of Usage

History and Operation: This area was the original location of the fly ash pond. Sluiced fly ash was discontinued in 1978 until May 1991 when it was reactivated. Prior to resuming sluicing to this area, approximately 173,000 cubic yards of ash was hauled from it and used for fill material in the Corp of Engineers levee. Sluicing was again discontinued in October 1992 and the pond water was pumped out. The area has been inactive since.

Past Failures/Releases: No failures or releases reported.

4. Owner's Operations, Maintenance and Inspection Information

Emergency Action Plan:	No EAP has been prepared for this facility.
Operations Manual:	No Operations Manual has been prepared for this facility.
TVA Maintenance:	Exterior slopes are mowed as necessary to keep vegetation minimized.
TVA Inspections:	TVA Engineering performs dike inspections and prepares reports annually. Plant personnel make observations throughout the year on a random basis.
Problems Previously Identified During Past TVA Inspections:	Prior to inactivating this area in 1992, seepage problems with the spillway structure were noted. Additional concerns included trees and dense brush cover on most of the exterior slopes.

5. Documents Reviewed

See attached Document Log for complete list of documents provided by TVA for review. In particular, the following provided pertinent information for the assessment of this facility:

TVA Design Drawings:	10N223 R2, 10N224 R1
TVA As-Built Drawings:	No drawings identified as As-Built.
TVA Construction Testing Records:	None available.
TVA Annual Inspection Reports:	TVA annual inspection reports from 1967 to 2008.
Geotechnical Data:	Limited data includes lab results, but difficult to tell specific locations of soil borings. (File: ALF MEMO TO GLBUCHANAN FROM GENE FARMER ON ALF ASH DISPOSAL AREA DIKES - SOIL INVESTIGATION.pdf)

6. Stantec Field Observations

See attached Concerns/Photo Log, Photos, and Site Plan Drawing.

6.1. Interior Slopes

Vegetation: Dense vegetation at the toe of all slopes.

Trees: Dense trees at the toe of all slopes.

Wave Wash Protection: None.

Erosion: No significant erosion observed.

Instabilities: None observed.

Animal Burrows: None observed.

Freeboard:
Measured: N/A - pond is empty
Design: Unknown

Encroachments: The Chemical Pond was constructed inside the northeast corner of the pond. Approximately 25% of the pond was filled in to create a staging area for Reed Minerals.

Slope:
Measured: North, East and West - 3H:1V
South - 4H:1V (USACE Levee)
Design: North, East and West - 3H:1V
South - Unknown (USACE Levee)

6.2. Crest

Crest Cover and Slope: North - Grass cover with no slope.
South - Gravel road with no slope.
East - Gravel with no slope.
West - Grass cover with no slope.

Erosion: Minor erosion on all crests.

Alignment: North and East are somewhat irregular.
South and West appear uniform.

Settlement/Cracking: No significant settlement or cracking observed.

Bare Spots/Rutting: Several minor bare spots on all dikes. Consistent rutting along the crest (up to 6 inches deep).

Width:	**Measured:**	North - 18 to 20 feet South - 50 feet + (USACE Levee) East - 30 feet + West - 18 to 20 feet
	Design:	North - 16 feet South - Unknown (USACE Levee) East - Unknown West - 16 feet

6.3. Exterior Slopes

Vegetation:
North - Dense brush and vegetation.
South - N/A
East - N/A
West - Dense brush and vegetation.

Trees:
North - Very dense trees covering entire slope.
South - N/A
East - N/A
West - Some trees near the toe and sporadically on slope.

Erosion:
North - Not visible to observe.
South - N/A
East - N/A
West - Difficult to observe. None noted.

Instabilities:
North - Not visible to observe.
South - N/A
East - N/A
West - Difficult to observe. None noted.

Uniform Appearance:
North - Not visible to observe.
South - N/A
East - N/A
West - Difficult to observe. None noted.

Seepage:
North - Not visible to observe.
South - N/A
East - N/A
West - Difficult to observe. None noted.

Benches:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.	
Foundations, Drains, Relief Wells, Instrumentation:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.	
Animal Burrows:	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. None noted.	
Slope:	**Measured:**	North - Not visible to observe. South - N/A East - N/A West - Difficult to observe. Estimate 3H:1V.
	Design:	North - Unknown South - N/A East - N/A West - 3H:1V
Height:	**Measured:**	North - Not visible to observe. South - N/A East - N/A West - 10 to 15 feet
	Design:	North - Unknown South - N/A East - N/A West - 10 to 15 feet

6.4. Spillway Weirs/Riser Inlets

Number:	1 (abandoned)
Size, Type and Material:	The decant structure is constructed using stacked 48 inch diameter RCP risers that outlet through the west dike into McKellar Lake via a 36 inch diameter RCP pipe and channel. The base/foundation is designed to be concrete.
Height of Riser Inlets:	Approximately 15 feet.

Access: The pond is empty so access to the spillway is difficult due to the dense vegetation.

Joints: Could not be observed.

Mis-Alignment: No significant mis-alignment was observed on the exposed portion of the spillway.

Closed/Abandoned Conduits: Unknown, however design drawing 10N223 R2 shows two pipes that were to be removed prior to construction of the west dike. Their status is unknown.

6.5. Outlet Pipes

Number: 1

Size, Type and Material: Unable to access outlet.

Headwall: Unknown.

Joint Separations: Unknown.

Mis-Alignment: Unknown.

Closed/Abandoned Conduits: Unknown.

7. Notable Observations and Concerns

- This structure is inactive and appears to be empty. See Photo WAP-1.
- Original Decant Structure should be evaluated to determine if operation of the pond relies on this structure for storm water hydraulic and hydrologic capacity. No ponding water was observed within the pond during the site visit so the drainage may be adequate. See Photo WAP-1.
- Trees and dense vegetation are growing on the pond interior which is approximately 10 feet below the crest of the dikes (See Photo WAP-2).
- Trees and dense vegetation are growing on the exterior slope of the north dike (See Photo WAP-3).

8. Recommendations

8.1. Phase 2 Engineering and Programmatic Recommendations

- Based on the limited as-built drawings available, it is recommended that a program be established to develop current conditions / as-built drawings to record future modifications to this facility. Construction records should also be included as part of this program to record and quantify construction means, methods and results.
- Although this facility is inactive, based on observations made during the site visits and review of the documents provided, it is recommended that a hydraulic and hydrologic analysis be performed for this facility to evaluate the storm water inflow and determine the suitability of the outlet structure to pass the design storm.
- It is recommended that a facility specific Operations & Maintenance Plan be developed to provide means and methods of operating this facility efficiently and identifying the maintenance necessary to allow for proper evaluations.

8.2. Maintenance Recommendations

- Cut and maintain heavy/tall vegetation on interior and exterior slopes to allow better observation.
- Remove trees and brush from the interior and exterior slopes.

Drawing Mark EAP-1 Erosion is occurring on the interior slope along the south dike looking west.

Drawing Mark EAP-2 Outlet Structure operated using stop logs.

Drawing Mark EAP-3 Fly Ash influent pipes at northwest corner.

Drawing Mark EAP-4 Dredge Cell interior drainage looking south.

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Concerns/Photo Log		
Drawing Mark	**Comments**	**Photo/GPS ID**
EAP-1	Erosion is occurring on the interior slope along the south dike looking west.	IMG_1373
EAP-2	Outlet structure operated using stop logs.	IMG_1327
EAP-3	Fly ash influent pipes at northwest corner.	IMG_1383
EAP-4	Dredge Cell interior drainage looking south.	IMG_1391

Drawing Mark EASP-1 — Overview of pond showing railroad to the south.

Drawing Mark EASP-2 — Concrete inlet structure with stop logs.

Drawing Mark EASP-3 — Access ramp to crest on southeast corner of pond. Note the erosion on the ramp.

Drawing Mark EASP-4 — Eastern embankment has animal paths extending from toe of exterior slope to water surface of interior slope.

Drawing Mark EASP-5

Eastern embankment showing ponding water and thick vegetation at the toe. Portions of the slope had small (1 to 2 inch diameter) animal burrow holes.

Drawing Mark EASP-6

Decant structure outlets to Horn Lake. Note partially submerged outlet pipes.

Drawing Mark EASP-7 Decant structure outlet into McKellar Lake has erosion occurring.

Drawing Mark EASP-8 Decant structure outlets to McKellar Lake.

Drawing Mark EASP-9 Decant structure inlets with skimmers.

Drawing Mark EASP-10 Interior slope wave erosion.

Concerns/Photo Log		
Drawing Mark	**Comments**	**Photo/GPS ID**
EASP-1	Overview of pond showing railroad to the south.	IMG_1321
EASP-2	Concrete inlet structure with stop logs.	IMG_1327
EASP-3	Access ramp to crest on southeast corner of pond. Note the erosion on the ramp.	IMG_1329
EASP-4	Eastern embankment has animal paths extending from toe of exterior slope to water surface of interior slope.	IMG_1334
EASP-5	Eastern embankment showing ponding water and thick vegetation at the toe. Portions of the slope had small (1 to 2 inch diameter) animal burrow	IMG_1335
EASP-6	Decant structure outlets to Horn Lake. Note partially submerged outlet pipes.	IMG_1338
EASP-7	Decant structure outlet into McKellar Lake has erosion occurring.	IMG_1346
EASP-8	Decant structure outlets to McKellar Lake	IMG_1347
EASP-9	Decant structure inlets with skimmers.	IMG_1348
EASP-10	Interior slope wave erosion.	IMG_1358

Drawing Mark WAP-1 Interior of Ash Pond mainly empty and covered with trees and dense vegetation.

Drawing Mark WAP-2 Dense trees and vegetation are growing on the interior of the pond.

Drawing Mark WAP-3 Dense trees and vegetation are growing on the exterior slope of the north dike.

Drawing Mark WAP-4 Abandoned decant structure on west end of pond. Deteriorated and surrounded by heavy vegetation.

Concerns/Photo Log

Drawing Mark	Comments	Photo/GPS ID
WAP-1	Interior of Ash Pond mainly empty and covered with trees and dense vegetation.	IMG_1401
WAP-2	Dense trees and vegetation are growing on the interior of the pond.	IMG_1399
WAP-3	Dense trees and vegetation are growing on the exterior slope of the north dike.	IMG_1408
WAP-4	Abandoned decant structure on west end of pond. Deteriorated and surrounded by heavy vegetation.	IMG_1404

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Coal Combustion Product Disposal Facility Assessment
Phase 1 Document Review Form
Allen Fossil Plant (ALF)

Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	Aerial View From Book ALF East Ash Pond Temorary Dredge Cell.pdf	PDF
3/10/2009	RJK	ALF - Aerial Photo Of East Portion Of Facility.pdf	PDF
3/10/2009	RJK	ALF - Ash Pond Drawings (From Cal).pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2000.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2001.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2002.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2003.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2004.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2005.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2006.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy2007.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy67.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy68.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy69.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy70.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy71.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy72.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy73.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy74.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy75.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy76.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy77.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy78.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy79.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy80.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy81.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy82.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy83.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy84.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy85.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy86.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy87.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy88.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy89.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy93.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy94.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy95.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy96.pdf	PDF

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Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	ALF Ash Pond Insp Fy97.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy98.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Insp Fy99.pdf	PDF
3/10/2009	RJK	ALF Ash Pond Red Water Seep Inspections 2006 - 2008.pdf	PDF
3/10/2009	RJK	ALF Civil Design Gbuide Dg C5.2 Earth Design Slope Stability Analysis.pdf	PDF
3/10/2009	RJK	ALF Memo Ash Disposal Areas Dikes - Soil Investigation Dated May 2 1973 (Duplicate With Notes).pdf	PDF
3/10/2009	RJK	ALF Memo O Fplacy From Jcmccraw On ALF Ash Disposl Area Dike Borrow Source.pdf	PDF
3/10/2009	RJK	ALF Memo To Fplacy From Jcmcgraw ALF Ash Disposal Area Dike - Borrow Exploration.pdf	PDF
3/10/2009	RJK	ALF Memo To Gene Farmer From Glbuchanan On ALF Ash Disposal Areas Kikes Raising - Construction Information.pdf	PDF
3/10/2009	RJK	ALF Memo To Glbuchanan From Gene Farmer On ALF Ash Disposal Areas Kikes - Soil Investigation.pdf	PDF
3/10/2009	RJK	ALF Proposed West Ash Pond Extension Figure 4.pdf	PDF
3/10/2009	RJK	ALF Report Of Additional Geotechnical Exploration Potential Ash Disposal Area Belz Property July 1 2005.pdf	PDF
3/10/2009	RJK	ALF Report Of Geotechnical Exploration East And West Ash Disposal Areas Aug 18 2004 Mactec Project.pdf	PDF
3/10/2009	RJK	ALF Report Of Geotechnical Exploration Potential Ash Disposal Area Belz Property Oct 19 2004.pdf	PDF
3/10/2009	RJK	ALF Table 1 ALF Ccw Drawing List.pdf	PDF
3/24/2009	RJK	ALF.pdf	PDF
3/10/2009	RJK	ALF_Ashpondinsp_Fy09_Draft.pdf	PDF
3/10/2009	RJK	ALF-10N223-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N223-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area West Of Powerhouse Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10N224-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N224-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area West Of Powerhouse Sheet 2.cal	CAL
3/10/2009	RJK	ALF-10N226-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N226-Sht -Rev 2 Main Plant - Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 2.cal	CAL
3/10/2009	RJK	ALF-10N226-Sht -Rev 2.cal	CAL
3/10/2009	RJK	ALF-10N227-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N227-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 3.cal	CAL
3/10/2009	RJK	ALF-10N227-Sht -Rev 1.cal	CAL
3/10/2009	RJK	ALF-10N228-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area (cal).pdf	PDF
3/10/2009	RJK	ALF-10N228-Sht -Rev 1 Main Plant - Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 4.cal	CAL
3/10/2009	RJK	ALF-10N228-Sht -Rev 1.cal	CAL
3/10/2009	RJK	ALF-10N229-1-Sht -Rev 0 Standard Drawing Weir For Ash Disposal Spillway (cal).pdf	PDF
3/10/2009	RJK	ALF-10N229-1-Sht -Rev 0 Standard Drawing Weir For Ash Disposal Spillway.cal	CAL
3/10/2009	RJK	ALF-10N229-1-Sht -Rev 0.cal	CAL
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0 Standard Drawing Ash Disposal Spillway (cal).pdf	PDF
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0 Standard Drawing Ash Disposal Spillway.B00	B00
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0 Standard Drawing Ash Disposal Spillway.cal	CAL
3/10/2009	RJK	ALF-10N229-2-Sht -Rev 0.cal	CAL
3/10/2009	RJK	ALF-10W200-1-Sht -Rev 4.cal	CAL

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Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	ALF-10W201-1-Sht -Rev 7.cal	CAL
3/10/2009	RJK	ALF-10W202-2-Sht -Rev 1.cal	CAL
3/10/2009	RJK	ALF-10W208-1-Sht -Rev 0 Yard East Ash Pond Dredge Cell Plan (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-1-Sht -Rev 0 Yard East Ash Pond Dredge Cell Plan.cal	CAL
3/10/2009	RJK	ALF-10W208-2-Sht -Rev 0 Yard East Ash Pond Dredge Cell Sections & Detai (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-2-Sht -Rev 0 Yard East Ash Pond Dredge Cell Sections & Details.B00	B00
3/10/2009	RJK	ALF-10W208-2-Sht -Rev 0 Yard East Ash Pond Dredge Cell Sections & Details.cal	CAL
3/10/2009	RJK	ALF-10W208-3-Sht -Rev 0 Yard East Ash Pond Dredge Cell - Manhole Detail (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-3-Sht -Rev 0 Yard East Ash Pond Dredge Cell - Manhole Details & Sections.cal	CAL
3/10/2009	RJK	ALF-10W208-4-Sht -Rev 0 Tva Ash Pond Crossing Plan Intersection Of Plt (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-4-Sht -Rev 0 Tva Ash Pond Crossing Plan Intersection Of Plt & Riverport Road Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10W208-5-Sht -Rev 0 Tva Ash Pond Crossing Intersection Of Plt & Riv (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-5-Sht -Rev 0 Tva Ash Pond Crossing Intersection Of Plt & Riverport Road Sheet 2.cal	CAL
3/10/2009	RJK	ALF-10W208-6-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverp (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-6-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverport Road Sheet 3.cal	CAL
3/10/2009	RJK	ALF-10W208-7-Sht -Rev 0 Yard East Ash Pond Dredge Cell Spillway Structu (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-7-Sht -Rev 0 Yard East Ash Pond Dredge Cell Spillway Structure.cal	CAL
3/10/2009	RJK	ALF-10W208-8-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverp (cal).pdf	PDF
3/10/2009	RJK	ALF-10W208-8-Sht -Rev 0 Tva Ash Pond Crossing Intersection Plt & Riverport Road Sheet 4.cal	CAL
3/10/2009	RJK	ALF-10W210-1-Sht -Rev 0 Crushing Facility Plan & Sections Crusher Build (cal).pdf	PDF
3/10/2009	RJK	ALF-10W210-1-Sht -Rev 0 Crushing Facility Plan & Sections Crusher Building Wash Down Sump.cal	CAL
3/10/2009	RJK	ALF-10W210-3-Sht -Rev 0 Crushing Facility Washdown Sump Concrete And Re (cal).pdf	PDF
3/10/2009	RJK	ALF-10W210-3-Sht -Rev 0 Crushing Facility Washdown Sump Concrete And Reinforcing Plan, Sections, And Details.cal	CAL
3/10/2009	RJK	ALF-10W211-Sht -Rev 0 Main Plant - East Ash Disposal Area Catwalk To Wa (cal).pdf	PDF
3/10/2009	RJK	ALF-10W211-Sht -Rev 0 Main Plant - East Ash Disposal Area Catwalk To Water Level Monitoring Station.cal	CAL
3/10/2009	RJK	ALF-10W214-3-Sht -Rev 0 Civil Coal Yard Runoff And Drainage Ditch Improv (cal).pdf	PDF
3/10/2009	RJK	ALF-10W214-3-Sht -Rev 0 Civil Coal Yard Runoff And Drainage Ditch Improvements 2006 Retention Pond Plan View.cal	CAL
3/10/2009	RJK	ALF-10W215-Sht -Rev 0 Yard Concrete Retaining Wall At Ash Sluice Pipe T (cal).pdf	PDF
3/10/2009	RJK	ALF-10W215-Sht -Rev 0 Yard Concrete Retaining Wall At Ash Sluice Pipe Trench Near Bc 3A & 3B.cal	CAL
3/10/2009	RJK	ALF-10W225-Sht -Rev 5 Main Plant Ash Disposal Areas Ash Disposal Area E (cal).pdf	PDF
3/10/2009	RJK	ALF-10W225-Sht -Rev 5 Main Plant Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10W225-Sht -Rev 6 Main Plant Ash Disposal Areas Ash Disposal Area Ea (cal).pdf	PDF
3/10/2009	RJK	ALF-10W225-Sht -Rev 6 Main Plant Ash Disposal Areas Ash Disposal Area East Of Powerhouse Sheet 1.cal	CAL
3/10/2009	RJK	ALF-10W234-1-Sht -Rev 0 Yard Ash Pond Discharge Discharge Flume Repairs (cal).pdf	PDF
3/10/2009	RJK	ALF-10W234-1-Sht -Rev 0 Yard Ash Pond Discharge Discharge Flume Repairs.cal	CAL
3/10/2009	RJK	ALF-10W234-2-Sht -Rev 0 Yard Ash Pond Discharge Partial Plan Sections & (cal).pdf	PDF
3/10/2009	RJK	ALF-10W234-2-Sht -Rev 0 Yard Ash Pond Discharge Partial Plan Sections & Details.cal	CAL
3/10/2009	RJK	ALF-10W235-Sht -Rev 18.cal	CAL

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Date Reviewed	Reviewed by	File Name	File Type
3/10/2009	RJK	ALF-10W260-Sht -Rev 0 Yard Units 1-3 Concrete & Misc Steel Ash Disposal (cal).pdf	PDF
3/10/2009	RJK	ALF-10W260-Sht -Rev 0 Yard Units 1-3 Concrete & Misc Steel Ash Disposal Pipe Trench Outline & Reinf (Nldf).cal	CAL
3/10/2009	RJK	ALF-10W402-1-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-1-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-10W402-2-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-2-Sht -Rev 1 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-10W402-3-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-3-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-10W402-4-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Tre (cal).pdf	PDF
3/10/2009	RJK	ALF-10W402-4-Sht -Rev 0 Yard Units 1 - 3 Concrete And Misc Steel Ash Trench Modifications Outline And Reinforcement.cal	CAL
3/10/2009	RJK	ALF-17W500-4-Sht -Rev 3.cal	CAL
3/10/2009	RJK	ALF-Facility-Wide Drawings (From cal).pdf	PDF
3/10/2009	RJK	Allen Fossil Plant - Aerial Photo Scan With Structure Labels.pdf	PDF
3/10/2009	RJK	Allen Fossil Plant - Aerial Photo.pdf	PDF
3/10/2009	RJK	FY2008_ALF_Summary.pdf	PDF

APPENDIX A

Document 11

Typical Quarterly, Monthly, Daily Inspection and Field Reports

TVA Monthly /Quarterly/Special Facility Inspection Form — Form Date 6-01-10

1. Site Name: ALF 2. Facility Name: Ash Complex 3. Date and Start Time of Inspection: 6/22/11 8 am CST

4. Operator Name: Trans Ash 5. Inspection Method: X Walk Ride Both

6. Inspector's Name(s): Griffin R. Lifsey, Jacob Horton, Jake Booth, Bronson Reed, Gary Melton, and Brian Gerbus (KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

7. Hazard Classification: High Significant Low

8. Inspection Frequency: MONTHLY X QUARTERLY (MUST BE WALKED) SPECIAL (after significant rain or earthquake event)

9. Current weather conditions Cloudy 80°F Prior Conditions, if notable

Check the appropriate box below. If not applicable, record "N/A". Provide comments when appropriate. Any other areas that should be brought to the attention of the Program Manager should also be noted in the "Comments" section. Indicate the locations of any areas identified, and photograph and attach to the form. Previous observation forms should be reviewed and any NEW observations or degradation of pervious conditions should be reported on this inspection form. (NOTE - ONE FORM PER FACILITY)

	Yes	No
10. Pre-Job Safety Briefing Performed	✓	
11. Activity / Construction on/ at facility	✓	
12. DIKE CREST		
A. Settlement / Cracking		✓
B. Rutting		✓
C. Lateral Displacement		✓
D. Erosion		✓
13. INTERIOR / EXTERIOR DIKE SLOPES		
A. Minimum Freeboard	ft.	
B. Current Freeboard	>4' ft.	
C. Instabilities (Sloughs or Slides)		✓
D. Erosion	✓	
E. Sinkholes/Depressions ○ New ○ Existing		✓
F. Vegetation / Brush / Trees	✓	
Heavy/(Adequate)/Sparse/Bare		
G. Animal Burrows ○ New ○ Existing		✓
H. Seepage ○ New ○ Existing		✓
Clear/Cloudy/Red/Muddy		
Flow Increased/Decreased/Same	gpm	
Ash or Clay Deposits Below Seep Outlet		
I. Seep around Drain Pipe(s)		✓
Clear/Cloudy/Red/Muddy		
14. DEFICIENCIES		
A. Prior Key Deficiencies Checked	✓	
B. New Deficiencies Identified / Flagged	✓	
C. Immediate Actions Taken (Note Below)		✓
D. Photos of deficiencies attached	✓	

	Yes	No
15. DIKE TOE AREAS		
A. Seepage ○ New X Existing	✓	
○ Clear/Cloudy/Red/Muddy — Marked & Logged		
○ Flow Increased / Decreased/Same	gpm	
○ Aquatic Vegetation Growing		
○ Ash or Clay Deposits Below Seep Outlet		
B. Boils ○ New ○ Existing		✓
○ Clear/Cloudy/Red/Muddy		
○ Flow Increased / Decreased/Same	gpm	
○ Growing in Size		
C. Sinkholes/Depressions ○ New ○ Existing		✓
16. SEEPAGE COLLECTION SYSTEM		
A. Estimated Flow Measurement	N/A gpm	
B. Increased Flow		
C. Emitting Clear or Dirty Water		
17. SPILLWAY WEIRS & OUTLETS		
A. Decant Riser Misaligned		✓
B. Decant Pipe Joints		✓
○ Leaking		
○ Separated		
C. Headwall In Good Condition		
18. OPERATIONS & MAINTENANCE		
A. Routine O&M Performed	✓	
B. Weekly Observations Performed	✓	
C. Any Changes in Operations		✓

19. Major adverse changes in these items could cause instability and should be reported to the Program Manager as soon as possible for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, etc.) in the space below and on the backside of this sheet if needed.

NOTE: Quarterly Inspection Deficiencies to be documented on spreadsheet with applicable latitude and longitude coordinates referenced. SHOW ALL QUARTERLY INSPECTION DEFICIENCIES ON AERIAL PHOTOS

Item #	Comments/New Observations/Action Taken:
	Debris present on corps levee from flooding at the end of April. Once conditions become drier, Facilities will remove & clean up for RHO&M.

20. PA(E) was Notified of New Key Deficiency: (Date / Time)

21. Who else Notified of New Key Deficiency: (Date / Time)

22. I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.

Period Covered:
From: Apr 2011 To: Jun 2011 Signature: [signature] Date: 6/27/11

LOCATION: Allen Fossil Plant - 3rd Quarter FY2011 Dike Inspection
WEATHER: 80 degrees F, Cloudy
INSPECTION BY: Griffin Lifsey, Jacob Horton, Jake Booth, Bronson Reed, Brian Gerbus, and Gary Melton
DATE: 06/22/2011

ITEM NO.	DESCRIPTION	PICTURE NO.	POINT NO.	NORTHING	EASTING	COMMENTS
1	Erosion at CYROP	-	1000	273398.14	760763.98	Previously repaired, reoccuring issue. To be repaired with rip-rap already on-site.
2	Erosion/rill near light pole	-	1001	273581.09	760484.28	To be repaired with rip-rap alread on-site.
3	Flood debris all along corps levee	-	-	-	-	Facilities will remove debris at RHO&M's request once conditions become drier to allow the work in the area.


1001
1000

TVA Monthly /Quarterly/Special Facility Inspection Form — Form Date 6-01-10

1. Site Name: ALF 2. Facility Name: East Flyash Pond/ CYROP p 3. Date and Start Time of Inspection: 08/10/2011

4. Operator Name: Trans Ash

5. Inspection Method: ☐ Walk ☐ Ride X Both
(KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

6. Inspector's Name(s): Gary Wilford

7. Hazard Classification: ☐ High X Significant ☐ Low

8. Inspection Frequency: X MONTHLY ☐ QUARTERLY (MUST BE WALKED) ☐ SPECIAL (after significant rain or earthquake event)

9. Current weather conditions Partly Cloudy Prior Conditions, if notable

Check the appropriate box below. If not applicable, record "N/A". Provide comments when appropriate. Any other areas that should be brought to the attention of the Program Manager should also be noted in the "Comments" section. Indicate the locations of any areas identified, and photograph and attach to the form. Previous observation forms should be reviewed and any NEW observations or degradation of pervious conditions should be reported on this inspection form. (NOTE - ONE FORM PER FACILITY)

	Yes	No		Yes	No
10. Pre-Job Safety Briefing Performed	X		**15. DIKE TOE AREAS**		
11. Activity / Construction on/ at facility	X		A. Seepage ○ New x Existing		X
12. DIKE CREST			○ Clear/Cloudy/Red/Muddy		
A. Settlement / Cracking		X	○ Flow Increased / Decreased/Same		gpm
B. Rutting		X	○ Aquatic Vegetation Growing		X
C. Lateral Displacement		X	○ Ash or Clay Deposits Below Seep Outlet		X
D. Erosion		X	B. Boils ○ New ○ Existing		X
			○ Clear/Cloudy/Red/Muddy		
A. Minimum Freeboard		4 ft.	○ Flow Increased / Decreased/Same		gpm
B. Current Freeboard		>4ft.	○ Growing in Size		X
C. Instabilities (Sloughs or Slides)		X	C. Sinkholes/Depressions ○ New ○ Existing		X
D. Erosion		X	**16. SEEPAGE COLLECTION SYSTEM**		
E. Sinkholes/Depressions ○ New ○ Existing		X	A. Estimated Flow Measurement		gpm
F. Vegetation / Brush / Trees	X		B. Increased Flow		n/A
○ Heavy/Adequate/Sparse/Bare	ADEQUATE		C. Emitting Clear or Dirty Water		
G. Animal Burrows ○ New x Existing		X	**17. SPILLWAY WEIRS & OUTLETS**		
H. Seepage ○ New x Existing	X		A. Decant Riser Misaligned		n/a
○ Clear/Cloudy/Red/Muddy			B. Decant Pipe Joints		n/a
○ Flow Increased/Decreased/Same		No change	○ Leaking		
○ Ash or Clay Deposits Below Seep Outlet		X	○ Separated		
I. Seep around Drain Pipe(s)		X	C. Headwall In Good Condition		N/a
○ Clear/Cloudy/Red/Muddy			**18. OPERATIONS & MAINTENANCE**		
14. DEFICIENCIES			A. Major Changes in Operations	X	
A. Prior Key Deficiencies Checked	X		Sewer Repair across ash pond has changed operations		
B. New Deficiencies Identified / Flagged	X		Siphon project started by E&T group; stilling pond draw down started.		
C. Immediate Actions Taken (Note Below)		X			
D. Photos of deficiencies attached	X				

19. Major adverse changes in these items could cause instability and should be reported to the Program Manager as soon as possible for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, etc.) in the space below and on the backside of this sheet if needed.

NOTE: Quarterly Inspection Deficiencies to be documented on spreadsheet with applicable latitude and longitude coordinates referenced.
SHOW ALL QUARTERLY INSPECTION DEFICIENCIES ON AERIAL PHOTOS

20. Item #	Comments/New Observations/Action Taken:

21. PA(E) was Notified of New Key Deficiency: (Date / Time)

22. Who else Notified of New Key Deficiency: (Date / Time)

23. I hereby attest the above is original information (not reproduced) based on actual field observations made during the period indicated, by either myself or an appointed representative and are accurate, complete, and correct to the best of my knowledge.

Period Covered:
From: 7/11 To: 8/11 Signature: Gary V. Wilford Date: 08/12/2011

TVA Weekly Facility Observation Form — Form Date 7-20-10

1. Site Name: ALF 2. Date & Start Time of Observation 8-4-11 12:00pm

3. Operator Name: Trans-Ash 4. Observation Method: ☐ Walk ☐ Ride X☐ Both

(KNOWN KEY DEFICIENCIES MUST BE INSPECTED)

5. Observer's Name(s): RODOCKER

6. Current Weather Conditions 91' sunny

7. Prior Weather Conditions, if notable

CHECK ALL BOXES WHERE DEFICIENCIES ARE KNOWN AND MAKE APPROPRIATE COMMENTS, OBSERVATIONS, AND/OR ACTIONS TAKEN. NOTE LOCATIONS OF DEFICIENCIES ON AERIAL PHOTO

8. Type(s) of Facilities Observed	Name of Facility	Minimum Freeboard	Current Freeboard
X ☐ Wet Fly Ash Pond	Active ash pond A-B-C	3' FT	5' FT
☐ Wet Gypsum Pond		FT	FT
X ☐ Wet Bottom Ash Pond	Pond 1 & 2	FT	FT
☐ Dry Ash Stack			
☐ Dry Gypsum Stack			
☐ Other			

	YES	NO	COMMENTS
9 .Pre-Job Safety Briefing Performed	X		
10. Activity / Construction on/ at facility	X		sewer pipe installation.
11. DIKE CREST (Good)	☐ Transverse or Longitudinal Cracks or bulges ☐ Settlement ☐ Displacement ☐ Rutting		
12. DIKE SLOPES (Good)	☐ Erosion, ☐ Cracks or Bulges ☐ Slides/Sloughs ☐ Subsidence ☐ Seepage (clear/muddy water, new or flow increasing over time) ☐ Wet or soft spot ☐ Changes in geometry, depth and elevation ☐ Changes in freeboard ☐ Vegetation (excessive/ sparse) ☐ Animal Burrows ☐ Sinkholes ☐ Rutting X ☐ Trees		
13. DIKE TOE AREAS (Good)	☐ Seepage Areas ☐ Boils ☐ Equipment Rutting ☐ Perimeter Ditches Properly Draining ☐ Sinkholes		
14. SPILLWAY WEIR SYSTEM (Only visibly accessible features checked)	☐ Discharge Channel Erosion ☐ Riser Vertical Alignment ☐ Riser/Outlet Pipe Joint Leakage/Separation ☐ Headwall Condition ☐ Box Weir/Skimmers Operating Properly ☐ Vegetation blocking overflow		
15. SEEPAGE COLLECTION SYSTEM	☐ Check Flow and Water Clarity ☐ Check For Blockages		

16. DEFICIENCIES	YES	NO	COMMENTS
A. Prior Key Deficiencies Checked		X	
B. New Deficiencies Identified / Flagged		X	
C. Immediate Actions Taken (Note Below)		X	
D. Photographs Taken / Attached		X	

17. DESCRIPTIONS OF NEWLY IDENTIFIED AND DEGRADING EXISTING KEY DEFICIENCIES/ACTIONS TAKEN/COMMENTS

18. **Who was Notified of New Key Deficiency:** (Date & Time) William Davis/ Dave Boley (Trans Ash)

19. **PA(E) Notified of New Key Deficiency:** (Date & Time) N/A

Period Covered: 8-1-11 8-7-11

Signature RJ Rodocker Date 8-4-11

RHO&M Daily Field Report

Date	08/08/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High: 95	Low: 77
Rain Gauge Reading:					

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

D DEFICIENCY FOUND AT THIS TIME

ho Was Notified of Deficiency:

Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ar Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	12	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

Plant / Visitor Interface:

Completed By: WILLIAM DAVIS

Routine Handling Activities

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley					
Vhite	8	TRAC HOE	C-63	8	357600
Smalley	8	DOZER	B-83	8	357601
Boswell	8	GREASE TRUCK	GT-52	8	357704
Plez		SPOTTER			357601
Walker		SPOTTER			357601
Turner		SPOTTER			357601
'.Partee	8	WATER TRUCK	WT-44	8	357704

PPED RIM DITCH, ROLLED ASH, PADDED MINI DREDGE CELL,

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
					356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date	08/09/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High 92	Low 75
Rain Gauge Reading:	.30				

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency:

Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	0	0	0	0
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

Plant / Visitor Interface:

Completed By: WILLIAM DAVIS

Routine Handling Activiti

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
. Davis	3				357905
Mosley		Trac Hoe	C-68		
Vhite	8	Trac Hoe	C-63	8	357600
Smalley	8	Dozer	B-83	8	357601
Boswell	8	Bobcat	Rental	8	356030
Plez		SPOTTER			357601
Walker	4	SPOTTER		4	356030
Turner	4	SPOTTER		4	356030
'.Partee		WATER TRUCK	WT-44		357704

PPED RIM DITCH, ROLLED ASH, PADDED MINI DREDGE CELL, BACK FILL AROUND ASPHALT PAVING.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	6.5	Trac-hoe	c-95	6.5	356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023
					356023
Turner	6.5	Labor		6.5	356023
Walker	6.5	Labor		6.5	356023
Plez	6.5	Labor		6.5	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL. EXCAVATED IN COE. LEVEE FOR SEWER LINE. REMOVED MANHOLE ON NORTH SIDE OF LEVEE.

RHO&M Daily Field Report

Date	08/10/11	Plant	ALF		Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High 92	Low 70	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency:		Date & Time of Notification:	

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ar Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	14	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:		Completed By:	WILLIAM DAVIS

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley	8	DOZER	B-83	8	357600
Nhite	8	TRAC HOE	C-63	8	357600
Smalley	8	TRAC HOE	C-68	8	357601
Boswell		BOBCAT	RENTAL	8	356030
Plez		SPOTTER			357601
Walker	8	SPOTTER		8	356030
Turner	8	SPOTTER		8	356030
'.Partee	8	WATER TRUCK	WT-44	8	357704

P RIM DITCH,ROLLED ASH, PADDED POND. DUST CONTROL.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
Plez	8	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date	08/11/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High: 93	Low 78
Rain Gauge Reading:					

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing], Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency:

Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ar Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation	
o "A"	0	0	0	0	0
o "B"	0	0	0	0	0
o "C"	n/a	n/a	n/a	n/a	n/a
o "D"	n/a	n/a	n/a	n/a	n/a

Constraints / Expectation

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	13	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:

Completed By: WILLIAM DAVIS

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley	8	DOZER	B-83	8	357600
Nhite	8	TRAC-HOE	C-63	8	357600
Smalley	8	TRAC-HOE	C-68	8	357601
Boswell	7	GREASE TRUCK	GT-52	7	357704
Plez	3	SPOTTER		3	357601
Walker	8	SPOTTER		8	356030
Turner	8	SPOTTER		8	356030
'.Partee	4	WATER TRUCK	WT-44	4	357704
Boswell	2	BOBCAT	RENTAL	2	356030

P RIM DITCH,ROLLED ASH, PADDED POND. DUST CONTROL.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date	08/12/11	Plant	ALF		Partner	TRANS ASH
oject No.	357	Weather Conditions :	CLEAR	High 90	Low 72	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

O DEFICIENCY FOUND

ho Was Notified of Deficiency:

Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations	0	0
fety Coaching		0	Safety Coaching		0

fety / Environmental:

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
/ Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	14	0	0	8
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:

Completed By: Michael Gerbus

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	8				357905
Mosley	8	DOZER	B-83	8	357600
Vhite	8	TRAC-HOE	C-63	8	357600
Smalley	8	TRAC-HOE	C-68	8	357601
Boswell	8	GREASE TRUCK	GT-52	8	357704
Plez	3	SPOTTER		3	357601
Walker	8	SPOTTER		8	356030
Turner	8	SPOTTER		8	356030
'.Partee	4	WATER TRUCK	WT-44	4	357704

P RIM DITCH,ROLLED ASH, PADDED POND. DUST CONTROL.

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID
'. Davis	2				356023
Plez	4	water pumps	P-92	8	356023
			P-93	8	356023
			P-35	8	356023

:WATERED MANHOLE, DEWATERED DREDGE CELL.

RHO&M Daily Field Report

Date	08/13/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions :	High	Low	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

ho Was Notified of Deficiency: | Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
terventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	0	0	0	0
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:

Completed By: Michael Gerbus

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

O TRANS ASH EMPLOYEES ON SITE

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

RHO&M Daily Field Report

Date	08/14/11	Plant	ALF	Partner	TRANS ASH
oject No.	357	Weather Conditions :	High	Low	Rain Gauge Reading:

aily Facility Observation; List deficiencies found beyond Routine Maint. items (Boils, Freeboard, Seeps [new or changes to existing] , Sloughs Spillways)

ho Was Notified of Deficiency: | Date & Time of Notification:

Safety Statistics	Current	Year to Date Totals	Environmental Statistics	Current	Year to Date Totals
ear Misses		0	Near Misses		0
st Aides		0	REE's		0
cordable		0	NOV's		0
erventions & Observations		0	Interventions & Observations		0
fety Coaching		0	Safety Coaching		0

fety / Environmental Explanation

Silo Status

	Starting Level	Ending Level	Load Count	No. Pug Mills in Operation		Constraints / Expectation
o "A"	0	0	0	0	0	
o "B"	0	0	0	0	0	
o "C"	n/a	n/a	n/a	n/a	n/a	
o "D"	n/a	n/a	n/a	n/a	n/a	

Daily Production / Materials Handled

	No. of Loads	CY/TNS Hauled	CY/TNS Dipped	Hours
ttom Ash	0	0	0	0
Ash	0	0	0	0
psum Hauled	0	0	0	0
psum Dipped	0	0	0	0
iler Slag	0	0	0	0
al Fine Haul	0	0	0	0
al Fine Blend	0	0	0	0
rt	0	0	0	0
nd	0	0	0	0
ck	0	0	0	0
ater/Dust Cont	0	0	0	0
edging	0	0	0	0
her	0	0	0	0
nospheres	0		0	

NOTE: Loc 1 thru Loc 3 to be used to identify / breakout sub areas such as JOF cells and CUF Gypsum Shed / Pond

Loc 1	Loc 2	Loc 3	Comments

Materials / Equipment Delivered

scription:

ant / Visitor Interface:

Completed By: William Davis

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

) TRANS ASH EMPLOYEES ON SITE

Approved Additional (T&M Work)

Man Power	Hours	Equipment Description	Equipment # / Rental	Hours	Work ID

APPENDIX A

Document 12

Sewer Force Main Temporary Bypass Plan – Selected Dwgs

38 | C | 10W505-01

PLANS FOR CONSTRUCTION

EAST DREDGE CELL
FORCEMAIN TEMPORARY BYPASS
WORK PLAN 5 (ALF-110216-WP-5)
ALLEN FOSSIL PLANT

MEMPHIS, TENNESSEE

PREPARED FOR

TENNESSEE VALLEY AUTHORITY

PREPARED BY

Stantec

Stantec Consulting Services Inc.
601 Grassmere Park Road, Ste. 22
Nashville, Tennessee
37211
Tel. 615.885.1144
Fax 616.885.1102
www.stantec.com

INDEX OF SHEETS

SITE LOCATION MAP
NOT TO SCALE

RECORD DRAWING

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	05/03/12	RGS	PS	SFF	SFF	SEB	MST	JCK	–	–	–
ISSUED AS-BUILT AS PER WORK PLAN 5 (ALF-110216-WP-5)											
R 0	02/16/11	RGS	PS	RGS	SFF	SEB	MST	JCK	–	–	–
ISSUED FOR CONSTRUCTION											

DISCIPLINE INTERFACE
1
2
3
4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
EAST DREDGE CELL
FORCEMAIN TEMPORARY BYPASS
COVER SHEET
WORK PLAN 5 (ALF-110216-WP-5)

RICHARD G. SCHUFF — STATE OF TENNESSEE — No. 00101950 — 05/03/2012

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
R.G. SCHUFF	P. SILPACHARN	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

Stantec Consulting Services Inc.
601 Grassmere Park Road
Suite 22
Nashville, Tennessee 37211
Tel. 615.885.1144
Fax 616.885.1102
www.stantec.com

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 02/16/11 | 38 | C | 10W505-01 | R 1

STANTEC	1
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

38 | C | 10W505-02

GENERAL NOTES

1. DEFINITIONS: WHENEVER THE FOLLOWING TERMS ARE USED IN THESE PLANS FOR CONSTRUCTION, IT IS UNDERSTOOD THAT THEY REPRESENT THE FOLLOWING:

   CONTRACTOR: THE TENNESSEE VALLEY AUTHORITY (TVA) CIVIL PROJECTS OR OTHER TVA OR PRIVATE CONTRACTING ENTITY WHICH IS RESPONSIBLE FOR CONSTRUCTION FOR THIS PROJECT (OR THEIR DESIGNEE).

   TDEC: TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION WHICH IS THE REGULATORY AUTHORITY FOR THE SITE.

   ENGINEER: STANTEC CONSULTING SERVICES INC.

   OWNER: TENNESSEE VALLEY AUTHORITY – ALLEN FOSSIL PLANT IS THE OWNER AS REFERRED TO IN THESE PROJECT DOCUMENTS.

   TDOT: THIS MEANS THE TENNESSEE DEPARTMENT OF TRANSPORTATION AND SPECIFICALLY REFERENCES THE "STANDARD TECHNICAL SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", CURRENT EDITION. ANY MATERIAL DESIGNATED AS "TDOT" IS TO CONFORM TO THE MATERIAL STANDARDS NOTED AND PLACEMENT/INSTALLATION METHODOLOGY SPECIFIED IN THE CURRENT EDITION OF THE "STANDARD TECHNICAL SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION".

   CONSTRUCTION QUALITY CONTROL (QC) PLAN: REFERS TO A DOCUMENT THAT ESTABLISHES MINIMUM QUALITY CONTROL REQUIREMENTS, TESTING FREQUENCY AND QUALITY OVERSIGHT RESPONSIBILITY.

   COAL COMBUSTION PRODUCTS (CCP) INCLUDING BOTTOM ASH AND FLY ASH.

   CONSTRUCTION MANAGER: RESPONSIBLE FOR CONSTRUCTION ACTIVITY TO INCLUDE BUT NOT BE LIMITED TO THE CHARACTER AND SEQUENCE OF WORK, COORDINATION AND SCHEDULING.
2. THESE PLANS FOR CONSTRUCTION ARE PRESENTED AS AN AID IN PROJECT CONSTRUCTION BUT SHOULD NOT BE CONSTRUED AS THE ONLY REFERENCE NEEDED. CONTRACTOR SHALL BECOME FAMILIAR WITH, AND ADHERE TO THE QC PLAN AND APPLICABLE ENVIRONMENTAL AND SAFETY REGULATIONS.
3. TOPOGRAPHIC INFORMATION SHOWN IN THE PLANS FOR CONSTRUCTION IS DATED AND DOES NOT REFLECT CHANGES SINCE THE TIME OF THE SURVEY.
4. THE CONTRACTOR SHALL PROTECT ALL WORK AND STAGING AREAS FROM INTRUSION BY UNAUTHORIZED PERSONNEL.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR HEALTH AND SAFETY OF ITS PERSONNEL AND SHALL MEET INDUSTRY STANDARD REQUIREMENTS. THE CONTRACTOR SHALL ADHERE TO OWNER REQUIREMENTS FOR SAFETY AND CONSTRUCTION.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL ACCESS ROADS, STAGING AREAS AND STORAGE AREAS USED DURING CONSTRUCTION, AND SHALL RESTORE SAID AREAS TO THEIR ORIGINAL CONDITION, OR BETTER ONCE CONSTRUCTION IS COMPLETE UNLESS THE OWNER GIVES WRITTEN PERMISSION TO THE CONTRACTOR TO RETAIN THE AREA "AS IS".
7. THE CONTRACTOR SHALL CONDUCT ALL OPERATIONS IN ACCORDANCE WITH APPLICABLE ENVIRONMENTAL PERMITS, RULES, LAWS AND REGULATIONS.
8. THE CONTRACTOR IS RESPONSIBLE FOR SITE DRAINAGE THROUGHOUT CONSTRUCTION AND SHALL INSTALL TEMPORARY DRAINAGE STRUCTURES OR PUMP WATER AS NECESSARY TO PREVENT INTERFERENCE WITH THE WORK. SUCH TEMPORARY DRAINAGE FEATURES SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OF ENVIRONMENTAL PERMITS AND THE ALLEN FOSSIL PLANT NPDES PERMIT.
9. MATERIALS DELIVERED FOR INCORPORATION INTO THE WORK SHALL BE TEMPORARILY STORED IN AREAS SELECTED BY THE CONTRACTOR AND APPROVED BY TVA. MATERIALS SHALL BE STORED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
10. THE CONTRACTOR SHALL CONTROL FUGITIVE DUST EMISSIONS DURING CONSTRUCTION IN SUCH A MANNER AS TO COMPLY WITH APPLICABLE REGULATIONS. DUST CONTROL MEASURES SHALL BE SUBJECT TO APPROVAL OF THE QC MANAGER AND THE OWNER.
11. ALL PIPE TRENCHING SHALL BE CONDUCTED IN STRICT ACCORDANCE WITH APPLICABLE TVA AND OSHA PROCESS AND PROCEDURE REQUIREMENTS.
12. CERTIFICATIONS OF MATERIAL QUALITY AND CONFORMANCE TO PROJECT REQUIREMENTS SHALL BE SUBMITTED TO THE QC MANAGER FOR APPROVAL PRIOR TO INSTALLATION.
13. THE OWNER WILL PROVIDE CONSTRUCTION LAYOUT SURVEYING SERVICES. SURVEY CONTROL WILL BE BASED ON GPS SURVEYING TECHNIQUES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION OF ALL CONSTRUCTION RELATED SURVEYING. ANY ESTABLISHED OWNER BENCH MARKS OR OTHER MONUMENTS SHALL BE PRESERVED AND PROTECTED. ANY ESTABLISHED MARKER OR BENCHMARK THAT IS DAMAGED BY CONSTRUCTION ACTIVITIES SHALL BE REPLACED BY OWNER SURVEYING SERVICES.
14. THE CONSTRUCTION MANAGER SHALL COMMUNICATE CONSTRUCTION ISSUES, PROBLEMS OR DISCREPANCIES IN THE PLANS FOR CONSTRUCTION TO THE ENGINEER OF RECORD AND OWNER IMMEDIATELY UPON BECOMING AWARE OF SUCH PROBLEMS.
15. HIGH DENSITY POLYETHYLENE (HDPE) PIPE SHALL BE PRESSURE TESTED IN ACCORDANCE WITH ASTM F2164-10 STANDARD PRACTICE FOR FIELD LEAK TESTING OF POLYETHYLENE PRESSURE PIPING SYSTEMS USING HYDROSTATIC PRESSURE. TEST PRESSURE SHALL BE 65 PSI.
16. CONTRACTOR SHALL NOTIFY THE U. S. ARMY CORPS OF ENGINEERS ONE WEEK PRIOR TO BEGINNING EXCAVATION IN THE NORTH LEVEE.

MATERIAL SPECIFICATIONS:

1. RIP-RAP SHALL MEET TDOT SPECIFICATIONS FOR MATERIALS AND INSTALLATION-CLASS A-3.
2. HIGH DENSITY POLYETHYLENE (HDPE) PIPE SHALL BE DR-17, DIPS HDPE PIPE OR APPROVED EQUIVALENT.
3. AGGREGATE BACKFILL STONE SHALL MEET TDOT SPECIFICATION SECTION 903.
4. DUCTILE IRON FITTINGS SHALL BE COATED ON THEIR INTERIOR WITH INDURON PROTECTO 401 CERAMIC EPOXY.
5. RESTRAINED FLANGE ADAPTERS SHALL BE EBBA IRON SERIES 2100 OR APPROVED EQUIVALENT.
6. PVC MANHOLE LINING SHALL BE SPRAY APPLIED SOLVENTLESS ELASTOMERIC POLYURETHANE COATING-SPECTRASHIELD OR APPROVED EQUIVALENT.
7. GRANULATED BENTONITE SHALL BE ENVIROPLUG #16 BY WYO-BEN INC. OR APPROVED EQUIVALENT.
8. EXPOSED STRUCTURAL STEEL SHALL BE GALVANIZED OR COATED WITH BE EPOXY COATED (PRIMER: 2-3 MILS PLYAMIDOAMINE EPOXY (TNEC SERIES N69 HI-BUILD EPOXOLINE OR EQUAL) TOP COAT: 2-3 MILS HIGH BUILD ACRYLIC POLYURETHANE (TNEMEC SERIES 1074 OR 1075 OR APPROVED EQUIVALENT))
9. JOINT RESTRAINT SHALL BE MEGALUG SERIES 1100 OR APPROVED EQUIVALENT

SUBMITTAL REQUIREMENTS:

1. SUBMITTALS (PRODUCT DATA) SHALL BE PROVIDED TO THE QC MANAGER IN QUADRUPLICATE OR ELECTRONICALLY BY EMAIL PRIOR TO PURCHASING OF MATERIALS.
2. SUBMITTALS SHALL BE MADE FOR ALL MATERIALS AND PRODUCTS FURNISHED BY THE CONTRACTOR FOR INCORPORATION INTO THE WORK.
3. WITHIN 10 DAYS OF NOTICE OF AWARD, CONTRACTOR SHALL PROVIDE A DETAILED CONSTRUCTION SCHEDULE AND A LIST OF SUBMITTALS TO BE PROVIDED.
4. SUBMITTALS SHALL BE PROVIDED FOR, BUT NOT LIMITED TO, THE FOLLOWING MATERIALS:
   - STONE (#57, #67, #9, CLASS A-3 RIP-RAP)
   - PIPE AND FITTINGS (PE AND DIP)
   - CONCRETE MIX, REBAR, GROUT FOR DOWELS, AND OTHER CONCRETE ACCESSORIES
   - GRANULAR BENTONITE
   - FLANGE ADAPTERS AND JOINT RESTRAINERS
   - EPOXY COATING

PROJECT PHASING

UNLESS OTHERWISE APPROVED BY THE ENGINEER, CONTRACTOR SHALL USE THE FOLLOWING GENERAL SEQUENCE OF CONSTRUCTION IN ACCOMPLISHING THIS PROJECT:

PRIOR TO PUMP SYSTEM SHUTDOWN

1. LOWER WATER LEVEL IN THE DREDGE CELL TO ±220.0' MSL
2. CONSTRUCT DIVIDER DIKE TO INITIAL CUT/FILL ELEVATIONS (DETAIL 1/4).
3. PLACE RIP-RAP AND CHOKE STONE (DETAIL 1/4)
4. BUILD NEW 30" PIPELINE ACROSS POND FROM APPROXIMATELY STA 0+70 TO STA 9+42 (SHEET 03)
5. REMOVE EXISTING 48" RISER SECTIONS, CONE, CASTING AND LID AT THE DISCHARGE MANHOLE (STA 0+00)
6. REMOVE THE TRANSITION SLAB.
7. FORM AND POUR NEW RECTANGULAR JUNCTION BOX RISER SECTION (SHEET 05)
8. FABRICATE INTERNAL HDPE PIPING FOR MANHOLE (DETAIL 1/04 AND SECTION A-A' ON SHEET 05)
9. FOUR-HOUR SYSTEM SHUT DOWN FOR TEST FIT.
10. TEST FIT INTERNAL HDPE PIPING SECTION.
11. REPEAT 9. AND 10. AFTER MODIFICATIONS OF HDPE PIPE SECTION IF NEEDED.
12. PLACE BOTTOM ASH FILL AROUND MANHOLE TO SECONDARY FILL ELEVATION (DETAIL 1/4)
13. TRENCH AND INSTALL 24" AND 30" HDPE FROM MANHOLE AT STA 0+00 TO STA 0+70.
14. NOTIFY USACE OF EXCAVATION IN LEVEE 1 WEEK PRIOR TO BEGINNING.
15. EXCAVATE TO EXPOSE CONNECTION LOCATION AT MANHOLE
16. DEMO MANHOLE AT STA 10+45
17. INSTALL DIP AND FITTINGS FROM ~STA 10+00 TO MANHOLE INCLUDING FIRST VERTICAL 90° BEND
18. FABRICATE DIP SECTION TO FIT BETWEEN FIRST VERTICAL 90° BEND AND TOP OF EXISTING 30x30 TEE (2 BENDS PLUS 3 STRAIGHT SPOOL PIECES).
19. DEMO MANHOLE AT STA 10+00

DURING 12-HOUR PUMP SYSTEM SHUTDOWN

CREW #1(AT STA 10+45-NORTH END OF PROJECT)

1. CUT ~ 6-FT 30" DIP PIPE SECTION (DETAIL 2/4). ATTACH SLEEVES FOR CONTINGENT USE
2. REMOVE MJ PLUG FROM TOP OF EXISTING 30" TEE
3. INSTALL PRE ASSEMBLED 30" DIP U SECTION.
4. REMOVE DIP PIPE CONNECTED TO DOWNSTREAM SIDE OF EXISTING 30" TEE AND INSTALL MJ PLUG

CREW #2 (AT STA 0+00-DISCHARGE MANHOLE)

1. INSTALL 6" GROUT PIPE RISER AND BULKHEAD (DETAIL 1/4)
2. INSTALL 24" HDPE FABRICATED PIPE SECTION AND CONNECT TO 24" FLANGE OUTSIDE MANHOLE (DETAIL 1/4)
3. PLACE STONE FILL AROUND BASE OF FABRICATED PIPE SECTION AND GROUT PIPE IN BOTTOM OF DISCHARGE MANHOLE
4. AFTER COMPLETION OF ALL TASKS BY CREWS #1 AND #2 RESTART SEWAGE PUMPS.

AFTER SYSTEM STARTUP

AT ~ STA 9+81 – 10+45

1. INSTALL 90° ELBOW, RISER AND BLIND FLANGE ON OLD 30"
2. PLACE AND COMPACT GRANULATED BENTONITE
3. COMPLETE TRENCH BACKFILL
4. PLACE JERSEY BARRIERS
5. COMPLETE STONE RAMP OVER PIPE CROSSING
6. INSTALL JERSEY BARRIERS

AT STA 0+00

1. FORM AND POUR CONCRETE AROUND A-LOK FIELD SLEEVE.
2. REINSTALL TRANSITION SLAB
3. INSTALL NEW 48" RISER SECTIONS, CONE, CASTING AND COVER
4. INSTALL VENT PIPE AND GROUT RISER PIPE ABOVE SLAB LEVEL
5. BACKFILL WITH BOTTOM ASH TO FINAL FILL ELEVATION

LATER ACTIVITIES (NOT IN CURRENT SCOPE)

1. GROUT EXISTING 30" DIP
2. CONSTRUCT PERMANENT REPLACEMENT FORCE MAIN
3. EXCAVATE DISCHARGE MANHOLE TO 229'
4. REMOVE CASTING, CONE AND 48" RISERS AND TRANSITION SLAB
5. REMOVE 24" HDPE FABRICATED S-CURVE PIPE SECTION.
6. GROUT 42" SANITARY SEWER TO DOWNSTREAM MANHOLE
7. FILL DISCHARGE MANHOLE WITH (CONCRETE) TO TRANSITION SLAB LEVEL.

NOTE:
CITY OF MEMPHIS IS RESPONSIBLE FOR CONFIRMING ADEQUACY OF PUMPING SYSTEM CONNECTED TO THIS FORCE MAIN AND WILL ASSUME OWNERSHIP/OPERATION OF FORCE MAIN UPON COMPLETION OF PROJECT.

*ESTIMATED QUANTITIES

ITEM	QUANTITY	UNITS
30" DR-17 DIPS HDPE PIPE	1,100	LF
30" HDPE 90° BEND	2	EA
30"x24" HDPE REDUCER	1	EA
24" FABRICATED PIPE SECTION (IN MH)	1	EA
24" DR-17 DIPS HDPE PIPE	20	LF
30" COUPLINGS	2	EA
30" HDPE VERTICAL BEND-FIELD FABRICATE	1	EA
30" DIP 90° BEND-MJ	2	EA
30" DIP TEE-MJ	1	EA
30" DUCTILE IRON PIPE	40	LF
30" DIP TO HDPE RESTRAINED ADAPTER	1	EA
30" DIP MJ PLUG	1	EA
30" MEGALUG SERIES 1100	7	EA
30" DIP BLIND FLANGE	1	EA
30" DIP 90° BEND-FLG	1	EA
30" DIP FLANGE ADAPTER	1	EA
MODIFICATIONS TO DISCHARGE MANHOLE**	1	LS
#57 OR #67 STONE INSIDE DISCHARGE MH	11	TONS
RIP-RAP TYPE A-3	750	TONS
#57, #67 OR #9 CHOKE STONE	175	TONS
#57 STONE TRENCH BACKFILL	550	TONS
GRANULATED BENTONITE	78,000	LB
PIPE BOLLARDS	13	EA
METALLIC UNDERGROUND TAPE	1,000	LF
CRUSHER RUN STONE	100	CY
CONCRETE JERSEY BARRIERS	2	EA
DEMO MANHOLES	2	EA
REMOVE EXISTING 30" DIP	55	LF

*ESTIMATED BID QUANTITIES ONLY. TABLE NOT UPDATED POST-CONSTRUCTION TO REFLECT ACTUAL QUANTITIES INSTALLED.

** MANHOLE MODIFICATION INCLUDES ALL CONCRETE, REINFORCING, STRUCTURAL STEEL, PRE-CAST MANHOLE SECTIONS, A-LOK SLEEVE, POLYURETHANE COATING, VENT PIPE AND GROUT PIPE

RECORD DRAWING

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	06/22/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	–	–	–
REVISION NO. 1											
R 2	07/10/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	–	–	–
REVISION NO. 2											
R 3	05/03/12	RGS	RGS	SFF	SFF	SEB	MST	JCK	–	–	–
ISSUED AS-BUILT AS PER WORK PLAN 5 (ALF-110216-WP-5)											
R 0	02/16/11	RGS	PS	RGS	SFF	SEB	MST	JCK	–	–	–
ISSUED FOR CONSTRUCTION											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: NONE EXCEPT AS NOTED

YARD
EAST DREDGE CELL

FORCEMAIN TEMPORARY BYPASS GENERAL NOTES WORK PLAN 5 (ALF-110216-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
R.G. SCHUFF	P. SILPACHARN	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

RICHARD G. SCHUFF — STATE OF TENNESSEE — 05/03/2012

Stantec

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ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 02/16/11 | 38 | C | 10W505-02 | R 3

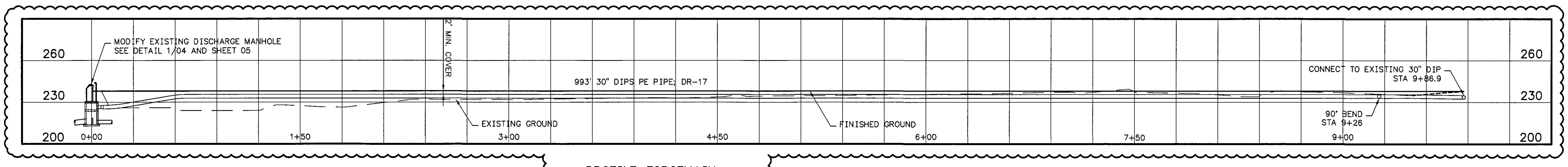
PLOT FACTOR:1
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

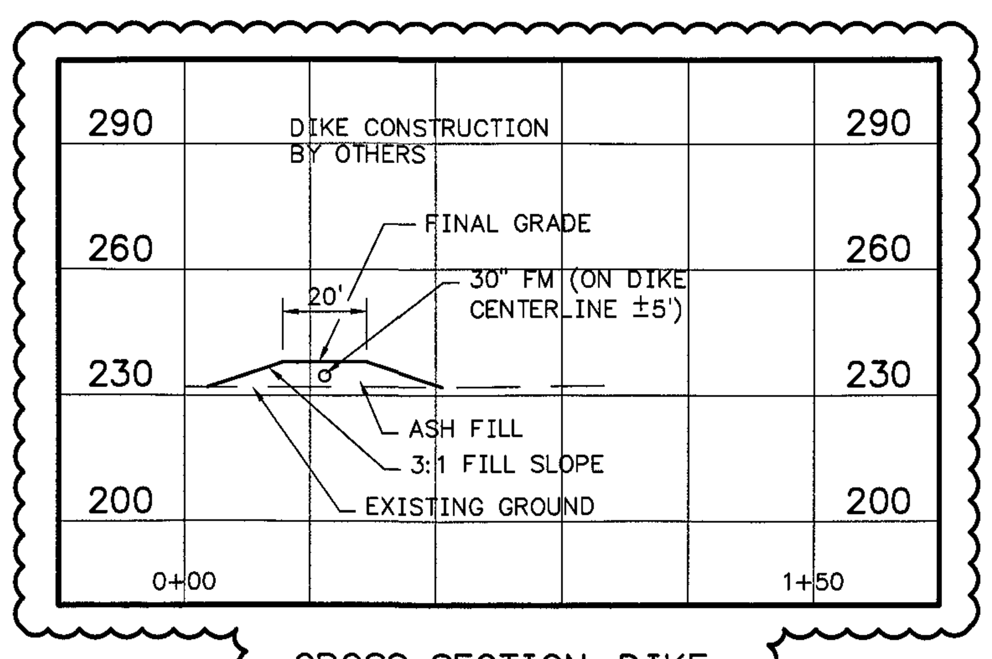
STANTEC | 3
TASK COMPLETED BY: | REV NO.

PLOT DATE: 05/02/2012

GRADING AND PIPE ALIGNMENT PLAN
SCALE: 1"=50'



PROFILE-FORCEMAIN
SCALE: 1"=30'



CROSS SECTION-DIKE
SCALE: 1"=30'

SURVEY CONTROL NOTE:
A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

NOTE:
THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES INCLUDING A HYDROGRAPHIC SURVEY DRAWING FILE (ALLEN_HYDRO_10-6-10_B.DWG). HORIZONTAL COORDINATES ARE REFERENCED TO TENNESSEE STATE PLANE COORDINATE SYSTEM, NAD 27. ELEVATIONS ARE BASED ON NGVD 29.

RECORD DRAWING

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	07/10/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	–	–	–
REVISION NO. 1											
R 2	05/03/12	RGS	RGS	SFF	SFF	SEB	MST	JCK	–	–	–
ISSUED AS-BUILT AS PER WORK PLAN 5 (ALF-110216-WP-5)											
R 0	02/16/11	RGS	PS	RGS	SFF	SEB	MST	JCK	–	–	–
ISSUED FOR CONSTRUCTION											

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
EAST DREDGE CELL

FORCEMAIN TEMPORARY BYPASS PLAN AND PROFILE WORK PLAN 5 (ALF-110216-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
R.G. SCHUFF	P. SILPACHARN	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S TURNBOW	J.C. KAMMEYER

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ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 02/16/11 | 38 | C | 10W505-03 | R 2

PLOT FACTOR:50
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

STANTEC 2
TASK COMPLETED BY: REV NO.

PLOT DATE: 05/03/2012

RECORD DRAWING

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV ID
R 1	06/22/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	–	–	–
REVISION NO. 1											
R 2	07/10/11	RGS	RGS	PVK	SFF	SEB	MST	JCK	–	–	–
REVISION NO. 2											
R 3	05/03/12	RGS	RGS	PVK	SFF	SEB	MST	JCK	–	–	–
ISSUED AS-BUILT PER WORK PLAN 5 (ALF-110216-WP-5)											
R 0	02/16/11	RGS	PS	RGS	SFF	SEB	MST	JCK	–	–	–
ISSUED FOR CONSTRUCTION											

SCALE: AS SHOWN — EXCEPT AS NOTED

YARD
EAST DREDGE CELL

FORCEMAIN TEMPORARY BYPASS DETAILS
WORK PLAN 5 (ALF-110216-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
R.G. SCHUFF	P. SILPACHARN	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

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AUTOCAD R 2000 | DATE 02/16/11 | 38 | C | 10W505-04 | R 3

PLOT FACTOR:5
W_TVA

STANTEC | 3
TASK COMPLETED BY: | REV NO.

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RECORD DRAWING

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 1	05/03/12	TSM	TMM	RGS	SFF	SEB	MST	JCK	–	–
	ISSUED AS-BUILT AS PER WORK PLAN 5 (ALF-110216-WP-5)									
R 0	02/16/11	TSM	TMM	RGS	SFF	SEB	MST	JCK	–	–
	ISSUED FOR CONSTRUCTION									

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
EAST DREDGE CELL

FORCEMAIN TEMPORARY BYPASS MANHOLE DETAILS AND SECTIONS WORK PLAN 5 (ALF-110216-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
T.S. MARSHALL	T.M. MYERS	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

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AUTOCAD R 2000 | DATE 02/16/11 | 38 | C | 10W505-05 | R 1

PLOT FACTOR:2
W_TVA

STANTEC 1
TASK COMPLETED BY: REV NO.

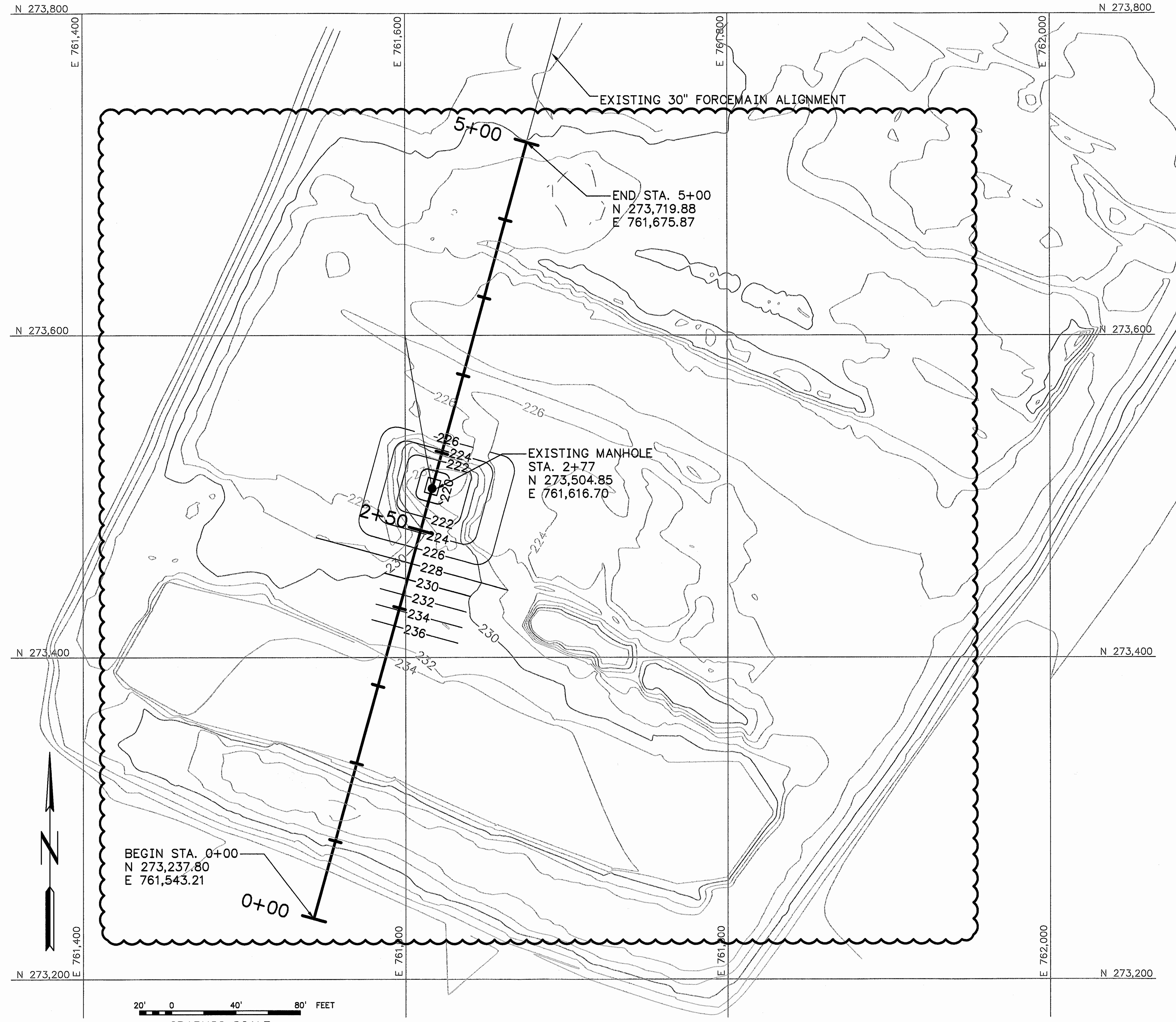
C.A.D. DRAWING DO NOT ALTER MANUALLY

SURVEY CONTROL NOTE:

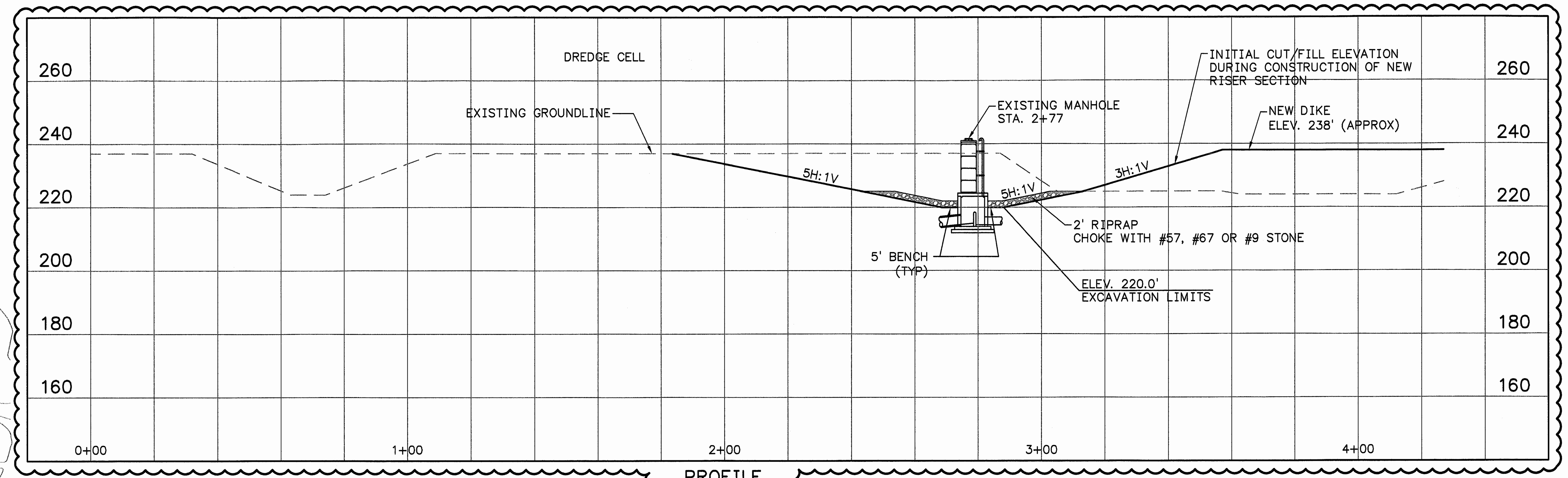
A GLOBAL POSITIONING SYSTEM (GPS) BASE STATION HAS BEEN ESTABLISHED AND TRANSFORMATION PARAMETERS DETERMINED BY TVA USING SELECTED SURVEY CONTROL MONUMENTS. CONTACT WITH TVA SURVEYING DEPARTMENT (423)751-8416 OR (423)751-2571 SHALL BE MADE BEFORE ANY SURVEY OR CONSTRUCTION WORK IS COMMENCED. BASE STATION FREQUENCIES AND TRANSFORMATION PARAMETERS WILL BE PROVIDED TO THE CONTRACTOR FOR USE IN CONSTRUCTION ACTIVITIES AT THE SITE. PREVIOUSLY USED OR ESTABLISHED CONTROL POINTS AND MONUMENTS SHALL NOT BE USED BY THE CONTRACTOR WITHOUT PRIOR APPROVAL BY TVA SURVEYING DEPARTMENT.

NOTE:

THE TOPOGRAPHIC MAPPING PRESENTED ON THIS DRAWING WAS PROVIDED TO STANTEC BY TVA SURVEYING AND PROJECT SERVICES INCLUDING A HYDROGRAPHIC SURVEY DRAWING FILE (ALLEN_HYDRO_10-6-10_B.DWG). HORIZONTAL COORDINATES ARE REFERENCED TO TENNESSEE STATE PLANE COORDINATE SYSTEM, NAD 27. ELEVATIONS ARE BASED ON NGVD 29.



PLAN – PROPOSED EXCAVATION
SCALE: 1"= 40'



PROFILE
SCALE: 1"= 20'

NOTES:

A. ALL EXCAVATIONS SHALL BE OBSERVED BY A STANTEC GEOTECHNICAL ENGINEER OR HIS REPRESENTATIVE.

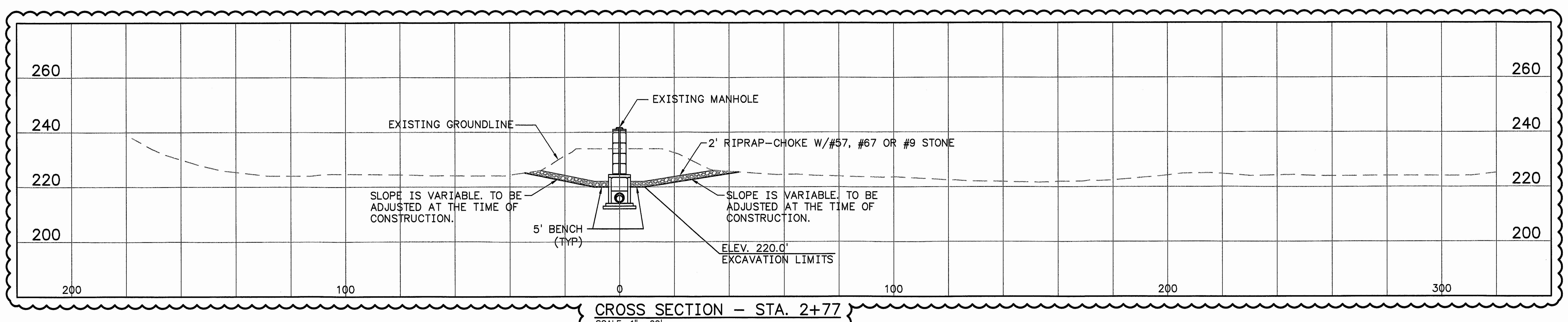
B. THE 5H:1V EXCAVATION SLOPE ON THE SOUTH SIDE OF THE MANHOLE SHALL BE CONSIDERED PRELIMINARY. A FLATTER SLOPE OR ADDITIONAL STABILIZATION MEASURES MAY BE REQUIRED BASED ON ACTUAL FIELD CONDITIONS AS DETERMINED BY THE GEOTECHNICAL ENGINEER AT THE TIME OF CONSTRUCTION.

C. EXCAVATIONS MAY EXTEND BELOW THE EXPECTED DREDGE CELL WATER LEVEL AT THE TIME OF CONSTRUCTION. THEREFORE, PUMPING FROM SUMP PITS AT THE BOTTOM OF EXCAVATION WILL BE REQUIRED TO KEEP THE WORK AREA FREE OF WATER.

D. A 2-FOOT (MINIMUM) THICK LAYER OF RIP-RAP SHALL BE PLACED AT THE BOTTOM OF EXCAVATION TO STABILIZE WET ASH. THE RIP-RAP SHALL BE PLACED AROUND THE MANHOLE AND ON THE TOE OF THE EXCAVATION SLOPE EXTENDING 2 FEET ABOVE THE WATER ELEVATION (ASSUMED WATER ELEVATION IS 224'). CHOKE WITH #57, #67 OR #9 STONE.

THE ENGINEERING ANALYSES ARE BASED ON THE FOLLOWING ASSUMPTIONS:

1. THE SUBSURFACE PROFILE BENEATH THE EAST DREDGE CELL IS IDENTICAL TO THE NORTH DIKE AND EAST DIKE. STANTEC DID NOT PERFORM ANY SUBSURFACE EXPLORATION WITHIN THE DREDGE CELL TO VERIFY SUBSURFACE CONDITIONS ASSUMED IN THE ANALYSES.
2. WATER LEVEL USED IN THE ANALYSES ARE VALID. A DREDGE CELL WATER ELEVATION OF 224 FEET WAS USED IN THE ANALYSES. IN EXCAVATIONS EXTENDING BENEATH EL. 224, THE WATER TABLE IS ASSUMED TO MATCH THE GROUND ELEVATION. WATER PUMPING MAY BE REQUIRED TO MAINTAIN THE WATER LEVEL AT OR BELOW ELEVATION 224 FEET.
3. NO PIEZOMETER DATA IS AVAILABLE TO VERIFY PIEZOMETRIC SURFACE AFTER DRAWDOWN.
4. MANHOLE DESIGN INFORMATION OBTAINED FROM TVA DRAWING 10W208-3 IS VALID.
5. MATERIAL PROPERTIES USED IN THE ANALYSES ARE VALID. THESE VALUES ARE BASED ON LABORATORY TEST DATA FOR THE NORTH DIKE, EAST DIKE AND OTHER TVA SITES. NO LABORATORY TESTING WERE PERFORMED USING MATERIALS FROM THE DREDGE CELL TO VERIFY THESE VALUES.
6. THE HYDROGRAPHIC SURVEY PERFORMED IN OCTOBER, 2010 IS STILL VALID. THE GROUND SURFACE DATA WITHIN THE DREDGE CELL IS BASED ON THE HYDROGRAPHIC SURVEY.



CROSS SECTION – STA. 2+77
SCALE: 1"= 20'

RECORD DRAWING

PROJECT REVISION HISTORY

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R 1	05/03/12	RGS	PS	SFF	SFF	SEB	MST	JCK	–	–	–
ISSUED AS-BUILT AS PER WORK PLAN 5 (ALF-110216-WP-5)											
R 0	02/16/11	RGS	PS	RGS	SFF	SEB	MST	JCK	–	–	–
ISSUED FOR REVIEW											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
EAST DREDGE CELL

FORCEMAIN TEMPORARY BYPASS
EXCAVATION PLAN
WORK PLAN 5 (ALF-110216-WP-5)

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
R.G. SCHUFF	P. SILPACHARN	R.G. SCHUFF	S.F. FIELD	S.E. BENNETT	M.S. TURNBOW	J.C. KAMMEYER

RICHARD G. SCHUFF — STATE OF TENNESSEE — 05/03/2012

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ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 02/16/11	38	C	10W505-06	R 1

PLOT FACTOR:40
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

STANTEC 1
TASK COMPLETED BY: REV NO.

10W505-06 C 38

APPENDIX A

Document 13

Stantec Hydrologic and Hydraulic Analysis Report – East Ash Pond

Report of Hydrologic and Hydraulic Analysis

Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby 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

September 30, 2010

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

September 30, 2010 rpt_001_175660008

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

Re: Report of Hydrologic and Hydraulic Analysis
Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

Dear Ms. Bennett:

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

The normal freeboard conditions were assessed and found to be adequate (>5 feet) according to TVA guidelines. Storm surge conditions were also assessed. In general, the capacity of the Ash Pond and Stilling Pond along with their spillways was found to be adequate for the assessed storm events up to and including the Probable Maximum Precipitation (PMP) storm event. However, if during the course of operations TVA were to alter the current weir configuration between the Ash Pond and the Stilling Pond it is possible for the Ash Pond to overtop its embankment. A closure scenario for the Ash Pond was also modeled and it was found that there is a chance the Stilling Pond could overtop during the PMP event under that scenario. Stantec recommends that TVA assess the risk associated with a PMP event in comparison with the amount of time this pond system will remain in operation, and then consider options to reduce the flooding potential for this pond system if performance during the PMP event is required. Additional information from the modeling efforts and an explanation of the modeling results is included herein.

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

Sincerely,

STANTEC CONSULTING SERVICES INC.

Nathan Jean, PE
Water Resource Engineer

Erman Caudill, PE, CFM
Project Manager

/cmw

Report of Hydrologic and Hydraulic Analysis

Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

September 30, 2010

Report of Hydrologic and Hydraulic Analysis

Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

Table of Contents

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(Continued)
List of Tables

Table **Page No.**

List of Appendixes

Executive Summary

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

The current conditions at the plant consist of two ponds, an Ash Pond and a Stilling Pond. The Ash Pond captures process water and storm water runoff from a 128 acre drainage area consisting of the pond itself, the coal stockpile, the dredge cell area and part of the power plant. The Stilling Pond captures storm water runoff from a 9.9 acre drainage area consisting of the pond itself. The Ash Pond is hydraulically connected to the downstream Stilling Pond by an adjustable weir. The Stilling Pond spillway system consists of 4 concrete risers 4-feet in diameter with 3-foot diameter outlet pipes. Storm water runoff must enter the Ash Pond then flow into the Stilling Pond before it can enter the adjacent McKellar Lake.

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

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

- Aside from the principal spillway systems, there are no defined emergency spillways or overflow paths. Ponds similar in size and capacity to these typically have emergency spillway systems to prevent overflows.
    - If the principal spillways were to become clogged, or if a heavy rainfall event were to cause any of the ponds to overtop, there are no defined and protected overflow paths to help prevent erosion of the dikes.
- Based on modeling the current conditions, the Ash Pond and Stilling Pond appear able to pass the 6-hr PMP event through the existing principle spillway system without overtopping the embankment.
- It is possible for the Ash Pond to overtop by altering the weir structure that separates the Ash Pond and Stilling Pond. If the weir were to extend from the pond floor to an elevation of approximately 231 feet, the Ash Pond could overtop during the 6-hr PMP event. The key to preventing this overtopping appears to be maintaining a minimum of 6 feet of freeboard for normal operations.

- A potential closure scenario was modeled assuming the Ash Pond would be closed and the Stilling Pond would act as a settling basin prior to discharge. As presently configured and under this operational scenario, the Stilling Pond appears unable to pass the 6-hr PMP event through the spillway system without overtopping the embankment. It does appear to be able to pass the 100-year storm event.
    - In the event of a PMP storm during close-out conditions, the Stilling Pond would overtop the dike between the Stilling Pond and the McKellar Lake.

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

- Assess the risk of a PMP event occurring during the remaining life of the pond system.
- The current pond and riser configuration can convey each of the modeled storm events, so Stantec recommends operating the weir structure as presently configured and maintaining at least 6 feet of freeboard in the Ash Pond and Stilling Pond.
- Consider installing an emergency spillway between the Stilling Pond and McKellar Lake for the closeout condition or closeout the Stilling Pond and the Ash Pond at the same time.

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

Report of Hydrologic and Hydraulic Analysis

Ash Pond and Stilling Pond
TVA Allen Fossil Plant
Shelby County, Tennessee

1. Introduction

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

The current conditions at the plant consist of two ponds, an Ash Pond and a Stilling Pond. The Ash Pond captures process water and storm water runoff from a 128 acre drainage area consisting of the pond itself, the coal stockpile, the dredge cell area and part of the power plant. The Stilling Pond captures storm water runoff from a 9.9 acre drainage area consisting of the pond itself. The Ash Pond is hydraulically connected to the downstream Stilling Pond by an adjustable weir. The Stilling Pond spillway system consists of 4 concrete risers 4-feet in diameter with 3-foot diameter outlet pipes. Storm water runoff must enter the Ash Pond then flow into the Stilling Pond before it can enter the adjacent McKellar Lake.

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

2. Modeling Assumptions

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

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

c. The model takes into account the tailwater effect from downstream water surface elevation (WSEL) of the Stilling Pond on the upstream outfall structures in the Ash Pond. A rating curve was developed for each storm event for the Ash Pond utilizing an expected downstream WSEL for the Stilling Pond. The expected WSEL of the Stilling Pond was generated using the HEC-HMS model as if the outfall structures of the Ash Pond were free flowing. This generated a maximum WSEL for the Stilling Pond. This WSEL was then used to generate a new rating curve for the Ash Pond. This gives a conservative value for the Ash Pond rating curves because only the maximum WSEL of the downstream Stilling Pond was used. All rating curves can be reviewed in Appendix C

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

e. Contours were not available in the coal stack area and the buildings and operational facilities surrounding the coal stack. Field observations and aerial photography were used to estimate the area draining to the Ash Pond.

f. Detailed survey information was not available for the minimum weir elevation for structure that separates the Ash Pond from the Stilling Pond. Maximum possible weir height was noted in the TVA survey. It is known that there is an opening below the weir because the water surface elevations are noted as being the same for the Ash Pond and the Stilling Pond in the TVA provided survey and were observed as such during the site visit. It was assumed for this model that the weir is at a maximum elevation and that the opening from the pond floor to the bottom of the weir is 2 feet.

g. As a boundary condition, calculations were made to determine what the maximum height of the weir could be raised to and still have enough volume in the pond to store runoff from the 6-hr probable maximum precipitation (PMP) event. This calculation assumes that the weir touches the pond floor. The 6-hr PMP event Ash Pond elevation was used to determine what amount of storage the pond could be reduced by and still contain the runoff from the 6-hr PMP event. Iterations were made to determine to what elevation the weir could be raised before the volume reduction was greater than the remaining volume in the Ash Pond after the 6-hr PMP event.

h. The Stilling Pond overflow structures 1 and 2 are assumed to have no tailwater effects.

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

3. Methodology

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

A HEC-HMS model was developed and used to simulate runoff from the probable maximum precipitation (PMP) event in accordance with TVA design guidance. SCS Type II rainfall depth for the 1, 10, 15, 50, and 100-year storm events were taken from NOAA Atlas 14 for Memphis, TN. Rainfall depth for the 6-HR PMP event was taken from NOAA HMR-56. From Figure 23 *"6 hr 1-mi^2 PMP (in.) – eastern half of Tennessee River Watershed"* of HMR-56, the 6-HR PMP rainfall depth for the Allen site was estimated to be 29.8 in.

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

A flow schematic, dated January 2010, shows the various flows into the Ash Pond. The combination of all plant process flows into the Ash pond generates a flow of 9.05 MGD (14 cfs). This value is used as a constant flow source in the model (Appendix E).

4. Input Data

4.1. Watershed Parameters

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

Table 1. Watershed Parameters

Name	Drainage Area (acres)	Receiving Pond	Curve Number	*Percent Impervious	Estimated Lag Time (min)
Ash Pond Area	128	Ash Pond	84	43	3
Stilling Pond Area	10	Stilling Pond	82	76	3

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

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

4.2. Rainfall Data

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

Rainfall depth for the 6-Hr PMP event was taken from NOAA HMR-56. From Figure 23 *"6 hr 1-mi^2 PMP (in.) – eastern half of Tennessee River Watershed"* of HMR-56, the 6-hr PMP rainfall depth for the Allen Fossil Plant site was estimated at 29.8 in.

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

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

Table 2. Rainfall Depths

Storm Event	Rainfall Depth (inches)
1-year 24-hour	3.35
10-year 24-hour	5.58
25-year 24-hour	6.51
50-year 24-hour	7.25
100-year 24-hour	8.02
6-hour PMP	29.8

4.3. Spillway Data

TVA drawings 10N226, 10N227, 10N229-1, 10N229-2 depict the 4 risers in the Stilling Pond. The 4 riser structures as shown in these drawings were consistent with conditions observed during the field visit. Data was used from these drawings in the H&H analysis.

An Excel file provided by TVA titled "TVA Spillway Concrete Top Survey", dated 1-23-09, lists multiple plants with surveyed riser elevations and approximate riser invert elevations. Data was used from these files in the H&H analysis. See Appendix C.

Table 3. Existing Principal Spillway Data – Ash Pond

Pond	Weir/Orifice Structure	Weir Length (ft)	Weir Elevation (ft)	Orifice Opening (ft^2)	Orifice Invert (ft)	Data Source
Ash Pond	1	28.5	234.9	57	222.00	TVA Survey 08/02/2010 & Stantec Assumptions

Table 4. Existing Principal and Overflow Spillway Data – Spilling Pond

Pond	Riser Structure	Riser Diameter (inches)	Rim Elevation (ft)	Pipe Diameter (inches)	Pipe Invert (ft)	Data Source
Stilling Pond	East	48	229.47	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**
Stilling Pond	West	48	229.47	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**
Stilling Pond	Overflow 1	48	230.43	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**
Stilling Pond	Overflow 2	48	230.30	36	216.00	**TVA drawings 10N226, 10N227, 10N229-1, 10N229-2**

Table 5. Pond Tailwater Elevations

Pond	Weir/Riser Structure	Storm Event	Tailwater Elevation (ft)
Ash Pond	1	1-YR	230.3
Ash Pond	1	10-YR	230.6
Ash Pond	1	25-YR	230.7
Ash Pond	1	50-YR	230.8
Ash Pond	1	100-YR	230.8
Ash Pond	1	6-hr PMP	232.7
Stilling Pond	East and West	1, 10-YR	217.0
Stilling Pond	East and West	25,50,100-YR,6-hr PMP	225.0

4.4. Pond Overflow and Normal Pool

Table 6 shows the embankment elevation and the assumed normal pool elevations at each pond. The normal pool elevations were assumed to be equal to the principal riser elevation in the pond.

Table 6. Pond Overflow Elevation

Pond Name	Embankment Elevation (feet)	Normal Pool Elevation (feet)
Ash Pond	236	229.5
Stilling Pond	236	229.5

4.5. Stage Storage Data

Stage storage curves were developed for each pond based on data provided by TVA. For the Ash Pond and Stilling Pond, the stage-storage data came from AutoCAD files *79016c-cb05-06-09.dwg*. Stage-storage curves are included in Appendix C for each pond. Survey data utilized can be found in Appendix D.

4.6. Spillway Rating Curves

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

The model takes into account a tailwater effect of the downstream WSEL of the Stilling Pond on the upstream outfall structures in the Ash Pond. A rating curve was developed for each storm event for the Ash Pond utilizing an expected downstream WSEL for the Stilling Pond. Tailwater elevation for the Stilling Pond was assumed to be the 100-YR WSEL of the receiving waterway (McKellar Lake), for the 25, 50, 100-yr and 6 hr PMP events. Tailwater elevation for the Stilling Pond was assumed to be the 10-yr WSEL of the receiving waterway (McKellar Lake), for the 1 and 10-yr events. Rating curves for each pond are attached in Appendix C.

4.7. Plant Process Flow

A flow schematic, dated January 2010, shows the various flows into the Ash Pond. The combination of all plant process flows into the Ash Pond generates a flow of 9.05 MGD (14 cfs). This value is used as a constant flow source in the model.

5. Results

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

5.1. Capacity and Freeboard Results

Estimated peak pool elevations for the storms analyzed are shown in Table 7. Table 8 shows the estimated peak pond inflows associated with each event and Table 9 shows estimated peak pond outflows associated with each event.

Table 7. Estimated Peak Pool Elevations – Existing Conditions

Pond Name	1-year 24-hour storm (ft)	10-year 24-hour storm (ft)	25-year 24-hour storm (ft)	50-year 24-hour storm (ft)	100-year 24-hour storm (ft)	6-hr PMP storm (ft)
Ash Pond	230.4	230.8	231.0	231.1	231.3	234.8
Stilling Pond	230.3	230.6	230.7	230.7	230.8	232.7

Table 8. Estimated Peak Pond Inflows – Existing Conditions

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hr PMP storm (cfs)
Ash Pond	483	879	1046	1178	1316	2807
Stilling Pond	119	162	192	207	232	450

Table 9. Estimated Peak Pond Outflows – Existing Conditions

Pond Name	1-year 24-hour storm (cfs)	10-year 24-hour storm (cfs)	25-year 24-hour storm (cfs)	50-year 24-hour storm (cfs)	100-year 24-hour storm (cfs)	6-hr PMP storm (cfs)
Ash Pond	100	129	149	158	174	384
Stilling Pond	62	100	123	134	152	393

6. Conclusions and Recommendations

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

- Aside from the principal spillway systems, there are no defined emergency spillways or overflow paths. Ponds similar in size and capacity to these typically have emergency spillway systems to prevent overflows.
  - o If the principal spillways were to become clogged, or if a heavy rainfall event were to cause any of the ponds to overtop, there are no defined and protected overflow paths to help prevent erosion of the dikes.
- Based on modeling the current conditions, the Ash Pond and Stilling Pond appear able to pass the 6-hr PMP event through the existing principle spillway system without overtopping the embankment.
- It is possible for the Ash Pond to overtop by altering the weir structure that separates the Ash Pond and Stilling Pond. If the weir were to extend from the pond floor to an elevation of approximately 231 feet, the Ash Pond could overtop during the 6-hr PMP event. The key to preventing this overtopping appears to be maintaining a minimum of 6 feet of freeboard for normal operations.

- A potential closure scenario was modeled assuming the Ash Pond would be closed and the Stilling Pond would act as a settling basin prior to discharge. As presently configured and under this operational scenario, the Stilling Pond appears unable to pass the 6-hr PMP event through the spillway system without overtopping the embankment. It does appear to be able to pass the 100-year storm event.
  - In the event of a PMP storm during close-out conditions, the Stilling Pond would overtop the dike between the Stilling Pond and the McKellar Lake.

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

- Assess the risk of a PMP event occurring during the remaining life of the pond system.
- The current pond and riser configuration can convey each of the modeled storm events, so Stantec recommends operating the weir structure as presently configured and maintaining at least 6 feet of freeboard in the Ash Pond and Stilling Pond.
- Consider installing an emergency spillway between the Stilling Pond and McKellar Lake for the closeout condition or closeout the Stilling Pond and the Ash Pond at the same time.

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

7. References

"Allen Fossil Plant Flow Schematic Diagram." NPDES Permit No. TN0005452FP August, 2003.

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Brater, E.F. and King, H.W. Handbook of Hydraulics. 1976.

Chow, V.T., Open Channel Hydraulics. 1959.

Federal Emergency Management Agency, Flood Insurance Study, Shelby County, TN. September 100, 2006.

Schreiner, Louis C. and Riedel, John T. (National Weather Service), "Hydrometeorological Report No. 51, Probable Maximum Precipitation Estimates, United States East of the 105th Meridian."

United States Department of Agriculture, Natural Resources Conservation Service, Urban Hydrology for Small Watersheds TR-55. June 1986.

US Department of Agriculture (USDA) National Engineering Handbook Part 630 – Hydrology. May, 2007.

US Department of Agriculture, Natural Resources Conservation Service, Earth Dams and Reservoirs TR-60. July, 2005.

US Department of Transportation Federal Highway Administration (FHWA) "Hydraulic Design of Highway Culverts, Hydraulic Design Series No. 5 (HDS-5)." 1985.

Appendix A

Connectivity Map

SaveDate: 2010/09/01 1:30 PM Login: Gaskill, CW
u:\175660008\h&h\analysis\allen\drawing\79016c-cb05-06-09.dwg

Stantec Consulting Services Inc.
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Legend

Notes

Client/Project
TVA
ALLEN H&H

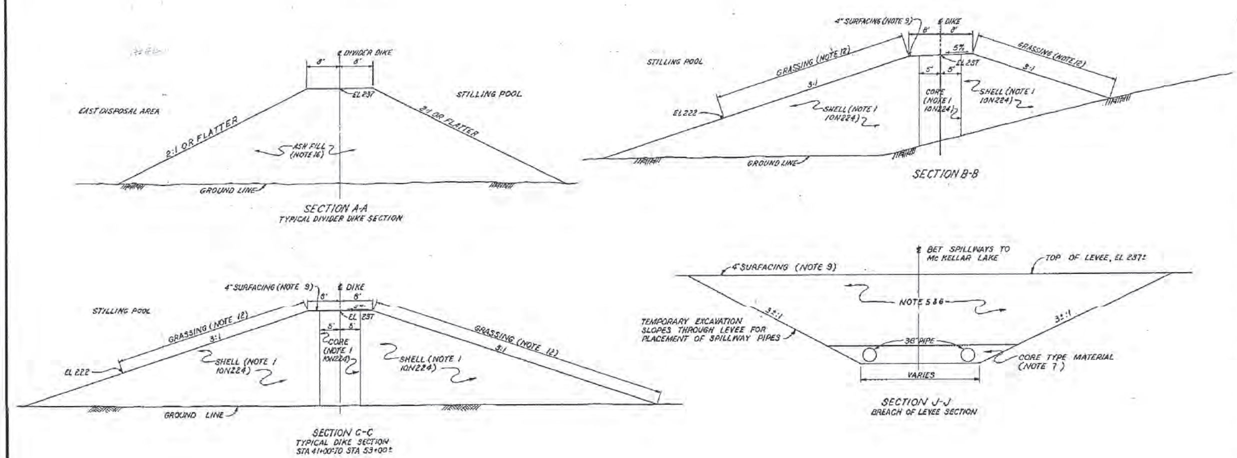
Figure No.

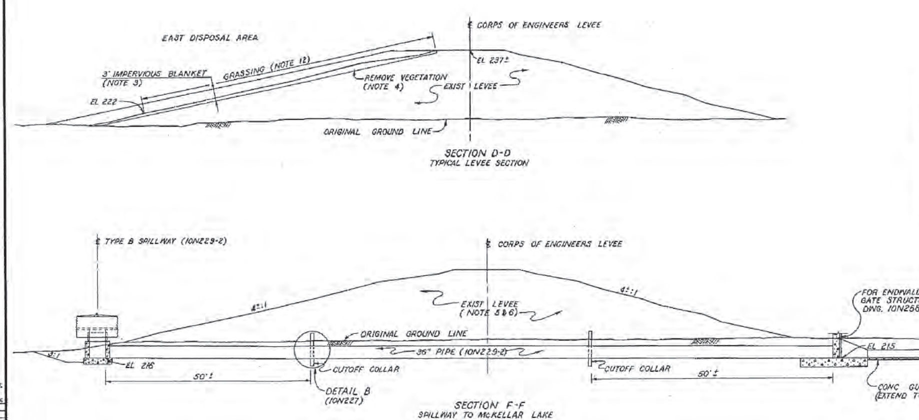
Title

Appendix B

TVA Historical Drawings

38 | C | 10N226





NOTES:

1. FOR GENERAL NOTES SEE DRAWING 10N224.
2. FIELD SHALL USE EXTREME CAUTION TO AVOID DAMAGE TO THE 60" RAW SEWER LINE LYING OUTSIDE AND SOUTH OF THE DISPOSAL AREA.
3. THE IMPERVIOUS BLANKET PLACED ON THE LANDSIDE SLOPE OF THE CORPS OF ENGINEERS' LEVEE SHALL BE OF CORE TYPE MATERIAL (MINIMUM 3 FEET THICK). PLACEMENT AND COMPACTION SHALL BE AS SPECIFIED FOR THE CORE MATERIAL (NOTE 1, 10N224). AT THE INTERSECTION OF THE LEVEE AND THE DIKE, THE IMPERVIOUS BLANKET ON THE SLOPE OF THE LEVEE SHALL EXTEND TO INTERSECT WITH THE CORE OF THE DIKE.
4. EXISTING VEGETATION SHALL BE STRIPPED FROM THE LANDSIDE SLOPE OF THE LEVEE BEFORE PLACEMENT OF THE IMPERVIOUS BLANKET AND STOCKPILED. AFTER PLACEMENT OF THE IMPERVIOUS BLANKET, THE STOCKPILED MATERIAL SHALL BE UNIFORMLY SPREAD OVER THE IMPERVIOUS BLANKET. THIS SLOPE SHALL THEN BE SEEDED PER NOTE 7, DRAWING 10N224.
5. THE BREACH IN THE LEVEE FOR CONSTRUCTION OF THE DISCHARGE SPILLWAYS TO McKELLAR LAKE SHALL NOT BE MADE UNTIL THE DIKES FOR THE EAST DISPOSAL AREA ARE CONSTRUCTED.
6. MATERIALS EXCAVATED FROM THE BREACH IN THE LEVEE SHALL BE STOCKPILED AND USED IN REFILLING THE BREACH AFTER INSTALLATION OF THE SPILLWAY PIPES. COMPACTION SHALL BE AS SPECIFIED FOR OTHER DIKE MATERIALS, (NOTE 1, 10N224), WITH CONTROLS AS ESTABLISHED BY THE CENTRAL SOILS LABORATORY. THE EXISTING LEVEE BREACH WHERE THE ASH SLUICE PIPES ARE LOCATED SHALL BE FILLED WITH SHELL TYPE MATERIAL, (NOTE 1, 10N224). THE LANDSIDE LEVEE SLOPE AT BOTH BREACHES SHALL BE PROVIDED WITH THE IMPERVIOUS BLANKET OF NOTE 3. SEVERAL ROUTINE FILL COMPACTION TESTS SHALL BE MADE ON THE COMPACTED FILL IN EACH BREACH, WELL DISTRIBUTED IN PLAN AND ELEVATION TO OBTAIN GOOD REPRESENTATION THROUGHOUT THE FILLS.
7. PIPE BACKFILL AND BEDDING MATERIAL SHALL CONSIST OF CORE TYPE MATERIAL (NOTE 1 10N224) AND SHALL BE PLACED IN ACCORDANCE WITH SECTION 7.7 OF THE G-9 SPECIFICATIONS.
8. THE ASH, HYDRAULIC FILL, AND FOUNDATION STRIPPING, EXCEPT FOR THAT REMOVED FROM THE CORPS OF ENGINEERS' LEVEE EXCAVATED FOR CONSTRUCTION OF THE EAST DISPOSAL AREA DIKES SHALL BE DISPOSED OF INSIDE THE DISPOSAL AREA.
9. CRUSHED STONE OR GRAVEL SURFACING, 4" THICK, SHALL BE APPLIED FOR THE FULL WIDTH OF THE TOP OF DIKE AND ALL DISTURBED SECTIONS OF THE CORPS OF ENGINEERS' LEVEE IN ACCORDANCE WITH SECTION 210 OF T-1 SPECIFICATIONS.
10. RIPRAP SHALL BE PLACED AT SPILLWAY OUTLETS AS SHOWN. AT LEAST 50%, BY WEIGHT, OF THE RIPRAP SHALL CONSIST OF STONES AT LEAST 200 POUNDS EACH. RIPRAP SHALL CONFORM TO SECTION 830 OF THE T-1 SPECIFICATIONS.
11. FILTER SHALL CONFORM TO SECTION 836.
12. ALL CUT AND FILL SLOPES AND OTHER DISTURBED AREAS SHALL BE SEEDED WITH TYPE 6, MIXTURE B OR TYPE 7, MIXTURE A IN ACCORDANCE WITH SECTION 180 OF T-1 SPECIFICATIONS. DEPENDING ON THE TIME OF CONSTRUCTION, IT MAY BE NECESSARY TO PROVIDE A TEMPORARY COVER (TYPE 9) ON THE DIKE AND LEVEE SLOPES. ALL GRASSED AREAS SHALL BE FERTILIZED AND MULCHED IN ACCORDANCE WITH SECTIONS 180 AND 182 RESPECTIVELY.
13. CONCRETE GUTTER SHALL CONFORM TO SECTION 390. INTERMEDIATE ANCHORS AND 3/4" EXPANSION JOINTS SHALL BE PLACED AT INTERVALS NOT TO EXCEED 50'.
14. WELDED WIRE FABRIC SHALL CONFORM TO ASTM SPECIFICATION A185 PLAIN FINISH, AND SHALL HAVE A MINIMUM LAP DISTANCE OF 6 INCHES.
15. THE MINIMUM FACTOR OF SAFETY FOR ALL LOADING CONDITIONS ON THE EAST DISPOSAL AREA IS 1.42. THIS FACTOR OF SAFETY IS FOR THE END OF CONSTRUCTION CONDITION.
16. THE DIVIDER DIKE SHALL BE CONSTRUCTED OF BOTTOM ASH PLACED IN NOT MORE THAN 9-INCH LAYERS, AND WELL COMPACTED WITH RUBBER-TIRED HAULING EQUIPMENT.

SUMMARY OF QUANTITIES EAST DISPOSAL AREA

ITEM	DESCRIPTION	QUANTITY	UNIT
101	CLEARING AND GRUBBING (DIKE)	3.4	AC.
120	CHAN EXCAV (TO HORN LAKE CUTOFF)	290	C.Y.
	ASH FILL (DIVIDER DIKE)	74,000	C.Y.
120	UNCLASSIFIED EXCAVATION (BREACH LEVEE)	4,745	C.Y.
123	EARTH BORROW - SHELL MATERIAL (DIKE)	102,000	C.Y.
	- CORE MATERIAL (DIKE)	13,500	C.Y.
	- SHELL MATERIAL (LEVEE)	5,945	C.Y.
	- CORE MATERIAL (LEVEE)	26,000	C.Y.
180	GRASSING (DIKE)	21,000	S.Y.
	GRASSING (LEVEE)	26,000	S.Y.
210	SURFACING (DIKE)	610	TONS
392	CONCRETE GUTTER (LEVEE)	300	L.F.
418	WELDED WIRE FABRIC	810	S.Y.
830	RIPRAP (DIKE)	390	C.Y.
836	FILTER (DIKE)	460	TONS

P.A. 3092
AND W.O. P33-544-62-31401-J6

COMPANION DWGS., 10N223, 224, 225, 227, 228, 229-1, 229-2
SCALE 1" = 10'

INSPECTED AND APPROVED FOR ISSUE
B.K. Montgomery

REV NO.		DATE		
2		3-16-77	REVISED RIPRAP & FILTER QUANTITIES P.A. 3076	
1		10-11-76	ADD DIVIDER DIKE - P.A. 3076; EXTEND ASH AREA DIKE TO RR FILL - P.A. 3092	

DSGN J.L. GLOVER
DRWN J.S. BERRY
CHKD R.W. SCHENK
SUPV J.L. GLOVER
ENGINEER K.W. Burnett

MAIN PLANT - ASH DISPOSAL AREAS

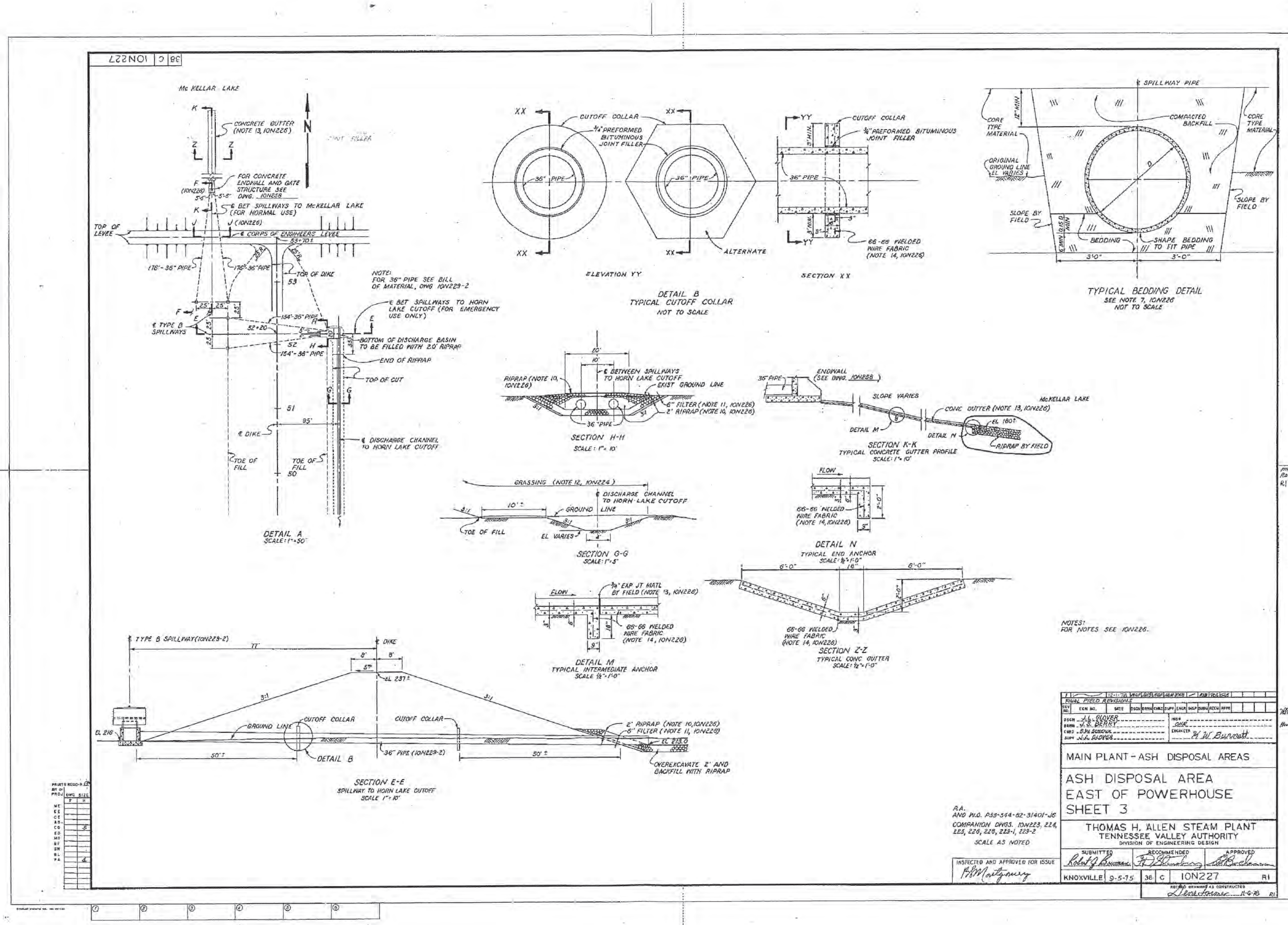
ASH DISPOSAL AREA
EAST OF POWERHOUSE
SHEET 2

THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED Robert J. Bowman | RECOMMENDED F.D. Stansbury | APPROVED

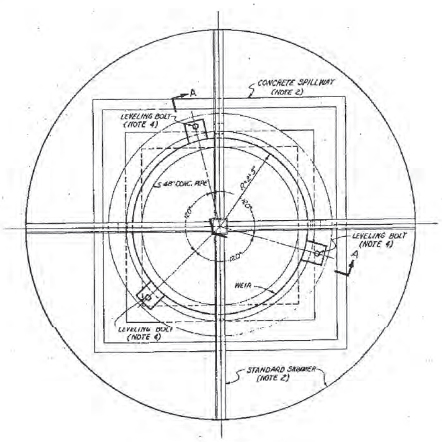
KNOXVILLE | 9-5-75 | 38 | C | 10N226 | R2

RECORD DRAWING AS CONSTRUCTED 11-6-78 R2

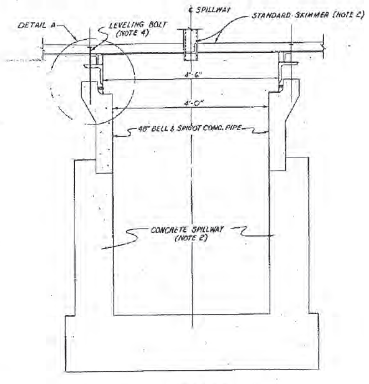


38 C 10N227
Mc KELLAR LAKE
CONCRETE GUTTER (NOTE 13, 10N226)
FOR CONCRETE ENDWALL AND GATE STRUCTURE SEE DWG. 10N688
℄ 6ET SPILLWAYS TO McKELLAR LAKE (FOR NORMAL USE)
TOP OF LEVEE
℄ CORPS OF ENGINEERS LEVEE
176'- 36" PIPE
TOP OF DIKE
NOTE: FOR 36" PIPE SEE BILL OF MATERIAL, DWG 10N229-2
℄ 8ET SPILLWAYS TO HORN LAKE CUTOFF (FOR EMERGENCY USE ONLY)
℄ TYPE B SPILLWAYS
154'- 36" PIPE
BOTTOM OF DISCHARGE BASIN TO BE FILLED WITH 2.0' RIPRAP
END OF RIPRAP
TOP OF CUT
℄ DIKE
℄ DISCHARGE CHANNEL TO HORN LAKE CUTOFF
TOE OF FILL
DETAIL A
SCALE: 1"=50'
CUTOFF COLLAR
3/4" PREFORMED BITUMINOUS JOINT FILLER
36" PIPE
ALTERNATE
ELEVATION YY
DETAIL B
TYPICAL CUTOFF COLLAR
NOT TO SCALE
6б-66 WELDED WIRE FABRIC (NOTE 14, 10N226)
SECTION XX
℄ SPILLWAY PIPE
CORE TYPE MATERIAL
COMPACTED BACKFILL
ORIGINAL GROUND LINE EL VARIES
SLOPE BY FIELD
BEDDING
SHAPE BEDDING TO FIT PIPE
TYPICAL BEDDING DETAIL
SEE NOTE 7, 10N226
NOT TO SCALE
RIPRAP (NOTE 10, 10N226)
℄ BETWEEN SPILLWAYS TO HORN LAKE CUTOFF
EXIST GROUND LINE
6" FILTER (NOTE 11, 10N226)
2' RIPRAP (NOTE 10, 10N226)
SECTION H-H
SCALE: 1"= 10'
ENDWALL (SEE DWG. 10N688)
SLOPE VARIES
CONC GUTTER (NOTE 13, 10N226)
McKELLAR LAKE
RIPRAP BY FIELD
SECTION K-K
TYPICAL CONCRETE GUTTER PROFILE
SCALE: 1"= 10'
GRASSING (NOTE 12, 10N224)
℄ DISCHARGE CHANNEL TO HORN LAKE CUTOFF
GROUND LINE
EL VARIES
SECTION G-G
SCALE: 1"=5'
DETAIL N
TYPICAL END ANCHOR
FLOW
3/4" EXP JT MATL BY FIELD (NOTE 13, 10N226)
DETAIL M
TYPICAL INTERMEDIATE ANCHOR
SECTION Z-Z
TYPICAL CONC GUTTER
NOTES: FOR NOTES SEE 10N226.
℄ TYPE B SPILLWAY (10N229-2)
℄ DIKE
CUTOFF COLLAR
36" PIPE (10N229-2)
2' RIPRAP (NOTE 10, 10N226)
6" FILTER (NOTE 11, 10N226)
OVEREXCAVATE 2' AND BACKFILL WITH RIPRAP
DETAIL B
SECTION E-E
SPILLWAY TO HORN LAKE CUTOFF
SCALE 1"= 10'
A.A. AND PLO. P38-544-82-31401-J6
COMPANION DWGS. 10N223, 224, 225, 226, 229, 229-1, 229-2
SCALE AS NOTED
INSPECTED AND APPROVED FOR ISSUE
MAIN PLANT - ASH DISPOSAL AREAS
ASH DISPOSAL AREA
EAST OF POWERHOUSE
SHEET 3
THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN
SUBMITTED
RECOMMENDED
APPROVED
KNOXVILLE 9-5-75 36 C 10N227 R1

10N229-1



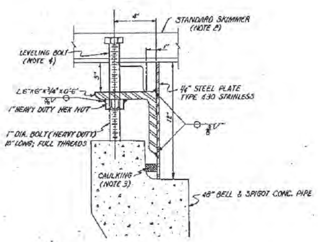
PLAN
SCALE 1"=1'-0"



SECTION A-A
SCALE 1"=1'-0"

WEIR DISCHARGE IN CUBIC FEET PER SECOND										
HEAD IN 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	.52	.72	.95	1.20	1.34
0.1	1.54	1.75	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	5.69	6.04	6.38	6.73	7.10
0.3	7.47	7.85	7.23	8.62	9.00	9.41	9.82	10.2	10.6	11.1
0.4	11.5	11.9	12.4	12.8	13.3	13.7	14.2	14.7	15.1	15.6
0.5	16.1	16.6	17.1	17.6	18.1	18.6	19.1	19.6	20.1	20.7
0.6	21.2	21.7	22.3	22.8	23.4	23.9	24.5	25.0	25.6	26.2
0.7	26.7	27.3	27.9	28.5	29.1	29.7	30.3	30.9	31.5	32.1
0.8	32.7	33.4	34.0	34.6	35.2	35.9	36.5	37.2	37.8	38.5
0.9	39.1	39.8	40.4	41.1	41.8	42.5	43.1	43.8	44.5	45.2
1.0	45.9									

NOTES:
1. ALL CONNECTIONS TO BE WELDED.
2. FOR SKIMMER AND SPILLWAY DETAILS SEE DWG. 10N229-2
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.



DETAIL A
3 REQUIRED
SCALE 3"=1'-0"

BILL OF MATERIAL				
ITEM	DESCRIPTION	NO. SPLWYS.*	PER SPLWY.	TOTAL REQD.
ANGLES	6"×6"×3/4"×0'-6"	5	3	15
BOLTS	1"×10" HEAVY DUTY (FULL THREADS) W/NUT	5	3	15
STEEL PLATE	12"×14'-2"; TYPE 430 STAINLESS	5	1	5
CAULKING	BY FIELD			

* INCLUDES 4 SPILLWAYS FOR DISPOSAL AREA EAST OF POWERHOUSE AND 1 SPILLWAY FOR DISPOSAL WEST OF POWERHOUSE.

P.A. AND W.O. P33-544-82-31401-J8

COMPANION DWGS., 10N223, 224, 225, 226, 227, 229-2

INSPECTED AND APPROVED FOR ISSUE

SCALE AS NOTED

STANDARD DRAWING

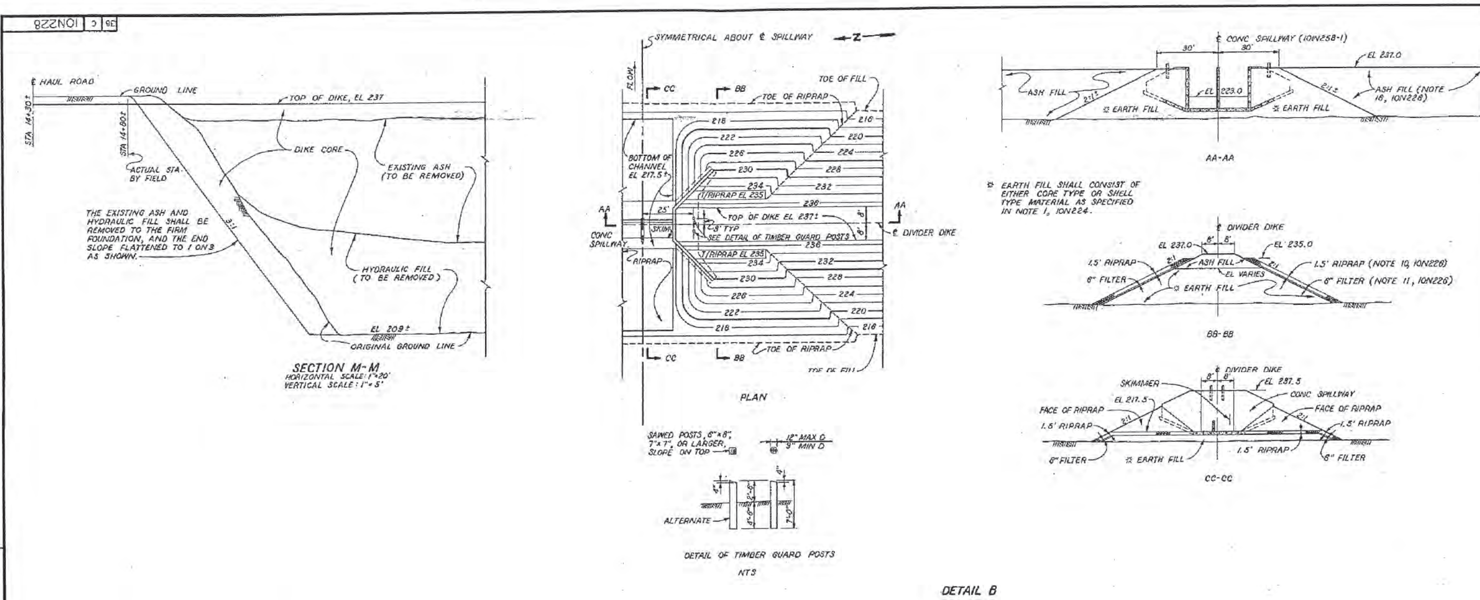
WEIR FOR ASH DISPOSAL SPILLWAY

THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

KNOXVILLE | 9-5-75 | 38 | C | 10N229-1 | R0

RECORD DRAWING AS CONSTRUCTED



P.A. 8092
AND NO. P33-544-82-31401-J6

COMPANION DWGS., 10N223, 224, 225, 226, 227, 228-1, 228-2

SCALE 1"=20' EXCEPT AS NOTED

INSPECTED AND APPROVED FOR ISSUE

1	ADDED DETAIL B P.A. 8092
DSGN	J.L. GLOVER
DRWN	J.S. BERRY
CKD	R.W. SCHENK
SUPV	J.L. GLOVER
ENGINEER	E.W. Burnett

MAIN PLANT - ASH DISPOSAL AREAS

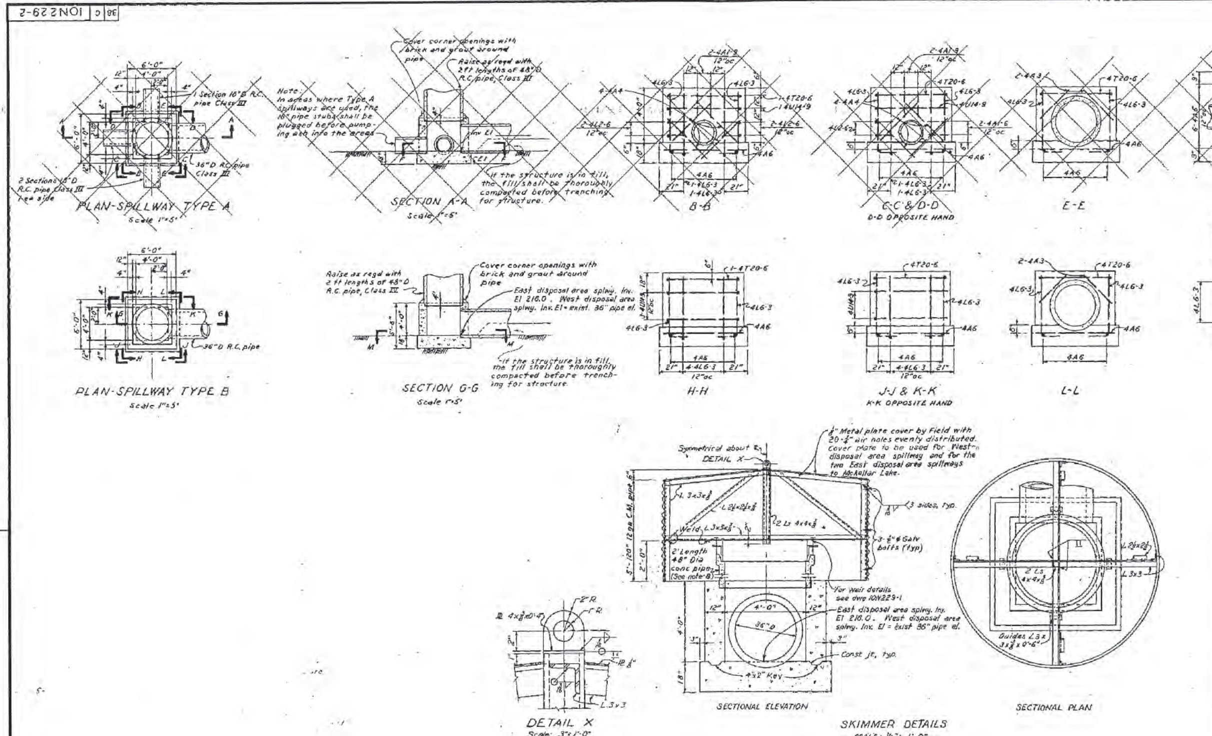
ASH DISPOSAL AREA
EAST OF POWERHOUSE
SHEET 4

THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED / RECOMMENDED / APPROVED

KNOXVILLE | 9-5-78 | 38 | C | 10N228 | R1

RECORD DRAWING AS CONSTRUCTED



SKIMMER DETAILS

SCALE: 1/2" = 1'-0"

REINFORCEMENT SCHEDULE

Location	Mark	No. of Units	Per Unit	Total Reqd	Bend Dim. a	Bend Dim. b	Bend Dim. c
Sect B-B	4T20-6	1		1	5-0	5-0	
	4U14-9	1		1	5-0	5-0	Ex
	4L6-3	1		2	2-0	Ex	
	4L2-6	1		4	1-3	Ex	
	4A4	1		4			
	4A1-9	1		2			
Sect CC & DD	4L6-3	2	2	4	2-0	Ex	
	4A4	2	4	8			
	4A1-9	2	2	4			
	4A1-6	2	2	4			
Sect E-E	4A3	1		2			
Sect F-F	4L6-3	1		4	2-0	Ex	
	4A6	1		12			

~~TYPE A SPILLWAY~~

Location	Mark	No. of Units	Per Unit	Total Reqd	Bend Dim. a	Bend Dim. b	Bend Dim. c
Sect H-H	4T20-6	1		1	5-0	5-0	
	4U14-9	1		3	5-0	5-0	Ex
	4L6-3	1		4	2-0	Ex	
Sect J-J & K-K	4L6-3	2	4	8	2-0	Ex	
Sect L-L	4A3	1		2			
Sect M-M	4L6-3	1		4	2-0	Ex	
	4A6	1		12			

TYPE B SPILLWAY

BILL OF MATERIAL

	ITEM	DESCRIPTION	NO. OF SPLWYS	PER SPLWY	TOTAL REQD
ASH DISPOSAL AREA EAST OF POWERHOUSE	401	CLASS A CONCRETE	4	5 CY	20 CY
	418	REINFORCING STEEL	4	170 LB	680 LB
	603	36" D "O" RING RUBBER GASKET REINFORCED CONCRETE PIPE - CLASS IV	4	[illegible]	660 FT
		48" D REINF CONC PIPE - CLASS IV (BELL & SPIGOT) (2' LENGTHS)	4	12 FT	48 FT
	660	120" - 12 GAGE CORRUGATED METAL PIPE	4	5 FT	20 FT
		1/2" ϕ GALVANIZED BOLT	4	12	48
		2 1/2 x 2 1/2 x 3/8 ANGLE	4	23 FT	92 FT
		3 x 3 x 3/8 ANGLE	4	67 FT	268 FT
		4 x 4 x 3/8 ANGLE	4	8 FT	32 FT
ASH DISPOSAL AREA WEST OF POWERHOUSE	401	CLASS A CONCRETE	1	5 CY	5 CY
	418	REINFORCING STEEL	1	170 LB	170 LB
	603	48" D REINF CONC PIPE - CLASS IV (BELL & SPIGOT) (2' LENGTHS)	1	12 FT	12 FT
	660	120" - 12 GAGE CORRUGATED METAL PIPE	1	5 FT	5 FT
		1/2" ϕ GALVANIZED BOLT	1	12	12
		2 1/2 x 2 1/2 x 3/8 ANGLE	1	23 FT	23 FT
		3 x 3 x 3/8 ANGLE	1	67 FT	67 FT
		4 x 4 x 3/8 ANGLE	1	8 FT	8 FT

P.A.
AND W.O. P33-544-82-31401-J6

COMPANION DRAWING: 10N223, 224, 225, 226, 227, 229-1

INSPECTED AND APPROVED FOR ISSUE

NOTES:

① SPECIFICATIONS: All work shall be done in accordance with the T-1 Specifications.

② All concrete shall be Class A in accordance with Section 400.

~~③ Where earth borrow can be obtained economically, for example, from disposal area, it may be used to raise dikes.~~

~~④ Vegetation shall be established on all earth slopes, initial and future construction. Seeding specifications to be furnished with drawings for each project. In general, Type 7 Section 180 of T-1 Specifications is recommended.~~

~~⑤ Location and elevation of the spillways shall be selected so as to maintain the depth of water in the ash pond at an absolute minimum.~~

~~⑥ Use Type A spillways for ash areas not scheduled for immediate use.~~

⑦ A section of 120" corrugated metal pipe, fully coated, shall be used for the skimmer device. All seams and joints shall be riveted. Fabrication of the pipe shall be complete prior to coating.

⑧ During initial construction, two 2' sections of 48" dia pipe shall be installed at the east disposal area spillways to Horn Lake cutoff. One 2' section of 48" dia pipe shall be installed at all other spillways.

⑨ As additional sections of 48" pipe are added, grout the joint to form a stable and water-tight connection.

⑩ Top of dike must be maintained a minimum of 4' above the elevation of water in the Ash Disposal Area.

~~⑪ As dikes are raised the Field shall provide drainage from the top and outside slopes of the dikes that will control erosion of dikes.~~

REFERENCE DRAWINGS:
30B519 REINFORCEMENT BENDING DIAGRAMS

Scale 1/8" = 1'-0"
Except as noted

STANDARD DRAWING

ASH DISPOSAL SPILLWAY

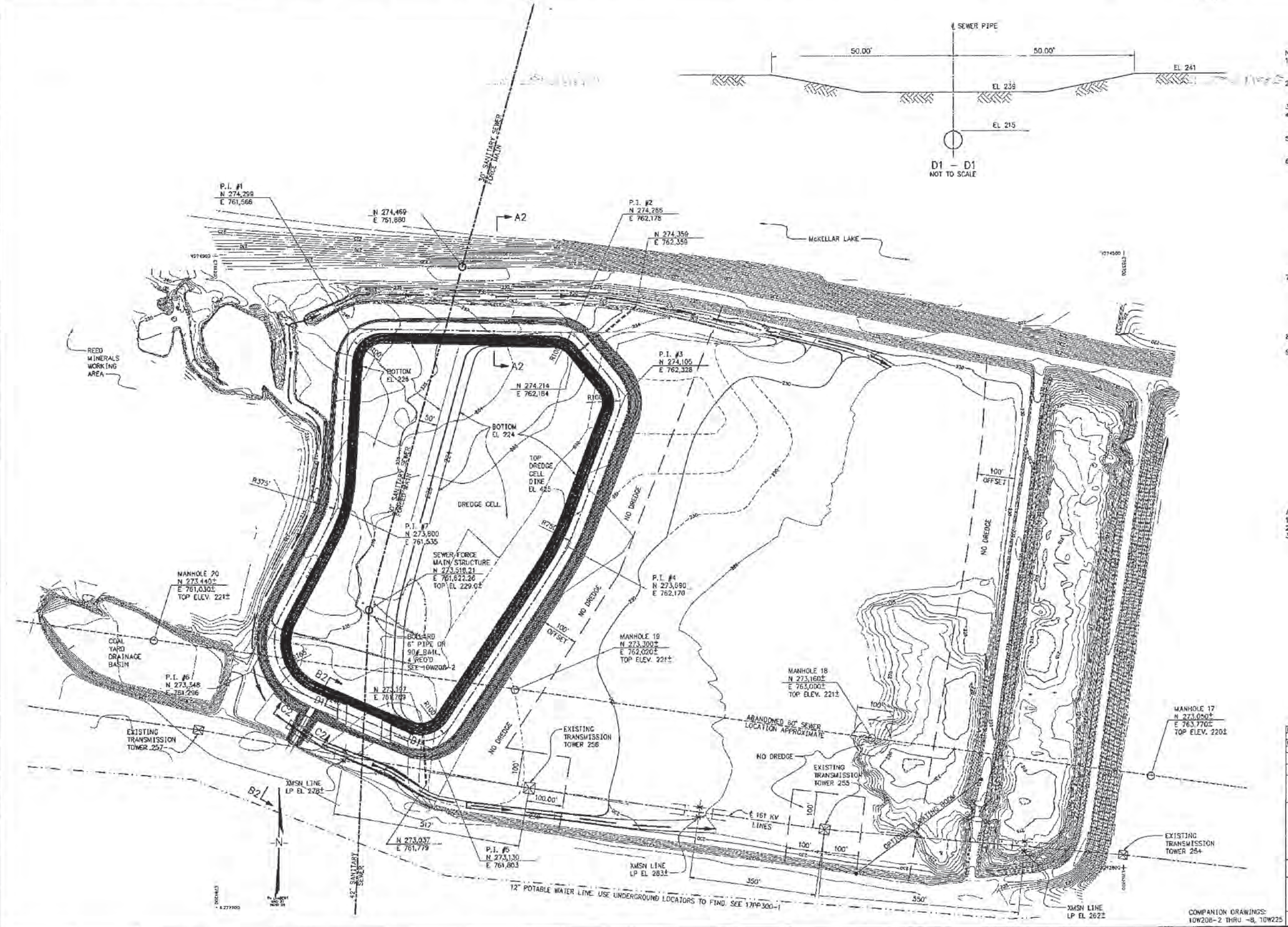
THOMAS H. ALLEN STEAM PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED | RECOMMENDED | APPROVED

KNOXVILLE | 9-5-75 | 38 | C | 10N229-2 R0

RECORD DRAWING AS CONSTRUCTED

38 C 10N229-2



NOTES:

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE T-1 GENERAL CONSTRUCTION SPECIFICATIONS, UNLESS OTHERWISE NOTED. SECTION NUMBERS REFER DIRECTLY TO THE T-1 SPECIFICATION.
2. THE AREA FOR THE BASE OF THE DIKE IS TO BE CLEARED OF VEGETATION BY SCRAPING THE SURFACE ACCORDING TO SECTION 101.
3. BASE REINFORCEMENT SHALL CONSIST OF 18" TO 24" OF BOTTOM ASH.
4. TYPE A RIPRAP SHALL BE 9" THICK. A MINIMUM OF 50% BY WEIGHT, OF THE STONES SHALL BE 25 LB. EACH AND IN ACCORDANCE WITH SECTION 575.
5. TYPE B RIPRAP SHALL BE 18" THICK. A MINIMUM OF 50% BY WEIGHT, OF THE STONES SHALL BE 100 LB. EACH AND IN ACCORDANCE WITH SECTION 575.
6. FACTORS OF SAFETY FOR THE 3.5:1 OUTSIDE SLOPE OF DREDGE CELL USING PCSTABLE 5M
   FOR Q VALUES F.S. = 2.00
   FOR RBAR VALUES F.S. = 1.51

SOIL	UNIT WEIGHT (pcf)		Q		RBAR	
	MOIST	SATURATED	c (psf)	ɸ (deg.)	c (psf)	ɸ (deg.)
EXIST. DIKE & INSITU	125	125	1000	35	1000	35
EXIST. ASH	100	100	150	25	150	25
DREDGED ASH	100	100	150	25	150	25
ASH DIKE FILL	102.8	102.8	250	28	0	30
EXIST. ASH UNDER DIKE	101	101	165	27	165	27

7. COMPACTED ASH IN DREDGE CELL DIKE TO 95% OF STANDARD PROCTOR USING COMPACTION EQUIPMENT. SPREAD ASH IN 6" TO 9" LAYERS BEFORE COMPACTION. TEST FOR COMPACTION AT LEAST ONCE PER WEEK OR EVERY 5000 CUBIC YARDS OF ASH PLACED, WHICHEVER IS MORE FREQUENT, USING NUCLEAR DENSIMETER OR EQUAL TECHNOLOGY. COMPACTION TESTING OF THE FIRST 3 FEET OF THE BASE OF THE DIKE IS OPTIONAL. RECORDS OF COMPACTION TESTING MUST BE KEPT OF THE JOB UNTIL COMPLETION AND THEN FORWARDED TO JOHN ALBRIGHT, LP 2P-C.
8. LOCATION OF DREDGE POND SPILLWAYS SUGGESTED. ANY OTHER LOCATION IN THE DREDGE POND IS ACCEPTABLE.
9. FLOATING BOOM OPTIONAL FOR CONTROL OF CENOSPHERES.

ADDITIONAL NOTES

1. FOR ADDITIONAL NOTES SEE SHEET 2
2. EXISTING CONTOURS FROM MAY 20, 2004 POND SURVEY.
3. MINIMUM CLEARANCE FROM EQUIPMENT TO 161KV TRANSMISSION LINE CONDUCTORS IS 14 FEET. MINIMUM CLEARANCE FROM 161KV CONDUCTORS TO GROUND IS 26 FEET.

COMPANION DRAWINGS: 10W208-2 THRU -8, 10W225

R 0 | OCT 07 2004 | JGA | DRD | HLP | SRC | LJP | DLL | ALFSHORF

INITIAL ISSUE PER DCA ALF-04-1001-001-R0

SCALE: 1" =100' EXCEPT AS NOTED

YARD

EAST ASH POND
DREDGE CELL
PLAN

DESIGNED BY	DRAWN BY	CHECKED BY	SUPERVISED BY	REVIEWED BY	APPROVED BY	ISSUED BY
J.G. ALBRIGHT	D.R. DODSON	H.L. PETTY	S.R. CATHEY	L.J. PETERSON	D.L. LUNDY	

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R14 | 38 | C | 10W208-1 | R 0

PLOT FACTOR:100
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

TASK COMPLETED BY: REV NO.

38 C 10W208-1

Appendix C

Rating Curves

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

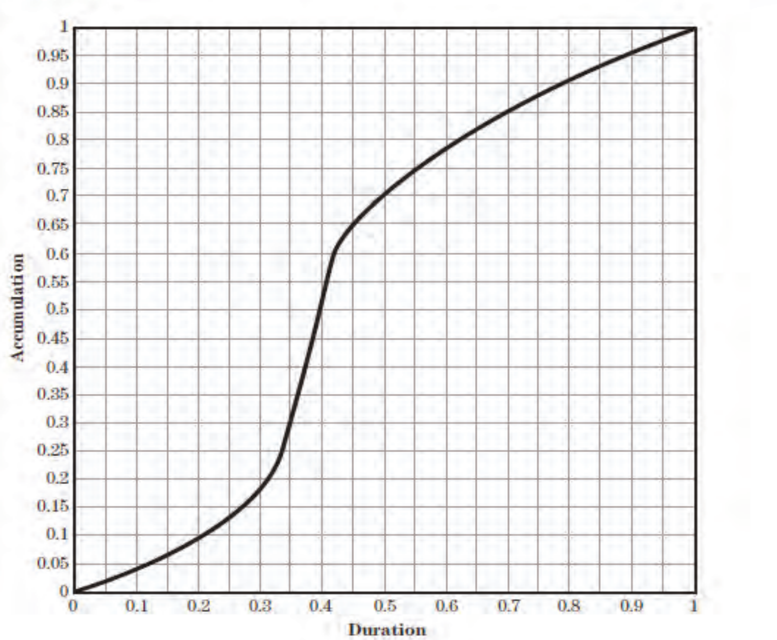
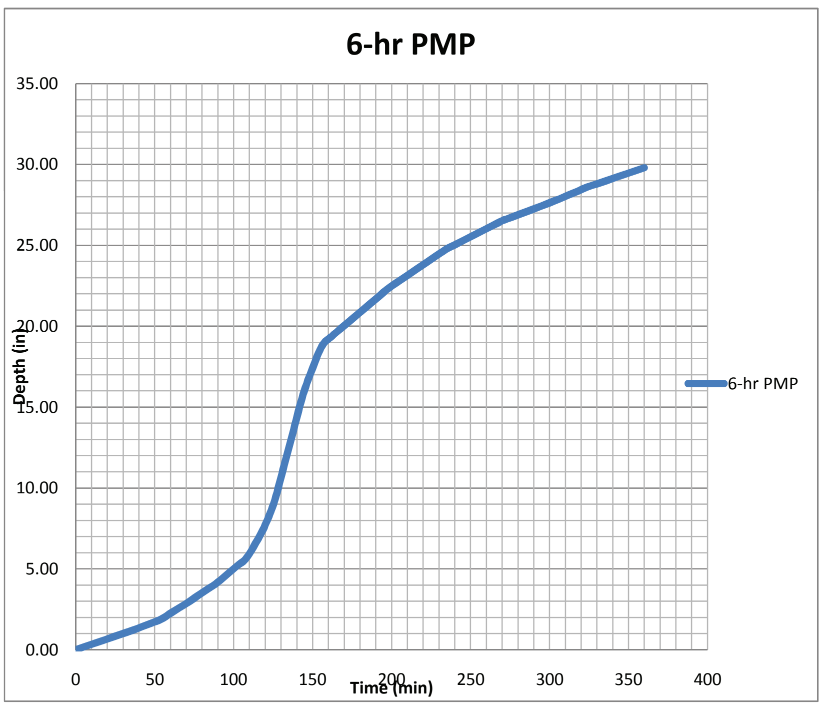


Fig 2-4 NRCS TR-60 - Eath Dams and Resevoirs, July 2005



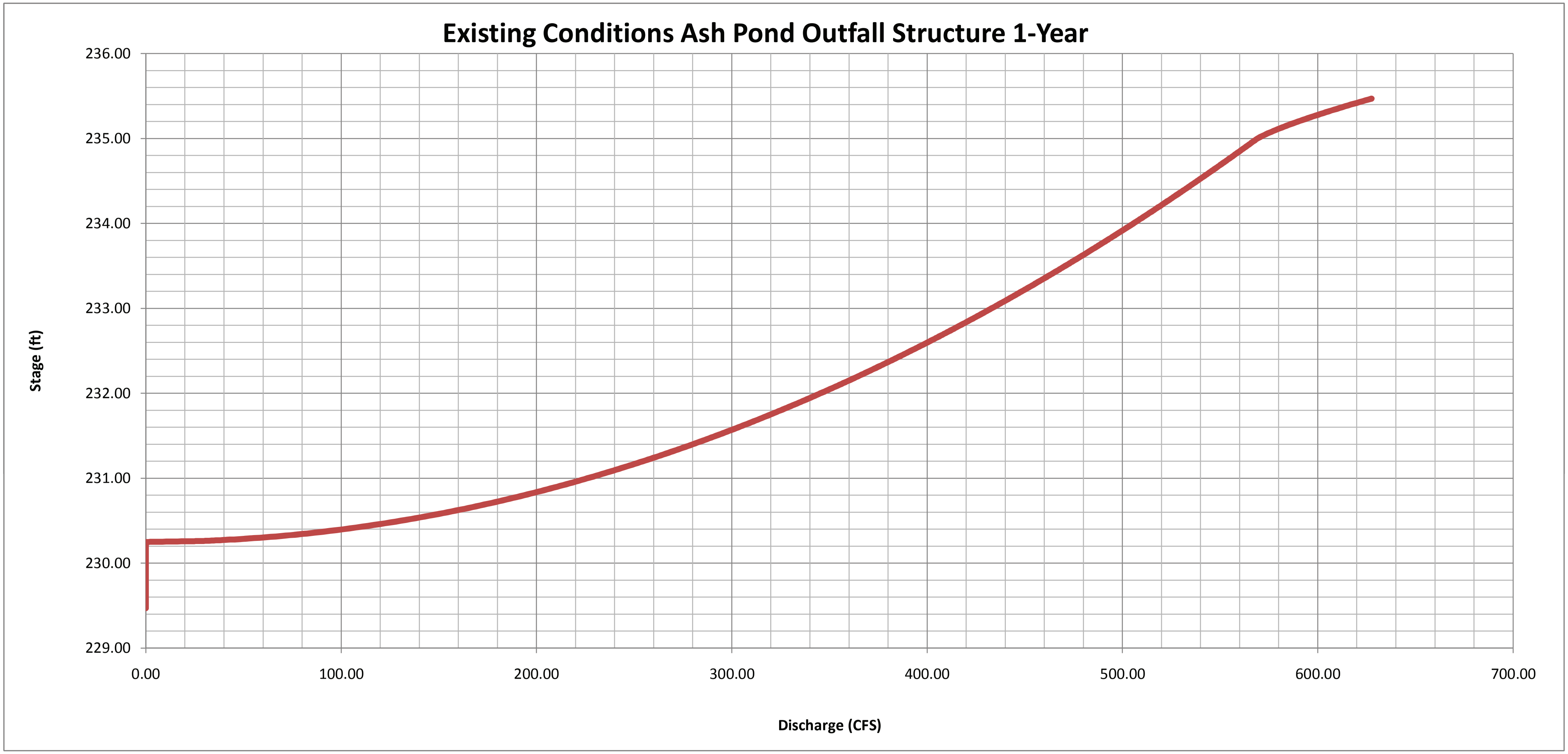
ASH POND

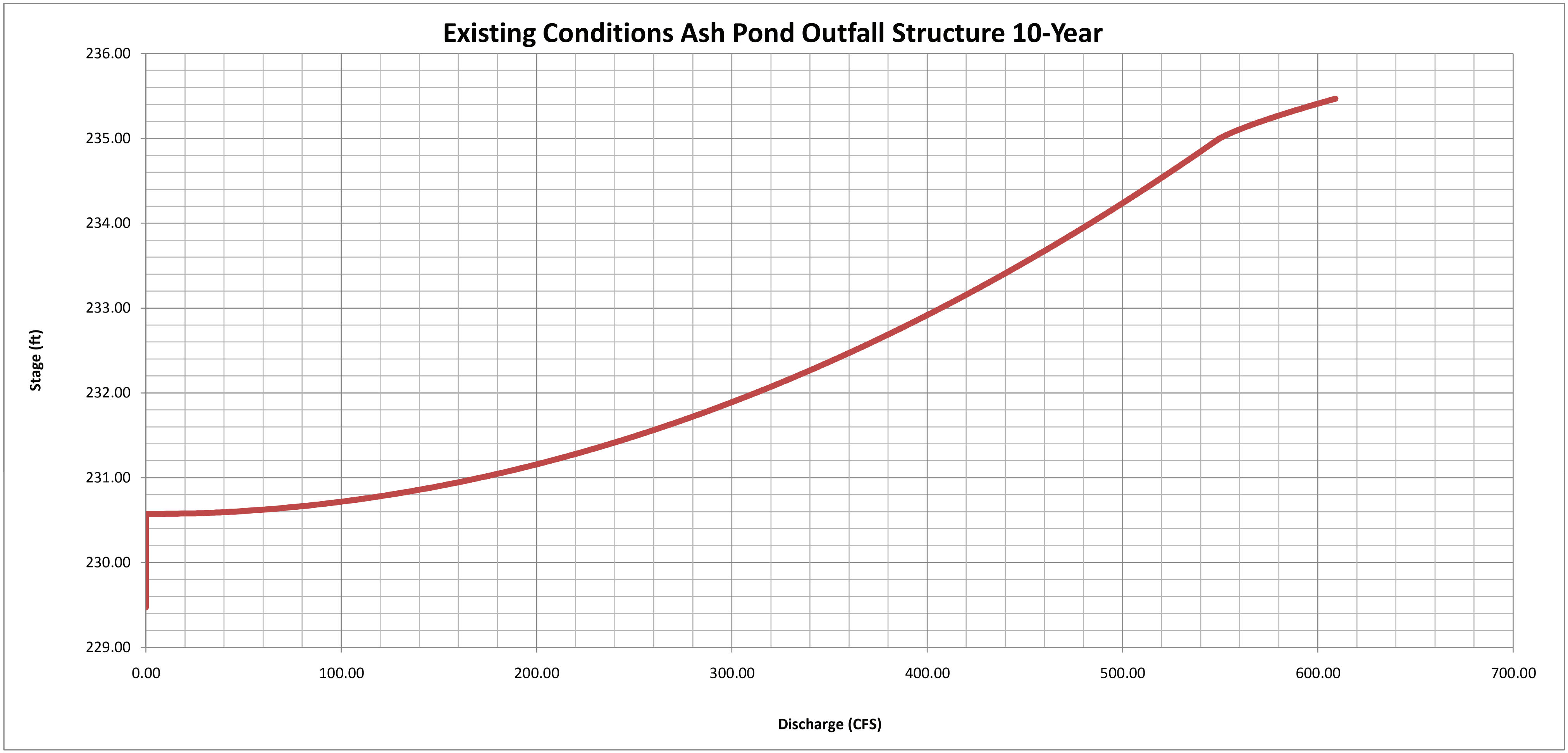
Pond Elev. (ft)	Pond Area (SF)	Pond Area (ac)	Incremental Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (gal)	
211	17295	0.397036974	0	0	0	
212	44630	1.024559708	29,873	29,873	223,462	
213	66932	1.536541124	55,350	85,223	637,509	
214	90643	2.0808686	78,410	163,632	1,224,054	
215	120296	2.761605078	105,015	268,647	2,009,620	
216	164669	3.780264901	141,761	410,408	3,070,064	
217	197433	4.532419825	180,622	591,030	4,421,210	
218	276364	6.344418981	235,558	826,588	6,183,308	
219	443797	10.18813634	356,433	1,183,021	8,849,614	
220	594774	13.65407743	516,927	1,699,949	12,716,499	
221	641636	14.7298766	617,436	2,317,385	17,335,244	
222	685198	15.7299185	662,632	2,980,017	22,292,075	
223	733981	16.84981759	708,737	3,688,754	27,593,799	
224	767285	17.61436916	749,818	4,438,572	33,202,827	
225	799991	18.36519259	782,794	5,221,366	39,058,536	
226	844088	19.37751635	821,116	6,042,482	45,200,908	
227	910475	20.90154605	876,192	6,918,674	51,755,276	
228	1033310	23.72143831	970,270	7,888,943	59,013,399	
229	1226599	28.15872537	1,127,441	9,016,385	67,447,246	
230	1344424	30.86360432	1,283,771	10,300,156	77,050,521	Water Surface Elev. 229.47
231	1560480	35.82354768	1,449,654	11,749,810	87,894,688	
232	1801315	41.35233632	1,677,772	13,427,582	100,445,292	
233	1861604	42.73637577	1,829,538	15,257,120	114,131,189	
234	1910560	43.86024637	1,884,135	17,141,255	128,225,502	
235	1967353	45.16402902	1,936,941	19,078,196	142,714,824	
236	1997950	45.86643666	1,980,641	21,058,837	157,531,050	Lowest Elevation at Top of Dike

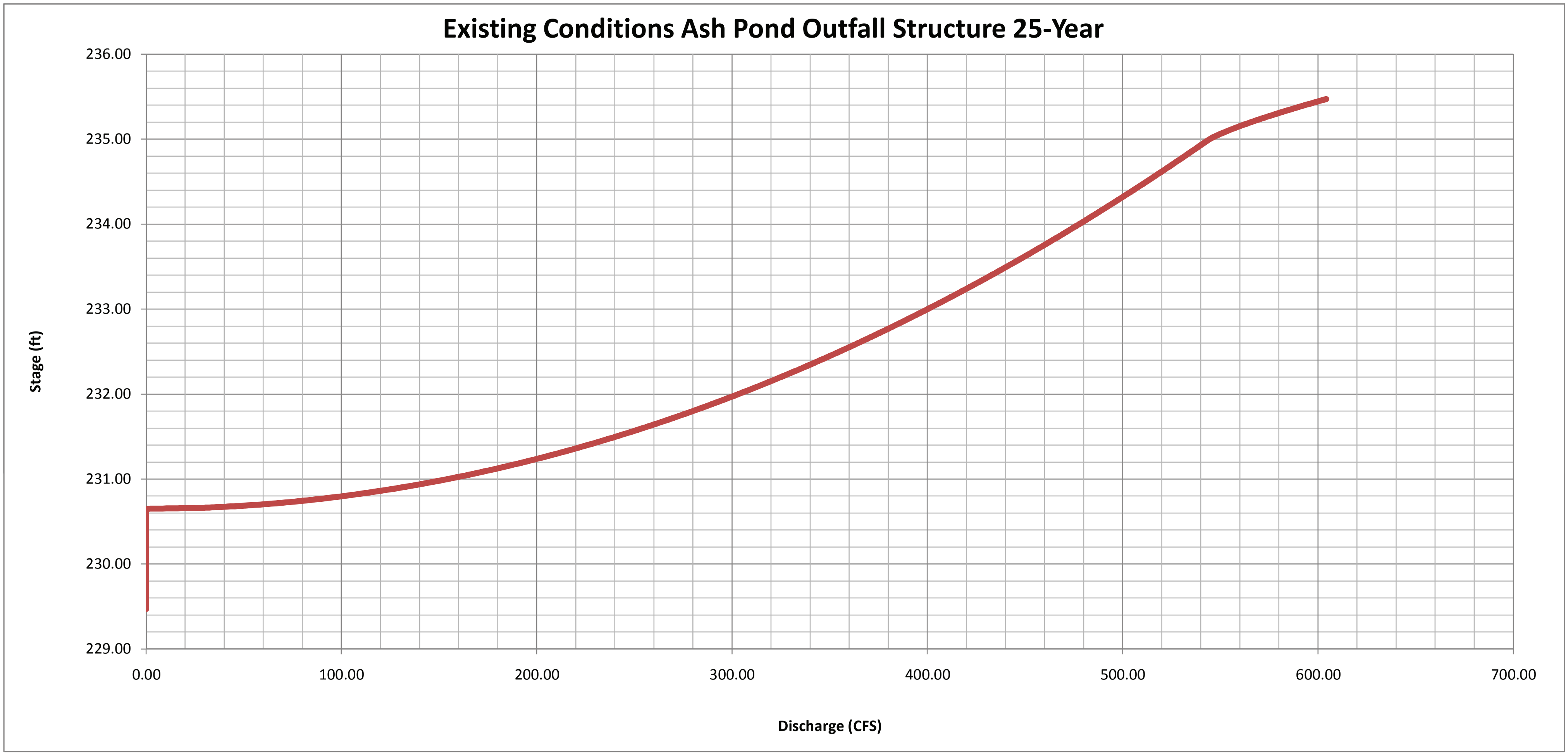
STILLING POND

Pond Elev(ft)	Pond Area (SF)	Pond Area(ac)	Incremental Volume (ft^3)	Cumulative Volume (ft^3)	Cumulative Volume (gal)	
215	67532	1.550315173	0	0	0	
216	133053	3.054464325	98,360	98,360	735,783	
217	179384	4.118073463	155,487	253,846	1,898,903	
218	201521	4.626267015	190,154	444,000	3,321,354	
219	217734	4.998464787	209,365	653,365	4,887,512	
220	230387	5.288936532	223,806	877,171	6,561,695	
221	241557	5.545363418	235,713	1,112,884	8,324,952	
222	251060	5.763521404	246,046	1,358,930	10,165,503	
223	260148	5.972152339	255,334	1,614,264	12,075,534	
224	269519	6.187280034	264,554	1,878,818	14,054,534	
225	277909	6.379887158	273,428	2,152,246	16,099,921	
226	287725	6.605230606	282,519	2,434,765	18,213,309	
227	297136	6.821276571	292,124	2,726,889	20,398,551	
228	307003	7.047790813	301,753	3,028,642	22,655,819	
229	317167	7.28112321	311,758	3,340,400	24,987,930	
230	325001	7.460966382	320,754	3,661,154	27,387,334	Water Surface Elev. 229.47
231	331738	7.615626	648,199	4,309,353	32,236,200	
232	339008	7.782521565	335,030	4,644,382	34,742,396	
233	346770	7.960711851	342,537	4,986,920	37,304,754	
234	355138	8.152813926	350,593	5,337,513	39,927,375	
235	365097	8.38144019	359,744	5,697,258	42,618,450	
236	377459	8.665231521	370,888	6,068,146	45,392,886	Lowest Elevation at Top of Dike

		Total Free Water Volume	Storage Capacity	Total Capacity
Ash Pond (gal)		67,447,246	90,083,804	157,531,050
Stilling Pond (gal)		24,987,930	20,404,957	45,392,886
Total (gal)		92,435,176	110,488,761	202,923,937
Permit Requirement (gal)		32,000,000		


Existing Conditions Ash Pond Outfall Structure 1-Year
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)


Existing Conditions Ash Pond Outfall Structure 10-Year
Stage (ft)
236.00
235.00
234.00
233.00
232.00
231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)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235.00
234.00
233.00
232.00
231.00
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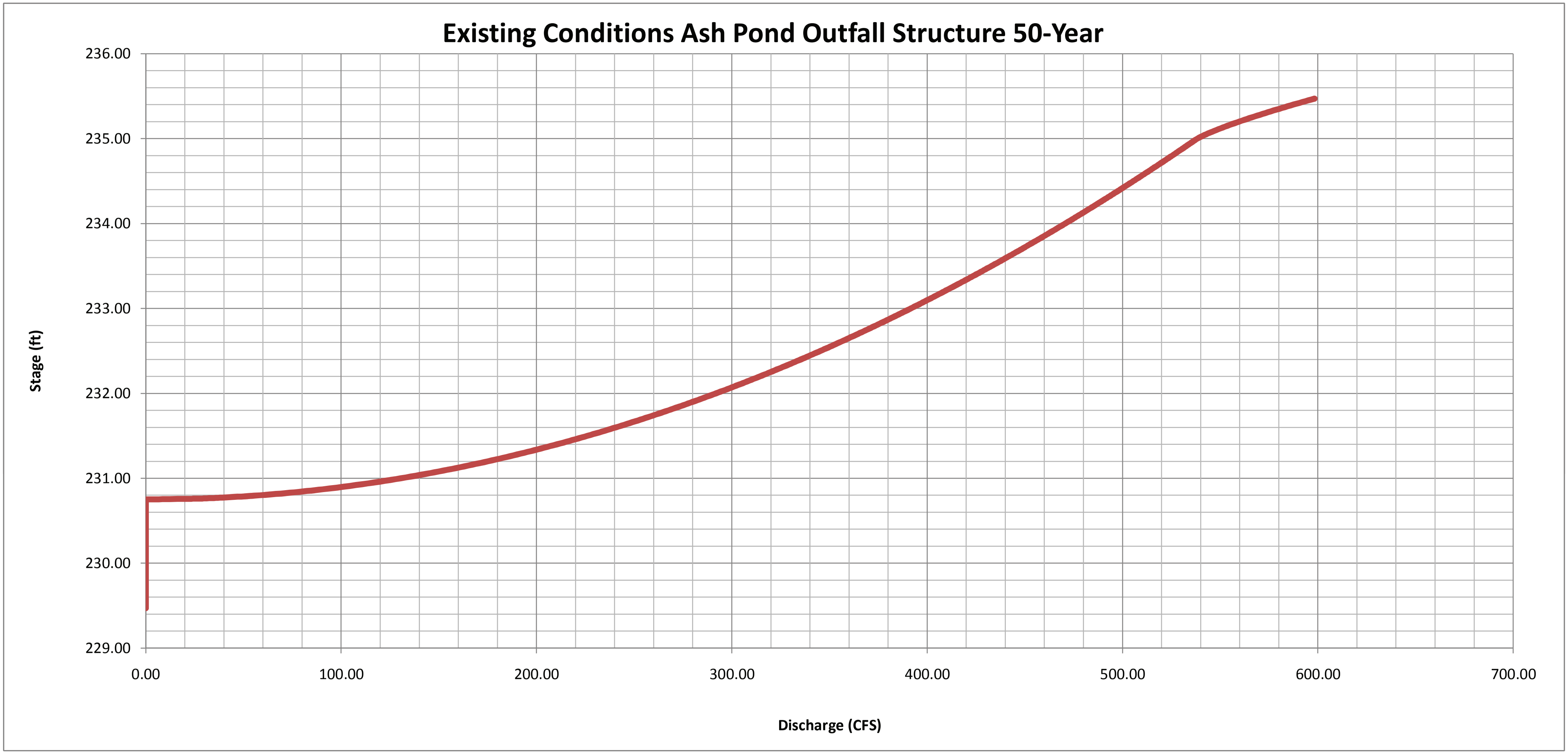
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)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233.00
232.00
231.00
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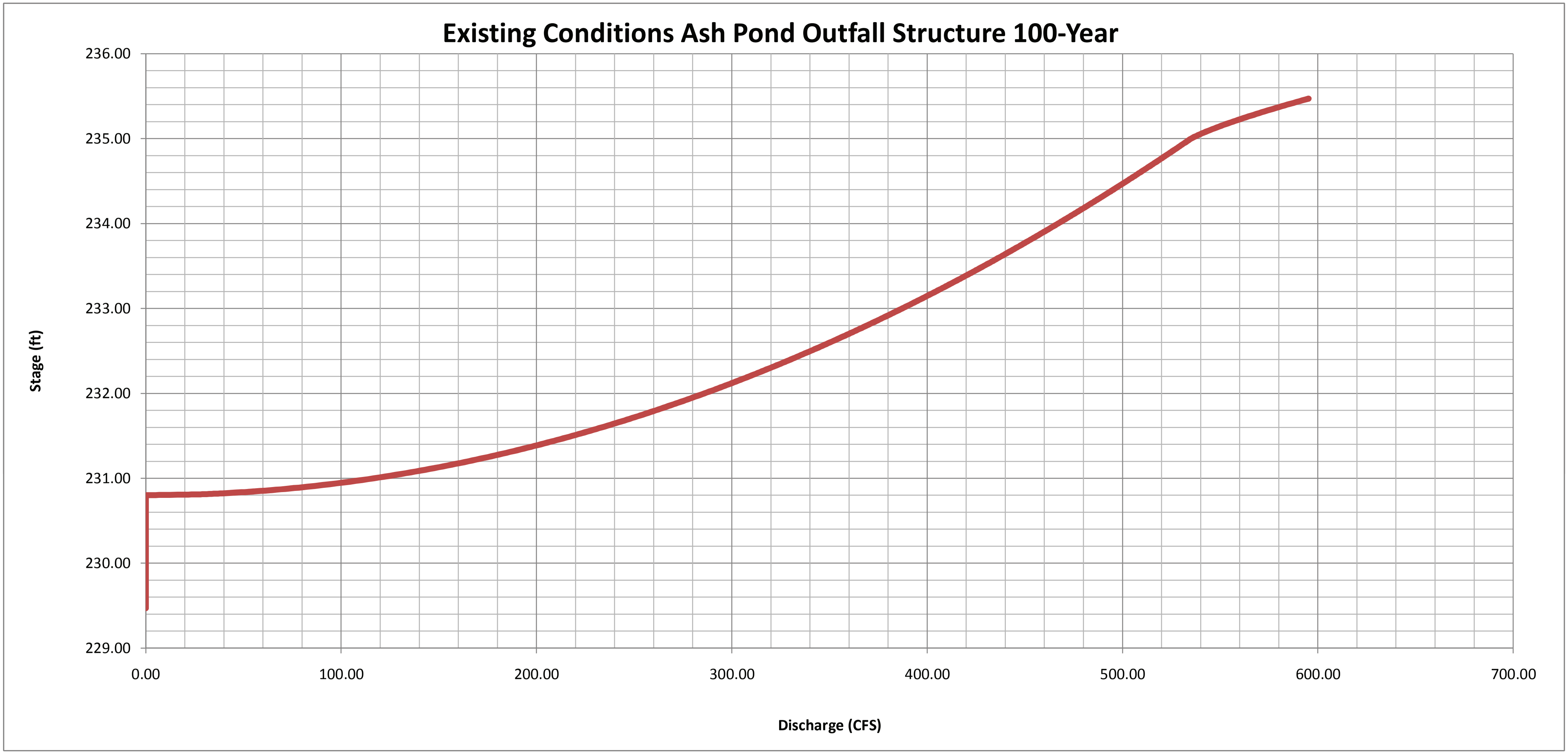
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)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Stage (ft)
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234.00
233.00
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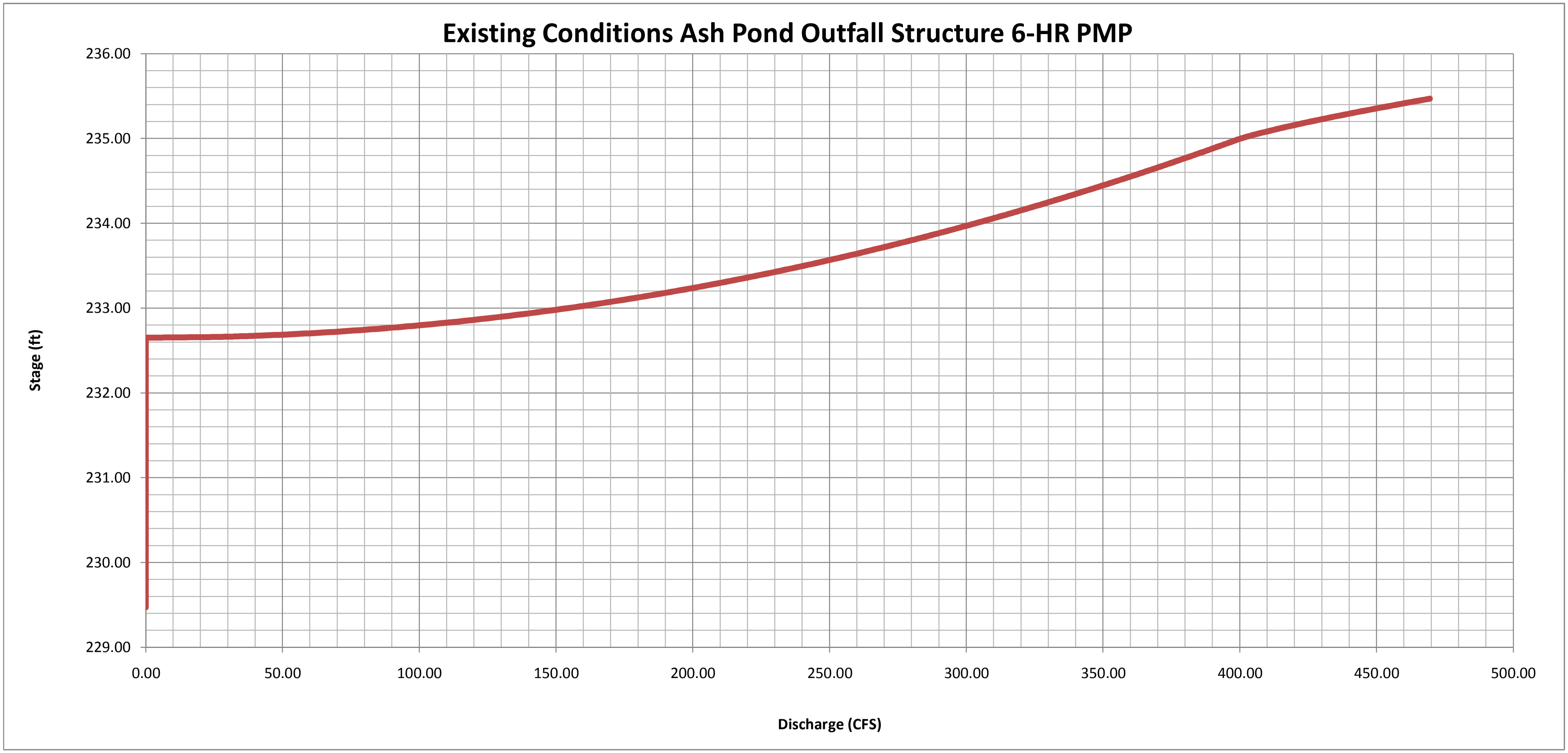
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)


Existing Conditions Ash Pond Outfall Structure 6-HR PMP
Stage (ft)
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230.00
229.00
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150.00
200.00
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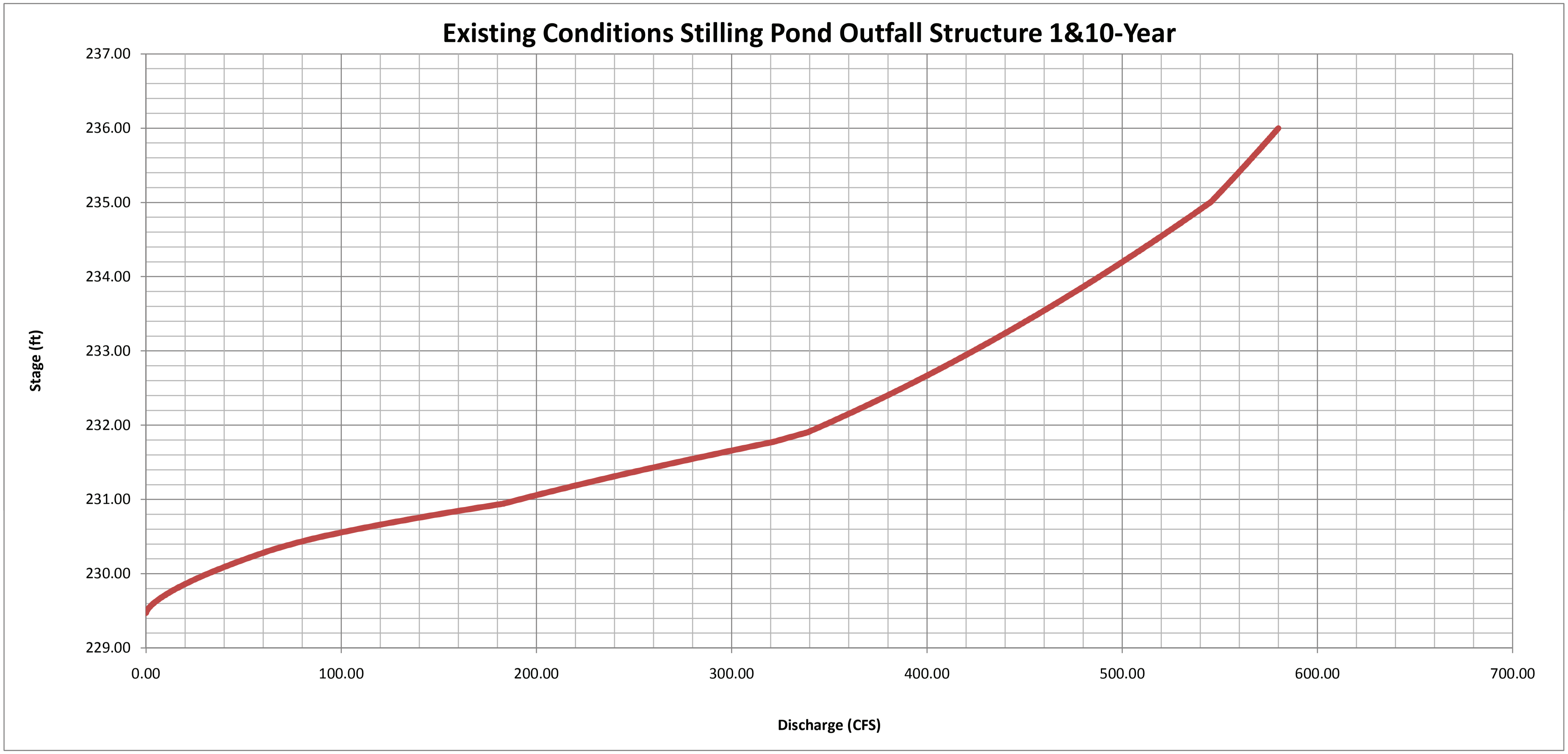
300.00
350.00
400.00
450.00
500.00
Discharge (CFS)



Existing Conditions Stilling Pond Outfall Structure 1&10-Year
Stage (ft)
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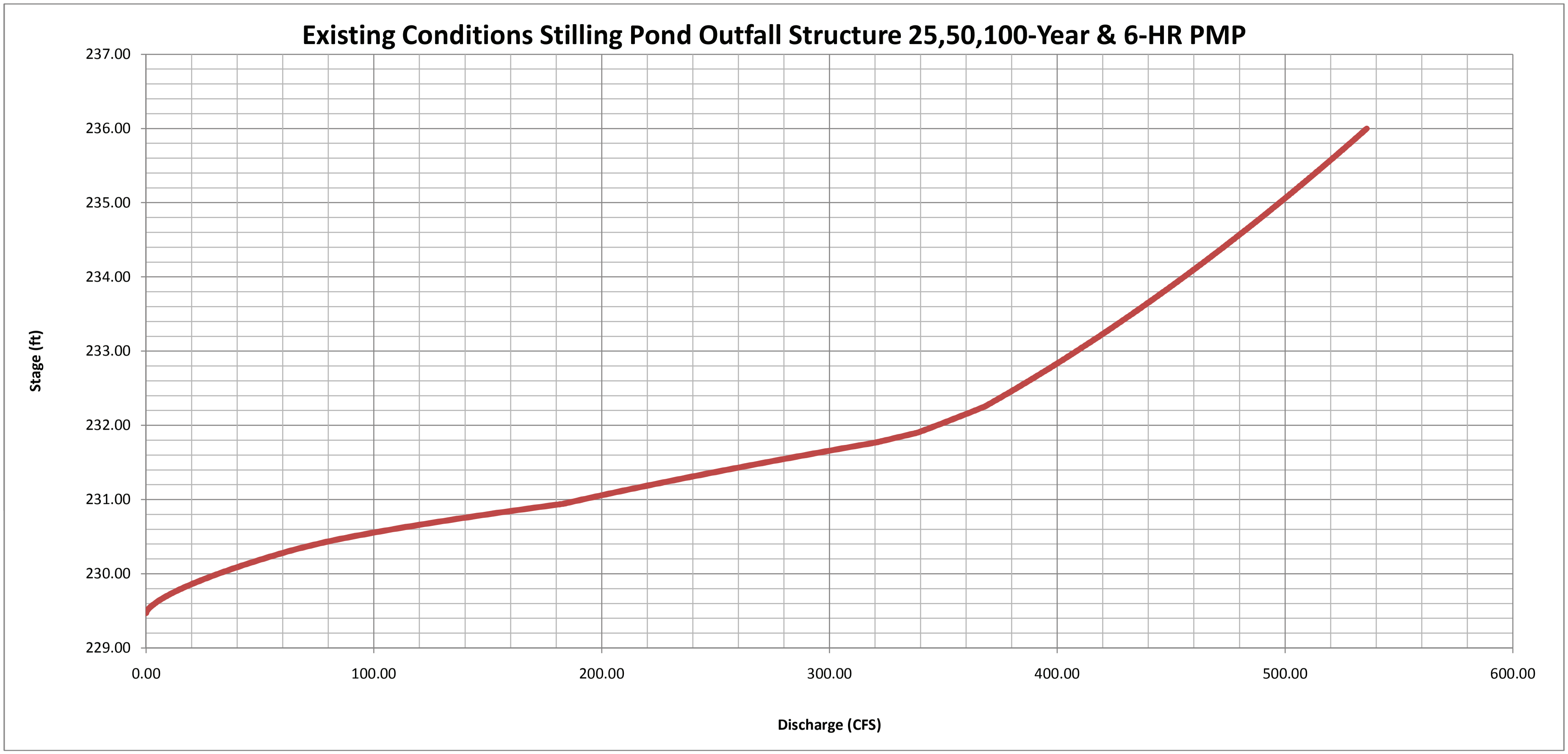
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Discharge (CFS)


Existing Conditions Stilling Pond Outfall Structure 25,50,100-Year & 6-HR PMP
Stage (ft)
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231.00
230.00
229.00
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Discharge (CFS)

Appendix D

TVA Survey Data

APPENDIX A

Document 14

Pseudo-Static Slope Stability Analysis Summary – East Ash Pond

Enclosure B

Pseudostatic Analysis Results

Allen Fossil Plant - Pseudostatic Stability Analysis Summary

CCP Disposal Facility		Cross-Section Information		500 yr Return		FS = 1 Data		Mitigation and Improvement Activities Since January 2009 As-Found Conditions
Name	Type	Section Analyzed	Section Location	PGA (g)	Factor of Safety	PGA (g)	Approx. Return Period (yrs)	
East Active Ash Pond	Impoundment	B	North Side	0.127	0.7	0.06	250	No mitigation activities were necessary for the north dike of the stilling pond. As-found static FS was sufficient. Section B represents current and as-found conditions.
East Stilling Pond	Impoundment	D	East Side		0.9	0.09	370	Pool level in stilling pond lowered to El. 226. Section D represents lowered pool.

Notes:
1) Acceleration is from March 28, 2011 TVA region-specific seismic 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 recent improvements/mitigations using either construction drawings or as-built information, as appropriate.
4) Liquefaction was not considered in this analysis.

Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

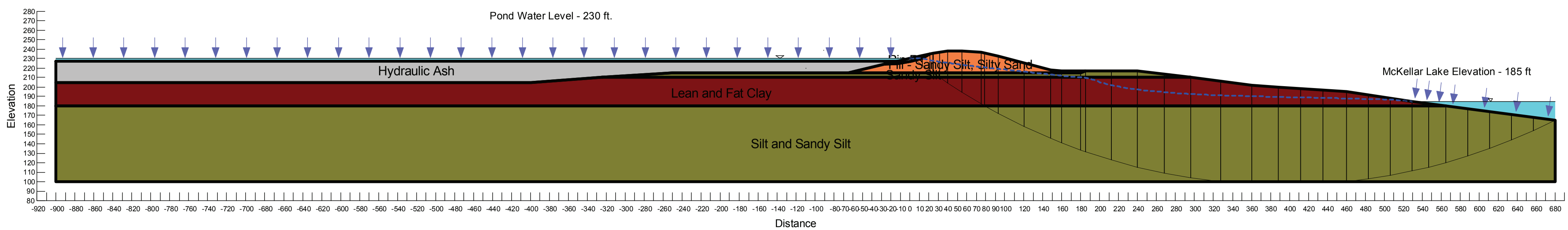
Section BB - East Active Ash Pond
Allen Fossil Plant
Memphis, Tennessee

Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt, Silty Sand	125 pcf	125 pcf	200 psf	22 °
Rip Rap	115 pcf	115 pcf	0 psf	38 °
Silt and Sandy Silt	115 pcf	110 pcf	200 psf	12 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	10 °
Lean and Fat Clay	115 pcf	110 pcf	400 psf	12 °
Sandy Silt	125 pcf	125 pcf	200 psf	22 °

Factor of Safety: 0.73

Horizontal Seismic Coefficient Kh = 0.127 g
500-year Return Period Event



Pseudostatic Slope Stability Analysis
CCP Storage Facilities - Existing Conditions
Tennessee Valley Authority Fossil Plants

Section DD - East Stilling Pond
Allen Fossil Plant
Memphis, Tennessee

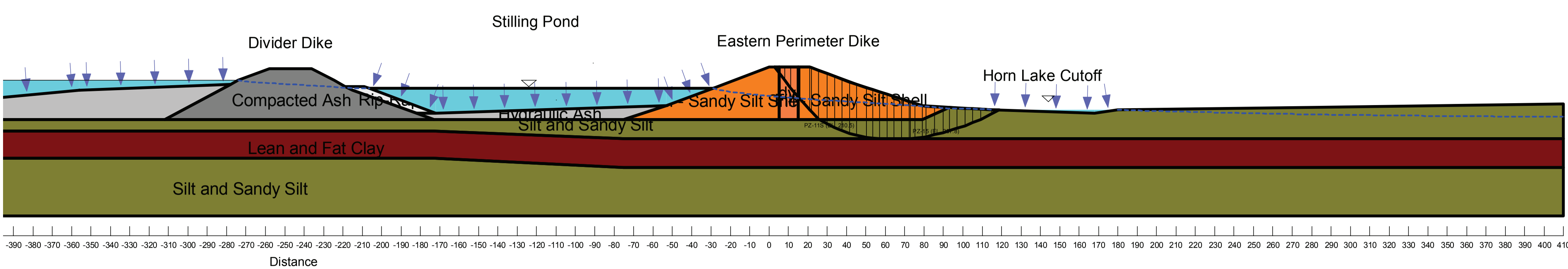
Material Type	Sat. Unit Wt.	Wet Unit Wt.	Cohesion	Friction Angle
Fill - Sandy Silt Shell	124 pcf	124 pcf	200 psf	22 °
Fill - Sandy Silt Core	125 pcf	125 pcf	200 psf	22 °
Lean and Fat Clay	115 pcf	110 pcf	400 psf	12 °
Silt and Sandy Silt	115 pcf	110 pcf	200 psf	12 °
Hydraulic Ash	105 pcf	95 pcf	0 psf	10 °
Compacted Ash	123 pcf	110 pcf	0 psf	30 °
Rip-Rap	115 pcf	115 pcf	0 psf	38 °

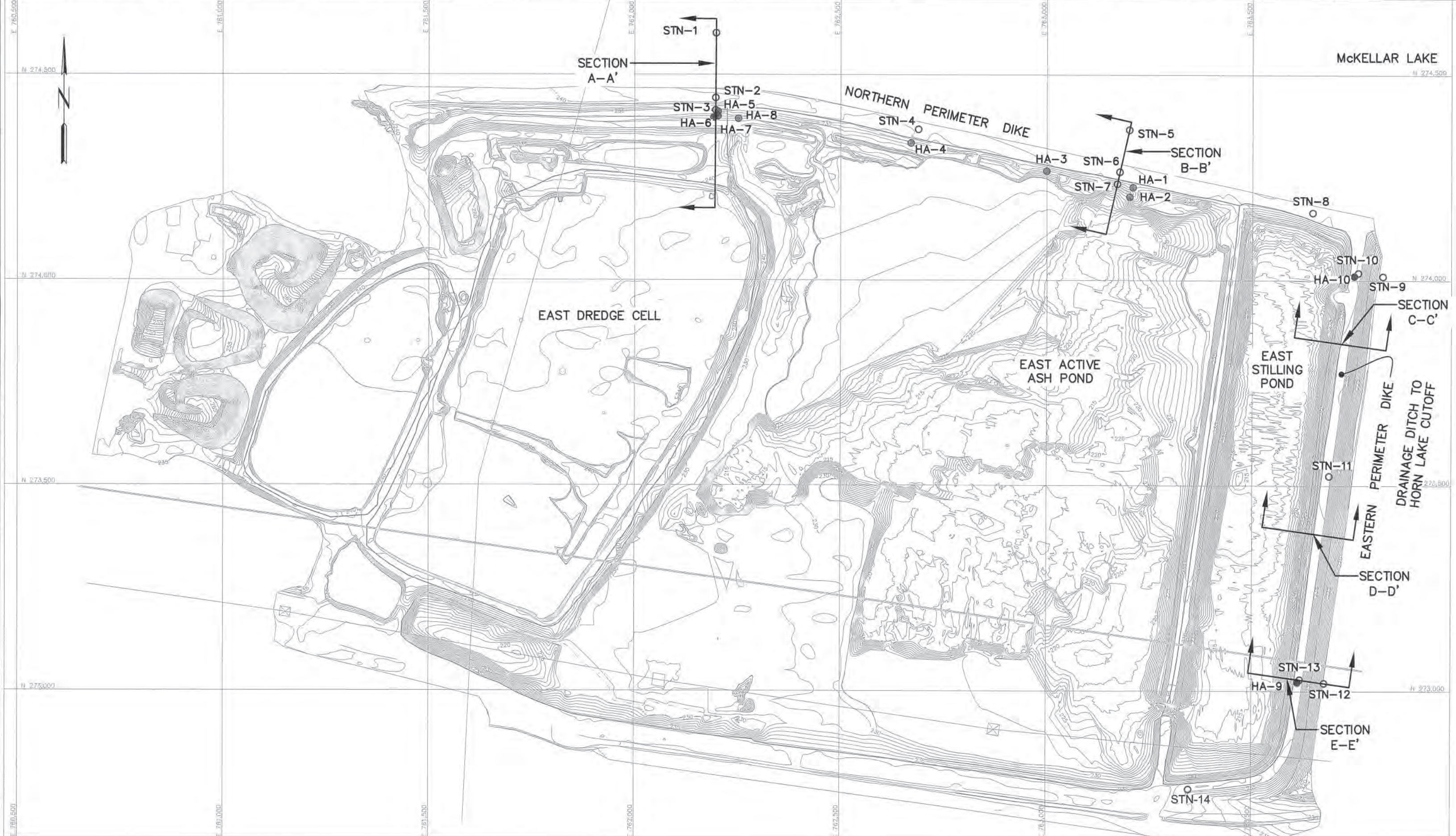
Note:
The results of this analysis are based on available subsurface information, field and laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Deep Failure Circle

Factor of Safety: 0.90

Horizontal Seismic Coefficient Kh = 0.127 g
500-year Return Period Event





LEGEND

- ○ Soil Boring with Undisturbed (Shelby) Tube Samples and/or Standard Penetration Tests and Location of Piezometers
- ◉ Hand Auger Boring

NOTES:

1. The topographic mapping presented on this drawing was provided to Stantec by TVA Surveying and Project Services. This plan view was prepared to support development of the geotechnical exploration program and should not be used for construction.
2. 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.)
STN–1	274600.73	762196.97	215.3
STN–2	274443.30	762195.73	238.8
STN–3	274413.31	762195.54	234.6
STN–4	274366.97	762687.88	237.5
STN–5	274366.34	763200.60	217.5
STN–6	274264.03	763177.15	238.3
STN–7	274234.70	763171.06	235.6
STN–8	274165.16	763646.95	237.5
STN–9	274009.16	763820.47	221.2
STN–10	274018.24	763758.37	236.9
STN–11	273523.29	763688.16	237.8
STN–12	273018.83	763676.83	216.7
STN–13	273020.21	763618.05	236.9
STN–14	272761.34	763347.91	236.5

HAND AUGER BORING LOCATION TABLE

BORING	NORTHING	EASTING	ELEV. (FT.)
HA–1	274226.34	763209.32	235.7
HA–2	274202.98	763201.48	230.5
HA–3	274265.91	762999.17	234.2
HA–4	274333.93	762669.73	233.6
HA–5	274409.74	762201.44	233.7
HA–6	274395.67	762191.04	232.5
HA–7	274398.58	762201.29	232.4
HA–8	274392.70	762251.17	232.1
HA–9	273021.67	763612.37	237.0
HA–10	274010.59	763748.55	237.2

RECORD DRAWING

For Supporting Design Calculations See FPGALFFESCDX00000020100001

R 0 02/04/10 PVK PS SF HRA HRA PVK TJ — RECORD DRAWING

SCALE: 1"=100' EXCEPT AS NOTED

YARD

GEOTECHNICAL EXPLORATION
EASTERN PERIMETER DIKE
BORING LAYOUT

DESIGNED BY: P. KISER | DRAWN BY: P. SILPACHARN | CHECKED BY: S. FIELD | SUPERVISED BY: H. APARICIO | REVIEWED BY: H. APARICIO | APPROVED BY: P. KISER | ISSUED BY: T. JOHNSON

ALLEN FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

Stantec Consulting Services Inc.

AUTOCAD R 2000 | 02/04/10 | 38 | C | 10W502–01 | R 0

PLOT FACTOR:XX TJ

C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC 0 TASK COMPLETED BY: REV NO.

38 C 10W502–01

APPENDIX A

Document 15

Allen Fossil Plant Procedures

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this document is to define the procedures for handling production ash at Kingston Fossil Plant (KIF). This document defines the roles and responsibilities of all parties, active permits, operational requirements, required documentation, and general procedures for the daily operations of the Ballfield Interim Ash Staging Area and the Peninsula Site at KIF.

2.0 OPERATIONS

Operations at ALF consist of sluicing material the East Ash Pond. Material is excavated and hauled to the Pidgeon Industrial offsite landfill where it is used as structural fill. The operations are described in more detail below.

2.1 Dredge Cell

Fly ash and boiler slag are wet sluiced to a rim ditch in either the East Dredge Cell (EDC) or West “Mini” Dredge Cell (WDC). The CCP material is then excavated from the rim ditch using a long reach excavator where it is stockpiled in rows and allowed to dewater. Once a sufficient amount of material has dewatered, it is loaded into dump trucks and hauled to the offsite landfill. Hauling operations are discontinued during inclement weather when ash is unable to dewater to a suitable moisture content for hauling and placing. Specific operations are determined by the contractor. The current contractor, Trans-Ash, developed an operations plan for the east disposal area which is included under Section 1101 – Operations Plans.

2.2 Offsite Hauling

Material that has been excavated and allowed to dewater is loaded into trucks suitable for on-road travel and transported to the offsite structural fill location. The haul route is shown on the Trans-Ash 2011 operations plan included in Section 1101.

All posted speed limits are to be observed and are strictly enforced. This includes a speed limit of 20 MPH on all roads within the plant, unless otherwise posted. Dust and debris from haul trucks is to be cleaned from plant roads using a sweeper truck. Dust suppression is to be used on all ash/gravel haul roads to reduce fugitive dust.

3.0 GENERAL MAINTENANCE

3.1 Mowing and Vegetation Removal

The slopes shall be mowed to reduce the opportunity for tree growth and allow for visual inspection and observations. The slopes shall be mowed to a height of no less than 3-inches and no more than 12-inches tall with a minimum of three mowings per growing season. If woody growth is detected, it shall be removed.

3.2 Tree Removal

At the location of all trees which are greater than two (2) inches in base diameter, remove the tree and grub to the bottom of the root system at least twelve inches below grade. Backfill the excavations with a similar slope material and compact with a manual tamper. See the *General Guidelines for Tree Removal* in Section 1104.

3.3 Fertilize and Reseed Bare Areas

Prepare all regraded and exposed areas for seeding by disking the surface three (3) inches in depth. Apply fertilizer (600 lbs/acre), seed mixture (as directed by facility engineer), mulch (1.5 tons/acre), and netting (0.75 inch by 1.0 inch mesh openings) with pins to the prepared areas. Other application rates may be requested by the facility engineer. The seed mixture utilized depends on the seeding application period and location.

3.4 Erosion Rill and Gully Repair

The cause of erosion shall be identified before beginning repair. Causes of erosion include poor vegetative cover, breach of a hydraulic structure or ditch, long or steep slopes and concentrated flows. Gullies or rills shall be graded, re-seeded and covered with an erosion control blanket. If the problem is ongoing, then consider shaping the gully and forming a ditch lined with riprap. See the *General Guidelines for Rill and Gully Erosion Repair* in Section 1104.

3.5 Animal Burrow Repair

Animal burrows provide a potential location for seepage and piping to occur. In order to repair animal burrows, locate burrows, trap animals, and relocate or dispose of animals as directed. See the *General Guidelines for Animal Burrow Repair* in Section 1104.

3.6 Wave Wash Riprap Protection

Wave erosion shall be controlled on TVA facilities to maintain the integrity of dams and dikes. When present, wave wash erosion typically occurs along interior slopes of dikes near pool level. If left unrepaired, erosion can expand, deepen, and can eventually lead to interior slope sloughing. General guidelines for repair of wave erosion using riprap are provided below. See the *General Guidelines for Wave Wash Erosion Repair & Rip-rap Protection* in Section 1104.

3.7 Rutting Repair

Rutting due to maintenance vehicle traffic can commonly occur along dike crests, slopes, and other areas at TVA fossil plant facilities. It is typically caused by near-surface dike crest materials which have become weak over time because of moisture infiltration. Repeated passes of maintenance traffic/equipment over weakened materials can lead to rutting. The *General Guidelines for Rutting Repair* is provided in Section 1104. The attached guide is intended to be applicable for minor to moderate cases of rutting, and generally consists of reworking the upper portion of the affected area, followed by re-shaping to provide positive surface drainage. Where widespread or extensively deep rutting has occurred or is recurring, case-specific engineering evaluations may be needed.

4.0 INSPECTIONS AND REPORTING

TVA conducts daily, weekly, quarterly, and annual inspections of the active ash disposal areas at JOF. Following these inspections, reports are completed and filed. Any deficiencies requiring corrective actions/maintenance are reported and tracked using Maximo. A seepage action plan has been developed to track seeps and determine the level of repair necessary. Signs have been placed at all known seeps and pipe penetrations to aid during inspections.

4.1 Daily Field Reports

The daily field reports are used to determine minor deficiencies in operations. These are compiled by the contractor into a weekly report. These two reports are described below.

a. **RHO&M Daily Field Report** - Contractor

The purpose of the **RHO&M Daily Field Report** is to list deficiencies found beyond routine maintenance issues such as seeps or boils, freeboard issues, sloughs, or spillway issues. Also, daily production and activities conducted shall be tracked. The RHO&M Daily Field Repot is included in Section 1105.

b. **Ash Haul Operations Checklist** – Field Supervisor

The **Ash Haul Operations Checklist** is the responsibility of the field supervisor. When not onsite, the field supervisor should delegate a representative of the contractor to complete the form. The form is used to rate the effectiveness of various haul route requirements. The form is included in Section 1105.

c. **RHO&M Weekly Field Report -** Contractor

The **RHO&M Weekly Field Report** summarizes the daily activities for the week based on the daily field report. The Weekly Field Report is included in Section 1106.

4.2 Weekly Inspections

The active ash disposal area shall be inspected weekly by the Field Supervisor. The inspection shall be recorded using the **Weekly Facility Observation Form** included in Section 1107. The dikes shall be inspected for cracks, rutting, settlement, erosion, sloughs, seepage, vegetation, animal burrows, sinkholes, and other deficiencies. Deficiencies noted in previous inspections shall be checked if repairs have not yet been implemented.

4.3 Monthly Inspections

The active ash disposal area shall be inspected monthly by the Construction Manager. The inspection shall be recorded using the **Monthly/Quarterly/Special Facility Inspection Form** included in Section 1108. The dikes shall be inspected for cracks, rutting, settlement, erosion, sloughs, seepage, vegetation, animal burrows, sinkholes, and other deficiencies. Deficiencies noted in previous inspections shall be checked if repairs have not yet been implemented.

4.4 Quarterly Inspections

Quarterly inspections shall be conducted once every three months. The inspection shall be recorded using the **Monthly/Quarterly/Special Facility Inspection Form** included as in Section 1108. The quarterly inspection shall be led by the RHOM Program Manager. The RHOM team including the construction manager and field supervisor shall walk the active ash disposal areas, looking for seeps, sloughs, animal burrows, and any other deficiency which could affect the integrity of the facility. All deficiencies shall be flagged, surveyed, and photographed. A report shall be compiled with all deficiencies, locations, photos, and recommendations for repairs. Areas requiring engineering recommendations shall be sent to CCP Engineering or a geotechnical engineer to provide recommendations for the repair.

4.5 Annual Inspection

Once a year, an annual inspection shall be performed under the ownership of CCP Engineering. This shall be performed by a qualified geotechnical engineer. The purpose of the annual inspection is to inspect both the active and inactive ash disposal areas for structural integrity and make recommendations for any deficiencies noted. Photos shall be taken to describe the existing conditions at the time of the inspection, as well as to show the deficiencies found.

4.6 Inspection Deficiencies

Each potential deficiency encountered as a result of an inspection should be recorded in accordance with the CPP RHO&M Work Control procedure (FGDC-SPP-07.007), Section 3.2 E. Deficiency Monitoring. Recorded deficiencies should be tracked in the Maximo system as “Other” work orders with a work type of “OTH.”

4.7 Seepage Monitoring

The Seepage Action Plan for Allen dated June 25, 2010 shall be followed as planned to observe, document, and remediate potential seepage areas. The seepage action plan shall be routinely implemented and updated at Johnsonville. This requires stockpiles of aggregate, sandbags and culvert pipe and updates to the seepage log when evidence of seepage is observed. Signs shall be installed at any new seepage areas.

5.0 PROJECT MANAGEMENT

The following forms are included to assist in project management requirements.

a. Project Startup Checklist

The purpose of the project startup checklist is to define the roles and responsibilities of the various groups within TVA and to insure that the required tasks are completed during the project planning stage. It also includes the required steps to be completed at project completion. The project startup checklist is included in Section 1109.

b. RHO&M Additional Work/ Change Order Form

The additional work/ change order form shall be used when the scope of work changes for the routine handling contractor. The form addresses the reason for the change, who initiated the change, who needs to be notified, and the financial impacts of the change. The additional work/ change order form is included in Section 1110.

c. Environmental Review (NEPA)

Procedures were developed to provide guidance for compliance with the National Environmental Policy Act (NEPA). These procedures for the environmental review of a project are included in Section 1111.

6.0 Work Control Process

The work control process was developed to provide guidance for implementing a work control process that maximizes safety, facility reliability, work productivity, and risk assessment and management. The procedures describe the process by which maintenance and modification work activities are identified, planned, scheduled, monitored, and completed. It describes the work order process using the Maximo system. The work control process is included in Section 1112.

7.0 Clay Dike Restrictions

The clay dike study report is due September 2, 2011. A summary of the results should be discussed here and included in Section 1113.

8.0 Records

In accordance with the TVA Master Programmatic Documents, the Maximo database shall be used to track all inspection, monitoring, reporting, and maintenance recommendations. Final inspection reports and instrumentation data collection and analysis will be placed in the TVA BSL.

9.0 Subsections

Section 1101 – Operations Plan – Trans-Ash 2011

Section 1104 – General Maintenance Guidelines

Section 1105 – RHO&M Daily Field Report and Haul Road Inspection

Section 1106 – RHO&M Weekly Field Report

Section 1107 – Weekly Facility Observation Form

Section 1108 – Monthly/Quarterly/Special Facility Inspection Form

Section 1109 – Project Startup Checklist

Section 1110 – RHO&M Additional Work/ Change Order Approval Form

Section 1111 – NEPA Process

Section 1112 – CCP RHO&M Work Control Procedures

Section 1113 – Clay Dike Restrictions

Trans-Ash – 2011 Operations Plan for TVA Allen Plant Ash Pond & Structural Fill

Revised – March 10, 2011

Objective:

This plan is intended to provide a clear description of current and planned operations for time period described and as necessary to accommodate the recent changes to operating conditions as a result of the Process Water Repair Project. The purpose is to provide an effective planning tool that ensures a mutually agreed to schedule and methodology while maximizing efficiency and mitigating risks associated with ash excavation, hauling and placement operations.

Description of Activities through Winter 2011:

During this period, Trans-Ash will continue construction of the Levee across Dredge Cell #1 (DC1) for the Emergency Process Water Response. All production ash has temporarily been sluiced into the West "Mini" Dredge Cell (WDC) to allow for construction activities on the levee and manhole connections. Trans Ash will continue the following tasks until production can be turned over into the existing Rim Ditch Operation in (DC1) after the connections have been made to the Manhole:

- Dip production ash up to (7) days per week in efforts to maximize the capture rate.
- Utilizing dewatered production ash to pad across the (WDC) as a contingency to our operating plan described herein.

Description of Activities Spring 2011 through Fall 2011:

Trans Ash has installed a 30" culvert pipe under the proposed temporary sewer line in order to maintain and finish the working pad established in 2010. Trans Ash plans to turn the sluice water back into Dredge Cell 1 in order to operate from our existing working pad and to maximize the capture rate of the ash. In order to accommodate the recent modifications to Dredge Cell 1, Trans Ash plans to install a culvert pipe through the South end of the new levee to ensure equal water pressures from either side.

Production ash will continue to flow into the (DC1) Rim Ditch for dipping and dewatering. When the quantity of dewatered ash is sufficient enough to justify hauling, broker trucks will be brought in to transport the ash to the beneficial use site for placement per the grading plan. Routine Handling operations will continue year round with a hauling period during the months of April through November. When inclement weather has set in, hauling operations will temporarily shut down; however, routine operations will continue at the pond on a daily basis to include using a portion of the production material to continue padding across (DC1). Trans

Ash will monitor weather conditions and haul dewatered material throughout the winter months as permissible.

At the structural fill site, the ash, sand, and soil cover will be placed as indicated on the plans. Also, closure operations will continue to provide finished product wherever possible. This includes silt fence maintenance, completion of slope letdowns, ditch grading, grading of fill area, clearing and grubbing, sand & soil cover, and seeding of all areas at final grade.

Current Plant Production:

- Plant production = **175,000 CY** dewatered ash per year.

Safety Guidelines:

Dike Inspections:
- Trans Ash to perform daily inspections of pond levees and dikes and perform quarterly repairs as needed.

Truck Loading:
- Watch for cracks in the ash surface. If tension cracks appear, move the machine at least 10-feet behind the cracking zone to more stable ground.
- Do not swing the excavator bucket over the truck cab at any time.
- Excavator shall maintain a safe slope in order to avoid undercutting the loading machine and creating an unstable condition.
- Keep trucks on the designated proven haul road at all times. If haul roads start to rut, or pump, move truck traffic to a more stable location or stop hauling until the affected area can be repaired.
- When excavating near water, swing with cab away from the water whenever possible.

Pond Gloving & Dipping:
- Pad lift shall be a minimum of 12-inches.
- Trucks must be kept in stable areas that have been checked by excavator or dozer.
- If the pond surface begins to pump, stop pond prep operations until the pond heals.
- Ensure material used for padding is adequately dewatered before placement across the pond area.

APPENDIX A

Document 16

Allen Fossil Plant General Maintenance Guidelines

1.0 GENERAL MAINTENANCE GUIDELINES

1.1 GENERAL GUIDELINES FOR REPAIR OF ANIMAL BURROWS

1.1.1 IDENTIFICATION

Animal burrows are relatively common along slopes of dams and dikes. If left untreated, these burrows can result in the creation of seepage paths through the embankment. Additionally tunnels may eventually collapse resulting in surface irregularities in the embankment. General guidelines for repair of animal burrows are provided below. However, if the burrow extends more than three (3) feet below the embankment surface or extends across a dam, the repair of these features should be evaluated by a geotechnical engineer on a case-by-case basis so that appropriate recommendations can be made.

1.1.2 GUIDELINES FOR BURROW REPAIR

It is recommended that shallow animal burrows (up to 3 feet) shall be repaired with surface treatment methods as follows:

- Animals shall be captured and removed from the area. It is recommended that a local conservation representative be consulted prior to this action.
- The animal burrow shall be excavated and cleaned of excess soil along its pathway up to a depth of 3 feet. With this type of repair, an isolated excavated area of the embankment is exposed.
- The excavated area shall be backfilled with compacted cohesive material.
- If the burrow extends more than three feet into the embankment, a geotechnical engineer shall further evaluate the burrow depth and recommend a deep burrow treatment method or other exploratory methods.
- One possible method which may be recommended to treat a deep burrow can consist of a special grout (flowable fill) pumping system with a hose inserted into the burrow.

Ultimately, these repairs will not prevent rodents from creating new burrows within dam embankments. Accordingly, continual efforts must be made to discourage rodent activity. Mowing of vegetation on the slopes / crest of the embankment and trimming of water-side vegetation at regular intervals will tend to discourage rodents from re-establishing burrows along the dike and will allow timely observation of new activity if it occurs.

1.2 GENERAL GUIDELINES FOR REPAIR OF RILL AND GULLY EROSION

1.2.1 IDENTIFICATION

Erosion features can commonly occur along dike slopes, dry stack slopes, or other sloped surfaces at TVA fossil plant facilities. Erosion normally appears in the form of rills (shallow channels) and gullies (larger and deeper eroded channels) and is formed by concentrated flow of storm water runoff, especially on bare slopes or where vegetation is sparse. If left untreated, the rills and gullies can progress in size and could lead to slope instability or other adverse issues. General guidelines for the repair of rills and gullies are provided below. The following guide is intended to be applicable to minor to moderate cases of rill/gully erosion. Where widespread or extensively deep gullies have formed or are recurring, case-specific engineering evaluations may be needed.

1.2.2 GUIDELINES FOR RILL AND GULLY EROSION REPAIR

Shallow Rills and Gullies:

For cases where shallow rills and gullies are present, repair should consist of the following:

- Dump and spread clay soil to fill, re-grade, and shape affected areas to conform to original ground line. Tracking and blading material with a dozer should be performed until the original ground line is reformed and material is reasonably compacted.

- Repaired areas should be seeded to re-establish vegetative cover. Erosion control blankets should be placed over re-graded areas following seeding. Materials and placement of erosion control blankets should comply with the following specifications, depending on the state in which the work is being performed.

Kentucky Plants –	KYTC Standard Specifications, Sections 212.03.03 E and 827.07
Tennessee Plants –	Vegetation Specifications, Landfill Permit
Alabama Plants –	ALDOT Standard Specifications, Section 659

Deep Rills and Gullies:

For deep gullies that cannot be repaired as described above, the following filling procedures apply:

- Clean loose soil/debris from bottom and sides of gullies.

- Place and compact clay in 6 inch lifts using small compaction equipment or hand-held tampers. Vibratory plate compactors are not applicable for clay. Filling should start at the toe (or lowest elevation) and progress upslope.

- In some cases, over-excavation may be required to create benches to facilitate compaction on level surfaces. Benching, if required, will likely have to be performed by hand methods or using small excavation equipment.

- If several side-by-side deeper gullies are present in an area to be repaired, it may be more practical to rework the entire affected area to facilitate use of larger equipment. In this case, slight over-excavation of the slope face will be needed so that foundation benches can be cut to facilitate compaction on level surfaces. Filling should start at the lowest elevation and progress upslope.

- Final filling/shaping to reform the original ground line can be executed by tracking and blading with a dozer.

- Repaired areas should be seeded to re-establish vegetative cover. Erosion control blankets should be placed over re-graded areas following seeding. Materials and placement of erosion control blankets should comply with the following specifications, depending on the state in which the work is being performed.

Kentucky Plants –	KYTC Standard Specifications, Sections 212.03.03 E and 827.07
Tennessee Plants –	Vegetation Specifications, Landfill Permit
Alabama Plants –	ALDOT Standard Specifications, Section 659

1.3 GENERAL GUIDELINES FOR REPAIR OF RUTTING

1.3.1 IDENTIFICATION

Rutting due to maintenance vehicle traffic can commonly occur along dike crests, slopes, and other areas at TVA fossil plant facilities. It is typically caused by near-surface materials which have become weak over time because of moisture infiltration. Repeated passes of equipment over weakened materials can lead to rutting. Maintenance traffic/equipment should avoid wet/rutted areas until repairs can be made. General guidelines for the repair of rutting are provided below. The following guide is intended to be applicable for minor to moderate cases of rutting, and generally consists of reworking the upper portion of the affected area, followed by re-shaping to provide positive surface drainage. Where widespread or extensively deep rutting has occurred or is recurring, case-specific engineering evaluations may be needed.

Guidelines for Rutting and Repair

- Drain any standing water and undercut affected areas to remove rutted and overly wet/soft materials. The undercut depth will be determined by TVA in the field, depending on the severity of the rutting.
- Fill undercut area with clay or bottom ash material and compact in 6 to 8 inch lifts to restore original ground line. Excavated material can be re-used if it is free of organics and can be dried to facilitate re-compaction. Otherwise, borrow material will be needed. For compaction, use hand held jumping jacks or small power equipment.
- Grade and shape repaired areas to provide positive/improved drainage. For dike crests, grade the area to drain inwardly toward the pond or perimeter ditch, as applicable. Re-grade surrounding areas and/or drainage ditches to improve drainage, if possible.
- Repaired surfaces or dike crests that are to be used as access roads should be topped with crushed stone or bottom ash. The thickness should be equal to that which was originally in place prior to the repair, or as judged by TVA to be sufficient for the expected amount of vehicle/equipment traffic.

- For other repaired areas, place seed and cover with erosion control blanket to re-establish vegetation. Materials and placement of erosion control blankets should comply with the following specifications, depending on the state in which the work is being performed.

Kentucky Plants –	KYTC Standard Specifications, Sections 212.03.03 E and 827.07
Tennessee Plants –	TDOT Standard Specifications, Section 805
Alabama Plants –	ALDOT Standard Specifications, Section 659

1.4 GENERAL GUIDELINES FOR TREE REMOVAL ON SLOPES

1.4.1 IDENTIFICATION

Trees and heavy brush growth should be controlled on TVA dams and dikes. If left in place, trees can result in the creation of seepage paths within the embankment. Allowing vegetation to become overgrown restricts the level of inspection that can be performed on the structure. General guidelines for removal of trees and maintenance of vegetation are provided below. Evaluations other than those outlined below shall be made by a geotechnical engineer in consultation with facility representatives on a case-by-case basis.

1.4.2 GUIDELINES FOR TREE REMOVAL AND MAINTENANCE OF VEGETATION

Tree Removal

At locations where it is not reasonable to remove trees by a mowing them with a bush hog or with similar mowing equipment:

- All trees shall be cut using a handsaw or chainsaw and the cut tree and branches discarded.
- Remove the remaining tree trunk, stump, and rootwad.
- Grub any remaining roots of the tree so that only 2 inches or smaller roots are left in place.
- The resulting cavity from removal of the rootwad shall be cleaned of loose soil and debris.
- The cavity shall then be backfilled with cohesive soil and compacted and the area seeded to re-establish vegetation. If the tree has been removed from along the upstream or downstream face of a slope, benches shall be cut into the slope face where the cavity is to be backfilled. This will allow for a proper bond between the existing dike and the backfill being used to reform the slope. If benches are needed, bench heights shall not exceed 4 to 5 feet in height.

Maintenance of Vegetation

- Mowing is recommended at regular intervals to allow for appropriate inspection of embankment slopes.

- If areas lacking vegetation are observed during mowing and clearing operations or subsequent inspections, the areas should be seeded to re-establish vegetation as soon as practicable.

1.5 GENERAL GUIDELINES FOR REPAIR OF WAVE WASH EROSION REPAIR AND CONSTRUCTION OF RIPRAP PROTECTION

1.5.1 IDENTIFICATION

Wave erosion should be controlled on TVA facilities to maintain the integrity of dams and dikes. When present, wave wash erosion typically occurs along interior slopes of dikes near pool level. If left unrepaired, erosion can expand, deepen, and can eventually lead to interior slope sloughing. General guidelines for repair of wave erosion using riprap are provided below.

<u>Guidelines for Wave Wash Erosion Repair and Riprap Protection</u>

The following describes repair of wave wash erosion using riprap protection:

- Vegetation and loose soil should be removed within the affected slope areas to be repaired. This includes undercutting the slope a minimum of 12 inches to remove vegetation and associated roots. The minimum vertical extent of the vegetation removal should extend from one-foot below the pool level upwardly to two feet above pool level.

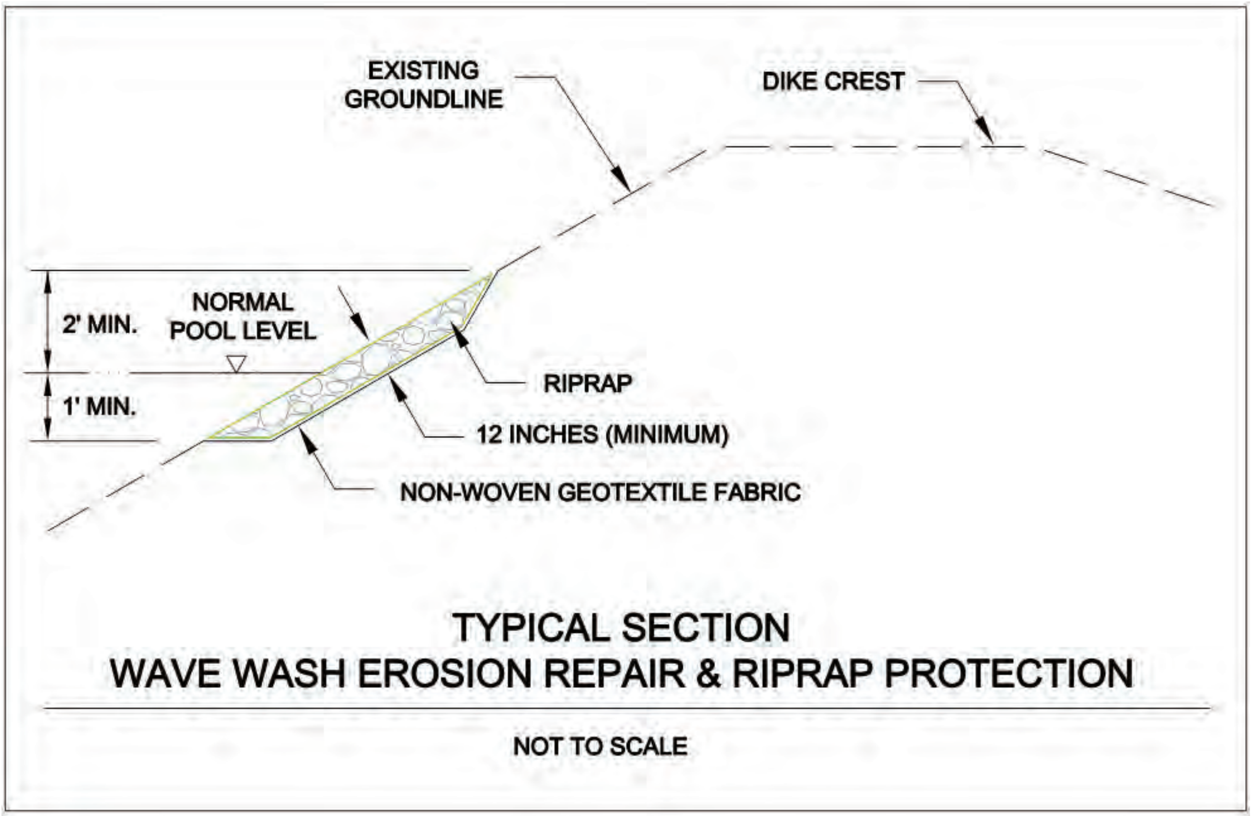
- Place non-woven geotextile fabric along the slope where vegetation and loose soil have been removed. Use fabric meeting or exceeding the following designations, depending on the state in which the work is being performed.

Kentucky Plants -	KYTC Type I Geotextile Fabric
Tennessee Plants -	TDOT Type III Geotextile Fabric
Alabama Plants -	Fabric conforming to Section 608 of ALDOT Standard Specifications

- Place riprap over the geotextile fabric. An excavator should be used to place the riprap in layers (starting from the bottom). Place thickness of riprap to conform to original ground line, or as necessary to create a stable slope face. Use riprap meeting the following designations, depending on the state in which the work is being performed.

Kentucky Plants -	KYTC Class II Channel Lining
Tennessee Plants -	TDOT Class A-1 Machined Riprap
Alabama Plants -	ALDOT Class 2 Riprap

- Field adjustments may be necessary as the work progresses, depending on actual conditions encountered.



1.6 GENERAL GUIDELINES FOR MOWING AND VEGETATION REMOVAL

Slopes shall be mowed to reduce the opportunity for tree growth and allow for visual inspection and observations. The slopes shall be mowed to a height of no less than 3 inches and no more than 12 inches tall with a minimum of three mowings per growing season. If woody growth is detected, it shall be removed.

1.7 GENERAL GUIDELINES FOR BARE AREA FERTILIZING AND RESEEDING

Prepare exposed or bare areas for seeding by discing the surface 3 inches in depth. Apply fertilizer (600 lbs./acre), seed mixture (as directed by facility engineer), mulch (1.5 tons/acre), and netting (0.75" x 1" mesh openings) with pins to the prepared areas. Other application rates may be requested by the facility engineer. The seed mixture utilized depends on the seeding application period and location.

APPENDIX A

Document 17

Instrumentation (Piezometer) Readings

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					7/20/2009		8/3/2009		8/13/2009		8/31/2009		9/11/2009	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	25.85	192.39	26.54	191.70	25.90	192.34	28.78	189.46	29.71	188.53
STN-2	19.65	238.78	238.69	219.04	18.03	220.66	17.56	221.13	17.30	221.39	18.07	220.62	17.94	220.75
STN-3	20.07	234.52	237.44	217.37	13.12	224.32	12.46	224.98	13.50	223.94	14.66	222.78	12.78	224.66
STN-4	19.20	237.55	237.32	218.12	17.85	219.47	17.79	219.53	15.50	221.82	19.09	sump	19.12	sump
STN-5	38.18	218.04	220.69	182.51	24.57	196.12	24.64	196.05	23.70	196.99	26.20	194.49	26.58	194.11
STN-6	17.94	238.47	238.41	220.47	17.85	sump	17.84	sump	17.80	sump	17.86	sump	17.85	sump
STN-7	15.56	235.53	235.44	219.88	Dry	dry	Dry	dry	Dry	dry	Dry	dry	Dry	dry
STN-8	19.03	237.75	237.67	218.64	Dry	dry	19.02	sump	19.03	sump	19.04	sump	Dry	dry
STN-9	41.00	221.15	224.19	183.19	8.41	215.78	10.06	214.13	10.40	213.79	10.76	213.43	10.93	213.26
STN-10	13.05	237.39	237.10	224.05	Dry	dry	11.00	226.10	11.70	225.40	12.21	224.89	12.42	224.68
STN-11	14.35	237.93	237.81	223.46	Dry	dry	Dry	dry	Dry	dry	Dry	dry	Dry	dry
STN-12	43.10	217.16	220.08	176.98	27.60	192.48	28.32	191.76	27.60	192.48	30.02	190.06	30.77	189.31
STN-13	17.68	237.24	236.96	219.28	15.19	221.77	12.05	224.91	11.60	225.36	Damaged	NM	11.88	225.08
STN-14	19.50	236.64	236.44	216.94	8.27	228.17	6.71	229.73	6.90	229.54	8.07	228.37	8.79	227.65
Mississippi River Gauge MS126 - Memphis						192.33		192.81		190.58		187.49		185.07
McKellar Lake Pool Elevation						189.55		189.05		187.85		184.05		182.65

sump	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.
NM	Not Measured. PZ Riser was damaged by a construction equipment. It was subsequently fixed and surveyed

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					10/12/2009		11/2/2009		11/11/2009		11/17/2009		12/11/2009	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	24.19	194.05	15.58	202.66	13.98	204.26	17.19	201.05	19.23	199.01
STN-2	19.65	238.78	238.69	219.04	16.80	221.89	15.97	222.72	16.26	222.43	16.50	222.19	17.68	221.01
STN-3	20.07	234.52	237.44	217.37	11.97	225.47	10.98	226.46	11.68	225.76	11.99	225.45	12.02	225.42
STN-4	19.20	237.55	237.32	218.12	17.27	220.05	15.57	221.75	16.03	221.29	16.11	221.21	17.48	219.84
STN-5	38.18	218.04	220.69	182.51	25.23	195.46	16.02	204.67	14.38	206.31	17.21	203.48	20.45	200.24
STN-6	17.94	238.47	238.41	220.47	17.86	sump	17.85	sump	17.94	sump	17.93	sump	17.94	sump
STN-7	15.56	235.53	235.44	219.88	Dry	dry	Dry	dry	15.90	sump	15.58	sump	15.90	sump
STN-8	19.03	237.75	237.67	218.64	19.05	sump	Dry	dry	19.14	sump	19.04	sump	19.06	sump
STN-9	41.00	221.15	224.19	183.19	11.40	212.79	11.66	212.53	18.80	205.39	18.31	205.88	19.39	204.80
STN-10	13.05	237.39	237.10	224.05	11.25	225.85	10.14	226.96	11.32	225.78	10.68	226.42	11.89	225.21
STN-11	14.35	237.93	237.81	223.46	14.19	sump	14.22	sump	14.28	sump	14.30	sump	14.20	sump
STN-12	43.10	217.16	220.08	176.98	30.29	189.79	24.41	195.67	21.90	198.18	23.47	196.61	25.44	194.64
STN-13	17.68	237.24	236.96	219.28	11.42	225.54	10.45	226.51	11.01	225.95	11.09	225.87	12.54	224.42
STN-14	19.50	236.64	236.44	216.94	7.98	228.46	7.63	228.81	8.19	228.25	8.42	228.02	8.98	227.46
Mississippi River Gauge MS126 - Memphis						192.45		206.19		207.44		201.13		198.96
McKellar Lake Pool Elevation						189.75		202.05		203.05		198.05		195.55

sump	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					1/12/2010		2/2/2010		2/25/2010		4/6/2010		5/5/2010	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	20.98	197.26	10.76	207.48	19.54	198.70	10.14	208.10	12.58	205.66
STN-2	19.65	238.78	238.69	219.04	17.87	220.82	16.79	221.90	14.79	223.90	16.30	222.39	17.50	221.19
STN-3	20.07	234.52	237.44	217.37	12.48	224.96	10.90	226.54	11.41	226.03	11.74	225.70	12.00	225.44
STN-4	19.20	237.55	237.32	218.12	17.61	219.71	16.83	220.49	16.19	221.13	18.01	219.31	18.92	sump
STN-5	38.18	218.04	220.69	182.51	21.57	199.12	12.28	208.41	18.87	201.82	11.37	209.32	13.76	206.93
STN-6	17.94	238.47	238.41	220.47	17.97	sump	17.97	sump	17.94	sump	17.97	sump	17.97	sump
STN-7	15.56	235.53	235.44	219.88	13.52	221.92	11.75	223.69	11.13	224.31	11.47	223.97	11.72	223.72
STN-8	19.03	237.75	237.67	218.64	19.07	sump	19.07	sump	19.05	sump	19.07	sump	19.07	sump
STN-9	41.00	221.15	224.19	183.19	17.81	206.38	18.18	206.01	16.54	207.65	15.34	208.85	17.27	206.92
STN-10	13.05	237.39	237.10	224.05	12.12	224.98	10.13	226.97	10.27	226.83	11.45	225.65	11.07	226.03
STN-11	14.35	237.93	237.81	223.46	14.24	sump	14.32	sump	14.27	sump	14.28	sump	14.28	sump
STN-12	43.10	217.16	220.08	176.98	25.05	195.03	19.86	200.22	23.57	196.51	17.68	202.40	19.80	200.28
STN-13	17.68	237.24	236.96	219.28	12.46	224.50	11.79	225.17	11.45	225.51	12.31	224.65	12.23	224.73
STN-14	19.50	236.64	236.44	216.94	9.28	227.16	8.47	227.97	8.15	228.29	8.18	228.26	7.91	228.53
Mississippi River Gauge MS126 - Memphis						193.53		212.72		196.42				
McKellar Lake Pool Elevation						190.75		208.55						

sump — Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.

Dry — The PZ was dry at depth so no water level was measured.

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					6/1/2010		7/7/2010		8/2/2010		9/10/2010		10/22/2010	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	12.11	206.13	15.90	202.34	18.23	200.01	23.85	194.39	25.25	192.99
STN-2	19.65	238.78	238.69	219.04	17.34	221.35	19.60	sump	19.30	sump	19.50	sump	19.62	sump
STN-3	20.07	234.52	237.44	217.37	12.69	224.75	15.40	222.04	14.10	223.34	15.55	221.89	17.74	219.70
STN-4	19.20	237.55	237.32	218.12	17.01	220.31	19.30	sump	18.75	218.57	19.20	sump	19.17	sump
STN-5	38.18	218.04	220.69	182.51	12.17	208.52	17.23	203.46	19.56	201.13	25.70	194.99	26.34	194.35
STN-6	17.94	238.47	238.41	220.47	17.97	sump	17.98	sump	17.90	sump	17.90	sump	17.91	sump
STN-7	15.56	235.53	235.44	219.88	11.95	223.49	12.20	223.24	11.90	223.54	12.28	223.16	12.19	223.25
STN-8	19.03	237.75	237.67	218.64	19.07	sump	19.00	sump	18.70	sump	19.00	sump	19.15	sump
STN-9	41.00	221.15	224.19	183.19	13.79	210.40	16.47	207.72	17.50	206.69	20.42	203.77	22.45	201.74
STN-9R	15.25	223.76	227.01	211.76	NA	NM	NA	NM	NA	NM	NA	NM	11.01	216.00
STN-10	13.05	237.39	237.10	224.05	11.49	225.61	12.10	225.00	12.00	225.10	12.55	224.55	13.32	sump
STN-11	14.35	237.93	237.81	223.46	14.27	sump	14.30	sump	14.30	sump	14.35	sump	14.31	sump
STN-11S	27.00	237.52	237.52	210.52	NA	NM	NA	NM	NA	NM	NA	NM	18.79	218.73
STN-12	43.10	217.16	220.08	176.98	17.75	202.33	21.40	198.68	23.05	197.03	28.23	191.85	30.03	190.05
STN-12R	14.83	215.99	219.82	204.99	NA	NM	NA	NM	NA	NM	NA	NM	13.74	206.08
STN-13	17.68	237.24	236.96	219.28	11.66	225.30	11.95	225.01	11.90	225.06	12.15	224.81	13.22	223.74
STN-14	19.50	236.64	236.44	216.94	8.17	228.27	9.10	227.34	8.34	228.10	9.57	226.87	10.77	225.67
STN-15	15.00	216.77	219.77	204.77	NA	NM	NA	NM	NA	NM	NA	NM	8.15	211.62
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

sump	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.
NM	Not Measured. PZ Riser was damaged by a construction equipment. It was subsequently fixed and surveyed

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					11/11/2010		12/8/2010		1/18/2011		2/11/2011		3/11/2011	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	28.42	189.82	21.48	196.76	26.70	191.54	24.88	193.36	9.41	208.83
STN-2	19.65	238.78	238.69	219.04	19.53	sump	19.53	sump	17.73	220.96	18.84	219.85	15.89	222.80
STN-3	20.07	234.52	237.44	217.37	15.15	222.29	11.79	225.65	10.75	226.69	11.84	225.60	10.95	226.49
STN-4	19.20	237.55	237.32	218.12	19.15	sump	19.18	sump	18.89	sump	18.75	218.57	17.85	219.47
STN-5	38.18	218.04	220.69	182.51	27.63	193.06	23.51	197.18	26.09	194.60	26.17	194.52	12.28	208.41
STN-6	17.94	238.47	238.41	220.47	dry	dry	17.92	sump	17.92	sump	17.93	sump	dry	dry
STN-7	15.56	235.53	235.44	219.88	12.10	223.34	11.44	224.00	11.90	223.54	12.08	223.36	14.44	221.00
STN-8	19.03	237.75	237.67	218.64	18.60	219.07	18.90	sump	18.90	sump	18.93	sump	dry	dry
STN-9	41.00	221.15	224.19	183.19	23.60	200.59	23.31	200.88	22.55	201.64	23.81	200.38	20.22	203.97
STN-9R	15.25	223.76	227.01	211.76	10.53	216.48	9.19	217.82	8.61	218.40	8.35	218.66	7.85	219.16
STN-10	13.05	237.39	237.10	224.05	13.00	sump	13.08	sump	13.08	sump	13.08	sump	11.33	225.77
STN-11	14.35	237.93	237.81	223.46	14.32	sump	14.32	sump	14.32	sump	14.32	sump	dry	dry
STN-11S	27.00	237.52	237.52	210.52	18.72	218.80	18.08	219.44	17.29	220.23	17.34	220.18	17.35	220.17
STN-12	43.10	217.16	220.08	176.98	32.10	187.98	28.26	191.82	30.02	190.06	30.12	189.96	21.14	198.94
STN-12R	14.83	215.99	219.82	204.99	13.25	206.57	7.79	212.03	7.14	212.68	7.01	212.81	6.78	213.04
STN-13	17.68	237.24	236.96	219.28	13.87	223.09	14.43	222.53	13.85	223.11	13.72	223.24	12.72	224.24
STN-14	19.50	236.64	236.44	216.94	10.93	225.51	10.12	226.32	9.44	227.00	9.25	227.19	8.62	227.82
STN-15	15.00	216.77	219.77	204.77	7.32	212.45	5.80	213.97	5.23	214.54	5.17	214.60	5.03	214.74
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

sump	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					4/7/2011		5/3/2011		6/17/2011		6/25/2011		6/28/2011	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	12.08	206.16	**	**	14.62	203.62	NA	NA	NA	NA
STN-2	19.65	238.78	238.69	219.04	15.27	223.42	14.76	223.93	17.42	221.27	NA	NA	NA	NA
STN-3	20.07	234.52	237.44	217.37	11.29	226.15	9.48	227.96	13.30	224.14	NA	NA	NA	NA
STN-4	19.20	237.55	237.32	218.12	16.00	221.32	13.67	223.65	17.04	220.28	NA	NA	NA	NA
STN-5	38.18	218.04	220.69	182.51	10.79	209.90	**	**	14.16	206.53	NA	NA	NA	NA
STN-6	17.94	238.47	238.41	220.47	17.96	sump	15.87	222.54	17.85	sump	NA	NA	NA	NA
STN-7	15.56	235.53	235.44	219.88	11.74	223.70	12.18	223.26	12.37	223.07	NA	NA	NA	NA
STN-8	19.03	237.75	237.67	218.64	18.64	219.03	17.91	219.76	***	***	NA	NA	NA	NA
STN-9	41.00	221.15	224.19	183.19	14.55	209.64	12.74	211.45	11.68	212.51	13.19	211.00	13.56	210.63
STN-9R	15.25	223.76	227.01	211.76	7.73	219.28	6.53	220.48	7.98	219.03	8.58	218.43	8.83	218.18
STN-10	13.05	237.39	237.10	224.05	11.27	225.83	9.40	227.70	11.95	225.15	12.09	225.01	12.17	224.93
STN-11	14.35	237.93	237.81	223.46	14.28	sump	14.24	sump	14.25	sump	14.35	sump	dry	dry
STN-11S	27.00	237.52	237.52	210.52	17.41	220.11	17.29	220.23	17.77	219.75	18.07	219.45	18.33	219.19
STN-12	43.10	217.16	220.08	176.98	19.43	200.65	11.69	208.39	19.13	200.95	19.63	200.45	19.35	200.73
STN-12R	14.83	215.99	219.82	204.99	6.91	212.91	6.45	213.37	7.22	212.60	9.58	210.24	10.16	209.66
STN-13	17.68	237.24	236.96	219.28	12.46	224.50	11.63	225.33	11.74	225.22	11.87	225.09	11.98	224.98
STN-14	19.50	236.64	236.44	216.94	8.24	228.20	7.67	228.77	8.35	228.09	8.51	227.93	8.78	227.66
STN-15R	15.00	216.77	219.77	204.77	5.27	214.50	4.74	215.03	5.78	213.99	dry	dry	6.80	212.97
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

sump	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.
** Underwater	The piezometer was underwater due to the recent flooding of the Mississippi River.
*** Buried	

Stantec

Allen Fossil Plant
2574 Steam Plant Rd
Memphis,TN
Stantec Project No. 172679016 and 172679032

					6/29/2011		7/6/2011		7/11/2011		7/25/2011		8/26/2011	
Piezometer	PZ Depth (ft)	Surface Elevation (ft)	TOC Elevation (ft)	PZ Tip Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)	Depth Measurement (ft)	Water Elevation (ft)
STN-1	40.21	215.47	218.24	178.03	NA	NA	NA	NA	14.71	203.53	NA	NA	22.54	195.70
STN-2	19.65	238.78	238.69	219.04	NA	NA	NA	NA	19.26	219.43	NA	NA	19.62	sump
STN-3	20.07	234.52	237.44	217.37	NA	NA	NA	NA	16.70	220.74	NA	NA	19.21	218.23
STN-4	19.20	237.55	237.32	218.12	NA	NA	NA	NA	dry	dry	NA	NA	19.20	sump
STN-5	38.18	218.04	220.69	182.51	NA	NA	NA	NA	15.78	204.91	NA	NA	24.92	195.77
STN-6	17.94	238.47	238.41	220.47	NA	NA	NA	NA	17.89	sump	NA	NA	17.92	sump
STN-7	15.56	235.53	235.44	219.88	NA	NA	NA	NA	15.20	220.24	NA	NA	14.43	221.01
STN-8	19.03	237.75	237.67	218.64	NA	NA	NA	NA	***	***	***	***	***	***
STN-9	41.00	221.15	224.19	183.19	13.71	210.48	14.04	210.15	14.42	209.77	16.28	207.91	20.13	204.06
STN-9R	15.25	223.76	227.01	211.76	8.86	218.15	9.36	217.65	9.61	217.40	10.61	216.40	11.68	215.33
STN-10	13.05	237.39	237.10	224.05	12.29	224.81	12.35	224.75	12.47	224.63	dry	dry	13.09	sump
STN-11	14.35	237.93	237.81	223.46	14.34	sump	14.34	sump	dry	dry	dry	dry	14.35	sump
STN-11S	27.00	237.52	237.52	210.52	18.46	219.06	19.06	218.46	19.35	218.17	19.80	217.72	20.16	217.36
STN-12	43.10	217.16	220.08	176.98	19.26	200.82	19.28	200.80	20.21	199.87	22.85	197.23	27.21	192.87
STN-12R	14.83	215.99	219.82	204.99	10.28	209.54	11.13	208.69	11.47	208.35	12.67	207.15	14.18	205.64
STN-13	17.68	237.24	236.96	219.28	12.12	224.84	12.39	224.57	12.64	224.32	13.28	223.68	14.12	222.84
STN-14	19.50	236.64	236.44	216.94	8.88	227.56	9.39	227.05	9.78	226.66	10.50	225.94	10.86	225.58
STN-15R	15.00	216.77	219.77	204.77	6.67	213.10	7.00	212.77	7.02	212.75	7.69	212.08	8.30	211.47
Mississippi River Gauge MS126 - Memphis														
McKellar Lake Pool Elevation														

sump	Level measured is most likely water trapped in the sump (bottom 0.36') of the PZ and not a measurement of groundwater.
Dry	The PZ was dry at depth so no water level was measured.

*** Buried

APPENDIX A

Document 18

Stantec's Letter Dated October 11, 2012, and Geocomp's Letter Dated October 10, 2012

Stantec Consulting Services Inc.
10509 Timberwood Circle
Louisville KY 40223-5301
Tel: (502) 212-5000
Fax: (502) 212-5055

October 11, 2012 let_009_175551015_rev_1

Mr. John C. Kammeyer, PE
Vice President
Tennessee Valley Authority
1101 Market Street, LP 5G
Chattanooga, Tennessee 37402

Re: Response to Recommendations
USEPA CCR Impoundment Assessment DRAFT Report
Allen Fossil Plant (ALF)
Memphis, Tennessee

Dear Mr. Kammeyer:

As requested, Stantec has reviewed the DRAFT report *Coal Combustion Residue Impoundment Dam Assessment Report, Allen Fossil Plant, Tennessee Valley Authority, Memphis, Tennessee,* dated August 2012 prepared by Dewberry and Davis, LLC (Dewberry) for the United States Environmental Protection Agency (USEPA). The purpose of this letter is to address Dewberry's conclusions and recommendations pertaining to structural stability, hydrologic/hydraulic capacity, and technical documentation; and to provide additional supporting information relative to ongoing plant improvements, further analysis, and planned activities where applicable. Dewberry's recommendations followed by Stantec's corresponding responses are provided below.

Dewberry Report Section 1.2.3 1) – East Ash Pond: *Perform appropriate seismic stability analyses that use the USEPA design earthquake criterion for Significant hazard impoundments (i.e., earthquake with 2,475-year return period). Provide the basis and reasoning for the "design" seismic coefficient used in further pseudostatic slope stability analysis or perform a higher level of analysis that uses more sophisticated methods.*

Response: Refer to attached letter containing results of seismic analysis provided by Geocomp Consulting, Inc.

Dewberry Report Section 1.2.3 2) – East Ash Pond: *Review/evaluate liquefaction potential and, if necessary, perform a quantitative liquefaction analysis.*

Response: Refer to attached letter containing results of liquefaction analysis provided by Geocomp.

Dewberry Report Section 1.2.3 3) – East Ash Pond: *If it is determined that liquefaction is not likely, review/investigate the very soft to soft soils in the alluvial foundation beneath the dike embankments, evaluate deformation potential during the design earthquake, and assess the impact of any such deformation on the stability of the embankment.*

Response: Geocomp's analysis indicates that liquefaction will occur; therefore, they performed a post-earthquake stability analysis. Their results produced a factor of safety greater than the target value of 1.0**.** For additional information, please refer to the attached letter containing description of seismic analysis performed by Geocomp Consulting, Inc.

Dewberry Report Section 1.2.3 - Last Paragraph – West Ash Pond: *If future plans call for re-activating the West Ash Pond, perform all required engineering analyses and develop all necessary technical documentation to demonstrate its ability for continued safe and reliable operation before it is brought back into service.*

Response: TVA does not presently intend to reactivate ash sluicing to the West Ash Pond, and management of the minor, low volume wastewater streams currently routed to the pond does not result in discharge from the pond. Consequently, no additional analysis is deemed necessary.

Dewberry Report Section 1.2.5 – Maintenance Items:

1) *Repair gully erosion on the divider dike;*
2) *Add crushed stone surfacing material in worn shallow depression on the dike crest south side where haul trucks turn into the dredge cell;*
3) *Avoid mowing the slopes when the ground is still wet from rainfall to minimize mower ruts on the slopes;*
4) *Observe over time the wet area at the toe of the north side exterior slope to verify that the puddle is not due to seepage. If the water source is found to be seepage, then repair the slope with an inverted filter. If the water is not from seepage, then re-grade or fill the slight depression with crushed stone surfacing material.*
5) *Paint corroded metal parts and hardware at the spillway in the divider dike and on the gates and gate-operators at the discharge end of the primary outlet conduits.*

Response:

1) TVA has repaired the previously eroded area by installing riprap.
2) TVA has repaired this dike crest area by placing 4 inches of asphalt pavement.
3) TVA's mowing crews have been advised not to mow slopes when the ground is wet.

4) TVA has monitored the area and has concluded that the area is not exhibiting seepage. Additionally, the area has been regraded and also covered with crushed stone for additional protection.
5) TVA plans to paint the corroded materials within the next 30 days.

Based on the responses provided in this letter and on Geocomp's seismic analysis indicating acceptable performance under seismic loading, it is Stantec's opinion that the final rating for the ALF East Ash Pond should be upgraded to Satisfactory.

We appreciate the opportunity to provide these responses. If you have any questions or need additional information, please call.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Stephen H. Bickel, PE
Senior Principal

Randy L. Roberts, PE
Principal

/cdm

Cc: Roberto L. Sanchez, PE
Michael S. Turnbow

Geocomp CONSULTING, INC.
Technologies to manage risk for infrastructure

Atlanta
Boston
Chicago
New York
San Francisco
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October 10, 2012 let_20329-01

Mr. John C. Kammeyer
Vice President
Tennessee Valley Authority
1101 Market Street, LP 5G
Chattanooga, Tennessee 37402

Re: USEPA CCR Impoundment Assessment DRAFT Report
Allen Fossil Plant (ALF)
Memphis, Tennessee

Dear Mr. Kammeyer:

As requested, Geocomp Consulting, Inc has evaluated the seismic response of a representative cross section of the East Ash Pond in response to comments raised in the DRAFT report *Coal Combustion Residue Impoundment Dam Assessment Report, Allen Fossil Plant, Tennessee Valley Authority, Memphis, Tennessee,* dated September 2012 prepared by Dewberry and Davis, LLC (Dewberry) for the United States Environmental Protection Agency (USEPA). The purpose of this letter is to provide a summary of results obtained from additional investigations and analyses to assess the likely performance of this facility to the design earthquake. We have performed this work with the assistance of Professor Steve Kramer, a well-known expert in earthquake engineering, from the University of Washington.

Location and conditions

The Allen Fossil Plant is located at 2574 Steam Plant Road in the town of Memphis, Shelby County, Tennessee. The plant is situated on the south shore of Lake McKellar and on the eastern bank of the Mississippi River, approximately 5 miles southwest of Memphis, Tennessee. The existing impoundment facilities at the Allen Fossil Plant consist of two ash disposal areas; one inactive ash disposal area to the west of the centrally located power plant and one active ash disposal area to the east of the centrally located power plant.

Consistent with previously submitted seismic analysis, cross section B-B' along the northern perimeter dike system of the east active ash disposal area was analyzed. Please refer to Figure 1 for an aerial image of the east active ash disposal area facility layout as well as the location of cross section B-B'.

Approach

Appendix 1 summarizes the approach taken to assess the likely performance of the East Ash Pond for the design earthquake, which is taken as that with a recurrence interval of 2,500 years. The approach consists of the following steps:

- Additional site investigation consisting of borings for SPT testing and recovery of undisturbed samples of cohesive soils, cone penetration test soundings with shear wave velocity measurements, and field vane tests to the extent that site conditions would allow.
- Installation of two strings of permanent piezometers to measure the pore water pressure distribution within the cross-section.
- Laboratory testing to determine basic soil parameters and the undrained shear strength of cohesive soils.
- Development of representative cross section with soil parameters and pore water pressures.
- Stability analyses to determine the minimum factor of safety with no earthquake forces present.
- Stability analyses to determine the minimum factor of safety for average horizontal acceleration values from 0 to 0.5 using soil strengths modified to account for reduction of static strength by cyclic loading.
- Dynamic analyses to determine the representative average horizontal acceleration value for the cross section using site specific input accelerations and subsurface conditions.
- Determine the pseudostatic factor of safety for stability failure.
- Dynamic analyses to compute the potential displacements that might occur assuming that liquefaction does not occur.
- Determine extent of liquefaction, if any, and its potential consequences.

Site Conditions

Figure 2 provides the cross section details developed from the existing information and the additional information obtained during the supplemental site investigation program. A significant result from the field investigation was the determination that pore pressures are significantly less than hydrostatic throughout the cross section. This means that effective stresses are higher and correspondingly soil strengths are higher than what is obtained if pore pressures are assumed to be hydrostatic below the top phreatic surface.

Figure 2 also includes a table that summarizes the soil strength parameters. A major effort was devoted to determining soil strength parameters with current state-of-practice methods. SPT testing was done under the observation of a geotechnical engineer or geologist to help ensure that all test conditions met the requirements of ASTM D1586. Cone penetration testing with shear wave velocity measurements was done to help define the layering and strength characteristics of the various soil layers. Field vane tests were run to measure in situ shear strength. Laboratory tests were run to determine undrained shear strength of cohesive strengths. Results of a laboratory test program on fly ash done by GEI Consultants were used to set the strength parameters for fly ash. Table A-2 summarizes the approach used to define strength parameters for the various materials and analysis methods.

Ground motions and cyclic shear stresses were determined from site-specific response analyses. A suite of seven spectrum-compatible, hard-rock motions provided by AMEC Geomatrix were propagated upward from bedrock at a depth of 2,800 ft through a one-dimensional soil profile to the ground surface. The ground motions at a depth of 138 ft below the crest of the embankment were extracted from these analyses and used as input motions to two different two-dimensional finite element models of Section B. One set of analyses, using the nonlinear computer program, OpenSees, allowed direct modeling of the permanent deformations of the profile under earthquake loading conditions. The other set, performed using the equivalent linear program, Quad4M, produced dynamic motions from which the average acceleration history of the potentially unstable soil could be evaluated. Those average acceleration histories where then used in Newmark sliding block analyses to provide an additional estimate of permanent deformations of the profile.

Results

Section B-B' has a factor of safety against a global stability failure of 2.8 for current conditions. The yield acceleration for this section is 0.185g. The critical failure surface at this yield acceleration is shown in Figure 3.

Peak average horizontal accelerations for this cross section as determined from the Quad4M analyses ranged from 0.210g to 0.339g with an average of 0.259g. This means the yield acceleration for the slope would be momentarily exceeded by the average horizontal acceleration, which would result in some permanent deformation of the slope. If the yield acceleration is exceeded only for several short intervals of time, the permanent displacements can be quite small.

The nonlinear OpenSees analyses produced maximum permanent displacements ranged from 1.9 in to 3.7 in with an average of 2.3 inches. Newmark sliding block type displacement analyses using the yield acceleration from the pseudostatic stability analysis gave estimated permanent displacements ranging from 0.1 in to 1.2 in with an average of 0.7 inch. Thus, two independent approaches to the estimation of permanent deformations both showed that such deformations can be expected to be quite small – on the order of only a few inches.

Calculations to determine the factor of safety against liquefaction versus depth were made using the Youd et al (2001) recommendations to determine cyclic resistance ratio. Cyclic stress ratio was determined from the dynamic analyses described above. Tables 2 and 3 summarize the calculations and results to determine potential for liquefaction for the two new borings performed as part of this evaluation. Blow count data from prior borings were not used in this valuation because for reasons not yet understood, they gave higher SPT values. We gave more credence to the latest borings that were done using cased holes filled with drilling mud under the constant monitoring by a geotechnical engineer or geologist. The native silty sand layers generally have low blow counts and liquefy. The strength of the fly ash is not a factor in the stability of this facility.

Since liquefaction may potentially occur for the design earthquake, the post-shaking stability of the slope comes into question. This was examined with stability analyses for static conditions but with reduced shear strengths. The pseudo-static strength values were used for all soils that do not liquefy. The residual shear strengths computed by the method of Idriss and Boulanger (2007) were used for the soils that may potentially liquefy. The computed residual strength values are given in Table 2 and 3 as well. Figure 4 shows the results of the post-shaking stability analysis. The factor of safety is 1.1 which is an acceptable value for this condition. The critical surface drops into the native silty sand layer that has relatively low blow counts.

Conclusions and Recommendations

The results show that the East Ash Pond at the Allen Fossil Plant has adequate safety for the design basis earthquake. While some of the soils, the native silty sands, have factors of safety against liquefaction that are less than 1, the representative cross section has sufficient strength to resist a shear slide even with soil strengths reduced for repeated loading and liquefaction.

Sincerely yours,

W. Allen Marr, PE, PhD, NAE
Chief Executive Officer

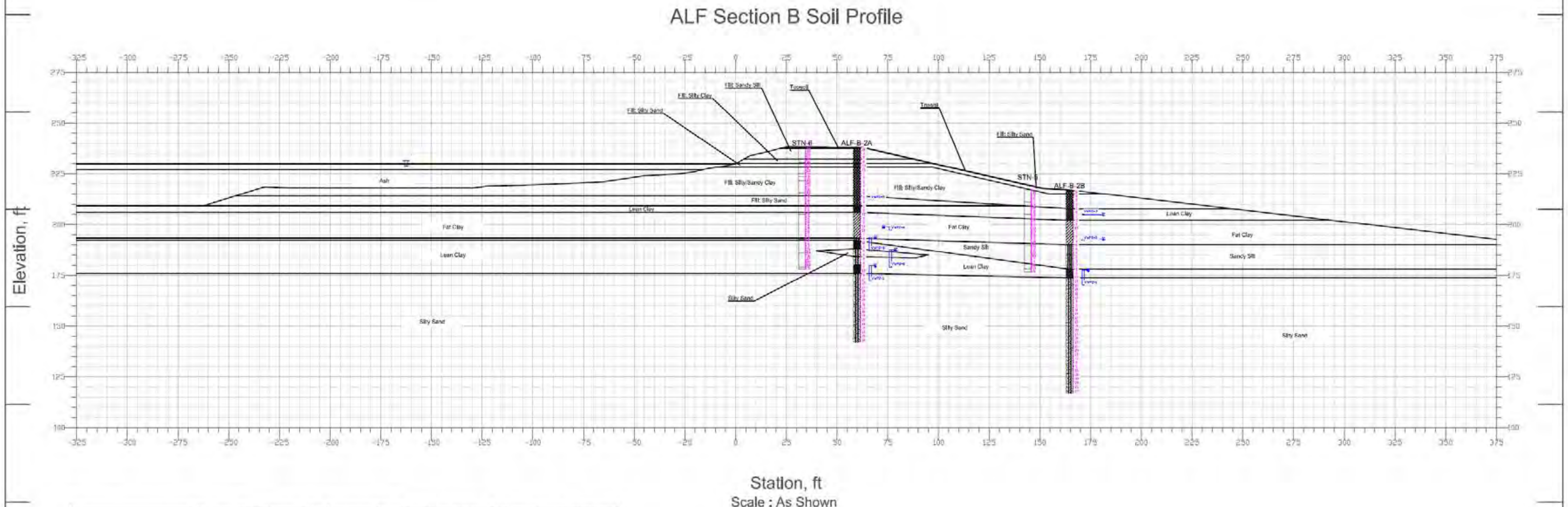
Steven Kramer, PhD
Professor, University of Washington

Figure 1: Site Layout for Allen Fossil Plant

Geocomp Borehole Locations		
Borehole ID	Northing	Easting
ALF-B-2A	35.07371 deg	-90.13454 deg
ALF-B-2B	35.07402 deg	-90.13445 deg

Stantec Borehole Locations		
Borehole ID	Northing	Easting
STN-6	274264.03 ft	763177.15 ft
STN-5	274366.34 ft	763200.60 ft

Notes:
1. DEPICTION OF SOIL PROFILE BETWEEN EXPLORATION HOLES IS FOR ILLUSTRATION OF POSSIBLE GEOLOGICAL CONTINUITY, ACTUAL CONDITIONS WILL MOST LIKELY BE DIFFERENT.
2. SURFACE CONTOUR IS DEPICTED BASED ON DRAWING PROVIDED BY TVA TITLED "EAST ASH POND - USACE LEVEE".
3. DEPICTION OF THE SUBSURFACE SOIL PROFILE GEOMETRY IS BASED ON 2012 SUBSURFACE INVESTIGATION CONDUCTED BY GEOCOMP CORPORATION, INC.
4. UNCORRECTED SPT N-VALUES ARE PRESENTED.
5. *BOREHOLE INVESTIGATIONS CONDUCTED BY STANTEC ARE DEPICTED FOR COMPARATIVE PURPOSES, NO WARRANTIES CAN BE MADE REGARDING THE ACCURACY OF THEIR DATA, HORIZONTAL LOCATION OF BOREHOLE HAS BEEN ADJUSTED FOR VISUAL CLARITY. SURFACE ELEVATION OF STANTEC BOREHOLES IS ACCURATELY DEPICTED. REFER TO TABLE FOR EXACT NORTHING AND EASTING.
6. †NORTHING AND EASTINGS BASED ON CPT DATA



		STATIC			Reduction	PSEUDOSTATIC			Post-Shaking		
		Drained		Undrained		Drained		Undrained	Drained		Undrained
Soil	Type	c	φ'	Su		c	φ'	Su	c	φ'	Su
Fill - Sandy	U	0	30		100	0	30		0	30	
Fill - Sandy	S	0	30		80	0	25				
Fill - Silty Clay	U			2000	100			2000			2000
Fill - Silty Clay	S			2000	80			1600			1600
Fill - Silty Sand	U	0	30		100	0	30		0	30	
Fill - Silty Sand	S	0	30		80	0	25				245
Fill - Silty/Sandy Clay	U			2000	100			2000			2000
Fill - Silty/Sandy Clay	S			2000	80			1600			1600
Hyrdaulic Ash	S	0	30		80	0	25				c/p=0.06
Sandy Silt	S	0	25		80	0	20.5				225
Lean Clay	S			1200	80			1000			1000
Fat Clay	S			1200	80			1000			1000
Lean Clay (2)	S			1200	80			1000			1000
Silty Sand	S	0	35		100	0	35		0	35	
silty sand (2)	S	0	30		80	0	24.5				*

* Lower Silty Sand is modeled in several layers. For more information see the analysis cross section.

ALF-B-2A VWPZ Readings		
Piezometer ID	Tip Elevation	Head
ALF-B-2A-VWPZ-5	212.3 ft	0.0 ft
ALF-B-2A-VWPZ-4	197.3 ft	1.7 ft
ALF-B-2A-VWPZ-3	187.3 ft	6.7 ft
ALF-B-2A-VWPZ-2	179.3 ft	8.5 ft
ALF-B-2A-VWPZ-1	172.3 ft	7.8 ft

ALF-B-2B VWPZ Readings		
Piezometer ID	Tip Elevation	Head
ALF-B-2B-VWPZ-3	205.5 ft	-0.2 ft
ALF-B-2B-VWPZ-2	192.5 ft	0.9 ft
ALF-B-2B-VWPZ-1	170.5 ft	7.4 ft

ENGINEERS SEAL:

Tennessee Valley Authority
EPA Seismic Assessment
Oversight of Supplemental Site Exploration Program
Allen Fossil Plant - Section B Soil Profile

Geocomp Consulting, Inc.

REV. NO.	DATE	NATURE OF REVISION			
1	28-AUG-2012	INCORPORATED STANTEC BH	DRAWN: MGD	CHECKED: VP	SUPERVISED: WAM
0	13-AUG-2012	INITIAL DRAWING	REVIEWED: WAM	APPROVED: VP	ISSUED: VP

AutoCAD CMI 3D 2012 | DATE: | DRAWING NUMBER: Section B - Soil Profile

Figure 2: Representative Cross Section for ALF East Ash Disposal Area

Tennessee Valley Authority
EPA Seismic Assessment
Project No. 20329
Oversight of Supplemental Site Exploration Program
Allen Fossil Plant - Memphis, TN

ALF Section B - Geocomp Soil Profile with Multiple Piezometric Lines - Pseudo-Static Analysis
10/02/2012

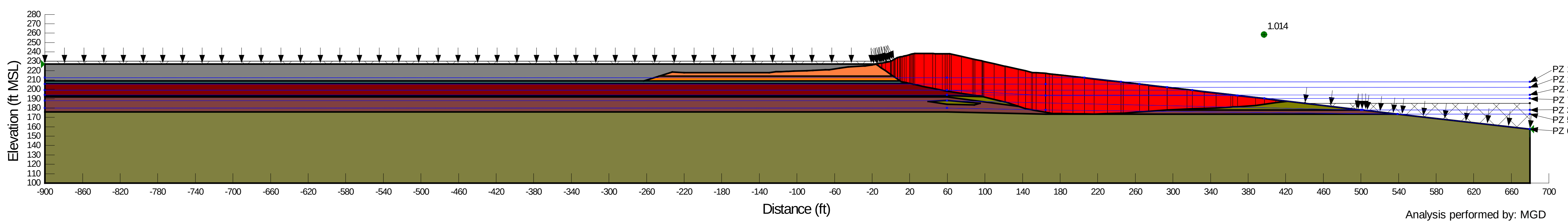
Surface contour is depicted based on drawing called "East Ash Pond - USACE Levee" provided by TVA.
Depiction of soil profile between exploration holes is for illustration of possible geological continuity.
Actual conditions will most likely be different.

Piezometric lines are drawn based on field measurements of piezometric data at boring locations
and are assumed to be constant or a straight-line interpolation to extents of analysis where piezometric data is not available.

Factor of Safety: 1.014
Horizontal Seismic Coefficient: 0.185

Material Properties

Material Type	Unit Weight	Cohesion	Friction Angle	PZ Line
Fill - Sandy Silt	125 pcf	0 psf	30°	1
Fill - Silty Clay	125 pcf	2000 psf	0°	1
Fill - Silty Sand	125 pcf	0 psf	25°	1
Fill - Silty/Sandy Clay	125 pcf	2000 psf	0°	1
Hydraulic Ash	105 pcf	0 psf	0°	1
Sandy Silt	125 pcf	0 psf	20.5°	3
Lean Clay	115 pcf	1000 psf	0°	2
Fat Clay	115 pcf	1000 psf	0°	7
Lean Clay (2)	115 pcf	1000 psf	0°	5
Silty Sand	125 pcf	0 psf	35°	4
Silty Sand (2)	125 pcf	0 psf	24.5°	6



Analysis performed by: MGD
Analysis checked by: MK

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Figure 3: Critical Failure Surface at Yield Acceleration for ALF East Ash Disposal Area

Tennessee Valley Authority
EPA Seismic Assessment
Project No. 20329
Oversight of Supplemental Site Exploration Program
Allen Fossil Plant - Memphis, TN

ALF Section B - Geocomp Soil Profile with Multiple Piezometric Lines - Post Quake
10/04/2012

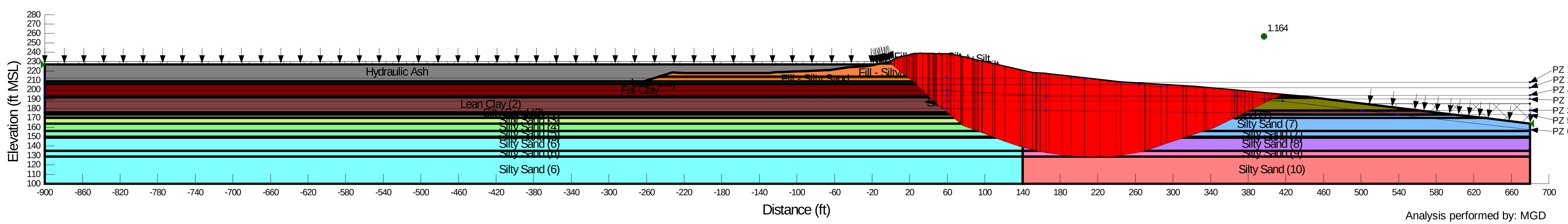
Material Properties

Material Type	Unit Weight	Cohesion	Friction Angle	PZ Line
Fill - Sandy Silt	125 pcf	0 psf	30	1
Fill - Silty Clay	125 pcf	2000 psf	---	1
Fill - Silty Sand	125 pcf	245 psf	---	1
Fill - Silty/Sandy Clay	125 pcf	1600 psf	---	1
Hydraulic Ash	105 pcf	c/p' = 0.06	---	1
Sandy Silt	125 pcf	225 psf	---	3
Lean Clay	115 pcf	1000 psf	---	2
Fat Clay	115 pcf	1000 psf	---	7
Lean Clay (2)	115 pcf	1000 psf	---	5
Silty Sand	125 pcf	0 psf	35	4
Silty Sand (2)	125 pcf	609 psf	---	6
Silty Sand (3)	125 pcf	693 psf	---	6
Silty Sand (4)	125 pcf	581 psf	---	6
Silty Sand (5)	125 pcf	672 psf	---	6
Silty Sand (6)	125 pcf	1052 psf + 6.5/ft	---	6
Silty Sand (7)	125 pcf	444 psf	---	6
Silty Sand (8)	125 pcf	658 psf	---	6
Silty Sand (9)	125 pcf	489 psf	---	6
Silty Sand (10)	125 pcf	810 psf + 6.5/ft	---	6

Surface contour is depicted based on drawing called "East Ash Pond - USACE Levee" provided by TVA.
Depiction of soil profile between exploration holes is for illustration of possible geological continuity.
Actual conditions will most likely be different.

Piezometric lines are drawn based on field measurements of piezometric data at boring locations
and are assumed to be constant or a straight-line interpolation to extents of analysis where piezometric data is not available.

Factor of Safety: 1.164



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Analysis performed by: MGD
Analysis checked by: MK

Figure 4: Critical Failure Surface for Post-Shaking Residual Shear Strength at ALF East Ash Disposal Area

Table 1: Factor of safety as a function of average horizontal acceleration coefficient

Tennessee Valley Authority
EPA Seismic Assessment
Project No. 20329
Oversight of Supplemental Site Exploration Program
Allen Fossil Plant - Memphis, TN
ALF - Section B

Strata	Static				Pseudo-Static				Post Quake - Idriss & Boulanger				Post Quake -Kramer			
	Unit Weight γ [pcf]	Cohesion [psf]	Undrained Shear Strength [psf]	Friction Angle ϕ [degrees]	Unit Weight γ [pcf]	Cohesion [psf]	Undrained Shear Strength [psf]	Friction Angle ϕ [degrees]	Unit Weight γ [pcf]	Cohesion [psf]	Undrained Shear Strength [psf]	Friction Angle ϕ [degrees]	Unit Weight γ [pcf]	Cohesion [psf]	Undrained Shear Strength [psf]	Friction Angle ϕ [degrees]
Fill - Sandy Silt	125	0	---	30	125	0	---	30	125	0	---	30	125	0	---	30
Fill - Silty Clay	125	---	2000	---	125	---	2000	---	125	---	2000	---	125	---	2000	---
Fill - Silty Sand	125	0	---	30	125	0	---	25	125	0	245	---	125	0	245	---
Fill - Silty/Sandy Clay	125	---	2000	---	125	---	1600	---	125	---	1600	---	125	---	1600	---
Hyrdaulic Ash	105	0	---	30	105	---	---	25	105	---	c / p' = 0.06	---	105	---	c / p' = 0.06	---
Sandy Silt	125	0	---	25	115	0	---	20.5	115	0	225	---	115	0	225	---
Lean Clay	115	---	1200	---	115	---	1000	---	115	---	1000	---	115	---	1000	---
Fat Clay	115	---	1200	---	115	---	1000	---	115	---	1000	---	115	---	1000	---
Lean Clay (2)	115	---	1200	---	115	---	1000	---	115	---	1000	---	115	---	1000	---
Silty Sand	125	0	---	35	125	0	---	35	125	0	---	35	125	0	---	35
Silty Sand (2)	125	0	---	30	125	0	---	24.5	125	0	620	---	125	0	609	---
Silty Sand (3)													125	---	693	---
Silty Sand (4)													125	---	581	---
Silty Sand (5)													125	---	672	---
Silty Sand (6)													125	---	1052+6.5 psf/ft	---
Silty Sand (7)													125	---	444	---
Silty Sand (8)													125	---	658	---
Silty Sand (9)													125	---	489	---
Silty Sand (10)													125	---	810+6.5 psf/ft	---

Global Stability Analysis Results

Horizontal Acceleration, K [g]		0.0	0.1	0.181	0.2	0.3	0.389	0.4	0.5	0.6
Static	Factor Of Safety	3.02	---	---	---	---	---	---	---	---
Pseudo-Static	Factor Of Safety	2.50	1.38	1.01	0.95	0.71	0.58	0.58	0.49	0.41
PQ - Idriss & Boulanger	Factor Of Safety	1.16	---	---	---	---	---	---	---	---

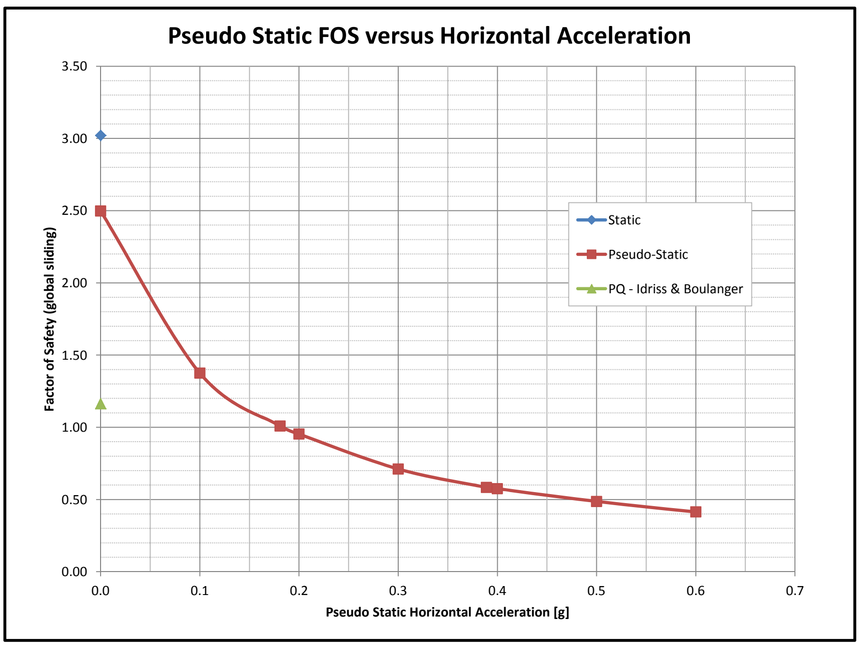


Table 2: Factor of safety against liquefaction and residual shear strengths (Borehole 2A)

Boring ALF-B-2A														
Depth (ft)						SPT			Liquefaction					
From	To	Elevation (ft)	Soil Type	Plastic / Non-Plastic	Fine Content (%)	Blow Counts (N)	$(N_1)_{60}$	$(N_1)_{60,cs}$	CRR	CSR	K_σ	CRR x K_σ	FOS	Post Shaking Strength (Idriss) (psf)
0	1	238.3	Fill - Sandy Silt	N/P	58.3	18	36.0	48.2	NL	0.341	1.00	NL	NL	74
1	2	237.3	Fill - Sandy Silt	N/P	58.3	18	36.0	48.2	NL		1.00	NL	NL	148
2	3	236.3	Fill - Sandy Silt	N/P	83.3	11	22.0	31.4	NL		1.00	NL	NL	119
3	4	235.3	Fill - Sandy Silt	N/P	83.3	11	22.0	31.4	NL	0.286	1.00	NL	NL	159
4	5	234.3	Fill - Sandy Silt	N/P	75.0	3	5.4	11.5	0.127	0.261	1.00	0.127	0.485	60
5	6	233.3	Fill - Sandy Silt	N/P	75.0	3	4.9	10.9	0.121	0.235	1.00	0.121	0.516	70
6	7	232.3	Fill - Silty Clay	P		6	9.2	NL	NL	0.210	1.00	NL	NL	NL
7	8	231.3	Fill - Silty Clay	P		6	8.6	NL	NL		1.00	NL	NL	NL
8	9	230.3	Fill - Silty Sand	N/P	83.3	13	17.6	26.1	NL		1.00	NL	NL	240
9	10	229.3	Fill - Silty Sand	N/P	83.3	13	16.7	25.0	NL	0.183	1.00	NL	NL	250
10	11	228.3	Fill - Silty Clay	P		13	15.9	NL	NL		1.00	NL	NL	NL
11	12	227.3	Fill - Silty Clay	P		13	15.2	NL	NL		1.00	NL	NL	NL
12	13	226.3	Fill - Silty Clay	P		2	2.2	NL	NL		1.00	NL	NL	NL
13	14	225.3	Fill - Silty Clay	P		2	2.2	NL	NL	0.171	1.00	NL	NL	NL
14	15	224.3	Fill - Silty Clay	P		7	7.3	NL	NL		1.00	NL	NL	NL
15	16	223.3	Fill - Silty Clay	P		7	7.1	NL	NL		1.00	NL	NL	NL
16	17	222.3	Fill - Silty Clay	P		6	5.9	NL	NL	0.168	0.99	NL	NL	NL
17	18	221.3	Fill - Silty Clay	P		6	5.7	NL	NL		0.97	NL	NL	NL
18	19	220.3	Fill - Clayey Silt	P		2	1.9	NL	NL		0.96	NL	NL	NL
19	20	219.3	Fill - Clayey Silt	P		2	1.8	NL	NL	0.166	0.94	NL	NL	NL
20	21	218.3	Fill - Silty Clay	P		4	3.5	NL	NL		0.93	NL	NL	NL
21	22	217.3	Fill - Silty Clay	P		4	3.4	NL	NL	0.164	0.91	NL	NL	NL
22	23	216.3	Fill - Silty Clay	P		5	4.2	NL	NL		0.90	NL	NL	NL
23	24	215.3	Fill - Silty Clay	P		5	4.1	NL	NL		0.89	NL	NL	NL
24	25	214.3	Fill – Silty Sand	N/P	83.3	3	2.4	7.9	0.095	0.163	0.88	0.084	0.514	237
25	26	213.3	Fill – Silty Sand	N/P	83.3	3	2.4	7.9	0.095	0.163	0.87	0.082	0.505	245
26	27	212.3	Fill – Silty Sand	N/P	83.0	3	2.3	7.8	0.094	0.163	0.86	0.081	0.499	253
27	28	211.3	Fill – Silty Sand	N/P	83.0	3	2.3	7.8	0.094	0.163	0.86	0.081	0.496	257
28	29	210.3	Fill – Silty Sand	N/P	83.0	1	0.8	5.9	0.079	0.161	0.85	0.067	0.417	227
29	30	209.3	Lean Clay	P		1	0.8	NL	NL	0.160	0.84	NL	NL	NL
30	31	208.3	Lean Clay	P		0	0.0	NL	NL	0.159	0.84	NL	NL	NL
31	32	207.3	Lean Clay	P		0	0.0	NL	NL	0.161	0.83	NL	NL	NL
32	33	206.3	Fat Clay	P				NL	NL	0.159	0.82	NL	NL	NL
33	34	205.3	Fat Clay	P				NL	NL		0.81	NL	NL	NL
34	35	204.3	Fat Clay	P		2	1.4	NL	NL		0.81	NL	NL	NL
35	36	203.3	Fat Clay	P		2	1.4	NL	NL	0.157	0.80	NL	NL	NL
36	37	202.3	Fat Clay	P		3	2.0	NL	NL		0.79	NL	NL	NL
37	38	201.3	Fat Clay	P		3	2.0	NL	NL		0.79	NL	NL	NL
38	39	200.3	Fat Clay	P				NL	NL		0.78	NL	NL	NL
39	40	199.3	Fat Clay	P				NL	NL	0.157	0.78	NL	NL	NL
40	41	198.3	Fat Clay	P				NL	NL		0.77	NL	NL	NL
41	42	197.3	Fat Clay	P				NL	NL		0.77	NL	NL	NL
42	43	196.3	Fat Clay	P		1	0.6	NL	NL	0.163	0.76	NL	NL	NL
43	44	195.3	Fat Clay	P		1	0.6	NL	NL		0.76	NL	NL	NL
44	45	194.3	Fat Clay	P		4	2.5	NL	NL		0.76	NL	NL	NL
45	46	193.3	Sandy Silt	N/P	8.3	4	2.5	2.9	0.058	0.169	0.75	0.043	0.257	272
46	47	192.3	Lean Clay	P		10	6.2	NL	NL	0.171	0.75	NL	NL	NL
47	48	191.3	Lean Clay	P		10	6.1	NL	NL		0.74	NL	NL	NL
48	49	190.3	Lean Clay	P		7	4.2	NL	NL	0.162	0.74	NL	NL	NL
49	50	189.3	Lean Clay	P		7	4.2	NL	NL		0.74	NL	NL	NL
50	51	188.3	Silty Sand	N/P	8.3	9	5.4	5.8	0.078	0.157	0.73	0.058	0.366	395
51	52	187.3	Silty Sand	N/P	8.3	9	5.4	5.8	0.078	0.161	0.73	0.057	0.356	398
52	53	186.3	Silty Sand	N/P	33.3	6	3.6	9.1	0.105	0.164	0.73	0.077	0.468	409
53	54	185.3	Silty Sand	N/P	33.3	6	3.5	9.1	0.105	0.166	0.73	0.077	0.461	412
54	55	184.3	Lean Clay	P		4	2.3	NL	NL	0.168	0.72	NL	NL	NL
55	56	183.3	Lean Clay	P		4	2.3	NL	NL		0.72	NL	NL	NL
56	57	182.3	Lean Clay	P		6	3.4	NL	NL		0.72	NL	NL	NL
57	58	181.3	Lean Clay	P		6	3.4	NL	NL		0.71	NL	NL	NL
58	59	180.3	Lean Clay	P		2	1.1	NL	NL	0.159	0.71	NL	NL	NL
59	60	179.3	Lean Clay	P		2	1.1	NL	NL		0.71	NL	NL	NL
60	61	178.3	Lean Clay	P				NL	NL		0.70	NL	NL	NL
61	62	177.3	Lean Clay	P				NL	NL		0.69	NL	NL	NL
62	63	176.3	Silty Sand	N/P	41.7	9	4.8	10.8	0.120	0.152	0.69	0.082	0.540	561
63	64	175.3	Silty Sand	N/P	41.7	9	4.8	10.7	0.120	0.154	0.68	0.082	0.532	565
64	65	174.3	Silty Sand	N/P	8.3	17	9.0	9.5	0.109	0.155	0.68	0.074	0.477	678
65	66	173.3	Silty Sand	N/P	8.3	17	9.0	9.5	0.108	0.157	0.68	0.074	0.470	682
66	67	172.3	Silty Sand	N/P	8.3	13	6.8	7.3	0.090	0.159	0.68	0.061	0.384	582
67	68	171.3	Silty Sand	N/P	8.3	13	6.8	7.3	0.090	0.161	0.68	0.061	0.377	585
68	69	170.3	Silty Sand	N/P	8.3	17	8.8	9.3	0.107	0.161	0.68	0.073	0.450	693
69	70	169.3	Silty Sand	N/P	8.3	17	8.8	9.3	0.107	0.162	0.67	0.072	0.447	697
70	71	168.3	Silty Sand	N/P	33.3	15	7.7	14.1	0.151	0.162	0.67	0.101	0.627	752
71	72	167.3	Silty Sand	N/P	33.3	15	7.7	14.0	0.150	0.161	0.67	0.101	0.625	756
72	73	166.3	Silty Sand	N/P	8.3	14	7.2	7.6	0.093	0.161	0.67	0.062	0.385	628
73	74	165.3	Silty Sand	N/P	8.3	14	7.1	7.6	0.093	0.161	0.67	0.062	0.384	632
74	75	164.3	Silty Sand	N/P	8.3	12	6.1	6.6	0.084	0.162	0.67	0.056	0.345	583
75	76	163.3	Silty Sand	N/P	8.3	12	6.1	6.5	0.084	0.163	0.66	0.056	0.342	586
76	77	162.3	Silty Sand	N/P	8.3	11	5.5	6.0	0.080	0.164	0.66	0.053	0.322	563
77	78	161.3	Silty Sand	N/P	8.3	11	5.5	6.0	0.079	0.165	0.66	0.053	0.319	567
78	79	160.3	Silty Sand	N/P	8.3	13	6.5	7.0	0.087	0.166	0.66	0.058	0.348	622
79	80	159.3	Silty Sand	N/P	8.3	13	6.5	6.9	0.087	0.165	0.66	0.057	0.347	626
80	81	158.3	Silty Sand	N/P	8.3	10	5.0	5.4	0.075	0.165	0.66	0.049	0.299	550
81	82	157.3	Silty Sand	N/P	8.3	10	4.9	5.4	0.075	0.163	0.66	0.049	0.302	553
82	83	156.3	Silty Sand	N/P	16.7	14	6.9	10.2	0.115	0.160	0.65	0.075	0.471	663
83	84	155.3	Silty Sand	N/P	16.7	14	6.9	10.2	0.115	0.158	0.65	0.075	0.475	666
84	85	154.3	Silty Sand	N/P	25.0	12	5.9	10.8	0.121	0.156	0.65	0.079	0.505	671
85	86	153.3	Silty Sand	N/P	25.0	12	5.9	10.8	0.120	0.153	0.65	0.078	0.510	675
86	87	152.3	Silty Sand	N/P	8.3	14	6.8	7.3	0.090	0.151	0.65	0.058	0.386	677
87	88	151.3	Silty Sand	N/P	8.3	14	6.8	7.2	0.090	0.149	0.65	0.058	0.390	680
88	89	150.3	Silty Sand	N/P	25.0	15	7.2	12.4	0.135	0.149	0.65	0.087	0.584	770
89	90	149.3	Silty Sand	N/P	25.0	15	7.2	12.3	0.134	0.150	0.64	0.087	0.576	774
90	91	148.3	Silty Sand	N/P	16.7	14	6.7	10.0	0.114	0.150	0.64	0.073	0.486	690
91	92	147.3	Silty Sand	N/P	16.7	14	6.7	10.0	0.113	0.150	0.64	0.073	0.484	694
92	93	146.3	Silty Sand	N/P	8.3	15	7.1	7.6	0.093	0.151	0.64	0.059	0.394	725
93	94	145.3	Silty Sand	N/P	8.3	15	7.1	7.6	0.092	0.151	0.64	0.059	0.393	729
94	95	144.3	Silty Sand	N/P	16.7	16	7.6	10.9	0.122	0.151	0.64	0.078	0.515	761
95	96	143.3	Silty Sand	N/P	16.7	16	7.5	10.9	0.121	0.151	0.64	0.077	0.513	764

Table 3: Factor of safety against liquefaction and residual shear strengths (Borehole 2B)

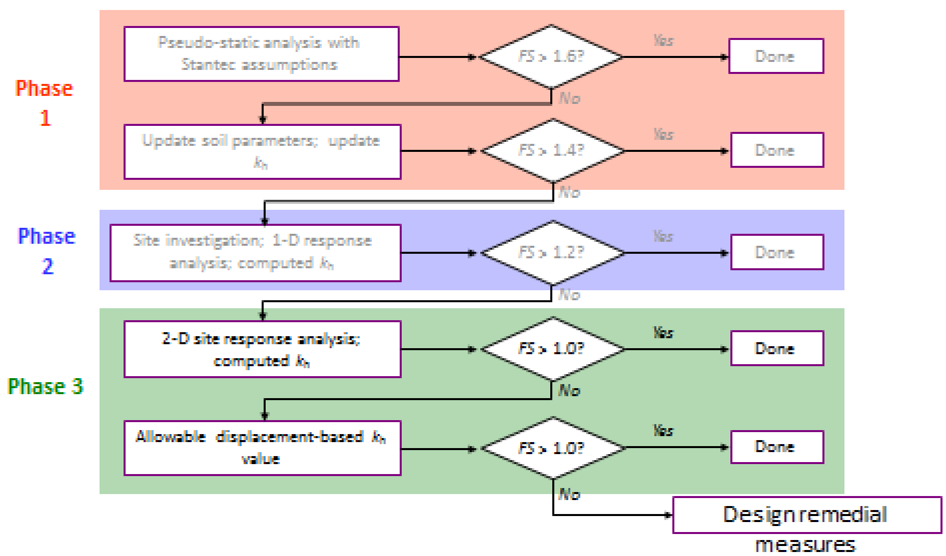
Boring ALF-B-2B														
Depth (ft)						SPT			Liquefaction					
From	To	Elevation	Soil Type	Plastic / Non-Plastic	Fine Content (%)	Blow Counts (N)	$(N_1)_{60}$	$(N_1)_{60,cs}$	CRR	CSR	K_σ	CRR x K_σ	FOS	Post Shaking Strength (Idriss) (psf)
0	1	217.5	Fill - Silty Sand	N/P	33	8	16	23.8	0.270	0.555	1.00	0.270	0.487	20
1	2	216.5	Fill - Silty Sand	N/P	33	8	16	23.8	0.270	0.527	1.00	0.270	0.512	41
2	3	215.5	Fill - Sandy Clay	P		8	16	NL	NL	0.500	1.00	NL	NL	NL
3	4	214.5	Fill - Sandy Clay	P		8	16	NL	NL	0.472	1.00	NL	NL	NL
4	5	213.5	Fill - Sandy Clay	P		2	4	NL	NL	0.444	1.00	NL	NL	NL
5	6	212.5	Fill - Sandy Clay	P		2	3	NL	NL		1.00	NL	NL	NL
6	7	211.5	Fill - Sandy Clay	P		3	5	NL	NL		1.00	NL	NL	NL
7	8	210.5	Fill - Sandy Clay	P		3	4	NL	NL	0.342	1.00	NL	NL	NL
8	9	209.5	Fill - Sandy Clay	P		1	1	NL	NL	0.353	1.00	NL	NL	NL
9	10	208.5	Fill - Sandy Clay	P		1	1	NL	NL		1.00	NL	NL	NL
10	11	207.5	Lean Clay	P		2	2	NL	NL	0.304	1.00	NL	NL	NL
11	12	206.5	Lean Clay	P		2	2	NL	NL	0.247	1.00	NL	NL	NL
12	13	205.5	Lean Clay	P		1	1	NL	NL		1.00	NL	NL	NL
13	14	204.5	Lean Clay	P		1	1	NL	NL	0.248	1.00	NL	NL	NL
14	15	203.5	Lean Clay	P		3	3	NL	NL		1.00	NL	NL	NL
15	16	202.5	Fat Clay	P		3	3	NL	NL	0.236	1.00	NL	NL	NL
16	17	201.5	Fat Clay	P		2	2	NL	NL		1.00	NL	NL	NL
17	18	200.5	Fat Clay	P		2	2	NL	NL		0.99	NL	NL	NL
18	19	199.5	Fat Clay	P				NL	NL	0.219	0.98	NL	NL	NL
19	20	198.5	Fat Clay	P				NL	NL		0.96	NL	NL	NL
20	21	197.5	Fat Clay	P		1	1	NL	NL		0.95	NL	NL	NL
21	22	196.5	Fat Clay	P		1	1	NL	NL	0.220	0.94	NL	NL	NL
22	23	195.5	Fat Clay	P		2	2	NL	NL		0.93	NL	NL	NL
23	24	194.5	Fat Clay	P		2	2	NL	NL		0.91	NL	NL	NL
24	25	193.5	Fat Clay	P		1	1	NL	NL	0.224	0.90	NL	NL	NL
25	26	192.5	Fat Clay	P		1	1	NL	NL		0.89	NL	NL	NL
26	27	191.5	Fat Clay	P		6	5	NL	NL		0.88	NL	NL	NL
27	28	190.5	Sandy Silt	N/P	67	6	5	10.8	0.120	0.214	0.87	0.105	0.489	292
28	29	189.5	Sandy Silt	N/P	67	2	2	6.9	0.087	0.213	0.87	0.075	0.353	233
29	30	188.5	Sandy Silt	N/P	67	2	2	6.9	0.086	0.211	0.86	0.074	0.351	240
30	31	187.5	Sandy Silt	N/P	67	2	2	6.8	0.086	0.209	0.85	0.073	0.349	248
31	32	186.5	Sandy Silt	N/P	67	2	1	6.8	0.086	0.208	0.84	0.072	0.348	255
32	33	185.5	Sandy Silt	N/P	67	5	4	9.4	0.108	0.206	0.83	0.090	0.436	
33	34	184.5	Sandy Silt	N/P	50	5	4	9.3	0.107	0.204	0.82	0.089	0.434	
34	35	183.5	Sandy Silt	N/P	50	3	2	7.6	0.092	0.202	0.82	0.075	0.373	271
35	36	182.5	Sandy Silt	N/P	50	3	2	7.5	0.092	0.200	0.81	0.075	0.373	278
36	37	181.5	Sandy Silt	N/P	16.67	5	3	6.6	0.084	0.198	0.80	0.068	0.343	243
37	38	180.5	Sandy Silt	N/P	16.67	5	3	6.6	0.084	0.196	0.80	0.067	0.342	249
38	39	179.5	Sandy Silt	N/P	16.67	2	1	4.4	0.067	0.194	0.79	0.053	0.275	202
39	40	178.5	Lean Clay	P		2	1	NL	NL	0.192	0.78	NL	NL	NL
40	41	177.5	Lean Clay	P		0	0	NL	NL	0.184	0.78	NL	NL	NL
41	42	176.5	Lean Clay	P		0	0	NL	NL	0.177	0.77	NL	NL	NL
42	43	175.5	Lean Clay	P				NL	NL	0.182	0.77	NL	NL	NL
43	44	174.5	Silty Sand	N/P	42				0.049	0.187	0.77	0.038	0.201	
44	45	173.5	Silty Sand	N/P	42	14	9	15.7	0.167	0.187	0.76	0.128	0.682	535
45	46	172.5	Silty Sand	N/P	42	14	9	15.6	0.167	0.192	0.76	0.127	0.659	540
46	47	171.5	Silty Sand	N/P	42	10	6	12.6	0.136	0.198	0.76	0.103	0.523	454
47	48	170.5	Silty Sand	N/P	42	10	6	12.5	0.136	0.197	0.76	0.103	0.521	458
48	49	169.5	Silty Sand	N/P	42	15	9	16.2	0.172	0.197	0.75	0.130	0.660	577
49	50	168.5	Silty Sand	N/P	42	15	9	16.1	0.172	0.197	0.75	0.129	0.655	582
50	51	167.5	Silty Sand	N/P	42	10	6	12.4	0.135	0.196	0.75	0.101	0.514	471
51	52	166.5	Silty Sand	N/P	42	10	6	12.3	0.134	0.196	0.74	0.100	0.511	475
52	53	165.5	Silty Sand	N/P	42	15	9	16.0	0.170	0.195	0.74	0.126	0.645	596
53	54	164.5	Silty Sand	N/P	8	15	9	9.5	0.109	0.195	0.74	0.080	0.412	522
54	55	163.5	Silty Sand	N/P	8	8	5	5.3	0.074	0.195	0.74	0.055	0.280	370
55	56	162.5	Silty Sand	N/P	0	8	5	4.8	0.071	0.194	0.74	0.052	0.267	338
56	57	161.5	Silty Sand	N/P	0	7	4	4.2	0.066	0.194	0.73	0.048	0.249	320
57	58	160.5	Silty Sand	N/P	0	7	4	4.1	0.066	0.194	0.73	0.048	0.248	323
58	59	159.5	Silty Sand	N/P	8	11	6	6.9	0.087	0.189	0.73	0.064	0.337	448
59	60	158.5	Silty Sand	N/P	8	11	6	6.9	0.087	0.183	0.73	0.063	0.345	451
60	61	157.5	Silty Sand	N/P	0	14	8	8.2	0.097	0.178	0.72	0.070	0.396	484
61	62	156.5	Silty Sand	N/P	0	14	8	8.1	0.097	0.173	0.72	0.070	0.405	488
62	63	155.5	Silty Sand	N/P	0	10	6	5.8	0.078	0.167	0.72	0.056	0.335	400
63	64	154.5	Silty Sand	N/P	0	10	6	5.7	0.078	0.162	0.72	0.056	0.344	403
64	65	153.5	Silty Sand	N/P	17	13	7	10.8	0.120	0.162	0.71	0.086	0.530	515
65	66	152.5	Silty Sand	N/P	17	13	7	10.8	0.120	0.163	0.71	0.085	0.526	519
66	67	151.5	Silty Sand	N/P	17	14	8	11.3	0.125	0.163	0.71	0.089	0.546	546
67	68	150.5	Silty Sand	N/P	17	14	8	11.3	0.125	0.163	0.71	0.088	0.543	550
68	69	149.5	Silty Sand	N/P	8	20	11	11.7	0.129	0.163	0.71	0.091	0.560	706
69	70	148.5	Silty Sand	N/P	8	20	11	11.7	0.128	0.163	0.70	0.090	0.556	710
70	71	147.5	Silty Sand	N/P	17	14	8	11.2	0.124	0.163	0.70	0.087	0.533	561
71	72	146.5	Silty Sand	N/P	17	14	8	11.1	0.123	0.163	0.70	0.086	0.530	564
72	73	145.5	Silty Sand	N/P	8	18	10	10.4	0.117	0.163	0.70	0.082	0.502	669
73	74	144.5	Silty Sand	N/P	8	18	10	10.4	0.116	0.163	0.70	0.081	0.499	673
74	75	143.5	Silty Sand	N/P	8	13	7	7.6	0.092	0.163	0.70	0.064	0.394	550
75	76	142.5	Silty Sand	N/P	8	13	7	7.5	0.092	0.163	0.69	0.064	0.392	554
76	77	141.5	Silty Sand	N/P	8	21	11	11.9	0.130	0.163	0.69	0.090	0.553	766
77	78	140.5	Silty Sand	N/P	8	21	11	11.8	0.130	0.163	0.69	0.089	0.550	770
78	79	139.5	Silty Sand	N/P	17	20	11	14.3	0.153	0.162	0.69	0.105	0.647	747
79	80	138.5	Silty Sand	N/P	17	20	11	14.2	0.152	0.162	0.69	0.105	0.644	751
80	81	137.5	Silty Sand	N/P	8	14	7	7.9	0.095	0.162	0.68	0.065	0.402	596
81	82	136.5	Silty Sand	N/P	8	14	7	7.9	0.095	0.162	0.68	0.065	0.400	600
82	83	135.5	Silty Sand	N/P	0	13	7	6.9	0.086	0.162	0.68	0.059	0.363	530
83	84	134.5	Silty Sand	N/P	0	13	7	6.8	0.086	0.162	0.68	0.059	0.362	533
84	85	133.5	Silty Sand	N/P	0	9	5	4.7	0.070	0.162	0.68	0.047	0.292	439
85	86	132.5	Silty Sand	N/P	0	9	5	4.7	0.070	0.162	0.68	0.047	0.292	442
86	87	131.5	Silty Sand	N/P	0	11	6	5.7	0.077	0.162	0.67	0.052	0.322	493
87	88	130.5	Silty Sand	N/P	0	11	6	5.7	0.077	0.162	0.67	0.052	0.321	496
88	89	129.5	Silty Sand	N/P	33	26	13	20.7	0.224	0.161	0.67	0.151	0.935	1094
89	90	128.5	Silty Sand	N/P	33	26	13	20.6	0.224	0.161	0.67	0.150	0.929	1099
90	91	127.5	Silty Sand	N/P	8	18	9	9.7	0.110	0.161	0.67	0.074	0.458	739
91	92	126.5	Silty Sand	N/P	8	18	9	9.7	0.110	0.161	0.67	0.073	0.455	743
92	93	125.5	Silty Sand	N/P	0	20	10	10.1	0.114	0.161	0.66	0.076	0.473	748
93	94	124.5	Silty Sand	N/P	0	20	10	10.1	0.114	0.160	0.66	0.076	0.471	751
94	95	123.5	Silty Sand	N/P	0	20	10	10.1	0.114	0.160	0.66	0.075	0.470	755
95	96	122.5	Silty Sand	N/P	0	20	10	10.0	0.113	0.160	0.66	0.075	0.467	758

Appendix 1

Approach to Evaluation for Earthquake Loading

Table A-1: Approach to Assessing Performance Under Earthquake Loading

Technical Approach:



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Technical Approach:

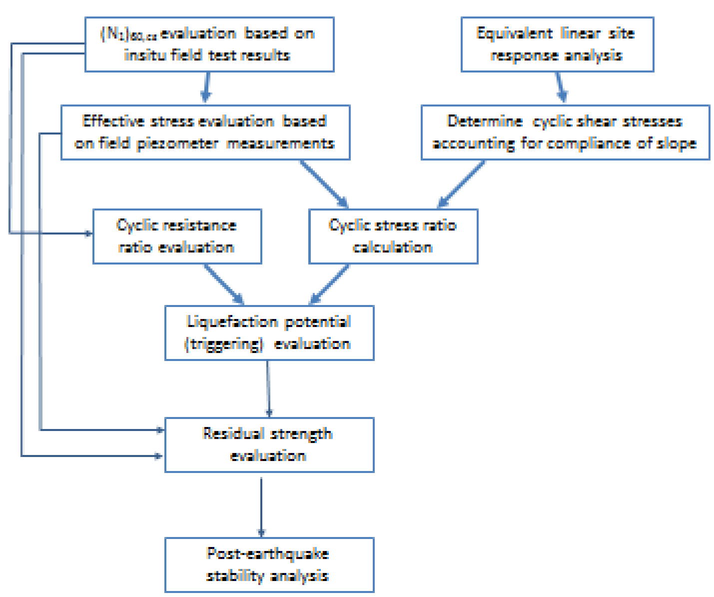


Table A-2: Procedure to Determine Shear Strength of Soil

Soil Material Type	Static Strength	Pseudo Static Strength	Residual Strength
Unsaturated non-plastic soils	$c'=0$; $\phi' = \{[15.4(N_1)_{60}]^{0.5} + 20\}$	100% of Static Strength	100% of Static Strength
Saturated non-plastic soils	$c'=0$; $\phi' = \{[15.4(N_1)_{60}]^{0.5} + 20\}$	80% of Static Strength	Idriss and Boulanger (2007)
Unsaturated plastic soils	Undrained Shear Strength from tests	100% of Static Strength	100% of Static Strength
Saturated plastic soils	Undrained Shear Strength from tests	80% of Static Strength	80% of Static Strength
Fly ash (sluiced)	$c'=0$; $\phi' = 30°$	$c'=0$; $\phi' = 25°$	$s_u/\sigma'_{vc} = 0.06$

$$(N_1)_{60} = N_{60} * \left(\frac{P_a}{\sigma'_v}\right)^{0.5} \quad \text{correction to not exceed 2.0}$$

S_u from interpretation of lab and field tests

- DSS – Direct Simple Shear
- $0.22p_c'$ - p_c' is preconsolidation test measured in one-dimensional consolidation test
- Triaxial Compression*0.64 – consolidated undrained triaxial strength converted to DSS
- $(q_c-\sigma_v)/15$ - cone penetration resistance converted to undrained shear strength
- s_u psf $= 0.085*V_s^{1.6}$ V_s in ft/sec – shear wave velocity converted to undrained shear strength,
- s_u psf = 125 *N_{60} – uncorrected blow count converted to undrained shear strength

APPENDIX B

Document 19

Dam Inspection Check List Form

Site Name:	**Allen Fossil Plant**	**Date:**	**19 September 2011**
Unit Name:	**East Ash Pond/Dredge Cell & East Ash Stilling Pond**	**Operator's Name:**	**TVA**
Unit I.D.:	**NID: TN15801**	**Hazard Potential Classification:**	**High ☐ Significant ☒[1] Low ☐**
	Assessor's Name:	**Stanley W. Notestine, PE; Frederic C. Tucker, 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?	Annually[2]		18. Sloughing or bulging on slopes?		X
2. Pool elevation (operator records)?	230'/226'[3]		19. Major erosion or slope deterioration?		X
3. Decant inlet elevation (operator records)?	225.5'		20. Decant Pipes: (Emergency Outfall Structure)		
4. Open channel spillway elevation (operator records)?	N/A		Is water entering inlet, but not exiting outlet?		X
5. Lowest dam crest elevation (operator records)?	237' TBV		Is water exiting outlet, but not entering inlet?		X
6. If instrumentation is present, are readings recorded (operator records)?	X[4]		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)?	UKN[5]		From underdrain?	N/A	
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?	N/A	
11. Is there significant settlement along the crest?		X[6]	Over widespread areas?		X[10]
12. Are decant trashracks clear and in place?	X[7]		From downstream foundation area?		X
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		X[8]	"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?	N/A	
16. Are outlets of decant or underdrains blocked?		X[9]	23. Water against downstream toe?		X[11]
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.

N/A = Not Applicable UKN = Unknown TBP = To Be Provided TBV = To Be Verified

Note #	Comments
1	Hazard potential classification was determined by TVA. The indicated "significant" hazard potential classification also is Dewberry's interpretation, based on EPA criteria shown on page 3.
2	TVA engineers conduct annual inspections. The inspections are documented in written reports, which include measures, as needed, for maintenance and repair. Plant personnel make observations throughout the year.

3	These are the normal operating water levels in the East Ash Pond (EAP) & East Ash Stilling Pond (EASP) cells, respectively. The water level in the EASP historically was maintained at about the same elevation as in the EAP but is now maintained 4' lower than that in the EAP to provide greater stability of the east side perimeter dike.
4	Piezometers are monitored monthly.
5	Construction records are not available. However, test borings made in 2009 did not encounter organic matter, such as stumps, decayed vegetation, and other such deleterious material or evidence that would suggest that the foundation was not prepared.
6	A large puddle of water from recent rainfall was noted on the crest of the south perimeter dike, near the Dredge Cell, where there appeared to be a slight depression, possibly due to heavy equipment traffic, and poor drainage between railroad tracks on the south side of the crest and a windrow along the upstream (inside) edge of the crest.
7	Skimmers are in place at the inlets.
8	TVA reported that an active 30" diameter sanitary sewer line passing north-south under the Dredge Cell part of the East Ash Pond developed a hole that allowed ash material into the pipe; a new plastic pipe was installed at a higher elevation across most of the Dredge Pond to bypass the defective sewer line, which was abandoned in place.
9	Outlets are not blocked, but emergency outlets are partly submerged. There are no underdrains.
10	No areas of seepage were observed during the site visit. However, along a portion of the outside toe of the east perimeter dike seepage has been observed in the past, when the water level in the Stilling Pond was maintained at a 4' higher elevation. The ends of the seepage area had been marked with signs, but only the north marker was seen. The other one was not observed but may have been obscured by tall weedy vegetation that was present along the dike toe.
11	No water was observed against the downstream (outside) toe at the time of the site visit. However, it is understood that during the wet season (generally winter and early spring) water does rise onto the outside toe along portions of the east perimeter dike.

Coal Combustion Waste (CCW)

Impoundment Assessment

Impoundment NPDES Permit TN0005355 **ASSESSOR** Stanley W. Notestine, PE; Frederic C. Tucker, PE

Effective Date 01/01/2008

Impoundment Name East Ash Pond (EAP)/Dredge Cell & East Ash Stilling Pond (EASP)

Impoundment Company TVA

EPA Region 4

State Agency Tennessee Department of Environment and Conservation
Division of Water Pollution Control.

(Field Office) Address 401 Church street, 6th Floor, L & C Annex
Nashville, TN 37243-1534

Name of Impoundment East Ash Pond/Dredge Cell & East Ash Stilling Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ☐ **Update** ☒

	Yes	No
Is impoundment currently under construction?	☐	☒
Is water or ccr currently being pumped into the impoundment?	☒	☐

IMPOUNDMENT FUNCTION: The impoundment currently serves as a transfer facility. The impoundment receives both fly ash and boiler slag, which are stored temporarily. The fly ash is dredged, dewatered, loaded onto haul trucks and transported to a structural fill project. Approximately 90 % of the bottom ash/boiler slag is reclaimed and sold for beneficial reuse.

Nearest Downstream Town Name: Memphis, Tennessee

Distance from the impoundment: 0 miles (within city limits)

Location:

Latitude	35	Degrees	04	Minutes	19.1	Seconds	**N**
Longitude	90	Degrees	08	Minutes	11.4	Seconds	**W**

State Tennessee **County** Shelby

	Yes	No
Does a state agency regulate this impoundment?	☒	☐

If So Which State Agency? Tennessee Department of Environment and Conservation. For water quality only.

HAZARD POTENTIAL *(In the event the impoundment should fail, the following would occur):*

☐ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

☐ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

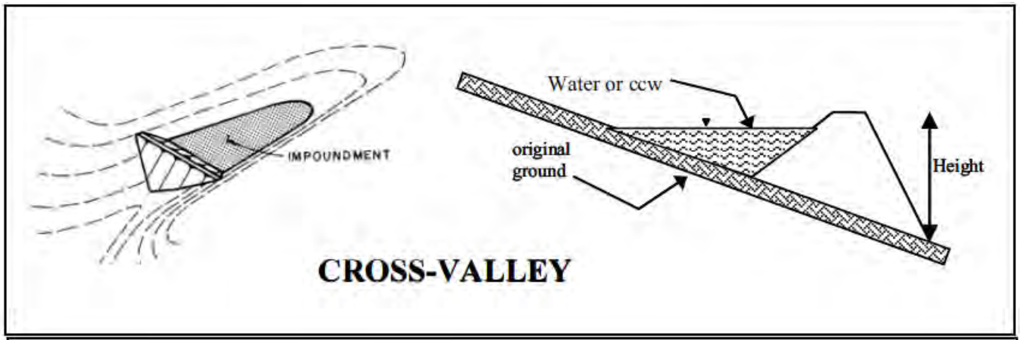
☒ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

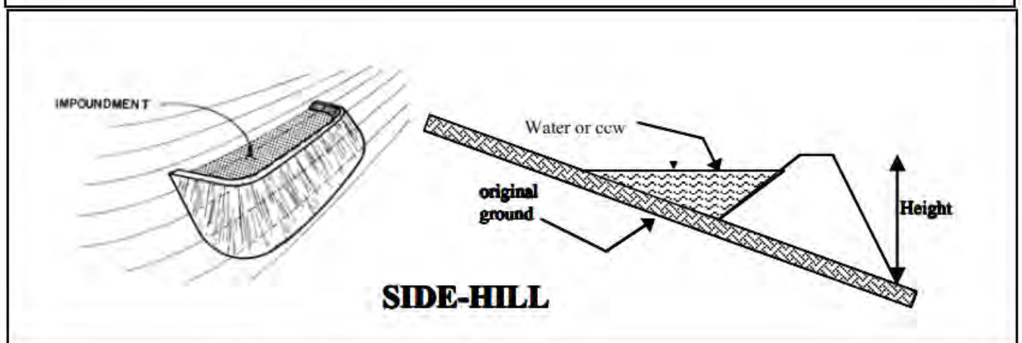
☐ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

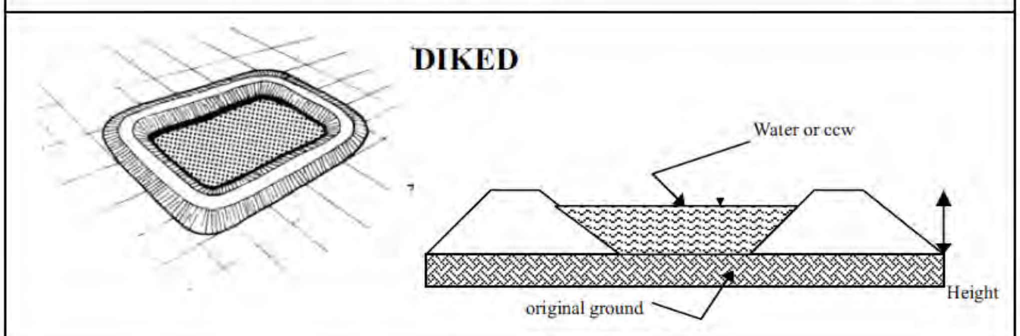
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

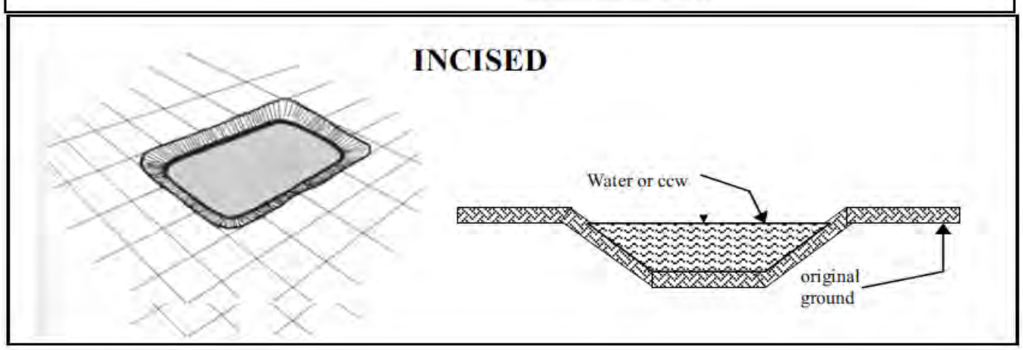
Dike failure would discharge coal combustion residue into Lake McKellar with potentially significant environmental consequences and some potential impact on nearby lower-lying shore areas that are within the Memphis City Limits.

CONFIGURATION:









☐ Cross-Valley ☐ Side-Hill ☐ Diked

☐ Incised (form completion optional) ☒ Combination Incised/Diked

Embankment Height (ft) 20 (max) **Embankment Material** Earth

Pond Area (ac) 70 EAP +10 EASP = 80 **Liner** No

Current Freeboard (ft) 7 EAP / 11 EASP **Liner Permeability** N/A

TYPE OF OUTLET (Mark all that apply)

☐ **Open Channel Spillway**

☐ Trapezoidal

☐ Triangular

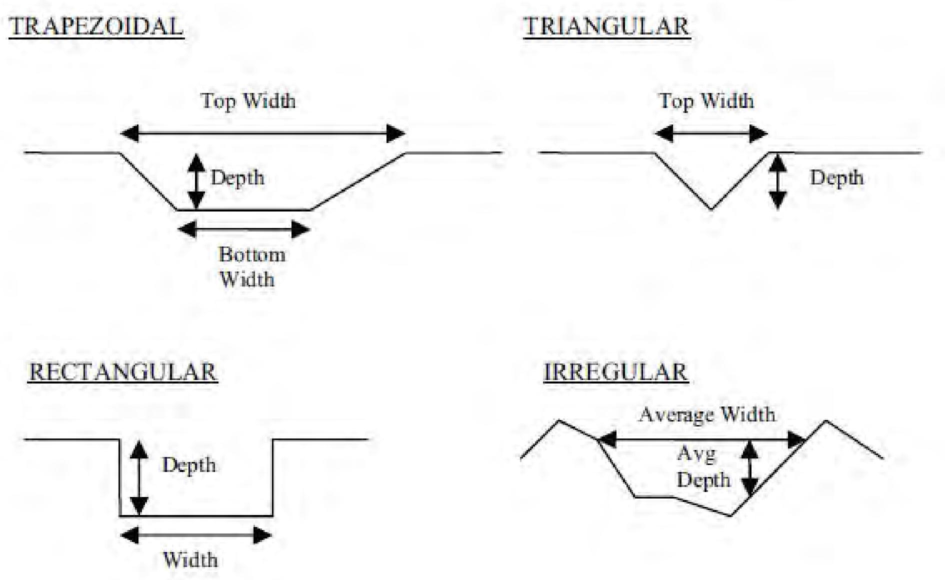
☐ Rectangular

☐ Irregular

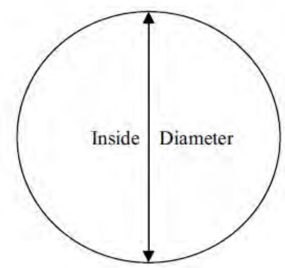
depth (ft)

average bottom width (ft)

top width (ft)



☒ **Outlet**



Four decant structures each consisting of 48" RCP risers with bottom discharge through 36" I.D. RCP outlet conduits lined with PVC. Two primary conduits pass through the north dike of the Stilling Pond to discharge into Lake McKellar, which is connected to the Mississippi River; the outlet ends of these conduits are fitted with sluice gates to prevent backflow when the Mississippi River floods into Lake McKellar. Two secondary (emergency) outlet conduits pass through the east dike of the Stilling Pond to discharge into a channel that flows south to Horn Lake and are used when the primary conduits cannot be used when the water level is too high in Lake McKellar. Flow into the Stilling Pond from the East Ash Pond/Dredge Cell is through a rectangular concrete spillway structure with an overall width of approximately 25' and fitted with stop-log gates across two bays. Water is allowed to flow only through the right (south) 12' wide (TBV) bay for purposes of pH adjustment.

Material

☐ corrugated metal

☐ welded steel

☒ Concrete (RCP) lined with PVC

☐ plastic (hdpe, pvc, etc.)

☐ other (specify):

	Yes	No
Is water flowing through the outlet?	☒	☐

Through primary conduits only (and through rectangular concrete spillway in divider dike)

☐ **No Outlet**

☐ **Other Type of Outlet** (specify):

The Impoundment was Designed By UNK (TVA acquired the plant in 1985)

	Yes	No
Has there ever been a failure at this site?	☐	☒

If So When?

If So Please Describe: There has been no failure. There was some damage done to the inside slope of the north perimeter dike from dredging operations, but the damage was reported to be immediately repaired.

	Yes	No
Has there ever been significant seepages at this site?	☐	☒
If So When?		

If So Please Describe: There have been no reported significant seepages. The area of seepage observed in the past along the outside toe of the east perimeter dike was reported to be an area of water saturation of the embankment soil with little or no observable flow.

	Yes	No
Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site?	☒	☐
If so, which method (e.g., piezometers, gw pumping,...)?	Normal operating pool level was permanently lowered 4' in the Stilling Pond.	

If So Please Describe: The normal operating pool level was permanently lowered to enhance slope stability to acceptable factor of safety.

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?

There was no indication of prior releases, failures, or patchwork on the dikes.